BESD-BİR
BEYAZ ET SANAYİCİLERİ VE DAMIZLIKÇILARI BİRLİĞİ DERNEĞİ

SAĞLIKLI TAVUK BİLGİ PLATFORMU

4th INTERNATIONAL POULTRY MEAT CONGRESS

26-30 April 2017 Kaya Palazzo Golf Resort & Kaya Belek - ANTALYA - TURKEY

4. ULUSLARARASI BEYAZ ET KONGRESİ

26-30 Nisan 2017 Kaya Palazzo Golf Resort & Kaya Belek - ANTALYA - TÜRKİYE

PROCEEDINGS

KONGRE KİTABI

Photos

Submissions

Turkish Poultry Meat Producers and Breeders Association (BESD-BİR)

BESD-BİR
BEYAZ ET SANAYİCİLERİ VE DAMIZLIKÇILARI BİRLİĞİ DERNEĞİ

BESD-BİR, provides approximately 91% of Turkey's total production of poultry meat, broiler hatching egg and day old broiler chick and represents the poultry sector on highest level.

The objective of the Association is to develop the poultry meat industry and to create values that would contribute to the establishments, to represent the sector most correctly and to establish the required communication between the government and the sector. 29 companies are the members of BESD-BİR. BESD-BİR cooperates with all stakeholders for the development of the sector.

Please visit the web site, http://www.besd-bir.org/ to have detailed information about Turkish Poultry Meat Producers and Breeders Association and send e-mail to besd-bir@besd-bir.org address for any of yours remarks, comments and questions.

BESD-BİR
BEYAZ ET SANAYİCİLERİ VE DAMIZLIKÇILARI BİRLİĞİ DERNEĞİ

OUR MEMBERS

Banvit, şenpiliç, beypiliç, erpiliç, Lezita, Keskinoğlu, HasTavuk, Gedik piliç, CP, EGE TAV, Bakpi, Bupiliç, Lades, doyum piliç, aspiliç, Alphin, Aviagen Anadolu, ak piliç, ROSS ANKARA, şahin, KÖYTÜR PİLİÇ, Bolca, PINAR, TAD, BaHaR GRUP, Cobb, ÖZTAVUK, Çamlı, ROSS HAYMANA

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Healthy Chicken Information Platform (STBP)

Healthy Chicken Information Platform has been established in 2005 by the leading companies of the sector that realize 85% of poultry meat production of our country. The objective of the platform is to raise awareness of consumers and the society related with healthy poultry meat production and consumption, to emphasize the importance of poultry meat with regard to healthy diet and eliminate perception pollution and infollution due to unscientific arguments. Final target of the Platform is combine this value that has a significant role in healthy diet with the protein source and to contribute to raising enlightened, healthy, successful and happy generations.

Please visit the web site, http://www.sagliklitavuk.org/ to have detailed information about Healthy Chicken Information Platform and send e-mail to info@sagliklitavuk.org address for any of your remarks, comments and questions.

Wish you days full of health and with "chickens".

MEMBERS OF STBP

Banvit, Şenpiliç, Beypiliç, Erpiliç, Keskinoğlu, Lezita, CP, Gedik Piliç

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Welcome

Organisation and Committees

Program & Contents

Organization and Committees

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Dear Stakeholders of Poultry Meat Industry, Dear Friends

First three of the International Poultry Meat Congress which is traditionally organised by Turkish Poultry Meat Producers and Breeders Association (BESD-BİR) in each two years has realized in 2011,2013 and 2015 spring in Antalya with increased participation and success.

The quality of the third congress has successfully reached to the international standards with it's high quality content including 52 poster presentations, 22 short presentations, 36 invited papers presented by scientists from our country and 9 different countries in 19 scientific session distributed into 3 different meeting room. We have hosted total 1573 participants including family members and, approximately 1040 active national and come from 26 countries international participants in the third congress which has significant mission for our industry to extend and share the science and technology, and also strong integration to the world.

Turkish poultry meat industry grew up around 90% in a very short period, from 1.1 million tons poultry meat in 2007 to 2.1 million tons in year 2016. This huge growth made an incredible increase in our export by 550% , from 52 thousand tons to about 337 thousand tons for that short period. So it is clear that Turkish Poultry Meat Industry makes valuable contribution to supply healthy, enough and safe foods for humans not just live in Turkey, but also live in other foreign countries.

As a representative of Turkish Poultry Industry which has become the world's 8th largest poultry producers, we together with organising and scientific committees are proud of being accomplished a higher quality congress as worthy of our country in April 2017. Including 24 invited by distinguished scientists and 45 short oral presentation, total 133 presentation during the congress were presented related to poultry meat production from farm to fork including all disciplines. The total participant forf the congress were 1700 from 30 different countries from all around the world. The main theme of the 4th congress was new devolopments, challanges, strategies for future considerations, safe poultry meat , sustainability besides importance of poultry meat for human nutrition and supplying enough and healthy meat for consumers.

We really look forward to welcoming you to 5th International Poultry Meat Congress which will be held in beautiful Antalya from April 2019 to obtain more and more benefits for humanity with science and industry hand in hand by discussing the innovations and changes of poultry meat production in most comprehensive way with participation of leading scientists and experts. Many thanks to all those who contribute and join us for making the congress possible.

With our best wishes to you all..

Dr. Sait KOCA **President of BESD-BİR**	Prof. Dr. Necmettin CEYLAN **Chair of the Congress**

INVITED AND ORAL PRESENTATIONS

IS[01] Important Aspects of Sustainable Broiler Production to Keep Safe the Industry

Anne-Marie Neeteson, Santiago Avendaño, Magnus Swalander
Aviagen Group

Introduction

Poultry meat is an important, healthy, affordable source of protein. It accounts for 35% of global meat consumption, after pork (36%) (1). Half of the increase in total meat production within the next decade will be captured by poultry meat and will be located mostly in developing countries (1, 2). The human population is expected to grow to nine billion people by 2050, with people in the upcoming economies adding significant animal product to their diets, resulting in a demand-driven livestock revolution (3, 4).

There are a number of factors affecting the availability of resources for global production of food for human consumption:

Firstly, population and agricultural land (including pasture) are not equally divided across the globe: compared with relative scarcity of agricultural land in Europe and Asia (0.6 and 0.4 ha/person respectively), North and Latin America have agricultural land per capita: 1.4 and 1.2 ha/person (5). If there is no alteration in available land, Africa, with a fast growing population, will change from 1.1 ha/person in 2011 to 0.5 in 2050. Globally, the area for producing food per person will decrease from 0.7 to 0.5 ha/person (Figure 1). Furthermore, sustainable water supplies are one of humanity's most critical resource needs (6) – the available amount of freshwater is 24,776 m³ (cu m)/inhabitant/year (5).

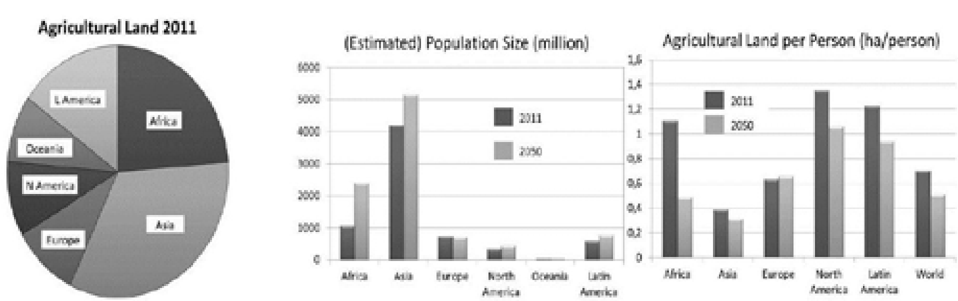

Figure 1. Population and agricultural land in the regions of the world

Left. Agricultural land 2011. Middle. Populations 2011 and 2050. Right. Agricultural land per person. Assuming available land will not change, 2011 areas are divided by 2050 population projections. (5, 7).

Secondly, increasing populations and growing economies will increase competition for available resources between feed, food, fibre and fuel production (6). For example, for the European Union (EU) to produce 5.75% of its fuel as biofuel (not achieved goal for 2010), it would need 13-15% of the its agricultural area. Goals for 2015 and 2030 were/are 8% and 25%, respectively (8, 9).

Thirdly, with societies becoming more affluent people are tending to eat more animal protein, starting with poultry, and this trend is expected to continue. Generally, meat consumption patterns are shifting towards poultry, as is indicated in the opening paragraph. Some policy makers (e.g. UNEP, 2012) call for moderation of meat consumption, but globally an increase is likely to precede any possible decline in animal protein consumption.

Fourthly, climate change will increase insecurity in harvesting and food availability. Food security in the widest sense will become more of an issue, with problems in volatility of feed prices and food availability. This will have most impact on less wealthy regions and people. (7)

This paper will focus on the aspects of sustainability of poultry production, and in particular how breeding contributes to increase the sustainability of poultry production, through targeted improvements in efficiency, health and welfare.

Sustainability

Sustainability, as defined in the Brundtland report (10), p.15, is "meeting the needs of the present without compromising the ability of future generations to meet their own needs". The United Nations General Assembly (2005) has adopted a resolution indicating the three major aspects of sustainability to be environment, society and economy. Since then, these categories are commonly used as the pillars of sustainability, e.g. http://www.un.org/en/ga/president/65/issues/sustdev.shtml or http://en.aviagen.com/social-responsibility/.

Environmental impact

The first sustainability pillar to address is the environment, i.e. the environmental impact of (animal) food production. In this section, the environmental impact of poultry production will be addressed in the following contexts: i. livestock production broadly; ii. different poultry production systems; iii. genetic improvement and expression of the genetic potential in the field.

Life cycle assessment (LCA) is a methodology for calculating the lifetime environmental impact of a product or service, i.e. the environmental impacts associated with all the stages of a product's **life** from cradle to grave. During the 1970s and '80s, many approaches to reducing environmental impact emerged, but they included one stage of the process. In the late 1980s, life-cycle assessment was developed as tools to better understand the risks, opportunities and trade-offs of product systems and of the nature of environmental impacts.

Environmental impact of poultry

An early study to work out a life-cycle-assessment system model for agricultural and horticultural production was made by Adrian Williams and colleagues (11, Figure 2).

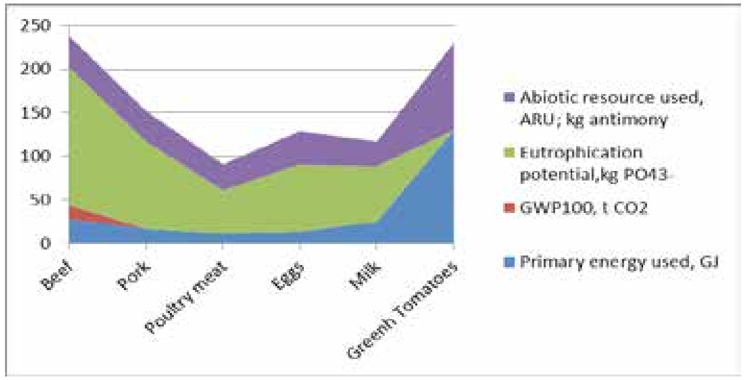

Figure 2. Environmental Impacts and Resources Used of various UK Production Systems
Meats / t of carcass, / 20,000 eggs (~ 1 t) / 10m³ milk. GWP=Global Warming Potential; ARU = Scale related to scarcety of resources.
(After: Williams *et al*., 2006. DEFRA Project Report ISO 205).

Williams *et al.(11)* show that poultry has a low environmental impact compared to other livestock systems. In their study, the global warming potential (GWP, in kg CO_2 equivalent) of beef, milk, sheep meat, pork, poultry meat and eggs is 16, 10.6, 17, 5.5 and 4.6 respectively. The primary energy use (GJ) is 28, 25, 23, 17, 12 and 14 respectively. Eutrophication potential (kg PO_4^{3-}) is 158, 64, 200, 100, 49 and 77. The acidification potential (kg SO_2) of the respective systems is calculated as 471, 163, 380, 394, 173 and 306. The abiotic resource use (kg antimony; a scale related to scarcity of resources) turns out to be 36, 28, 27, 35, 30 and 38.

Environmental impact of systems

The environmental impact of various poultry production systems has been calculated by Williams *et al*. (11) and by Leinonen *et al.* (12, Figure 3). The comparisons of conventional, free range and organic broiler systems by Leinonen *et al.* (12) show important environmental advantages for conventional over free range and organic broiler systems for primary energy used, global warming potential, eutrophication and acidification potential, abiotic resource use and land use.

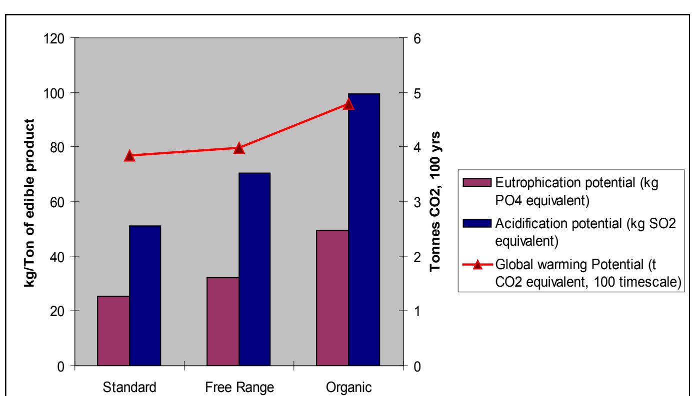

Figure 3. Environmental Impact of Three Alternative Broiler Production Systems.
Pollutants/Ton edible product. Global warming potential to 100 yrs**.** (After: Leinonen *et al.*, 2012).

Animal breeding and expression of genetic potential

The impact of animal breeding to reduce nitrogen and methane emissions from livestock based food chains have been laid out in a DEFRA study by Jones for Genesis Faraday Partnership (13), estimating that environmental impact improvement could be achieved mainly by improving FCR and growth rate in broilers. The review and modelling study revealed that more data were required to come to precise estimations.

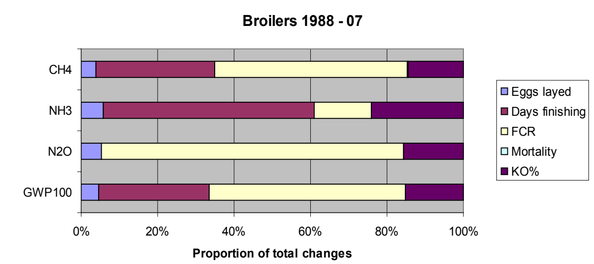

Figure 4. Drivers for Improvement of Environmental Impact via Animal Breeding.
Left: Broilers; FCR = Feed Conversion Ratio. (After Genesis Faraday Partnership, 2008. Defra Project Report AC204).

The impact of genetic change in broilers on environmental footprint has been quantified recently. Leinonen *et al.* (14) predicted the potential effects of 15yr prospective broiler breeding on the environmental impacts of a standard UK broiler production system. The scenario included changes in the traits of growth rate (reducing the time to reach a target weight 2.05 kg from 34 d to 27 d), body lipid content, carcass yield, liveability and chick output. The authors found predicted changes in biological performance due to selective breeding could lead to reduced environmental impacts of the broiler production in terms of Eutrophication Potential (12%), Acidification Potential (10%) and Abiotic Resource Use (9%) and Global Warming Potential (9%).

Global comparability

The various ways of calculating the LCA components across the world, across species and across feed sources developed over time were not fully comparable, with the methods being slightly different. A stakeholder group of industry associations, scientists and non-governmental organizations, with the secretariat provided by FAO, is addressing the global comparability of the various LCA methods in the LEAP (Livestock Environmental Assessment and Performance, 2010 - 2015) and LEAP + (2016 onwards) Partnership (http://www.fao.org/partnerships/leap/en/). LCA specialists from across the world have developed detailed joint guidelines to calculate LCA for feed, ruminants, poultry and pork. Close involvement of the international poultry associations with professional input and funding, has ensured the poultry LEAP guidelines (Version 1, LEAP, 15) to be based on detailed direct poultry sector knowledge. The LEAP+ project will amongst others develop LCA guidelines for water usage and road test the Version 1 guidelines in various countries and/or systems. The LEAP Feed guidelines (Version 1, LEAP, 16) are supplemented by a global feed database hosted by the virtual Global Feed LCA Institute (http://www.ifif.org/pages/t/Global+Feed+LCA+Institute+(GFLI). The land use change as from 1990 is included in the LCA system. Discussions on the inclusion of land use change are ongoing with questions like 'do economies that stop using new land for agriculture deserve to be rewarded for that in LCA?'

The expression of genetic potential in the field, will ultimately determine the real improvements made in land for feed requirements as well as requirements for e.g. water, buildings, and equipment. "The food-feed-fuel competition makes arable land an increasingly scarce resource. Improvement of livestock feed efficiency alleviates this, as can be illustrated by a broiler chicken example: The 2010 global consumption of chicken meat was 86.5 million tons (2012 data from FAOSTAT, undated), equivalent to 123.6 million tons body weight. The feed conversion ratio (FCR) converts this into the required amount of feed; our conservative estimate of the global commercial field *improvement* in FCR is -0.015 kg/kg each year, equivalent to a cumulative annual savings of 0.015 x 123.6 = 1.85 million tons of feed. The main chicken meat producing countries realized a 2010 harvest of 466 tons of wheat per km^2 (2012 data from FAOSTAT, undated), so the above FCR improvement frees up 1.85 million/466 = about 4000 km^2 of arable land, an area 1.5 times the size of Luxemburg or 3.3 times the size of New York City. This is a cumulative figure, realized every year" (17).

Similar land for feed improvements can be estimated for regions or countries.

Waste

Big efficiency improvements can also be made via the reduction of waste and losses along the food chain, including waste on the farm, during transport, and by retail, restaurants and consumers at home. At the global level, 10–40% of agricultural production is wasted as well as one third of food for human consumption (6). Of the food losses, 40% is found after harvest and during processing in developing countries, and in industrialized countries this is 40% at the retail and consumer level (18). Also, using or quantifying by-product usage of human foods as feed would contribute to a better poultry footprint. Unfortunately, many biofuel by-products (from grain, sugar beet) are not very useable as poultry feed, but some plant oil by-products (from soya and cole/rape seed) can be usefully included (8).

Societal aspects: human and animal

"Poultry production affects the animals that are farmed, the farmers managing the birds and the people providing support and processing, the organizations marketing the animals and products, and the consumers who eat poultry meat and eggs. The animals should be looked after with care, knowledge and skill. The people managing poultry production perform a role in society of providing food, and are due a reasonable income from that. The members of society who consume poultry products want a safe and secure supply. Additionally, also people not eating poultry products have opinions about poultry production" (7).

Human health and food safety

Poultry products are a healthy, affordable, lean source of protein. According to the Frequently Asked Questions section of the Second International Conference on Nutrition (ICN2, organized in 2014 by FAO and World Health Organization) 'animal foods are good sources of high-quality protein and vitamins and minerals such as iron and zinc, which are especially important for children and lactating mothers. Increasing access to affordable animal-source foods could significantly improve many people's nutritional status and health" and "excess consumption of high fat-containing meat is associated with heart disease and other non-communicable diseases" (http://www.fao.org/about/meetings/icn2/faq/en/). Poultry meats, for instance "a 3-ounce serving of boneless, skinless turkey breast contains 26 grams

of protein, 1 gram of fat and 0 grams of saturated fat" (http://www.eatturkey.com/consumer/healthyeating) and fulfil the requirements of a healthy protein source.

An indispensable requirement of food is that it is safe for the consumer, e.g. without pathogens or other substances that can influence their health negatively. Food health and safety standards and certificates play an increasingly important role. However, any food scandal will impact negatively on the whole food production sector – therefore, efforts on improving trust can never be seen in isolation.

Food security

As mentioned above, environmental impact analysis shows that poultry products are a very environmentally friendly source of animal protein, with the possibility of further improving its impact.

The role of sustainable poultry and pig breeding for food security is described in Animal Frontiers (17). Pig and poultry breeding goals, according to animal breeding experts worldwide, have broadened much over time and are expected to broaden further (Figure 5). Poultry breeding should further "broaden in a balanced way, focusing on productivity and efficiency, subject to constraints due to feed availability, environmental load, and animal welfare as well as to possible restrictions due to genotype by environment interaction (G x E), antagonisms between traits and selection limits." Breeding companies address GxE by selecting animals in high health environments using information of close relatives in challenging environments, and by providing technical support (both in a wide range of media and in person) to optimize the expression of genetic potential. The radial plots in Figure 5 show how breeding goals have changed from being mostly unidimensional during the 1950's with production being the main driver, to a currently multi-dimensional breeding goal where a wide range of aspects are included in the breeding goal.

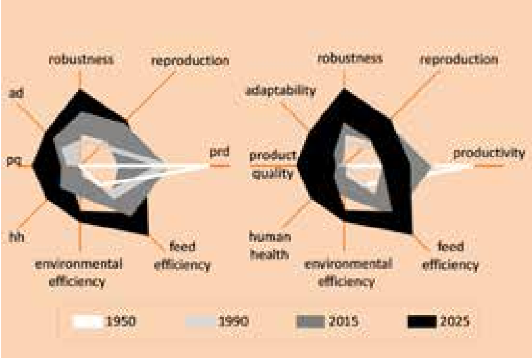

Figure 5. Time trends in the relative importance of elements of pig and poultry breeding goals**.** Inquiry amongst global animal breeding experts. (After: Neeteson-van Nieuwenhoven *et al.*, 2013).

Antagonisms between performance and reproduction or health traits are addressed via careful selection of birds which perform well on many traits simultaneously. "Given large enough breeding populations, high selection intensities, proper statistical methodology, and proper data-recording structure, this will maintain a desired balance". Figure 6 shows the real genetic improvement over time of two antagonistic traits: growth rate and leg strength in the Aviagen broiler breeding programme from 1996-2012. See also the paper on this subject by Kapell *et al.*

(19). The modern poultry breeding programme realizes this simultaneous improvement/maintenance of traits/strengths over time for tens of traits.

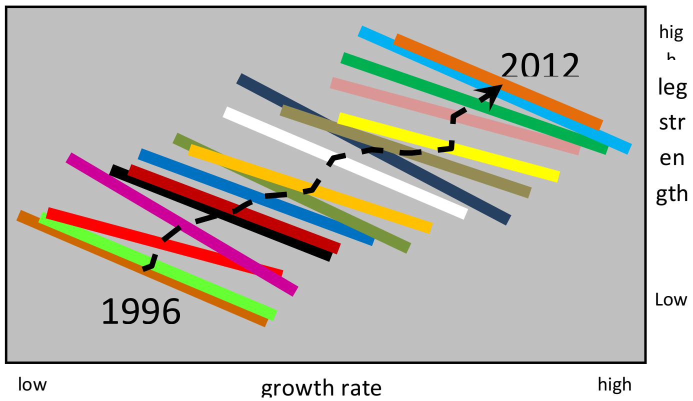

Figure 6. Genetic trend (black broken line) in growth rate and leg strength in a broiler chicken line**.**
(After: Neeteson-van Nieuwenhoven *et al.*, 2013)

This trend of broadening the breeding programme with simultaneous improvements of robustness, health, welfare, environmental impact and performance has been applied for decades in Aviagen and will continue.

Selection limits are not in sight. The evidence is that little genetic variation has been lost and such rates are indeed sustainable in the future (20).

Animal health and welfare

Farm animal welfare is a major item in the public debate. People do not all have the same concept of animal welfare, and in addition to physical aspects, many people put more emphasis on mental aspects and on naturalness (21). Animal welfare groups and members of the public express concern not only about the physical welfare of birds, but also about mental welfare and the degree of naturalness of conditions in which they are kept (22).

According to Marian Stamp Dawkins (professor of animal behavior, Oxford University, UK, 2012), it is dangerous to determine animal welfare in terms of anthropomorphism, "to think you should just open your hearths, and that you do not need any evidence about animal consciousness – just use your kind of intuition, as is often felt by people who are not scientists. If you look at free-range chickens, the mortality rates are much higher than they are inside or in cages. That surprises a lot of people, but it's an important piece of evidence, before you actually start evaluating the welfare of the animals. For example, being outside in cold English winter really isn't necessarily better for an animal's welfare than being warm and comfortable inside. We're very misled by these different words." Also, "a lot of people think that good welfare is when animals are allowed to perform natural behavior, and you can judge welfare by how natural it is. … Animals in the wild are regularly chased by predators, and that would be natural" (23). She indicates we are ignorant about consciousness – it is better to face this than to pretend we have solved what is consciousness and use that as a basis for animal welfare. "There's a lot of new legislation about animal welfare. Unfortunately, a lot of it is

not evidence-based." Stamp Dawkins defines animal welfare as animals that are healthy and have what they want. In investigating animal welfare, scientists must then work with the people who keep the animals, and with large scale production. "If you want to really do research on farm animal welfare that's going to really make a difference, you have to work with the people who keep the animals. You have to work with the producers. You have to get them on-board. They [can] see all the reasons for doing this. They wanted to know the answer…. The way to get animal welfare forward is to work with the actual producers, front-line. Not small-scale and then transfer it upwards. … That's the way to have impact—much more than try to criticize them." One of her researches in broilers, involving 70% of the UK broiler industry, shows that not stocking density is a key factor in lameness and mortality, but management factors like good litter, good air and good quality of environment. Another well-known animal welfare professor, Temple Grandin, also emphasizes that it is important for animal welfare to take account of what the animal shows us, and to take care that human perception of animal welfare is not taking over.

In line with this, FAWC (24) has outlined the Five Freedoms [freedom from hunger and thirst, from discomfort, from pain, injury or disease, from fear and distress, and freedom to express natural behavior] as "ideal states rather than standards for acceptable welfare" and to achieve these "stockmanship, plus the training and supervision necessary to achieve required standards, are key factors in the handling and care of livestock". FAWC (2007) has also defined the Three Essentials of Stockmanship [knowledge of animal husbandry, skills in animal husbandry, and personal qualities of affinity and empathy with animals, dedication and patience]: good tailored stockmanship to arrive as close to the ideal state of the Five Freedoms as possible. Similarly, the National Chicken Council recognizes the importance of professional knowledge, as well as scientific proof in its broiler and broiler breeder welfare guidelines (25, 26).

For the bird's welfare, it is best if there is a complete match between the welfare it experiences, and the perception of welfare by the consumer and the citizen. That should be the major drive for all parties to close possible gaps between welfare perception by humans and the welfare birds can perceive.

Transparency and communication

Poultry is a 'new meat'. It has grown in importance relatively recently. "Modern poultry production systems emerged in the late nineteenth century in Europe and America as breeders focused on improving meat and egg production, and it has subsequently spread across the globe" (15). However, "while agriculture in general has not been very successful in having a dialogue with society, particularly poultry, other agricultural sectors, in originally richer regions, have easier and stronger links to the influential circles of society." (7). There is a gap between perception of poultry by citizens and by consumers.

Transparency and communication about poultry are important. "In being transparent about animal food production in a pro-active and honest way while engaging in continuous welfare improvement, [the poultry sector] can play an important role to close the gap between welfare perception and welfare of the animal itself" (17).

"The players in the poultry sector, including the poultry associations, have been increasing their efforts towards transparency and dialogue with society during recent years. Although biosecurity is important, at local and national levels initiatives are frequently set up to ´open the doors,´

such as the Open Days organized by the Science and Information Centre for Sustainable Poultry Production of Vechta University (Germany), production of ´learning kits´ for schools, showing video clips on farming, and explaining poultry production via websites" (7), e.g. http://www.chicken.org.au/. The International Poultry Council (representing more than 90% of world broiler production) now employs activities on welfare and health, environment and sustainability, and communication.

Economy

An intrinsic part of the sustainability of poultry is its viability in economic terms. We will address the business prospects of poultry, the role of poultry for viability of regions, and the contributions of environment, health and welfare to performance and economy.

Business prospects of poultry

For poultry to be economically sustainable, it is important that there is demand for poultry, and that people working with poultry are able to get an income from this. "Production [of poultry meat] will increase by 17 % within the next decade, mostly in developing countries" (2). Rabobank reports the poultry economic growth to be 3.4 % in 2014, 3.1 % in 2015 (estimation) and forecasts 3.6% in 2016 (Rabobank, IMF Economic Outlook, January 2016, 27).

"Relative stability in feed prices combined with short production cycles allows poultry meat to improve in profitability and respond rapidly to demand changes. … Production is expected to grow especially in regions where feed is available and used intensively. Half of the increase in total meat production within the next decade will be captured by poultry meat and will be located mostly in developing countries, with an additional 26 million tons of poultry meat produced globally [per annum] between now and 2024. Better feed conversion ratios together with improved meat-to-feed price margins will also contribute to production growth" (2).

Performance and sustainability

The economy of poultry production is an intrinsic and not a contradictory part of its sustainability. Better FCR is good for the environmental impact of poultry production ànd for its economic strength. If money is spent to obtain chicks or poults, and feed, water, energy, buildings and manpower are used to raise the birds, then losses to disease or mortality will be impacting health, welfare, environmental impact ànd the economy negatively.

Poultry will develop further, and new people who have not yet managed birds, will enter poultry production. Gradually, and increasingly, they will improve skills to fine-tune management to the birds, the specific environment (climate, feed, water availability) and the markets.

Bird populations will change as breeding companies will continue to broaden and improve a balanced range of traits. In addition to regular markets, specialty markets will develop with different emphases like antibiotic 'free' or typical market schemes which can obtain higher price margins, like organic, and specific breeds coupled with tailor-made management programs. It is expected there will be a growing demand for specialty products. "It is important that specialty products are not marketed in a way that is detrimental to the image of conventional poultry meat and eggs, as the safety, environmental impact and the health and welfare of the birds producing the latter have much improved over time" (7).

There are ample opportunities in poultry production. Sustainability can and should go hand in hand with production, and vice versa. There does not need to be a contradiction.

Acknowledgements

Chris Renzelman for global 30 year field FCR improvement calculations. Dagmar Kapell for the 1996-2012 leg strength and growth rate genetic trend.

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IS[02] Genetic and Breeding Aspects of Meat Yield and Meat Quality

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Early history of breeding chickens for meat production

Since domestication, chickens were reared mainly for egg production, and their meat was a secondary product, due to other meat sources (cattle, sheep and goat, pork, etc.) During 1940's, chicken meat became more popular in North America and Europe. Mechanized processing and cold-chain shipping and marketing were developed. With the increasing demand for chicken meat in the developed countries, efficient meat production became an important breeding objective.

Efficiency of chicken meat production

Efficiency is improved by reduction of costs per unit of product (meat).

Total production costs of broiler meat consists of four main components:

1. Chicks' costs: reproductive performance (more chicks per breeder hen)

2. Rearing costs: fast growth (more flocks per year with same facility and labor)

3. Feed costs: fast growth & lean/meaty body for better FCR (feed conversion ratio)

4. Processing costs: high slaughter weight & meat yield (lower costs per product weight)

The traits affecting these cost factors have genetic background, and their breeding contributes to reducing production costs and improve efficiency

Chicks' costs are determined mainly by the reproductive performance of broilers' parent stocks
In the1940's, breeders started to select for high growth rate (heaviest individuals) in relatively heavy-body dual-purpose chicken breeds (mainly Plymouth Rock). The elevation in growth rate reduced egg production (less chicks per hen) due to negative correlation (genetic and non-genetic) between these traits. The selection's negative effects on reproduction have been partially relieved by restricted feeding and by separate feeding of the males in breeder flocks, yet meat-type breeder hens lay far less eggs than egg-type hens

In order to further improve the reproduction of day-old chicks for efficient meat production, a 3-way cross of specialized maternal and paternal breeds is used since 1950's. The mothers (breeder hens) are hybrid females expressing heterosis in egg production; they are progeny of a cross between two genetically different Plymouth Rock breeds. Cornish-type males from breeds with high potential for meat production are the fathers of commercial meat-type chicks. Due to the relative low number of males in breeder flocks (only 1 male per 10 females), the effect of their higher cost (due to the stock's poor egg production) is negligible.

Breeding to improve the efficiency of feed utilization

Feed accounts for 60-70% of total production costs chicken meat; therefore, it is highly desired to improve the feed conversion ratio (FCR = Total feed consumption divided by Body weight gain). The total feed consumption, from hatch to marketing, consists of two components, feed for growth and feed for body maintenance.

Feed consumption for growth is reduced by breeding for more meat and less fat because nutrients deposition in muscles is 4-times more effective than deposition in fat tissues. It is son because water content is ~80% in muscles and only ~20% in fat tissues. Therefore, when 1 gr feed's dry matter is deposited in muscles, add 5 gr body weight (1 gr dry matter + 4 gr water), whereas 1 gr feed's dry matter is deposited in fat tissue, add only 1¼ gr body weight (1 gr dry matter + ¼ gr water).

Feed consumption for maintenance is reduced by breeding for lower activity (docile broilers), but mainly by breeding for more rapid growth. More rapid growth, by decreasing the number of days to marketing weight, is reducing 'life-time' amount of feed consumed for body maintenance, and consequently is improving overall FCR.

The improvement in FCR from the 1980's (~2.5 i.e. 5kg feed to 2kg BW) to the current levels (~1.5 i.e. 3kg feed to 2kg BW) reduced total feed consumption by 40%. With feed accounting for about 65-70% of total broiler production cost, the better FCR improves the latter by 25-30%.

Breeding for higher breast meat yield:

The increasing demand for breast meat led to a very successful selection for higher breast meat yield, rising from ~13% of BW around the 1980's, up to ~25% in recent years. This dramatic elevation in breast meat yield, and in overall carcass yield, contributed to improved overall efficiency of broiler meat production, also by improving FCR and reducing relative processing costs. Additionally, the change in breast shape eliminated the phenomenon of breast blisters that was, until the 1990's, a major cause of reduced quality of broiler carcasses and breast-meat. On the other hand, rapidly growing large breast muscles appear to lead (in some broilers) to myopathies (white strips, woody breast, etc.), possibly due to insufficient supply of oxygen and nutrients to the expanding breast muscles. If the tendency to develop these myopathies has a genetic background, its incidence can be expected to be reduced by breeding – as in the cases of leg problems, excessive fatness and ascites.

Along with the continuous improvement in the genetic potential for high breast meat yield and quality, the materialization of this potential is increasingly susceptible to suboptimal conditions, especially heat. It is so because the higher body weight (BW), growth rate, and meat yield of fast-growing broilers are driven by higher rate of feed intake (more feed per day) and higher metabolism. Consequently, modern broilers generate more internal heat, and they must dissipate its excess in order to maintain normal body temperature. Under hot conditions, heat dissipation rate of broilers with body weights above ~1.5 kg is too low to allow them to consume feed as their counterparts under temperate conditions. Thus, modern broilers adapt to chronic hot conditions by reducing the rate of feed intake. This, in turn, reduces internal heat production and lethal elevation in body temperature is avoided. Consequently, mortality is not a major issue in flocks reared under hot chronic hot conditions, but their performance is compromised because by depressing feed intake, hot conditions reduce growth rate and therefore extend the rearing period. Moreover, because the breast muscle are non-functional, their growth has the "lowest priority" when feed intake is reduced, and therefore their growth is depressed more than the growth of all other body parts and organs. Therefore, hot conditions significantly reduce breast meat yield and its quality.

Due to their increasing susceptibility to hot conditions, modern broilers need lower ambient temperatures in order to fully express their improved genetic potential for rapid growth and for high meat yield. Presently, broiler houses need costly forced ventilation and cooling in most regions and seasons, to avoid (or reduce) the negative effects of hot conditions.

Genetics and breeding for heat tolerance enhance breast meat yield and quality:

Realizing that hot conditions are the main factor that negatively affect breast meat yield and quality, we studied these parameters in broiler genotypes differing in their susceptibility to heat due to different levels of feather coverage. Results from studies under experimental hot conditions and in hot climates (in Israel, Turkey, Egypt, Vietnam) indicated positive effects of the ***naked neck*** phenotype, but with only partial alleviation of heat stress (Cahaner et al., 1993, Cahaner, 2008). Consequently, we hypothesized that entirely naked body can fully alleviate heat stress, and may allow fast-growing broilers to acquire real heat resistance, with no reduction in growth, and in yield and quality of breast meat.

The option of entirely naked (**featherless**) chickens was available since 1954, when the spontaneous mutation called ***Scaleless*** was found in a population of New Hampshire chickens in the University of California at Davis (Abbott and Asmundson, 1957). The *scaleless* mutation is fully recessive (i.e., only homozygous ***sc/sc*** are featherless). The development of a new experimental population of featherless broilers was initiated at the Hebrew University's Faculty of Agriculture (Rehovot, Israel) in 2002. Males from the original New Hampshire *scaleless* line (*sc/sc*) were mated with females from contemporary fast-growing broiler stocks and the *+/sc* male progeny were repeatedly backcrossed to females from contemporary broiler stocks (Cahaner, 2008). Already after one cycle of backcross, the featherless birds were markedly superior to their fully feathered and *naked neck* sibs under hot conditions (Cahaner et al., 2008). After two additional cycles of backcross, growth rate and BW of the featherless broilers and their feathered sibs were further elevated yet considerably lower than those of contemporary commercial broilers under normal (comfortable) conditions (Azoulay et al., 2011). Under hot conditions in both studies, only the featherless broilers maintained normal body temperature, and consequently their mean growth rate and final BW were not depressed by heat, in contrast to the means of their feathered sibs and the contemporary commercial broilers (Azoulay et al., 2011).

Two early studies suggested that breast meat yield increases as feather coverage decreases (Cahaner et al., 1987, 1993). In agreement with this finding, breast meat yield of featherless birds was much greater than that of their feathered counterparts and contemporary broilers, mainly under hot conditions but also under normal conditions (Cahaner et al., 2008; Azoulay et al., 2011). Results from Cahaner et al. (2008) also suggested that greater oxygen-carrying capacity (larger hearts and higher hematocrit levels) contributes to the greater breast meat yield in featherless broilers.

In the studies of Hadad et al. (2014a,b), the following hypotheses were tested: (1) lack of feathers contributes to higher breast muscle yield and better meat quality, particularly when broilers are reared under hot conditions, and (2) these differences are due, at least in part, to higher cardiovascular capacity. The parameters growth rate, BW, breast muscles yield, body temperatures, cardiovascular parameters, and two main meat-quality parameters (color and "water-holding capacity"), were evaluated in featherless broilers and in their feathered sibs, as well as in contemporary commercial broilers, reared together under comfortable conditions versus hot conditions in several trials.

In all trials, the superior genetic background of the contemporary broilers was manifested under the control (comfortable) conditions; their mean BW was about 15% higher than the means of the featherless broilers and their feathered sibs. The hot conditions depressed BW of the two groups of broiler with feathers by approximately 25%, with hardly any effect on the BW of the featherless broilers. Breast meat yield (% of BW) in the featherless broilers was higher than in the feathered broilers (those with feathers), especially under the hot conditions. Furthermore, the featherless broilers were characterized by superior meat quality as indicated by lower drip loss, lower lightness and higher redness. The superior meat quality of the featherless broilers could be explained by their larger hearts and higher hematocrit values, suggesting superior cardiovascular capacity to supply oxygen and nutrients to the breast muscles.

Summary and Conclusions

The continuous genetic increase in growth rate of commercial broilers, with the subsequent reduction in number of days to marketing body weight and better FCR, has been the major drive for more efficient production of poultry meat. The counter reduction in reproductive performance of broiler mother was the main negative response, and it was partially alleviated by using hybrid mothers and crossing them to specialized high-yield paternal lines. Other negative phenomena (e.g. leg problems, excessive fatness, ascites) were found to be heritable and countered by the primary breeding companies.

Following the elevating demand for breast meat, its yield in commercial broilers has been continuously increasing, from ~10% in the 1960's to ~25% in contemporary broilers, in direct response to selection on body conformation and indirect response to the selection for better FCR. However, modern broilers do not fully express their higher potential for breast meat yield when reared under hot conditions, whereas their featherless counterparts, that continue to eat and grow under hot conditions, also maintained high breast meat yield. Also, meat quality in featherless broilers was superior – better colors and water-holding capacity – apparently due to better vascularization in the breast muscles. These results suggest that broiler meat yield and quality in hot regions and climates can be improved by introducing the featherless gene into contemporary commercial broiler stocks. Such introduction has become feasible since the recent development of a simple DNA test (Wells et al., 2012) to identify carriers of the recessive ***sc*** mutation.

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O01 Interaction Between Egg Storage Duration and Brooding Temperatures in Broilers

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Abstract

This study was conducted to test the hypothesis that chicks from longer egg storage durations would need higher brooding temperatures. Chicks were obtained from eggs stored for 3 or 14 days and exposed to optimum or higher brooding temperatures. Longer egg storage duration decreased chick weight and PepT1 (peptid transporter 1) and SGLT1 (sodium glucose linked transporter 1) expression at day of hatch. The results showed that chicks from eggs stored for 3 days did not require higher brooding temperatures. Higher brooding temperatures increased body weight of chicks from eggs stored for 14 days. This result associated with their villus height and crypt depth at 14 days. SGLT1 expression was found higher in chicks exposed to higher brooding temperatures regardless of egg storage duration at day 14. This result probably be due to increased glucose concentration in the intestinal lumen and organism in chicks exposed to higher brooding temperatures. These results suggested that in case of longer egg storage duration, higher brooding temperatures than optimum may be beneficial to give them a good start.

O02 The Effect of Hatching Time, Feed Access Time, and Post-Hatch Holding Time on Broiler Live Performance

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Abstract

This study was conducted to determine of the effects of broiler chick hatching time, immediate or delayed feed access (IFA or DFA), and post-hatching holding on subsequent broiler live performance. Hatching eggs from commercial flocks at 55 and 49 wk of age in experiments 1 and 2, respectively, were stored for 2 d at 18°C and 70% RH. Hatching was divided into Early hatch of 471-474 h, Middle hatch of 483-486 h, and Late hatch of 493-496 h. Half of the chicks were pulled at each hatch time and were weighed and transferred to pens to eat and drink (IFA) within 3 h. Remaining chicks were pulled at 510 or 504 h of incubation and held for 8 or 3 h before being placed in pens in experiments 1 and 2, respectively. Feed access time differences between IFA and DFA for Early, Middle, and Late chicks were 41, 29, and 19 h, respectively, in experiment1. In experiment 2 DFA Early, Middle, and Late chicks had 30, 18, and 8 h of no feed access after hatch, respectively. Feed consumption and BW was recorded at 7 and 35 d of age. Chicks in IFA groups were weighed either at the same time as DFA groups to determine the effect of early feeding or at the same age relative to placement on feed and water to evaluate the effect of post-hatch holding. BW were greater at placement in Late chicks compared to Early chicks in DFA groups in both experiments but this advantage disappeared at 7, and no significant difference was found any hatch time group at 35 d. The IFA chicks were initially heavier ($P<0.05$) than DFA chicks, which was maintained to 35 d in experiment 1 but not in experiment 2. DFA chicks consumed less feed ($P<0.05$) to 35 d compared with IFA chicks in experiment 1 but not in experiment 2. When chicks and feed were weighed relative to actual time on feed, chick BW was greater at 0 d in IFA than DFA groups chicks ($P<0.05$). On the contrary, BW of groups were similar at 35 d in both experiments. These results shown that effects of immediate feed access on broiler live performance was changed by hatch time and duration from hatchery to farm. Additionally, holding chicks in the hatcher for up to 41 h after hatching did not appear to necessarily negatively influence live performance.

Keywords: Hatching time, feed access time, post-hatch holding, body weight, feed consumption

O03 Some Performance Traits of Meat Type Chicken Parents Lines and Possibilities of Obtaining Heterosis

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Abstract

This study was conducted to execute some production traits of material of developing meat chicken parents project in our country. The experiment was conducted in Poultry Unit of Eskişehir Geçit Kuşağı Agricultural Research Institute. Egg production traits and broiler performance of 2 sire and 3 dam lines which were obtained from a breeding company in 2015 were given in the study. Also, heterosis levels in live weight and carcass parts (breast and thigh) of offspring obtained from the mating between dam and sire lines were determined. Egg production traits of sire (B1 and B2) and dam (A1, A2, A3) lines were determined in families of 10 hens and 1 cockerel. Growing traits were determined in day old chicks obtained from parent lines (A1, A2, A3, B1, and B2) and two-way crossings (B1xA1, B1xA2, B1xA3, B2xA1, B2xA2, B2xA3) in 6 weeks growing period.

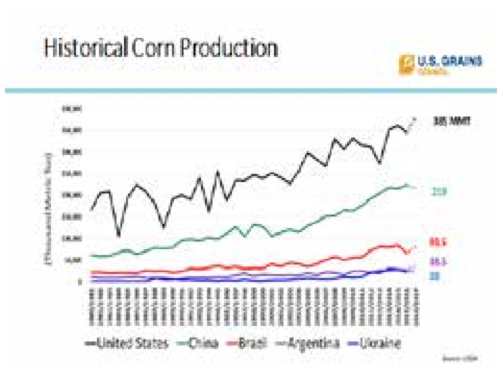
Sexual maturity ages of A1, A2, A3, B1, and B2 parent lines were found as 171, 176, 170, 175 and 171days, whereas sexual maturity weights were as 3034.7, 3272.2, 3087.9, 3377.2 and 3229.1 g, respectively. First egg weights of these lines were as 47.52, 46.39, 47.59, 48.3 and 47.67 g, and egg production in 52 weeks were 119.1, 114.6, 120.4, 78.4 and 89.8, respectively. Live weights of A1, A2, A3, B1, and B2 parent lines were as 2665.1, 2571.9, 2624.5, 2891.6 and 2917.8 g in 6 weeks. Live weights of B1xA1, B1xA2, B1xA3, B2xA1, B2xA2, B2xA3 crosses and commercial hybrid (Cobb) were determined as 2872.3, 2887.2, 2863.1, 2857.6, 2864.0, 2778.8 and 2970.9 g. Feed conversion ratios of all pure, cross and commercial hybrid groups were found between 1.604 and 1.703. heterosis levels of B1xA1, B1xA2, B1xA3, B2xA1, B2xA2, B2xA3 crosses were determined as 4.08 % , 5.85%, 4.84%, 2.37%, 4.34% and 2.56%.

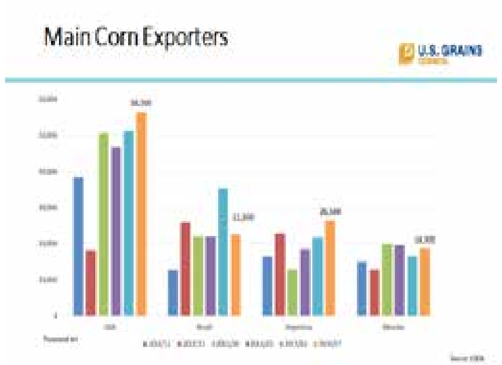
The findings of this study showed that these lines which breeding is still continuing have the enough traits to use in commercial production and can be used in developing parents.

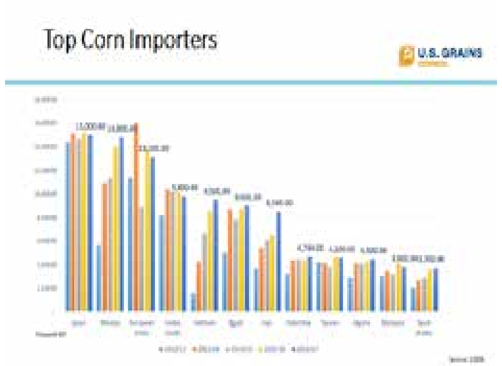
Keywords: Heterosis, live weight, feed conversion, breast ratio, meat type parent lines, egg production

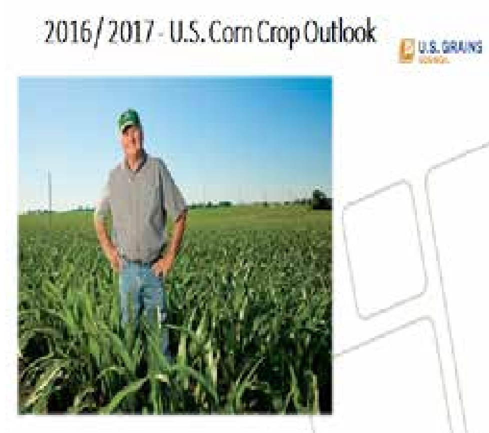
IS03 The Perspectives of Corn Production, Consumption and Developments in Trade and Its Effects to The Broiler Costs

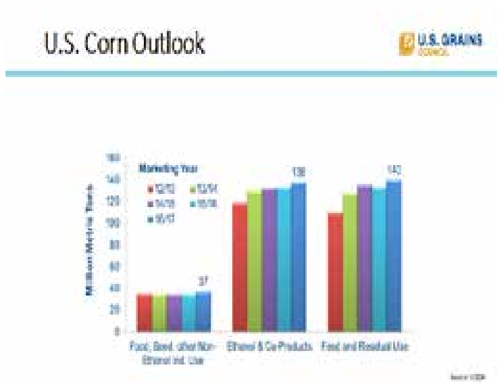
Alvaro Cordero
US Grains Council, USA

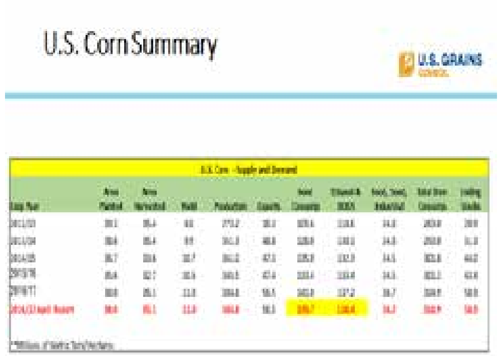


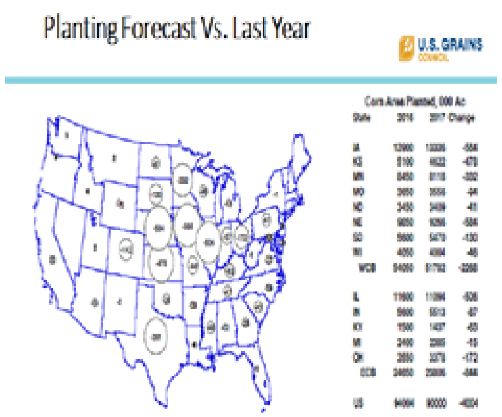


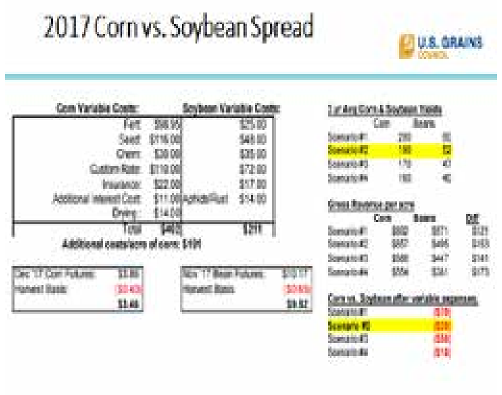












Grade Factors and Moisture

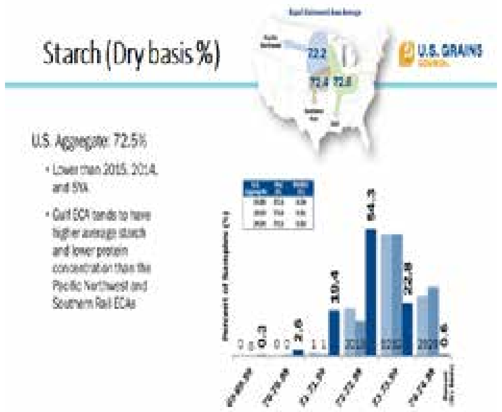
U.S. GRAINS COUNCIL

	No. of Samples	Avg.	Std. Dev.	Min.	Max.
Test Weight (lb/bu)	624	58.3	1.22	51.5	61.9
Test Weight (kg/hl)	624	75.0	1.57	66.3	79.7
BCFM (%)	624	0.7	0.45	0.0	4.0
Broken Corn (%)	624	0.5	0.34	0.2	3.8
Foreign Material (%)	624	0.1	0.16	0.0	1.6
Total Damage (%)	624	2.6	1.61	0.0	23.1
Heat Damage (%)	624	0.0	0.00	0.0	0.0
Moisture (%)	624	16.1	1.47	11.2	23.7

Chemical Composition

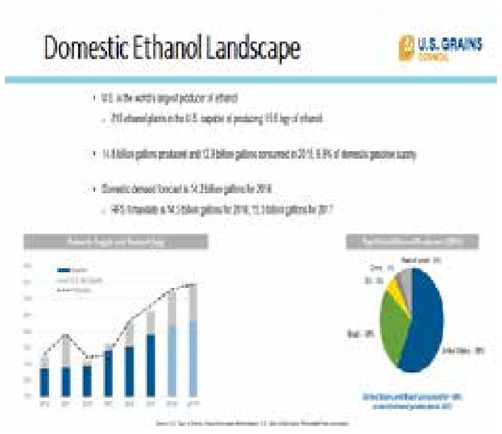
U.S. GRAINS COUNCIL

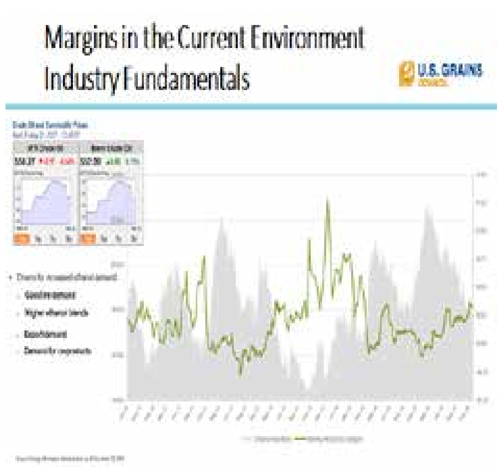
	No. of Samples	Avg.	Std. Dev.	Min.	Max.
Protein (Dry Basis %)	624	8.6	0.50	6.8	11.7
Starch (Dry Basis %)	624	72.5	0.59	69.2	74.3
Oil (Dry Basis %)	624	4.0	0.23	3.2	4.9




Pricing for energy
U.S. GRAINS COUNCIL
% Starch | g starch/kg | Starch 4.15 Kcal/g | Additional energy | $/Ton
67 | 670 | 2.781 | 0 | 185
68 | 680 | 2.822 | 1.5% | 188
69 | 690 | 2.864 | 3.0% | 191
70 | 700 | 2.905 | 4.5% | 194
71 | 710 | 2.947 | 6.0% | 197
72 | 720 | 2.988 | 7.5% | 200
73 | 730 | 3.030 | 9% | 203

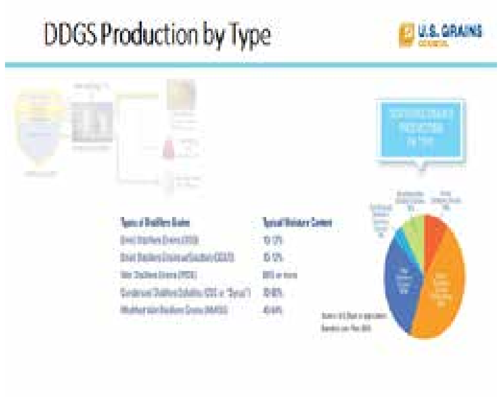

DDGS Market Analysis / Ethanol Brief
U.S. GRAINS COUNCIL

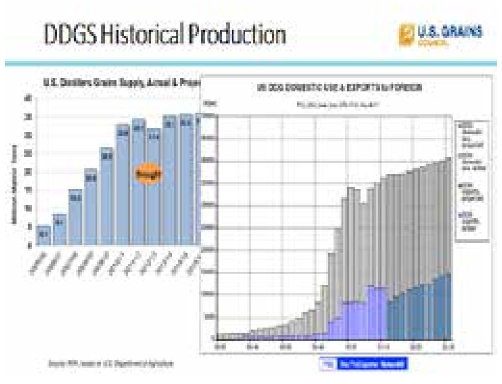

Domestic Ethanol Landscape
U.S. GRAINS COUNCIL

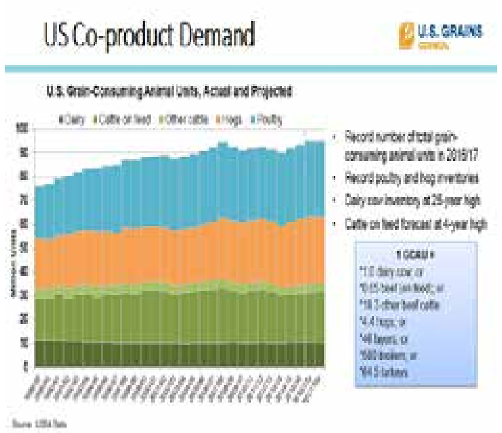

Margins in the Current Environment
Industry Fundamentals
U.S. GRAINS COUNCIL

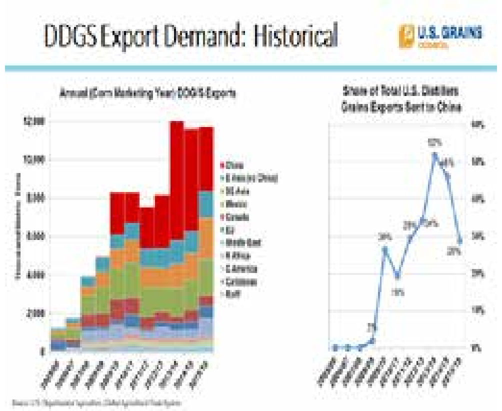

Export Demand is Growing
Ethanol Industry Drivers
U.S. GRAINS COUNCIL

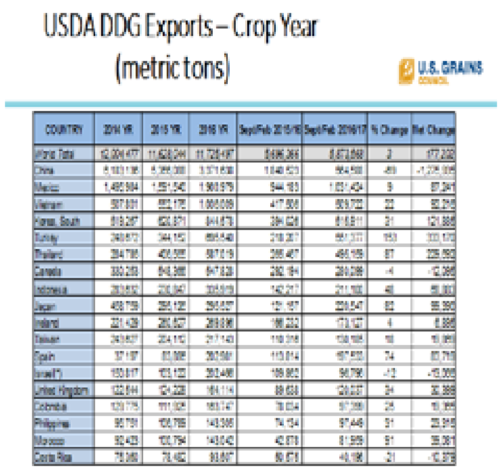

DDGS & Corn Gluten – Int. Market Analysis
U.S. GRAINS COUNCIL
In late 2014, USDA began publishing a monthly report: "Grain Crushings and Co-products Production"
All dry mill and wet mill ethanol plants surveyed monthly
Corn and sorghum use for fuel ethanol, beverage alcohol, and industrial alcohol production
Co-product production
Dry Mill
Wet Mill
Corn Use for Ethanol by Plant Type

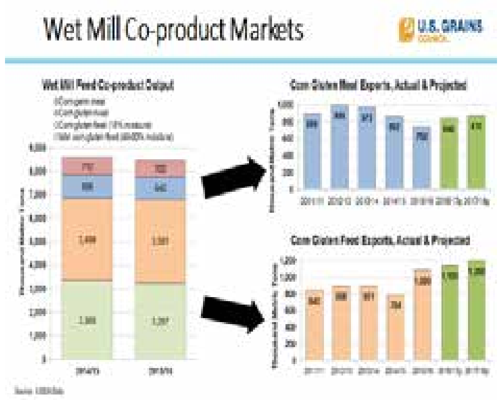

DDGS Production by Type
U.S. GRAINS COUNCIL

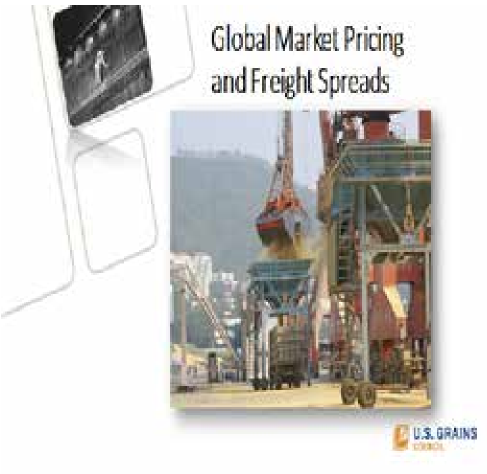

DDGS Historical Production
U.S. GRAINS COUNCIL

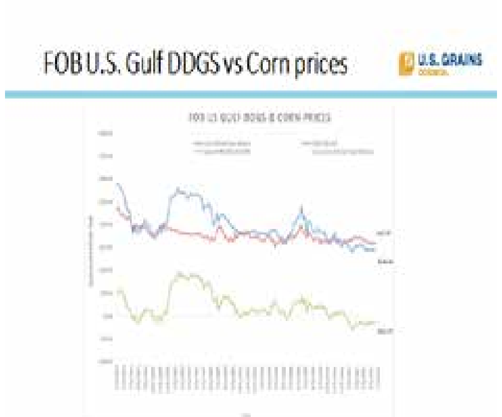

US Co-product Demand
U.S. GRAINS COUNCIL
U.S. Grain-Consuming Animal Units, Actual and Projected

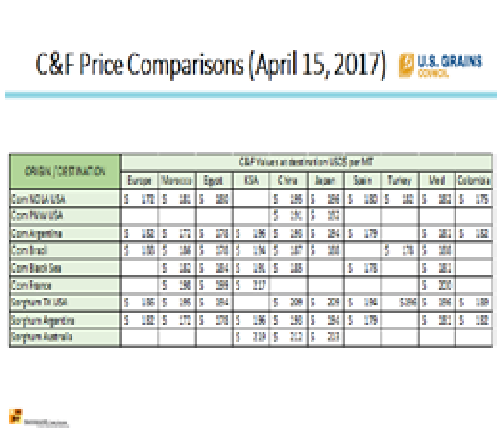

DDGS Export Demand: Historical
U.S. GRAINS COUNCIL


USDA DDG Exports – Crop Year
(metric tons)
U.S. GRAINS COUNCIL
COUNTRY
China
Mexico
Vietnam
Turkey
Thailand
Canada
Indonesia
Japan
Ireland
Taiwan
Spain
United Kingdom
Colombia
Philippines
Morocco
Costa Rica


Wet Mill Co-product Markets
U.S. GRAINS COUNCIL







O^{04} The Market Structure of Genetically Modified Products in the World and Their Effects on Nutrition, Socio-Economic Status and Sustainability

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Abstract

With the passage of time, the world population continues to grow on the other hand economic activities have some adverse effects on the environment. It is stated that product efficiencies should be increased by at least 60% in terms of adequate nutrition for the targeted population of 9,7 billion people to be reached in 2050. Risk factors due to adverse environmental conditions related to food production necessitate sustainable policies in terms of producing sufficient amounts of vegetable and animal origin foods, providing them at reasonable prices and fair distribution. Experts point out that there will be more severe drought and climate problems in the near future due to global warming. One of the basic measures to be taken against the scarcity problems that may arise as a result of these and other possible scenarios is development of resistant species which can be easily adapted to climate changes. Governments that have recognized the advantages of gene transfer technologies on productivity growth and sustainability have been approving gene transfer technologies as traditional agricultural practices have been inadequate to tackle existing problems. In 2015, 179 million hectares of GM crops were produced in 28 countries. Despite significant production levels, controversy continues over the risks of these products today.

Key Words: Genetically modified products, production, market, sustainability

O05 Determinants of Chicken Meat Production: Evidence From the Autoregressive Distributed Lag (ARDL) Bounds Test Approach for Turkey

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Abstract

The study aims to investigate the long-run and short-run relationships between chicken meat production in Turkey and its determinants (feed prices, chicken meat producer prices and chicken meat export). In the study, the autoregressive distributed lag (ARDL) bounds test approach is employed, using annual time series data for the period of 1994-2014. The emprical findings first suggest that there is a long-run equilibrium relationship between chicken meat production and its major determinants. Second, there exists too fast adjustment in chicken meat production when feed prices, chicken meat producer prices and chicken meat export change. Third, a 10% increase in the feed prices will lead in a long-run decrease of 2.29% in chicken meat production while other variables remain constant. On the other hand, a 10% change in the chicken meat producer prices and chicken meat export level will increase in a long-run change of 4.05% and 1.43% in chicken meat production, respectively, while other variables remain constant. As a results, the findings of the study enable to assist policymakers in supporting the broiler sector in Turkey. It is important for the broiler industry which has cost disadvantages in terms of feed prices to achieve a satisfactory level of producer income (chicken meat producer prices and export) in order to grow steadily.

Keywords: Chicken meat production, ARDL, cointegration analysis, Turkey

Introduction

Turkey has produced about 2 million tons of chicken meat, a share of 2% in the global production recently. The production volume of the chicken meat sector increased by 8.1 times and the export volume increased by 29 times between 1994 and 2014 (1, 2). It can be said that Turkey has reached a level where it can compete with the pioneering countries of the sector, in terms of technical performance of production (feed conversion rate and live-weight). However, the disadvantage of production costs particularly is challenging for export competition. It has been reported that the cost of 1 kg live weight in Turkey is 13-60% higher than the important countries of the sector (3).

The greatest share of production costs is the share of feed. In Turkey and in the major countries of the sector (Brazil and America), the ratio of the feed is close (66-70%) in total cost. However, feed prices in Turkey are higher than the corresponding countries. Enough maize and soybeans production in these countries provides a price advantage and reduces feed costs (3, 4). In Turkey due to insufficient production, maize and soybeans are imported in considerable quantities. This leads to an increase in production costs.

In recent years, feed prices have risen due to the use of maize and soybeans for energy sources such as biodiesel and ethanol in addition to the global drought in 2007 (5). For example, maize prices have increased 64% in the US between 2007-2012 and 49% in Brazil between 2007-2011. Soybeans prices have increased by 95% and 43% in Brazil and America, respectively, between 2007-2012. Although prices for both raw materials have fallen after 2013, which has not been reflected in chicken meat producer prices. In Brazil and the United States, chicken meat prices increased by 102% and 46%, respectively, between 2007-2014 (6).

In the same period (2007-2014), chicken meat producer prices in Turkey increased by 59% in terms of TL, but there was no change in terms of US Dollar (2). Although this seems to be a competitive advantage in exports, no increase in producer prices in real terms means that producer income also decreases. On the other hand, producer prices are known to affect chicken meat production positively (7). Therefore, it can be said that firms operating in the sector in Turkey try to grow both in cost and income trap. In this study, the possible relationships and effects of chicken feed prices, chicken meat producer prices and export levels on chicken meat production in Turkey were examined.

Materials and Methods

Annual data from the year of 1994 through the year of 2014 is obtained from the official sources of TUİK (2015). The functional relationship of the chicken meat production is assumed to be linear in parameters. Following Kapombe and Colyer (8) and Dagdemir et al. (7) the chicken meat production model in log-linear form is specified as:

$$LnCMP_t = \beta_0 + \beta_1 LnFP_t + \beta_2 LnCPP_t + \beta_3 LnExp_t + u_t \qquad \text{(A)}$$

where; CMP is chicken meat production (tons),

FP is feed prices (TL/kg),
CPP is chicken meat producer prices (TL/kg),
Exp is chicken meat export (tons).

To identify major drivers of chicken meat production in Turkey, the relatively new ARDL methodology is applied in the study. The ARDL bounds test approach developed by Pesaran et al. (9) has some advantages over the other methods, Engle and Granger (10) and Johansen (11).

The ARDL bounds test approach is required the estimation of the below equation.

$$\Delta LnCMP_t = \alpha_0 + \sum_{i=1}^{n-1} \alpha_{1i} \Delta LnCMP_{t-1} + \sum_{i=1}^{n-1} \alpha_{2i} \Delta LnFP_{t-1} + \sum_{i=1}^{n-1} \alpha_{3i} \Delta LnCPP_{t-1} + \sum_{i=1}^{n-1} \alpha_{4i} \Delta LnExp_{t-1}$$
$$+ \beta_1 LnCMP_t + \beta_2 LnFP_t + \beta_3 LnCPP_t + \beta_4 LnExp_t + u_t \qquad \text{(B)}$$

where; Δ denotes the first difference operator and n denotes the number of observations.

If the null hypothesis of no cointegration is rejected, the following unrestricted error-correction model (ECM) is estimated Pesaran et al. (9).

$$\Delta LnCMP_t = \alpha_0 + \sum_{i=1}^{n-1} \alpha_{1i} \Delta LnCMP_{t-1} + \sum_{i=1}^{n-1} \alpha_{2i} \Delta LnFP_{t-1} + \sum_{i=1}^{n-1} \alpha_{3i} \Delta LnCPP_{t-1} + \sum_{i=1}^{n-1} \alpha_{4i} \Delta LnExp_{t-1} + \lambda ECT_{t-1} + \varepsilon_t \qquad \text{(C)}$$

where; ECT denotes the error correction term and λ denotes the speed of adjustment parameter.

Results and Discussion

The time series variables are displayed in Figure 1.

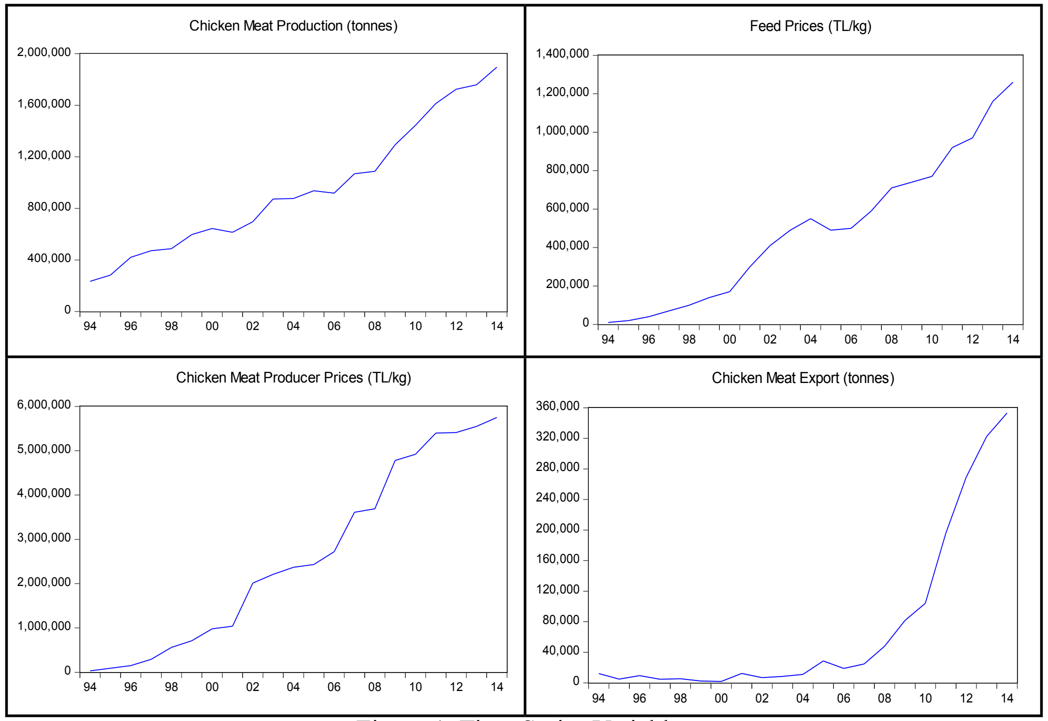

Figure 1. Time Series Variables

We use Augmented Dickey-Fuller (ADF) unit root test to check the stationary properties of the time series variables. Table 1 presents the results of the test.

Table 1. Unit Root Test Results

Variables	*Level*		*First difference*	
	ADF test statistic	*p*-value	*ADF test statistic*	*p*-value
$LnCMP_t$	-4.882**	0.005	-	-
$LnFP_t$	-4.123*	0.021	-	-
$LnCPP_t$	-2.763	0.228	-3.148*	0.044
$LnExp_t$	-3.033	0.148	-3.366*	0.027

**, * indicate significance levels at 1% and 5%, respectively.

The unit root test results show that the series $LnCMP_t$ and $LnFP_t$ are integrated of order zero, I(0) and the series Ll $LnCPP_t$ and $LnExp_t$ are integrated of order one, I(1) Since none of the series is, I(2)the ARDL bounds test approach can be applied to examine the existance of cointegration among the series. Table 2 displays the bounds test results.

Table 2. The Bounds Test Results

K	*F*-statistic	Significance Level	$I(0)$	$I(1)$
3	10.410	10% 5% 1%	2.37 2.79 3.65	3.2 3.67 4.66

*

k denotes the number of regressors.

Since the computed F-statistic for the bounds test is 10.410 which is larger than all the critical values for the upper bounds, we conclude to reject the null hypothesis of no cointegration. This result shows that there is a long-run equilibrium relationship between the chicken meat production and its determinants.

Table 3 indicates the results of the estimated ARDL cointegrating model (1,2,3,3). The model was selected automatically based on Akaike Information Criterion (AIC).

Table 3. The Estimated Long-run ARDL Cointegrating Model (1,2,3,3)

Variable	Coefficient	Standard Error	t-statistic	p-value
$LnFP_t$	-0.229	0.069	-3.295	0.022
$LnCPP_t$	0.405	0.062	6.529	0.001
$LnExp_t$	0.143	0.006	21.992	0.000
C	9.463	0.328	28.808	0.000

The coefficients of $LnFP_t$, $LnCPP_t$ and $LnExp_t$ are signed as expected and statistically significant at the 5% level. Table 3 also represents estimates of elasticities of chicken meat production with respect to the feed prices, the chicken meat producer prices and the chicken meat export.

Table 4. The Estimated ARDL Short-run Error-Correction Model (1,2,3,3)

Variable	Coefficient	Standard Error	*t*-statistic	*p*-value
$\Delta LnFP_t$	0.018	0.055	0.322	0.760
$\Delta LnFP_{t-1}$	0.559	0.079	6.999	0.001*
$\Delta LnCPP_t$	-0.423	0.063	-6.612	0.001*
$\Delta LnCPP_{t-1}$	-0.563	0.081	-6.933	0.001*
$\Delta LnCPP_{t-2}$	0.064	0.031	2.041	0.096
$\Delta LnExp_t$	0.026	0.011	2.346	0.065
$\Delta LnExp_{t-1}$	-0.101	0.018	-5.385	0.003*
$\Delta LnExp_{t-2}$	0.054	0.011	4.789	0.005*
C	14.733	2.653	5.552	0.002*
ECT_{t-1}	-1.556	0.161	-9.679	0.000*

* indicates significance at the 1% level.

Table 4 reports the results of the estimated ARDL cointegrating short-run error-correction model. The error-correction term, ECT_{t-1}, is significant at the 1% level and negative (-1.556) as expected confirming the existance of long-run relationship among the variables. However, the error-correction term is also expected less than one which is not true in our case. This can be interpreted that the disequilibria in the chicken meat production originating during the previous period will be adjusted too fast in the current period.

Finally, the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUM Square) tests are performed to test the stability of the long-run and short-run coefficients estimated by the ARDL model. Proposed by Brown et al. (12), the tests are applied to the recursive residuals of the ARDL (*1,2,3,3*) model. In Figure 2 and 3, the plots of both CUSUM and CUSUM Square are within the critical boundries of the %5 level.

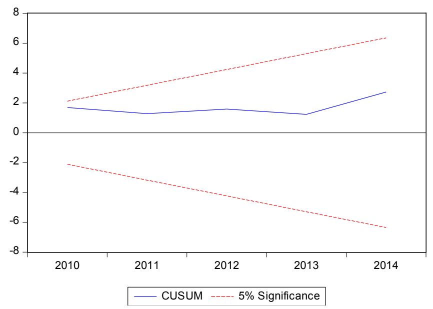

Figure 2. Plot of CUSUM Test

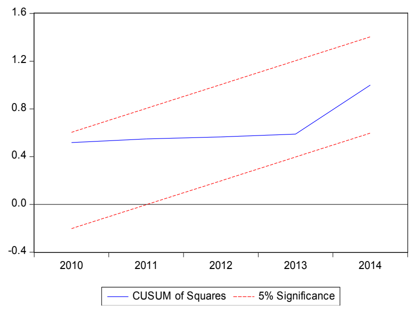

Figure 3. Plot of CUSUM Square

Thus, the two figures provide emprical evidence for the stability of the long-run and short-run coefficients estimated by the ARDL (*1,2,3,3*) cointegrating model.

Conclusion

The study aims to investigate the long-run and short-run relationships between chicken meat production in Turkey and its determinants (feed prices, chicken meat producer prices and chicken meat export). In the study, the autoregressive distributed lag (ARDL) bounds test approach is employed, using annual time series data for the period of 1994-2014.

The results of the ARDL bounds test first reveal that there exists a long-run equilibrium relationship between chicken meat production and its major determinants. In addition, the signs of all the long-run coefficients are all statistically significant and are consistent with the economic theory. Second, there exists too fast adjustment in chicken meat production when feed prices, chicken meat producer prices and chicken meat export change. Third, a 10% increase in the feed prices will lead in a long-run decrease of 2.29% in chicken meat production while other variables remain constant. A 10% change in the chicken meat producer prices will result in a long-run change of 4.05% in chicken meat production while other variables remain constant. A 10% change in the chicken meat export level will result in a long-run change of 1.43% in chicken meat production while other variables remain constant.

It is empirically detected that the independent variables; feed prices, chicken meat producer prices and chicken meat export, used in the study are the main determinants of chicken meat production. The findings of the study enable to assist policymakers in supporting the broiler sector. It is important for the broiler industry which has cost disadvantages in terms of feed prices to achieve a satisfactory level of producer income (chicken meat producer prices and export) in order to grow steadily. Since it is known that the feed prices have the biggest effect on chicken meat production, the main goal should be to lower the production costs. Therefore, incentives given to the broiler producers should be increased. Especially, procurement of raw materials for feed (maize and soybean) should be subsidized and promoted. The study also shows that chicken meat export is one of the major drivers of chicken meat production. So, new markets (such as European Union and the Middle East countries especially, Saudi Arabia) which allow for export opportunities are very important for increasing chicken meat production.

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IS04 Is Antibiotic-Resistant Bacteria Contamination in Poultry Meat A Serious Threat to Human Health?

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Summary

Poultry meat is often contaminated with resistant bacteria originating from live animals and external sources along the way from the farm to the consumer. Foodborne transmission of these resistant pathogens has been confirmed in numerous occasions, including recent studies that use high-resolution typing methods such as whole genome sequencing. However, some interesting hypotheses about transmission still remain unanswered.

Introduction

Antimicrobial resistance is a threat to public and animal health worldwide. The World Health Organisation (WHO) highlights the importance of non-human usage of antimicrobials in the frequency of infections and treatment failures in humans[1]. This means resistant pathogens can emerge under high selective pressure in animals and be transmitted to humans by direct or indirect contact, including meat[2]. Foodborne antimicrobial resistance can be transmitted to people in the form of zoonotic resistant bacteria that will cause disease in the person, and also in the form of resistance genes that may be subsequently acquired by other compatible bacteria. Therefore, in order to evaluate the impact of resistance in poultry meat and identify targets for implementation of control strategies, it is crucial to i) understand which pathways have led to their transmission, ii) choose appropriate methods for typing and iii) make a good interpretation of the results. This presentation will drive through these concepts and define which are the most important resistant bacteria associated to poultry meat and why, taking into consideration the antibiotic class that the bacteria have acquired resistance to and the impact of this resistance in the treatment of infections.

Narrative

Poultry meat, similarly to that from other food animals, can be contaminated with bacteria that originate from the live animals and cross contamination from other sources, mainly people involved in the manipulation of meat. In terms of pathogenic potential and resistance, the most important pathogenic bacteria isolated from poultry meat include non-typhoidal Salmonella, Campylobacter spp., Escherichia coli (E. coli), Enterococcus spp. and Staphylococcus aureus (S. aureus). These species have a great potential to cause invasive infections in humans and in addition have been reported resistant against drugs in the WHO list of Critically Important Antimicrobials (CIA)1 which classifies as critically important those antimicrobials used to treat diseases caused by bacteria from animal sources. Resistance to critically important antibiotics beta-lactams (including aminopenicillins and 3rd, 4th and 5th generation cephalosporins), fluoroquinolones (e.g. ciprofloxacin) and polymyxins (e.g. colistin) is found in poultry-associated pathogens3–7. Resistance to beta-lactams is transmitted horizontally among enterobacteria, including E. coli and Salmonella. Therefore, confirmation of poultry meat as the direct source of infection requires the analysis of the genetic determinants (genes and plasmids) that are transmitted horizontally between bacteria. Current research is able to confirm a poultry source of human infections based on whole genome sequencing (WGS) data4,8. Despite being a critically important antibiotic for human medicine, colistin is largely used to treat food animals in Europe9 and even as growth promoter in other countries10. Colistin resistance is plasmid-mediated and is increasingly reported in poultry-associated Salmonella and E. coli isolates711, including extraintestinal pathogenic E. coli (ExPEC) ST13112. A different mechanism of resistance to beta-lactams is the one mediated by mecA in methicillin-resistant S. aureus (MRSA), in this case transmitted vertically. Even though the prevalence in poultry meat can be high, especially in turkey meat13, MRSA has been considered a foodborne pathogen only in few occasions3,14,15. More research is needed to determine the risk of skin and mucosae colonization in people that handle MRSA-contaminated meat. Fluoroquinolone resistance emerges by a single-point mutation after exposure to the antibiotic in bacteria that will spread clonally and remain resistant even after termination of selective pressure. Fluoroquinolone-resistant Campylobacter is frequently isolated form broiler meat and human isolates worldwide16. In addition, fluoroquinolone resistance can be plasmid-mediated and transmit horizontally between enterobacteria5,17. Surveillance and antimicrobial stewardship in the last years in poultry medicine have contributed to the reduction of meat-associated human infections such as Salmonella2. In addition, alternatives to antibiotics such as phage therapy and vaccinations can reduce the presence of these pathogens in live poultry and slaughterhouse good practices and chemical decontamination can reduce the contamination of meat18. Additionally to reducing the risk of meat contamination, it is necessary to educate in good kitchen practices, as these represent the frontline against transmission and infection in people.

Conclusion

The impact on human health of poultry meat contaminated with antimicrobial-resistant zoonotic pathogens depends on the antibiotic class, the pathogenic potential of the bacterial species and on whether or not antimicrobial treatment is advised. Zoonotic transmission can only be confirmed through studies that use high resolution typing techniques. Such studies will elucidate the pathways of transmission and consequently allow the identification of targets for intervention.

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O[06] Determination of Salmonella *spp.* in Organic Poultry Meat

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Abstract

In this survey from May 2015 to August 2015, 150 samples of packaged organic chicken products (n=50 wings, n=50 whole chicken leg, n=50 without skin-breast) were randomly collected from the province of Samsun in order to investigate the presence of Salmonella *spp*. In this context; i) Salmonella *spp.* in the samples were isolated using conventional cultivation techniques and IMS method, ii) Isolated colonies suspicious for Salmonella *spp.* were identified with the MALDI-TOF (VITEK MS), iii) Confirmation of presumptive Salmonella isolates were completed using PCR. As a result of the analysis; contamination with Salmonella *spp.* were detected in 42 (28%) of 150 chicken samples. Research findings based on sample distribution shows that: 15 (15/50-30%) of whole chicken leg samples, 20 (20/50-40%) of wing samples and 7 (7/50-14%) of without skin-breast samples were contaminated with Salmonella *spp.*

O07 Determination Of *Listeria Monocytogenes* Presence and Antibiotic Resistance Profiles in Chicken Wing Samples

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Abstract

In this study, it was aimed to determine the presence of Listeria monocytogenes and antibiotic resistance profiles in chicken wing specimens. In this study, it was used to 110 chicken wing samples as material. According to the result of isolation and identification tests by classical culture method, Listeria monocytogenes was detected positively in 65 (83.3%) of the isolates. Antibiotic susceptibility of the obtained isolates was determined by standard disc diffusion method. It was found to be resistant to gentamicin of 3 isolates (4.61), to tetracycline of 4 isolates (6.15), to erythromycin of 23 isolates (35.38), to rifampin of 5 isolates (7.69), to ciprofloxacin of 11 isolates (16.92), to penicillin of 53 isolates (81.53), to cefotaxime of 15 isolates (23.07), to ampicillin of 6 isolates (9.23), to amikacin of 25 isolates (38.46), to trimethoprim / sulfamethoxazole of 49 isolates (75.38), to meropenem of 38 isolates (58,46) and to chloramphenicol of 5 isolates (7.69). Resistance to one or more antibiotics of isolates was very worrying in terms of public health.

Keywords: *Listeria monocytogenes,* chicken wing, antimicrobial resistance

O08 Investigation Inhibitory Effect of Different Concentrations of Laurel (*Laurus nobilis* L.)'s Oil and Sumac (*Rhus coriaria L.*)'s Oil on *Escherichia coli* and Total Aerophilic Mezophilic Bacteria Population Growth in Chicken Breast Meat

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Abstract

In this study, the inhibitory effect of laurel oil and sumac oil at different concentrations injected in chicken breast meat on the growth of *Escherichia coli (E. coli)* and total aerophilic mesophilic bacteria (TAMB) populations was invesitigated. The chicken breast meat used in the research was initially divided into 3 groups and the first group was used as a control sample. After inoculation of *E. coli* at 2 different concentrations (log 12 cfu / g, log 15 cfu / g) to chicken breast meat in the second and third groups, 6 different subgroups were formed and incubated for 30 minutes at room temperature (25ºC). Subsequently, each subgroup was injected with oil at 3 different concentrations (0%, 10%, 20%) from 2 different oil varieties (laurel oil, sumac oil) and incubated for 30 minutes at room temperature (25ºC). Than the samples cultivated to the selective agars and the inhibitory effects on the *E.coli* population with TAMB were investigated. Each parameters was tested in two replications.

The results suggest that the inhibitory activity on the TAMB and *E. coli* populations at different concentrations of sumac oil and laurel oil comparated to the control groups ($p<0,01$). As a consequence, considering the obtained from natural sources and grown in Turkey's climate conditions, laurel oil and sumac oil can be a good source of food preservatives for fresh chicken meats.

Keywords: Laurel oil, *Escherichia coli*, Sumac oil, Chicken breast meat, Total aerophilic mesophilic bacteria.

IS05 Does High Hatching Rate Means Best Quality Chicks Obtained? What is Important in Hatchery Practice?

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Abstract

Hatcheries, all over the world have been spending a lot effort to get good quality and healthy chicks. "Hatch of fertile" (HOF) is the main drive to assess the hatchery performance. But it is a must to hatch first grade chicks. Expected hatch of fertile should be over 90% for the young parent stocks but a few point less after 50 weeks of age as 88%. It is not uncommon to face high first week mortality and bad performance of the flocks hatched remarkably with very high HOF therefore high HOF does not always mean good quality chicks.

Fresh air need of embryos, egg weight loss, egg shell temperature, chick yield, yolk free body weight, cloaca temperature and chick holding place temperature and ventilation are the key factors which have significant impact on chick quality. Any mistakes will damp chick quality even you will have high HOF.

Setting and hatching rooms both must have tightly sealed fresh and exhaust plenums and also the fans should have variable speeds accordingly controlled by pressure. Unfortunately, most of the hatcheries have constant speed fans. The air supply to the setter fresh air room should be 13.52cmh per 1000 eggs. And speed of the fan should not be controlled by temperature. The air supply to the hatcher fresh air room or plenum should be 28.73 cmh per 1000 eggs.

Reference points or values about weight loss until transfer time is12%, egg shell temperature is 100.5 F^0, chick yield 67%, yolk/chick weight ratio less than 10%, Cloacal temperature is 40.5 C^0, temperature in holding area and inside the chick box shouldn't be more than 25 C^0 and 33 C^0.

Early and late hatches are the source of many issues therefore hatch window is a good indicator to assess many stages of incubation. Ideal hatch window is 30% hatch at minus 24 and 75% of hatch at minus 12 hours of pull time.

All the mistakes mentioned above will cause retarding of internal organs development, supressed immunity and poor entire life performance because of not having a good start for the life.

IS06 The Effect of Egg Turning During Incubation on Hatchability of Broiler Chicks

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Abstract

Turning is one of the main environmental factors for the success of incubation. Three main aspects of turning can affect the success of incubation; Turning duration, frequency and angle. In practice, generally all hatching eggs have been intended to be turned hourly through an angle of 90o for 18 days of incubation. It is very clear that the most critical period for turning commercial broiler hatching eggs during incubation was determined to be from 0-7 d with the single most critical 2-d period being 0-2d. However, turning is not absolutely necessary after 14 d of incubation. If turning eggs 96 times per day following a period of no turning after setting, decreased the incidence of Malposition II and so increased the hatchability of fertility as compared to turning 24 times per day. The incidence of malpositioned embryos was significantly increased and fertile hatchability of older broiler breeder flock eggs was numerically decreased by the 35o angle. However, malposition was significantly decreased and fertile hatchability improved at a turning angle of 35o when the turning frequency increased from 24 times daily to 96 times daily. Continuous turning through 90o each hour or normal rapid hourly turning through 90o had no overall effect on fertile hatchability but the incidence of early dead embryos was significantly reduced by continuous turning.

O09 Impact of Oxygen Suplementation and Alternative Temperature Application on Hatchability and Total Incubation Time at High Altitude

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Abstract

The aim of this study is to investigate the effect of hatchability and total incubation time at high altitude (1720 m) with incubation conditions (oxygen supplementation and high incubation temperature) of hatching eggs obtained from see level adapted broiler chicks (2 m). For this purpose, 1260 fertilized eggs were used from a Ross broiler genotype at 45 weeks of age provided by commercial hatchery. This study consisted of a total of 7 different groups in which one control and the other two incubation treatments [oxygen supplementation (O_2) and high temperature (S)] were carried out during the period of 3 different embryonic development (0-11, 12-21 and 18-21 days of incubation). To determine the time of embryo shell external pipping and total incubation period, eggs were counted every 3 hours from the 464th hour of incubation, and egg numbers of pipping and hatching chicks were recorded. In the last period of embryonic development (between 18th and 21st days), the lowest external pipping time was observed in the O_2 and S groups. The highest hatchery was determined in the middle and last periods of incubation for O_2 supplementation and S group for in the middle periods of incubation. Significant effect of O_2 supplementation (23.5% O_2) and high temperature (38.5 ºC) on external pipping and total incubation time have been determined.

Key words: high altitude, hypoxia, oxygen concentration, embryo, incubation

O10 The Effects of High Setter and Hatcher Temperatures During Incubation on Slaughter Weight and Carcass Yield in Broilers

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Abstract

This study was performed with the aim of determining the effects of higher setter and hatcher temperatures on slaughter weight and carcass yield in broilers. Setter temperatures were applied as 37.8–38.2 °C (control) and 38.9–40.0 °C (high) between days 10 and 18 during incubation (experiment 1)., and hatcher temperatures were applied as 36.8–37.0 °C (control) and 38.8–39.0 °C (high) during the hatching period (experiment 2). A total of 240 chicks from each experiment were randomly selected after the hatching process was complete. A total of 120 broilers from each experiment were weighed and slaughtered at 42 days of age. The carcass weight was lower in the higher temperature groups in both experiments. In the higher setter temperature group, the breast weight was lower (981.4 g), but the percentage of breast was higher (45.59%). In experiment 2, the weight and the percentage of breast was similar in the control and high hatcher temperature groups. In conclusion, slaughter weight and carcass yield, subsequently efficiency are affected by higher setter and hatcher temperatures.

Key words: incubation temperature, broiler, slaughter weight, carcass yield, breast yield

IS07 *M. Gallisepticum* And *M. Synoviae* in Broiler Breeders and Meat Type of Poultry: Clinical and Economical Relevance and Control Strategies

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Organisms which have been thought to be pathogenic avian mycoplasmas were first isolated from chickens in 1935 (Nelson). Currently approximately 25 species have been identified in birds, of which *M. gallisepticum* and *M. synoviae* are economically and clinically the most relevant for the commercial poultry industry (Kleven, 2008). Infections with *M. gallisepticum* and *M. synoviae* alone may be responsible for no or mild clinical disease. However the interaction with other pathogens is significant. This is also the main reason for the implementation of control programmes for these mycoplasma species in the poultry industry.

M. gallisepticum is responsible for mild respiratory disease, decreased growth, egg production losses, and impaired hatchability rates in broiler breeders. In the broiler and meat turkey industry, *M. gallisepticum* is related to respiratory disease and significant downgrading of carcasses at slaughter due to the systemic effects and airsacculitis (Stipkovits & Kempf, 1996; Ley, 2008). The severity of clinical signs may vary considerably between strains and can be complicated by the occurrence of other respiratory viral or bacterial agents (Gross, 1961; Fabricant & Levine 1962; Mohammed *et al.*, 1987; Stipkovits & Kempf, 1996). The clinical and economical relevance of *M. synoviae* in commercial poultry has for long been subject for debate. This however has changed during the last two decades due to the increasing number of clinical disease reports on this mycoplasma species. In broiler breeders reduction in egg production, reduction in hatchability and increased mortality in off spring has been reported to be associated with *M. synoviae* infections (Stipkovits & Kempf, 1996). *M. synoviae* has also been reported as the causative agent of infectious synovitis in broiler breeders and turkeys (Morrow *et. al.,* 1990 & Landman & Feberwee, 2012). Furthermore this mycoplasma species is also associated with airsac lesions and higher condemnation rates in broilers and pneumonia in turkey breeder hens (Kleven *et al.,* 1975, Osorio *et al.,* 2010).The most recent reports are on *M. synoviae* isolates with oviduct tropism. These isolates induce well defined eggshell apex abnormalities (EAA) with a significant reduction in eggshell strength and a decrease in egg production. These strains are also of importance for the broiler breeder industry although broiler breeders seem less susceptible for the production of eggs with EAA than commercial layers (Feberwee *et al.,* 2009, 2010). In analogy with *M. gallisepticum,* the severity of clinical signs may also vary considerably between *M. synoviae* strains a can be complicated by occurrence of other respiratory viral or bacterial agents (Kleven *et al.,* 1972; Springer *et al.,* 1974; Feberwee *et al.,* 2009, 2010). Also subclinical infections with *M. gallisepticum* or *M. synoviae* can occur which may have an economic impact resulting from trade limitations.

M. gallisepticum and *M. synoviae* can be transmitted vertically (in ovo) and horizontally. Transmission in ovo from infected breeder birds to progeny is the major route of spread of the infection, and is of economic relevance regarding international trade Transmission of *M. gallisepticum* and *M. synoviae* in ovo from infected breeder birds to their progeny is the major route of spread of the infection. The egg transmission rates are unpredictable and may vary between strains (Stipkovits & Kempf, 1996). The peak egg transmission rates occur about 3-4 weeks after infection and is the lower in the chronic phase of the infection. Although the number of infected progeny are low in the chronic phase, they are still able to infect the entire flock. The understanding regarding the reservoirs and the survival of both mycoplasma species has improved, however the epidemiology is not yet fully understood and outbreaks are still common (Soeripto *et al.*, 1989; Ley, 2008). Mechanisms of spread between flocks are largely unknown and may involve aerosol and fomite transmission as well as intermediate hosts like backyard poultry and wild birds (Stipkovits & Kempf, 1996; Ley *et al.,* 2016; Michels *et al.,* 2016). *M. gallisepticum* demonstrated the ability to produce biofilms which may enhance survival outside of the host (Hongjun Chen *et al.,* 2012). Multiple age premises and high density poultry areas are expected to have an increased risk of infection .

Mycoplasma control programmes are aiming at the reduction of vertical and horizontal transmission. Control programmes are based on three principles (i) accurate identification of infected breeding stock by frequent monitoring of flocks (ii) minimize the risk of vertical transmission by slaughter of infected reproduction flocks (iii) reduce risk of horizontal transmission by improvement of hygiene management procedures and implementation of practical channeling. Practical channeling means the separation of contacts (egg and feed transport etc) between infected and non-infected farms (Landman, 2014). Although elimination of infected breeding stock will minimize risk of vertical transmission, in a situation of high prevalence this approach is not economically sustainable. In a situation of high prevalence antibiotic treatment and vaccination programmes may contribute to the reduction of the clinical and economic impact of the disease (Levisohn & Kleven, 2000; Landman, 2014).

Monitoring programmes for the detection of *M. gallisepticum* and *M. synoviae* infected breeder flocks are in general based on serological tests using the Rapid Agglutination (RPA test) test and the Enzyme-Linked Immunoabsorbent Assay (ELISA) (Landman, 2014). The accuracy of the detection of an infection is dependent on the sample frequency, sample size and the specificity and sensitivity of used serological tests. To prevent vertical transmission a *M. gallisepticum* and *M. synoviae* infection needs to be detected as early as possible (preferably at 5 to 10% prevalence with 95% confidence). This can be achieved by monitoring flocks regularly and collecting a representative number of blood samples (30 to 60) per house ((Cannon & Roe, 1982). A flock cannot be regarded infected on basis of one serological positive sample. In case of indecisive serological results an additional confirmation test like a PCR test is needed. PCR in contrast to culture enables the direct detection of specific DNA which reduces the time to diagnose the infection (Feberwee *et al.,* 2005). For the monitoring of turkey flocks the PCR tests seem more sensitive than serological tests (Landman & Feberwee, 2012). Whenever freedom of both *M. gallisepticum* and *M. synoviae* by elimination of infected breeder flocks is not economically attainable, antibiotic treatment and vaccination can contribute to the reduction of the clinical and economic impact. The major shortcoming of medication is that it does not eliminate the infection (Whithear, 1996). In general mycoplasma vaccines do not prevent colonization and horizontal transmission however they can contribute to the reduction of shedding and spread of the mycoplasma species. It has shown that long term vaccination eventually can contribute to the control of *M. gallisepticum* on multiple-age farms. A beneficial effect of the use of live mycoplasma vaccines is that they are able to replace field strains by vaccine strains. This latter has been shown for *M. gallisepticum* but recently experimentally also for *M. synoviae* (Whithear, 1996; Feberwee, 2006; Feberwee *et al.,* 2017). However the disadvantage of the use of live *M. gallisepticum* and *M. synoviae* vaccines is that they may interfere with the serological and PCR tests used in monitoring programmes.

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O[11] Methods Used For Diagnosis of Chicken Mycoplasma Gallisepticum Infection and Importance of PCR Method

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Abstract

Mycoplasma gallisepticum (MG) belongs to the class Mollicutes, order Mycı-oplasmatales, family Myco-plasmatacea. MG can cause significant economic loss in chickens and turkeys due to chronic respiratory diseases, downgrading of carcasses in meat-type birds and loss of production in layers. Infection is diagnosed by detection of specific antibodies and/or the organism or its DNA. Several serological tests have been used to detect MG antibodies, but specificity and sensitivity have been lacking to some degree in all of them. They are more satisfactory for flock screening than testing individual birds. Significant antigenic variability among MG strains also exists, which could affect the sensitivity of serological tests, depending on the strain infection the flock and the strain used to prepare antigen. Cultivation techniques, have been considered an indispensable tool for definite diagnosis of MG, for they help determine the existence of infection in a certain flock and discover the casual organism, which, in return, allows for further epidemiological studies such as pathogenicity, antibiotic resistance, virulence factors and strain differences. However, cultivation techniques are laborious and time-consuming and isolation by these techniques may be difficult in chronically infected chickens or in those receiving antibiotics. Besides, there is the problem of overgrowth due to faster-growing Mycoplasmas or other organisms. Currently suspected situation in MG diagnosis by serological test can be readily figure out by molecular DNA based methods. DNA detection methods, mainly based on the polymerase chain reaction, have become more prevalence into use in laboratories by ready-use MG-PCR detection kits now, compared to the past.

O[12] Investigations on Infectious Bursal Disease Virus (IBDV) VP2 Gene Variations in Chickens

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Abstract

Infectious bursal disease (IBD-Gumboro) is an economically important viral disease in chickens. The disease is caused by infectious bursal disease virus (IBDV) which initiates immunosuppression and immunosuppressed chickens can not have a good immune response to vaccinations against other viral infections such as Newcastle disease or infectious bronchitis. Also, the risk of secondary infections is increases. In IBD, the degree and duration of immunosuppression varies depending on the genotype and virulence of virus detected.

This study was aimed to investigate IBDV genotypes in chickens and the lesions occurred in bursa of Fabricius during infections. For this purpose, bursa of Fabricius from 65 broiler flocks located in different regions in Turkey were collected. In these samples, presence of IBDV and viral loadwee investigated by SYBR-Green real time RT-PCR. Of the samples with high CT value, the variable region of the VP2 gene was amplified, sequenced and phylogenetic analyses were performed to generate phylogenetic tree. Results of SYBR-Green real time RT-PCR showed that IBDV-RNA was detected in 50 (77%) samples and CT values were found to be between 19 and 37. Phylogentic analyses revealed very virulent genotypes were present in 6 broiler flocks. In addition, classical and vaccine strains were identified. On histopathology, lesions indicating varying degrees of immunosuppression were observed in the bursa of Fabricus infected.

In conclusion**,** IBDV continues to be a problem in our country in chickens. Especially subclinical immunosuppressions are not noticed easily and therefore this point needs attention. It will be useful to reevaluate the current preventive and control measurements for IBD.

IS[08] Enzyme Application Experiences in Broiler Feeds And Practical Application Strategies

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Introduction

In the last quarter century the development in molecular genetics, microbiology and fermentation technologies provide immense developments in the area of enzyme production technologies and usage. Today, enzymes are widely used in food, textile, detergent and feed industries.

Market of feed enzyme and developments

The monetary volume of global feed enzyme market in 2014 was greater than 1 billion USD and it is indicated that it will be 1.5 billion USD and 2.5 billion USD 2020 and 2025, respectively. In 2014 phytase enzyme and NSP enzymes protease enzymes value in the total market were 450 and 550 million USD, respectively. The usage and monetary value of phytase enzymes in the enzyme market has increased rapidly.

Currently, the usage of phytase enzyme usage become standard in almost all of the poultry feed since it is very economic compared to inorganic P sources to increase P utilization and it decreases the negative results of anti nutritional effects of phytate.

Mode action of enzymes and substrate relation

Generally under normal conditions enzymes combine with substrate involving in key lock relation and form an enzyme-substrate complex and then form an enzyme -product complex by the impact of enzyme on the substrate and as a result a product based on substrate is formed.

The parts of the grains that form a substrate for enzymes and that show anti-nutritional characteristics are located in the aleurone layer at 6-9% that is on the outer layers of the grain and in the outer pericarp sections that consists 3-5 % of the outer layer. Aleurone layer that has the anti-nutritional characteristics consists of fiber components that contains xylan and β-glucan compounds that large amounts are water insoluble and small amounts are water soluble (≤ %5) and also phytic acid. The outer pericarp section consists of fiber components that are insoluble as anti-nutritional factors (xylan, cellulose and lignin).

Brief overview of feed enzymes and their impacts

We can categorize the feed enzymes for broilers in 4 main groups;

Phytase : Plant hydrolyze its phytate and expose P, Ca, protein/AA and minerals and energy.

Carbonhydrases : Main group is xylanase and beta-glucanase. They especially have an impact on the water-soluble NSP of the grain and cause a decrease of viscosity of intestine content, increase of energy of grains that is metabolizable by 3-8% and increase of absorption of nutrients. Besides they enable AXOS production as a result of AX decomposition in ileum and finally show prebiotic effect.

Protease : Decreases nitrogen excretion by feces at 1/3 ratio and enhance protein/amino acid digestibility by 3-6% as an addition support to endogenous enzymes.

Mannanase : Decompose the mannan that causes immune triggering based on feed and save energy (average 90 Kcal ME/kg feed) and other nutrients.

Developments related to Phytase enzyme and its effects

Phytate P compose of approximately 2/3 of phosphorus (total P) that vegetal feed raw materials consist. The phytate P percentage in the total P in corn, soya bean meal, full fat soya bean and sunflower seed meal that are used widely and at high amounts in broiler feed are 72-85%, 60-68%, 55% and 83-85%, respectively. Besides 92 % of the total P of wheat middlings, 72-80% of wheat and 76% wheat bran is phytate P. The same raw materials consist of 250-850, 1700-3100 and 2500 FTU structural (herbal endogenous) phytate per kg, respectively.

Herbal structural (endogenous) phytase does not have any practical importance for the utilization of phytate p for broilers because herbal phytate is negatively affected from feed production process related to activity.

Miyoinozitol hexosephosphate (phytate P); binds food stuffs like starch, protein, mineral, Ca, Zn besides P. By usage of phytase enzyme, the utilization of these food stuff also increase at some certain rate as P, matrix value is used for ME and other food stuff besides P and Ca in feed formulation. Disintegration of phytate compound with phytase enzyme has a significant contribution to the decrease of anti nutritional effect of phytate. In this matter degrading of IP6 to IP5, IP5 to IP4 and IP4 to IP3 forms a structure that is less harmful and binds minerals weaker when it is compared to IP6. Phytic acid compound binds nutrients and digestion enzymes and causes endogenous nutrition losses at stomach HCL secretion and mucin in ileum and therefore it decreases ileum nutrient digestibility.

Phytase enzymes were developed by the help of new technologies. Phytase enzyme was produced so as to provide utilizable P by the rate of 0.1%, 0.125 % and 0.15-0.18% in years 1991-1995, 2007-2009 and after 2011, respectively. By introduction of the last generation phytase (6-phytase) super dose usage came up and addition to phosphor releasing feature by removing the anti nutritional effects of phytate compound at great extent and by release of inositol freely, the performance of broiler become better by immune and indirect effects. The state of art technology phytase enzymes has important contribution in general as bacterial 6-phytase enzymes. Related to the technological evolution of phytase enzymes due to years, a significant decrease in P clearance by feces which causes environmental pollution has been realized. Significant developments were achieved in heat treatment and storage stability besides the phytate P disintegration effectiveness of phytase enzymes.

Considering the phytase effectiveness in broilers there are many factors related to the animal, phytase enzyme and feed including the duration of feed in the digestion system, pH of feed and digestion system content, existence of metal ions, phytate substrate density and specialty, organic acids added to the feed, toxin binders, antibacterial feed additives, Ca, total P and vitamin D3 content of the feed and Ca/P ratio, whether it is 3- or 6-phytase, the age of the poultry, efficiency direction, etc. In the feeds that has low amino acid digestibility, the contribution of phytase to amino acid digestibility is higher. Besides the contribution from amino acids to the digestibility of methionine and lysine is lower. The effect of phytase on the digestibility of aspartic acid, sistine, glycine, threonine and serine amino acid is high and its effect on tryptophane, tyrosine and valine is at medium level.

The contribution of Phytase enzyme related to the exposition of utilizable P from phytate P is not linear but curvilinear [$(y=71.90+(-22.15*(0.998^x))$] Linear effect is up to a certain level but after a certain level additional contribution decreases considering the additional phytase dose. Today the 6-phytases decompose appr. 70% of the phytate phosphor in the broiler feed and therefore phytate P at 0.07% could not be utilized. Since the P exposition of phytase is curvilinear, the economic optimum phytase dose should be determined according to the marginal utility. It means 1 kg phytase is important or the price of 1 FTY phytase inorganic source (like DCP or MCP) and price of 1 g inorganic P are important. For example when the price of 500 FTU phytase is 0.65$ and the price of DCP including 19.76 % P is 660$/ton the optimum phytase dose is 996 FTU/kg feed. When the price of same DCP is 990 $/ton then the optimal phytase dose becomes 1231 FTU/kg feed. However at the same DCP prices when the price of phytase is 0.95$ for 500 FTU the optimum doses are 762 and 996 FTU/kg feed, respectively. According to the P exposition characteristics of each enzyme the optimum doses shall differ even at the same prices. It is a very important matter in super dose applications considering the maximum utilization of phytase. In the feed formulation programs that has not the optimum dose determination feature by model input, it will be meaningful to determine and use of optimum dose practically by considering the P exposition matrix value of phytase at some certain phytase dose intervals.

As a result, following could be indicated related to phytase; the effect of phytase differs from phytase to phytase, coarse grinding of feed increases the effectiveness of phytase, thin particles has a negative effect of P release, phytase has different effect according to the phytate solubility of feed materials, phytate is very strong anti nutritional factor, phytase effectiveness is maximum at optimum feed Ca level, stability for feed processing should be noted, phytase that has a lower effectiveness than expected causes acidity in broiler and deteriorate live weight uniformity, phytase that has a higher effectiveness than expected causes TD syndrome at animals, highly soluble lime stone decreases phytase effectiveness, addition of organic acid to feed increases phytase effectiveness, protease addition to raw materials that consists phytate-protein globoide increases phytase effectiveness, super dose phytase application increases performs compared to the control group that is insufficient of P and in phytase usage optimum economic dose addition to the feed causes the most appropriate result.

NSP enzymes and impacts

When NSP enzymes like β- glucanase (primarily xylanase) were first started to be used in commercial feed, they were used against substrate in feed like wheat, barley, oat and triticale flour which increase ileum content viscosity and that have high content of pentosan and/or β- glucanase soluble in water. Based on the results that the NSP enzymes have positive effect on water insoluble NSP subtracts they are started to be used in all kinds of broiler feed including corn-soybean based feeds. Further issues related to this matter came up due to the occurrence of AXOS and XOS after decomposition of AX of bacterial xylanase and that these compounds show prebiotic effect on the feed of broilers. Today broiler feed is produced so as to include xylanase of NSP enzymes

Proteases

Protease enzyme has an essential contribution to eliminate the negative effects of anti-nutritional factors like lectin etc. (primarily ant-tripsin factor for soya) that is in the protein sources that are not subject to appropriate or sufficient heat treatment or increase the amino acid digestion of feed materials that low protein digestion. Protease enzyme provides low amino acid digestibility in met and Lys amino acid and high amino acid digestibility in Cys and Thr amino acid. It is a great flexibility for rations and people preparing the rations that the low quality protein sources are introduced to rations economically. The success and progress of Protease still lag behind of phytase.

Mannanase enzyme and effects

Recently it is determined that some of the lectin that the feed raw material consists have negative impact on the ileum health of the broiler and causes impairment of the in. Intestine entrance barriers specialty and as a result it causes a nutritional cost. This feature triggers natural immune system by creating an effect like the carbohydrate structure receptors of the bacteria as Salmonella and E. coli of β-Mannanase that are in the soybean products that are widely used at high levels for broilers and it causes inflammation and high level excretion of mucin secretion due to immune system and expelling the Thr and Val amino acids as endogenous that are consisting at high levels in mucin secretion and also energy loss. Mannanase enzyme reduce the mannan compounds to more lower molecules that do not bring out anti nutritional impacts and causes feed caused inflammation in ileum and decreases nutritional losses and provides saving effects in some of the amino acids and energy. It is important that the mannan level of the feed reaches the critical level if the soya products are used more that 12% in the ration.

Matrix usage of enzymes and strategies

Matrix usage for enzymes consists of the most important part of the reflection of enzyme's contribution to feed and it is the major issue that most of the mistakes occur in the field. This problem especially occurs when more than one different enzymes are used in the same feed and the energy and amino acid matrix is given and at what level the matrix values of the feed raw materials that the quality is indicated by the companies shall be used. We should be very careful about the contribution of each enzyme to the feed related to the same subtract and/or the enzymes that the impact mechanism interfere with each other. This situation leads to the question as "enzyme + enzyme 2 equals to what?". Therefore, we see that in most of the cases 1+1 is not equal to 2. So, in order not to make any mistake in this matter supervision and information from broiler nutrition expert and/or enzyme producer company should be demanded and obtained.

Conclusion

Today it is impossible and meaningless to produce economic broiler feed without using feed enzymes and even double, triple enzymes. The success and the level of success in this subject could be attained by the quality of feed raw materials, the condition of broilers and the field, the accurate information related to the real impact of enzymes and also the matching of these information. Broiler nutrition experts should update and develop himself /herself in this subject, should not forget that the same enzymes can have different nutrient matrix values at some certain levels in order to provide a successful service for establishments and the perception of the keeper in the subject can also lead to have better results in general. It should be noted that feed enzymes both provide contribution to the supply of nutrients in broiler nutrition and also provide important contribution to animal health, welfare, product quality and environment protection.

O[13] Optimisation of Enzymes Combinations to Improve Overall Digestibility of Corn and Soybean Meal-Based Diets

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Abstract

A common indigestible fraction of cereal grains, representing a large part of poultry diet, is their content in non-starch polysaccharides of which arabinoxylan is the prominent type for wheat and corn. Despite being both mainly composed of xylose (X) and arabinose (A), their A:X ratio will be different with a higher value for corn than wheat (1). While an enzymatic solution such as classic xylanase based multienzyme composed of more than 50 hydrolytic enzymes (2) has already been proven efficient at improving nutritional value of feed by degrading NSP (3). Therefore, research work has been done to improve its capacity to degrade highly branched arabinoxylans. To address such complexity, a modified strain of *Talaromyces versatilis* has been developped to secrete a higher amount of xylanaseses and arabinofuranosidases. Such enzymatic enhancement is key to attack arabinoxylans with a high A:X ratio which are recalcitrant to breakdown by single xylanasese activity (4). This enzymatic enlargement allowed an improvement of the global feed digestibility by restoring to the control level AMEn and AA digestibility of a feed diet diluted by 3 % with an inert diluent when new type of xylanase based multienzyme is applied.

Key words: Arabinoxylan, Xylanasese, Arabinofuranosidase, Overall feed digestibility, Feedase

Introduction

Cereals are an important source of energy in poultry diets. However, they are also rich in antinutritional factors such as non-starch polysaccharides (NSP) with content ranging from 7 to 19 % in cereals (5). Arabinoxylan chains (AX) are the main NSP in wheat and corn, reaching up to 7.3 and 4.7% dry matter (DM), respectively (1). NSP-degrading carbohydrases, particularly xylanaseses (Xyn), have long been used in poultry diets (6). Endo-xylanaseses help degrade AX by hydrolyzing the xylan backbone. However, multiple arabinose substitutions reduce the efficiency of Xyn, especially in corn and associated by-products (1). Arabinofuranosidases (Abf) can cleave arabinose from the xylose backbone and offer access to endo-xylanasese activity (7). T. Lagaert *et al.* (2014) suggested that optimal hydrolysis of AX required the combined action of endo Xyn and Abf. The breakdown of AX offers higher accessibility to nutrients, which explains a large part of the observed digestibility improvement and mitigation of negative effects of NSP (9, 10). Objective of the present study was to present the best way of engineering *Talaromyces versatilis* to increase AX degradation potential through Xyn and Abf enrichment while keeping its broad spectrum of activities. Then, the effect of the newly developed product was estimated by comparing the overall feed digestibility of broilers fed a standard corn based diet to that of broilers fed a 3% diluted similar diet supplemented with. new type of xylanase based multienzyme

Material and methods

Enzymatic products

Rovabio® products are composed of multiple enzymes produced by *Talaromyces versatilis* under specific production conditions, strain: IMI378536 for Rovabio® Excel and DSM26702 for Rovabio® Advance. These cocktails are composed of more than 50 different enzymes mainly involved in NSP degradation (2), with xylanasese, beta-glucanase and cellulase being three of the major activities.

In vivo assay

Effect of new type of xylanase based multienzyme (Rovabio® Advance) was studied in a digestibility trial with 120 broilers using a 2 x 2 factorial arrangement with two diets (standard and diluted, Table 1) and two level of enzymes (0 and 200 mL/t), to achieve at least 1250 xylanasese visco Units per kilo of feed). Diet was composed using wheat and soybean meal and was formulated to meet or exceed the birds' nutrient specifications requirement according to Rhodimet® Nutrition Guide recommendations (Adisseo Rhodimet Nutrition Guide, version 2013). A diluted form of the standard diet was achieved using sand as an inert diluent to give a diet containing 97% of the plant raw ingredient base relative to standard diet. Titanium oxide (TiO) was added to both experimental diets at 0.5% to serve as an indigestible marker. From 0 to 12d, broilers were housed together in a floor pens and fed the diets *ad libitum*. The experimental period was divided into three phases: adaptation (13 - 19 d of age), excreta collection (20 - 22 d of age) and preparation prior to digesta collection (23 – 26 d of age). Digestibility of dry matter (DM), and gross energy (GE) were determined by analysis of feed and excreta, whereas AA digestibility was calculated based on measurement in diet and ileal digesta. The data (n = 120) were subjected to ANOVA with block (n = 30), diet (n = 2) and enzyme (n = 2) as fixed effects.

Enrichment in xylanaseses and arabinofuranosidases activities

Based on the observations of Bach Knudsen *et al.* (2014),AX is the main type of NSP brought by common cereals such as wheat and corn. In order to further improve the arabinoxylanolytic efficacy of the product, it was decided to enrich the product in Xyn and Abf activities. To obtain this, while keeping the already broad spectrum of activities in the product, gene regulation has been studied through transcriptomic analyses in order to identify the regulator of the AX catabolic pathway (Llanos et al. 2017 in press). The XlnR transcription factor was then identified and its over-expression in *Talaromyces versatilis* led to an enzymatic mix named Rovabio® Advance. Mass spectrometric analyses and enzymatic assays confirm the over-expression of hemicellulases, mainly composed in Xyn and Abf activities compared to Rovabio® Excel (Table 2). As a consequence, new type of xylanase based multienzyme contains three more Xyn and two additionnal Abf. So, at the end, Xyn from CAZy (11) families 10 and 11 and Abf from families 43, 51, 54 and 62 are represented in. new type of xylanase based multienzyme This led to an increase of approximately 3 folds of xylanasese and arabinofuranosidase acitivities.

In-vivo validation :new type of xylanase based multienzyme nutritional efficiency

Nutritional interest of the Rovabio® Advance has been demonstrated in a study using a standard wheat/soybean-based diet compared with a 3% nutrient-diluted diet using sand as an inert diluent.

Comparing the two control diets, dilution of feed had no effect on gross energy digestibility (AME:GE) (around 73% for both diets), whereas apparent metabolisable energy corrected for zero N retention (AME_N) content was 2.9% lower in the diluted versus standard diet (13.3 and 13.7 MJ/kg DM respectively; $P < 0.001$). Rovabio® Advance improved gross energy digestibility (AME:GE) of the 2 diets by +2.8% in average ($P < 0.001$), leading to a significant increase in AME_N content of 500 and 400 kJ/kg DM in standard and diluted diets, respectively. Apparent metabolisable energy corrected for zero N retention content of the diluted diet with new type of xylanase based multienzyme was similar to that of the standard diet without new type of xylanase based multienzyme ($P = 0.98$), thus demonstrating the ability of enzymes to fully compensate for the 3% nutrient dilution. At ileal level, AA digestibility was around 75% across all treatments and the addition of enzymes increased AA digestibility by an average of 4.4%, ranging from x to y ($P < 0.001$) as presented in Figure 1.

Conclusion

First, this study presented an original way for enzyme development and improvement in connection with substrate evaluation. In order to further improve degradation of all patterns of AX, even the most substituted (A:X > 1,), classic xylanase based multienzyme, was modified to overproduce Xyn and Abf thanks to a tuned gene regulation. A combination of Xyn and Abf improves AX degradation whatever the substitution rate by arabinose that, if too high, impairs the xylose backbone hydrolysis by the xylanasese by steric hindrance (12). Secondly, *In vivo* assay demonstrated that new type of xylanase based multienzyme can restore nutrient availability when the nutrient content of a diet is diluted by 3%. The exact mechanism responsible for this is not fully understood, but degrading the main NSP type in the feed leads to limit the cage effect and resulted in a larger access of nutrients for endogenous enzymes also to a better mixing between digestive enzymes and nutrients. In this case, it is apparent that an increase in AA digestibility and a potential effect on endogenous AA flow may be, in part, responsible of this restoration. In conclusion, this study has shown that new type of xylanase based multienzyme, a multi-enzyme complex containing Xyn and Abf, can improve the overall feed digestiblity.

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Table 1. Composition and calculated analysis of experimental diets

Item	Standard diet	Diluted diet
Ingredient, % of diet		
Wheat	57.72	55.99
Extruded soybean	7.5	7.27
Soybean meal	24.4	23.67
Vegetable oil	5.75	5.58
Dicalcium phosphate	1.27	1.23
Limestone	1.18	1.14
Salt	0.27	0.27
Sodium sulphate	0.14	0.14
DL-Methionine	0.32	0.31
L-Lysine	0.26	0.25
L-Threonine	0.08	0.08
Filler	-	2.96
Mineral and vitamin premix[1]	0.6	0.6
Titanium oxide	0.5	0.5
Energy and nutrient content		
DM, %	89.3	89.5
AME, kcal/kg	3010	2919
CP, %	20.2	19.6
Crude fat, %	8.5	8.2
NDF, %	11.0	10.6
Digestible lysine, %	1.12	1.08
Digestible sulphur amino acids, %	0.87	0.84

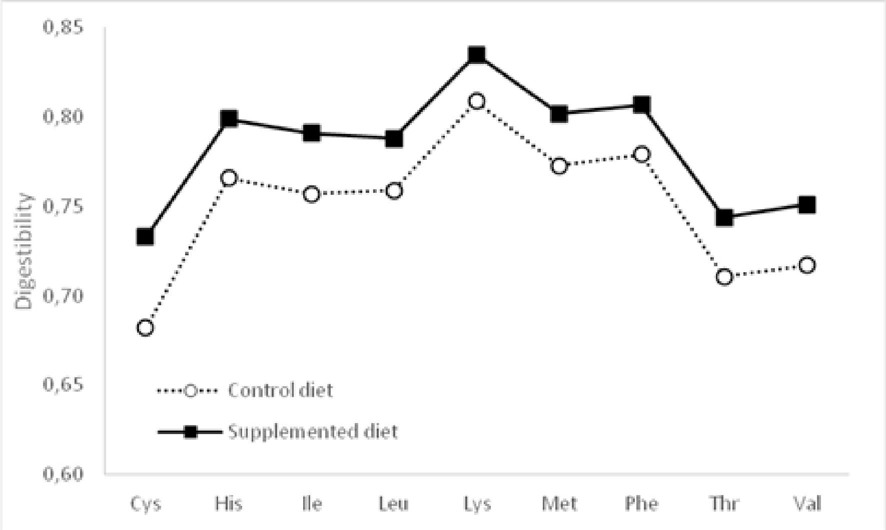
[1] Mineral and vitamin premix supplied the following per kg of feed, as fed: vitamin A, 12,000 IU; vitamin D3, 3,000 IU; vitamin E, 100 IU, vitamin K3, 3 mg; vitamin B1, 2 mg; vitamin B2, 8 mg; vitamin B6, 3 mg; vitamin B12, 0.02 mg; folic acid, 1 mg; biotin, 0.2 mg; pantothenic acid, 15 mg; niacin, 40 mg; Mn, 80 mg; Zn, 60 mg; I, 1 mg; Fe, 80 mg; Cu, 15 mg; Co, 0.4 mg; Se, 0.2 mg; ethoxyquin, 0.5 mg; BHA, 0.5 mg; narasin+nicarbazin, 80 mg

Table 2. Relative composition of Rovabio® Excel and Advance based on mass spectrometric products characterization.

Item	classic xylanase based multienzyme	new type of xylanase based multienzyme
family of enzymes, % of all hydrolytic enzymes		
Cellulases	56.2	44.8
Hemicellulases	42.1	52.8
Pectinases	1.7	2.4
type of enzymes, % of all hydrolytic enzymes		
Xylanaseses	21.4	27.7
Arabinofuranosidases	5.8	10.7

A reduced, alkylated and heat denaturated extract of each Rovabio® was digested by trypsin. The peptides were then separated based on their charge on an ionic exchange chromatography column before analysis by tandem LC-MS/MS. Spectrometrical data were then confronted to *Talaromyces versatilis* annotated proteome. Quantitation is based on sepctral counting.

Figure 1. Effect of enzyme supplementation on ileal digestibility of AA at 27d.



O[14] Effect of Xylanase on Digestibility of Cereals and Proteinaceous by-products in Broiler

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Abstract

A trial was conducted to evaluate the effect of a fungal Non-Starch Polysaccharide (NSP) degrading enzyme complex on digestibility of wheat, corn, barley, soybean meal, rapeseed meal and DDGS (wheat based) in broilers. In total 48 cages, of 6 birds each, were fed a general starter diet until 13 days of age. From 13-22 days, birds were fed the different test feeds with or without the enzyme complex. Feeds contained either 65 % of corn, wheat or barley, supplemented with a 35 % soybean meal based protein concentrate, or 30 % of either DDGS or soybean meal supplemented with a 70 % corn/wheat based carbohydrate concentrate. Further two test diets containing 10 or 20 % rapeseed meal were incorporated in the trial. Digestibility was measured between the age of 18 and 22 days based on the total faecal collection method. Results showed that enzyme inclusion led to an increase in metabolisable energy of 45, 104, 94, 89, 120, 33 and 111 kCal/kg, and of fat digestibility of 1.6, 5.4, 3.2, 1.2, 7.7, 2.6 and 3.2 % for wheat, corn, barley, soybean meal, DDGS, 10 and 20 % rapeseed meal based feeds respectively. Faecal droppings were reduced by 4 to 14.5 % when using the enzyme complex while water intake was reduced between 0.5 and 6.1 %. From this trial it can be concluded that the inclusion of a particular fungal NSP enzyme complex in different types of feed gives a clear improvement in digestibility, while reducing faecal output and water consumption.

Introduction

Broilers need efficient ways to extract more nutrients out of the diet, in order to reach their full growth potential and to maintain intestinal health. Well-targeted feed enzymes offer nutritionists a tool to meet these crucial objectives in everyday broiler diet formulations. A multi-enzyme digestive complex produced by a non-GMO *T. citrinoviride Bissett* via a single Surface Fermentation process, demonstrates to provide a consistent solution in dietary energy utilization. Such a xylanolytic complex of enzymes with high intrinsic stability properties shows to overcome the anti-nutritional effects of multiple NSP fibre fractions, present inside conventional as well as more challenging broiler diets (1). Enzymes are used to degrade non-starch polysaccharides, mainly to reduce viscosity in the intestine (caused by soluble fibers) and to liberate more nutrients which are entrapped by insoluble fibrous structures. This improves the digestibility of the nutrients present in the feed, while reducing excretion, optimizing performance and improving gut health status.

Material and methods

The digestibility study was composed out of 56 cages of 6 female broilers (ROSS 308) per cage. Broilers were fed a starter feed till 13 days of age. From 13 till 22 days of age, animals were fed with the 14 different feeds. Day 13-18 was considered as the adaptation period, while the digestibility assay was conducted from day 18 till day 22. Different feeds were produced with or without the fungal NSP degrading enzyme complex (Hostazym® X at 1500 EPU/kg of feed; Table 1). The first 3 feeds were composed diets containing 65 % wheat, corn or barley, combined with a 35 % protein based (soybean meal) complementary feed. The fourth and fifth feed was composed by either 30 % soybean meal or 30% wheat-based DDGS, added to a complementary feed containing corn/wheat as cereal sources in a 50/50 ratio. The last two feeds contained 10 or 20 % rapeseed meal (at the expense of soybean meal), in which corn/wheat was dosed in a 50/50 ratio. Eight cages per feedstuff were used, of which 4 cages received the control feed and 4 cages received the control feed + Hostazym® X at 1500 EPU/kg. During the period of digestibility (d18-22) daily feed intake, total faecal droppings and water intake were measured. Digestibility was determined by the total collection method quantifying the total amount of faecal material produced (dry) and the total amount of feed ingested. After homogenization of the faecal material and subsampling, 250 g was freeze-dried to determine the dry matter content. The dry matter was then analyzed for energy, starch and fat. Feed was also analysed for these nutrients. The digestibility was calculated as follows: digestibility (%) = (total nutrient intake by feed – total nutrient output by faeces)/(total nutrient intake by feed) x 100 %.

Table 1. composition of the different feeds

	Cereal feed	Protein feed	Rapeseed meal feed	
			10 %	20 %
Cereal[1]	65	0	0	0
Protein source[2]	0	30	0	0
Rape seed solvent extr	0	0	10	20
Wheat	0	26.6	31.4	28.5
Corn	0	26.6	31.4	28.5
Soja, hipro	23.2	0	14.6	9.13
Corn gluten meal	1.41	5.99	4.00	4.00
Soybean oil	6.46	7.10	5.00	6.50
Premix (Ca 0 g/kg)	0.50	0.50	0.50	0.50
Salt	0.14	0.15	0.14	0.15
Sodiumcarbonate	0.35	0.37	0.35	0.33
MCP	1.14	1.04	1.09	1.00
Limestone	1.03	0.98	0.95	0.84
DL-Methionine 99 %	0.25	0.11	0.15	0.1
L-Lysine HCl 98.5 %	0.32	0.57	0.37	0.35
L-Threonine98%	0.11	0.1	0.07	0.04

[1]wheat, corn or barely
[2]soybean meal of wheat DDGS

Results and Discussion

The inclusion of the enzyme complex increased the metabolisable energy (ME) of all feeds, ranging from 33 kCal/kg (rapeseed meal 10 %) up to 120 kCal/kg (wheat DDGS at 30 %) (Fig. 1). Surprisingly a higher improvement in energy content was found for corn diets compared to wheat diets. It has always been assumed that endo-xylanases work better on wheat diets, as wheat contains higher levels of soluble fibres compared to corn diets (2). However it is also known that some endo-xylanases can degrade insoluble fibres, making entrapped nutrients like

protein and starch granules more available for digestion by the endogenous proteases and amylases produced in the intestine, contributing to a higher feed digestibility (1, 3).

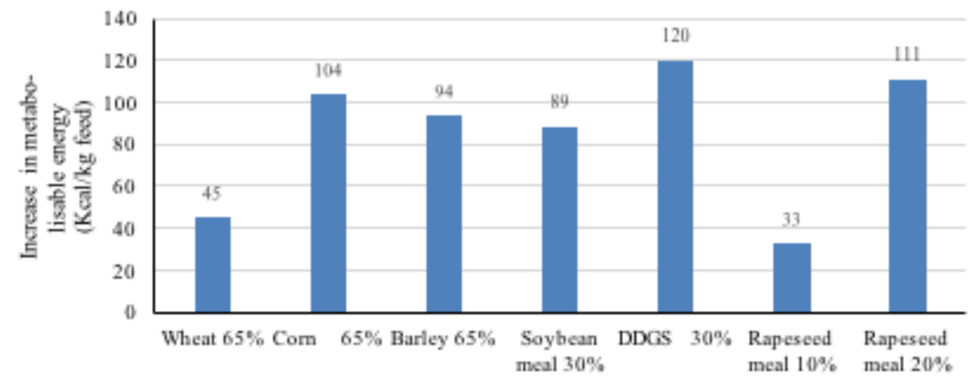

Fig. 1. increase in ME (kCal/kg feed) when including a NSP degrading enzyme complex

Secondly, the inclusion of the enzyme complex increased the fat digestibility by 1.2 % (soybean meal up to 7.7 % (DDGS) (Fig. 2). This effect was also higher in corn diets compared to wheat diets, which could also explain the higher energy improvement by the enzyme complex as discussed above. It is well known that fiber exerts an important effect on the gut microbiota in broilers, and thereby gut health (4). Feeding fibre can lead to a higher bacterial counts in the intestine, and thereby a higher bile salt hydrolysis capacity (5). A high bile salt hydrolysis capacity means a reduction in the emulsifying capacity of the fat by bile salts in the small intestine. As corn has a 2 to 3 times higher fat content than wheat, the impact of the reduction of bile salt hydrolysis due to the enzyme complex addition (which reduces the quantity of gut microflora) might partly explain the higher energy improvement of the corn diet (Fig. 1).

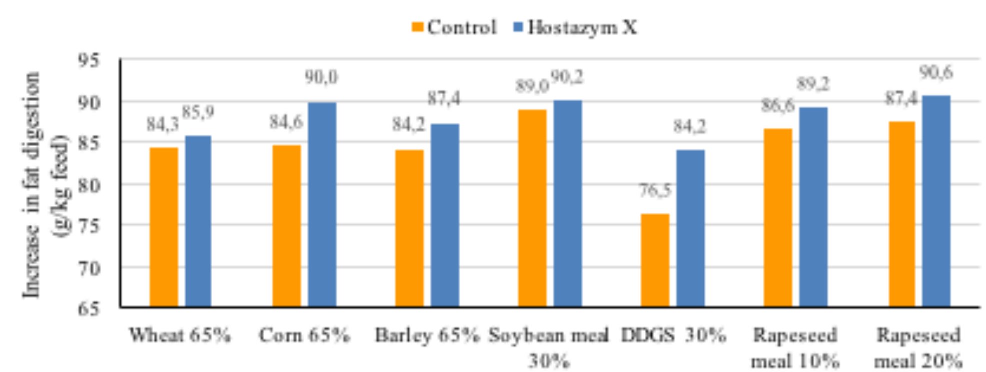

Fig. 2. fat digestibility (%) with or without a NSP degrading enzyme complex

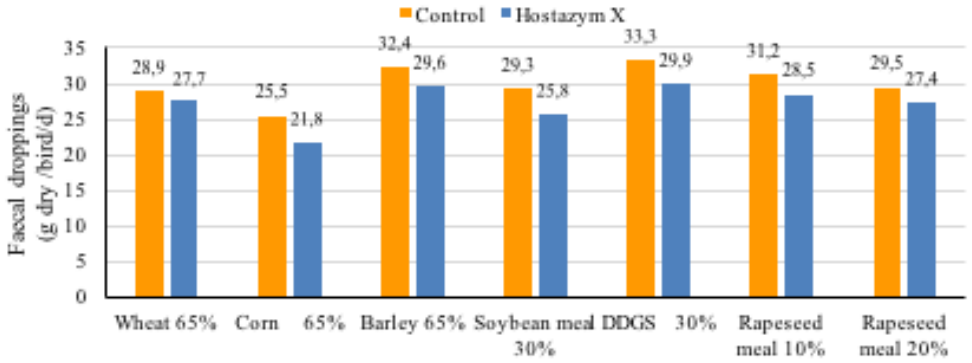

Fig. 3. daily faecal droppings (g/bird/d) with or without a NSP degrading enzyme complex

The inclusion of the enzyme complex also led to a reduction in faecal droppings (Fig. 3). This reduction in the excretion of dry matter, corrected for intake, demonstrates clearly that the enzyme complex is improving the overall dry matter digestibility. This might be linked to the effect of the enzyme complex on the degradation of insoluble fiber, making starch and protein more accessible for degradation by endogenous enzymes in the gut.

Additionally, the inclusion of the enzyme complex resulted in a reduced daily water consumption, which might be linked to a reduced viscosity in the gut (Fig. 4). As a consequence of the effects shown in Fig. 3 and 4, a reduction in wet litter in field conditions can be expected when using the enzyme complex.

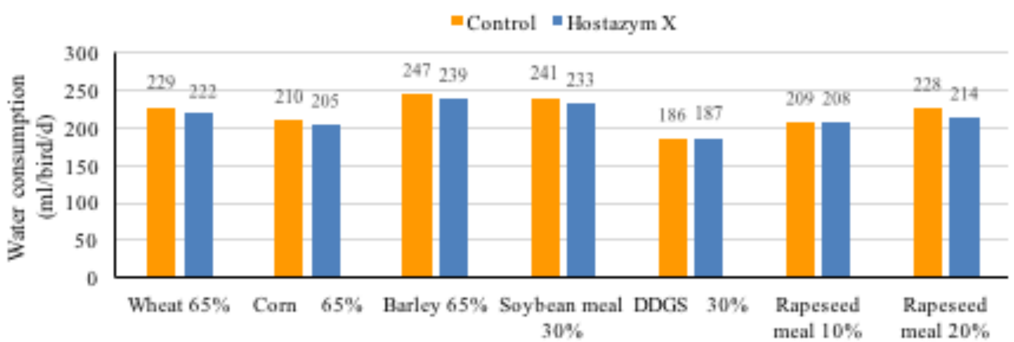

Fig. 4. daily water consumption with or without a NSP degrading enzyme complex

Conclusions

The inclusion of a fungal NSP degrading enzyme complex (Hostazym® X at 1500 EPU/kg) led to an increase in ME which was highest in the DDGS-based diet, followed by the diets containing 20 % rapeseed meal, 65 % corn or 65 % barley. It also resulted in an increase in fat digestibility (highest in the corn diets followed by the 30 % DDGS diet), as well as reduction in daily faecal droppings, thereby showing an increased digestibility of the feed dry matter and also a reduced water consumption. Both of these key findings effectuate a better performance and a lower risk of wet litter.

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O15 Implications of Protease Addition to Diets with NSPases and Different Levels of Phytase in Broiler Diets

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Abstract

Proteases have become a nutritional tool to improve not only chicken performance in terms of protein utilization, growth and FCR but also because of their positive impact on environment, gut health and animal welfare. The aim of the present study was to evaluate the effect of protease contribution when used with different combination levels of phytase and NSPases in broiler diets. A total of 1890 Ross day-old mixed chicks were used in this study and randomly assigned to one of the 6 treatments with 7 replicate pens of 45 birds. In a 2 × 2 factorial scheme (2 levels of phytase: 500 or 1000 FTU; 2 levels of protease: 0 or 500g/ton) plus 2 positive control (PC) diets were used. Phytase was formulated at 500 FTU dose using suggested matrix for AA, AMEn, P & Ca; or 1000 FTU at 30% higher than 500 FTU-matrix. Negative Control (NC) diet were marginally deficient in AAs and ME levels based on Ross recommendations to make basal diet more sensible to enzymes addition. All diets were formulated with an NSPase containing xylanase, α-galactosidase and β-glucanase activities with matrix value of 50kcal at 500 g/ton dose level. Life performance (pen averages) and carcass (from 5 birds/pen) traits were analyzed by ANOVA and Tukey Test. Interactions between either phytase and protease were tested as a 2x2 factorial without PC. The results of the present experiment demonstrated that supplementation of protease at 500 g/ton dose level together with NSPase and with 2 dietary levels of phytase, 500 or 1000 FTUs, significantly ($P<0.0001$) affected body weight and FCR. Addition of protease into NC diet increased body weight respectively from 2574 to 2637 g at 500 FTUs and from 2579 to 2640 g at 1000 FTUs phytase dose levels. Similar effect was observed with decreased FCR respectively from 1.746 to 1.695 in 500 FTUs phytase and from 1.756 to 1.702 in 1000 FTUs phytase, indicating positive response in energy and protein utilization as a result of protease supplementation in addition to phytase and NSPase. There was no significant ($P>0.05$) difference among experimental treatments with respect to FI and mortality in relation to different levels of fhytase and protease supplementation. However, beneficial effect of protease addition was also evident in carcass yield and breast weights. Significant ($P<0.05$) improvement was also detected in carcass weight (from 2.320 to 2.367 kg) by protease supplementation at 1000 FTUs phytase level. Similar significant ($P<0.05$) increase in breast weight from 0.671 to 0.706 kg was also observed by protease addition at 500 FTUs phytase level. No significant difference was found among the treatments with respect to wing and leg weights. The results of the present experiment demonstrated that exogenous protease could significantly improve BW and FCR, carcass yield and breast weight when used together with phytase and NSPase in additive manner.

Keywords: protease, phytase, non-starch polysaccharidase, broilers, enzyme blends

Introduction

Proteases have become a nutritional tool to improve not only chicken performance in terms of protein utilization, growth and FCR but also because of their positive impacts on environment, gut health and animal welfare (Cowieson and Roos, 2016; Angel, et.al., 2010). Research studies recently carried out using proteases in combination with other enzymes such as phytase and xylanase have demonstrated that supplementation of proteases together with phytase and carbohydrases need to be clarified in relation to their additive effects, since contradictory results have been reported by using of proteases with phytase and or carbohydrases (Sultan, et al., 2011; Romero et al. 2013) Therefore the present study aimed to evaluate the effect of protease contribution when used with different combination levels of phytase and NSPases in broiler diets.

Materials and Methods

A total of 1890 Ross day-old mixed chicks were used in this study and randomly assigned to one of the 6 treatments (Table 1) with 7 replicate pens of 45 birds. A 2 × 2 factorial scheme (2 levels of phytase (Phytaverse® Novus Int.): 500 or 1000 FTU; 2 levels of protease (Cibenza DP100®; Novus Int.): 0 or 500g/ton plus 2 positive control diets were used. Phytase was formulated at 500 FTU dose using suggested matrix for AA, AMEn, P & Ca; or 1000 FTU at 30% higher than 500 FTU-matrix (Table 2). Negative Control diets were marginally deficient in AAs and ME levels based on Ross recommendations to make basal diet more sensible to enzymes addition (Table 3). All diets were formulated with NSPase (Cibenza CSM®; Novus Int.) with matrix value of 50kcal at 500 g/ton dose level. Cibenza Phytaverse 10,000 “liquid”, Cibenza DP100® and Cibenza CSM® were used in this trial. The matrix values to be used for Phytase formulation (in all treatments and depending on its inclusion) are shown in Table 2. Nutritional contributions of the protease (Cibenza DP100) for starter, grower and finisher based on phytase dose levels have been shown in Table 4.

Management and Diets

The present trial was carried out in an experimental farm at Morelia, Michoacán, Mexico. All main ingredients (Corn, SBM and MBM) were analyzed prior to the study for: proximate analysis and amino acids. Dietary feeds were offered in mash form and feeding program was divided in 3 periods: Starter 1-21 days; Grower 22-35 days; and Finisher 36-42 days of age. Water and feed was given *ad libitum*. Salinomycin was used only in the Grower and Finisher phases to control coccidiosis. Chicks were observed at least twice daily. Bird mortalities were collected daily and weighted to be used in the calculation of mortality-corrected feed conversion. Feed intake corrected for the number of broilers, BW, BWG, commercial FCR, FCR corrected for mortality, production Index, and livability were measured at 42d of age. At 42d of age, 5 males per pen were randomly selected to carcass and cuts yield assessment (breast, wings, thighs and upper thighs in grams and % related to carcass).

Statistical design and analysis of data

Overall treatment effect was subjected to ANOVA using the GLM procedure of SAS. In addition, treatments, except for positive controls, were analyzed in factorial scheme. Tukey test was used to compare

multiple treatments. Significant differences were declared at $P < 0.05$.

Results and Discussion

The results of this experiment demonstrated that supplementation of protease at 500 g/ton dose level together with NSPase containing xylanase, α-galactosidase and β-glucanase activities and with 2 dietary levels of phytase, at 500 or 1000 FTUs, significantly (P<0.0001) affected BW and FCR. Addition of protease into formulated of basal diet to be lower at 0.15% of Pav and Ca, and AA and ME as suggested by the enzymes supplier, increased body weight respectively from 2574 to 2637 g at 500 FTUs and from 2579 to 2640 g at 1000 FTUs phytase dose levels. Similar effect was observed with decreased FCR, indicating positive response in energy and protein utilization as a result of protease supplementation in addition to phytase and NSPase (Table 5).

There was no significant (P>0.05) difference among the treatments with respect to FI and mortality in relation to different levels of phytase and protease supplementation. However, beneficial effect of protease addition was also evident in carcass and breast weights. Significant (P<0.05) improvement was detected in carcass weight too (from 2.320 to 2.367 kg) by protease supplementation into NC feed at 1000 FTU phytase level. Similar significant (P<0.05) increase in breast weight from 0.671 to 0.706 kg was also observed by protease addition at 500 FTU phytase level. No significant difference was found among the treatments with respect to wing and leg weights (Table 6).

Beneficial effect of protease supplementation on growth and FCR has been attributed to degradation of antinutritional factors, such as tripsin inhibitors, lectins and antigenic proteins (Castanon and Marquardt, 1989; Huo et al. 1993; Guenter et al., 1995) or to improved feed intake and increased apparent ileal N digestibilities (Hessing et al., 1996). Gazi et al. (2002) more recently indicated improvement not only in weight gain but also in apparent ileal N digestibility and TME in the two experiments. Very recently, Cowieson and Roos (2016) confirmed the improvement in AA digestibility by means of exogenous protease considering 25 independent experiment through a meta-analysis. The average response in apparent ileal AA digestibility was found to be increased by 3.7%, ranging from 5.6% for threonine and 2.7% for glutamic acid. Albeit the effects of protease on apparent ileal AA digestibility were independent of geographical influences and animal species (layers, broilers, turkeys, pigs), a substantial amount (47%) of variability in the effect of exogenous protease was explained by the inherent digestibility in the control diet. It was reported that when the inherent digestibility of AAs in the control diet was less than 70% protease addition had improved AA digestibility approximately by 10%. When it was more than 90%, the researchers reported to had been a protease-mediated improvement in digestibility of around 2%. Apart from clear improvement in ileal AA digestibility, "extra-proteinaceous" effect by protease such as influence on reduction of putrefaction in distal gut (Windey et al, 2012), tight junction and integrity, enhanced AA availability for mucin synthesis (Cowieson and Roos, 2014), reduced viscosity of lumen contents (Odetallah, et al., 2003), interactions with non-protein nutrient digestibility, in fat or starch, improved retention in Ca and P (Olukosi et al., 2015), carcass yield (Rada, et al., 2014) and litter quality had also been reportedt. On the other hand, NSPases enhance protein digestibility which has been shown to be driven by one of the following mechanisms; reduced intestinal viscosity, direct endosperm cell walls puncturing, and production of fermentable oligosaccharides which trigger an entero-hormonal response which results in delayed gastric emptying. This facilitate more complete gastric and proximal small intestinal digestion of the whole diet (Cowieson and Bedford, 2009a). Addition of protease with xylanase and amylase was shown to improve apparent ileal AA digestibility and AMEn in young broilers (Romero et al., 2013). In the work of Yan et al. (2012) it was demonstrated that the benefit of protease was greater in the starter phase compared with the finisher phase which suggested that the young broiler may be more responsive to proteases. Consequently, the results obtained in the present study are in line with the findings of various research results (Romero et al., 2013; Rada et al., 2014; Olukosi et al., 2015; Cowieson and Roos, 2016).

Conclusions

Protease is effective in corn-soybean meal based diets in broilers until 42d of age.

Protease can be used in broiler diets and present additional benefits in performance when used together with either 500 or 1000 FTUs phytase and a blend of NSPases (xylanase, α-galactosidase and β-glucanase) or with 1000 FTUs phytase.

Table 1. Dietary Treatments

	Treatments	Phytase (FTUs)	Protease
T1	Positive Control	500	0
T2	Negative Control*	500	0
T3	T2 + Protease	500	500g/ton
T4	Positive Control	1000	0
T5	Negative Control*	1000	0
T6	T5 + Protease	1000	500g/ton

*Reduced AAs/ME levels based on improvements obtained with protease (500g/MT), according to the feeding phase and using PC as basal diet

Table 2. Phytase Matrices

Parameter	Units	Matrix 50g/t feed	Contribution 500FTU/kg diet	Matrix 100g/t feed	Contribution 1000FTU/kg diet
AMEn	kcal/kg	340000	17	221000	22
Crude Protein	%	10020	0.501	6513	0,651
Calcium	%	3000	0.15	1950	0,195
Sodium	%	840	0.042	546	0,055
Dig Lysine	%	420	0.021	273	0,027
Dig Methionine	%	180	0.009	117	0,012
Dig Cysteine	%	300	0.015	195	0,020
Dig M+C	%	480	0.024	312	0,031
Dig Threonine	%	580	0.029	377	0,038
Dig Tryptophan	%	80	0.004	52	0,005
Dig Leucine	%	1000	0.050	650	0,065
Dig Isoleucine	%	520	0.026	338	0,034
Dig Arginine	%	240	0.012	156	0,016
Dig Phenylalanine	%	520	0.026	338	0,034
Dig Histidine	%	240	0.012	156	0,016
Dig Valine	%	560	0.028	364	0,036

Table 3. Negative Control Levels (marginally deficient ME and AAs)

	Starter (1-21d)	Grower (22-35d)	Finisher (36-42d)
ME, kcal/kg	3000	3100	3180
Lys, %	1,15	0,95	0,85
Met+Cis, %	0,86	0,74	0,66
Met,%	0,43	0,37	0,33
Tre, %	0,76	0,64	0,57
Val, %	0,87	0,73	0,66
Ile, %	0,78	0,66	0,58
Arg, %	1,19	1,00	0,89
Trp, %	0.18	0.15	0.13
Ca, %	1.00	0.90	0.80
Pav, %	0.50	0.43	0.40
Choline, %	1500	1400	1300

Table 4. Nutritional Contribution of the Protease and Calculated Matrices at 500g/ton

	Starter		Grower		Finisher	
	500FTU	1000FTU	500FTU	1000FTU	500FTU	1000FTU
ME, kcal/kg	19,21	19,02	17,39	17,26	15,64	15,50
Protein, %	0,568	0,562	0,514	0,510	0,462	0,458
Lys, %	0,030	0,029	0,027	0,026	0,023	0,023
Thr, %	0,023	0,023	0,021	0,020	0,018	0,018
Met, %	0,008	0,008	0,007	0,007	0,007	0,007
Cys, %	0,012	0,011	0,011	0,011	0,010	0,010
M+C, %	0,020	0,019	0,018	0,018	0,016	0,016
Trp, %	0,007	0,007	0,006	0,006	0,005	0,005
Val, %	0,025	0,025	0,022	0,022	0,020	0,020
Arg, %	0,033	0,033	0,030	0,029	0,026	0,026

Table 5. Effects of Protease and Phytase on Life Performance Parameters

Phytase (FTU)	Protease	BW	FI	FCR	Livability
500	PC	2,643 **a**	4,492	1,726 **ab**	98,41
500	NC	2,574 **b**	4,425	1,746 **a**	98,41
500	NC+Protease	2,637 **a**	4,402	1,695 **c**	99,05
1000	PC	2,653 **a**	4,416	1,690 **c**	98,41
1000	NC	2,579 **b**	4,457	1,756 **a**	98,73
1000	NC+Protease	2,640 **a**	4,426	1,702 **bc**	96,51
P		< 0.0001	0,0958	< 0.0001	0,2198
Mean		2,621	4,437	1,719	98,26
SE		0,005	0,009	0,003	0,30
CV (%)		1,24	1,36	1,10	1,97

Means with different letters (a-c) within the same column differ significantly (P< 0.05).

Table 6. Effects of Protease and Phtaverse on Carcass and cuts at 42d (kg)

Phytase	Protease	Carcass	Wings	Breast	Legs
500	PC	2,366 **a**	0,235	0,701 **a**	0,609
500	NC	2,330 **bc**	0,230	0,671 **b**	0,595
500	NC+Protease	2,335 **bc**	0,229	0,706 **a**	0,606
1000	PC	2,356 **ab**	0,234	0,706 **a**	0,597
1000	NC	2,320 **c**	0,228	0,680 **ab**	0,607
1000	NC+Protease	2,367 **a**	0,236	0,694 **ab**	0,606
P		<.0001	0,6167	< 0.0009	0,2056
Mean		2,346	0,232	0,693	0,603
SE		0,003	0,002	0,003	0,002
CV (%)		0,79	4,74	2,40	2,00

Means with different letters (a-c) within the same column differ significantly (P<0.05).

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IS[09] Emerging Myopathies: White Striping and Wooden Breast Conditions and Meat Quality in Broiler

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Broiler chicken meat will soon become the most consumed animal protein globally. The breeding efforts for improved health, growth efficiency, and muscularity of commercial lines of broiler chickens has been very effective. The rapid growth of the food service and its market preference for chicken white meat (i.e., breast muscle) have led to a steady increase in market weights of broiler chickens destined for value-added processing. Compared to other animal protein sources, the broiler chicken breast meat provides the processors with a homogenous raw material for further-processed, ready-to-cook and ready-to-eat products that are always consistent in their composition, quality (nutritional, sensory), functionality and price.

Broiler chickens even slaughtered at heavy market weights are still considered developmentally as juveniles (1). The growth efficiency and muscle accretion rate of broilers during the juvenile phase of growth period is maximal, naturally requiring a sustained demand for nutrients, metabolic resources, and structural support. Muscle growth is a complex and extensively regulated process that involves a high rate of protein turnover. Degeneration and regeneration are normal physiological maintenance processes in the muscle tissue of rapidly growing animals, but even subtle aberrations in repair can result in the loss of tissue homeostasis and cellular dysfunction, leading to myopathies such as white striping (WS) and woody breast (WB). WS is characterized by the presence of white striations that occur between muscle fibers. Histologically, abnormal fat and connective tissue deposition is seen as a response to degenerating myofibers .Fillets affected by WS have significantly increased fat and collagen content, and lower protein content compared with normal fillets. WB, on the other hand, is abnormally firm to the touch, tough in texture and have a pale, bulging appearance. In severe cases, petechial hemorrhaging and fibrinous exudate may be present on the proximal end of the affected fillets.

Broiler chicken myopathies have been reported in varying prevalence with all breeds/strains of chickens, under a wide-range of slaughter weights and rearing systems globally. Breast myopathies result in poor meat quality (i.e., color, texture, and composition) often manifested following slaughter, as affected birds exhibit excellent health and growth performance with no signs morbidity. Histological observations of muscle fiber fragmentation, swelling, and degeneration, as well as accumulations of connective tissue, fat and inflammatory cell have been commonly observed in all myopathies, but with varying severities. There is no indication of systemic or local infections, but only aseptic ischemic necrosis and inflammatory response. Histological observations include a high variability if fiber size, presence of degenerating fibers, accumulation of connective tissue and infiltration of inflammatory cells (macrophages, heterophils, lymphocytes and fibroblasts). Molecular analysis of gene expression fillets affected by WB show build-up of reactive oxygen species, reduced glycolytic metabolism, abnormal calcium homeostasis and hypoxia, indicative of multifactorial triggers.

The breeding efforts that have been put in place to reduce their prevalence will naturally require some time, as the heritability values for myopathies are low. In the meantime, studies are focused on the influence of non-genetic factors (i.e., flock management, environment and nutritional programs), as the prevalence of WS, WB, and SB vary significantly by region, company, farms within a company, houses within a farm, and even lots of chickens within a house. So far, a number of factors have been investigated, including dietary nutrient (energy, amino acids) density, quantitative and qualitative feed restriction, high levels of phytase inclusion, dietary antioxidants (Vitamin E, creatine, carnosine) and trace mineral (Zn, Mn, Cu and Se) supplementation, and rearing temperature.

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O16 White Striping Prevalence and Its Effect on Proximate Composition, Color Properties and Oxidative Stability of Broiler Chicken Breast Fillets

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Abstract

White striping (WS) is characterized by white strations which are parallel to muscle fiber occurring on the broiler breast fillets. The severity of WS has gradually increased and it has become more common in poultry industry nowadays. A two-year constant period of observation in integrations indicated that WS is also a major problem in Turkey. It has been observed that the formation of WS incraeses with increasing age. Findings also indicated that more than 50 percent of broiler breast fillets obtained from 32-35 and 36-39 day of age had white stripes with different scores. From this point of view, in the current study, the effects of WS on the nutritional composition, color properties and lipid oxidation rate of breast fillets were examined. The incidence of white stripes with severe score induced the formation of less redness color on the cranial and caudal surface and darker color on the dorsal surface of breast fillets ($P < 0.05$). Lower protein and higher fat content were determined in moderate and severe white striped breast fillets compared to normal breast fillets ($P < 0.05$). Storage time had significant effect on meat malondialdehyde (MDA) so by increasing refrigerating time at 4ºC for 0, 3 and 7 days and freezing time at -18ºC for 30 days, breast fillet were found to be more sensitive to lipid oxidation ($P < 0.05$). The WS score and its interaction with storage time were not significant for MDA.

*Contribution was equal to that of the first author

Introductıon

The incidence of some abnormalities in chicken meat one of which is the occurrence of white striping (WS) are increasing rapidly in recent years (1, 2). White striping is one of the most important recent concerns in poultry meat quality (3) which decreases the acceptance of meat by consumers (4). White striping, the quantity and thickness of which changes from bird to bird, is characterized by white parallel lines in the same direction of the muscle fibers which are visible to naked eyes (1). Visual classification of the WS incidence in the breast fillets is based on the intensity and thickness of white striations: score 0, is a normal fillet without any white striations; score 1 (moderate) is fillets with small thin lines (<1 mm); and score 2 (severe) is a fillet with thick (>1 mm) white striations (5, 6). Additionally, in 2016, Kuttappan et al. (3) added the forth score (Extreme) to this classification with super thick white bands (> 2 mm thickness) covering almost entire surface of fillet.

During last five years, several studies have been conducted with the aim of determining the influence of WS on breast meat quality (7) and histological changes in breast meat. Structure of white lines in WS breast muscles are composed of adipose tissue. It has been reported that the breast tissue severely affected by WS can exhibit varying degrees of muscle myofibril degeneration resulting from an increase in connective tissue which can also be visible under microscope (8, 9). Kuttappan et al. (7) reported an increase in the percentage of fat and a decrease in the crude protein level in the breast muscle based on the increasing degree of WS. In the same study they showed that normal scored fillet had different fatty acid profile compare to severe scored fillet. Some researchers attempt in reducing WS by dietary vitamin E supplementation was not successful (10, 11). Studies to this point have shown that the incidence of WS is under the effect of factors like genotype (high > standard breast yield), sex (males > females), growth rate (fast > low), diet (high > low energy diet), and weight at slaughter (heavy > light) (4). More recently Bailey et al. (1) showed the essentiality and contribution of some other factors such as the environment and/or management with an effect greater than 65% of the variance in the incidence of WS.

Based on our knowledge, there is rare information regarding the effect of WS on chemical composition, color and lipid oxidation level of breast fillets. With that said, the purposes of the current study were to investigate 1) the difference regarding proximate composition and color properties among normal, moderate and severe breast fillets; 2) lipid oxidation level of those fillets during 7 days of refrigerated storage; 3) the effects of freeze-thawing on lipid oxidation in breast fillets.

Materıal and Method

The determination of WS in integrations

The incidence of WS was observed through lesion scoring by collecting samples from different broiler integrations in Turkey from Dec. 2014 to Dec. 2016. To take samples for lesion scoring, regular visits were given to 12 integrations and 5 healthy birds with no clinical symptoms of any diseases were selected and sacrificed by cervical dislocation from 5 houses in each integration (in total 25 birds from each integration in each visit). Samples were from 5 different age groups which are given in Table 1. Selected samples' weight were close to the flock weight (±10). Breast fillets were scored visually as Normal (Score 0; NORM), Moderate (Score 1; MOD), and Severe (Score 2; SEV) according to the grading system described by Kuttappan et al. (5). The results of scoring are shown in Table 1. The Extreme score defined by Kuttappan et al. (3) was not observed in the samples in the current study. Briefly, fillets with no white striations were served as Normal, Moderate were fillets with striations generally less than 1 mm thick but it can easily be seen on the fillet surface, and Severe score had white striations more than 1 mm thick.

Table 1. White Striping prevalence observed on Pectoralis major muscle at different ages of broilers

	Incidence (%) of white striping in different age groups			
Scores	25-28 day of age	29-31 day of age	32-35 day of age	36-39 day of age
Normal	56.00	50.67	38.47	28.12
Moderate	37.33	40.00	45.33	51.32
Severe	6.67	9.33	16.20	20.56

Sampling procedure for laboratory experiment

In a visit to a commercial local slaughter house (22.01.2016), totaly 1000 birds were separated from 35000 birds aged 41 days (Ross 308 broilers) after slaugthering. Then the selected slaughtered birds were lesion scored at the deboning section as Normal, Moderate and Severe (27%, 51% and 22% respectively). After scoring, 40 breast fillets were separated for each score (in total 120 samples) to perform the laboratory analysis. Having been bagged separately (40 fillets / group), samples were packed on ice and transported to the Ankara University Meat Science and Technology laboratory.

Before preparation the fillets for analysis, excess fat and connective tissues were trimmed from fillets. CIE L^*, a^*, b^* color values was measured in triplicate on both dorsal surface and cranial-caudal surface of each fillet using a Chroma Meter (CR300, Osaka, Japan).

Then the breast fillets were divided into four groups. Three groups were stored at 4ºC to determine the lipid oxidation rate at day 0, day 3 and day 7 of refrigerated storage. The last group was freezed at -18ºC during 30 days to state the effect of freze-thawing process on lipid oxidation level of breast fillets. Each group/replicate was placed into polystyrene plates as a monolayer and covered with stretch film.

Proximate composition of breast fillets

Moisture (Sec. 950.46), crude fat (soxhlet procedure, Sec. 991.36), crude protein (Kjeldahl method, Sec. 955.04), and crude ash (Sec. 920.153) were determined in homogenized samples at day 0 based on the method of AOAC (12). The conversion factor of 6.25 was used to convert nitrogen to percentage protein.

Thiobarbituric acid-reactive substances (TBARS) analysis

A modified method of Mielnik et al. (13) was used to determine the TBARS value of breast fillets. After homogenizing a mixture of 10g meat with 30 ml of a 7.5% aqueous solution of trichloroacetic acid (TCA) at 10000 rpm for 1 min by means of an ultraturrax (Miccra D9, Germany), the homogenate solution was centrifuged (10000 rpm, 5 min; Hermle Z326K, Germany) and filtered throughout Whatman filter paper (No. 40). A mixture of 5.0 ml of extract and 5.0 ml of 0.02 mol/l aqueous thiobarbituric acid (TBA) was prepared in a stoppered test tube. In another stoppered test tube a mixture of 5 ml distilled water and 5 ml TBA reagent was prepared as a blank. The samples were vortexed (Velp Scientifica, Usmate, Italy) and incubated at 100°C for 35 min in a water-bath and subsequently cooled for 10 min under tap water. Absorbance was measured at 532 nm aganist the blank (Perkin Elmer UV/VIS Spectrophotometer Lambda 35, USA). Results were expressed as milligrams malondialdehyde(MDA)/kg meat, by calculating from the standard curve of TEP (1,1,3,3-tetraethoxypropane) standard.

Statistical analysis

One way ANOVA analysis was performed by using SAS software, version 9.2 (SAS institute, 2001) for proximate composition and L^*, a^*, b^* color values to determine the significant differences among normal, moderate and severe samples. Regarding the TBARS values, the interaction of "WS degree × storage time" and main effect of "WS degree" or "storage time" were analyzed by using repeated measure ANOVA design. All data are shown as mean values ± standard error mean. When necessary, means separation was accomplished by using the Tukey's post hoc test. Statistical differences were considered significant at $P < 0.05$.

Results and Discussion

Kuttappan et al. (14) and Lorenzi et al. (15) reported that the incidence of WS increased with increasing live weight. According to Lorenzi et al. (15) birds that reached higher slaughtering weights (3.8–4.2 kg) exhibited higher incidence of WS than flocks slaughtered at lower weights (3.0–3.8 kg) at a similar age. As seen in Table 1, in the current study, the incidence of WS increased with the increasing ages for both moderate and severe samples.

The moisture, crude fat, crude ash and crude protein values of breast fillets are summerized in Table 2. No significant differences were determined for ash and moisture contents among different scores. However, the lowest fat and the highest protein amounts were measured in Normal breast fillets. In spite of that, the highest fat and the lowest protein amounts were determined in Severe breast fillets. These findings showed that crude fat amount increased while protein amount decreased with the increasing level of WS ($P \leq 0.05$). Similar results were also reported by previous processors (4,6). They determined higher fat and lower protein content in moderate or severe striped breast fillets.

Table 2. Comparison of proximate composition (%) of broiler breast fillets with 3 different scores of white striping*

Parameter	Crude fat	Crude Ash	Crude Protein	Moisture
Normal	4.12 ± 0.38^{c}	1.59 ± 0.013	21.24 ± 0.12^{a}	73.09 ± 0.74
Moderate	4.59 ± 0.41^{b}	1.54 ± 0.017	20.59 ± 0.16^{b}	73.29 ± 0.62
Severe	5.22 ± 0.35^{a}	1.56 ± 0.014	19.99 ± 0.15^{c}	73.22 ± 0.68

[a,b,c]: Values within the same column with no common superscript are significantly different ($P < 0.05$).
* Values represent the means of 40 samples per each scores of white striping.

Color is a critical food quality attribute because it affects consumer's initial selection of raw meat product in the market place (16). Color values of broiler breast fillets are presented in Table 3. L^* value indicates lightness, $+a^*$ indicates redness and $+b^*$ indicates yellowness color coordinates. Of these color parameters, L^* is probably the most important in poultry as consumers can detect and discriminate lightness values easier than the other values (17). On the cranial and caudal surfaces of breast fillets, with different scores of WS, no significant differences were observed in terms of L^* values, but darker color was measured on the dorsal surface of severe fillets ($P \leq 0.05$). The highest redness value on the cranial and caudal surfaces was determined in moderate fillets followed by normal and then severe ($P < 0.05$). Comparing moderate and severe, it is possible to note that a^* value decreased with increasing level of WS. In other respects, different degree of WS did not affect the b^* value of fillets for either of surfaces. In contrast to these results, previous researchers reported a significant increase for yellowness on dorsal surface of severe striped breast fillets while no alterations were observed for L^* and a^* values (14). More redness and more yellowness were determined on dorsal surface of moderate or severe striped breast fillets when comparing to normal groups (18). Mudalal et al. (19) noted the impact of WS on color properties of breast fillets were negligible. In that case, it is crucial to emphasis that further studies are needed to determine the relationship between WS and color properties of breast fillets.

Table 3. *L**, *a**, and *b** color values of broiler breast fillets with 3 different scores of white striping*

	Dorsal surface			Cranial and caudal surface		
Color parameters	*L**	*a**	*b**	*L**	*a**	*b**
Normal	54.92±0.42 [a]	3.66±0.25	7.82±0.36	55.51±0.32	3.04±0.37 [ab]	6.62±0.22
Moderate	54.96±0.47 [a]	3.64±0.29	7.57±0.37	55.33±0.39	3.74±0.39 [a]	6.11±0.49
Severe	53.10±0.61 [b]	3.61±0.31	7.94±0.47	55.02±0.65	2.59±0.28 [b]	5.33±0.37

[a,b]: Values within the same column with no common superscript are significantly different ($P < 0.05$).
* Values represent the means of 40 samples per each scores of white striping.

Lipolysis is a main reaction for hydrolysis of triglycerides and phospholipids in fresh meat during storage. This reaction results in formation of free fatty acids which are major substrate for lipid oxidation defined as reaction of free fatty acids with molecular oxygen via free radical chain mechanism. This oxidation reaction causes formation of carcinogenic compounds such as MDA. TBARS analysis is used to measure MDA amount in meat and meat products from past to date to determine lipid oxidation rate (20,21,22). TBARS values of breast fillets during refrigerated or frozen storage are summerized in Table 4. No significant differences were determined for the WS scores and interaction of "WS degree × storage time" ($P > 0.05$), while the level of MDA increased by increasing the storage time both in refrigerated storage at 4ºC or frozen storage at -18ºC. The highest ($P < 0.05$) level of MDA was observed in 7 days refrigerated meat compare to fresh meat (0 day storage). The level of MDA was also significantly ($P < 0.05$) higher in frozen meat than in fresh meat.

Table 4. TBARS value (mg MDA/kg) of broiler breast fillets with 3 different scores of white striping*

Interaction WS degree × time	Storage time			
	Day 0	*Day 3*	*Day 7*	*Day 30*
Normal	1.03±0.03	1.18±0.03	1.48±0.05	1.38±0.07
Moderate	1.04±0.02	1.26±0.04	1.62±0.06	1.50±0.08
Severe	1.02±0.03	1.26±0.02	1.61±0.09	1.53±0.11
Main effects				
WS degree	Normal	Moderate	Severe	
Refrigerated storage	1.23±0.04	1.31±0.05	1.28±0.05	
Frozen storage	1.20±0.05	1.27±0.07	1.28±0.08	
Storage time	Day 0	Day 3	Day 7	Day 30
	1.03±0.01 [cy]	1.23±0.02 [b]	1.57±0.04 [a]	1.47±0.05 [x]
p-value	WS degree × time	WS degree	Storage time	
Refrigerated storage	0.56	0.11	0.01	
Frozen storage	0.49	0.39	0.01	

[a,b,c]: Values within the same row with no common superscript are significantly different due to the main effect of refrigerated storage ($P < 0.05$).
[x,y]: Values within the same row with no common superscript are significantly different due to the main effect of frozen storage ($P < 0.05$).
* Values represent the means of 40 samples per each scores of white striping.

Conclusion

White striping is a popular and major problem for meat industry nowadays. The findings of a two-year follow up in Turkey showed that more than 50 percent of broiler breast fillets obtained from birds aged 32-35 or 36-39 have white stripes with different scores. On the other hand, based on results of laboratory study, the WS prevalance influenced the proximate composition, color properties and oxidative quality of broiler breast fillets. To our knowledge, limited number of studies were conducted regarding the physico-chemical quality of breast fillets since the discovery of white striping. With that said, more future studies should be carried out and the effects of WS on the quality of breast fillets for food industry should be propounded.

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O17 Effects of Ultrasound Pre-Treatment on Some Physical Properties of Chicken Breast Meat

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Abstract

The objective of this study was to determine the effect of ultrasound pre-treatment on some physical properties such as, color (L*, a*, b* and Browning index) porosity and apperent density of dried chicken breast meat. For this purpose, ultrasonic probe with 20 kHz frequency was used for pre-treatment. Ultrasound pre-treatment applications were made in distilled water with 100 % amplitude during 5 and 10 minutes to the vacuum packed cubes of chicken breast meat. After ultrasound pre-treatment drying was performed by hot air at 0.3 m/s air velocity and at two different air temperatures of 50°C and 80°C. Ultrasound pre-treatment caused changes in L*, a*, b* and browning index values of the samples dried at both of the temperatures. The sample with highest apparent density was found as the sample dried at 80 ºC after 5 min ultrasound pre-treatment with 1.15 kg/m^3 density value. Ultrasound pre-treatment caused decrease in porosity values of the samples dried at 50 °C, however it caused increase in porosity values the samples dried at 80 °C.

O[18] The Effect of Marination and Sous Vide Cooking on the Quality Parameters of Chicken Meat

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Abstract

Sous vide, a populer thermal treatment process, is used in foods on the purpose of extending the shelf life and increasing the nutritional, sensory and microbiological quality. With that said, the purpose of this study was determination the effects of sous vide cooking and marination as a pre-treatment on physico-chemical, microbiological and organoleptic quality of chicken breast and thigh meats stored at 4ºC during 56 days. Cooking yield increased by 3.91% for breast meat and 6.26% for thigh meat as a result of marination applied before sous vide cooking ($p<0.05$). Darker, more redness and more yellowness color was measured in marinated breast and thigh meats ($p<0.05$). That results was in accordance with the evaluation of sensory panel. Additionally, marination prevented the lipid oxidation in chicken meats, but higher TBARS value was determined in thigh meat when compared to breast meat ($p<0.05$). However, odor, tenderness, juiceness, and taste scores decreased throughout the refrigerated storage, chicken breast and thigh meats have stil found to be consumable at the end of the storage. Vacuum packaging prevented the growth of total mesophilic aerobic bacteria, total psychrophilic aerobic bacteria, lactic acid bacteria, and Enterobacteriaceae. An increase was determined in Micrococcaceae counts while a decrease was observed in total yeast and mold counts during storage. As a conclusion, it is possible to note that sous vide cooked chicken breast and thigh meats should be stored at 4ºC up to 8 weeks. In addition, marination, an effective pre-treatment, improved color properties, cooking yield, sensory and oxidative quality.

O[19] Slow Food:Slow Growing Broiler, Meat Quality and Welfare

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Abstract

Slower growing broiler genotypes are not using in conventional poultry meat production because of longer slaughter age and high production cost. They are very popular in organic, free range and some special production such as Label Rouage. Compare to high-yielding, fast growing broilers, slow growing broilers have better meat quality, less health and welfare problems. They are more suitable for the consumers had a concern about sustainable production and seeking product differentation. In near future, it has been waiting to use a great number of slow or medium growing broiler in conventional broiler meat production, especially in developed countries. This study was made to investigate the meat quality, injuriy or lesion on foot pad, hock and breast meat of a slow growing broiler raised in conventional deep litter housing system.

Key Words: Slow food, broiler meat quality, welfare.

IS10 Significance of Poultry Meat For Public Health

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Abstract

The biochemical events which during the formation of the humankind, survival and generation are the transformation of the substance into other substances and the transformation of the substance into energy. The Law of conservation of substances is valid to the human body. For this reason, the person would like to be healthy must be fed regularly and in a continuous manner.

People need to fed constantly and regularly in order to survive in a healthy manner, at the same time this food consumption must be sufficient, balanced and hygienic.

The data on food consumption and illness in Turkey, shows that Inadequate and unbalanced nutrition, especially lack of animal protein is an important public health problem

The lack of animal protein in feed has a negative inpact on the infant and children, adolescents, and women of childbearing age, pregnant and breastfeeding and the elderly and the workers in Turkey.

Chicken meat may have a crucial role in solving this important public health problem; because of production and distribution more economical compared the other meats, on the other hand, there are also many more advantageous in comparison to cow and ship meat in terms of nutritional value.

IS11 Effects of Childhood Nutrition on Susequent Adult Obesity and Cardiovascular Diseases; Effects of Poultry Meat

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Summary

Poultry meat is an animal product important in human nutrition. A variable, and moderate energy content, highly digestible proteins of good nutritional quality, unsaturated lipids, fat-soluble and B-complex vitamins as well as minerals make poultry meat a valuable food.

Poultry meat is one of the recommended constituents of Dietary Approaches to Stop Hypertension Diet as well as the Mediterranean Diet. The substitution of red meat with poultry as well as fish, nuts and legumes decreases the risk of developing type 2 and gestational diabetes mellitus, improves glycemic control and cardiovascular risk factors. Low-fat diets supported by fruits, grains, nuts, fish and poultry instead of red meat yields cardiovascular health benefits. Anti-inflammatory and antioxidative diet enriched with high-quality foods reduces pro-inflammatory cytokines. This favors anti-inflammatory milieu which in turn improves insulin sensitivity and endothelial function and ultimately act as a barrier to obesity, metabolic syndrome, type 2 diabetes mellitus and development of atherosclerosis.

Introduction

Obesity is a chronic low-grade inflammatory disease. In recent years, it has become a major health problem particularly in children. The prevention of this disease particularly during childhood will inhibit the development of obesity in adulthood as well as obesity-associated diseases such as cardiovascular diseases, atherosclerosis, diabetes mellitus, non alcoholic fatty liver disease, hypertension and cancer. Overweight children are potentially at risk of early atherosclerosis as much as obese children (1). Overweight children are also susceptible to the development of heart failure (2). T cell immunity plays important roles in chronic inflammatory diseases such as obesity. Decreased regulatory T cells status is noted in obese children (3).

The major concern is the reduction in the energy intake of individuals, prevention of foods with high fat and carbohydrate content. Poultry meat is an animal product important in human nutrition. A variable, and moderate energy content, highly digestible proteins of good nutritional quality, unsaturated lipids, fat-soluble and B-complex vitamins as well as minerals make poultry meat a valuable food (4,5).

Poultry meat is under the threat of oxidative stress parameters, which impair the quality of it. However, successful antioxidative strategies may fight against oxidative damage produced and supported by the harmful effects of reactive oxygen species including those of free radicals (Figure 1).

Consumption of poultry meat along with vegetables and fruits is associated with a risk reduction of developing overweight and obesity, cardiovascular diseases, type 2 diabetes mellitus, cancer. The United Nations Food and Agricultural Organization consider poultry meat widely available, relatively inexpensive food to be particularly useful in developing countries. Poultry meat consumption due to its essential nutrients gains importance particularly in pediatric and geriatric age groups and during some physiological conditions such as pregnancy and breast feeding periods (4).

The nutritive value of poultry meat

The nutritive value of poultry meat depends on different factors such as age, feeding, keeping, hybrids, carcass parts and type of meat. Breast meat is richer in protein and poorer in fat than meat of drumsticks and thighs. Poultry meat is a good quality protein source. The low content of collagen is another positive aspect of poultry meat, because collagen reduces the digestibility of the meat (4,5).

Aside from fat soluble vitamins B group vitamins such as niacin, pyridoxine and pantothenic acid are found in considerable amounts in poultry meat. Variable concentrations of physiologically essential trace elements (iron, zinc and copper) essential for the human body are found across different types of meat. Poultry meat is also an excellent source of selenium, another essential trace element with antioxidative and anticarcinogenic properties (4,5).

The effect of oxidative stress

Protein oxidation takes place at the center of biochemical reactions, which affect the poor quality of pale, soft and exudative poultry meat. Proteins of the breast meat are more susceptible to oxidative stress due to lower pH, an impaired activity of endogenous antioxidant enzymes such as glutathione peroxidase, catalase, superoxide dismutase (6).

Cooking techniques as well as the length of cooking are two major contributors to the production of oxidation products, particularly the oxidation of thiols, tryptophan, alkaline amino acids and protein cross-linking, in poultry meat. Out of grilling, roasting, frying and sous-vide techniques, the last one seems to be the most advantageous cooking methods to obtain high-quality meat devoid of protein carbonylation and disulfide bond formation. Free thiol groups, Schiff base formation and hardness are impacted by the length of the cooking (7).

Poultry Meat Consumption, Obesity and Cardiovascular Diseases

Poultry meat is one of the recommended constituents of Dietary Approaches to Stop Hypertension Diet as well as the Mediterranean Diet (19-21). The substitution of red meat with poultry as well as fish, nuts and legumes decreases the risk of developing type 2 and gestational diabetes mellitus, improves glycemic control and cardiovascular risk factors. Low-fat diets supported by fruits, grains, nuts, fish and poultry instead of red meat yields cardiovascular health benefits. Anti-inflammatory and antioxidative diet enriched with high-quality foods reduces pro-inflammatory cytokines. This favors anti-inflammatory milieu which in turn improves insulin sensitivity and endothelial function and ultimately act as a barrier to obesity, metabolic syndrome, type 2 diabetes mellitus and development of atherosclerosis (22-24).

Introduction of some meat including poultry to children in later ages is detected in populations with low nutritional status compared to populations with middle and good nutritional status (25).

Adequate consumption of poultry meat can facilitate the control of body weight due to its high protein content and help to counteract against the development of obesity, cardiovascular diseases, diabetes mellitus and cancer (4).

Poultry is one of the most common dietary sources of L-arginine, the precursor amino acid for nitric oxide synthesis. L-arginine supplementation may be a novel therapy for obesity and metabolic syndrome (26).

Supplementation or fortification with selenium contributes to the matter with its anti-inflammatory and antioxidative properties. Selenium is also considered for the treatment of obesity (27).

Conclusion

Poultry meat is particularly susceptible to oxidative damage. Lipid oxidation is a major threat to the quality of processed poultry meat. Low feed intakes, poor performance, diseases, rancidity, formation of toxic compounds are some of the impacts of oxidation (28). Protein oxidation plays important roles in the impaired quality poultry meat. Therefore, it will contribute to the productivity in this field to avoid from applications, which may lead to oxidative damage.

Poultry meat prepared in optimum conditions will favor the healthy growth and development of children. The replacement of this valuable protein source with high calorie foods commonly consumed at present by the young population will help children to avoid obesity and obesity-associated chronic diseases both during childhood and also their adulthood.

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O20 Analyzing the Factors Affecting Household Chicken Meat Consumption Expenditures in Turkey with Bivariate Heckman Sample Selection Model

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Abstract

Human beings need to consume vitamins, minerals, carbohydrates and proteins in sufficient amounts in order to maintain their lives in a balanced and healthy way. Meat and meat products, because of their high protein content, are at the top of the list of the main nutrients that need to be consumed for a balanced and healthy life. Chicken meat that occupies an important place among different kinds of meat, has a great importance in human nutrition with its low fat, low calorie content, relatively low price and easy to digest peculiarity. In this study, the changes in the socio economic and demographic structure of the households on their chicken meat consumption expenditures in Turkey between the years 2002 and 2013 by using the Bivariate Heckman Sample Selection Model. The data has been compiled from the pool of 12 year household budget questionnaires of the Statistical Institution of Turkey covering the period of 2002 and 2013. It has been determined that several socio-economic and demographic factors of the household heads and household themselves have an effect on the household chicken meat consumption expenditures. It has been concluded that household chicken meat consumption expenditures increase if the age of the household head increases, if he (or she) has green card, if he is married and if he has children. On the other hand the expenditures decrease if the head of the household receive social aid and if the family lives in an urban area.

Key words: Bivariate Heckman Sample Selection Model, Chicken meat expenditures, Turkey

O21 Protected Organic Acids and Essential Oil Blends on Gut Microbiota and Production Performance of Broiler Chickens

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Abstract

The increasing concern about the use of antibiotics in poultry production has changed the ways in which producers manage the birds' overall health. Currently, additives with anti-microbial and growth promoting effects are added in poultry feeds to prevent and control GI-tract infections that adversely affect performance. A study was conducted to determine the effects of a blend of protected organic acids (OAs) and essential oils (EOs) in performance and gut microbial profile of broiler chickens. A total of 612 Ross 308 day old chicks were randomly assigned to receive 1 of 3 treatments for 28 d: 1) basal diet with no antibiotic + 100 ppm lasalocid (T1) (n=204), 2) T1 + 300 ppm of protected OAs and EOs (T2) (n=204), and 3) T1 + 1500 ppm of protected OAs and EOs (T3) (n=204). A completely randomized design with 3 treatments, 12 replicates, and 17 birds in each replicate was used. On d 14 and 28, 1 bird from each pen was sacrificed to collect ileal and cecal samples for microflora analysis using high-throughput sequencing based on 16S ribosomal RNA genes. The BW of birds in T2 and T3 at d 21 was significantly increased relative to T1 ($P<0.02$, 4.6%), as was the BW of birds in T2 at d 28 ($P<0.05$, 2%). The FCR was not different between treatments; however, there was a trend towards improved FCR at d 21 in T2 ($P<0.09$, 5.5%) and T3 ($P<0.06$, 5.6%), as well as at d 28 in T2 ($P<0.06$, 5.7%). Sequencing data at d 14 and 28 revealed retained complexity and overall structure of the ileal and cecal microbiota across treatments. However, the gut microbial profile of treatments changed in between these time points. Compared to T1, significant changes in the abundance of some *Lactobacillus* species within the cecum of birds in T2 and T3 were found at d 28. Overall, the supplementation of a blend of protected OAs and EOs had no adverse effect on the microbial diversity of the intestine and appears to offer benefits with respect to gut health and productivity in broiler chickens.

Introduction

Since the ban on antibiotics for growth promotion within the European Union was established in 2006, much interest has focused on the role of gut microbiota in animal health, production, and product safety (Castanon, 2007). In-feed antibiotics have been widely used since the 1950s to improve feed efficiency and animal growth through the modulation of the gut microbiota and the host's immune response (Niewold, 2007), as well as to reduce morbidity and mortality due to clinical and/or subclinical diseases (Feighner and Dashkevicz, 1987). However, due to the recent legislative changes and the increasing consumer demand for animal products produced without antibiotics, different natural alternatives with similar antimicrobial and growth promoting properties are currently being added in the animal feeds to prevent and control gastrointestinal diseases and reduce the proliferation of food-borne pathogens. Among the alternatives, organic acids (OAs) and essential oils (EOs) are two of the most commonly used.

In their un-dissociated form, OAs are considered to affect microbial activity by two primary mechanisms; first is by cytoplasmic acidification with subsequent uncoupling of energy production and regulation, and second is by accumulation of dissociated acid anion to toxic levels (Taylor et al., 2012). On the other hand, EOs work by disrupting the cell wall and cytoplasmic membrane, thereby impacting many cellular functions, including maintaining the energy status of the cell, membrane-coupled energy-transducing processes, solute transport, and metabolic regulation (Burt, 2004). More recent publications reported that EOs can also interrupt bacterial quorum sensing, and therefore may reduce the ability of the pathogen to initiate or cause an infection (Faleiro, 2011).

The growth promoting properties of antibiotics are known to be strongly related to their ability to inhibit pathogens and the modulation of the gut microbiota. Gut microbiota significantly affects nutrition, health status, and animal performance by interacting with gastrointestinal tract development and nutrient utilization. Therefore, the focus of alternative strategies to antibiotics has been centered on modulation of the gut microflora in particular the prevention of the proliferation of pathogenic bacteria in the gut. To this end, a study was conducted to demonstrate the impact of using an alternative natural product based on a protected OAs and EOs blends in terms of intestinal microbial profile and measures of production performance in broiler chickens.

Materials and Methods

Six hundred and twelve Ross 308 day old chicks were placed in 36 pens in a commercial broiler farm and fed three different rations, one a control (T1) with lasalocid at 100 g/MT, and two groups treated with a combination of matrix protected OAs and EO blends, one at 300 g/MT (T2) and the other at 1.5 kg/MT (T3) added to the control diet. There were no antibiotic growth promoters in any of the groups. Feed intake and BW were measured weekly until d 28. On d 14 and d 28, one bird from each pen was removed and samples of intestine and caecum removed for analysis of the microflora utilising high throughput sequencing technologies identifying unique tags for each organism based on the 16S ribosomal RNA gene sequence analysis on an Illumina MiSeq instrument. Samples were characterised using an average of at least 20,000 sequences per sample. Microflora profiles were assessed and compared using QIIME software. Operational Taxonomical Units (OTUs) were picked using the Uclust algorithm (Edgar, 2010) using a threshold of 97% sequence identity. This percentage identity is estimated to be equivalent to a species designation. Taxonomy was assigned using blast against the Greengenes database (DeSantis et al., 2006). The OTU frequency table was uploaded to Calypso Web V4.6, a data-mining and visualization tool for 16S ribosomal RNA datasets, to investigate the diversity of the microbial communities. Additional taxonomic assignment was done using a command line version of blast (Altschul et al., 1997) against the NCBI 16S microbial database. With two time points (1 and 2) and two tissue origins caecum and intestine, there are four sets of data to be analyzed.

Statistical Analysis

A completely randomized design with 3 dietary treatments was used. Data were subjected to ANOVA using the PROC GLM procedure of SAS software (SAS Institute, Cary, NC). Differences between treatment means were determined using Tukey's honestly significance difference. Differences with an α level of P<0.05 were considered to be statistically significant.

Results and Discussion

Performance

In this study, we examined the effects of a protected OAs and EO blends on production performance of broiler chickens. At d 21, BW of birds in the treatment groups T2 and T3 was significantly improved compare to the control T1 birds (4.6%, P< 0.02) as was the BW of birds in T2 at d 28 (2% P<0.05) (Figure 1). There was a trend towards improved FCR (over 5%) at d 21 in both treatment groups (P<0.09) and at d 28 in T2 (P<0.06) (Figure 2). No significant differences in feed intake were observed. These results were consistent to those reported by Bozkurt et al., (2012) who examined the effects of three doses of individual and combined dietary supplements of specific blends of OAs and EOs on broiler performance and found significant improvement in both BW and FCR as compared to the negative control group.

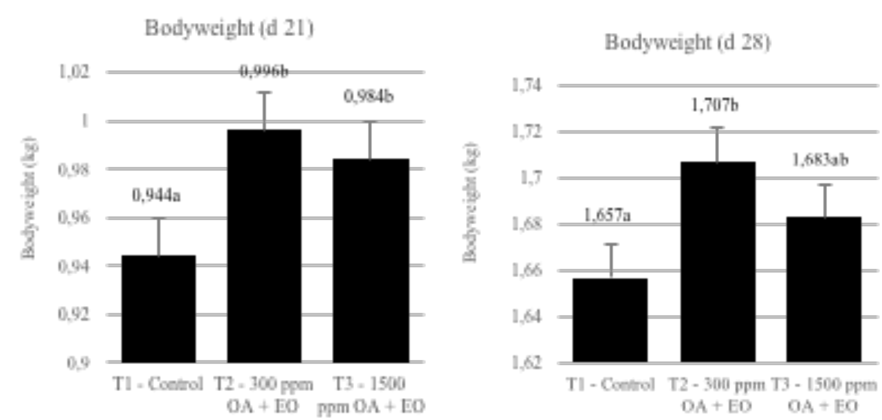

Figure 1. Average bodyweight (kg) of broilers supplemented with and without protected organic acids and essential oil blends at d 21 and d 28. Columns with different superscripts are significantly different (P< 0.05).

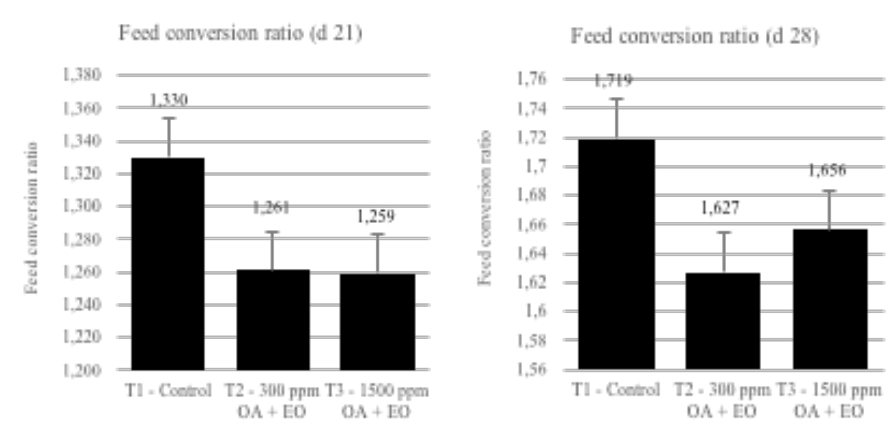

Figure 2. Feed conversion efficiency of broilers supplemented with and without protected organic acids and essential oil blends at d 21 and d 28.

Gut Microbiota:Initial investigation focused on the effect of protected OAs and EOs blends on the overall diversity of the microbiota. Diversity refers to the overall structure, or complexity, of the gut microbiota which was determined by measuring its richness, which refers to the number of different species (or OTUs) present; and its evenness, which is a measure of how similar or different in abundance each species is. It is generally regarded that more diversity is good because it allows for better homeostasis of the gut flora population and that the use of antibiotics reduce the diversity of the microflora in the gut.

In terms of microbiota diversity, the supplementation of protected OAs and EO blends at low and high dose rate did not result in altered microbial community diversity compared to the control group. At both d 14 and d 28, there were no significant differences in the caecal microbiota composition between treatment groups as judged by the Richness and Evenness indices (Figure 3). Similar results were found in the ileal microbiota composition. This result indicates that the treatments did not have any adverse effects on the complexity and overall structure of the gut microbiota.

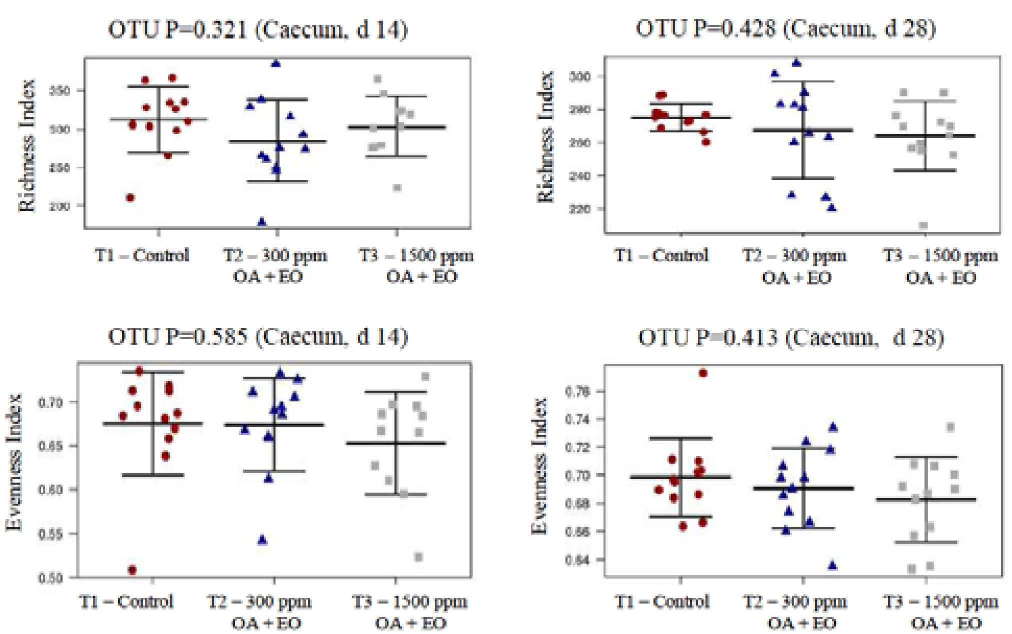

Figure 3. Richness and evenness indices of caecal microbiota of broilers supplemented with and without protected organic acids and essential oil blends at d 14 and d 28.

The next part of the analysis was the investigation of the actual species contributing to microbial diversity. ANOVA was used to identify those OTU's that had statistically different levels of abundance between treatment groups. At d 14 and d 28, 11 and 3 OTUs differed in abundance between treatment groups in the ileum, respectively. In the caecum, there were more differentially abundant OTUs, with identified 18 on d 14 and 26 on d 28. When the OTUs that were differentially abundant between treatment groups were further inspected, that is when the phylogenetic relationship of the bacterium represented by the OTU was manually checked by BLASTing against the NCBI 16S database. The most interesting results indicated a significant decreased in the abundance of *Enterobactericeae* in the caecal samples from the treated groups compared to the control. However, the observed response was not found to be dose related. In addition, differences were also seen between the treatment groups and the control group in the composition of gut microflora with more *Lactobacillus spp*. present in the treated broilers with 1.4 times the average level of caecal *Lactobacillus spp.* in T2 and 3.8 times the level of *Lactobacillus spp*. in T3 than in the control group, respectively (Table 1).

Table 1. Differentially abundant Operational Taxonomic Units (OTUs) in the cecum samples at d 28.

OTU	Identity	Homology %	% in T1	% in T2	% in T3
76727	*Lactobacillus salivarius*	100	0.062	0.076	0.22
57808	*Lactobacillus salivarius*	100	1.13	1.35	3.57
35274	*Lactobacillus salivarius*	97	0.018	0.019	0.096
217021	*Lactobacillus salivarius*	97	0.076	0.14	0.26
196333	*Lactobacillus salivarius*	97	0.078	0.076	0.18
157835	*Lactobacillus salivarius*	98	0.076	0.087	0.17
5797	*Lactobacillus* sp. crispatus/acidophilous/gallinarum	97	0.18	0.26	0.87
52716	*Lactobacillus reuteri*	96	0.063	0.061	0.21
35461	*Lactobacillus kitasatonis*	97	0.010	0.044	0.13
37371	*Lactobacillus satsumensis*	97	0.050	0.042	0.14
96403	*Lactobacillus salivarius*	97	0.093	0.15	0.45
	Average *Lactobacillus*	**N/A**	**0.167**	**0.210**	**0.572**

Conclusions

The use of the combination of matrix protected organic acids and essential oil blends had no adverse effect on the gut flora diversity, decreased and increased the levels of *Enterobactericeae* and *Lactobacillus spp* in the gut respectively, and appears to offer benefits with respect to gut health and productivity of broiler chickens.

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O[22] Effect Of 1-Monoglycerides of Organic Acid in Controlling *Clostridium Perfringens* and *Salmonella Typhimurium* in Experimentally Infected Broiler Chickens

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Abstract

The aim of the present study was to evaluate *in vivo* the antibacterial activity of specific mixture of organic acid 1-monoglycerides (SILOhealth 104 L) against *C. perfringens*, *Eimeria spp* (trial 1) and *Salmonella typhimurium* (trial 2).

In the first trial, 2 diets supplemented or not with SILOhealth 104 L (Control: 0 % in all periods; Group 1: 0.5 % from day 1 to day 10 and 0.025 % from day 11 to day 21) was offered to broiler chickens experimentally infected at day 5 of life with 3,000 sporulated oocysts of a mix of *Eimeria acervulina*, *maxima* and *tenella*, respectively, and at day 11 with 10^6 CFU of *C. perfringens.* The efficacy of SILOhealth 104 L was evaluated in terms of intestinal gross lesions.

In the trial 2 diets supplemented or not with SILOhealth 104 L (Control: 0 % in all periods; Group 1: 0.3 % from day 1 to day 34) was offered to 128 SPF broiler chickens experimentally infected via endoesophageal inoculation with 10^7 CFU of *Salmonella typhimurium.*

Salmonella typhimurium colonization was monitored in both experimental groups demonstrating a strong effect of SILOhealth 104 L in fighting against the bacterium.

Results of both trial indicated that the specific mixture of organic acid 1-monoglycerides (SILOhealth 104 L) was able to prevent acute necrotic enteritis in broilers caused by the combination of *Eimeria spp.* and *C. perfringens* and to reduce *Salmonella typhimurium* colonization in broiler chickens.

Organic acid 1-monoglycerides demonstrated to be a valid alternative to antibiotics in terms of antibacterial potency and absence of withdrawal periods in farms.

Introduction

The world-wide development of antibiotic resistance in bacteria and, in particular, the generation of multidrug-resistant bacteria among zoonotic agents, has highlighted the importance to reduce the usage of antibiotics and to provide new options and alternative strategies for preventing and treating animal diseases.

Moreover, the report issued in 2009 by the European Centre for Disease Prevention and Control and the European Medicines Agency, underlined that the increasing occurrence of multidrug-resistant bacteria is associated with poor development of new antibiotic molecules to treat infections sustained by these bacterial agents.

In this scenario, growing public health concern about food and environmental safety in terms of antibiotic resistance and residues has recently prompted research on the development of new disease control strategies. As a result, several alternatives to antibiotics were developed, such as pre- and probiotics, essential oils, plants extracts, spices, organic acids, bacteriophages, natural antibacterial peptides and many others.

Among the suggested alternative compounds, organic acid 1-monoglycerides showed high antibacterial activity *in vitro* and *in vivo*.

Several studies demonstrated both in vitro (Kabara *et al.*, 1972) and in vivo (Boyen *et al.*, 2008; Fernandez-Rubio *et al.*, 2009) that 1-monoglycerides of organic acids have stronger antibacterial activity compared with the corresponding fatty acids (Kabara *et al.*, 1972, 1984; Thormar *et al.*, 2006)

The antimicrobial activity depends on the selected fatty acid, concentration, bacterial species and other properties. Different mixtures of organic acid 1-monoglycerides were successfully tested against different bacterial species such as *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, *Helicobacter pylori*, *Staphylococcus aureus, Clostridium perfringens, Campylobacter jejuni, Listeria monocytogenes, Salmonella enteritidis* and *typhimurium* (Bergsson *et al.*, 1998, 1999, 2001, 2002; Wang and Johnson, 1992; Thormar *et al.*, 2006; Namkung *et al.*, 2011).

Considering the increase in the European poultry industry of drug-resistant bacteria and protozoa, we investigated the efficacy of specific mixture of 1-monoglycerides of organic acid as feed supplements to control *Clostridium perfringens* and *Eimeria spp* (Trial 1 monitored by Istituto Zooprofilattico Sperimentale della Lombardia e dell'Emilia-Romagna, Sezione Diagnostica di Forli, Forli, Italy) and *Salmonella typhimurium* (Trial 2 monitored by Istituto Zooprofilattico Sperimentale della Lombardia e dell'Emilia-Romagna, Sezione Diagnostica di Forli, Forli, Italy) colonization in broiler chickens.

Trial 1:

Materials and Methods

Birds Housing:Sixty female one-day old Ross 308 broiler chicks were divided into 2 groups of 30 chicks each group and randomly housed in poultry isolators (HM 1500, Montair Andersen B.V., ZG Sevenum, The Netherlands). The isolators were equipped with drinkers, heating lamps, and filtered air. A 16 h/ 8 h light/ darkness program was applied.

Chicks were vaccinated against Marek's disease, Infectious Bronchitis and Newcastle disease at the hatchery. Vaccination against coccidiosis was not carried out. Chicks were offered drinking water and feed *ad libitum*. The trial lasted 35 days and animals were individually weighted at 11, 16, 21 and 35 days.

C. perfringens and Eimeria spp. strains cultivation:*Eimeria spp.* strains (*E. tenella*, *maxima* and

acervulina) were isolated from clinical outbreaks of coccidiosis in unvaccinated broiler chickens. Oocysts were recovered from the intestinal contents of affected birds using saturated NaCl solution and centrifugation at 2000 rpm for 10 min. Collected oocysts were washed with distilled water, centrifugated and sporulated at 28 – 30 °C for 48 – 72 h. After all these steps, the sporulated oocysts were resuspended in KCr_2O_7 solution and stored at 4°C. The number of oocysts in the suspension was calculated using a Mc Master's chamber and the final concentration of oocysts was obtained adjusting the volume of the suspension by addition of a buffered saline solution.

The *C. perfringens* strain used in the study was isolated from the intestine of broiler chickens with lesions caused by necrotic enteritis.

The bacterium was growth under anaerobic conditions in brain heart infusion broth (BHI) for 24 h at

37 °C.

Diets :The feed used in the trial was antibiotic and coccidiostat-free and negative for spore count.

The experimental mixture of 1-monoglycerides of organic acids (MG) was provided by SILO S.p.A. (Florence, Italy; commercial name SILOhealth 104 L). The product contains 1-monoglycerides of propionic (C3:0), butyric (C4:0), caprylic (C8:0), capric (C10:0) and lauric (C12:0) acid.

The experimental protocol is reported in Table 1.

Table1. Concentration of SILOhealth 104 L and experimental protocol

Group	From day 1 to day 10	From day 11 to day 21	From day 21 to day 35
Control	===	===	===
Group 1	*0.5 % SILOhealth 104L*	*0.025 % SILOhealth 104L*	===

In vivo challenge:On day 5 of age each bird was challenged via oral gavage with 3,000 oocysts of a mixture of *Eimeria tenella*, *maxima* and *acervulina*.

During the trial, birds were daily monitored. On day 16, 21 and 35 of age, 10 birds for each group were sacrificed in order to be able to collect some samples.

In order to evaluate gross lesions associated with coccidiosis, a 4-point scoring system lesion was applied for each *Eimeria spp*. used in the trial.

The score ranged from 0 (no gross lesions) to 4 (gross lesions).

Gut lesions caused by *C. perfringens* have been evaluated according to the procedure of Keyburn et al.

A 6 point score was applied according to the following scheme: Score 0 = no gross lesions; score 1 = thin or friable walls; 2 = focal necrosis (<5 foci); 3 = focal necrosis (<15 foci); 4 = focal necrosis (<16 foci); 5 = patches of necrosis 2 to 3 cm long; 6 = diffuse necrosis

Results

In the control group, two birds died at 31 and 32 days of age. The birds showed typical gross lesions related to *E. tenella* infection (Table 2). In contrast, no mortality was observed in the treated group.

Table 2. *Eimeria* lesions count in control and treated group

Day 16		Day 21		Day 35	
Control	**Group1**	**Control**	**Group1**	**Control**	**Group1**
3	1	2	0	2	1
1	0	2	0	2	0
2	1	1	0	1	0
2	1	1	1	1	0
2	0	2	0	2	0
3	1	2	0	1	0
1	1	1	1	2	0
2	0	2	1	1	0
2	1	2	1	*	0
1	1	2	0	*	1

* = died birds

Body weights of the treated animals were significantly higher compared to the animals of the control group. Birds fed diet supplemented with SILOhealth 104 L showed higher growth compared to control group. (Data not showed)

SILOhealth 104 L treatment decreased the number of chicks with necrotic lesion in the treated group compared to the control group (Table 3).

Table 3. Lesions count in the control and treated group caused by *C. perfringens*

	Control	Group 1	Days of age
% of birds with score ≥ 2	20	0	16
% of birds with score < 2	80	100	
% of birds with score ≥ 2	70	0	21
% of birds with score < 2	30	100	
% of birds with score ≥ 2	50	0	35
% of birds with score < 2	50	100	

Trial 2:

Material and Methods

Birds housing:Sixty four one – day old 128 SPF chicks were divided into 2 groups of 32 birds each randomly allocated to different isolators units (Montair Andersen HM1500) equipped with drinkers, heating lamps, air filtration devices, bedding straw. Birds were given feed and water *at libitum.*

Before starting the experiment, a portion of chicks in each group were checked for the absence of *S. typhimurium* by serological analysis and microbiological assays in different organs after sacrifice.

At 7 day of age the animals were challenged via endoesophageal inoculation with 1 mL of saline solution containing $1x10^7$ CFU/bird of *S. typhimurium*. The control group chicks were inoculated with sterile saline solution only.

24 h post infection, cloacal swabs were collected to determine *S. typhimurium* infection.

At 7 and 17 days post-challenge, 10 birds in each group were sacrificed and the 12 birds left were sacrificed at day 27.

The ceca and liver were collected to perform Salmonella assay and to determine the number of CFU/g.

Diets : The experimental mixture of 1-monoglycerides of organic acids (MG) was provided by SILO S.p.A. (Florence, Italy; commercial name SILOhealth 104 L). The product contains 1-monoglycerides of propionic (C3:0), butyric (C4:0), caprylic (C8:0), capric (C10:0) and lauric (C12:0) acid.

The experimental protocol is reported in Table 4.

Table 4: SILOhealth 104 L concentration and experimental protocol

Group	Feed treatment
Control	===
Group 1	*0.3 % SILOhealth 104 L from day 1 to 34 of life*

Results

All the results are reported in Table 5.

24 h after infection all cloacal swabs resulted positive for *S. typhimurium*.

Control birds at 27 days post infection showed high mortality (25%).

The group 1, fed with 0.3 % of SILOhealth 104 L, revealed a reduction of CFU/g of *S. typhimurium* in the ceca starting from 7 days post infection.

Table 5. Media of CFU/g of *S. typhimurium* cecal content at different days post infection

Group	7 day post infection	17 days post infection	27 days post infection
Control	6.400.000	25.120.000	(*)
Group 1	2.226.000	1.242.100	387.5

(*)= value not determined due to the high mortality

Discussion

Nowdays, *C. perfringens*, *Eimeria spp.* and *S. typhimurium* are a serious issues in the poultry industry.Both trials mirrored a typical field exposure producing possible damages for the poultry industry. The trials and our results show that the use of SILOhealth 104 L may contribute to the prevention of coccidial and *C. perfringens* causing intestinal lesions, can reduce *S. typhimurium* colonization and can also improve performance in broiler chickens.

In fact, SILOhealth 104 L used in the trials showed to be effective in reducing *Eimeria spp*, *C. perfringens and S. typhimurium* intestinal colonization in broiler chickens. This was inferred from the detection of low clostridial and salmonella levels and the reduced intestinal gross lesion score in treated groups compared to the control group.

1-monoglycerides are derived by combining a molecule of glycerol with a molecule of organic acid, forming a molecule with hydrophilic and lipofilic characteristics.

The covalent bond between organic acid and glycerol is stable from pH 1 to pH 8 and to high temperatures up to 230 °C

These characteristics give stability to the molecule in different environments, such as water, feed, gizzard, stomach, gut and are associated with long-term preservation of antibacterial properties.

This is an important difference between 1-monoglycerides and organic acid salts; the latter are dependent on pH, and exert their antibacterial activity at acid pH only under undissociated state conditions.

1-monoglycerides of organic acid, due to their chemical – physical characteristics, are not incorporated into emulsion droplets formed in the upper intestinal tracts together with bile salts and are not re-combined into triglycerides. Hence, their fate is the transport through the intestinal lumen to colon and cecum exerting their action on intestinal villus (phosphorylation of protein composing tight junctions, anti-inflammatory and angiogenetic effect) and on pathogenic bacteria. 1-monoglycerides are able to penetrate through bacterial wall causing, through different mechanisms, the cell death.

The mode of action is still under study and new studies are needed.

Conclusion

In this scenario, 1-monoglycerides of organic acid in feed show the peculiar advantage to reduce the impact of *C. perfringens*, *Eimeria spp*. and *S. typhimurium* infection in the intestinal tract of broiler chickens. For this reason an effective alternative to the use of antibiotics could be represented by 1- monoglycerides mixture of organic acid as SILOhealth 104 L.

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O[23] Effects of Dietary Prebiotic Addition to Diets on Growth Performance and Intestinal Microflora in Broilers Exposed to Delay Feed and Water Access after Hatch

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Abstract

This study was conducted to determined effects of dietary prebiotic supplementation on growth performance, intestinal microflora and some stress parameters in broiler chickens exposed to delay feed and water access after hatch. A total of 648 broiler chicks, a day-old, were divided into 6 experimental groups (3x2 factorial design) which were formed by supplementation of a dietary prebiotic and three levels of post-hatching holding time (0-, 24- and 48-hours). There were 6 replications for each treatment group and each replication consisted of 18 birds. Different post-hatch holding times (0-, 24-, and 48-hours) had no effect on body weight gains while they had effects on feed intake and feed conversion ratio in broilers by the end of this study ($P<0,01$ and $P<0,001$, respectively). Other parameters, which examined in this trial, include carcass, body part and organ yields of birds, pH of ileum, weights and lengths of some intestinal parts and also concentration of malondialdehyde (MDA) levels showed no variances between treatments. The numbers of colony forming units of Coliform and Enterobacter were affected by post-hatch time at 6th day of study ($P<0.01$ and $P<0.001$, respectively). Addition of prebiotic to diets had no improvement effect on any parameters, which examined in this study. As a result prebiotic supplementation to birds exposed to delay feed and water access had no beneficial effects in broiler chickens.

Keywords: broiler, holding time, intestinal health, prebiotic, performance.

O[24] Effects of Guanidino Acetic Acid Supplementation and Energy Level of Broiler Diets with Poultry By-Product Meal on Growth Performance and Meat Quality

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Abstract

This experiment was conducted to evaluate the effects of guanidinoacetic acid (GAA) supplementation and energy level of broiler diets based on maize-soybean meal in the presence of 5% poultry by-product meal on growth performance, carcase yield and breast meat quality.A total of 792 one-day old male Ross 308 broiler chickens were randomly distributed into 6 dietary treatments with 8 replicates consisting of diets with 3 different energy level (standard AME_n, 50 kcal/kg reduced and 100 kcal/kg reduced) with 2 different level (0.00 and 0.06 %) of GAA. Birds were fed diets during the starter (days 0-10), grower (days 11-24) and finisher (days 25-41) periods. There was significant interaction between energy level and GAA supplementation for FCR, and no significant interaction for other performance parameters found. The FCR was significantly impaired ($P<0.05$) in birds fed both 50 and 100 kcal energy reduced feed without GAA while just 100 kcal/kg energy reduced feed with GAA resulted a significant impairment. Poor body weight gain were obtained due to reduced dietary energy level in broiler chickens ($P < 0.05$). GAA supplementation significantly improved FCR Though feed intake (FI) or mortality was not affected notably from dietary treatments for 41-day period ($P > 0.05$), European Production Efficiency Factor was favourably affected by the GAA supplementation ($P < 0.05$). No significant effects of dietary treatment were found on carcase parameters and abdominal fat weights (as percentage of body weight) except increasing liver percentage, induced by decreasing dietary energy level, which was reduced through GAA supplementation. Dietary energy level and GAA addition had also no remarkable effect on drip loss, pH and chemical composition of breast meat. It can be concluded that supplementation of GAA to diets even including poultry by-product meal has the potential to improve growth performance of broilers by most likely increasing energy utilisation.

Keywords: broiler, energy utilisation, growth performance, guanidinoacetic acid

Introduction

Feed cost contributes about 70 % to the cost of broiler production. Within this cost position the share of cost related to feed energy amounts to about 50 %. Thus, only feed energy covers about one third of the entire cost of broiler production. Fast-growing animals, such as broilers, need a lot of energy for the growth of muscle tissue. The universal source of energy in cells of all animals is adenosine triphosphate (ATP). The creatine phosphate/creatine system acts as a buffer, guaranteeing the permanent availability of ATP molecules. Creatine phosphate is a dynamic storage of energy-rich phosphate, and ensures a stable supply of ATP/ADP in the cell. The other important role that creatine plays is in transport of the high-energy phosphate groups from glycolysis and oxidative phosphorylation to cytosolic ATP-consumption. Here, it might be postulated that a deficit of creatine could potentially be a limiting factor in provision of these high-energy phosphate groups, thus, limiting energy utilisation within the rapidly growing muscle tissues. **C**reatine is synthesized from guanidinoacetic acid(GAA) in the liver, which in turn is synthesized from arginine and glycine in the kidney. Subsequently, GAA is methylated by S adenosylmethionine to creatine, and finally, adenosine triphosphate donates aphosphorus moiety to form the high-energy compound, phosphocreatine (Meister, 1965). Thus, GAA may be important for poultry nutrition not only as a replacement for dietary Arg, an essential nutrient, but also to support overall energy homeostasis of the bird. Animals can partly replace the losses inevitable of creatine with the help of *de-novo* synthesis, but the major part of it has to be delivered via feed. Because of vegetable feed ingredients not having creatine and usage of animal sources is limited, the objective of this study was to check the energy sparing effect of GAA in a broiler diet in presence of poultry meal.

Materials and Methods

Birds and Housing

The research was carried out in the Poultry House of Animal Science Department, Ankara University. 792 day-old male Ross 308 chicks were used .

Experimental Design

The research was conducted according to a completely randomised block design in 2x3 factorial arrangements. The 3 x 2 factorial arrangement included 3 different levels of apparent metabolizable energy (AME_N) (commercial standart level, 50 kcal/kg reduced and 100 kcal/kg reduced) and 2 levels of CreAMINO® (CreAM) supplementation(0.00 and 0.06%) which contains 96 % of guanidino acetic acid(GAA). Day old chicks were randomly distributed into 6 dietary treatments each having 4 replicates with 16 chicks and 4 replicates with 17 chicks (Total 8 replicates) in floor pens of the poultry house.

Feeds and Diets :

Starter (day 0-10), grower (day 11-24), and finisher (25-42 days) diets were based on corn, soybean meal, and poultry by-product meal. After amino acid analysis done in raw materials, diets were formulated to meet Evonik recommendations (Evonik 2012) with regard to energy, amino acids on an SID base, phosphorus, and calcium. Feeds were served as mash form. Feeds and water were provided *ad libitum* throughout the experiment.

Measurements:

Birds were weighed at the beginning of the experiment, at day 10, 24 and 41 for each replication to define body weight (BW) and weight gain (BWG). Feed consumption (FI) were measured at the beginning of the experiment, at day 10, 24 and 41 for each replication. Feed conversion (FCR) were calculated for day 0-10, and day 11-24, 25-41 and 0-41 days period using feed intake and weight gain for each replication on a pen-base. At the end of experiment, 2 chickens per pen close to the average pen weight were selected for processing. Carcass yield, abdominal fat, thighs + drumsticks and breast meat were weighed and calculated as a fraction of individual live body weight. Drip loss(DL) was measured as described by Remignon et al. (1996). Ultimate pH were measured 24 h postmortem with a portable pH-meter.

Statistical Analysis:

The data for all response variables were analyzed as a completely randomized block design with 6 dietary treatments and 8 replicate blocks by using General ANOVA/MANOVA procedure of the Statistica (1984), by analysis of variance or covariance. Main effects and interactions between the main affects were calculated. When significant differences ($P < 0.05$) among groups were found, means were separated using the Tukey HSD test.

Results

The results of GAA content in the experimental feeds introduced to broilers is shown in table 1. As seen in table 1, the proposed level of GAA supplementation in the feeds was reached. This mean that the research was conducted in a good shape.

Table 1. Analysed Guanidino Acetic Acid Contents of the Experimental Feeds

Treatments	Guanidino Acetic Acid Contents, (mg/kg)		
	Starter	Grower	Finisher
Treatment **1**-Control	<21	21	<21
Treatment **2**-50 kcal/kg Energy Reduced	<21	21	<21
Treatment **3**-100 kcal/kg Energy Reduced	<21	21	<21
Treatment **4**-Control plus **GAA**	614	601	682
Treatment **5**-50 kcal/kg Energy Reduced plus **GAA**	668	642	684
Treatment **6**-100 kcal/kg Energy Reduced plus **GAA**	704	659	608

Growth Performance Results

As the results of entire trial period, 0-41 days, was considered, there was significant interaction between energy level and GAA supplementation for FCR, and no significant interaction for other performance parameters found. The feed utilisation was significantly reduced($P<0.05$) in birds fed both 50 and 100 kcal energy reduced feed without GAA while just 100 kcal/kg energy reduced feed with GAA resulted a significant impairment in FCR($P<0.05$). The interaction effects was shown in figure 1 and figure 2 for FCR and body weight respectively. Almost 50 g weight gain differences (2586 vs 2536,6) was observed between GAA supplemented and unsupplemented groups($P<0.05$) at slaughter age. Total feed intake seems to be increased with GAA supplementation($P>0.05$). GAA supplementation significantly improved both European Production Efficiency Factor (EPEF), and weight corrected EPEF($P<0.05$). The improvement in FCR_{wc} was 2,17% (1.558 vs 1.551). Mortality rate was not significantly affected by energy level and GAA suuplementation throught the experiment.

Carcass and Quality Measurement Results

No differences related to dietary GAA supplementation and energy level were observed for carcass yield and yields of commercial parts($P>0.05$). Besides GAA and energy level had no influence on abdominal fat and pancreas weight. However there was also significant Energy Level*GAA interaction for liver percentage. Liver weight significantly increased by lowering energy both 50 and 100 kcal in nonsupplemented GAA groups while in GAA groups just increased in 100 kcal energy reduced group. GAA supplementation significantly decreased liver percentage from 2.027 to 1.910 % ($P<0.05$), but 100 kcal energy reduction resulted a bigger liver percentage($P<0.05$).

Energy level and GAA supplementation had no significant effect on drip loss and pH values of breast meat. The pH values of the treatments was around 5.2 and drip loss percentage of breast meat after 9 days was around 5.72-7.56%($P>0.05$).

Discussion

Feed intake was not significantly influenced by the ME level of the diet, implicating that the energy requirement may not have been low enough to affect feed intake. However there was a clear tendency to increase the feed intake to compansate energy requirement especially after grower period when huge energy demand being needed. However almost all other performance parameters negatively influenced by energy reduction($P<0.05$). Each step of energy reduction (50 and 100 kcal/kg) from regular dietary energy level of broilers resulted an impaired performance including BW, BWG, FCR and EPEF. This is well known issue on energy density and growth performance of the birds. Saleh *et al*. (2004) reported that decreasing the amount of energy in the diet decreases growth rate and feed efficiency. The response of feed conversion to dietary AME was more pronounced. Differences in feed energy are expected to affect FCR more markedly than BW gain (Leeson et al., 1996; Cheng et al., 1997; Proudfoot et al., 1987). Our findings are consistent with Abudabos et al.(2014) and Mousavi et al. (2013). They also observed a significant impairment in FCR and BWG of broilers by reducing dietary energy.

The dietary ME level is one of the major factors, which play an important role in regulating feed intake and feed efficiency in broilers (Lopez and Leeson, 2008). So it is important to supply enough energy from available sources with reliable cost for poultry. However another important aspects is the efficient utilisation of energy by broilers. As already mentioned one of the compound plays and key role in celular energy metabolism is creatine. Creatine phosphate is a rapidly mobilizable reserve of high-energy phosphate for ATP formation. It is likely that the requirement for creatine is proportionally greater in growing animals(Mousavi et al., 2013).

The present study showed the beneficial effect of GAA, precursor of creatine, on growth performance of broilers by contributing energy metabolism. When the entire growth performance results considered, it is clear that the GAA supplementation positively influenced the BWG, FCR_{wc} and EPEF.by 1.95, 2.17 and 5.90% respectively. This significant improvement comes from efficient energy utilisation of dietary energy in celular level by GAA. For example in ontop GAA supplemented group had always higher BWG than unsupplemented one($P<0.05$) and also 50 kcal/kg energy reduced group with GAA supplementattion reached to the positive control group(standart energy received group) after starter period by having similar BWG and FCR. This means that GAA supplementation contributed at least 50 kcal ME/kg to birds. This 50 kcal estimation is also consistent and same with suggested by Abudabos et al. (2014). Positive improvements regarding with creatine or GAA supplementation especially in FCR (Lemme et al., 2007; Abudabos et al., 2014;,Michiels et al., 2012; Carvalho et al., 2013) and BWG (Lemme et al., 2007;,Michiels et al., 2012;Mousavi et al., 2013;) were reported by other researchers.

Both energy and GAA supplementation did not influence the carcass parameters, dripp loss and pH of the breasr meat. Many researchers found also similar results and confirmed our findings. Michiels et al. (2012) examined the effectf of GAA on breast meat pH and drip loss and found no significant differences ($P>0.05$) between GAA supplemented and unsuplemented birds. Others have stated that GAA had no effect on carcass yield and carcas parts (Michiels et al., 2012; Carvalho et al., 2013; Mousavi et al., 2013;Abudobos et al., 2014).

As explained before GAA is synthesised in the liver and kidney from arginine and glycine then acted upon by the enzyme transamidinase and subsequently methylated by S-adenosyl- methione to creatine (Wyss and Kaddurah-Daouk, 2000). Because of important role of creatine in energy metabolism the load of liver seems to be increasing when the supplied energy is lowered. So supplementation of GAA is helpfull to support de novo synthesis of creatine. Our results on liver confirmed by previous reports. Abudobos at al.(2014) and Mousavi et al.(2013) reported that GGA supplementation decreased liver weight.

Broiler diets mainly based on vegetable ingredients and generally contain less amount of feedstuffs from animal origin which are rich in creatine. In both cases either containing animal by-product meal or not having them, the contrubution of creatine by dietary ingredients is low and one third of the requirment which is recomended as 195,8 mg/day/kg broiler (Thomson, 2015) supposed to be supplied by dietary sources because of insufficient (two third) de-novo synthesis of endogenous creatine in modern broilers. The need for creatine is age-dependent, higher amounts are needed by growing animals for muscle growth *vs* adults (Brosnan *et al*., 2009). So in the current study, although the diets have 5% poultry-byproduct meal, the contribution of dietary ingredient seems not enough to supply the creatine requirements.

Conclusion

So as a results of the present experiment, it can be concluded that dietary supplementation of GAA has the potential to improve growth performance of broilers by most probably increasing energy utilisation even in the diets have poultry meal. Based on that, it is recommended to lower the ME level at least by 50 kcal/kg when supplemented with GAA.

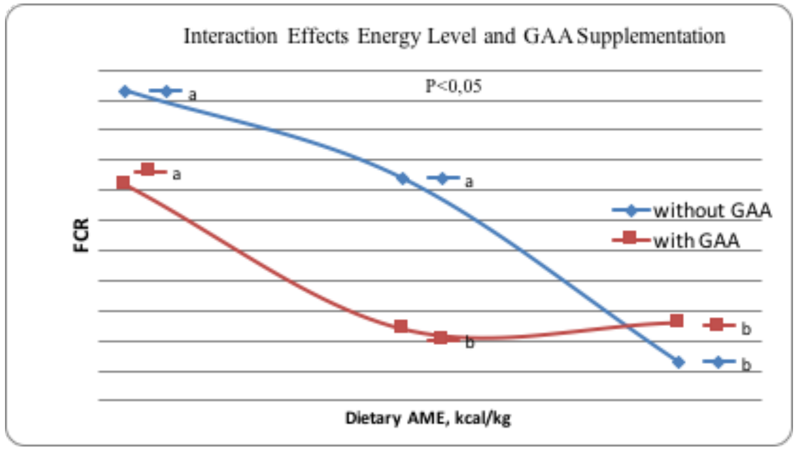

Figure 1.Effect on GAA supplementation on feed conversion ratio of broiler at 3 different apparent metabolisable energy level ($P<0.05$)

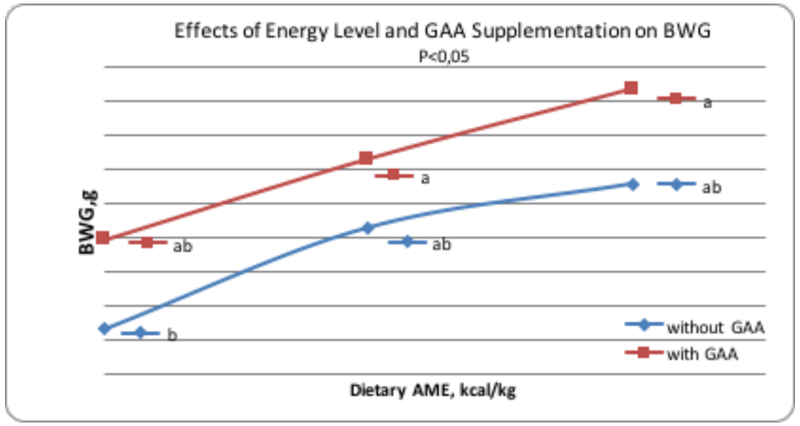

Figure 2.Effect on GAA supplementation on body weight gain of broilers at 3 different apparent metabolisable energy level (P<0.05)

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O25 Efficacy of an Algo-Clay Complex on Decreasing Mycotoxin Liver Toxicity in Broilers

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Abstract

The aim of this study was to measure the efficacy of an algo-clay complex (ACC) on T-2/HT-2 toxin (2ppm), fumonisin (100ppm) and aflatoxin (2.8ppm) individual toxicity on the liver. The study was conducted by Samitec Institute in Brazil. 360 one-day-old male broiler chicks (Cobb 500) were allocated to 11 treatments with 6 (test) or 12 (control) replicates and 10 animals in each group, from day 1 to day 21. Treatments differed by the contamination in mycotoxin and the inclusion of the algo-clay complex (0.25 or 0.50%). The inclusion of 0.50% of algo-clay complex in the diets containing mycotoxins always significantly improved the birds feed consumption and body weight compared with those fed with mycotoxins only ($P \leq 0.05$). In each treatment with ACC, the relative weight of the liver (RWL) of the animals that were supplemented with 0.50% of the algo-clay complex, was significantly improved and closer to the control value compared with those exposed to mycotoxins only. The inclusion of 0.50% of algo-clay complex in the diets containing 2.8 ppm of aflatoxin significantly improved the Lamic/Samitec Index compared with those from the birds fed with aflatoxin only ($P \leq 0.05$). The inclusion of 0.25% and 0.50% of algo-clay complex in the diets containing 100 ppm of fumonisin diminished significantly the Sa/So compared with those from the birds exposed to fumonisin only ($P \leq 0.05$). The inclusion of 0.25% and 0.50% of algo-clay complex in the diets containing aflatoxin and fumonisin significantly improved the level of total plasma proteins ($P \leq 0.05$), also indicating a reduction in liver damage thanks to the algo-clay complex. According to the evaluated parameters, the algo-clay complex significantly decreased ($P \leq 0.05$) the deleterious hepatic effects and performance losses caused by very high levels of three types of mycotoxins on broilers.

Introduction

Mycotoxins are secondary metabolites produced by *Aspergillus*, *Penicillium* and *Fusarium* molds. In 2003, FAO estimated that 25% of the cereals produced worldwide contain mycotoxins. Mycotoxins are very stable during storage and processing. They are thermo-resistant and thus are not destroyed by technological treatments. Consequently, mycotoxins remain in the finished feed, even once molds disappear (CAST, 2003). Mycotoxin toxicity is variable depending on toxin and concerned animals. Poultry sensitivity to mycotoxins is now well established (AFSSA, 2009; Andretta, 2012). Prevention measures are not always enough to reduce the risk. Different types of decontamination processes have been studied (physical, chemical and biological) with more or less efficacy. The aim of this study is to test the efficacy of an algo-clay complex, used in a premix of additives, on decreasing mycotoxin liver toxicity on broilers. Three families of mycotoxins have been tested: aflatoxin, fumonisin and T-2/HT-2 toxin.

Material and Methods

Experimental Design

The study was conducted by the Samitec Institute of Analytical, Microbiological and Technological solutions in May 2016. The broilers were housed in a negative pressure room – size: 22 m^2 – under ideal temperature at each stage of development. The birds were contained within batteries with four overlap cages separated in two boxes with 0.5 x 0.5 m (0.25 m^2 of area) and 0.33 m of height each. Each box had a feeder, an individual nipple watering system with height adjustment and a conventional brooder. To conduct this experiment, 360 one-day-old male broiler chicks (Cobb 500) with an average weight of 46.92 grams were used. Mycotoxins were tested individually and 3 trials were performed. Treatments differed in mycotoxin contamination and inclusion of the algo-clay complex (ACC) used in a premix of additives named MT.X+.

Feed:All the birds received the same feeding treatment, in other words, chickens were given *ad libitum* access to feed and water during the experimental period (day 1 to day 21), except in the weighing days, when they were subjected to a solid fasting for six hours. The animals received an iso-nutritive diet formulated according to the NRC (1994) recommendations, after NIRS evaluation, using maize, soybean meal and vitamin/mineral premix (Table 1). Raw materials and experimental diets were screened for the presence of mycotoxin (aflatoxin, deoxynivalenol, diacetoxiscirpenol, fumonisin, ochratoxin A, T- 2 Toxin and zearalenone) and nothing was detected. The feed used for the aflatoxin treatment (AFLA), contained 2.8ppm of aflatoxin composed of 93.1% of aflatoxin B1, 2.1% of aflatoxin B2, 3.4% of aflatoxin G1 and 0.7% of aflatoxin G2 produced with *Aspergillus parasiticus.* The feed used for the fumonisin treatment (FUM) contained 100ppm of fumonisin composed of 73% of fumonisin B1 and 27% of fumonisin B2, produced with *Fusarium moniliforme.* The feed used for the T-2/HT-2 toxin treatment (T-2/HT-2) contained 2 ppm of T-2/HT-2 toxin composed of 82% of T-2 toxin and 18% of HT-2 toxin, produced with *Fusarium sporotrichioides*.

Measurements

*Performance:*Feed intake and body weight gain were recorded at D7, D14 and D21.

*Liver parameters and clinical biochemistry:*The following parameters were obtained or calculated at 21 days of the experiment:

- Relative weight of the liver: obtained by the ratio of the liver weight and the bird weight multiplied by 100;

- Clinical biochemistry: average levels of total plasma proteins (TPP). Twelve blood samples were collected in each treatment, totaling sixty samples that were analyzed by Biureto's Technique and measurements performed by Thermo Plate Analyzer®.

- Sphinganine/Sphingosine ratio (Sa:So), biochemical marker of liver lesions. It was measured only in fumonisin trial at D21.

- Lamic/Samitec Index (LSI). The Lamic/Samitec Index (LSI) consists of the relative weight of the liver and ΔE*ab variables, according to the equation: LSI = % RWL (100 – ΔE*ab) where % RWL = Relative weight of the liver; ΔE*ab = Difference between the liver's color and the reference color (white).

Statistical Analysis:All data obtained in this experiment were subjected to analysis of variance (One-way ANOVA). Any differences between the means were compared by Bonferroni test (*P*≤0.05). The analyses were performed by Statgraphics Centurion XV version 15.1 Software.

Results and Discussion

Feed consumption

Table 1. Feed consumption per group for each trial

Trial	AFLA	FUM	T-2/HT-2
Negative control	1121^{a}	1121^{a}	1121^{a}
Control with 0.50% ACC	1125^{a}	1125^{a}	1125^{a}
Mycotoxin	877^{c}	1001^{c}	1021^{b}
Mycotoxin + 0.25% ACC	859^{c}	1065^{b}	1032^{b}
Mycotoxin + 0.50% ACC	988^{b}	1070^{b}	1094^{a}

All mycotoxin treatments decreased feed intake when compared to the negative control (*P*≤0.05). The inclusion of 0.50% of ACC in the diet containing mycotoxin significantly improved the birds feed consumption compared with those exposed to mycotoxin only (*P*≤0.05), and fully compensated the deleterious effects of 2 ppm T-2/HT-2 toxin contamination.

Final body weight

All mycotoxin treatments decreased the broilers body weight when compared to the negative control (*P*≤0.05). The inclusion of 0.50% of ACC in the diets containing mycotoxin significantly improved the birds body weight compared with those exposed to mycotoxin only, and fully compensated deleterious effects of 2 ppm T-2/HT-2 toxin contamination.

Table 2. Final body weight per group for each trial

Trial	AFLA	FUM	T-2/HT-2
Negative control	762^{a}	762^{a}	762^{a}
Control with 0.50% ACC	753^{a}	753^{a}	753^{a}
Mycotoxins	568^{c}	676^{c}	707^{b}
Mycotoxins + 0.25% ACC	584^{c}	713^{b}	708^{b}
Mycotoxins + 0.50% ACC	632^{c}	709^{b}	749^{a}

Liver parameters

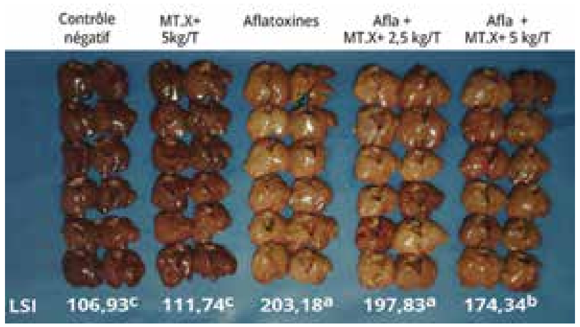
Table 3. Relative liver weight per group per trial

Trial	AFLA	FUM	T-2/HT-2
Negative control	3,11^{c}	3,11^{c}	3,11^{a}
Control with 0.50% ACC	3,14^{c}	3,14^{bc}	3,14^{a}
Mycotoxins	4,81^{a}	3,44^{a}	2,94^{b}
Mycotoxins + 0.25% ACC	4,80^{a}	3,28^{b}	2,96^{ab}
Mycotoxins + 0.50% ACC	4,03^{b}	3,25^{b}	3,08^{ab}

The relative weight of the liver (RWL) of chickens that were exposed to mycotoxin was either higher (aflatoxin and fumonisin) or lower (T-2/HT-2 toxin) than those from the control treatment (*P*≤0.05). The inclusion of 0.50% of ACC in the diets containing mycotoxin allowed to improve the RWL, to be closer to the negative control value.

Figure 1. Lamic/Samitec Index (LSI) and liver aspect (AFLA trial)

Negative control	Control with 0.5% ACC	AFLA	AFLA + 0.25% ACC	AFLA + 0.5% ACC



The LSI of broilers exposed to 2.8 ppm of aflatoxin was higher than in the negative control (+90%, *P*≤0.05). The inclusion of 0.50% of ACC in the contaminated diet significantly diminished the LSI compared with the aflatoxin group (-14%, *P*≤0.05).

Table 4. Sphinganine-sphingosine ratio (Sa:So), FUM trial

Negative control	0.43^{c}
Control with 0,50% ACC	0.43^{c}
Mycotoxins	3.32^{a}
Mycotoxins + 0,25% ACC	2.3^{b}
Mycotoxins + 0,50% ACC	2.33^{b}

Fumonisin alters the enzyme secretion in the liver and leads to an accumulation of sphinganine in this organ. Consequently, the sphinganine to sphingosine ratio (Sa:So) evolves and makes a good marker of fumonisin intoxication. This way, the Sa:So was significantly higher for broilers exposed to 100 ppm of fumonisin than the negative control (+67%, $P \leq 0.05$). Meanwhile, the inclusion of ACC in the diet containing 100 ppm of fumonisin significantly diminished the Sa:So compared to birds exposed to 100 ppm of fumonisin (-30 and -31%, respectively with 0.25% and 0.50% of ACC, $P \leq 0.05$).

Clinical biochemistry

Trial	AFLA	FUM
Negative control	3.44[a]	3.33[a]
Control with 0.50% ACC	3.48[a]	3.36[a]
Mycotoxins	2.56[c]	2.93[c]
Mycotoxins + 0.25% ACC	2.6[c]	3.12[b]
Mycotoxins + 0.50% ACC	2.86[b]	3.12[b]

Total plasma protein (TPP) is an indicator of toxin damage in the liver. As a consequence, TPP levels of broilers exposed to 2.8 ppm of aflatoxin or 100 ppm of fumonisin were lower than in the negative control ($P \leq 0.05$). No significant difference was observed in the presence of T-2/HT-2 toxins. The inclusion of 0.25% or 0.50% of ACC in the diets containing mycotoxins significantly increased the level of TPP ($P \leq 0.05$).

Conclusion

According to the evaluated parameters, the use of ACC (0.50%) significantly decreased the deleterious effects caused by very high levels of mycotoxin (2.8 ppm of aflatoxin, 2 ppm of T-2/HT-2 toxin or 100 ppm fumonisin) added to the broiler chicken feed during the experimental period of 21 days ($P \leq 0.05$)

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IS[12] The Real Truth on Poultry Meat and Management of Consumers Perception

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City myths on foods is negatively influence the consumption of meat, milk and eggs and be a barrier for access of these foods by consumers.

Based on the results of the survey, the ENOUGH Movement is sharing the "Truth About Food," a digital and media driven program to put accurate, fact-based information in forums to spark discussion to dispel misunderstanding on April 29th at the 4th International White Meat Congress.. Information about the campaign can be found at www.enough.com/truthaboutfood

Conflicting sources of information about how our food is produced make it difficult for families to make smart choices about nutrition and health, according to a new study from the ENOUGH movement, carried out in 11 countries globally, including countries in Europe. The consumer survey measured understanding and knowledge of popular food and nutrition topics including product labels, farming methods, nutritional value and environmental impacts.

Among the key findings in Europe: although food and nutrition is a frequent topic of discussion for more than 93% of the respondents – there is a lot of uncertainty of what food claims and labels mean. A majority of consumers report choosing foods labeled "all-natural" or "organic" despite not knowing what the labels mean in terms of environmental impact, animal welfare, and other metrics commonly associated with healthy food choices.

"The farm-to-table movement has revealed that we all want to know what's in our food and where it comes from,". "But it's hard to separate fact from fiction when it comes to food labels, farming practices, and other food production topics. Distinguishing myth from reality can make a big difference in the choices families make about nutrition, household budgets and environmental impact."

Key findings from the survey and the Truth About Food program include:

Food labels are one of the most confusing topics for consumers.

-Organic buyers main motivation is because 36% believe free of chemicals/pesticides and 17 % belive its safer.

- "Organic" is a type of farm management and food production that only allows natural products to be used, but it doesn't mean "pesticide free." For example, the use of a certain number of organic (i.e. derived from natural sources and processed lightly if at all before use)(1) pesticides is allowed in EU organic farming(2)
- For example, the use of a certain number of organic (i.e. derived from natural sources and processed lightly if at all before use)(3) pesticides is allowed in EU organic farming(4)

- Further, an analysis done by Stanford University on more than 237 studies concluded the quality, safety and nutrition content of organic and conventionally produced foods to be equal.(5)
- When it comes to "natural", in the UK for example it means that a product consists of natural ingredients, i.e. ingredients produced by nature, not the work of humans or interfered with by humans.(6)

Consumers are confused about modern agriculture, farming, and food production.

-85 percent of survey respondents believe that more organic production globally is one of the top three solutions to feeding the growing population.

- In fact, organic farming produces less food – about 25 percent on average globally[i]. It requires significantly more land and resources to produce the same yield as modern farming methods.
- If Europe would try to feed itself exclusively through organic agriculture (at constant consumption), it would need an additional 28 million hectares, more than all cultivable land of Tuırkey and equal to all the remaining forests covering France, Germany, Denmark, and Great Britain combined.(7)

While organic methods use less fertilizer, herbicides and energy, modern farming methods resulted in less soil erosion with better yields[1]. In fact, modern farming practices are often the most environmentally sustainable, using innovation to decrease the amount of land, feed and water to raise meat, milk and eggs. In fact, today's conventional chicken production in Europe saves the equivalent of the CO^2 emission of 250 000 cars/year in Europe (2% of total). Thanks to continuous improvement less feed is needed, the carbon footprint impact is reduced by half, while producing the same quantity of meat.(8)

Food waste and loss is a top concern among survey respondents.

-91 percent of people surveyed believe that the number one way to eliminate hunger globally is to eliminate food waste.

- Food waste is a significant challenge we must address, but it's only part of the problem. And we also have to look at food waste across the entire production system. According to the Food and Agriculture Organization of the United Nations, 30 to 40 percent of food is lost in production each year. (9)

- In animals, more than 20 percent of production is lost to death and disease(10). Best management practices and tools that help keep animals healthy are critically important to this challenge.

-Veterinary medicines and vaccines leads to 20% resource waste reduction(11).

When it comes to what we eat, globally, consumers are most concerned about hormones, antibiotics, and generally food safety. With so much conflicting information, it's no wonder. But we can put these fears to rest. Did you know?:

- All living things contain hormones – people, plants, animals and therefore also the food we eat.
- There are no hormones used in livestock production in Europe. Yet 73% of consumers believe there are and 66% belive hormons are carcinogen.
- All animals have the right to be free from pain, injury or disease. If an animal is sick, it should be treated(12). However, regardless of whether an animal was sick and treated with an antibiotic at some time in its life or was raised antibiotic free, the food you buy is free from any harmful residue.
- Globally, 87% of respondants thinks meat is important for healthy nutrition but, 78 believe, protein from meat can be met by other sources. This rate is 80% for Turkish respondants.
- Globally, 37% of respondants believe food quality is worse compare to 30 years ago.

Notes to Editors

The Truth About Food Survey was conducted within large cities in 11 different counties – United States, France, Germany, United Kingdom, Italy, Turkey, Brazil, Mexico, Colombia, Argentina and Peru – between August 17 and 31, 2016 among 3,337 adults aged 20 and over (at least 300 per country). This online survey was sponsored by Elanco Animal Health and conducted by Kynetec. For more information about the survey, please visit http://www.kynetec.com/.

About the ENOUGH Movement

It's time to solve the greatest issue of our time: building a food-secure world. In order to achieve this goal, we must have the courage to work together to tackle this complex issue from all sides. We need to produce more food using fewer resources. We must support farmers as food producers as they make sustainable choices that are right for their business. We should empower consumers to make the healthy food choices that are right for them. We must supply the high-quality and nutritious food that will nourish our children and lead to better health and development. And we must foster the kind of international infrastructure that ensure food reaches the people who need it, wherever they are.

The ENOUGH Movement is a global community working together to ensure everyone has access to nutritious, affordable food — today and in the coming decades. We're consumers, farmers, businesses, activists, and everyday people — passionate people who believe in implementing practical solutions to build a food-secure world.

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O[26] A Public Survey on Consumer Habits Related to Label Informations of Packaged Raw Poultry Meat and It's Evaluation by Turkish Food Regulation

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Abstract

Food manufacturer marketing food under its own name or trade name is responsible for food labeling and must provide on the food of the obligatory labeling information and should ensure its accuracy. Information in accordance with Turkish Food Codex (TFC) on Labeling on prepackaged food or on a label affixed to the packaging must be presented to the final consumer. Manufacturers that produce raw poultry meat production (including shredding/packaging) have to do packaging and labeling of the products considering the requirements of TFC Meat and Meat Products Notification, A Regulation of Special Hygiene Rules For Animal Food. In this study, a public survey was made to determine which information most interested in purchasing packaged poultry meat products for sale on the market of the consumers and also it was assessed whether the label information considering the legislations selected randomly at collective sale places for different 12 trademarks with 35 of these group products was appropriate. The survey was conducted on a https://www.google.com/intl/en_US/forms/about/ page, face-to-face and via social media, with a total of 264 people. Participants were asked to grade the questions on the questionnaire according to their importance by 10 points, as well as to express opinions and thoughts on other topics. The results were evaluated according to the arithmetic mean obtained by arranging the frequency table. According to the results, it has been determined that 75-98% of the participants were great importance to the date of last consumption, the name of the manufacturer, the conditions of cleaning and product storage in the sales department. The only 31% of them was great importance to the Manufacture's Certification Number, 70.1% of them didn't consider the Party Serial Number to be insignificant, 59% of them thought that it was not important for the products to have organic or good agricultural practices. Among the statements mentioned elsewhere, it was stated that the chickens were not raised in the natural environment; they prefer not to consume it because they were grown with needle. So far as the results obtained regarding the suitability of the label information to the legislations; all product labels contained the statements regarding storage conditions, but some product labels included statements covering storage conditions for both fresh and frozen products, not with respect to the present physical condition. It was observed that some products had superseded similarities (such as chickens being cut off by individual feeding) than the others. Some of them didn't have address information for the firms that generate supremacy. The manufacturers of processing meat and meat products must have Veterinarian, Food Engineers, Agricultural Engineers (Food Department) anyway as the necessary personnel to be employed in accordance with the article of 22/7 in Law No.5996. The presence of this information on the label does not constitute a superiority in terms of product safety, and it can also cause a perception of superiority in the consumer about products with the same characteristics. Excluding these determinations, it was observed that labeling and packaging have been carried out in accordance with all other legal requirements.

Key words: Raw poultry meat, Law No.5996, Labelling Regulation.

O27 Consumption Habits of Poultry Meat and Products in Konya Region of Turkey

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Abstract

Chicken meat for regular and balanced feeding, one thing to be consumed is one of the most important animal protein sources.

This study was carried out to determine consumption habits, qualities, production levels and types related to advertisements and advertisements in Konya. This descriptive study has been applied to individuals aged 18 years or older at the 5 family health centers in the central province of Konya.

116 people participated in the survey. The median age of participants was 36. The proportion of chicken meat produced with organic methods was found to be 45.7% and the rate of those who had knowledge about industrial chicken meat production was found to be 31.3%. 56.9% of chicken meat is easy to prepare, 31.9% is healthy and your preference is stated. Half of the news about chicken meat on the spot (58 people) was adversely affected in the media and 52 people were not affected. 62.9% of the advertisements related to chicken meat were not affected. 75.2% of the participants stated that they did not feed on the healthy diet of the chickens, 54% thought the chicken meat was safe, 85.2% the chicken meat was hormone and 61.3% thought it was halal chickens.

Although it is not influenced by visual and written media in the beginning, it affects the news both positively and negatively. Chicken is in the first place because it is delicious, easy to prepare, cheap. The most of participants think that chicken meat is hormone but the safe at the same time.

O28 Evaluation of Poultry Sector in Terms of Occupational Health and Safety

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Abstract

The aim of occupational health is to provide the development and maintenance of physical, mental and social wellbeing of employees at the highest level. Risk control and consistency of human and work studies must be necessary in order to reach this aim. Around 1.3 billion workers are employed in agriculture industry an this population is nearly equal to 50% of industry and this population is nearly equal to 50 % of the whole employment in the world. Poultry sector is an important part of agriculture industry, which keeps a significant place in animal food production industry. Occupational health and safety condition becomes an important topic from day to day in poultry sector which is a potential ascending economy. Number of studies related with occupational health and safety in this sector are rare. Studies related with working environment, risk factors, health status of workers and implemented measures are required in this sector. In this study it is aimed to detect occupational health and safety practices and health status of the workers in a poultry plant. Descriptive type study was carried out in a poultry plant in Bolu and reached to 625 workers. Significance level of statistical analysis was taken $p<0.05$. Demographic range of the participants was evaluated as 59.5 % of female, 81.9 % of married, 60.6 % of primary school graduate, 96.2 % of line worker and mean age 38.1±7.1.Work accident and work related disease history, working environment conditions, trainings related with work, general health status and complaints related with skeletal system were evaluated in this study.Participants stated that:85.8 % of them work in a noisy environment, 89.8 % of them have personal protective equipment (PPE), 88.2 % of them use PPE and 83.2 % of them is aware about negative effects of noise to human health. 33.6 % of female participants and 25.9 % of male participants have a work accident history. Mean and median of the physical health score are evaluated as 52.0±9.6 and 53.5 (17.8-67.8) respectively. On the other hand mean and median of the mental health score of participants are found as 50.8±9.2 and 50.0 (16.6-73.3) respectively. It was stated by participants that half of them has back pain, around one-third has pain in neck, shoulder and wrist during the last one year. At the and, it is offered to take effective counter measures about noise, dust exposure, injury risk and forced and routin works. It also proposed to increase the efficiency of trainings. Finally a special evaluation system is necessary for female workers and workers who had chronical diseases.

KeyWords: Poultry sector, occupational health and safety, health status

IS[13] Diagnosis Failures of Respiratory Diseases in Broiler Chickens and Key Strategies

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Whenever the issue is "respiratory problems" we immediately receive the standard complaints from our practitioner veterinarian colleagues and producers: difficulty in breathing, panting, sneezing, wheezing, gurgling, etc. and the next thing we inevitably hear is the growl of the boss: But what exactly is the problem?!

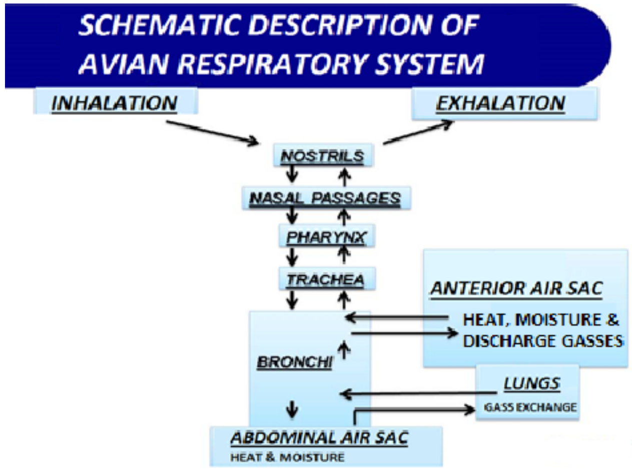
Differential Diagnosis Is Not Easy, Because:

The respiratory systems of modern broilers which are genetically forced for fast growth and weight gain, fail to keep pace with this accelerated corporal development and this situation is further aggravated by a multitude of highly effective predisposing factors:

Predisposing Factors	
Bird Associated Factors	**Environmental Factors**
Nature of the respiratory system	**Physical factors (dust, heat, moisture, ventilation)**
Age	**Chemical factors (gasses, nutrition)**
Genetic factors	**Biological factors (social stressors, growing conditions)**
Immunity	

Avian respiratory system and function are very different than mammalian (comparable to air vs water cooled engines):

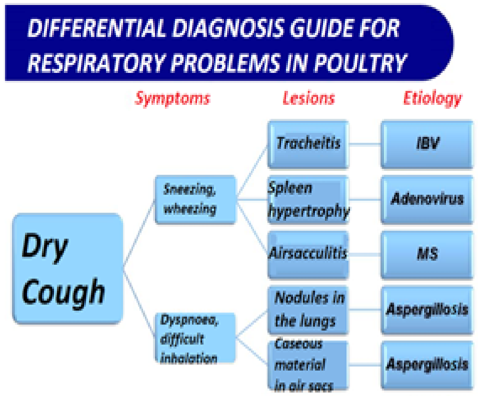
As shown in the following chart, the inhaled air first reaches the abdominal air sacs and the four stage moisture, heat, gas exchange process can be described as the "water cooled" system. Therefore the air sacs will be infected before the onset of pneumonia. This will render impossible the treatment of the air sacs - where the blood vessels are sparse - and consequently of the bird.

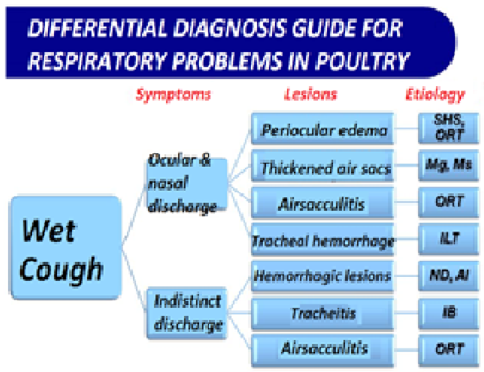


Could "age" be of help in diagnosis…

It should be noted that maternally transmitted Mg activity may express clinical signs only after 2 weeks. Due to the robust immunity of the breeders, ND and IB infections are hardly seen during the first weeks. Agents such as ART and ORT can become clinically visible only after day 10 or so. On the other hand, Aspergillosis which may appear within the first 3 days is an indication of hatchery contamination. This will recede in about 15 days but flock uniformity will remain impaired. Later cases of Aspergillus infection are related either to the housing or to the litter and they will be more persistent.

"Dry" or "wet" cough signs cannot provide a clear clinical differentiation:





Typical observations in problematic houses are morbid birds and swollen heads.

As shown in the following photographs the swellings in the heads are associated with inflammations or edema. They can also be consequences of each other. Therefore, a definitive diagnosis based solely on swollen head will be premature.

SUBCUTANEOUS INFLAMMATION

PERIORBITAL EDEMA

SINUSITIS

INFRAORBITAL INFLAMMATION

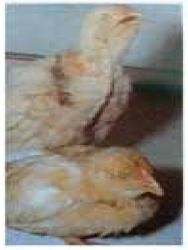
While torticollis is typical in NDV and AIV infections, it will often be observed also in ART infections complicated with encephalitis.

TORTICOLLIS

NDV SIGNS

While, difficult inhalation with stretched out neck is typical in chicks with Aspergillosis, it is also the clinical sign of early IBV infection cases.

ASPERGILLOSIS

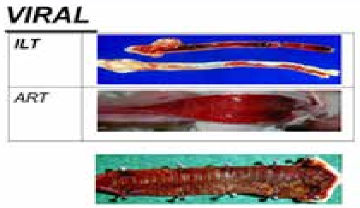


Although conjunctivitis (slanted eye) is a typical sign of ART infection, ammonia factor must not be overlooked.

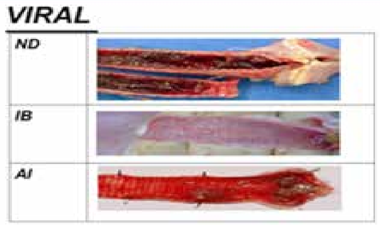
CONJUNCTIVITIS

In necropsy the tracheas will always appear affected and will present various degrees of haemorrhage. However, as the complications will aggravate the level of bleeding this cannot serve as a clear diagnostic sign.

NECROPSY



NECROPSY



It is still disputed whether E.Coli is a primary infectious agent or main cause of complications. Let us reflect on this issue: The broiler is living in a house where billions of agents are swarming around and furthermore 10^{5-6} /gr of the bird's intestinal microbiota is Coli of which 15% is pathogenic…?

It is quite uncommon that signs of airsacculitis, pericarditis, perihepatitis be associated with a single factor such as E.coli. A thorough investigation is needed to rule out any possibility of complication and to be sure that the primary factor is not masked.

Could "incubation time" be of help in diagnosis…?

Incubation Times of Common Diseases	
ILT	4 – 12 days
IBV	18 - 36 hours
NDV	3 – 6 days
ART	6 – 12 days
Coryza	1 -3 days
Mg	4 days – 3 weeks
E.coli	1 – 3 days

…to further complicate the issue:

- In necropsies we commonly make the mistake of looking at the signs of the complications instead of the primary factors;
- We create pathognomic changes by continuing vaccinated / unvaccinated, treated / untreated production that blur the classic clinical signs;
- We fail to evaluate epidemiological reports and share information with our neighbours to determine regional issues in order to engage in joint action with them to counteract the problems;
- Since we don't archive the results of routine serology tests, in case of problems we need to wait the emergence of antibodies or repeat the tests. We fail to perform slaughter age serology tests on all suspect flocks so that we can determine the measures we must adopt for the next cycle;
- We do not make full use of determinative capabilities of PCR.

Treatment Also Becomes A Challenge Because…

- It is a hard fact that in every case of economic difficulty the first expense cuts are made on health controls;
- Due to diagnostic difficulties listed above we fail to adopt the necessary measures fast enough;

- Effective medication cannot always be possible due to price concerns or withdrawal period requirements.

And we must never forget; "pharmacoeconomics" is not trying out cheap drugs but finding the correct treatment in a cost effective way!

Prevention

1. Biosecurity
2. Biosecurity
3. Biosecurity
4. Accurate diagnosis
5. Right vaccine – Right time – Right application

IS14 Diagnosis, Prevention and Control of Infectious Laryngotracheitis(ILT) in Broilers and Broiler Breeders

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Abstract

Infectious laryngotracheitis (ILT) is an upper respiratory tract infection of chickens caused by an *alphaherpesvirus*, *Gallid herpesvirus* tiype 1 (GaHV-1). This virus may cause significant economic losses to poultry industry due to decreased weight gain, decreased egg production, and mortalities in broilers, broiler breeders and layer chickens.

Different epidemiological and clinical forms of ILT, continuing virus spread by latent carriers and/or recovered birds in long-lived production types such as broiler breeders and layers, probable role of vaccines in spreading of ILT virus, gaining virulence in the field, and even emergence of new viruses, lax biosecurity, lack of collaboration between institutions in the control of disease could be the main factors effecting the proper control of ILT.

Recent ILT cases observed in Turkey as well as in other countries of the world, created the necessity for re-evaluation of methods used in identification, prevention and control of ILT. For this reason, distinguishing characteristics of the disease, present identification methods, ILT vaccines, prevention and control strategies, as well as implications on regarding subjects will be briefly discussed in this review.

O29 Frequency of Infectious Bronchitis Virus (IBV) S1 Genotypes In Chickens and Development of ELISA by Using Recombinant IBV-N Protein

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Abstract

The avian coronavirus infectious bronchitis virus (AvCoV-IBV) is recognized as an important global pathogen because new variants are a continuous threat to the poultry industry worldwide. Hence, the European Union has started a prevention and control action (COST FA-1207). In line with this action, this project (Number: 113O411) was supported by TUBITAK. The aims of this project were detection of S1 variants of infectious bronchitis virus, phylogenetic analyses, production of recombinant N protein by cloning IBV-N genes and development of an *in-house* ELISA test for diagnostic purposes by using the recombinant N protein produced in our laboratory. For these purposes, between 2014 and 2016, internal organs or tracheal swabs were taken from 108 broiler and 26 layer flocks (4-5 samples for each farm) located in different regions in Turkey and the virus isolation was performed. AvCoV-IBV RNA was detected in 98 (91%) broiler flocks and 16 (61%) of the layer flocks by TaqMan real-time RT-PCR. A phylogenetic tree based on partial S1 sequences of the 73 detected AvCoV-IBVs in broiler flocks revealed that viruses detected in 2 (2.7%) samples were similar to the 793/B genotype, 59 (80.8%) samples to Israeli variant-2 genotype, 10 (13.6%) samples to Ma5, M41, H120 genotypes, 2 (2.7%) samples to Morocco strain genotype and 1 (1.3%) sample to D274 genotype. Phylogentic analyses of partial S1 gene of IBV detected in 8 layer fams showed that viruses detected in 1 (12.5%) sample was similar to Massachuset and 7 (87.5%) 793/B, Israeli variant-1 genotypes. Recombinant IBV-N protein was produced by cloning of N gene of Israeli variant-2 in Baculovirus system and SF9cells. A band of 52-54 kDa was observed on Western immunobloting with recombinant N protein. Studies were conducted to develop an *in-house* ELISA test using recombinant N protein. The newly developed ELISA test was compared with the commercial IBV-ELISA test kit. Concordance was found in data obtained from both tests. These results indicate that the ELISA test developed by our laboratory can be used to detect IBV antibodies in chicken sera in the field.

In conclusion, Israeli variant-2 genotypes of IBV were mostly determined in samples taken from chickens. Epidemiological studies should be performed before vaccination to determine IBV genotypes and variants to dtermine which vaccine to be used to get a better immunity to protect chickens against circulating genotypes around the region. dtermine which vuseful to use vaccines that can protect against genotypes circulating in the region. Also, mutations and recombinations in IBV viruses need to be monitored. ELISA developed in our laboratory can be used to detect IBV antibodies in chickens.

IS[15] Nutritional Modulation of Broiler Intestine in Starter Period and Intestinal Integrity

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Summary

Gut health which is characterized by intestinal integrity, intestinal microflora, mucin and enterocyte functionality, may be of greatest concern among poultry producers because it has a great influence on the growth performance and welfare of poultry, as it affects feed digestion, nutrient absorption, protein and energy utilization, immunity and disease resistance.

A critical period in the lifespan of the broiler is the first week post hatch (starter period) were chicks are commonly fasted for the first 36 to 72 h post hatch (because of the logistics of commercial production), their digestive tract is not fully developed with low ability to digest absorb and assimilate nutrients. Moreover, their intestinal microbial community is not established yet and enables the colonization of the photogenic bacteria.

The current presentation describes several nutritional manipulations which promote the intestinal development and influence intestinal microflora and gut integrity

Introduction

The immediate post hatch developmental period represents a significant phase in attaining quality broiler performance at marketing. An efficient transition period from late term embryo to a viable independent chick is necessary for achieving results. Post hatch birds must develop intensively their intestinal ability to digest and absorb, to make a shift from egg and embryonic nutrients to exogenous feed and to establish the "right" microflora. Under practical conditions many birds have access to feed only 36-72 h after moment of hatch and during this time body weight decreases, intestine and muscle development is retarded. Moreover, as the modern broiler lines are intensively selected for a higher growth rate and increased pectoral muscles, there is an enhanced requirement of chicken embryos for energy and protein. Accordingly, some of the challenges faced by broilers chicks include weakness, reduced feed intake, impaired growth, susceptibility to disease, and mortality. These symptoms may be due to immature digestive system unable to reload depleted energy reserves from consumed feed, to limitations in some nutrients in the first day's post hatch and to luck of beneficial bacteria which promote the development of the intestine.

Maintaining gut integrity and health and efficient growth performance in poultry is a priority. A stable enteric ecosystem, particularly in the hind gut of poultry, is essential as symbiotic microflora competitively excludes the adverse effects of more pathogenic species. Establishment of stable ecosystem depends on uncompromised early intestinal development, gut motility conditioning by the structural properties of feed and strategic use of organic acids, essential oils, prebiotics, probiotics, and enzymes.

Narrative

Intestinal development

The transition from embryo to independent chick is mediated by processes that occur during the critical period of a few days pre- and post-hatch. During this period, chicks make the metabolic and physiological transition from egg nutrients (i.e. yolk sac and amniotic fluid) to exogenous feed.

Immediately post-hatch, the chick draws from its limited body reserves and undergoes rapid physical and functional development of the GIT in order to digest feed and assimilate nutrients. Therefore, the sooner the GIT achieves its functional capacity, the sooner the young bird can utilize dietary nutrients and efficiently achieve its genetic growth potential, while resisting infectious and metabolic diseases.

An exploration of intestinal development shows that the GIT develops throughout incubation, but the functional abilities of the small intestine only begin to develop 3 days before hatch. Towards the end of incubation, extensive morphological, cellular and molecular changes occur in the intestine. Research in broiler embryos has shown that during the last days of incubation there is a significant increase in the weight of the intestine relative to embryonic weight (1.4% at 17 days of incubation to 3.4% at hatch). Activity and RNA expression of brush-border enzymes, which digest disaccharides (sucrase-isomaltase) and small peptides (aminopeptidase), and of major transporters (sodium-glucose transporter and ATPase), begin to increase a few days before hatch and continue to increase on day of hatch.

In the first two days' post hatch chick the small intestinal mucosa appears to be immature and not fully developed. However, later on, from day 3 to day 10, the intestinal mucosa exhibit organization and establishment of the crypt region, a several-fold increase in villus height and area, an increase in the number and polarity of enterocytes and maturation of the goblet cells, which are capable of producing both acidic and neutral mucins.

The immediate post-hatch period seems to be critical for intestinal development. Decreased development was found when chickens were fasted for 36 to 48 h post-hatch. This "fasting" condition is a common situation in the poultry industry. Since chicken embryos have a wide "hatching window", commercial hatcheries do not remove birds until the maximum number of eggs have hatched; thus, chick age at exit from the hatchery averages more than 1 day. Hatchery treatments such as sexing, vaccination and transport to farms result in an additional time lag before birds receive first access to food and water. Thus, most chicks are fasted for 48 h or more before their first access to feed.

The concept that meanwhile this process the yolk sac can maintain the hatchling, until stable feeding becomes available, is not proper for the current fast growing breeds. It has been shown that 36 to 48 h of fasting immediately post-hatch decreases enterocyte number, crypt size, the number of crypts per villus, crypt proliferation, villus area, rate of enterocyte migration, goblet-cell size and mucin dynamics. This withholding of feed also results in a decrease in growth at an early age and lower body weight (BW) and proportion of breast muscle at marketing.

Modulating the functional development of the chicken intestine

Since access to feed soon after hatch is critical for the development of the intestine and its digestive capacity there is a need to feed the hatchlings as soon as they hatched. A large body of knowledge shows that "feeding" the embryo 3 days before hatch (by in ovo feeding methodology; Uni and Ferket 2003) accelerate enteric development and its capacity to digest nutrients. By injecting an isotonic in ovo feeding (IOF) solution into the embryonic amnion, the embryo can naturally consume supplemental nutrients orally before hatching. In ovo feeding, "jump-start" and stimulate intestinal development to begin earlier than would otherwise occur after

Microflora in the chicken intestine

Composition of intestinal microflora, definition and characterization of healthy intestinal ecosystem, examples for modifying intestinal microflora by feed and by feed additives and ways for early establishment of microflora to form healthy intestine is a hot topic nowadays in poultry production. Traditionally, intestinal health has been largely dependent on prophylactic and therapeutic uses of antibiotics. However, today as a result of customers' concern about food safety and traceability and due to increasing antibiotic-resistance pathogenic bacteria – there are voluntary or legislated limits on the use of antibacterial feed additives for poultry. Therefore, a change in the methods to maintain good intestinal health is one of the major aims in poultry and veterinary research.

Modulating gut health is possible by several mechanisms. Among them are altering intestinal pH; maintaining protective intestinal mucins; selection for beneficial intestinal organisms or against pathogens; enhancing the fermentation volatile short-chain fatty acids; enhancing nutrient uptake; and increasing the humeral immune response (Ferket, 2003).

Since AGPs mainly targeting the gut microflora population, manipulation of the intestinal microbial flora profile, by other ways, may apply similar health benefits and growth promoting effects as AGPs. Strategic use of different feed additives can be used to stabilize the enteric ecosystem. These enteric conditioning feed additives include probiotics, prebiotic non-starch polysaccharides, essential oils, organic acids and short-chain fatty acids, mananoligosaccharide (MOS) derivatives of yeast cell wall, and microbial enzymes.

Microbes in the gut and intestine may be grouped into either commensal organisms or transient and potential pathogens. The commensals are adapted to the host environment and are often considered beneficial by providing vitamins, amino acids, and short-chain fatty acids to the host: acetate, butyrate, and succinate are commonly produced, with butyrate being the preferred energy source for host epithelial cells. The normal microbiota also militates against pathogens by mechanisms that are not yet fully understood.

Cultivation techniques limit the ability to define the intestinal micobiota. However, molecular techniques based on determining DNA and RNA sequences similarity of selected genes within microbial community are being used successfully to detect and characterized microbiota. Previous studies consist on culturing methods have been replaced with new methgenomic approaches for defining population biodiversity and their relative abundantly. Using 16s rRNA analysis on chicken GIT, revealed that groups of *Clostridiales, Bacteroidaceae, Lactobacillaceae, Enterococcaceae, Porphyromonadaceae, Eubacteriaceae, Ruminococcaceae, Lachnospiraceae, Veillonellaceae* and *Rikenellaceae* were dominant (Tang et al., 2014). Analysis in our lab indicated that in young chicks (4 d) the major species presented in the small intestines and ceca was *Lactobacilli,* with a *Bifidobacteria* population becoming more dominant in the ceca at older age while *Clostridium* was detected only in some segments of the small intestine. In older chickens, *Salmonella, Campylobacter,* and *E. coli* species were found in the ceca (Amit-Romach 2004).

This microflora has a role in nutrition, detoxification of certain compounds, growth performance, and protection against pathogenic bacteria. The intestinal microflora lives in close contact with its surrounding intestinal wall (enterocyte epical membrane, mucin, intestinal immunity) as well as with other bacteria that may exert beneficial or harmful effects on the host, depending on whether they are classified as symbiotic or as pathogens. The interaction is determined on one hand by characteristics of the microorganisms (e.g. type of microorganism), and on the other hand by characteristics of the intestinal wall (e.g. level of intestinal immunity). Together they determine the health status of the intestine.

A healthy gut is one that has a stable and diverse microbial ecosystem. The criteria for desirable microflora is not high or low presence of specific microbial species but a bacterial community which have a significant influence on animal performance.

Modulating the intestinal microflora and intestinal integrity by feed and feed additives

Diet formulation and feed form affect the colonization of enteric pathogens. Structural properties of the feed that stimulate gizzard motility has been demonstrated to promote reverse peristalsis, thereby improving the foregut digestion of proteins, fat, and starches leaving little for competitive microbiota to prosper. In contrast, viscous non-starch polysaccharides that impede reverse peristalsis and digestion of protein, fat, and starches in the foregut of poultry will cause the competitive microbiota (pathogens) to grow.

Essential oils have been recognized for their anti-microbial activity (Lee et al., 2004), and they have gained much attention for their potential as alternatives to antibiotics. Lee and Ahn (1998) found that cinnamaldehyde, derived from the cinnamon essential oil, strongly inhibits *Clostridium perfringens* and *Bacteroides fragilis in vitro,* and moderately inhibits *Bifidobacterium longum* and *Lactobacillus acidophilus*. Also, a wide range of *in-vitro* anti-microbial activities of essential oils derived from cinnamon, thyme and oregano were presented during the last 10 years. The exact anti-microbial mechanism of essential oils is poorly understood; it may be associated with their lipophilic property and chemical structure (Lee et al., 2004). To be as effective as growth promoters, these herbal antimicrobial compounds must be supplemented to the feed in a more concentrated form than found in their natural state, which will increase usage costs.

Prebiotics are non-digestible food ingredients, which beneficially affect the host by selectively stimulating the growth of one or limited number health-promoting bacteria in the GIT (Gibson and Roberfroid 1995, Roberfroid 2007). Prebiotic selectively utilized by endogenous microbial population groups such as bifidobacteria and lactobacilli leads to changes, both in the composition and/or activity in the GIT microflora that confers benefits upon host well-being and health. Moreover indirectly, prebiotic treatment may have immunomodulatory (Babu et al., 2012) effects by enhanced the IgM and IgG antibody titers in plasma (Janardhana et al., 2009). These findings emphasize the multisystem involved by bacteria gut modulation. Prebiotics refers groups are: trans-galacto-oligosaccharide, fructo-oligosaccharide (FOS), Xylo-oligosacchrides, Mannan-Oligosaccharides (MOS), inulin and lactulose.

MOS: During the past years, poultry feed industry has proceeded to non-pharmaceutical alternative additive, mannan-oligosaccharide, which constructs the yeast cell wall. Comprehensive data-pulling from 1993 to 2003 of bird feed with Bio- MOS (Alltech Inc. from the yeast *Saccharomyces cerevisiae*) indicated that MOS reduced mortality in bird as much as antibiotics (Hooge 2004). Since MOS have high affinity to ligands, it's acting as lectin, offering a competitive binding site rather than intestinal epithelial cells for bacteria attachment (Ofek et al., 1977). Several studies have demonstrated the benefits of adding MOS to broiler diets, improved gut morphology in features such as villus length and villus area (Iji et al., 2001; Baurhoo et al., 2007 a,b); Solis de los Santos et al., 2007), growth performance characteristics such as body weight, feed-conversion rate and apparent metabolized energy (Hooge, 2004; Rosen, 2007; Yang et al., 2007a;Yang et al., 2007b; Yang et al., 2008a; Yang et al., 2008b). Adding MOS to the poultry diet also exhibited beneficial changes in intestine and performance (Oliveira, M. C., et al. 2008), in mucin secretion and in goblet cell number per villus (Baurhoo et al., 2007a,b; Solis de los Santos et al., 2007), in digestibility and brush-border enzyme activity (Yang et al., 2007a,b) and in gut immune responses (Newman, 1994; Kocher et al., 2004; Baurhoo et al., 2007a,b). Furthermore, MOS has been shown to alter the gut microflora (Fernandez et al., 2000; Baurhoo et al., 2007) by reducing the number of pathogenic bacteria that colonize the GIT (Spring et al., 2000; Fernandez et al., 2002). Work to study MOS's molecular interaction on broilers intestinal transcriptome was investigated by Affymetrix microarrays. Results indicated that a cell energy production, death, and protein translation were altered. Further pathway analysis indicated up-regulation of oxidative phosphorylation, cellular stress response, and immune processes cycles (Xiao et al., 2012).

Fiber-degrading enzymes supplementation has become a standard practice in the poultry industry, largely driving by the rising feed ingredient costs. Supplemental enzymes in the feed are used to achieve the following aims: alleviate the adverse effects of anti-nutritional factors (such as arabinoxylans, b-glucans); extract certain nutrients more available for absorption and enhance the energy value of feed ingredients and also modulate intestinal microflora to a healthier state (Engberg et al., 2004).

Probiotics: Probiotic microorganisms increase the colonization of commensal bacteria at the lower intestinal tract and inhibit growth of potentially pathogenic microorganisms by competitive exclusion (Nurmi and Rantala, 1973). Competitive exclusion of commensal microflora against pathogens include: 1) lowering the pH through production of lactate, lactic acid and short-chain fatty acids (SCFA); 2) competing for gut lining attachment and available nutrients; 3) producing bacteriocins; 4) stimulating the gut associated immune system through cell wall components (Nousiainen and Setala, 1998); and 5) increasing the production of SCFA, which have bacteriostatic and bactericidal properties (Fuller, 1977) and stimulate intraepithelial lymphocytes, and natural killer cells (Ishizuka and Tanaka, 2002; Ishizuka et al., 2004). Thus, probiotics have been shown to improve performance, decrease mortality, and improve FCR of poultry. Most commercial probiotic products are composed of pure defined cultures of one or more micro-organisms. Thus, prebiotic is also known as defined competitive exclusion cultures. Defined competitive exclusion cultures given to broilers have been shown to decrease *Salmonella* Typhimurium (Corrier et al., 1995). Also, undefined competitive exclusion products originating from adult intestinal microbiota are usually inoculated to 1-day-old chicks in order to control of *Salmonella* contamination (Mead, 2000). Another recent publication (Zhang and Kim (2014) states that dietary supplementation with multi-strain probiotics improved broiler growth performance, ileal amino acids digestibility, and humoral immunity. Furthermore, the probiotics decreased the cecal numbers of E. coli and decreased the NH3 content of excrete.

Many recent publications demonstrated the multifunction of probiotic bacteria on GIT epithelium: Altering the broiler GIT epithelium morphologic and cell development (Rodríguez-Lecompte et al., 2012); Stimulate the Immune system (Brisbin et al., 2012, Rajput et al., 2014); Influences on tight junction dynamic proteins component (Ulluwishewa et al., 2011) and alter mucus secretion (Smirnov at el., 2005).

It should be noticed that Probiotics have some disadvantages in comparison to other modulators of enteric microflora (Fooks et al., 1999; Isolauri et al., 2004) as they may have a short shelf-life and sensitivity to excessive heat and pressure during feed processing. Some probiotic microorganisms may be reduced or eliminated by the low pH in the gizzard, and thus have little effect in the lower intestinal tract where pathogens pose problems. If a probiotic is added to the drinking water, the chlorine sanitizer may adversely affect its survivability. Acidification would be a better sanitizer than chlorine when delivering a probiotic *via* the drinking water. Coating technology has helped with some of these concerns.

Synbiotics : The combinations of prebiotics and probiotics are known as synbiotics (Patterson and Burkholder, 2003). Study showed that supplementation of broiler diets with a prebiotic MOS and a probiotic-mixture significantly increased the body weight gain with slightly improved feed conversion ratios, compared with the un-supplemented control (Falaki et al., 2011).

Conclusions

Challenges faced by broilers chicks in the starter week include weakness, reduced feed intake, impaired growth, susceptibility to disease, and mortality. These symptoms may be due to immature digestive system unable to reload depleted energy reserves from consumed feed, to limitations in some nutrients in the first day's post hatch and to luck of beneficial bacteria which promote the development of the intestine.

This microflora has a role in nutrition, detoxification of certain compounds, growth performance, and protection against pathogenic bacteria. The intestinal microflora lives in close contact with its surrounding intestinal wall (enterocyte epical membrane, mucin, intestinal immunity) as well as with other bacteria that may exert beneficial or harmful effects on the host, depending on whether they are classified as symbiotic or as pathogens.

Maintaining gut integrity and health and efficient growth performance in poultry is a priority. Establishment of stable ecosystem depends on uncompromised early intestinal development, gut motility conditioning by the structural properties of feed and strategic use of organic acids, essential oils, prebiotics, probiotics, and enzymes.

Modulating gut integrity for the starter period and afterwards is possible by several mechanisms. Among them are in ovo feeding with specific nutrients, altering intestinal pH; maintaining protective intestinal mucins; selection for beneficial intestinal organisms or against pathogens; enhancing the fermentation volatile short-chain fatty acids; enhancing nutrient uptake at early age ; and increasing the humeral immune response

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O[30] Effects of *Paenibacillus Xylanexedens* on Growth Performance and Intestinal Histomorphology in Broiler Chickens Challenged With *Escherichia Coli* K88

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Abstract

This study investigated the effects of dietary *Paenibacillus xylanexedens* supplementation on growth performance and histomorphology in broiler chickens challenged with *Escherichia coli* K88. A total of 320 one-day-old male broiler chickens were randomly allocated to 4 experimental groups with each group comprising 8 replicate pens containing 10 birds each. The treatments were as follows: negative control (**NC**) birds were fed a corn-soybean meal basal diet and not challenged with *E. coli* K88; positive control (**PC**) birds were fed a basal diet and challenged with *E. coli* K88; *Paenibacillus xylanexedens* treatment (**PRO**) birds were fed a basal diet supplemented with 1×10^9 *P. xylanexedens* cfu/kg feed and challenged with *E. coli* K88; and colistin sulphate treatment (**ANT**) birds were fed a basal diet supplemented with 20 mg of colistin sulphate/kg of feed and challenged with *E. coli* K88. The *E.coli* K88 challenge decreased BWG in PC birds compared with the ANT birds on d 21 ($P = 0.039$) and 28 ($P = 0.007$). Feed conversion ratio was improved by dietary *P. xylanexedens* and colistin sulphate supplementation on d 14, 21 and 28 ($P < 0.001$). Villus height and crypt depth decreased in PC birds both in jejunum and ileum on d 28. These results suggested that, dietary *P. xylanexedens* addition improved growth performance and intestinal integrity of broilers challenged with *E. coli* K88.

Introduction

In modern broiler production, newly hatched birds initially contact bacteria in the hatchery and house environment, rather than that of the hen or nest material. This arrangement leads to insufficient bacterial colonization of the gastrointestinal tract of the chicks, making the birds more susceptible to intestinal disorders (1,2). Pathogenic *Escherichia coli* is one of the important microorganism which cause enteric diseases and increase mortality rate in chickens (3) . Antibiotics are usually used to treat or control bacterial diseases in broiler industry; on the other hand emerge of antibiotic-resistance bacteria and possibility of antibiotic residues in meat and other animal products have put restrictions on the use of antibiotics (3,4). Probiotics influence the host organisms' health by maintaining the normal intestinal microbiota, preventing the growth of pathogenic microorganisms, promoting digestion and intake of feed, and inducing the immune system (5,6). Spore forming probiotic bacteria's, such as Bacillus species, has received much more attention than their non-spore-forming counterparts and this particular advantage making them suitable for use as feed supplements in broiler diets (7). *Paenibacillus* is a genus of facultative anaerobic, endospore-forming bacteria, which previously distinguished from the other *Bacillus* groups by comparative 16S rRNA sequence analysis (8)Farrow, Wallbanks and Collins. Certain Bacillus and *Paenibacillus* species isolated from gastrointestinal tract (**GIT**) of bovine, appeared to have potential as a probiotic candidate, according to their antimicrobial effects, resistance to simulated gastrointestinal conditions, antibiotic susceptibility, colonization capacity, and lack of toxicity (7).

To our knowledge, the effect of *P. xylanexedens* on infected broilers have not been investigated. The present study evaluated the effects of *P. xylanexedens* on growth performance and intestinal epithelium integrity in broiler chickens challenged with *E. coli* K88.

Materials and Methods

Animal Care and Use:All experimental procedures were approved by the Animal Ethics Committee of Gazi University **(G.Ü.ET-15.049)**.

Birds, Diets, and Experimental Design: Three hundred and twenty 1-day-old male broiler chicks (Ross 308), with average weight of 40.51 ± 1.94 (Mean ± SD), were obtained from a commercial hatchery (Beypiliç, Bolu, Turkey). The birds were randomly allocated to 4 experimental groups, with each group comprising 8 replicate pens containing 10 birds each. Birds were housed in a controlled environment for 28 d. The ambient temperature was thermostatically controlled and gradually decreased from 32 to 35°C on the first day, to 22°C when the broilers were 3-weeks-old. The temperature was maintained at 22°C thereafter. The treatments were as follows: negative control (NC) birds were fed a corn-soybean meal basal diet and not challenged with *E. coli* K88; positive control (PC) birds were fed a basal diet and orally challenged with of *E. coli* K88; *Paenibacillus xylanexedens* treatment (PRO) birds were fed a basal diet supplemented with 1×10^9 *P. xylanexedens* cfu/kg feed and orally challenged with *E. coli* K88; and colistin sulphate treatment (ANT) birds were fed a basal diet supplemented with 20 mg of colistin sulphate/kg of feed and orally challenged with *E. coli* K88. *E. coli* K88 was provided by Ankara University Faculty of Veterinary Medicine, Department of Microbiology. Birds in PC, PRO, and ANT treatment groups were orally gavaged with 0.1 mL *E. coli* K88 (2×10^9 cfu/mL) on d 7 and 0.5 mL mL *E. coli* K88 (2×10^9 cfu/mL) on d 10, 14 and 21. The negative control birds were administrated similarly with the same amount of 0.9% saline solution. The birds of each treatment placed individual rooms to prevent cross-contamination. The rooms had same condition throughout the study. The starter and grower diets were based on maize-soybean meal and were offered to the birds from 0 to 14 and 15 to 28 d of age, respectively (Table 1). All diets were formulated to meet or exceed NRC (1994) nutrient recommendations. Each pen was equipped with a manual plastic feeder and nipple drinker. Water and the experimental diet (in mash form) were provided ad libitum throughout the experimental period.

Experimental Protocol:All chicks were individually weighed and feed intake (FI) was recorded at weekly intervals. Body weight gain (BWG), FI, and the feed conversion ratio (FCR) were subsequently calculated based on performance values. At 28 d of age, one bird from each replicate was selected according to the average body weight of each treatment group. Birds were euthanized by exsanguination and the intestinal tract was immediately removed. Tissue samples were obtained from the jejunum and ileum for histomorphological analysis.

Morphological Measurements of the Jejunum and Ileum:Tissue samples in the formalin solution were dehydrated in graded ethanol solutions, cleared with xylol, and then embedded in paraffin. The intestinal segments were sectioned at a thickness of 5 µm with a microtome. Cross sections were prepared and stained with Mallory's triple stain, as modified by Crossman, in order to determine the jejunal and ileal morphometry (9). Villus height was measured from the top of the villus to the crypt mouth, and crypt depth was defined as the depth of the invagination between adjacent crypt mouths. Villus width was measured at the bottom of the villus.

A total of 10 well-oriented villi and crypts were randomly selected for histological measurements. Histological sections were examined under a light microscope (Leica DM 2500, Leica Microsystems GmbH, Wetzlar, Germany) and photographed with a digital microscope camera (Leica DFC450, Leica Microsystems GmbH, Wetzlar, Germany). The images were evaluated using the ImageJ software (US National Institutes of Health, Bethesda, MD).

Table 1. Ingredients and composition of basal diet

	Basal Diet	
	0-14 d	15-28 d
Ingredient, g/kg		
Corn	549.40	575.00
Soybean meal, CP 48%	375.00	342.40
Vegetable oil	33.00	44.00
Limestone	5.00	3.60
Dicalcium phosphate	24.50	23.40
DL-Methionine (98%)	3.60	3.15
L-Lysine HCI (78%)	3.00	2.35
L-Threonine	1.50	1.10
Salt	2.50	2.50
Vitamin premix[1]	1.00	1.00
Mineral premix[2]	1.00	1.00
Cholin chloride	0.50	0.50
Total	1000	1000
Chemical composition (Calculated)		
Dry Matter, %	87.93	87.93
Crude Protein, %	23.04	21.57
AME_n, kcal/kg	3006	3105
Lysine, %	1.44	1.30
Methionine + cysteine, %	1.08	0.99
Threonine, %	1.00	0.90
Calcium, %	0.97	0.88
Available phosphorus, %	0.48	0.44

[1] Provided per kilogram of complete diet: vitamin A, 15,000 IU; vitamin D3, 5,000 IU; vitamin E, 100 mg; vitamin K3, 3 mg; thiamin, 5 mg; riboflavin, 8 mg; pyridoxine, 5 mg; pantothenic acid, 16 mg; niacin, 60 mg; folic acid, 2 mg; biotin, 200 µg; vitamin B12, 20 µg.
[2] Provided per kilogram of complete diet: Cu, 16 mg; I, 1.5 mg, Co, 500 µg; Se, 350 µg; Fe, 60 mg; Zn, 100 mg; Mn, 120 mg; Mo, 1 mg.

Proliferating Cell Nuclear Antigen (PCNA) Staining: Immunohistochemical staining was performed on the stored 4-µm thick formalin-fixed paraffin-embedded tissue sections. Tissue sections were placed on poly-L-lysine microscope slides (Thermo Scientific, Braunschweig, Germany). The microscope slides were then placed in an oven at 37°C overnight and deparaffinized with xylene and rehydrated through graded alcohols. Endogenous peroxidase activity was blocked by quenched with H_2O_2 (3% in methanol) for 30 min. The sections were pre-treated by heating for 20 min in 0.01 M citric acid buffer (pH 6) in a microwave oven at 800 W. After cooling for 20 min at room temperature, tissue sections were washed with PBS and incubated with 10% normal goat serum for 30 min for protein blocking to prevent the non-specific binding of antibodies, followed by incubation with the primary antibody to PCNA (MAB424, mouse anti PCNA monoclonal antibody, PC10 clone; EMD Millipore, Darmstadt, Germany) at dilutions of 1:100 overnight at 4 ºC. After incubation with the primary antibodies, the tissue sections were washed with PBS and incubated with a biotinylated secondary antibody (Goat anti-rabbit IgG, Invitrogen) for 30 min at room temperature. Negative control experiments were performed by replacing the primary antibodies with PBS. After a PBS wash, tissue sections were incubated using a streptavidin horseradish peroxidase kit (Histostain-Plus IHC Kit, HRP, broad spectrum, Invitrogen, USA) for 30 min at room temperature. Final PBS was followed by incubation for color development 3,3-diaminobenzidine tetrahydrochloride (DAB, Invitrogen, USA) for 3 min at room temperature. Tissue sections were counterstained with Gill's hematoxylin, dehydrated in graded alcohols, applied to a coverslip using Entellan (Merck, Darmstadt, Germany), and examined with a Leica DM2500 light microscope. All images were captured with a digital camera (Leica DFC450) and processed with Image J. Proliferating cell nuclear antigen positive nuclei of total crypt epithelial cells on ten different randomly selected intact crypts, regardless of the staining intensity, were counted as described by Bologna-Molina ve ark. (10).

Statistical Analysis:Data were analyzed using the ANOVA procedure of the SPSS software, version 14.01 (SPSS Inc., Chicago, IL). Significant differences among treatment groups were tested by Tukey multiple range tests. Statistical differences were considered significant at $P \leq 0.05$.

Results

Growth Performance: The *E.coli* K88 challenge decreased BWG in PC birds compared with the ANT birds on d 21 (P = 0.039) and 28 (P = 0.007) (Table 2). Feed intake were increased (P = 0.028) in PC birds in comparison to NC birds on d 14. No significant differences in FI was observed on d 7, 21, and 28. The FCR was higher in PC birds compared with the unchallenged birds and PRO and ANT birds on d 14 (P = 0.004), 21 (P < 0.001), and 42 (P < 0.001).

Table 2. Effects of *Paenibacillus xylanexedens* on growth performance in broilers.[1]

	Dietary treatment[2]					
Item[3]	NC	PC	PRO	ANT	SEM	*P*-value
0 to 7 d						
BWG (g)	128.3	128.6	128.2	129.0	0.18	0.392
FI (g)	141.9	144.4	143.4	144.3	0.88	0.754
FCR	1.106	1.122	1.119	1.118	0.01	0.881
0 to 14 d						
BWG (g)	358.7	354.6	362.8	368.3	1.92	0.063
FI (g)	425.1^{b}	446.8^{a}	434.7^{ab}	439.7^{ab}	2.72	0.028
FCR	1.185^{b}	1.261^{a}	1.199^{b}	1.194^{b}	0.01	0.004
0 to 21 d						
BWG (g)	797.2^{ab}	751.7^{b}	784.4^{ab}	803.4^{a}	7.09	0.039
FI (g)	1013	1009	996	1016	6.41	0.711
FCR	1.271^{b}	1.343^{a}	1.270^{b}	1.267^{b}	0.01	<0.001
0 to 28 d						
BWG (g)	1382^{ab}	1332^{b}	1407^{ab}	1454^{a}	13.48	0.007
FI (g)	1823	1870	1845	1890	14.69	0.417
FCR	1.320^{b}	1.404^{a}	1.311^{b}	1.300^{b}	0.01	<0.001

[a-b] Means with different superscripts in the same row are significantly different ($P < 0.05$).
[1] NC: birds fed a basal diet and not challenged with *E. coli* K88; PC: birds fed a basal diet and orally challenged with of *E. coli* K88; PRO: birds fed a diet supplemented with 1×10^9 *P. xylanexedens* cfu /kg feed and orally challenged with *E. coli K88*; ANT: birds fed a diet supplemented with 20 mg of colistin sulphate/kg of feed and orally challenged with *E. coli* K88
[2] Data represent mean values of 8 replicates per treatment.
[3] BW: Body weight; FI: Feed intake; FCR: Feed conversion ratio.

Morphological Measurements of the Jejunum and Ileum: Morphological measurements of jejunum and ileum are shown in Table 3. Both jejunum and ileum villus height decreased in PC control birds compared with the NC, PRO and ANT birds (P < 0.001 and P < 0.001, respectively). Similarly, lowest crypt depth was observed in both jejunum (P < 0.001) and ileum (P < 0.001) of PC birds on d 28.

Table 3. Effects of *Paenibacillus xylanexedens* on intestinal morphology and PCNA–positive cells of the jejunum and ileum on d 28.[1]

	Dietary treatment[2]					
Item	NC	PC	PRO	ANT	SEM	*P*-value
Jejunum						
Villus Height (µm)	1067^{a}	910.4^{c}	985.1^{b}	1016^{ab}	13.58	<0.001
Crypt Depth (µm)	108.0^{a}	90.21^{d}	96.10^{c}	101.7^{b}	1.33	<0.001
VH:CD[3]	9.89	10.09	10.25	9.99	0.08	0.414
PCNA-positive cell	59.95^{a}	51.54^{c}	53.96^{bc}	54.40^{b}	0.64	<0.001
Ileum						
Villus Height (µm)	532.8^{a}	413.9^{b}	511.8^{a}	521.3^{a}	9.07	<0.001
Crypt Depth (µm)	95.43^{a}	80.05^{c}	91.06^{b}	95.11^{a}	1.16	<0.001
VH:CD	5.58^{a}	5.17^{b}	5.62^{a}	5.48^{ab}	0.05	0.003
PCNA-positive cell	56.26^{a}	49.83^{b}	51.29^{b}	50.58^{b}	0.51	<0.001

[a-d] Means with different superscripts in the same row are significantly different ($P < 0.05$).
[1] NC: birds fed a basal diet and not challenged with *E. coli* K88; PC: birds fed a basal diet and orally challenged with of *E. coli* K88; PRO: birds fed a diet supplemented with 1×10^9 *P. xylanexedens* cfu /kg feed and orally challenged with *E. coli K88*; ANT: birds fed a diet supplemented with 20 mg of colistin sulphate/kg of feed and orally challenged with *E. coli* K88
[2] Data represent mean values of 8 replicates per treatment.
[3] Villus height to crypt depth ratio

Discussion and Conclusion

Probiotics, prebiotics and synbiotics are used as a potential substitute for antibiotics to alleviate the effects of bacterial pathogens on immune system, intestinal integrity and growth performance (11,12). Our previous in vitro study results revealed that, *Paenibacillus xylanexedens* displayed an antimicrobial activity against *E. coli* was reduced due to. In this context, the present study aimed to determine the effects of *Paenibacillus xylanexedens* on growth performance and histomorphology in broiler chickens challenged with *Escherichia coli* K88. As a new and promising probiotic, the effect of *P. xylanexedens* on broiler intestinal health has not previously been reported.

In this study, *E. coli* challenge reduced BWG accompanied by an increase in FCR in PC birds. However, dietary supplementation of *Paenibacillus xylanexedens* alleviated the growth suppression effect of *E. coli* in broilers. *Paenibacillus xylanexedens* and antibiotic had nearly similar effect on *E. coli*, as there were no significant differences in performance between these experimental groups. Our results are in agreement with those of Cao ve ark. (12) who reported that supplementation of *Enterecoccus faecium* significantly improved growth performance in chickens after challenge with pathogenic *E. coli* K88. The exact mechanism(s) underlying the growth-promoting effects of probiotics is still unclear but might be attributable to the ability of probiotics to induce beneficial changes in intestinal microflora and intestinal integrity (13,14).

Morphological changes in the small intestine, such as increased villus height and VH:CD ratio, can improve the performance of birds by enhancing the absorptive surface area, which is important when alternative growth stimulators are applied (4). Our results showed that, pathogenic *E.*

coli K88 challenge influenced small intestine morphology by decreasing villus height and crypt depth in jejunum and ileum. Moreover, dietary supplementation of *Paenibacillus xylanexedens* was effectively reduced negative effect of *E. coli* K88 on intestinal lining. In agreement with previous study results Wang ve ark. (11) observed that yeast supplementation improved intestinal integrity under challenged conditions. It can be assumed that, aforementioned improvements in intestinal integrity may be related to the beneficial effect of *Paenibacillus xylanexedens* on intestinal microflora population which influenced the differentiation and proliferation of enterocytes.

Intestinal epithelial cells have a short lifespan and need to be replaced rapidly and continuously via the replication of undifferentiated cells. Proliferating cell nuclear antigen, also known as cyclin or DNA-polymerase delta auxiliary protein, is an endogenous nuclear protein that is used to identify replicating cells in tissues (15-17). Increased villus height is directly related to higher epithelial turnover (18) and activated cell mitosis (19). The improvements in intestinal integrity in the present study are presumably related to the positive effects of *Paenibacillus xylanexedens* administration on intestinal epithelial cell turnover in the crypt region, which supports the growth of beneficial bacteria.

In conclusion, the results of present study revealed that enterepathogenic E. coli K88 decreased growth performance of broiler chickens, however dietary supplementation of *Paenibacillus xylanexedens* improved intestinal integrity and alleviate the growth suppression effect.

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O31 Effects of The Mixture of Essential Oils and Organic Acids on Performance and Intestinal Histomorphology in Broilers

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Abstract

The purpose of this study was to determine the effects of dietary additive containing essential oils wıth organic acids on performance and intestinal histomorphology in broilers. A total of 300 Ross 308 broiler male chicks aged one day were divided into one control group and two treatment groups each group containing 100 chicks. Each group was divided into 5 replicates, as subgroups, each comprising 20 chicks. The experimental period lasted 39 days. Basal diet was supplemented with the additive containing essential oil with organic acids (NafOil Anti Plus, thyme oil, orange oil, garlic oil and organic acids, Biotem Ltd Company). Additive was added at 0.1 and 0.2% to the first and second treatment groups, respectively. Dietary supplementation of additive containing thyme oil, orange oil, garlic oil and organic acids didn't affect the final body weight, body weight gain, feed intake and feed efficiency during the 39 days of experimental period. Livability was increased significantly with the usage of additive. Supplementation of essential oil-organic acid mixture increased the ratio of villus height to crypt depth in jejenum, villus height and depth in ileum. As a conclusion effectiveness of the mixture of essential oil and organic acids (NafOil Anti Plus) could be more pronounced when the additive is supplemented into diets in suboptimal conditions due to improvement in livability and intestinal development.

Keywords: Broiler, essential oils, organic acids, performance, intestinal histomorphology

O32 The Effect of Intra-Amniotic Co-Enzyme Q10 Administration on Liver Oxidation, Fatty Acid Profile of Transported Hatchlings and Post-Hatch Performance of Broiler

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Abstract

This study was investigated the effects of intra-amniotic Coenzyme Q10 (CoQ10) administration on hatching performance, liver oxidation, liver fatty acid profile of transported hatchlings and also post-hatch performance of broiler chickens. Total of 480 eggs, containing viable embryos were divided into 5 groups of 96 eggs each. The embryonic amnion was injected according to the following treatment descriptions; NC = Negative Control (not injected); PC = Positive Control (injected with 0.1 mL olive oil); Q5 = 0.5 mg/0.1 mL CoQ10 in 0.1 mL olive oil; Q10 = 1 mg/0.1 mL CoQ10 in 0.1 mL olive oil; Q20 = 2 mg/0.1 mL CoQ10 in 0.1 mL olive oil. After sampling, remaining hatchlings were transported for 6 h with an average speed of 80 km/h. Prior to transportation, a total of 150 broiler hatchlings were randomly allocated to 5 experimental groups (based on with 5 replicate pens containing 6 birds per each. The administration of intra-amniotic CoQ10 to the embryonated eggs on E17 did not affect hatchability and hatching weight. Liver MDA level linearly decreased ($P \leq 0.001$) with the increasing level of CoQ10. Intra-amniotic CoQ10 inclusion had a positive effect on FCR at d 0 to 11 ($P = 0.001$). Our results show that intra-amniotic administration of CoQ10, as an antioxidant, reduced transport stress and improved broiler early growth performance.

[1]Contribution was equal to that of the first author

Introduction

Chicken embryonic development happens in egg and all the nutrient needs are met by egg yolk and white that accumulated within the egg for the development of a healthy hatchlings (1). During the 21-d incubational period, an intense transfer of yolk polyunsaturated fatty acids (**PUFA**) results in a preferential incorporation of 20- and 22-carbon long-chain PUFA in the tissues of newly hatched chicks (2). Due to highly PUFA nature of the chick embryonic tissue, such system need antioxidant defense mechanism (1,3).

Coenzyme Q10 (CoQ10) is a lipophilic molecule composed of a quinoid head and a hydrophobic tail, which contains 10 isoprenoid units (4). Coenzyme Q10 present in both animal and plant cellular membranes and this compound plays two major functions as an electron carrier in the mitochondria respiratory chain and as a lipid soluble antioxidant

Transportation is an essential part of the intensive poultry production and responsible to a different degree of stress to birds, ranging from mild discomfort to death (5). During the transportation, birds may encounter several stressors such as handling by humans, feed withdrawal, noise, vibration thermal changes, social disruption, crowding, and restriction of movement (6,7). Transport alters both metabolism and physiological state of the birds which involves changes in concentration of several hormones, enzymes, blood and muscle metabolism, and immune function of the domesticated animals (5,8). Exceptionally from the other production animals, poultry hatchings transported at very early life which makes them more vulnerable to several stressors (9,10). Degree of the transport stress that exposed at early ages might have detrimental effect in broiler future performance (11). However, most of the studies focused on pre-slaughter transport stress and based on our knowledge, there is very little evidence about post-hatch transport stress and how intra-amniotic antioxidant administration effect on liver antioxidant status and early broiler performance. Based on findings that also suggest beneficial antioxidant effect of CoQ10, two experiment was conducted to survey the effect of intra-amniotic CoQ10 administration. In experiment 1, fertile eggs were injected with different levels of CoQ10 to determine hatching performance, liver oxidation and liver fatty acid profile after hatchlings transportation. In experiment 2, chicks from same incubational basket were randomly assigned and transferred to a floor pen for performance study.

Material and Methods

Experiment 1

***Incubation Procedures and In Ovo Administration*:**Nine hundred eggs (Ross 308) were obtained from a 36 wk old maternal flock in a commercial hatchery (Beypiliç A.Ş., Bolu, Turkey). On arrival, all eggs were individually weighed and 573 eggs with an average weight of 61.43 ± 1.82 g (Mean ± SD) were selected and placed in the incubator under standard conditions. Prior to the injection, at 17th d of incubation (E17), the eggs were candled and those unfertilized or with dead embryos were discarded and total of 480 eggs, with an average weight of 56.39 ± 1.93 (Mean ± SD) containing viable embryos were divided into 5 groups of 96 eggs each.

The Coenzyme Q10 which used in current study was provided from Antiaging Institute of California (USA, California). Four glass cylinders containing olive oil were autoclaved (Systec D-90, Linden-Germany) for 20 psi for a period of 20 min by autoclave prior to use (12). Due to the fat soluble nature of the CoQ10, injectable solutions were prepared using sterile olive oil. Fatty acid profile of experimental olive oil is presented in Table 3. The location of amnion was previously marked through candling process on the day of injection (E17) and the site of injection was disinfected by ethyl alcohol. The injection was done through a hole on the side of air-cell chamber which was made by using a sterile 21-gauge needle. The embryonic amnion was injected according to the following treatment descriptions; **NC** = Negative Control (not injected); **PC** = Positive Control (injected with 0.1 mL olive oil); **Q5** = 0.5 mg/0.1 mL CoQ10 in 0.1 mL olive oil; **Q10** = 1 mg/0.1 mL CoQ10 in 0.1 mL olive oil; **Q20** = 2 mg/0.1 mL CoQ10 in 0.1 mL olive oil.

Intra-amniotic administration was performed by injecting the eggs with 0.1 mL of the test solution using self-refilling syringes (Socorex, Ecublens, Switzerland), in accordance with the method described by Tako et al. (13). The amount of time that the eggs were out of the incubator during the in ovo injection procedure was similar for all replicates. After injection, the injection holes were sealed with cellophane tape, and eggs were placed in hatching trays such that each treatment was equally represented in each location of the incubator (13).

Hatch Sampling:At hatch, the number of live-hatched and non-hatched chicks was counted to determine hatchability of fertile eggs (%). Non-hatched eggs were opened to determine cause of death. All hatched chicks were weighed, sexed, leg banded and 16 male chicks from each treatment were randomly selected to determine the internal organ and residual yolk weights. Liver tissue were collected and stored at -20 ^{o}C to determine malondialdehyde (**MDA**) level and fatty acid (**FA**) profile (analysis procedures are detailed in the section describing Experiment 2).

Road Transportation:Remaining hatchlings were leg banded and rood-transported in hatchery chick baskets. The baskets were loaded to a van and transported for 6 h with an average speed of 80 km/h. The journey covered highways, roads with traffic lights without any traffic. The ambient temperature was 33 to 35°C during transportation (7,14). After arriving, 8 male chicks per treatment were randomly selected, killed by cervical dislocation and liver tissue was excised and snap frozen in liquid nitrogen, and preserved at –80 ^{o}C for further analysis.

Liver Fatty Acid Profile and Oxidation Level:The sample preparation for gas chromatography was according to the method presented by Wang et al. (15) with a little modification. Briefly, frozen liver sample tissues thawed at 4 °C and homogenized were homogenized and mixed with 4 ml anhydrous diethyl ether (contains 10 ppm BHT). The homogenates were vortexed for 1 min. After 1 hour, diethyl ether level was transferred to teflon-lined tubes and solvent was evaporated. Samples were dissolved in 2N NaOH-methanol (5 mL) in a 60 °C bath for 15 min. Subsequently, 2.175 mL of BF3-Methanol (10% w/w) was added and samples placed in 60 °C bath for 30 min. Fatty acid methyl esters were extracted with 1 mL hexane and 2 mL of saturated sodium chloride. After centrifugation (4000 rpm for 5 min) top layer were transferred to gas chromatography vials for analysis.

Supernatants were analyzed by using gas chromatography (Shimadzu GC-2010, Shimadzu Co., Kyoto, Japan) coupled with 30 m × 0.25 mm i.d. column (SP™-2330, Supelco, Bellefonte, PA) and a flame ionization detector to determine FA methyl esters of yolk and liver samples. Conditions were as follows: injector: 250 °C; detector: 250°C; oven: 160 °C for 1 min increased to 240°C (4°C/min), and held for 1 min. One microliter was injected automatically with a split of 1:100. Each FA was identified in the form of a methyl ester by comparing the retention times with the F.A.M.E Mix C8-C24 (Supelco 18918-1AMP) methyl ester standard. Fatty acid peaks were identified by using pure standards. Those data were presented as relative percentage of total fatty acids.

The extent of lipid peroxides in liver samples was assessed by measuring thiobarbituric acid according to the method described by Botsoglou et al. (16). A 1 ± 0.1 g sample was transferred into a 25-mL centrifuge tube, and volumes of 5% aqueous trichloroacetic acid (TCA; 4 mL) and 0.8% BHT in hexane (2.5 mL) were added. The content of the tube was homogenized at 10000 rpm for 1 min by means of an ultraturrax (IKA T25, Germany- Deutschland). The samples were centrifuged for 3 min at 3000g, and the top hexane layer was discarded. The bottom aqueous layer was made to 5-mL volume with 5% TCA plus the whole of the aliquot and a volume (3 mL) of 0.8% aqueous TBA were pipetted into a stoppered test tube. The other stoppered test tube was prepared as a blank by adding a mixture of of 5 ml distilled water and 5 ml TBA reagent. The tube was cooled under tap water after a 30-minute incubation at 70 °C in a water-bath. Absorbance was measured at 521.5 nm aganist the blank (Shiamdzu UV-1208, UV-Vis, Japan). Results were expressed as milligrams malondialdehyde (MDA)/kg sample, were calculated from the standard curve of TEP (1,1,3,3-tetraethoxypropane) standard.

Experiment 2

Birds and Management: Male chicks (totally 150 day-old-chicks) from same incubational basket, with an average body weight (**BW**) of 42.04 g, were randomly allocated to 5 experimental groups with 5 replicate pens (90 × 80 cm; covered by wood shaving as a litter material) containing 6 birds per each. Birds were housed in a controlled environmental house form day 0 to day 11. Ambient temperature was gradually decreased from 33-35°C to 28°C. All experimental procedures were approved by Animal Ethics Committee of Ankara University (2015-4-76).

All treatments were fed on same commercial maize–soybean meal based starter diets from 0 to 11 d of age (Table 1). Diet was formulated to meet or exceed NRC (17)DC</pub-location><publisher>Natl. Acad. Press</publisher><urls></urls></record></Cite></EndNote> and Aviagen (18) nutrient recommendations. Each pen was equipped with a manual plastic feeder and two automatic nipple drinker. Water and the experimental diet (in crumble form) were provided *ad libitum* throughout the experimental period. All chicks were weighted individually and feed intake (**FI**) was recorded at the end of 11 d. Feed conversion ratio (**FCR**) were subsequently calculated based on the performance values.

Statistical analysis: In Experiment 1, a randomized complete block design was employed during incubation with each of the tray levels of the setter and each of the hatching basket levels in the hatcher, and with all treatments being equally represented in each block. Treatments were viewed as a fixed effect, and blocks as a random effect in the one-way ANOVA. An arcsine square root transformation was used for hatchability data to obtain normally distributed data. Repeatedly measured data regarding liver MDA level on d 0 (before and after transport) were analysed by the mixed model procedure of SAS software. In experiment 2, male hatchlings were randomly allocated to 5 experimental groups with 5 replicate of 6 birds placed in cage pens (90×80 cm). Data were analyzed using the 2-way ANOVA using the GLM procedure of the SAS software, version 9.2 (SAS institute, 2001). Polynomial orthogonal contrasts were individually carried out for all data to investigate the linear and quadratic trends. In addition, means were separated by the Tukey's post hoc test. A probability value of less than 0.05 was considered significant, unless otherwise noted. All data are shown as mean values with pooled standard error of the mean (SEM).

Results

Hatchling Performance and Organ Weights: The effects of graded levels of intra-amniotic CoQ10 administration on hatchability (%), hatching weight, and internal organ and yolk weights are shown in Table 2. The administration of intra-amniotic CoQ10 to the embryonated eggs on E17 did not affect hatchability and hatching weight. However, significant quadratic responses in yolk ($P = 0.03$) and liver ($P = 0.03$) weight were observed with increasing level of CoQ10 at day of hatch.

Fatty Acid Composition of Liver: The effects of graded levels of intra-amniotic CoQ10 administration on major fatty acid compositions of liver are shown in Table 3. Percentage of C14:0 in liver significantly decreased linearly ($P = 0.002$) with the increasing level of CoQ10. Apart from C14:0, no significant changes were observed for the rest of fatty acid in liver at day of hatch.

Malondialdehyde Level of Liver on Day of Hatch : The effects of graded levels of intra-amniotic CoQ10 administration on MDA level acid compositions of yolk and liver are shown in Table 4. Liver MDA level linearly decreased ($P \leq 0.001$) with the increasing level of CoQ10. A lower MDA level ($P \leq 0.001$) were found in hatchlings inoculated 0.5, 1, and 2 mg CoQ10 compared with those positive and negative control prior to transport.

Posthatch Performance: Birds were in good health throughout the entire experimental period and there was no mortality during the experiment. The effects of intra-amniotic administration of CoQ10 on the growth performance of chicks are shown in Table 5. Intra-amniotic CoQ10 inclusion had a positive effect on FCR at d 0 to 11 ($P = 0.001$) so birds from eggs with 2 mg/0.1 mL (Q20) CoQ10 injection had the lowest FCR in compare other treatments. There was no significant effect on the growth performance of the birds in terms of BWG.

Discussion

During the normal hatchery practices, day old chicks are kept in hatching baskets between 24 to 48 h until transport which results in some chicks being deprived of feed and water. Broiler chickens that maintained in intensive production systems are transported at least twice during their life span. Procedures and practices involved in transportation may influence broiler welfare status, immune system and performance due to the inevitable stressors that exposed during transport (10). In addition, growth performance might be affected negatively due to the transportation stress that exacerbate the depletion of yolk (9,10,19). Current evidence suggested that chicken embryo has two major antioxidant system that consisting of yolk derived and embryo synthesised which acting in harmony (20,21). In this context, we hypothesised that intra-amniotic CoQ10 administration could make a valuable contribution to this integrated antioxidant system by reducing transport stress and improving early life performance.

In the present study, intra-amniotic CoQ10 administration did not affect hatchability or hatching weight of the birds. These findings are consistent with those of previous studies that reported that the inclusion of several nutrients (13,22,23) and active compounds (24,25). According to our results, inclusion of CoQ10 at up to 2 mg is well tolerated and had no detrimental effect on affect hatchability or hatching weight.

Malondialdehyde (MDA) is the organic compound and it is a bio-marker of oxidative stress in an organism and an increase of MDA level demonstrates oxidative stress (26). MDA is a product of lipid peroxidation and used as an indicative for determination of lipid peroxidation. It has been shown the serum level of MDA has been decreased by dietary inclusion of the CoQ10 (27). In addition, the activity of superoxide dismutase was found to increase in CoQ10 supplementation at 40 mg/kg in broiler diet (28,29). In agreement with the previous studies, our results showed that intra-amniotic CoQ10 supplementation improved antioxidant status of the transported chicks and may influence the postpatch performance of the birds.

Broiler hatchlings experience variety of stressors, such as transportation, handling etc., which affect their early life performance negatively. Our results showed that intra amniotic CoQ10 administration improved broiler performance in starting period by influencing broiler antioxidant status. Transportation of one-day old chicks, for 18 hours at 25ºC reduced the rate of subsequent growth to 45 days of age and some sustained biochemical changes compared with un-transported chicks (Pijarska et al., 2006). Our results show that intra-amniotic administration of CoQ10 as an antioxidant reduced transport stress and improved broiler early growth performance.

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Table 1. Composition of basal diet and fatty acid profile of experimental oive oil[1]

Item	Starter 0-11 d	Feed composition (calculated and analyzed)	
Ingredient, %		Chemical composition (calculated)	
Corn	51.81	ME, kcal/kg	3056
Soybean meal (CP, 46%)	26.00	Crude protein, %	23.36
Soybean (Full fat)	11.00	Lysine, %	1.49
Corn gluten meal (CP, 60%)	4.00	Methionine + cysteine, %	1.09
Soybean oil	1.80	Calcium, %	0.99
Limestone	0.60	Available phosphorus, %	0.48
Dicalcium phosphate	2.35	Chemical composition	
Methionine (88%)	0.28	Dry matter, %	88.00
Lysine suphate (51%)	0.70	Crude protein, %	23.10
L-Threonine	0.10	Crude fiber, %	3.80
Salt	0.25	Crude fat, %	7.15
Sodium bicarbonate	0.20	Starch, %	33.15
Yeast	0.40	Suger, %	4.05
Vitamin premix[2]	0.10	ME, kcal/kg[5]	3082
Mineral premix[3]	0.10	C14:0	0.53
Organic acid	0.10	C16:0	35.66
Anticoccidial [4]	0.06	C18:0	13.33
Enzyme	0.10	C18:1 cis-9	42.07
Choline chloride	0.05	C18:2	7.40
Total	100.00	Other fatty acids	1.01

[1] As-fed basis. [2] Provided per kilogram of complete diet: vitamin A, 15,000 IU; vitamin D_3, 5,000 IU; vitamin E, 100 mg; vitamin K_3, 3 mg; thiamin, 5 mg; riboflavin, 8 mg; pyridoxine, 5 mg; pantothenic acid, 16 mg; niacin, 60 mg; folic acid, 2 mg; biotin, 200 µg; vitamin B_{12}, 20 µg.
[3] Provided per kilogram of complete diet: Cu, 16 mg; I, 1.5 mg, Co, 500 µg; Se, 350 µg; Fe, 60 mg; Zn, 100 mg; Mn, 120 mg; Mo, 1 mg. [4] Sacox - Intervet, Inc., Millsboro, DE
[5] Metabolizable energy (ME) content of diets was estimated according to the equation of Carpenter ve Clegg (30).

Table 2. Effect of graded intra-amniotic CoQ10 administration on hatchability (%), hatching weight, and internal organ and yolk weights on day of hatch.

Item	Treatment[1]					Statistics[2]			
								P-value for trend	
	NC	PC	Q5	Q10	Q20	SEM	*P*	L	Q
Egg weight (E17),	56.48	56.37	56.35	56.36	56.37	0.09	0.99	0.41	0.40
Hatchability, %	92.71	91.67	90.62	90.62	91.66	1.21	0.98	0.73	0.63
Chick weight, g	42.86	43.87	43.79	43.52	43.76	0.20	0.52	0.32	0.31
Yolk weight, g	5.53	6.93	6.60	6.22	5.89	0.20	0.17	0.99	0.03
Liver weight, g	0.98	0.93	0.94	0.93	1.01	0.01	0.20	0.53	0.03
Heart weight, g	0.309	0.304	0.303	0.315	0.314	0.003	0.81	0.46	0.57
Gizzard weight, g	1.93	1.82	1.80	1.83	1.92	0.03	0.55	0.97	0.08

[1]NC = Negative Control (not injected); PC = Positive Control (injected with 0.1 mL olive oil); Q5 = 0.5 mg/0.1 mL Coenzyme Q10 in 0.1 mL olive oil; Q10 = 1 mg/0.1 mL Coenzyme Q10 in 0.1 mL olive oil; Q20 = 2 mg/0.1 mL Coenzyme Q10 in 0.1 mL olive oil.
[2]Polynomial contrasts: L = linear and Q = quadratic effect of injected Coenzyme Q10.

Table 3. Fatty acid profile of experimental olive oil and effect of graded intra-amniotic CoQ10 administration on major fatty acid composition of liver on day of hatch[1]

Fatty acid	Molecular formula	Olive oil	Treatment[2]					Statistics[3]			
										P-value for trend	
			NC	PC	Q5	Q10	Q20	SEM	*P*	L	Q
Myristic	C14:0	-	0.28^{a}	0.24^{a}	0.26^{a}	0.18^{ab}	0.12^{b}	0.01	0.008	0.002	0.074
Palmitic	C16:0	11.87	11.41	11.45	10.46	10.92	10.90	0.22	0.24	0.32	0.22
Palmtoleic	C16:1	0.52	1.24	1.14	1.11	1.12	1.06	0.03	0.41	0.08	0.61
Stearic	C18:0	2.85	11.73	11.61	11.15	11.65	11.68	0.15	0.77	0.96	0.34
Oleic	C18:1 cis-9	74.60	55.18	56.31	56.29	56.93	55.44	0.40	0.57	0.72	0.14
Linoleic	C18:2	8.61	19.04	18.15	19.60	18.11	19.55	0.22	0.07	0.53	0.34
Arachidic	C20:0	0.52	0.01	0.01	0.01	0.01	0.02	0.00	0.65	0.50	0.22
Linolenic	C18:3	0.48	0.54	0.50	0.61	0.51	0.59	0.02	0.08	0.26	0.71
-	Others	0.54	0.57	0.60	0.52	0.58	0.66	0.02	0.25	0.22	0.33

[1]Data represent mean values of 16 replicates per treatment.
[2]NC = Negative Control (not injected); PC = Positive Control (injected with 0.1 mL olive oil); Q5 = 0.5 mg/0.1 mL Coenzyme Q10 in 0.1 mL olive oil; Q10 = 1 mg/0.1 mL Coenzyme Q10 in 0.1 mL olive oil; Q20 = 2 mg/0.1 mL Coenzyme Q10 in 0.1 mL olive oil.
[3]Polynomial contrasts: L = linear and Q = quadratic effect of injected Coenzyme Q10.

Table 4. Effect of graded intra-amniotic CoQ10 administration on liver MDA level on d 0 (before and after transport)

Item	Treatment[1]					Statistics[2]			
								P-value for trend	
	NC	PC	Q5	Q10	Q20	SEM	*P*	L	Q
d 0									
Before	43.17^{a}	43.03^{a}	37.67^{b}	34.24^{c}	33.15^{c}	0.49	<0.001	<0.001	0.99
After Transport	46.35^{a}	46.08^{a}	42.34^{a}	34.15^{b}	34.06^{b}	0.94	<0.001	<0.001	0.19

[1]NC = Negative Control (not injected); PC = Positive Control (injected with 0.1 mL olive oil); Q5 = 0.5 mg/0.1 mL Coenzyme Q10 in 0.1 mL olive oil; Q10 = 1 mg/0.1 mL Coenzyme Q10 in 0.1 mL olive oil; Q20 = 2 mg/0.1 mL Coenzyme Q10 in 0.1 mL olive oil.
[2]Polynomial contrasts: L = linear and Q = quadratic effect of injected Coenzyme Q10.

Table 5. The effect of intra-amniotic Coenzyme Q10 administration on post hatch broiler performance on d 11.

Item	Dietary treatment[2]					Statistics[3]			
								P-value for trend	
	NC	PC	Q5	Q10	Q20	SEM	*P*	L	Q
BW, g, on d 0	42.4	41.9	41.27	42.4	42.2	0.19	0.30	0.98	0.13
BW, g	284.6	283.3	281.6	287.2	299.5	4.00	0.68	0.26	0.38
FI, g	319.3	313.2	305.8	310.6	316.2	5.14	0.39	0.82	0.45
FCR	1.123^{a}	1.104^{a}	1.088^{ab}	1.080^{ab}	1.057^{b}	0.01	0.001	0.01	0.99

IS[16] Strategic Approaches of Brazil in the World Poultry Production

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The world meat consumption in 2015 is estimated to be at about 462 million tons. 38% of it is represented by fish, 24% by pork, 21,97% by chicken, 12% by beef, and about 5% by the other meat varieties.

Chicken is the cheapest animal protein growing faster among all other meats. We can mention totally 97 million tons of consumption in the world. The US is the number one consumer with 15% and China has the ratio of 13%, the EU 10%, Brazil 10%, while Turkey has only 2%. Turkey ranks number 12 in consumption of chicken in the world but it has a growing rate of CAGR (Compound Annual Growth Rate) which is faster than the world average. There is a parallel between per capita income and per capita meat consumption.

When it comes to the world trade, Brazil produces approximately 13 million-ton chicken meat, consumes approximately 9.8 million tons, and exports 3.8 million tons of it. Brazil's production in terms of the world trade has grown exponentially since early 2000. The biggest reason of Brazil for being the leader in the world trade is cost competitiveness. Sanitary conditions, high quality products, and products with high added value are the other significant factors.

Brazil is one of the largest countries in the World. It is the 5th largest country and has 8 million square kilometers of land. Moreover, Brazil is the second largest soybean producer in the world and very close to the number one; it ranks 3rd in corn production. Brazil has the ability to produce two crops of corn per year while the rest of the world has only one crop. In addition, the fact that there are spaces between the farms in Brazil and that it is surrounded by trees which represent a natural barrier to prevent airborne diseases like bird flu constitutes the other issues that render Brazil advantageous.

It is very interesting to look into Iraq as well. For Brazil, sales for Iraq have been declining in the past 5 years by 10.6% per year. This ensured that the Turkish poultry sector, which has done excellent job in Iraq for the last two years, became by far the leading exporter to Iraq. This is due to the advantage of the proximity of Turkey to Iraq in terms of logistics and the freshness of the products delivered. Brazil sells frozen products from stock to Iraq and the delivery would take at least 2 to 3 months. In terms of competitiveness, even the perception of Turkish Products in Iraq is doing very well and it is possible to sell at higher prices than Brazil with this good perception.

When it comes to the halal market, the biggest import market is the Middle East. If we take the halal food and beverage expenditure as a segment, it represents 1.2 trillion-USD and it is bigger than China and the USA. Turkey is the largest market of halal poultry with 1,8 million ton consumption; Indonesia has the consumption of 1,4 million tons; Saudi Arabia, 1,4 million tons; Malaysia, 1 million tons; Egypt, 1 million tons; and Pakistan, 1 million tons. Indonesia has 6 kilos per capita that is very low but they have 200 million-people population that makes it the second largest country. We see that in Saudi Arabia, this consumption figure is around 46-47 kg.

Malaysia represents a very big market with 50 kilos per capita consumption and 30 million population. The consumption per capita in Indonesia is small and that of Malaysia is very big while Turkey has medium-level per capita. Qatar, Bahrain, UAE, and Kuwait have big consumption per capita and they depend on import. Saudi Arabia is the second largest market with a very big consumption per capita but it has only around 45% of local production and it also relays on import with around 50%.

What brings these countries together here is that all of these countries are large markets and have potential for growth. The difference between Turkey and these other markets is that Turkey is a much more structured, modern market. Turkey has a big potential to play a big role on the halal market and everywhere in the world.

IS[17] Management of Precise Broiler Production in Farm Level and Technology Usage

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Summary

Farming broilers today has some very real challenges, namely birds are reaching their kill weights quicker, the profits from farming chicken are under pressure, technology is developing faster than the industry can keep up with, recruiting and retaining good farm managers is very difficult and the industry needs to use less medication whilst maintaining bird welfare and productivity.

A new way of farming that is more focused on precision and technology maybe the answer but this will require a fresh way of thinking and an adjustment in the way business invest and operate. There is a possibility to invest in technology, commit time and resources to using data outputs from technology as a business tool and starting to have ways of reliably forecasting what the birds require. The potential of this new approach is that we will be aware of things well before the birds show any actual physical symptoms.

This approach will allow for not only improved productivity but clearly also further improved bird welfare.

Introduction

Globally chicken meat is fast becoming one of the, if not the, most eaten meat proteins. Consumers globally like the versatility and consistency of the product. However consumers also like the cost of the product meaning that it is difficult to add value beyond smaller niche sectors within the industry. This means that whilst demand for the product is rising and production volumes are rising the economic returns for the farmer are becoming in real terms less each year. For farming businesses to survive going forward they need to ensure that they are getting the absolute best performance from their birds and at the same time meeting the demands of the consumer.

Modern broiler production requires the traditional stockmanship skills of the past but this may not be enough on its own. Bird performance and bird welfare require attention 24 hours a day, 7 days a week and as technology evolves there is a real possibility of enhancing our current practices by predicting what is going to happen over the coming days not just watching and seeing what happens followed by a reaction to the symptoms. The industry has a real opportunity to become proactive not reactive.

Never has this been more important than today when as all meat protein production is under real pressure to reduce the usage of antibiotics in the production systems. At present antibiotics offer one of the few options for reactive intervention when detrimental symptoms are seen in our birds. Sensible and appropriate antibiotic usage is generally considered good for animal welfare and good for the farming business however with rising pressures to get usage to an absolute minimum we must learn more about our birds and learn it quicker to allow us to utilise other alternatives such as probiotics for animal gut health.

Design of a Facility

When considering a fresh approach to farming broiler chickens many things start with the design of the chicken farm and its environment for the birds. Important aspects to consider include biosecurity measures. Biosecurity is clearly understood by all to be the first defence in protecting indoor reared poultry from disease challenges. The best biosecurity designs ensure that staff fulfil the requirements every time the enter a premises no matter for what they are entering or for how long they plan to be in there. This requires staff training in awareness but also for the facility to be designed to make the use of biosecurity measures as simple and straight forward as possible.

Bird Behaviour

In evaluating design features of our broiler units it is also essential that we consider the birds themselves and understand what they truly desire from their environment. Recent advances in technology have allowed us as farmers to better understand the specific needs of the birds. For example evidence on farm has shown that birds will consume more feed and water to the outer edges of a broiler house than in the middle area. Why then do we evenly space feed and water access across a house if more want access to the outer areas? Other behavioural data has also shown a natural digression of bird activity through the 24 hour day and so we need to design facilities for all levels of activity, those higher levels in the early morning as well as the less active evenings.

It is essential for the birds to perform commercially to their optimal that at all times and as new technologies are developed the birds themselves are considered. Recent on farm trials using new technologies and data analysis are helping to ensure that newly introduced technologies such as LED lighting is not compromising bird welfare or performance.

Ventilation

A key element of any broiler farm is its ventilation. In simple terms we want to introduce oxygen for the birds to utilise through respiration whilst removing carbon dioxide, water vapour and other non beneficial gases such as ammonia. We want to fulfil this process during all weathers and at all times of day whilst maintaining a static environment for the birds themselves. This is difficult to achieve when the physical properties of air are considered. Cooler air acts differently to warm air and the birds feel the effects of the air by way of a mixture of physical factors; the temperature of the air, the moisture content of the air and the speed at which the air is travelling.

Modern broiler facilities have an array of sensors and technology to monitor and manage these factors and give consideration to the effects of the specific air properties have on the birds at that actual moment but it is possible to use various technologies and equipment to assess the environment manually in all facilities whatever their age, design or state of repair.

Often the biggest causes of problems ae simple to fix and may simply require staff training in ventilation or some simple maintenance to be completed.

Water

Water consumption is a key area in broiler production requiring analysis and understanding. Monitoring consumption flow rates as well as daily consumption figures can give great insight into the birds the growth and their welfare. We are able to consider everything from activity and potential growth rates through to understanding the intestinal integrity of a bird at any given moment. Companies supplying drinker equipment now offer precise ways to control the birds access to water by controlling the water pressure in the drinker lines. Given that water is consumed at nearly twice the level of feed it is essential to monitor and control its up take. Drinker heights, cleanliness, physical properties as well as flow rates are all essential pieces of information in managing broilers.

Predictive Management

Given the amount of data and knowledge that it is now possible to gather from a broiler farm we are now able to not just monitor current information from a broiler house but also to predict, forecast and establish optimal parameters for each broiler house individually. Previously any predictive data was established on a genetic type basis, e.g. a bird of this genetic strain has the potential to grow at a certain rate and will eat and drink predicted amounts to achieve this. All based on trials conducted by the genetic companies. The great thing now is having the ability to predict for each farm specifically, in some cases exceeding genetic averages and in others establishing more achievable targets for their specific scenario.

The Future

Broiler farming requires the control and management of a whole range of parameters and as such technological advancements are almost unlimited. As sensors develop the industry will be able to embrace them and use them for its own needs. Some will give more data and information, more accurately and quicker than we can currently, such as electronic noses detecting disease days earlier than symptoms are seen by the eye. Other technologies will be about labour saving and helping to offer a better solution to the current shortage of good reliable labour to work with the birds, such as robotic technologies.

One significant change maybe the way in which we all purchase and operate these new technologies. Be it due to the prohibitive capital cost of technologies or the complex operational demands of the technologies we are likely to see a move towards service based technologies. You won't, as a farmer, necessarily own the sensors but instead purchase the information that is gathered by the sensors. You may not own a robot but instead pay someone to remove your dead birds on a hourly basis and they in turn will supply a robot to do that at their cost. We are already seeing these models in the consumer economy with items such as cars and razor blades, effectively monthly subscriptions.

Conclusion

Broiler farming is an agricultural sector that operates on small margins but large volumes and so the potential to improve bird welfare and farmers margins is considerable if small improvements in efficiency can be made. From what is generally globally an efficient sector the best way to further drive improvements in productivity and welfare is to focus on the precision of our businesses and one essential prerequisite to precise management has to be the embracing of technologies and the data generated to give us better, more accurate, information for even better and faster decision making on farm. All of this requires investment and the cost of some of this new information will be paid for either by way of capital purchases of equipment or more likely the purchase of the information on a subscription basis. Future broiler businesses will need to embrace production partners which is in many ways similar to the integrated production models that already exist in the broiler sector globally only involving many technology and information partners rather than one commercial partner.

O[33] Live Weight and Body Measurements of Male and Female Native Ducks of Reared in Different Housing System

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Abstract

This study was conducted in order to determine live weight and body measurements on male and female native ducks raised in different housing system. 120 native ducks (60 males, 60 females) were used in the study. The ducks were raised in deep litter system (DLS) and Cage system (CS). Live weight and body measurements were taken every two weeks, until they were 56 days old. 3-parameter logistic regression and Gompertz model were used to determine growth model of male and female ducks. Interactions of time-housing system and time-gender in terms of live weight were found to be statistically significant ($P<0.001$). At the end of eight weeks, live weights of ducks raised in deep litter system were determined to be higher than ducks raised in cage system. In addition, live weights of male ducks were found to be higher than female ducks. Consequently, accuracy rate of Logistic and Gompertz models for estimating growth in ducks was determined to be between 0.91-0.95 and similar results were obtained from both models. However, because iteration number was lower, Gompertz model was concluded to be more appropriate.

Key Words: Duck, live weight, body measurements, housing system

O34 Influence of Stunning with AC-pDC Electrical Current with Square-Chirp Waves Types and Low-High Frequencies on Some Welfare Parameters and Carcass Defects in Broilers

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Abstract

Stunning of broilers prior to slaughtering is an important practice, not only because it renders the bird unconscious, but also because it affects blood loss, feather-release and meat quality. Combinations of current, frequency and duration of application belonging to square wave type are prevalently used for rendering broiler chickens unconscious with electrical current prior to slaughtering. This study was performed to examine the effects of exposing to the electrical currents of AC and pDC of 120 mA in square and chirp wave types of frequencies of 50 (low) and 400 Hz (high) to broiler chickens for 5 sec prior to slaughtering on some welfare parameters and carcass defects. This study was conducted with eight treatment groups with 10 chickens (5♀:5♂)forty four-days old, weighing on average 2628±333g in each. Wing flapping responses and jerky movements in feet and wings occurred in birds during apnoea depending on because of applying electrical current observed and then slaughtered. After slaughtering process of chicken, amount of bleeding and carcass defects determined. The effects of electrical current applied to birds prior to slaughtering were found significant on wing flapping responses and jerky movements in feet and wings ($P<0.05$). Effectiveness of stunning in a frequency level of 400 Hz of square and chirp wave types of AC current to broiler chickens determined to be higher according to the other electrical values applied. Square wave type on breast, thigh and feather follicle of chickens and the chirp wave type on in the parts of wing caused more hemorrhages. It is understood that the wave type of chirp showed more positive results on some parameters examined.

Keywords: Effectiveness of stunning, square wave, chirp wave, carcass defects

IS18 Efficacy of Vaccination of Broiler Chickens Against Coccidiosis and Recent Advancements

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Summary

Coccidiosis is the major parasitic disease of poultry with substantial economic losses. In the past it has been realized that eradication of coccidia is not realistic and hygienic measures alone are not able to prevent infections. Today the prevention and control of coccidiosis is based on chemotherapy, using anticoccidial drugs and /or vaccines along with hygienic measures and improved farm management. The efficiency of anticoccidial agents can be reduced by drug resistance and management programmes are designed to prevent this developing. Several different live vaccines have been commercially developed. Long-term sustainability of coccidiosis control in poultry in the future may therefore be facilitated by the adoption of rotation programs, involving the alternate use of a vaccine and drugs in successive flocks. Currently some trails are being carried out on the efficacy of alternative products with various results. The present paper review the prevention and control approaches of poultry coccidiosis in past and future

Key words: Coccidiosis, Chickens, Prophylaxis, Vaccination

Introduction

Coccidiosis is the major parasitic disease of poultry with substantial economic losses due to malabsorption, impaired feed conversion, reduced weight gain and increased mortality. In addition, the use of anticoccidial drugs and /or vaccines for treatment and prevention, contributes a major production cost. Coccidia are protozoa, which have the ability to multiply rapidly inside cells lining of the intestine and/or caeca. The species of coccidia that are infective to poultry belong to the *Eimeria* genus. Many of these species can infect poultry and there is no cross-immunity between them. Most infestations under field conditions are mixed but one species will be dominant

Seven species of *Eimeria* are known to infect **chickens** and they show a wide variation in their pathogenicity (Table 1). In addition, two further species have been described, namely *E. hagani* and *E. mivati*, but further studies on the importance of these species are needed (Conway and McKenzie, 2007). not all these species are considered to be of real economic importance

The Eimeria cycle includes two distinct phases; (a) the internal phase (schizogony + gamogony) in which the parasite multiplies in different parts of the intestinal tract and the non- sporulated oocysts are excreted in the faeces (The part of the intestinal tract and the total duration of the internal phase of the cycle is dependent on Eimeria species), (b) the external phase (sporogony) during which the oocyst must undergo a final process called sporulation, before they are again infective. Sporulation requires warmth (25-30°C), moisture and oxygen (LEVINE, 1982). Eimeria have a self-limiting life cycle and are characterized by a high tissue and host specificity.

The sporulated oocysts are extraordinary resistant to environmental stress and disinfectants, remaining viable in the litter for many months. Temperatures above 56°C and below 0°C are lethal, but it seems to be impossible to decontaminate a previously contaminated poultry house or environment. Sporulated oocysts can be spread mechanically by wild birds, insects or rodents and via contaminated boots, clothing, equipment or dust. Direct oral transmission is the natural route of infection (McDOUGALD, 2013).

Table 1: Some characteristics of important *Eimeria* spp. infecting chickens

Host	Eimeria	Location	Pathogenicity*
Chickens	*E. acervulina*	Duodenum, Jejunum	++
	E. brunetti	Ileum, Rectum	+++
	E. maxima	Duodenum, Jejunum, Ileum	++
	E. mitis	Duodenum, Jejunum	+
	E. necatrix	Jejunum, Caeca	+++
	E. praecox	Duodenum, Jejunum	+
	E. tenella	Caeca	+++

* - non-pathogenic; + low pathogenic; ++ moderately pathogenic; +++ highly pathogenic

Clinical Signs and Lesions

Several *Eimeria* species are able to cause clinical signs in infected and unprotected birds; however subclinical infections are frequently seen. These are often underestimated but mostly result in impaired feed conversion and reduced weight gain. Coccidiosis generally occurs more frequently during the warmer months of the year (SMITH, 1995). Young birds are more susceptible and more readily display signs of disease, whereas older chickens are relatively resistant as a result of prior infection. The severity of an infection depends on; the age of birds, *Eimeria* species, number of sporulated oocysts ingested, immune status of the flock and environmental management. Infected birds tend to huddle together, have ruffled feathers and show signs of depression. The birds consume less feed and water, and droppings are watery to whitish or bloody. This results in dehydration and poor weight gain as well as mortalities. The lesions of coccidiosis depend on the degree of inflammation and damage to the intestinal tract. They include thickness of the intestinal wall, mucoid to blood-tinged exudates, petechial haemorrhages, necrosis, haemorrhagic enteritis and mucous profuse bleeding in the caeca.

The tissue damage in the intestinal tract may allow secondary colonization by various bacteria, such as *Clostridium perfringens* (HELMBOLT and BRYANT, 1971), or *Salmonella Typhimurium* (ARAKAWA *et al.*, 1981). Infestation with *E. tenella* also increases the severity of *Histomonas meleagridis* infection in chickens (McDougald and HU, 2001).

Diagnosis

Coccidiosis is often extremely difficult to diagnose on the base of the clinical signs and lesions and can only be done in the laboratory (CONWAY and McKENZIE, 2007), by counting coccidian oocysts per gram of faeces and/or examining the intestinal tract to determine the lesion scores, as described by JOHNSON and REID (1970).

Prevention and Control

In the past, it has been realized that eradication of coccidia is not realistic and hygienic measures alone are not able to prevent infections. However, if an outbreak of coccidiosis occurs, treatment via the drinking water should start as soon as possible. The most commonly used drugs are sulphonamides, amprolium and toltrazuril. Today the prevention and control of coccidiosis is based on chemotherapy, using anticoccidial drugs and /or vaccines along with hygienic measures and improved farm management.

Anticoccidial Drugs

According to SHIRLEY and CHAPMAN (2005) the most significant study that had the greatest impact on control of coccidiosis was that of DELAPLANE *et al.* (1947) which showed that the administration of low concentrations of sulphaquinoxaline in the feed effectively controlled the disease.

The rapid development of the broiler industry in the 1950s required the urgent availability of anticoccidial drugs. This soon led to intensive activities by several companies to produce a range of chemical products such as amprolium, clopidol decoquinate, halofuginone that were effective in the control coccidiosis.

A major enhancement in coccidiosis control occurred in the 1970's with the introduction of monensin as the first polyether ionophores such as monensin lasalocid, salinomycin, narasin, and maduramycin. Introduction of ionophores changed the ability to control coccidiosis – an impact that remains to this day. The effectiveness of ionophore coccidiostats lies in the fact that whilst they kill the majority of the invading parasites, they permit a small leakage of coccidia enabling a degree of host immunity to develop. Resistance to ionophores develops very slowly and there is more of a tendency to increased levels of tolerance. CHAPMAN and HACKER (1994) as well as MATHIS (1999) observed a marginal to poor effect of different ionophores to several *Eimeria sp.*In addition some mixed products consisting of either a synthetic compound and ionophore (nicarbazin/narasin (Maxiban®)) or two synthetic compounds (meticlorpindol/methylbenzoquate (Lerbek®)), are also used against coccidiosis.

Cross-resistance and multiple resistance to antic- occidial medications has also been noted. Cross-resistant strains exhibit resistance to compounds sharing a similar mode of action. On the other hand multiple resistant strains means develop of resistant to compounds having diferent modes of action (CHAPMAN, 1993).

In recent years, few new drugs have been introduced. All types of drug used for coccidiosis control are unique; in their mode of action, the way in which parasites are killed or arrested, and the effects of the drug on the growth and performance of the bird. Very few drugs are equally efficacious against all *Eimeria* species (McDOUGALD, 2013).

Since the 1970's, coccidiostats have been regulated under the Feed Additives Directive 524/70/EEC (EEC, 1970, 2004), which has now been replaced by Regulation No 1831/2003/ EC (EC, 2003) As such, they have not been subject to veterinary prescription status, since they are required routinely in the feed of commercial broilers and turkeys.

The efficiency of anticoccidial agents can be reduced by drug resistance and management programmes are designed to prevent this developing, which results in better gut health and feed utilization by birds. Using a drug rotation, with constant monitoring of the oocysts in the faeces and in the litter, or shuttle programme (ionophore/ chemical) seems to be of great value. Rotation involves changing the product used every 4 - 6 months. The alternative to a rotation programme is a continuous program where the same products are used until a problem develops or until a new product is introduced on the market. Rotations are only possible if drugs with different mode of action follow each other. On the other hand, a shuttle programme uses two or more products during the grow-out period of a flock. The principle is to use the drug most suited to each phase of the grow-out, so that one drug is used for the starter period, whilst another is used during the grower and finisher phase. The drug withdrawal period is a very important consideration for treatments used in finisher feeds (Paeffgen *et al.*, 1988, Smith, 1995, Hafez, 2008). A 'switch' system can also be used where the anti-coccidial agent is changed at each restocking within an operation.

A coccidiosis 'break' is often an indication of an immunosuppression problem. Concurrent infection with immunosuppressive diseases such infectious bursal disease (IBD) may exacerbate coccidiosis, placing a heavier burden on anticoccidial drugs (McDOUGALD, *et al.*, 1979).

Vaccination

Currently the poultry industry worldwide is facing problems of drug resistance, a lack of new anticoccidial products as well as the consumer pressure to decrease the use of antibiotics in animal feed. It is therefore being forced to seek alternative strategies to control coccidiosis, which has made the use of vaccines more attractive.

Although it has been known for many years that the host exposure to low numbers of coccidia oocysts allows the development of a protective immunity, live coccidiosis vaccines were not used in poultry until the 1960's. There is now a tremendous amount of knowledge about the immune response of chickens to coccidia infections (DALLOUL and LILLEHOJ, 2005) and the development and use of vaccines is increasing (Shirley and Chapman, 2005).

Mostly the vaccines composed of either virulent or attenuated parasitic strains (SHARMAN *et al.*, 2010, PEEK and LANDMAN, 2011, CHAPMAN and JEFFERS, 2014, WITCOMBE and SMITH, 2014). Vaccines contain live oocysts of non-attenuated or attenuated strains and some killed antigen (Table 2). Their effectiveness based on the recycling of what are initially very low doses of oocyst and on the gradual build-up of solid immunity.

Non-attenuated vaccines have been used for many years in the USA. Coccivac® vaccine (Schering Plough Animal Health) was developed in the early 1950s. The "B" and "D" types are different mixtures of *Eimeria* species; the "T" type is for turkeys and was introduced in 1970`s (WILLIAMS, 2002, SHIRLEY and CHAPMAN, 2005). In addition, Immucox® and Immuncox - T® were developed in Canada (Vetech Laboratories). In addition, further live non-attenuated vaccines have developed; Nobilis® CoxATM (Intervet), ADVENTTM and InovocoxTM. Nobilis® CoxATM consists of a mixture of wild-type Eimeria spp. that is relatively tolerant to ionophores (VERMEULEN et al., 2001). AdventTM (Viridus Animal Health, USA) is marketed as having more viable oocysts (truly sporulated oocysts that can cause immunity) than other vaccines and InovocoxTM (Embrex) was designed for administration in ovo. Other live vaccines have been reported to be under development and /or introduced in some countries (WILLIAMS, 2002; CONWAY and McKENZIE, 2007).

Towards the end of the 1980's new **live attenuated** vaccines came onto the market including; Paracox® (Schering-Plough Veterinary Ltd, UK) and Livacox® (Biopharm, Czech Republic). They have been characterized, for their short life cycle, as "precocious" and with their reduced pathogenicity were introduced commercially in the EU (SHIRLEY, 2000).

Furthermore a **sub-unit vaccine** CoxAbic® (Abic-Israel) has been introduced, prepared from purified gametocyte antigen, isolated from *E. maxima* (Wallach *et al.*, 1995). Broiler breeder flocks vaccinated, twice intramuscularly, during the rearing period are able to pass maternal antibodies to their offspring and immunity to infection has been demonstrated with *E. acervulina, E. maxima, E. mitis* and *E. tenella* (FINGER and MICHAEL, 2005).

Commercial use of coccidia vaccines in the EU began in 1992 with the introduction of a vaccine for replacement breeders and laying pullets, followed in 2000 by a vaccine for commercial broilers. Currently vaccines are used as the primary method for coccidiosis prevention in breeding flocks and to some extent in laying hens and broiler chickens. Currently, several vaccines are available, EU-wide such Livacox®, Paracox®-5, Paracox®-8 and Hipracox®. The use of vaccines is able to replace drug-resistant field strains of *Eimeria* with "drug-sensitive" vaccine strains. This is observed in the restoration of sensitivity to ionophores such as monensin and salinomycin as well as to the chemical drug diclazuril (CHAPMAN *et al*., 2002).

Long-term sustainability of coccidiosis control in poultry may therefore be facilitated by the adoption of rotation programs, involving the alternate use of a vaccine and drugs in successive flocks. Programs involving the rotation of vaccines with traditional chemotherapy are currently used by the poultry industry. The highly effective chemical anticoccidials need only be used for specific cycles, when conditions in the house produce a greater coccidiosis challenge. Chemical use, limited to a single cycle, will dramatically reduce oocyst levels in the facility. The following cycles can then use vaccination to repopulate the house with anticoccidial-sensitive oocysts, which are highly sensitive to both the chemical and ionophore programs. The vaccination cycles should be followed by the use of an ionophore, which should perform very efficiently in the vaccine-repopulated house. In addition, several trails were carried out on the efficacy of natural alternatives to control coccidiosis such as fat, antioxidants, essential oils, herbal extracts and medicinal plants as well as immune response modulators were published and summarized by QUIROZ-CASTAÑEDA and DANTÁN-GONZÁLEZ (2015).

Conclusion

Infections with coccidia are often associated with severe economic losses. Currently the prevention and control of coccidiosis is based on good hygiene, chemotherapy (Coccidiostats) and immunization. Monitoring programmes are essential for the early recognition strains developing resistance. Generally, anticoccidial drugs or vaccination alone is of little value, unless they are accompanied by improvements in all aspects of management. More attention should be given to improved sanitation and hygiene at the farm level. Including, all parameters which can improve litter quality such as; appropriate installation and management of watering systems, providing adequate feeding space, maintaining recommended stocking density and supplying adequate ventilation.

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Table 2. Overview of anticoccidial vaccines that are being used or being registered for use in chickens (modified from Peek and Lamndmann, 2015)

Vaccine (manufacturer)	*Eimeria* speciesa	Attenuated	Bird type	Administration route	First registration
CocciVac®-D (Schering Plough Animal Health)	*Eac*, *Ebr*, *Eha*, *Emax*, Emiv,Enec,Epra,Eten	No	Breeders/ layers	water or feed spray Ocular, hatchery spray	1951 (USA)
CocciVac®-B (Schering	*Eac*, *Emax*, *Emiv*, *Eten*	No	Broilers	Ocular, hatchery spray	1952 (USA)
Immucox®C1 (Vetech Laboratories)	*Eac*, *Emax*, *Enec*, *Eten*	No	Broilers	Water or gel	1985 (Canada)
Immucox®C2 (Vetech Laboratories)	*Eac*, *Ebr*, *Emax*, *Enec*, *Eten*	No	Breeders/layers	Water or gel	1985 (Canada)
ADVENT®b (Novus International)	*Eac*, *Emax*, *Eten*	No	Broilers	Hatchery spray, water or feed spray	2002 (USA)
Inovocox® (Embrex Inc. and Pfizer)	*Eac*, *Emax* x2, *Eten*	No	Broilers	***In ovo* injection with the**	2006 (USA)
Livacox® Q (BioPharm) precocious, except Eten (embryo – adapted)	*Eac*, *Emax*, *Enec*, *Eten*	**Yes**	Breeders/ layers	Hatchery spray, water or feed spray	1992 (Czech Republic)
Livacox® T (BioPharm) precocious, except Eten (embryo – adapted)	*Eac*, *Emax*,, *Eten*	**Yes**	Broilers	Hatchery spray, water or feed spray	1992 (Czech Republic)
Paracox®-8 (Schering Plough Animal Health) precociou	*Eac*, *Ebr*, *Emax* x2, *Emit*, *Enec*, *Epra*, *Eten*	**Yes**	Breeders/ layers	Water or feed spray	1989 (UK)
Paracox®-5 (Schering Plough Animal Health) precociou	*Eac*, *Emax* x2, *Emit*, *Eten*	**Yes**	Broiler	Hatchery spray, water or feed spray	1989 (UK)

Table 2 (qunt.):

Vaccine (manufacturer)	*Eimeria* speciesa	Attenuated	Bird type	Administration	First registration
Eimeriavax® 4m (precocious) (Bioproperties Pty)	*Eac, Emax, Enec, Eten*	**Yes**	Breeders/ layers/ broilers	Eye-drop	2003 (Australia)
Inmuner® Gel-Coc (Vacunas Inmuner)	*Eac*, *Ebr*, *Emax*, *Eten*	**Yes**	Breeders/ layers/ broilers	Oral	2005 (Argentina)
Hipracox® Broilers (Laboratorios Hipra, SA)	*Eac*, *Emax*, *Emit*, *Epra*,*Eten*	**Yes**	Broilers	Drinking water	2007 (Spain)
Eimerivac® Plus (Guangdong Academy of Agricultural Sciences)	*Eac*, *Emax*, *Eten*	**Yes**	Breeders/ layers/ broilers	Oral	Expected (China)
Supercox® (Qilu Animal Pharmaceutical Company) Attenuated (precocious: Eten) non-attenuated (Eac and Emax)	*Eac*, *Emax*, *Eten*	Yes+No	Broilers	Oral	2005 (China)
CoxAbic® (Abic Biological Laboratories)	*Emax* gametocytes antigen	Killed	Breders (to protect hatchlings	Intramuscular	2002 (Israel)

Notes: aEac, E. acervulina; Ebr, E. brunetti; Eha, E. hagani; Emax, E. maxima; Emit, E. mitis; Emiv, E. mivati; Enec, E. necatrix; Epra, E. praecox; Eten, E. tenella; and Emax x2, two antigenically different lines of E. maxima.

[b]ADVENT® enables in vitro assessment of parasite viability using ViacystSM (non-viable sporocysts stain with ethidium bromide).

IS[19] The Latest Situation on Avian Influenza (Bird Flu) in the World and Ministry Application and Efforts of Turkey

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Abstract

Our Ministry has the priority to struggle against poultry animal diseases and primarily Avian Influenza in order to protect animal health and provide safe food from farm to fork and also to eliminate any obstacle for poultry meat and product exports. Within the context of the struggle against diseases including Avian Influenza establishments are subject to inspection according to the Commercial Broiler and layer Poultry Establishments Biosecurity Directive, active and passive surveys are conducted and annual regular real time practices are realized to improve the efficiency in the struggle against the disease. Besides Poultry Information System became active and all commercial poultry animal movements could be monitored by this system. In case of occurrence of Avian Influenza disease, Definition and Announcement of Regions free from notifiable Bird Flue (Avian Influenza) Disease Directive was published so as to protect public and animal health, to continue safe animal origin production and especially to provide international trade. Within the context of this directive 81 provinces have been declared as free of disease region and these regions were notified to OIE and WTO. Consequently it is vital to struggle against diseases in order to provide safe food production by protecting animal health and also to eliminate any challenges that might occur in exports. Therefore cooperation between our Ministry and the private sector would provide convenience to reach the desired target.

O[35] Antimicrobial Effects of Peptide Isolated From Chicken Blood on Salmonella Serotypes

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Abstract

In this study, antimicrobial activities of peptides obtained from chicken blood haemoglobin were investigated. Blood taken from broilers reared in controlled conditions were processed and digested enzimatically. Antimicrobial activities of crude extracts against Salmonella Enteritidis, S.Typhimurium and S.Infatis from broiler origin were tested by agar diffusion method. In addition, the peptides generated by enzymatic digestion were examined in silico. Crude extracts were found to have antimicrobial activity against Salmonella serotypes, with an equal level of effect of antibiotics such as beta-lactams, tetracyclines, sulphonamides and phenicols. It was concluded that processed materials such as chicken blood can be used for antimicrobial purposes, and that the technologies and products developed in this direction will make a significant contribution to the broiler industry.

IS[20] Protein Nutrition of Breeders to Improve Performance, Hatchability and Offspring Performance

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Summary

Nowadays, management issues in broiler breeders associated with nutrition and reproductive characteristics, are becoming increasingly challenging. Due to genetic selection on broilers, body composition of breeders has changed dramatically during the last 50 years to less fat and more breast muscle. It is postulated that a certain amount of body fat in broiler breeders at the onset of lay is necessary for maximum performance and offspring quality. Body composition of breeders can be influenced by different feed allowances during rearing and lay, as well as by changes in nutrient composition of the diet. It can be concluded that feeding a low protein diet during rearing decreased breast muscle and increased abdominal fat pad. The higher abdominal fat pad content resulted in an increased hatchability during the first phase of lay and a larger number of eggs during the second phase of lay. On the other hand, a low daily protein intake during the rearing and first phase of lay can lead to a poor feather cover. Feeding a high-energy diet during the second phase of lay resulted in increased hatchability, decreased embryonic mortality and more first grade chicks.

Introduction

The last decades, poultry meat is becoming the most important protein sources in human diet and production is worldwide growing. Global poultry meat production in 2000 was 69 million tons and this increased to over 97 million tons in 2010 (Windhorst, 2011). This equates to an annual production of approximately 70 billion broilers originating from approximately 600 million broiler breeders. So a relatively small number of broiler breeders have a major impact on the poultry meat chain and optimizing management of breeders will have benefits for the total chain. Broiler breeders need to produce first class and healthy chicks (Zuidhof et al., 2007). Due to the continuing increase in the genetic potential of the offspring (e.g., Havenstein et al., 2003a,b; Renema et al., 2007) this is becoming increasingly challenging.

In the past, obesity, mainly in the second phase of the laying period, was a major problem in broiler breeder flocks and resulted often in a decreased reproduction rate during the laying period (Bornstein et al., 1984; Leclercq et al., 1985; Cahanar et al., 1986; Robinson et al., 1993). Overweight hens have sperm storage problems (due to the fat deposition in the sperm storage glands) and physical problems during the cloacal contact during natural mating (Mc Daniel et al., 1981). The body composition of breeders, however, has changed dramatically during the last five to six decades (Havenstein et al., 2003a; De Beer, 2009). In modern broiler breeders, obesity is not an issue anymore, due to the selection of strains with increased breast muscle and decreased fat pad deposition characteristics (Havenstein et al., 2003a). The selection for increased feed efficiency, growth rate and body fat content has not only affected the offspring but also the parent stock. This was recently confirmed by Eitan et al. (2014) who compared a 1980 to a 2000 breeder strain. The 2000 strain contained 42% more breast meat (21.2 vs. 14.9% of BW) and 50% smaller abdominal fat pad (2.7 vs. 5.4% of BW) compared to the 1980 strain.

Feeding high yield breeders high levels of amino acids (e.g. lysine) will lead to more muscle production and this extra muscle requires more energy to maintain (De Beer, 2009). Therefore, during the last decade several researchers have reported that broiler breeders need a certain proportion of body fat at the onset of lay for subsequent reproductive performance (Sun and Coon, 2005; De Beer, 2009; Mba et al., 2010). Because tissue growth is directly affected by dietary nutrient composition, a nutritional approach to this topic is highly relevant. Therefore, the overall practical objective of the present presentation is to give an overview of the research on the effect of protein intake during the rearing and laying period on body composition, breeder performance and offspring.

Effect of protein intake during rear on body composition

Changes in feed allowance or a change in diet composition (energy and/or protein levels) have been used as generally applied dietary interventions. Several authors have evaluated the use of a change in feed allowances on body composition during rearing (Fattori et al., 1993; Renema et al., 2001a; Robinson et al., 2007) or laying (Bornstein et al., 1984; Bowmaker and Gous, 1989; Renema et al., 2001b). Other studies evaluated the effects of a change in diet composition on body composition during rearing (Miles et al., 1997; Hudson et al., 2000; Mba et al., 2010) or laying (Pearson and Herron, 1981; Spratt and Leeson, 1987). The combination of different feed allocations and different dietary protein levels in a single trial during the rearing period and its effects on body composition has received limited attention with the exception of a trial by Hocking et al. (2002). Such an experiment has been the focus of Van Emous et al. (2013), however, no interactions of the different feeding strategies on body composition were found. Moreover, differences in dietary protein levels during the rearing period were more effective than modifying the growth pattern by different feed allocations in changing body composition. This was probably due to the rather small differences (8%) in BW between treatments at the end of the rearing period as described in Van Emous et al. (2013). For example, Renema et al. (2001a) did not find an effect of an 11% higher BW, while a 21% higher BW increased abdominal fat content at the end of the rearing period. On the other hand, feeding broiler breeders to a 20% higher BW (2,640 vs. 2,200 g) at the end of rearing is relatively beyond practical conditions.

A, on average, 16% lower dietary CP during the rearing period in the studies reported by Van Emous et al. (2013, 2015a) resulted in a decreased breast meat and increased abdominal fat pad content at 10 wk of age and at onset of lay (20 and 22 wk of age). This was in close agreement with Mba et al. (2010) who found the same effects of a 12.5% reduction in crude protein content of the diet (14 vs. 16%) on body composition at 12 and 23 wk of age. In fact, not the dietary crude protein or amino acid content influenced body composition, but the differences in daily or total intake of the macro nutrients. On average, in both experiments of this thesis, the 16% lower protein diets (low vs. high protein diet) resulted in a 11% higher total energy, 5% lower total crude protein, and 7% lower total amino acid intake during the rearing period.

Average breast muscle (18.8 vs. 17.2%) and abdominal fat pad (1.0 vs. 0.4%) content at the end of the rearing period of all birds was relative higher in the study reported by Van Emous et al. (2015a) than the study by Van Emous et al. (2013). The differences between the experiments in breast muscle content might be explained by the differences in the higher total dietary protein and moreover total digestible lysine intake (+4.5%) in the second compared to the first experiment. Particularly dietary lysine is known as the major essential amino acid for breast muscle deposition in broilers and thus also for broiler breeders (Leeson and Summers, 2005).

The abdominal fat pad content roughly doubled in the study reported by Van Emous et al. (2015a) compared to the study reported by Van Emous (2013) could be explained by two different factors. Firstly, body composition at the end of the rearing period was determined at 20 (Van Emous et al., 2013) and 22 (Van Emous et al., 2015a) wk of age. In this pullet to breeder transition period, body composition or moreover fat content of the body changes dramatically. Secondly, the differences could be explained by the, on average, 4.5% higher cumulative energy intake in the study reported by Van Emous et al. (2015a).

At 15 wk of age, no effects of dietary protein level on abdominal fat pad (% BW) were found while this was present at wk 10 (Van Emous et al., 2013). This phenomenon was also reported by Mba et al. (2010) who observed a difference in abdominal fat pad affected by differences in dietary protein level at wk 12 while this disappeared at 19 wk of age. It seems that abdominal fat pad and fat contents of the body follows a specific pattern during rearing with ageing. This pattern in body composition was previously reported by Bennet and Leeson (1990) who found a decreased total fat content between 2 and 14 wk of age but an increased fat content between 14 and 24 wk of age. Combining the data of different authors yields a quadratic relationship between age and abdominal fat pad content (% BW) during the rearing and pullet to breeder transition period ($P < 0.001$).

The decreased abdominal fat pad weight around 12 wk of age is caused by the severe feed restriction levels (67 to 75%) between 7 and 16 wk of age, as described by De Jong and Guéméne (2011). It is likely that due to the severe feed restriction program during the midterm phase of rearing, pullets are required to use body (fat) reserves to meet energy requirements. This explains that the fat content of the body decreased during the severe feed restriction period while it increased again when energy intake increases substantially after 15 wk of age.

Feathers are high in protein and amino acids (Stilborn et al., 1997), especially the sulfur-containing amino acids methionine and cysteine which are needed for the synthesis of feather keratin (Wheeler and Latshaw, 1981). Feather cover development is not well described in broiler breeder nutrition research. A low protein diet during the rearing period, however, had a negative effect on feather cover quality (Van Emous et al., 2013; 2015c). In the experiment of Van Emous et al. (2013), feather cover was inferior on the low protein diet at 6 and 11 wk of age while this difference disappeared from 16 wk of age onward. In the experiment of Van Emous et al. (2015c), feather coverage was inferior on the low protein diet during the entire rearing period. It is, therefore, suggested that the protein and amino acid levels of the diets in the studies here were critical or deficient, in particular those amino acids needed for feather growth and development. The effect of daily protein intake on feather growth in broilers was previously reported by Twining et al. (1976), Aktara et al. (1996), Melo et al. (1999) and Urdaneta-Rincon and Leeson (2004). The suggestion of protein deficiency was underlined by the malformed cover feathers on the wings in the current study what might be an indication of amino acids deficiency. Moran (1984) already showed that marginal dietary deficiencies of sulfur containing amino acids resulted in abnormal feathering. Data of Van Emous et al. (2013) were used to analyze the linear relationships between the total crude protein intakes at different phases during the rearing period on feather cover score. The data show that the effect of a low total CP intake on feather cover score was much more pronounced between 2 and 6 wk of age ($P < 0.001$) than between 6 and 15 wk of age ($P = 0.182$). It is, therefore, important to conclude that total CP (and AA) is a critical factor in development of feathers cover during rearing till approximately 6 wk of age.

A low daily protein intake during the first phase of the laying period resulted in a poor feather cover during the entire laying period (Van Emous et al., 2015c). This phenomenon (low CP intake and poor feather cover) was observed during the rearing period as well. This effect was more pronounced in the first than in the second phase of lay, potentially because feather cover during the second phase was already almost completely damaged, thereby, masking treatment differences.

Effect of protein intake during rear on breeder performance

An interesting significant carryover effect of dietary protein level during rearing on the number of total and settable egg production during the second phase of lay was observed by Van Emous et al. (2015a). Pullets fed a low protein diet during rear produced between 45 and 60 wk of age 3.0 more total and 3.6 more settable eggs than pullets fed a high protein diet. The better persistency of lay of birds fed low-protein diet during lay might be explained by the higher proportion of abdominal fat and lower proportion of breast muscle at the end of rearing. Breeders with a higher body fat content are probably more able to mobilize energy reserves in periods of a negative energy balance (Renema et al., 2013) which probably prevent them for molting. The lower muscle content of the body may decrease the daily energy requirement for maintenance and increase the amount of energy that would be available for egg production (Ekmay et al., 2013).

Contrary to the study of Van Emous et al. (2015a), Miles et al. (1997) did not find any effects of a low protein diet during rearing on total egg production. This may be caused by the different breeds, or moreover the different properties due to 15 years of advances in selection and breeding resulting in differences in body composition (Renema et al., 2013). On the other hand, when pullets were fed very low protein diets (approx. 10%) during rearing, total egg production was negatively affected (Hudson et al., 2000; Hocking et al., 2002).

Data of the experiment of Van Emous et al. (2015a) was used to analyze the relationship between breast muscle and abdominal fat pad content at 22 wk of age on total number of settable eggs. It was concluded that the effect of body composition on egg production persistency has to be refined. The data show that the number of settable eggs during the second phase of lay was affected by abdominal fat pad content and not by breast muscle content. It also show that either breast muscle or abdominal fat pad content at the end of the rearing period did not affect the number of settable eggs during the first phase of lay. Particularly abdominal fat pad is the cause of this difference while breast muscle content has no effect on persistency of lay. Breeders with a higher body fat content are probably more able to mobilize energy reserves during periods of a negative energy balance (Renema et al., 2013) which may prevent them start molting. On the other hand, breeders with a low body fat content lack energy to meet their energy requirements if dietary energy intake is limited and, thereby, may lost BW over time that finally initiate molting as part of a natural process. It is observed that natural molting starts with a voluntary reduction in food intake resulting in an approximately 20% BW loss (Mrosovsky and Sherry, 1980).

Hocking et al. (2002) indicated that diets with a low CP (10%) content between 15 and 18 wk of age could result in a doubling of mortality during lay. In line with these results, mortality of pullets fed the low protein diet during rearing by Van Emous et al. (2015a) showed a tendency to an increased mortality over the entire laying period (6.3 vs. 8.1%; $P = 0.079$). It is hypothesized that feeding low protein levels during the rearing period may negatively affect the immune system due to the indispensable need for certain amino acids (arginine, glutamine, and cysteine) for the development of the immune system (Kidd, 2004).

Effect of protein intake during rear on incubation traits

It was postulated by Van Emous et al. (2015a) that differences in late embryonic mortality during the first phase of lay between birds fed different dietary protein levels during the rearing period was caused by differences in body composition at the onset of lay. Data of Van Emous et al. (2015b) were used to analyze the relationship between breast muscle and abdominal fat pad content of the body at 22 wk of age on embryonic mortality during the first of the laying period. No effect on embryonic mortality was found during the second phase of lay. These data show that particularly abdominal fat pad content and not breast muscle content at the end of the rearing period seems to be an important factor to affect embryonic mortality during the first phase of lay. Thus a higher abdominal fat pad content at the end of rearing resulted in a decreased embryonic mortality. A sound explanation for this phenomenon may be that egg composition might be affected by the differences in abdominal fat pad content of the body.

Effect of protein intake during rear on offspring

Van Emous et al. (2015b) concluded that the combination of a higher target BW and increased abdominal fat pad content of the body of pullets at the end of the rearing period was slightly positive for the offspring BW gain. On the other hand, a changed body composition of pullets at the end of the rearing period by decreasing dietary protein levels showed no benefits on BW gain (Van Emous et al., 2015b). No comparable studies in the literature are available with regards to the effect of a different target BW at the end of the rearing period or different dietary protein levels fed to breeder pullets on offspring performance.

An interaction effect between sex of the offspring and dietary protein level of the breeder pullets on offspring breast meat gain was observed (Van Emous et al. 2015b). Male broilers from breeders fed the low protein diet had higher breast meat gain than male broilers from breeders fed the high protein diet, while breast meat gain of female broilers was not affected by dietary protein levels. It was suggested that this effect was caused by differences in protein deposition between the sexes. Feeding breeders a low protein diet during the rearing period may cause a gene-expression for maximum protein efficiency which is transferred to the offspring. This suggesting was underlined by the results of Rao et al. (2009) who found that offspring of Langshan breeders fed 10 vs. 15% CP diets had higher breast meat content at d 28. This finding and the results on breast meat gain (% of BW; males and females) of Moraes et al. (2011) who fed breeder pullets different energy and protein levels all show that feeding different levels of macronutrients to pullets, resulting in differences in body composition, can alter offspring processing yields.

Although, the underlying mechanisms behind these effects are still unknown, they may be related to metabolic changes by altering gene expression as suggested by (Rao et al., 2009; Choi and Friso, 2010). For example, as shown by Heijmans et al. (2008) and Rao et al. (2009), strong epigenetic effects on the offspring were found when humans or breeders, respectively, where exposed to suboptimal nutrition. It is therefore recommended that these effects need to be further studied in order to understand the physiological processes. This also will aid the feed industry in optimizing pullet and breeder diets for maximum performance of pullets, breeders and broilers, potentially differentiation to sexes.

Effect of protein intake during lay on breeder performance

The different feeding strategies during the laying period as described by Van Emous et al. (2015) did not affect breeder performance in the second phase, however, the high and low energy diet during the first phase resulted in a slightly lower number of eggs. It is not really clear what caused the difference in egg production during this laying phase. It was observed that a high energy diet resulted in a decreased feed intake and decreased eating time (Van Emous et al. 2015c). The most aggressive breeders ate a larger amount of feed resulting in decreased flock uniformity (Renema et al., 2013). A less uniform flock will reach peak production somewhat later caused by the larger variation in sexual development of individual birds (Laughlin, 2009). However uniformity during initial lay was not recorded in the study of Van Emous et al. (2015a), the more than 5 d delayed peak egg production for the birds fed the high energy diet is an indication of a decreased uniformity.

It could also be hypothesized that a low energy diet (and thus high daily protein intake) resulted in more breast muscle deposition. This might increase the daily energy requirement for maintenance and decreases, therefore, the amount of energy that remains for egg production (Ekmay et al., 2013).

In general, egg weight is affected by daily dietary protein and amino acids intake (Lopez and Leeson, 1995a; Fisher, 1998; Joseph et al., 2000). More specific, a higher egg weight is caused by a higher daily intake of sulfur amino acids (effect on albumen and yolk) and/or higher daily intake of linoleic acid (effect on yolk). This was confirmed in the study of Van Emous et al. (2015a) in the second phase of the laying period when daily amino acids and linoleic acid were increased. In the first phase of lay, the higher daily intake of amino acids was compensated by the lower daily linoleic acid intake potentially resulting in similar egg weights during that phase.

Total mortality during the entire laying period was increased when breeders were fed the high (9.4%) compared to the standard (6.5%) and low (5.7%) energy diets during the first phase of lay (Van Emous et al., 2015a). The majority (on average, 67% of the different treatments) of the total mortality was due to ruptures of the gastrocnemius tendons. It was hypothesised by Van Emous (2015) that the potential factors below are likely to account for inducing ruptures of the tendons:

1. A lower daily feed intake resulting in a lower daily macro- and micronutrients intake. No literature is available, however, regarding the effect of a lower nutrient intake on tendon development during rearing.
2. Lowering the daily amount of feed decreased time spent on feeding behavior (Van Emous et al., 2015c). It was observed that these birds were aggressive at feeding time resulting in (hyper)activity like running and jumping, inducing a higher risk of damaging the tendons.
3. Providing less feed leads to more competition at feeding time and a possible decrease in flock uniformity (unfortunately not recorded) during initial lay. More aggressive birds will develop higher BW due to the higher feed intake with possible effects on the tendon.

A combination of factor 2 and 3 seems to be the most reasonable explanation of the differences in mortality caused by ruptures of the tendons.

Effect of protein intake during lay on incubation traits

Feeding a low dietary energy level, resulting in a higher daily protein intake, during the first as well the second phase of the laying period did not affect fertility (Van Emous et al., 2015a), which is also found by other authors (Whitehead et al., 1985; Mejia et al., 2012b). In other studies, feeding broiler breeders a high daily protein level during the laying period resulted in decreased fertility (Lopez and Leeson, 1995a; Ekmay et al., 2013). It is not clear what caused the differences between the cited studies but probably causative factors are: housing system, diet, and breed. E.g., birds were individually housed and artificially inseminated (Mejia et al., 2012b; Ekmay et al., 2013) or group housed with natural mating (Whitehead et al., 1985; Lopez and Leeson, 1995a; Van Emous et al., 2015a). Besides the different ways of housing birds, also different dietary treatments were used for changing dietary protein or amino acids levels. For example, in the study of Lopez and Leeson (1995a) birds received different dietary crude protein levels while essential amino acids levels were equal. Some researchers used semi-purified diets (Mejia et al., 2012a,b; Ekmay et al., 2013) and changed specific amino acids levels while other researchers used more practical diets with reduced levels of crude protein or amino acids (Whitehead et al., 1985; Van Emous et al., 2015a). In the studies of Pearson and Herron (1982) and Whitehead et al. (1985), older Ross strains were used, while in the study of Van Emous et al. (2015a) Ross 308 birds were used. In the studies of Mejia et al. (2012a,b) and Ekmay et al. (2013) Cobb 500 breeders were used while Lopez and Leeson (1995a) used Hubbard breeders.

The results from Van Emous et al. (2015) showed conclusively that feeding birds a high energy diet (less daily protein intake) during the second phase of lay improved hatchability of fertilized eggs. These results are in agreement with Pearson and Herron (1982), Whitehead et al. (1985) and Lopez and Leeson (1995a). The differences in hatchability of the fertile eggs were caused by differences in embryonic mortality. A higher or lower embryonic mortality leads to a lower or higher hatchability of fertile eggs, respectively. This observation supports the earlier work of Pearson and Herron (1982) who found that lowering daily protein intake (27.0 vs. 21.3 g/bird) resulted in a decreased mortality and malformation of embryos. The decreased embryonic mortality in birds fed the high energy diet (low daily protein intake) in the study of Van Emous et al. (2015) can be explained by the lower egg weight (68.7 vs. 69.1 g). Larger eggs have a higher eggshell conductance (EC) due to an increased pore density or pore size (Shafey, 2002). A higher EC increased vital gas exchange and water loss which causes, respectively, an increased early and late embryonic mortality (Peebles et al., 1987).

The effect of an improved hatchability and decreased embryonic mortality, while feeding the high energy diet (low daily protein intake), was underlined by the decreased proportion of second grade chicks in the study of Van Emous et al. (2015a). The relationship between low embryonic mortality and less second grade chicks was previously found in studies of Reijrink et al. (2010) and Molenaar et al. (2011).

Effect of protein intake during lay on offspring performance

Relatively few papers are available on the effects of specific protein or amino acids intake of broiler breeders on offspring performance and processing yields (Wilson and Harms, 1984; Lopez and Leeson, 1995b; Mejia et al., 2013). In general, little or no effect of a change in maternal daily protein intake on growth and processing yields of the offspring has been reported. This is in agreement with the results of the two broiler trials obtained of hatching eggs from 28 and 53 wk of age during the study of Van Emous (2015). Breeders fed similar amounts of daily energy, but 7% more or less protein during the first phase of the laying period showed no difference in performance and processing yields of offspring from 28 wk old breeders. Moreover, feeding breeders a 9% lower daily protein intake during the second phase of the laying period did not, except a decreased mortality, affect broiler performance and processing yields of offspring from 53 wk old breeders as well. The lack of an effect of daily protein intake on offspring performance and processing yields can be explained by the research of Ekmay et al. (2011). They found that 60 to 70% of egg albumen lysine is derived from skeletal muscle reserves and the remainder from dietary resources. They suggested that skeletal muscles probably functioned as a transient protein pool from which lysine can be mobilized.

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O36 Feed Supplementation Effect of 25-Hydroxycholecalciferol and Canthaxanthin in Broiler Breeders and Their Progeny

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Abstract

Two trials were run to evaluate the effect of a supplemented diet with 25-hydroxycholecalciferol (25OHD$_3$, tradename Rovimix Hy·D®) and canthaxanthin (CTX, tradename Carophyll® Red) on the performances of broiler breeders and on their progeny. In the first trial, a group of breeders was fed a control diet supplemented only with vitamin D$_3$ and the other group was fed a combination of 25OHD$_3$ and CTX. Performances parameters were monitored at 30, 45 and 62 weeks of age. Breeders fed the combination of 25OHD$_3$ and CTX exhibited higher production, fertility and hatchability rates compared to the control group. The chicks hatched were further split in two groups and fed a control diet or a diet with 25OHD$_3$ and CTX up to 21 days. The broilers fed the 25OHD$_3$ and CTX diet exhibited the best performances in term of final weight, feed conversion and meat yields at the slaughterhouse. The results of this trial are suggesting that the diet supplemented with 25OHD$_3$ and CTX enhances the performances of the breeders and of their progeny up to the slaughter age. In the second trial two groups of breeders fed respectively a control diet, supplemented only with vitamin D$_3$, and a diet supplemented with 25OHD$_3$ and CTX were followed. The breeders fed the experimental diet showed better values of fertility and hatchability. The day old chicks continued to receive according to the maternal diet, either a diet supplemented with vitamin D$_3$ or with 25OHD$_3$. In the second trial, the expression of the myogenic markers was determined at hatch and at 6 days after hatch to evaluate the effect of the vitamin D source on the myogenesis of the embryos and of the chicks. The expression of the myogenic markers, like the MyoD and IGF-1, measured at hatch and after 6 days, showed a positive tendency of improvement in the chicks hatched from the breeders fed the 25OHD$_3$ diet. These outcomes are suggesting a positive role of the 25OHD$_3$ in enhancing the myogenesis both in the embryo phase and in the chicks.

More data are needed to better understand how to improve the quality and the performances of the broilers through the maternal diet. However, the results of these two trials are strongly suggesting a positive effect of the combination of the 25-hydroxycholecalciferol and canthaxanthin on the performances of the breeders and their progeny.

Introduction

The maternal nutrition plays a very important role in the development and health of the progeny. In the past years, the combined effects of 25-hydroxycholecalciferol and canthaxanthin as functional nutrients in poultry breeder nutrition have been investigated by several Research Institutions and DSM. The 25-hydroxycholecalciferol is involved in the bone and eggshell formation. The canthaxanthin as antioxidant traps the free radicals (saving alpha-tocopherol) and can improve the antioxidant status of the tissues in semen, embryo and one day old chick (Surai, 2012). Both nutrients are transferred by the breeder hen to the egg yolk, and to the embryo. Several studies were run to evaluate the effect of these nutrients on the performances of the breeders but very few trials were more focused on the evaluation of the performances of the hatched chicks. The aim of this short review is to provide more information about the effect of a dietary supplementation with 25-hydroxycholecalciferol and canthaxanthin to broiler breeders and the performance of their progeny.

Material and methods

In the first trial run by Araujio et al. (2014) a total of 80 broiler breeders, Cobb 500, were reared from 25 to 62 weeks in a floor pen facility. The breeder hens were fed either a control diet supplemented only with vitamin D_3 or the control diet supplemented with 25-hydroxycholecalciferol ($25OHD_3$, tradename Rovimix Hy·D®) and canthaxanthin (CTX, tradename Carophyll® Red). The hatchings were monitored at 35, 45 and 62 weeks. From each hatchery batch the chicks were split in a 2x2 factorial design: breeders fed or not $25OHD_3$ plus CTX and chicks fed or not $25OHD_3$ plus CTX up to 21 days of age. The parameters evaluated were: egg production, fertility and hatchability in the breeder hens and the farm and slaughterhouse performances in the broiler phase. ANOVA of data were performed using GLM procedure of SAS, considering 5% of significance.

The second study was run by Berri et al., (2015). A total of 358 eggs from Ross PM3 were hatched in INRA facility. The eggs were laid from breeders fed a control diet supplemented with vitamin D_3 or a treated diet supplemented with 25-hydroxycholecalciferol and canthaxanthin. The percentage of fertilized eggs and hatched chicks were determined according to the maternal diet. The day old chicks were fed a control diet supplemented with vitamin D_3 or a treated diet supplemented with 25-hydroxycholecalciferol. Day old chicks were weighted and sexed and only the males were kept. At hatch and at 6 days, 12 chicks per treatment were sacrificed and the *Pectoralis mayor* muscle were dissected. The breast samples were frozen into liquid nitrogen for RNA preparation. The level of gene expression was evaluated by real time PCR following reverse transcription. A total of 11 genes coding for several proteins were analysed: VDR, RXR, MyoD, Myf5, Myogenin and myogenic regulatory factors (MRF). The analysis of variance were performed using GLM procedure of SAS. Data on body weight, muscle growth and gene expression were further analysed by PCA using the SPAD8 software.

Results and discussion

In the first trial, the feed supplementation of $25OHD_3$ and CTX to broiler breeders enhanced their performance parameters compared to the control diet ($P < 0.05$) as shown in Figure 1. The egg production, the fertility and the hatchability rates were improved.

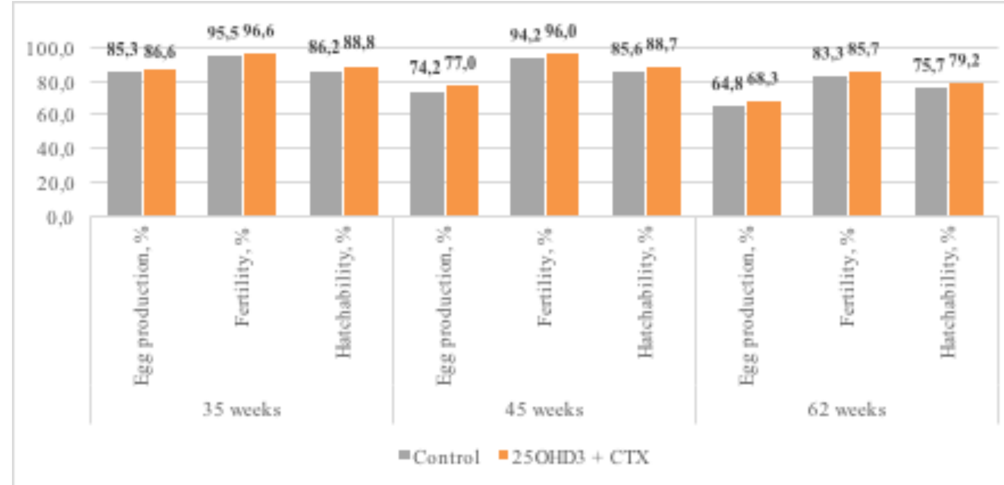

Fig. 1: *performance parameters evaluated in breeders fed a Control diet and a diet supplemented with $25OHD_3$ and CTX at 35, 45 and 62 weeks*

Results are in line with previous studies run by Rosa et al. (2010), Santos et al. (2011) and Duarte et al. (2015) and suggest that the combination of canthaxanthin and 25-hydroxycholecalciferol enhances the performance of the breeders. The chicks hatch were reared until 42 days of age. At the end of the rearing period the chicks hatch from the breeders supplemented with $25OHD_3$ and CTX and fed the same diet during the rearing period, exhibited the heaviest weight ($P < 0.05$) compared to the control birds (Fig. 2). Moreover the supplementation of $25OHD_3$ and CTX in the maternal diet improved ($P < 0.05$) the feed conversion of their progeny compared to the control birds (1,69 vs 1,72 at 35 weeks; 1,66 vs 1,69 at 42 weeks and 1,67 vs 1,75 at 62 weeks) .

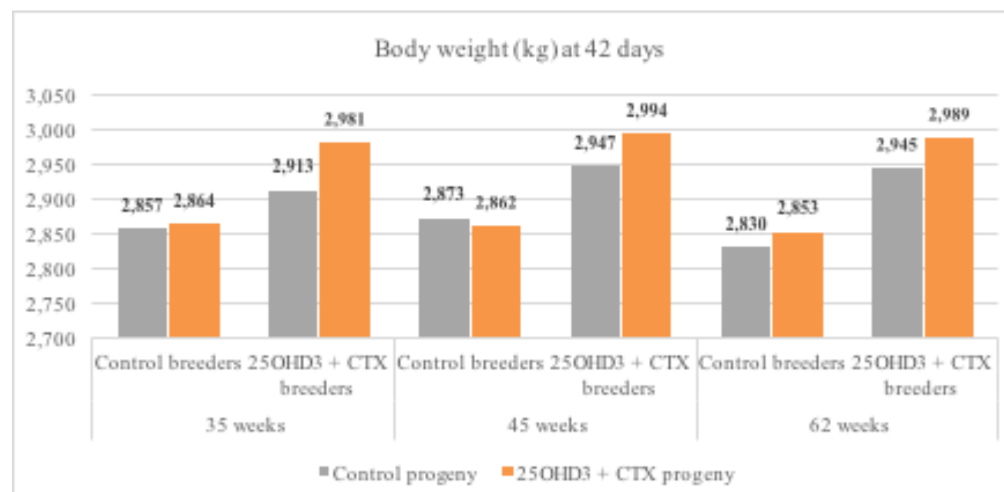

Fig. 2*: Body weight measured at 42 days in broilers hatched from breeders fed a Control diet and a diet supplemented with $25OHD_3$ and CTX at 35, 45 and 62 weeks*

At the slaughterhouse the meat yields data were recorded. The highest meat yields were obtained in the broilers fed a combination of 25OHD$_3$ and CTX either in the breeders and broilers diet ($P < 0.05$). In Figure 3 the data recorded for the carcass yields are presented. Moreover, also the breast meat yields were improved in broilers fed 25OHD$_3$ and CTX compared to the birds fed the control diet. The broilers fed the combination of 25OHD$_3$ and CTX both in the breeders phase and in the rearing period reached the higher values of breast meat yields compared to the birds of the control diet ($P < 0.05$). Values recorded were respectively 21,21% vs 22,79% at 35 weeks; 21,34% vs 23,16% at 42 weeks and 21,17% vs 23,03% at 62 weeks. These findings are in agreement with previous researches focused on the effect of the 25-hydroxycholecalciferol in enhancing the broiler meat yields (Michalczuk et al., 2010; Vignale et al., 2015). Vignale et al. (2015) is suggesting a direct effect of the 25-hydroxycholecalciferol in the stimulation of the protein synthesis.

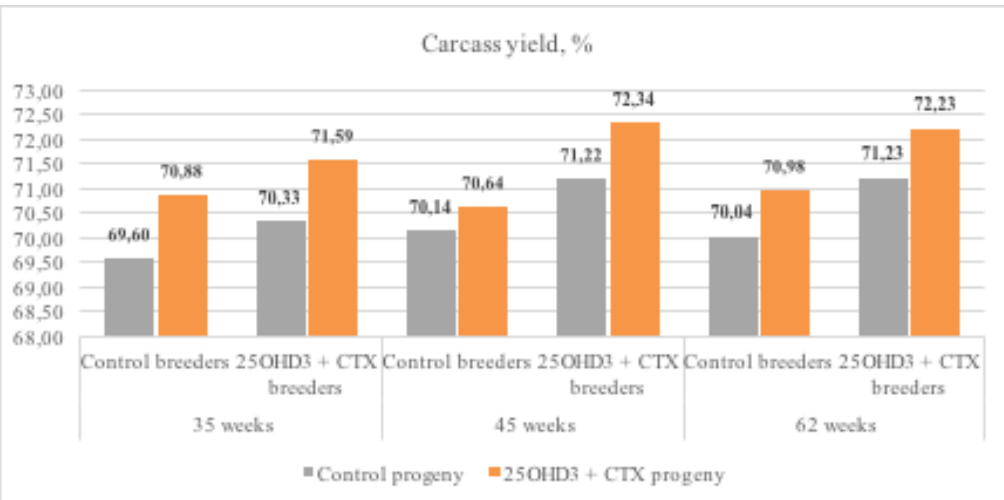

Fig. 3: *Carcass yield measured at 42 days in broilers hatched from breeders fed a Control diet and a diet supplemented with 25OHD$_3$ and CTX at 35, 45 and 62 weeks*

The overall data are suggesting a positive effect of the combination of the 25-hysroxycholeclaciferol and canthaxhantin on the enhancement of the breeders performances and on the broilers production.

In the second trial the breeders supplemented with the combination of 25OHD$_3$ and CTX exhibited the higher fertility percentage (90,5 vs 88,8) and the higher hatchability rate (87,2 vs 84,4) compared to the control birds. The relative levels of gene expression in the breast muscle of the day old chicks are presented in Table 1.

GENE	CONTROL	25OHD3 + CTX	ORIGIN EFFECT
VDR	0.66 ± 0.18	0.95 ± 0.16	0.24
RXR	0.84 ± 0.08	0.76 ± 0.08	0.48
MYOD	1.38 ± 0.14	1.62 ± 0.14	0.22
MYF5	1.20 ± 0.19	1.40 ± 0.19	0.48
MYOGENIN	0.35 ± 0.05	0.45 ± 0.05	0.18
PAX7	1.47 ± 0.09	1.62 ± 0.09	0.26
PCNA	1.06 ± 0.11	1.26 ± 0.11	0.20
IGF-1	0.43 ± 0.06	0.60 ± 0.06	0.05
MYHC EMBRYONIC	1.35 ± 0.20	1.72 ± 0.2	0.20
MYHC NEONATAL	0.08 ± 0.02	0.11 ± 0.02	0.23
MYHC ADULT	0.011 ± 0.002	0.017 ± 0.002	0.02

Table 1: *Relative gene expression levels measured by real time RT-PCR in the Pectoralis mayor muscle of day old chicks hatched from breeders fed either a control or a 25OHD$_3$ + CTX diets*

The maternal dietary treatment positively influenced the expression of the IGF-1 (insulin-like growth factor-1). Chicks hatched from breeders fed 25OHD$_3$ and CTX had a higher expression of the IGF-1 compared to the control chicks. IGF-1 plays an important role in the growth of young animal and have an anabolic effect in adult birds. This growth factor is a fundamental regulator factor of the muscle growth inducing the proliferation of the satellite cells.

The PCA analysis of the gene expression measured in chicks of 6 days old suggests that providing the breeders a supplemented diet with 25OHD$_3$ and CTX stimulates the expression of most of the genes involved in the muscle growth and differentiation (Fig 4). Moreover, the feed supplementation to broilers of 25-hydroxycholecalciferol instead of vitamin D$_3$ enhanced the expression of the breast weight and quantity.

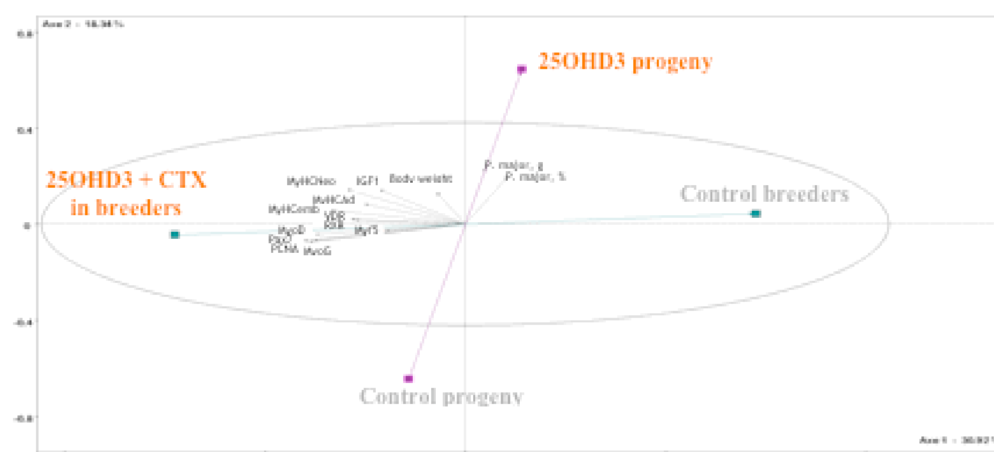

Fig 4: Graph of the PCA analysis of the gene expression measured in chicks of 6 days old. Maternal and broilers dietary treatments are indicated

Conclusions

The two studies presented are showing a positive effect of the maternal supplementation of 25-hydroxycholecalciferol and canthaxanthin to enhance the breeders performance, in particular the fertility and the hatchability rates. Very interestingly the feed supplementation of 25-hydroxycholecalciferol and canthaxanthin to the broiler breeders improved the chicks performances in term of myogenic gene expression, body weight, feed conversion and meat yields. These outcomes are indicating a beneficial effect of the combination of the 25-hydroxycholecalciferol and canthaxanthin to exploit the breeders and broilers potential.

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O[37] Nutritional Modulation of Antioxidant System In Poultry: New developments with selenium on Hatching and Embriyonic Developmment

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Introduction

Commercial poultry production is associated with various stresses leading to decrease of productive and reproductive performance of growing chickens, parent birds as well as commercial layers. Growing body of evidence indicates that most of stresses in poultry production at the cellular level are associated with oxidative stress due to excess of free radical production or inadequate antioxidant protection. Recently, a concept of the cellular antioxidant defence has been revised with a special attention paid to cell signalling. Indeed, in animals, redox signaling pathways use reactive oxygen species (ROS) to transfer signals from different sources to the nucleus to regulate a number of various functions including growth, differentiation, proliferation and apoptosis (Surai and Fisinin, 2016b; 2016c;2016d;2016e).

Stresses in poultry production

From a physiological point of view, stress is related to a deviation from optimal internal and external conditions. Under stressful conditions, the hypothalamic-pituitary-adrenal axis, the autonomic nervous system and the immune system are responsible for re-establishing homeostasis. Therefore, a cascade of regulatory mechanisms are involved, resulting in a mobilization of energy and a shift in metabolism with detrimental effects on growth performance and feed efficiency. In modern commercial poultry production oxidative stress-related nutritional metabolic diseases (e.g. encephalomalacia, exudative diathesis, muscular dystrophy, etc.) practically disappeared (Surai, 2002; 2006), however, various disorders of the biological antioxidant defence system still causing substantial problems. For example, the amount of a particular nutrient in the diet may be insufficient to meet the requirements, the diet may contain substances that inactivate the nutrient or inhibit its absorption/utilisation, or metabolism may be upset by the interaction of dietary and environmental factors causing oxidative stress. Domestication and genetic selection based on rapid growth rates, better feed conversion, and heavier BW of broilers has made domestic birds, including broilers and turkey, particularly susceptible to oxidative stress. In general, there are four major types of stress in poultry industry: technological, environmental, nutritional and internal stresses (Surai and Fisinin, 2016b). It seems likely that heat and diet are among main means causing oxidative stress in domestic birds that may lead to biological damage, serious health disorders, lower growth rates, and, hence, economic losses. Therefore, dietary antioxidants are considered to be the main protective means to deal with various stresses in poultry production

Indeed, the antioxidant defence includes several options (Surai, 2002; 2006; Surai and Fisinin, 2016b; 2016c; 2016d; 2016e):

- decrease localized oxygen concentration;
- decrease activity of pro-oxidant enzymes (carnitine, silymarin)
- improve efficiency of electron chain in the mitochondria and decreasing electron leakage leading to superoxide production (carnitine);
- induction of various transcription factors (e.g., NF-E2-related factor 2 [Nrf2], nuclear factor-kB [NF-kB] and others) and ARE-related synthesis of AO enzymes (SOD, GSH-Px, CAT, glutathione reductase [GR], glutathione S-transferase [GST], etc.);
- binding metal ions (metal-binding proteins) and metal chelating;
- decomposition of peroxides by converting them to non-radical, nontoxic products (Se-GSH-Px);
- chain breaking by scavenging intermediate radicals such as peroxyl and alkoxyl radicals (vitamins E, C, GSH, uric acid, carnitine, ubiquinol, bilirubin, etc.);
- repair and removal of damaged molecules (methionine sulfoxide reductase, DNA-repair enzymes, HSPs and other chaperons, etc.);
- redox-signaling and vitagene activation with synthesis and increased expression of protective molecules (GSH, thioredoxins, SOD, heat shock proteins [HSPs], sirtuins, etc.);
- antioxidant recycling mechanisms, including vitamin E recycling;
- apoptosis activation and removal terminally damaged cells and restriction of mutagenesis.

As it was shown above all antioxidants in the body are working as a "team" responsible for antioxidant defence and we call this team the antioxidant system. In this team one member helps another one working efficiently. In general vitamin E and coenzyme Q are considered to be a "head-quarter" of the antioxidant defences, while Se is a "chief executive" of antioxidant defence, since from 25 known selenoproteins, more than half participate in antioxidant defences. Furthermore, a central role in antioxidant system regulation belongs to vitagene expression and additional synthesis of protective molecules in stress conditions ("ministry of defence") to improve adaptive ability to stress.

Therefore if relationships in this team are effective, which happens only in the case of balanced diet and sufficient provision of dietary antioxidant nutrients, then even low doses of such antioxidants as vitamin E could be effective. On the other hand when this team is subjected to high stress conditions, free radical production is increased dramatically. During these times, without external help it is difficult to prevent damage to major organs and systems. This 'external help' is dietary supplementation with increased concentrations of natural antioxidants. For nutritionist or feed formulator it is a great challenge to understand when the internal antioxidant team in the body requires help, how much of this help to provide and what the economic return will be. Again, it is necessary to remember about essentiality of keeping right balance between free radical production and antioxidant defence. Indeed, ROS and RNS have another more attractive face participating in a regulation of varieties of physiological functions.

Nutritional Modulation of Antioxidant Systems in Poultry

A major strategy of nutritional modulation of antioxidant defences includes adding antioxidant into the poultry diet. This includes, vitamin E, selenium, carotenoids, flavonoids (polyphenols) and some other antioxidants and their role in poultry nutrition was characterised in our previous work (Surai, 2002; 2014; Surai and Fisinin, 2015a).

Vitamin E

Vitamin E – main chain-breaking antioxidant in the cell, located in biological membranes and proven to be effective in antioxidant protection. Recently it has been proven that vitamin E recycling in the cell is a key for its antioxidant activity. Ascorbic acid, selenium, vitamins B1 and B2 are important elements of vitamin E recycling. Therefore, if recycling is effective even low vitamin E concentration, for example in embryonic brain, can prevent lipid peroxidation in vivo (Surai et al., 1996). Increased vitamin E supplementation is proven to be effective means of stress prevention in heat stress and various nutritional stresses.

Carotenoids

Carotenoids are important elements of antioxidant system, possessing antioxidant activities and participating directly or indirectly (for example, by recycling vitamin E or regulating expression of various genes) in antioxidant defences. There are more than 750 carotenoids in nature and their efficiency vary considerably. Recently, an important role of canthaxanthin in breeder nutrition has been described (Surai, 2012a; 2012b).

Ascorbic Acid

Vitamin C (ascorbic acid) is an important antioxidant synthesized in chickens and its dietary supplementation is shown to be effective only in stress conditions, when its requirement substantially increased. The role of vitamin C in vitamin E recycling is a topic of great interest.

Polyphenolic Compounds, Including Flavonoids

Polyphenolic compounds comprise a group of various plant-derived compounds consisting of more than 8,000 various compounds possessing antioxidant and pro-oxidant properties in various conditions. The main problem with polyphenols, including flavonoids, is their low bio-availability. Their concentration in the diet could be very high, but their levels in blood is low and their concentration in target tissues (liver, muscles, egg yolk) usually is negligible. Therefore direct antioxidant properties of flavonoids were questioned (Surai, 2014) and it seems likely that main site of flavonoid action is the gut where they can have health-promoting properties participating in the maintaining antioxidant-prooxidant balance (Surai and Fisinin, 2015a).

Specific Role for Selenium

Antioxidant system of poultry includes three major levels of defence. The first line is based on antioxidant enzymes, including SOD, Se-dependent GSH-Px and Catalase. The second level of defence is built by natural antioxidants, including vitamin E, but they perform only first part of the job detoxifying peroxyl radical (ROO*) and producing hydroperoxide ROOH which is still toxic and must be detoxifying by Se-GSH-Px. The third level of antioxidant defence is based on specific enzymes involved in repairing various molecules damaged by free radicals. A selenoprotein MsrB is one of such enzymes dealing with oxidised Met molecules inside the protein structure. Therefore, Se is involved in all three levels of antioxidant defence in the cell/body. Indeed, from 25 known selenoproteins in avian species more than half (about 18) are shown or suggested to have antioxidant-related properties, including direct AO activities (GSH-Px and TrxRx) as well as maintaining redox balance of the cell and participating in cell signaling.

Analysis of research data on modulation of antioxidant defences by increasing levels of antioxidants in poultry diets indicates that Se has a special role, since its efficacy depends on the form of Se (organic vs inorganic) used in the supplement. Indeed, it has been proven that major effect of dietary Se is related to building Se reserves in the body in the form of SeMet which can be used in stress conditions when Se requirement increases but feed consumption is usually goes down. Therefore, stresses increase proteasome activities dealing with protein catabolism releasing SeMet which is an additional source of Se for selenoprotein synthesis. This gives an additional protection in stress conditions. The main dietary strategy is to transfer as much as possible Se to the muscles (building Se reserves in breeders, layers and broilers) and to the egg, improving antioxidant defences of the developing embryo at time of hatching, a stressful period in chicken life. Therefore, a comparison of efficacy of different forms of Se in the maternal diet as well as in chicken diet is an important point to be addressed.

Selenium Sources for Poultry

It has been shown that Se content of feed and food ingredients greatly varies depending on many different factors. For example, Se concentration in corn and rice grown in normal and high Se areas can vary 100-500–fold. Indeed average data on Se content in feedstuffs presented in various tables are not suitable for diet balancing and Se supplementation is a routing practice in commercial animal and poultry production. In fact, FDA approved Se supplements for poultry and swine in 1974 in the form of selenite or selenate (Surai, 2006).

While Se form was not rigorously considered in the initial research into Se nutrition, for the last 40 years information has accumulated indicating that the natural form of Se in plant-based feed ingredients consists of various selenoanimo acids with SeMet being major form of Se in grains, oil seeds and other important feed ingredients. Therefore, organic Se is the natural form of Se to include in feed formulations (Surai and Fisinin, 2016a). However, sodium selenite remains in use in many animal feeds. The limitations of using inorganic Se are well known and include toxicity, interactions with other minerals and vitamins, low efficiency of transfer to milk, meat and eggs and an inability to build and maintain Se reserves in the body. As a result, a high proportion of the element consumed in inorganic form is simply excreted. Further, a pro-oxidant effect of the selenite ion is a great disadvantage as well, particularly when shelf life of food animal products is considered. Furthermore, recently it has been found that sodium selenite at 0.3 ppm can cause damages to the gut structure. In fact, duodenum of a chicken fed 0.3 ppm sodium selenite showed vacuolar and hydropic degeneration of the epithelial cells lining the intestinal crypts, while ileum of the same chickens was characterised by an excess of mononuclear cell infiltration and aggregation in between degenerated and necrotic intestinal glands (Attia et al., 2010). Thus, the use of sodium selenite in animal diets has recently been questioned (Surai, 2006; Surai and Fisinin, 2016a). Therefore, the simplest idea was to use Se forms produced by plants.

Selenium-Enriched Yeast: Pluses And Minuses

It is well known that chemical and physical properties of Se and sulphur are very similar, reflecting similar outer-valence-shell electronic configurations and atomic sizes (Surai, 2006). Therefore plants cannot distinguish between these two elements when synthesizing amino acids. As a result they can synthesize SeMet when Se is available. This biological feature was the basis for development of the commercial technology of organic Se production from yeast. Indeed, various commercial forms of Se-Yeast found their way to the market place and shown to be effective sources of Se for poultry and animal production (for review see Surai, 2006; Surai and Fisinin, 2014; 2015; 2016; 2016a).

However, there are several points to be addressed in relation to commercial usage of Se-Yeast. First of all, it is necessary to mention that yeast is a live organism and its composition will depend on the genetics and conditions of growing, including temperature, pH, oxygen concentration, etc. It seems likely that selenoamino acid composition of the yeast depends on various factors, including yeast species, growth conditions as well as analytical techniques used. In fact, Se-yeast has been reported to contain over 60 unique selenium species (Arnaudguilhem et al., 2012) and it is well established that SeMet is the major selenocompound in Se-enriched yeast. However, its proportion greatly varies, usually from 50 to 70% (Surai and Fisinin, 2014; 2015; 2016; 2016a). Indeed the presented data depend not only on the technology of Se-Yeast production (strain of yeast, source of Se, temperature, oxygen concentration, etc.), but also are dependent on the extraction efficiency of the technique used by the analytical laboratory. Recently, a considerable incorporation of selenocysteine (SeCys) in proteins of the yeast proteome despite the absence of the UGA codon was demonstrated (Bierla et al., 2013). The authors concluded that 10–15% of selenium present in Se-enriched yeast is in the form of selenocysteine. This means, that if all Se in Se-Yeast is accounted for, the maximum SeMet proportion would not exceed 85%, but in many cases will be lower than that. There is also a difficulty in chemical detection of SeMet in yeast products and only few labs in the world can do such an analysis properly.

SeMet and OH-SeMet

Another option to improve Se status of poultry and farm animals would be to use pure SeMet as a dietary supplement. There are some respectable publications showing beneficial effect of organic Se in the form of SeMet in the poultry diets. However, SeMet in purified form is unstable and easily oxidised (For review and references see Surai and Fisinin, 2014; 2015; 2016; 2016a).

Recently a new stable organic Se source called Selisseo®(SO) has been developed which is a selenomethionine hydroxyanalogue, 2-hydroxy-4-methylselenobutanoic acid or HMSeBA (Briens et al., 2013, 2014). Two experiments were conducted on broiler chickens to compare the effect of HMSeBA (SO), with two practical Se additives, SS and Se-Yeast. The different Se sources and levels improved muscle Se concentration compared with the NC, with a significant source effect in the following order: SS, Se-Yeast and SO ($P<0.05$). In fact, the relative muscle Se enrichment comparison, using linear regression slope ratio, indicated an average of 1.48 (95% CI 1.38, 1.58) fold higher selenium deposition in muscle for SO compared to SY (Briens et al., 2014). Seleno-amino acid speciation results for Se-Yeast and SO at 0.3 mg Se/kg feed indicated that muscle Se was only present as SeMet or SeCys, showing a full conversion of Se by the bird. The results confirmed the higher bioavailability of organic Se sources compared with the mineral source and demonstrated a significantly better efficiency of HMSeBA compared with Se-Yeast for muscle Se enrichment. In particular, the authors showed that Se muscle concentrations significantly improve with SO, increasing the relative bioavailability for total Se by 39% compared with SY. From one hand this could be a reflection of higher SeMet level in the diet (almost 100% SeMet in SO vs 60–70% SeMet in Se-Yeast). On the other hand, there could be other biochemical differences in the Se metabolism, since SO increased SeCys level in the muscle. Since this review mainly concerns breeder nutrition, it would be interesting to note that hens fed the diet with HMSeBA-0.2 accumulated more Se in their eggs (+28.8%) and muscles (+28%) than those fed the diet supplemented with SY-0.2 (Jlali et al., 2013). After 21 days, organic Se sources maintained (Se-Yeast) or increased (Hydroxy-SeMet) breast muscle Se concentration compared to hatch value whereas inorganic source (Sodium selenite) or non-supplemented group (NC) showed a significant decrease in tissue Se concentration (Couloinger eta l., 2015). Furthermore, HMSeBA in turkey diet improved GSH-Px activity in thigh muscles and decreased lipid peroxidation (Briens et al., 2016). These results showed the greater ability of HMSeBA to increase Se deposition in eggs and breast muscle of laying hens, which could be of great importance for breeding birds and newly developing chicks. Recently, EU decided to limit the maximum supplementation with selenised yeast to 0.2 mg Se/kg complete feed for reasons of consumer safety (Commission Implementing Regulation No. 427/2013 of 8 May 2013). At this comparatively low level of supplementation advantages of organic Se in the form of Se-Yeast will be less pronounced, and alternative effective sources of organic selenium with higher efficiency of transfer to the egg and animal tissues would play bigger role in poultry reproduction. Therefore, aforementioned results indicated that a new source of organic selenium in the form of 2-hydroxy-4-methylselenobutanoic acid supplied in the same dose as Se-Yeast in the chicken diet could provide additional benefit in terms of Se reserves in the muscles as well as Se transfer to the egg and probably to the developing embryo. This potentially can be translated into better antioxidant protection in stress conditions of commercial poultry production.

Chelated Se Products

There is a range of products on the market claiming to contain chelated Se (Se-glycinates, Se-proteinates, Se-amino acids complexes, etc.), however, chemical position of Se in the Periodic table of elements indicates that Se is not a true metal and therefore its chelating ability is in question. Indeed, attempts to determine chelated Se in such products ended up with a detection of only inorganic Se (selenite and selenate, Kubachka et al., 2017). Indeed, chelated Se products are not related to SeMet and, probably, should not be included into organic Se category.

Nano-Se Products

Recently selenium nanoparticles (SeNPs, nano-Se) have received substantial attention as possible novel nutritional supplements because of their lower toxicity and ability to gradually release selenium after ingestion (Skalickova et al., 2016). In many cases low nano-Se toxicity is considered as its main advantage. However, one should also realise that Se toxicity is not a major problem in poultry industry and Se in the form of sodium selenite or organic Se (SeMet, Se-Yeast or other preparations) is an essential part of premixes produced worldwide. It seems likely that nano-Se nutritional value as a feed supplement for poultry industry is questionable.

Conclusions

In conclusion, a choice of an optimal form of Se with other available effective antioxidants is the most important step in building antioxidant defence program for poultry. However, some well-advertised natural antioxidants based on plant extracts are not proven to be antioxidants in biological systems. Therefore, there is a lot of food for thoughts for a poultry nutritionist.

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IS[21] Microbial Control Strategies in Poultry Meat Production and Future Approaches

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Abstract

The safety of poultry meat has been digressed between the official authority and poultry meat producers/industry and becoming the social concern of the public in recent years. It is obvious that there will be many studies on this subject in the future also. The main issue covered in this context is poultry meat can be contaminated with different microorganisms, mainly pathogens and spoilages, and this situation is being mainly concentrated on the control of these bugs. Due to its production model poultry meat can be easily contaminated with microorganisms likely other foods of animal origin. However, when considering the chemical structure of poultry meat, the inadequate processing and storage stages after contamination also pose significant risks for public health. Particularly, as virulence characteristics of pathogens increase-differentiation, gaining lower infectious dose characteristics, antimicrobial and production-related (heat, cold, disinfectant etc.) stress resistance changes, as well as entry of new pathogens into the food chain are the most important risks in this sense. In addition, the development of new products and distribution chain, differences in production models, enhancement in the international trade, consumer expectations and knowledge levels, the increase in meat consumption in the world and the increase in curiosity and interest in the media and society and also the related misinformation about the facts are increasing the importance of the poultry meat safety issues. In this manner the routine control strategies are sometimes becoming inadequate and this may require the use of new strategies.

O38 Contamination Sources of *Listeria monocytogenes* in Poultry Processing Plants

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Abstract

In this study, 252 samples (144 from production process, 36 whole chicken, 72 chicken part samples) collected from 4 different poultry processing plants were investigated for the presence of *L. monocytogenes*. During the analysis these steps were followed: i) The presence of *L. monocytogenes* was detected by conventional culture techniques and IMS, ii) Isolates were confirmed and serotyped by PCR. According to the results 24 [24/252, (9,5%)] samples were found as *L. monocytogenes* positive. 51 isolates belonging to 24 samples were identified as *L. monocytogenes*. The presence of *hlyA* gene was visualized in all of the isolates by PCR. *L. monocytogenes* serotype 1/2a was the dominant serotype (47/51, 92,1%) while 4 isolate were serotype 1/2c. As a result, isolation of the pathogen from poultry processing plants and contamination of products pose risks to public health. Assuring food safety from primary production to consumption gains importance to reduce the risk of listeriosis.

O39 Effects of Antimicrobial Usage on the Sensory Properties of Poultry Meat

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Abstract

Natural or chemical antimicrobials have been used in poultry meats for many years due to prevent microbial growth and deterioration, increase the shelf life, and protect the consumers' health. Antimicrobials should be used at high concentrations to show their effectiveness. However, limited number of studies reported that their usage in high quantities may adversely affect the organoleptic characteristics of the product desired by consumers. With that said, studies regarding the impact of antimicrobials on quality characteristics of poultry meat such as color, odor-flavor and taste should be conducted and findings should be observed to meet consumers' expectations.

O40 Determination of Lytic Effect Profiles of *Listeria* Phages Isolated from Poultry Slaughterhouse Wastewaters

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Abstract

Bacteriophages are biological destructors of bacteria, also known as bacteria-eater viruses. Due to their presence in a very wide environment and their high selective toxicity without harming live tissue compared to antibiotics and antiseptics make bacteriophages advantageous and functional in combating pathogens. Today, there are many studies on biocontrol of bacterial pathogens in foods. Especially in the last decade, the use of commercial bacteriophage preparations in foods has increased and has become legally applicable in several countries around the world. In this study, it was aimed to isolate *Listeria* phages from poultry slaughterhouses wastewaters and prepare a cocktail from bacteriophages that are lytic to *L. monocytogenes*. At the end of the study, three listeriophages were isolated from 60 slaughterhouse wastewater that collected in 12 months. Two out of the three bacteriophages that were isolated in this study showed litic activity to all of the *L. monocytogenes* serotypes and most of isolates used in this study. By this study two bacteriophages that showed broad lytic spectrum activity to LM and have potential to be a biocontrol agent have been detected.

O41 Effects of Acorns Extracts of Oak Trees on The Physicochemical and Antioxidative Properties of Chicken Thigh Meat

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Abstract

In this study, it has been the fact that the effects of the extracts obtained from the acorns of different oak trees on the physicochemical and antioxidative properties of chicken thigh meat. For this purpose, the chicken thigh(skinless and boneless) meats have been dipped for 5 minutes in the solution of 1000 ppm concentration prepared from the extracts of ordinary oak, valonia oak and holy oak acorns. Moreover, a group without including extracts by treating with distilled water under the same conditions have been obtained from total of four study groups (control, ordinary, valonia and holy). After the chickens which take from the solution was drained and put into polystyrene trays by covering with polyethylene film packaged and stored at ±2^{0}C for 7 days. During storage, chickens were subjected to pH, color, total phenolic substance, antiradical activity, lipid oxidation, protein oxidation and sensory test analyzes on 0, 1, 4 and 7th days. According to the results, the pH value did not change significantly (P>0,05). While use of extract decreased the L* value of chicken samples during storage, it didn't show a significant effect on a* values. In addition, acorn extracts were found to be effective in preventing lipid and protein oxidation when it compared to the control group. In addition, regardless to the results of sensory analysis, acorn extracts was effective on samples which flavor and overall acceptability points positively and the added concentration showed no effect on sensory properties. As a result, the extracts obtained from different oak trees are thought to be the extend the shelf life of chicken thigh meat.

Keywords: Oak acorn extract, antioxidant, oxidation, chicken meat

IS22 Predisposing Factors of Necrotic Enteritis (NE) in Broiler Chicks and Securing Broiler Flocks from NE

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Abstract

The increasing public health concerns, due to the spread of antimicrobial resistance from animals to human pathogens and the concomitant reduction in therapeutic efficacy have led to the ban of antimicrobial growth promoters in farm animals in European countries. This ban has significantly contributed to the emergence of economically important diseases of enteric origin in poultry, such as necrotic enteritis. It is one of the most widespread diseases in broilers, imposing a significant economic burden on the poultry industry worldwide.

Despite the identification of *Clostridium perfringens* as the etiological agent of the necrotic enteritis, the predisposing factors that lead to over proliferation of *C. perfringens* and the subsequent progression to disease are poorly understood. It is well accepted that necrotic enteritis is a multi-factorial disease process, in which a number of co-factors are required to precipitate an outbreak of the disease. These predisposing factors are numerous, but many are ill-defined and experimental results have been contradictory.

The ban of antimicrobials and the financial impact of necrotic enteritis in modern broiler industry have led to the development of new strategies for its control. The identification of *C. perfringens* virulence factors and the control of predisposing environmental factors are strategies of major importance. In addition, better farm management, including biosecurity measures, optimization of feed quality and nutriceutical alternatives (probiotics, prebiotics, organic acids, enzymes, herbs and so on) have become more relevant. The past decade was characterized by great progress in understanding the etiology and pathogenesis of necrotic enteritis in the gut of chicks. New research should focus on reducing the risk of the disease by controlling the *C. perfringens* in the intestine and by enhancing the immune system and the intestinal microbiota of chicks without the use of antibiotics.

Introduction

The increasing public health concerns, due to the spread of antimicrobial resistance from animals to human pathogens and the concomitant reduction in therapeutic efficacy have led to the ban of antimicrobial agent growth promoters in farm animals in European countries. This ban has significantly contributed to the emergence of economically important diseases of enteric origin in poultry, such as necrotic enteritis. It is one of the most common and economically devastating bacterial diseases in modern broiler flocks in terms of performance, mortality and welfare.

Necrotic enteritis is caused by *Clostridium perfringens* toxinotype A strains expressing the b-pore-forming NetB toxin. It is one of the most widespread diseases in broilers, imposing a significant economic burden on the poultry industry worldwide. Its total global economic loss is estimated to be over $2 billion annually, while its occurrence is estimated to result in a 12% reduction in body weight and a 11% increase in feed conversion ratio compared to healthy birds (McDevitt et al., 2006; Graham et al., 2007; Keyburn et al., 2008; Skinner et al., 2010; Tsiouris, 2010) .

Despite our present understanding of the disease, and the identification of *C. perfringens* as the etiological agent, the predisposing factors which are essential for the outbreak of the disease are not fully understood. These factors can influence the intestinal ecosystem and disrupt its balance, leading to the outbreak of the disease (Williams, 2005; McDevitt et al., 2006; Tsiouris, 2010). They are divided in three categories: nutritional, infectious and managerial factors (Table 1).

Nutrition

The chemical composition and physical form of poultry feed and feed ingredients are one of the most important factors affecting the pathogenesis of necrotic enteritis in broiler chicks. They can alter the intestinal microbiota and create an intestinal environment that favors the growth of *C. perfringens*, which is key risk factor to the outbreak of necrotic enteritis (Palliyeguru et al., 2010; Barekatain et al., 2013). Cereals, such as wheat, rye, oats and barley, contain high levels of indigestible, water-soluble, non-starch polysaccharides (NSP), and predispose to necrotic enteritis, whereas maize is not (Kaldhusdal & Skjerve, 1996; Timbermont et al., 2011). Animal proteins, such as fishmeal, are favorable substrates for clostridial growth, and high concentrations in broiler feeds are often associated with necrotic enteritis. Glycine and methionine levels in fish-meal are higher than in soya concentrate, and these amino acids are known to stimulate *C. perfringens* growth *in vitro* (Drew et al., 2004; Wilkie et al., 2005). The dietary fat source may also have an effect on the *C. perfringens* population. Animal fat (lard or tallow) increases *C. perfringens* ileal counts compared with vegetable oil (Knarreborg et al., 2002). The physical form of feed particles may influence the incidence of necrotic enteritis and evidence shows that diets that have been hammer-milled as opposed to roller-milled are less likely to induce necrotic enteritis (McDevitt et al., 2006). Programmed alterations in the feeding regime (moving from starter diets to grower diets) are frequently associated with necrotic enteritis (Ross Tech, 1999). The use of enzymes in diets is now ubiquitous in intensively produced poultry systems. They can affect the nutrient availability for the chick and the intestinal microbiota, simultaneously. Increased mortality, due to phytase supplementation, was also likely secondary to an increase in nutrient availability for *C. perfringens* (Acamovic, 2001; Paiva et al., 2014).

Infectious agents

The best-known predisposing factor for necrotic enteritis is the mucosal damage caused by coccidial infection (Williams, 2005). Intestinal damage results in the release of plasma proteins into the lumen of the intestinal tract and provides a necessary growth substrate for extensive proliferation of *C. perfringens*. Moreover, coccidial infection induces a T-cell-mediated inflammatory response that enhances intestinal mucogenesis. This enhanced mucin production provides a growth advantage to *C. perfringens*, due to its mucolytic ability (Collier et al., 2008). On the contrary, attenuated anticoccidial vaccination, which also causes mild intestinal lesions, showed a significant protective effect against subclinical experimental necrotic enteritis in broiler chicks (Tsiouris et al., 2013). Exposure to immunosuppressive agents, such as infectious bursal disease, chick infectious anaemia virus and Marek's disease, as well as non-specific stress, reduce the of chicks resistance to gut infections and could predispose birds to necrotic enteritis (McReynolds et al., 2004). Mycotoxins are one of the most common contaminants in poultry feed, worldwide. In an experimental necrotic enteritis model, broiler chicks fed a diet contaminated with 5 mg Deoxynivalenol/kg of feed were more prone to develop necrotic enteritis lesions compared to chicks on a control diet (Antonissen et al., 2014; Murugesan et al. 2015).

Management factors

Any factor that causes stress in broiler chicks could suppress the immune system and disturb the balance of the intestinal ecosystem in such a way that the risk of necrotic enteritis outbreak increases. Stocking density is a management factor with critical implications for the poultry industry since it can negatively affect the performance, welfare and health of birds. As far as necrotic enteritis is concerned, high stocking density increased the incidence and severity of necrotic enteritis significantly and liver lesions as well as the pH and *C. perfringens* counts in caecum in an experimental necrotic enteritis model (McDevitt et al., 2006; Tsiouris, 2015a).

Feed restriction constitutes a feed management strategy in poultry industry and is applied in order to control the growth rate and to prevent metabolic disorders. The reduction of nutrients in the intestinal tract alters the intestinal microbiota, changes the physico-chemical properties of the intestinal digesta and disturbs the balance of the intestinal ecosystem. The results of experimental study showed that feed restriction of broiler chicks limited the severity of necrotic enteritis lesion and reduced the *C. perfringens* population in the caecum in a necrotic enteritis experimental model (Zhan et al., 2007; Thompson et al., 2008; Tsiouris et al. 2014).

Temperature is one of the most important physical environmental stressors, which could significantly affect the performance, health and welfare of poultry as well as the profit for the producer. According to the results of the experimental study, cold stress predisposes birds to develop necrotic enteritis lesions, as a result of the immunosuppression of birds, when exposed to low temperatures. Similarly, heat stress was associated with the outbreak of necrotic enteritis in not challenged birds and increased severity of necrotic enteritis lesions in experimentally infected broiler chicks (Mashaly et al., 2004; Burkholder et al., 2008; Tsiouris et al., 2009; Tsiouris et al., 2015b).

Conclusion

The ban of antimicrobials and the financial impact of necrotic enteritis in modern broiler industry have led to the development of new strategies for its control. The identification of *C. perfringens* virulence factors and the control of predisposing environmental factors are strategies of major importance. In addition, better farm management, including biosecurity measures, optimization of feed quality and nutriceutical alternatives (probiotics, prebiotics, organic acids, enzymes, herbs and so on) have become more relevant. The past decade was characterized by great progress in understanding the etiology and pathogenesis of necrotic enteritis in the gut of chicks. New research should focus on reducing the risk of the disease by controlling the *C. perfringens* in the intestine and by enhancing the immune system and the intestinal microbiota of chicks without the use of antibiotics.

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Table 1. The effect of various factors on the pathogenesis of necrotic enteritis in broiler chicks.

FACTOR	EFFECT	PATHOGENESIS	REFERENCE
		NUTRITIONAL FACTORS	
Indigestible, water-soluble, non-starch polysaccharides (NSPs)	Predispose	Acts as substrates for the intestinal microbiota, increases the viscosity of intestinal content, decreases nutrient digestibility, increases intestinal transit time, diarrhea and wet litter	Kaldhusdal & Skjerve, 1996; Barekatain et al., 2013
Fishmeal (glycine and methionine amino acids)	Predispose	Stimulate *C. perfringens* proliferation and a-toxin production	Drew et al., 2004; Rodgers et al., 2015
High concentrations of protein, imbalanced profiles of amino acids	Predispose	Acts as substrate for the intestinal microbiota, raises the pH of the lower intestine, enhances proliferation of *C. perfringens*	Wilkie et al., 2005; McDevitt et al., 2006; Palliyeguru et al., 2010;
Animal fat (lard or tallow)	Predispose	Increases the viscosity of intestinal content, decreases nutrient digestibility, increases intestinal transit time, diarrhea	Knarreborg et al., 2002
Physical form of feed particles	Predispose	Small feed particles move more rapidly through the intestine, reduce *C. perfringens*' adhesion to the gut epithelium	Engberg et al., 2002
Programmed alterations in the feeding regime	Predispose	Changes in pH, diet composition, enzyme supplementation, host immune status	Ross Tech, 1999
Enzymes	Partially protect	Increases nutrient availability for the bird, reduces substrate availability for the intestinal microbiota	Acamovic, 2001; Barekatain et al., 2013; Paiva et al., 2014
Organic acids (OA)	Partially protect	OA with high pKa values reduce the pH of the intestine, OA with low pKa values are absorbed by the bacteria and disrupt the biochemical pathways	Van Immerseel et al., 2006
		INFECTIOUS FACTORS	
***Eimeria* spp. infection**	Predispose	Damage of intestinal mucosa, release of plasma proteins into the lumen of the intestinal tract, growth substrate for proliferation of *C. perfringens*, T-cell-mediated inflammatory, enhance intestinal mucogenesis, provides a growth advantage to *C. perfringens*	Williams, 2005; Collier et al., 2008
Attenuated anticoccidial vaccination	Partially protect	Stimulation of nonspecific and specific immunity mechanisms, prevention of coccidiosis, discourages the attachment of *C. perfringens* to epithelium, its colonization and toxinogenesis	Tsiouris et al., 2013
Immunosuppressive agents	Predispose	Reduce resistance to gut infections	McReynolds et al., 2004
		MANAGEMENT FACTORS	
Stocking density	Predispose	Increased build-up of *C. perfringens* spores in the litter, poor litter quality and increased risk of spread by contact or by aerosol	McDevitt et al., 2006; Tsiouris et al., 2015a
Starvation	Partially protect	Neuroendocrine and immune effects, beneficial effects on the cardiovascular system, stimulation of blood circulation to the intestinal mucosa and chemotaxis of immune cells	Tsiouris et al. 2014
Cold stress	Predispose	Immunosuppression, increased feed consumption	Tsiouris et al. 2015b
Heat stress	Predispose	Immunosuppression, alteration of synthesis of intestinal microbiota, increased heat shock proteins, hemodynamic changes and particularly the reduction in blood flow to the intestinal mucosa	Mashaly et al., 2004; Burkholder et al., 2008; Tsiouris et al., 2009

O42 Metagenomic Analysis of Gut Microbiome Associated with Early Chick Mortality

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Abstract

To determine the microbiome associated with early chick mortality, gut microbiomes of dead and healthy chicks were compared in this study. Bacterial 16S rDNA sequences in ceca of chicks were read by Ion Torrent next generation sequencing system and subjected to metagenomic analysis. While relative abundance of class *Clostridia* reduced from 65% in healthy to 5% in dead chicks, class *Proteobacteria* increased from 26% in healthy to 94%in dead chicks. Major differences were detected in *Lachnospiraceae* family of class *Clostridia* and *Gammaproteobacteria* family of class *Proteobacteria*. It was concluded that there were considerable differences between major taxons of microbiomes of dead and healthy chicks, and this microbiome can be associted with early chick mortality.

O43 Metagenomic Analysis of Cecal Microbiome Associated with Growth Retardation in Broiler

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Abstract

Cecal microbiome of an experimental broiler flock with 4 days retard in the mean-live weight gain at day 14 was determined by using 16S metagenomics kit with next generation sequencing (Ion Torrent). According to the consensus results of metagenomics analysis, 7 phyla, 13 classes, 18 orders, 40 families, 32 genera and 30 species were detected. Firmicutes and Proteobacteria constituted 99 and 0.9% of consensus, respectively; remaining was distributed into *Actinobacteria*, *Bacteroidetes*, *Cyanobacteria*, *Synergistetes* and *Tenericutes* phylum. In phylum Firmicutes, classes of Clostridia (51%), Erysipelotrichia (42%), Negativicutes (4%) and Bacilli (2%) were identified. Most abundant species within all prokaryotes and Firmicutes were *Clostridium spiroforme* (28%), *Faecalibacterium prausnitzii* (9%) and *Ruminococcus torques* (3%). Six species of Lactobacillus, known as probiotics were also detected in very low numbers. It was suggested that this dysbiosis might be originated from iota-toxin producing *C.spirofirme*, and bacteria such as *F.prausnitzii* and Lactobacillus might regulate the microbiota. When ingredients responsible for dysbiosis were removed from ration and ingredients promoting the beneficial bacteria were added to it, animals regained the normal development parameters.

Key words: broiler, cecum, microbiome, metagenomics

O[44] Investigation of Antimicrobial Resistance Profiles and Significant Serotypes of Chicken *E. Coli* Isolates

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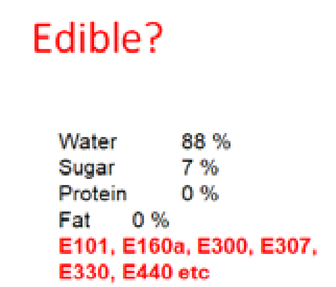
Abstract

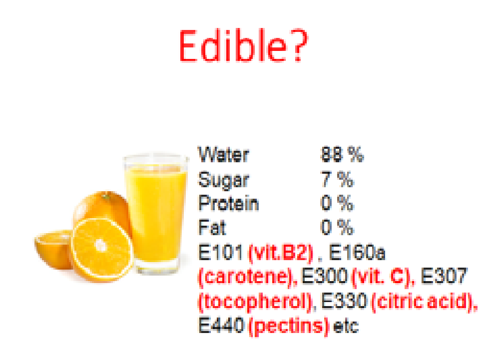
In this study, the isolation of *E. coli* from chickens infected by colibacillosis, the investigation of the antimicrobial susceptibility profiles of the these isolates, the determination of the distribution of most important antibiotic resistance genes in resistant isolates and the incidence of frequent serotypes (O1, O2, O18, O78) in poultry were aimed. One hundred-fifty isolates obtained from internal organs of chickens infected with colibacillosis were consisted the material of this study. The resistance status of these isolates to 12 antimicrobial agents that belongs to seven antimicrobial families was examined by antibiotic disk diffusion method. Twenty-three the most important resistance genes in antibiotic-resistant strains and the most common APEC serotypes were investigated with polymerase chain reaction (PCR). While the 6.7% of the isolates were susceptible for all antimicrobials, the 66.7% of these were multidrug resistant. It was determined that 150 isolates of *E. coli* were resistant at a rate of 73.3%, 68.7%, 63.4%, and 60.7% to amoxicillin/ampicillin, tetracycline, enrofloxacin, trimethoprim/ sulfamethoxazole, respectively. The bla_{tem}, bla_{cmy}, bla_{shv}, bla_{ctx}, bla_{oxa} resistant genes in beta-lactam-resistant isolates, the *tet*A, *tet*B resistant genes in tetracycline-resistant isolate, the *qnr*A in quinolone-resistant strains, the *drf*A1, *drf*A7,17 in trimethoprim-resistant isolates, the *sul*II gene in sulfamethoxazole-resistance isolates were detected as resistant genes. It was determined that 18.0% of isolates were O78, 10.0% were O2, 2.7% were O1, and 2.0% were O18. The high resistance to antimicrobials and multiple drug resistance in APEC isolates showed that there was a significant resistance problem in the region. The zoonotic potential of the identified serotypes was also important. It is thought that more epidemiological studies should be designed to investigate the virulence properties and clonal groups of APEC.

Key Words: Avian pathogenic *E. coli,* antibiotic resistance*,* serotype

IS[23] Alternative Feed Resources for Sustainable Broiler Production-Insect Meals

Damian Józefiak
Poznan University of Life Sciences Faculty of Veterinary Medicine and Animal Science





ENTOMOPHAGY

- 1900 EDIBLE INSECTS
- 150 COUNTRIES REGULAR PART OF THE DIET
- EUROPE?

PERCEPTION?

BEES ARE NICE!

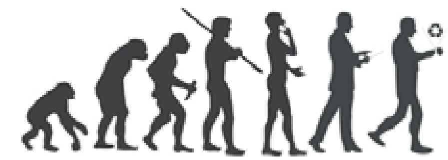
PERCEPTION?

E120 -CARMIC ACID

E120 -CARMIC ACID

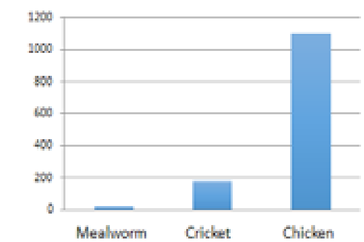
WHY WE SHOULD CONSIDER INSECTS IN ANIMAL NUTRITION?

FEED OF THE EVOLUTION



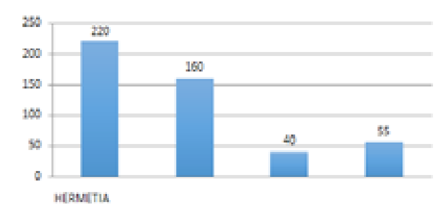
EVOLUTIONARY ADAPTATION - CHITINASE

Ammonia emission mg/day/kg body weight gain



Insects as a sustainable feed ingredient in pig and poultry diets - a feasibility study, Report 638, 2012
Józefiak et al. unpublished

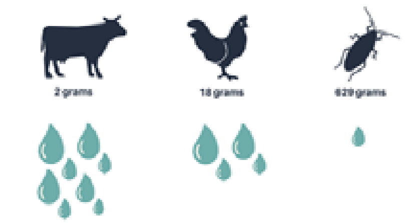
Live (kg) animals from 1 m^2 in 42d



Józefiak et al. 2015

STOCKING DENSITY – NO PROBLEM!

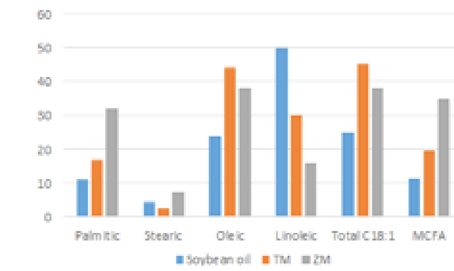
WATER CONSUMPTION



ENVIRONMENT

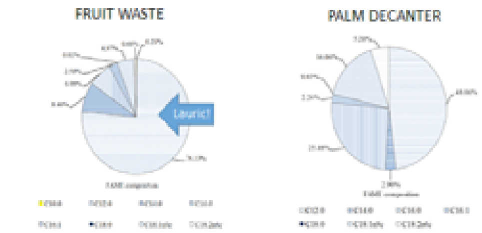
- Low green house gas emission
- Low use of H_2O
- Waste products transferred to high quality protein and fat
- Non-GMO

FATTY ACIDS PROFILE (%) OF THE TENEBRIO MOLITOR (TM) AND ZOPHOBAS MORIO (ZM)



Józefiak et al. 2017 in press

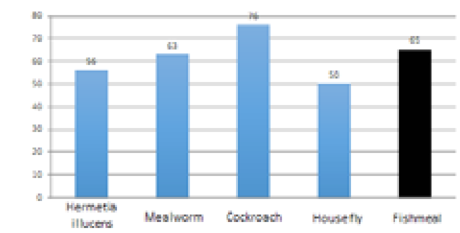
FATTY ACIDS PROFILE OF THE BLACK SOLDIER FLY LARVAE FED DIFFERENT DIETS (%)



Leong et al. 2015

NUTRITIVE VALUE OF INSECTS

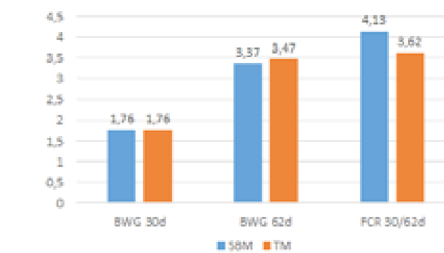
CRUDE PROTEIN (%) IN DIFFERENT FULL FAT INSECT MEALS



Józefiak et al. 2016

PERFORMANCE RESULTS?

IN VIVO PERFORMANCE OF „SLOW GROWING" BROILERS FED SOYBEAN MEAL (SBM) OR *TENEBRIO MOLITOR* LARVAE MEAL (TM) IN THE PERIOD 30 TO 62 D OF AGE



Bovera et al. 2016

INSECT FULL-FAT MEALS AMINO ACID PROFILE (% LYSINE)

	Mealworm	Cricket	Hermetia illucens	Cockroach	Housefly	Fish meal LT
Lysine	100	100	100	100	100	100
Histidine	55	42	46	51	41	33
Arginine	92	108	86	114	71	74
Threonine	73	66	64	67	48	55
Valine	120	98	100	104	64	62
Methionine	24	30	25	27	32	37
Cysteine	12	17	13	14	6	15
Isoleucine	81	131	119	118	83	51
Leucine	140	59	68	62	72	95
Phenylalanine	65	17	20	17	46	46
Tryptophan	19	17	20	17	46	15

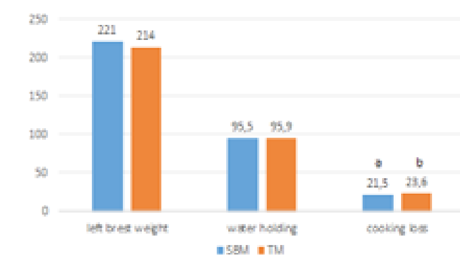
Józefiak et al. 2016

WHAT ABOUT INSECT OILS?

DRY MATTER, OM, AND CP ILEAL DIGESTIBILITY OF BROILERS FED SOYBEAN MEAL (SBM) OR *TENEBRIO MOLITOR* LARVAE MEAL (TM) AT 62 D OF AGE

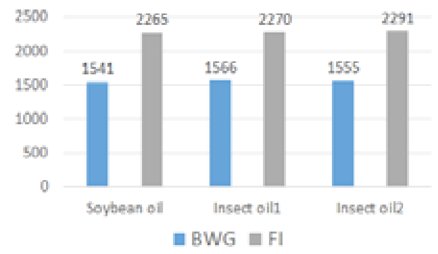
Bovera et al. 2016

PHYSICAL PROPERTIES OF BREAST MUSCLE OF BROILERS FED SOYBEAN MEAL (SBM) OR *TENEBRIO MOLITOR* LARVAE MEAL (TM) AT 62 D OF AGE



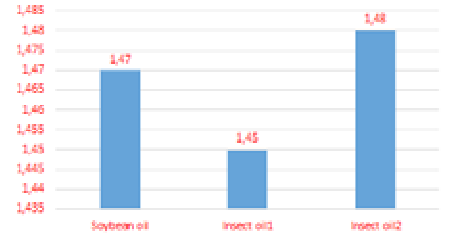
Bovera et al. 2016

PERFORMANCE OF THE FEMALE ROSS 308 1-28D FED 5% INCLUSION OF THE INSECT OILS IN PELLETED DIETS



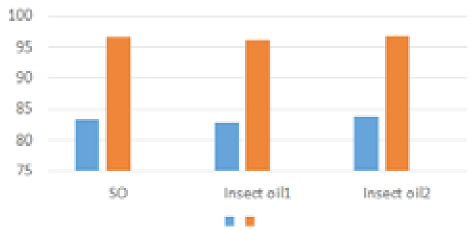
Józefiak et al. 2017 in press

FEED CONVERSION RATIO (kg/kg) OF THE FEMALE ROSS 308 1-28D FED 5% INCLUSION OF THE INSECT OILS IN PELLETED DIETS



Józefiak et al. 2017 in press

THE EFFECT OF SOYBEAN OIL AND SELECTED INSECT OILS ON APPARENT ILEAL DIGESTIBILITY OF CRUDE PROTEIN AND ETHER EXTRACT, FEMALES 28D



Józefiak et al. 2017 in press

INSECT DEFENSINS a class of small, cysteine-rich antimicrobial peptides primarily active on Gram-positive bacteria

Ganz 2003, Gao & Zhu 2013

PROGRESS IN EUROPEAN UNION ?

International Platform of Insects for Food and Feed

ipiff

IPIFF MEMBERS 2016

PROTIX, Ynsect, KOPPERT, Proti-Farm, Hermetia, MIPROMINE, micronutris, ENTOMO, nextProtein, AgriProtein, entomos, ENTOMEAL, gryö, BioBee, italbugs, PROVIVAM, VÍUR, DANISH TECHNOLOGICAL INSTITUTE, 4ento

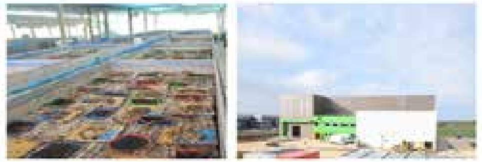
International Platform of Insects for Food and Feed

ipiff

IPIFF MEMBERS PROFILE

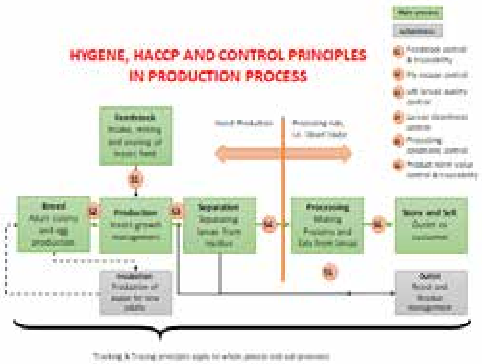
- Mainly European members, but also non-EU companies targeting at the EU market.
- Insect producing companies (farming & processing), other firms in the insect value chain (e.g. equipment, distribution) & 'knowledge sharing' members.
- All producing for feed & food, some of them producing also for other markets like biological control, green chemistry and plant nutrition.

SCALING UP INSECT PRODUCTION



From "hobby" style ⟷ to industrial scale & process control

HYGIENE, HACCP AND CONTROL PRINCIPLES IN PRODUCTION PROCESS



WHY INSECT PROTEIN&FAT COULD BE SUSTAINABLE ALTERNATIVE?

CONCLUSIONS

- Insects are a very promising source of protein&fat for animals
- Environmentally friendly production
- More research is needed in the area of nutritive value of processed insects
- Secondary effect of insect proteins and chitin?

IS24 Updates in Ca and P Requirements of Broiler Chickens

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[2]Beypiliç Inc. Bolu, Turkey

Abstract

3 consecutive large scale broiler trials were conducted in Beypiliç Broiler Research Development Facilities with 12000 broilers. 7 dietary treatments were tested including current 2014 Ca and P recomendation for Ross 308 broilers. The average Ca and P level as % of Ross recomendadtion were 93.39, 90.83, 89,80, 87.16, 87.16 and 85.63 for 2, 3, 4, 5 6 and 7th treatments respectively. In the 2nd and 3 rd experiment the number of treatments was reduced to 5 by removing 2 treatments closest to Ross recommendation and the left 5 including Ross control were tested. Each treatments has 8 replicates in the 1st experiment and 12 in the 2nd and 3 rd experiment with 200 broiler chicks. Growth performance and tibia parameters were explored to evaluate the dietary level of Ca and P by comparing the control treatment received Ross Ca and P recommendations. Body weight (BW), feed conversion (FCR), feed intake and mortality results of the first experiment showed that the birds received low Ca and P diets as low as 10 % reduced minerals did not cause any growth depression, besides average of Ross recommendation had almost same growth without any impairment. Besides it is interesting that all groups received reduced Ca and P diets had better BW and FCR than the birds fed Ross Ca and P recommended diets. (P>0.05). There was also no significant differences among the groups in ash and phosphorus content of tibia(P>0.05). The tibia ash level was between 35.07 to 36.59% and tibia P 17.31 to 17.36% respectively. The results of the 3 broiler experiments showed that the current Ca and P recomendation of Ross 308 broilers are higher than real requirement and needs to be updated. It can be concluded that at least 10% reduction is possible and would not cause any impairment in broiler growth and bone development.

Key words: Ca, P, requirement, tibia, growth, broilers

Introduction

Calcium (Ca) and phosphorus (P) are the most important minerals in poultry diets because of being involved skeletal development and celular metabolism. Therefore, accurate estimation of their requirement is essential to maximize poultry productivity. However, the requirement of both minerals have not been optimised because of changes in broiler growth, phytate presence in vegetable feeds, and the interaction between Ca and P. Selected fast-growing strains have shown lower bone-ash content than slow-growing strains (Williams et al., 2000), which suggest that optimum requirement for broilers needs to be adjusted properly. Current recommendations [10 g Ca/kg and 4.5 g nonphytate P (NPP)/kg at ages 1 to 21 d (NRC, 1994) seems to be higher for modern broilers. Although commercial broiler companies has chanced Ca and P recomendations, it has not still been optimised. For example Ca and P recomendation for Ross 308 broilers were reduced 6.3% and 4.4% respectively from 2009 to 2014, while Cobb company decreased higher level as 14.1% and 12.7% respectively from 2006 to 2012. The reason behind these assumption is interaction of Ca with many nutrients in the gut. High dietary Ca has been implicated in reduced animal performance (Sebastian et al., 1996) and interference with macromineral absorption (Simpson and Wise, 1990). Calcium may form soap precipitates with free saturated fatty acids, thus decreasing the dietary energy digestibility (Pepper et al., 1955; Edwards et al., 1960), and has the capacity to interact with inorganic P in the gut (Hurwitz and Bar, 1971) as well as to form a mineral–phytate complex in excess of pH 5.0. The Ca–phytate complex may reduce Ca absorption (Lonnerdal et al., 1989) but may also reduce the activity of endogenous and exogenous phytase (Tamim et al., 2004). Decreasing dietary Ca may improve P utilization, while an excess of Ca may aggravate a P deficiency for ash criteria (L´etourneau–Montminy et al., 2008). Other factors, such as the high acid-binding capacity of limestone, have also been related to significant decreases in the protein and P solubility in the gizzard, and may affect N and P digestibility (Tamim and Angel, 2003; Selle et al., 2009; Walk et al., 2012). Hamdi et al., (2015) showed significant reduction in fractional retention of Ca from 74% to 46% at 0.50 dietary Ca compared to 0.90%.

Therefore, it was aimed to evaluate the Ca and P requirements of the modern broilers by conducting 3 consecutive large scale broiler experiment.

Materials and Methods

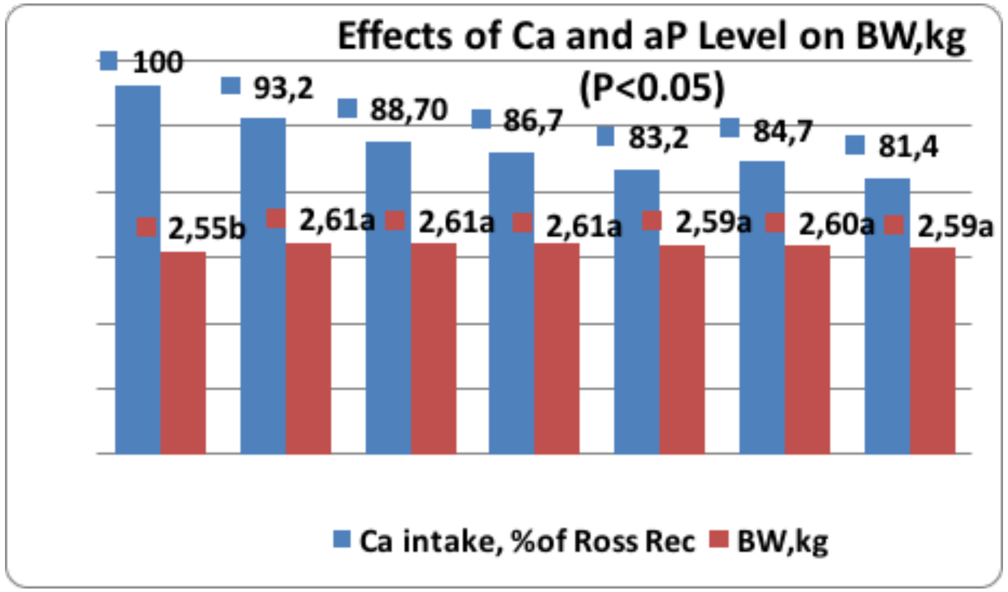
3 consecutive large scale broiler trials were conducted in Beypiliç Broiler Research Development Facilities which has 12000 broiler capacity. Each treatment was consisted of at least 8 replicates with 200 Ross 308 broilers

All basal diets based on corn and soybean but also contained wheat, sunflower meal , corn gluten meal and poultry meal depending on feedstuff availability. DCP, MDCP and Calcium Carbonate were used as Ca and P sources. In the 1st experiment 7 dietary treatments were tested including current 2014 Ca and P recomendation for Ross 308 broilers. The average Ca and P level as % of Ross recomendadtion were 93.39, 90.83, 89,80, 87.16, 87.16 and 85.63 for 2, 3, 4, 5 6 and 7th treatments respectively. All feeds were pelletted and served as adlibitum. Body weight, and feed consumption were measured at the beginning and end of starter and finisher periods thereafter. Mortality was defined daily. At the end of the experiment 1 male and 1 female birds close to average pen weights from each replicates were obtained for bone and carcasse measurements in all 3 trials. Left tibia were used to determine the ash, and P content. At the end of 6 weeks of age 1 male and 1 female birds from each replication were killed by cervical dislocation and their left tibia was removed for ash and P analysis. The tibias were kept in -20 ^{o}C until they analyzed for ash and P. When tibias used to mineral analysis, fat and meat on the bones were cleaned. The bones were burned at 550 ^{o}C in the oven to define the ash content. The ash for each tibia then further analyzed for phosphorus according to the procedures stated in AOAC, 2005(Association of Official Analytical Chemists, 2005). The data for all response variables were analyzed by ANOVA using the GLM procedure of Minitab 13..When significant differences (P < 0.05) among groups were found, means were separated using the Tukey HSD test.

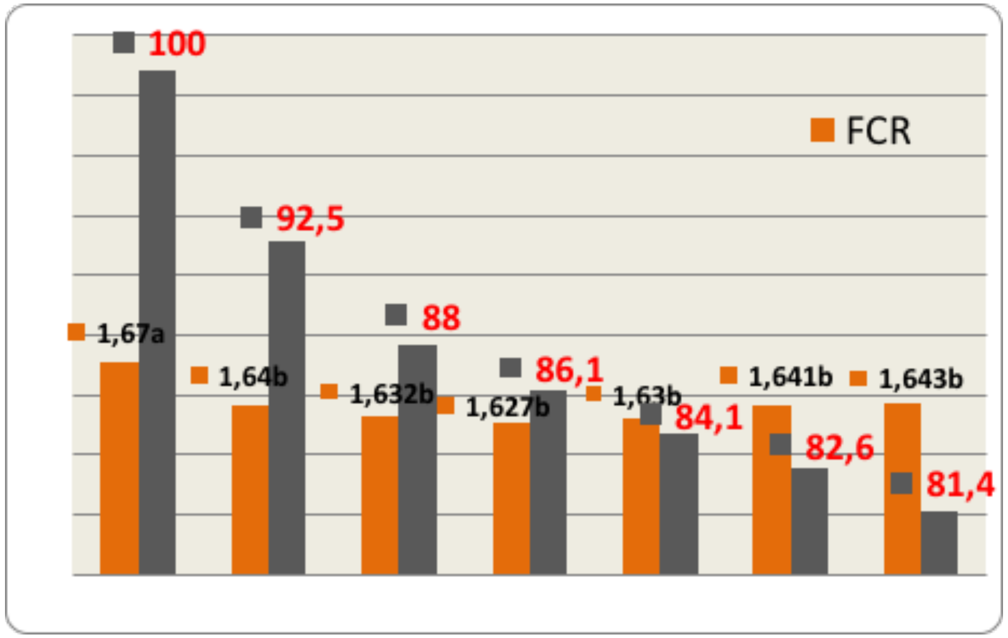
Results and Discussion

Body weight (BW) and feed conversion (FCR) results of the first experiment are summarized in the figures 1 and 2 respectively. The figures clearly showed that BW and FCR of the birds fed as low as around 82% average of Ross recommendation had almost same growth without any impairment(P>0.05). Besides it is interesting that all groups received reduced Ca and P diets had better BW and FCR than the birds fed Ross Ca and P recommended diets. There was also no significant differences among the groups in tibia ash and tibia phosphorus (P>0.05). This means that even bone development was not significantly influenced by the reduction in dietary Ca and P level (P>0.05). The tibia ash level was between 35.07 to 36.59% and tibia P 17.31 to 17.36% respectively. In the 2nd and 3rd experiment the number of treatments was reduced to 5 where the 2 treatments closest to Ross recommendation were removed and the left 5 including Ross control were applied. The results of the 1st experiment were confirmed in the 2nd and 3rd experiment. So the results of the 3 consecutive experiment showed very interesting results which updates the Ca and P requirements of modern broilers. Many reason can be speculated for these assumption. One of the important explanation about successful reduction in Ca and P level is the problematic structure and making insoluble complex of Ca with other nutrients. Because of understanding of Ca less or wrong way on bone development in the past, the level of dietary Ca in broiler diets kept higher by ignoring it's reaction capacity with especially P. So as Ca level kept higher the level of P was increased consequently. Some of below reports supported the above assumption. As high dietary Ca has been implicated in reduced animal performance (Sebastian et al., 1996) and interference with macromineral absorption (Simpson and Wise, 1990) and calcium could form soap precipitates with free saturated fatty acids, (Pepper et al., 1955; Edwards et al., 1960), and has the capacity to interact with inorganic P in the gut (Hurwitz and Bar, 1971) as well as to form a mineral–phytate complex in excess of pH 5.0, the net results of higher Ca would limit the growth performance of broilers. Also because of Ca–phytate complex could reduce Ca absorption (Lonnerdal et al., 1989), we need to have more work on Ca requirements of modern broilers. Without understanding the exact Ca requirement of broilers, it isnot possible to obtain best growth and FCR and also cheaper diets. This would also leed to keep environment more clean as P excretion via manure was reduced also.

Fiure 1: Effects of Ca and P level on body weight of broilers obtained in the 1st experiment



Fiure 2: Effects of dietary Ca and P level on FCR of broilers obtained in the 1st experiment



Conclusion

The results of the 3 broiler experiments showed that the current Ca and P recomendation of Ross 308 broilers are higher than real requirement and needs to be updated. It can be concluded that at least 10% reduction is possible and would not cause any impairment in broiler growth and bone development. However the reduction level is not same in each growth phase and can be significantly different. So total Ca and P intake should be carefully studied and then decided before any level of reduction applied, because no updated Ca and P recomendation from Ross has not reported. It is also recomended for Ross focuse on the Ca and P minerals and to meet the requirement of modern Ross 308 broilers soon.

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O45 A Commercial Blend of Plant-Derived Compounds Increases Production Performance of Broilers in a Commercial Broiler Farm

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Introduction

Plant-derived bio-active compounds are very promising alternatives for in-feed antibiotics in poultry nutrition to promote general health of the birds. Based on their antioxidant and immunomodulating capacities, phytogenic substances are proposed to have a beneficial effect on liver, kidney and gut health. In this research, the efficacy of a commercial phytogenic feed additive, to improve production performance was studied in a commercial broiler farm.

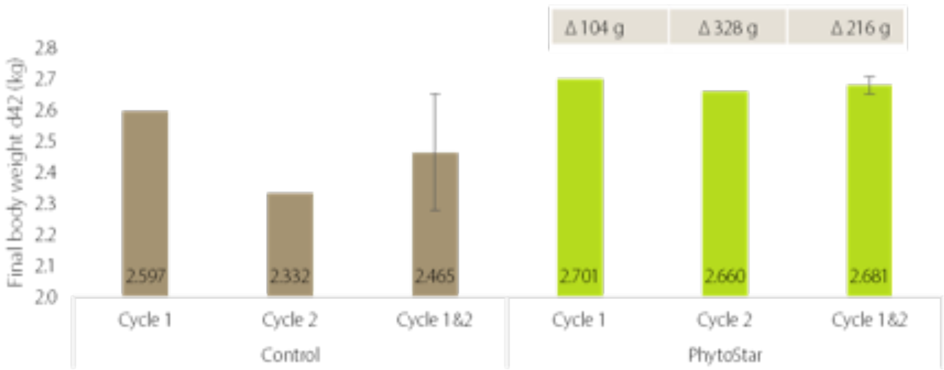
Material and Methods

An experiment was setup in a commercial broiler farm in Belgium in which 36,500 1-day old broilers (provided by Lafaut, Belgium) were divided over two poultry houses. On day 1, a vaccine against coccidiosis and on day 17, vaccines against Gumboro and Newcastle disease were added to the drinking water and water was available ad libitum. Two dietary treatments were tested: a commercial wheat-based diet (Joosen-Luyckx, Belgium), which served as control diet and the same diet supplemented with 350 ppm plant-derived compounds, from day 5 until day 42, provided in 5 dietary phases. In one of the two poultry houses, chickens received the control diet, whereas chickens in the other house received the plant-derived compounds -supplemented diet. After one cycle, the allocation of the treatment groups to the two houses was switched and the same protocol was repeated. Final average body weight was determined by calculation of the total weight per house and the number of birds at the end of the trial as registered by the slaughterhouse (Belki, Belgium).

Results

Supplementation of plant-derived compounds increased the body weight in both cycles. Body weight increased from 2.597 kg to 2.701 kg, and from 2.332 kg to 2.660 kg, this is an improvement of 104 g and 328 g compared to the control group, respectively. The average final body weight of the broilers increased from 2.465 kg to 2.681 kg or an average difference in weight gain of 216 g per broiler during a 6-week cycle (Figure 1).

Figure 1: The final bodyweight (kg) of broilers at day 42 receiving a control diet and a diet with plant-derived compounds.



Conclusion

Continuous supplementing PhytoStar to the diet improved broiler performance, indicating a potential beneficial effect on general health. The underlying mode of action needs further investigation.

POSTERS

P01 Effect of Dietary Sodium Butyrate Supplementation on Performance, Intestinal Microflora, and Intestinal Morphology

Umair Ahsan, Aybala Kübra Önal, Eren Kuter, Özcan Cengiz, Ifrah Raza
Adnan Menderes University, Faculty of Veterinary Medicine, Department of Animal Nutrition and Nutritional Diseases, Aydın, Turkey

Abstract

The effect of sodium butyrate on various bodily parameters of broilers such as performance, gut microflora, gut morphology, is reviewed in order to highlight its importance as an alternative to antibiotic growth promoters. Sodium butyrate is used as a source of butyric acid, which is known for its beneficial effects in the gut in monogastrics. Sodium butyrate is available in uncoated and entericcoated forms protected with fat or fatty acid salts. Varying results in productive performance, gut microbes, and gut morphology have been reported in the literature in response to supplementation of broiler diets with uncoated and fatcoated types of sodium butyrate. Although there are contrasting results of sodium butyrate in chicken, further research is needed using the sodium butyrate coated with the salts of fatty acids.

P02 Eubiotics in Broiler Nutrition

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Uludağ Adnan University, Faculty of Veterinary Medicine, Department of Animal Nutrition and Nutritional Diseases, Bursa, Turkey

Abstract

The purpose of this review is to declare the term of eubiotic that is supposed as alternative to antibiotics for the purpose of protecting the gut health following prohibition of antibiotics and to show the effects of eubiotics on performance in poultries.

P03 The Effect of Animal Welfare on Meat Quality in Poultry

Hatice Berna Poçan[1] Mustafa Karakaya[2]
[1] Selçuk University, Çumra Vocatıonal School, Department of Food Processıng, Konya
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Abstract

Healthy living, continuity of physical and mental activities, growth and development are only possible with adequate and balanced nutrition. The level of nutrition is accepted as one of the important criteria of social development. Today, the impact of adequate and balanced nutrition on community health has been seen in many studies. Animal products come first in meeting energy, protein, vitamins and minerals needs that are necessary for adequate and balanced nutrition of humans. Meat is among animal foods; High quality protein, rich in vitamins and minerals, delicious, satisfying and easy to digest food materials. The poultry meat has all these features and it is also favorite for consumers because of the low production cost. There are many factors that affect poultry meat quality. All factors are taken into account, from the genotypes of the animals to the way they are raised and to the pre-slaughter treatments. The fact that animals are physically and psychologically healthy, which is called animal welfare, is one of the issues that have attracted attention in recent years. If animal welfare is not provided, both physical and psychological problems arise in living things. This causes some biochemical changes in the body's living organism, which is reflected negatively in meat quality. It is important to serve quality meat to the consumer considering all the factors that affect carcass and meat quality in poultry. For this purpose, European Union animal welfare work is being done and it is very extensive. In our country, studies on animal welfare are fairly new and open to development. In this review, the factors affecting meat quality in poultry and the effect of animal welfare on meat quality were tried to be explained.

Keywords: Poultry meat, Animal welfare, Meat quality.

P04 Use of Coriender (*Coriendrum sativum L.*) Seed in Broiler Nutrition

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Abstract

Broiler production has the largest cut in animal production types for meets the needs of white meat of societies. The prohibition of antibiotics in the broiler nutrition; some medicinal and aromatic plants have attracted great interest as an alternative with for the antibiotics. One of these is coriander. The active ingredients of coriander seed are come into prominence with some specialities like performance improver, intestinal microflora and morphology developer for broilers. In this review, some researches about the use of coriander seed in broiler nutrition.

Key words: Coriander seed, broiler, performance.

P05 Use of Cinnamon (*Cinnamomum spp.*) in Broiler Nutrition

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Abstract

The use of antibiotics is banned as a growth promoter in broiler production, which is aimed to fast and high weight gain. However, especially aromatic plants have been seen as an important alternative to antibiotics. Cinnamon species (*Cinnamomum spp.)* are also these aromatic plants. Cinnamon is used as a spice and also medical plant, it's seems that cinnamon can be used in broiler feeds for performance and carcass quality improving effects. In this review, it's investigated that researches about using of cinnamon in broiler nutrition.

Key words: Cinnamon, broiler, performance, carcass.

P06 Use of Pulsed Electric Fields on Poultry Meat Industry and Effects On Oxidation, Color, Texture and Sensory Propertıes

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Abstract

Recent demand for fresh-like products, has caused alternative methods to be a priority in the protection of food products. Pasteurization of food by heat application is the oldest and the most common method for food in preservation with the objective of safe food production with longer shelf life by enzyme and microbial inactivation. However, heat treatment causes some unwanted changes in the physical and chemical features of food (such as browning, loss of texture, loss of vitamins and volatile compounds or decrease in the nutritional value etc). Therefore, it is the objective of food industry to inactivate both enzymes and microorganisms by using different forms of energy by the non-thermal food preservation methods are currently of foods. In this regards, alternative non-thermal food preservation methods such as pulsed electric fields (PEF) are at the forefront. However, it is possible that PEF causes physical degeneration in the muscle tissue and it can affect the sensorial features of the meat both positively (increased softening) and negatively (closed-flavor development). For this reason, effect of PEF on poultry meat and studies regarding processing of poultry meat by PEF are summarized in this article.

Keywords: Pulsed electric fields (PEF), poultry meat, sensorial features, oxidation

P07 The Use of Electrlyzed Water in Poultry Meat Industry

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Abstract

The basis of food safety depends on both hygiene and sanitation. For this reason, cleaning and disinfection process as well as the used disinfectant substances must not present health risks. Electrolyzed oxidizing (EO) water has been regarded as a new sanitizer in recent years. Electrolyzed water has certain important advantages to other conventional agents of cleaning, such as effective disinfection, user-friendly, relatively low cost, and being environment-friendly.

Studies have been carried out on the use of EO as a sanitizer for fruits, utensils, and cutting boards. It can also be used as a fungicide during postharvest processing of fruits and vegetables, and as a sanitizer for washing the carcasses of meat and poultry. Therefore, the aim of this review is to inform about electrolyzed water and its use in poultry meat industry.

Key words: Disinfection, electrolyzed water, poultry meat

P08 Ozone Applications in Poultry Meat Industry

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Abstract

Even though high hygiene and sanitation practices are applied in modern poultry processing plants, infections and intoxications related to poultry meat is one of the biggest public health issues. Ozone having antimicrobial properties finds a place to itself in primarily in food industry and especially in poultry processing plants. Production and potential applications of ozone and its potential as an alternative to classic disinfection agents in poultry industry as well as recent development were discussed in this review.

Key Words: Ozone, disinfection, shelf life, poultry meat

P09 Biogen Amins in Poutry Meat

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Abstract

Biogenic amines are compound formed by decarboxylation of free-amino acids or amination or transamination of aldehydes and ketones in the food. Histamine, cadaverine, putrescine, tyramine, spermidine and spermine are biogenic amines that often found in food. Biogenic amineformation is accelerated by various factors such as poor hygiene, contamination, microbial load of the raw materials and temperature. Cold storage is the most effective method to preventing the formation biogenic amine. Therefore, formation of biogenic amines and their impact on poultry meat need to be pronounced.

Key words: biogenic amine, decarboxylation, poultry meat, meat quality

P10 Influences of Vegetable Oil (Sun Flower Oil) Usage on Some Physico-Chemical Features in the Production of Turkey Meat Salami

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Abstract

Influences of vegetable oil (sun flower oil) usage on some physico-chemical features in the production of turkey meat salami was studied in this research. For that purpose, the rates of pH, colour, dry matter and TBARS on salami were determined with the using of turkey's brisket and sunflower oil. The impacts of using different sun flower oil ratios on the average pH and dry matter ratios that were established on salami was observed in the content of this research. Within the scope of the research, there was an observation that the TBARS values are more elevated at the groups in which sun flower oil was used by the researchers than the control groups (%100 meat fat) Nonetheless, there was a different observation that the L* values increase, a* values decrease and the b* values haven't important changes when the using of sun flower oil increase in the production of salami.

Key words: Hindi eti, salam, ayçiçek yağı, TBARS, renk.

P11 Importance of Poultry Meat in Human Nutrition

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Abstract

Meat has an important role in human growth and development. Meats are usually divided into two groups as red and white meat. The most commonly consumed meat type in the white meat group is chicken. Energy and fat value of chicken meat varies in the chest, wing and thigh. The skin increases energy value of chicken meat by 25-30% due to fat content. Protein content of chicken meat varies between 20.30-24.04% and is regarded as high quality protein. It is easily digested due to low collagen content. Chicken meat is a good source of water-soluble B group vitamins (especially niacin). It is stated that chicken meat is a good source for iron, zinc and selenium. By evaluating energy and protein requirements and physiological status of individuals, chicken meat can be recommended in appropriate quantities. It is important to use appropriate methods in preparing and cooking. Chicken meat should be consumed without skin. During preparation sauces containing sodium and fat should not be used. Instead of frying and roasting, more healthy cooking methods such as baking in the oven or grilling should be preferred. It is also important consumption of adequate amounts of other groups for optimal health protection and development.

Key words: Chicken meat, nutrition, nutrients

P12 The Importance of the Poultry Meat Sector in Terms of Food Security in Benin and Suggestions for the Development of the Sector

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Abstract

Located in the centre of West Africa, Benin is one of the poorest countries in the world with about 10.322 million inhabitants. Poverty affects about two out five people at national level. At the national level, 11% of households face severe (<1%) or moderate (11%) food insecurity, about 34% of households are in food security limit, about 55% of households are in food security. The level of protein consumption in Benin was estimated at 12 kg per capita per year. This level of protein consumption per capita per day is very low. About 22% of this total protein consumption is provided by poultry products in Benin. Poultry is the second largest source of meat consumption after cattle (21% for poultry compared to 58% for cattle, 13% for sheep and goats and 7% for pig). In this study, discussions are focused only on poultry meat sector. In view of the importance and preference of people of Benin to poultry products, the contribution of the poultry meat sector to the reduction of food insecurity, it is important that to its development require more attention. In this study, the contribution of the poultry sector to food security in Benin, challenges that impede the development of the poultry meat sector and suggestions to solve them, are evaluated.

Keywords: food insecurity, protein consumption, meat consumption, poultry meat sector.

Introduction

In Benin, poverty affects about two out of five persons at national level (37.4%).Approximately 45% of the population is food insecurity. Households in food insecurity are often the poorest. Animal protein consumption in Benin was estimated at 12kg per capita/year (1).About 22% of this total protein consumption per capita per year in Benin is provided by poultry products. Poultry is the second largest source of meat consumption, after cattle (2). In Benin, about 36% of households own livestock and 89% of all households with livestock have stated that they own poultry (3). Poultry farming is a growing sector in Benin and it is practiced throughout the country. There are two types of poultry farming:

a-Traditional poultry farming practiced mainly in rural areas and

b-Modern poultry farming practiced in the Southern Region of the country especially around large cities.

The poultry meat sector appears to be one of the important sectors involved in reducing food insecurity in Benin. A rapid development of poultry meat sector in Benin equals to credit plus subsidies by government (4).

The main objective of this study is to determine the contribution of the poultry sector to food security in Benin, to identify the challenges that impede the development of the poultry meat sector and to make suggestions for its effective development. These suggestions will generate interest and increased involvement of decision-makers and stakeholders in reducing food and nutrition insecurity in Benin. In this context, the study points out the place and importance of poultry meat in alleviation of food insecurity in Benin, the current problems encountered by the poultry meat sector and suggest solutions to solve these problems in order to permit a rapid development of poultry meat sector in Benin.

This study is a literature research made with the help of secondary sources. To achieve this study, collected data cover from 2004 to 2011.

The importance of poultry meat sector in terms of food security in Benin and problems

With a population of nearly 10.322 million, Benin offers a very good market for food distribution channels. However, 32% of imports concern food. Local production accounts for only 23% of the poultry market (5).

At the national level, in 2013, the poultry meat sector counted three main incubators with a total capacity of two million chicks per year, 28producers of feed with a capacity of 50000ton offered per year, about 520 poultry producers (3).Domestic production of poultry meat has evolved. It has increased from 14828 ton in 2004 to 23485 ton in 2011 (Table 1). Despite this evolution of poultry production, it is not sufficient to satisfy domestic demand. As poultry meat is now consumed by most of Benin people, its consumption is becoming more and more important. Consumed amount of poultry meat in Benin is around 12.4 kg / capita / year in 2011 (Table 1).This evolution of poultry meat consumption is explained by the low price of poultry meat compared to other meats such as beef meat, the purchasing power of Benin people which is low. In this case, the population, especially the rural one whose purchasing power remains the lowest, to ensure food security, especially the supply of animal proteins at low cost, prefer the consumption of poultry meat. Since poultry meat is also rich in protein and good for health, the choice of the population must be encouraged in order to ensure their good health.

The poultry sector, thanks to its rapid development capacities and the possibilities of diversifying its production, can sustainably contribute to the supply of animal protein at lower cost. However, the development of the poultry sector in Benin encounters many problems. One of these problems is related to the importation of poultry meat from countries of European Union, Brazil and others. Importation amount from these countries affects negatively domestic production. In order to fulfill the national poultry production deficit and satisfy the growing demand of the population, the government gives the right to import and finance individuals or companies to achieve these importations. Some companies quickly extinguished the evolution of domestic production of poultry meat by abusive importation of low-quality poultry meat highly financed by the government. These importations increased from 30.759 thousand tons in 2004 to 104.160thousand tons in 2011 (Table 1).

The exponential increase in the importation can be explained not only from the reasons listed above but also from the geographical position of Benin which makes it a re-exporter of poultry meat. About 80% of the importation of poultry meat is re-exported and 90% of this re-exportation is destined for Nigeria (6).

The poultry meat sector in Benin uses many actors with important incomes in particular modern producers, suppliers of veterinary inputs and poultry equipment, suppliers of raw materials, traders of poultry and processors of poultry products. Each of these actors constitutes a link in the inter-linked sector. A positive or negative change in a subsector affects the other systems and vice versa. The major changes observed in Benin in recent years are due to the sub-sectors of production, imports and supply of raw materials. There are some problems in the sector as well as developments. Especially, traditional livestock farming encounter health problems. The actors in class 1 to 3 according to the type of producers according to the FAO concerning commercial poultry farming respect the prophylaxis but are confronted with the import problems of the poultry and of poultry meat. In additional, the increase in maize prices resulted in a 60% decrease in commercial production. Decrease in livestock numbers lead to lower demand for poultry inputs and consequently reduced poultry activities. This affects negatively animal protein supplies and food security of the population is threatened. Once, because of avian flu, producers were no longer able to market their products due to the behavior of consumers who refused the consumption of poultry meat following the spread of the H5N1 virus in neighboring countries such as Nigeria, Niger, and Burkina Faso. The refusal of consumers to buy local poultry products affects negatively domestic production.

Table 1. Domestic production, availability and importation of poultry meat in Benin

Year	2004	2005	2006	2007	2008	2009	2010	2011
Meat production(tons)	14828	15382	15870	16253	20846	21360	22235	23485
Food availability of poultry meat (kg/capita/year)	9,0	7,9	7,7	8,1	12,8	10,7	8,9	12,4
Imports of poultry meat (1000 tons)	30.759	29.949	28.875	35.270	60.602	75.791	78.070	104.160

Source: 7

Conclusion and suggestions for the development of poultry meat sector

Benin has many advantages for the development of poultry sector. However the current environment does not allow its development. The poultry meat sector in Benin occupies the second place after the cattle meat sector. It provides between 10% and 22% of the total meat production of the country. However the current problems of the sector restrict its benefit in terms of food safety in Benin. Among the problems that are impeding poultry meat sector in Benin the most important problem remains importation of poultry meat from countries of European Union and Brazil. Since the importation of poultry meat cannot be entirely stopped because it provides an important currency for country economy through re-exportation, to develop the poultry meat sector, it will be preferable to impose charges on importation which will bring the cost of imported poultry meat to almost the same level as that produced locally. Stopping importation could impede the industrialization of the poultry meat sector (8).However, the funds obtained from the imposed charges on importation will be used for the implementation of projects in poultry meat sector and will facilitate access to credits at adequate rates by poultry meat producer in order to revive poultry sector in Benin. According to current economic situation of Benin, access to credits by farmers, mainly smallholder farmers from banks is very difficult. Farmers used to go to microfinance institutions, where conditions are not always appropriate:

high interest rate (from 12 to 24% per year) and requirement of important guarantees. In 2007, among 355 poultry farmers surveyed only, 136 had been financed including 12 by the banks (9). But research showed that importation of poultry meat can be removed. A removal of all imports of 30 000 tons of poultry meat would require domestic production of about 22 million broilers of 1.3 kg carcass weight per year. What would represent an income of approximately 22 billion francs CFA for the poultry sector in Benin by considering an average selling price of 1000 francs CFA /chicken (10). Moreover, the poultry meat sector needs to be organized by creating professional and inter-professional associations, to defend the different actors and to promote the sector. The government should promote technical support and training of poultry meat producer in order to improve zoo-technical performance and productivity.

The scientific researches oriented towards the problems of poultry nutrition according to the country climate should be encouraged and promoted by government.The development of the poultry meat sector also depends on the regulation of input and seed prices (maize, soybeans, chicks,veterinary products,etc.). The quantitative and qualitative availability of inputs at stable prices allows a rapid evolution of poultry production (11).Consequently, the poultry meat sector's contribution to food security will be improved. This depends on solving the sector's problems.

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P13 Sustainability in Broiler Meat Production

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Abstract

The purpose of this article was to evaluate poultry meat production systems within the scope of sustainability criteria. Recently, as a result of animal welfare and environmental perception increase, all meat production systems including poultry meat production are being questioned by consumers. Using sustainable production methods would positively affect both consumers' perceptions and the influence of the sector on the environment. Considering the previous findings, the existing rearing methods do not seem to carry the basic criteria for sustainability. Searching the new methods for the sustainable production systems should be continued.

P14 Influence of Different Levels of Phytogenic Feed Additive on Intestinal Microbiota and Intestinal Morphology on Broilers

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Abstract

The present study was conducted to investigate the influence of different levels of dietary phytogenic feed additive on intestinal microbiota and intestinal morphology of broilers. A total of 480 ROSS 308 one-day-old male broiler chicks were randomly assigned to 32 replicate pens of four experimental groups (each consisting of 8 replicate pens, each replicate pen consisting of 15 chicks). A basal diet was formulated based on corn and soybean meal that was fed to control group. Other dietary treatments received a commercial phytogenic feed additive at 100 mg/kg (PFA 100), 125 mg/kg (PFA 125) and 150 mg/kg (PFA 150) in basal diet. Body weight gain, feed intake and feed conversation rate of broilers were recorded on 1-21, 22-42 and 1-42 days of age. one bird from each replicate was slaugthered on 21 and 42 days. Total aerobic bacteria, coliforms, *Escherichia coli* and *Lactobacilli* were counted in the caecal contents. Villus height, villus diameter, crypt depth, muscular thickness and goblet cell number per villus were recorded. There was no difference among the dietary treatments for growth performance and gut microbe populations at any phase. However, the dietary phytogenic feed additive supplementation affected the gut morphology in broilers compared to those fed control diets. Based on the results, it can be concluded that the dietary inclusion levels for improving the growth performance and gut microbiota might be different from levels required for improving the gut morphology of broilers.

P15 Effect of Englightenment in Quails on Performance Parameters

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Abstract

Poultry consumption, which fulfill people's need for animal protein because economic and nutritional value is high, is at the top of the list. Production of poultry meat consits of chick, turkey, goose, duck, ostrich and quail meat. There are many important advantages compared to other poultry sectors due to the availability to production of small and large family type, return of the circulating capital of the management in short time because quail breeding doesn't need big investment since production can be done in narrow area and it is a durable poultry, there is high yield in short time, more products can be got from unit area, it doesn't require much cost during the operation, installation and transition to production.

The continuity of quail production that bred commercially as in chicken breeding is intrinsic. This can only be achieved by the application of the technological systems as in techniques of another poultry production.

The production that produced commercially in quail breeding should be done in closed or semi-open coops. As in other poultry breeding systems that are produced, quail is also affected by environmental factors in extreme quantities. These environmental factors are factors such as temperature of shelter and nematode, program of feeding, source of environment lighting and program of lighting, frequency of in-cage settlement, air circulation, male-female ratio in cage and disease. Together with all of the mentioned environmental conditions directly affect the yield poultry, the most important environmental factors are light and temperature. For this reason, the provision of the optimal conditions for these two elements in cages of poultry production is also a prerequisite.

Both the duration and intensity of the enlightenment and color of light have different interactions on the welfare and yield of the animals. There aren't enough studies on sources of light and color of light in quails although there are a lot of studies especially in egg chickens in duration of lighting and sources of light. The poultries by sensing the light through their eyes (retinal photoreceptors) and light-sensitive cells in brain (extra retinal photoreceptors); light, was taken from around, stimulates, a large part of the body secretion hormones controlling growth, maturation and propagation. As a result of research on the poultry, while the red light raises gaggling, the blue light has a calming effect. It has been, detected that while the green light stimulates growing, the yellow light has a trigger effect of uremia.

It has been proven that different lighting programs affect many important events such as live weight, rate of benefit from feed, behavioral movements, yield of egg, time of reaching to sexual maturity and consumption of feed in quails.

Key Words: Quail, Source of Light, Lighting, Live Weight, Benefit from Feed

P16 A Research of Knowledge, Attitude of Medical Faculty Hospital Kitchen Workers About Consumption of Chicken Meat And Products

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Abstract

Chicken meat has an important role in adequate and balanced nutrition. For this reason, it is important that the information on consumption, preparation and storage conditions of poultry and products are correct. Kitchen workers of hospital prepare and distribute meals to all hospital staff and inpatient. Therefore, it is valuable to have adequate and accurate knowledge about chicken meat and its products as well as to practice them, like every nutrient prepared in the kitchen. This study was carried out with the application of a questionnaire prepared by researchers for the kitchen staff of a Medical Faculty Hospital. According to the consumption frequency of the employees, chicken meat came first with 68.6% in consumption of meat. 28.5% of the employees had some concerns about chicken meat preferences. The first choice for consumption of chicken meat was organic chicken with 57.1%. Before cooking the chicken, 82.9% of employees state that they washed it. They pointed out that while making frozen chicken ready to cook, 62.9% of employees took down on the bottom of the refrigerator. 58.6% of the employees found that chicken meat to be reliable for them. 70.0% of participants stated that they were careful to wash eggs before cooking. 18.6% of the employees stated that working in a kitchen of hospital has a change in knowledge and behavior related to chicken consumption.

P17 Some Slaughter and Carcass Traits of Ducks Reared in Free-Range and Barn Conditions

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Abstract

The purpose of this research was to study the determination of some slaughtering and carcass characteristics that ducks grown in free range and closed system and it sustained for 14 weeks. The study started with 240 daily ducks and all environmental requirements of them are provided until slaughtering. Prior to slaughtering, body weight of ducks were determined with 0.1 accuracy scale. A total of 32 ducks were slaughtered by randomly choosing 1 female and 1 male close to average at each 14th week. After slaughtering, hot carcass, edible internal organs (heart, liver, gizzard) and abdominal fat weights and ratios were determined. As a result, the breeding system and gender have no significant effect on the ratio of the live weight, hot and cold carcass weight ($P>0.05$). In male ducks, liver weight was significantly higher than females ($P<0.05$), while other edible internal organ weights were not affected by breeding system and gender. It has been determined that the breast and thigh rate of ducks grown in the free-range system increased significantly ($P<0.05$; $P<0.01$). This study shows that ducks grown in free-range systems have better conditions for animal welfare standards and there is not any disadvantage in performance, slaughtering and carcass characteristics according to closed system.

Key words: Free-range system, closed system, duck, slaughtering characteristics.

P18 Effect of Selection Applied according to Breeding Values of the Fifth Week Live Weight on Growth Traits in Japanese Quails

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Abstract

Effects of selection applied 5 generations according to breeding values of 5th week live weight on growth traits in Japanese quails were determined. Fifteen years pedigree records (n= 6400) of the population were used in this study. The research was carried out in two groups as control (K) and selection (S). The quails in the control group were randomly mated. The quails in the selection group were selected according to the breeding value of live weight of the 5th week. The REML-BLUP methods were used to estimate the breeding values of fifth week live weight. The effect of group according to the 5th generations was found significant on 1-5 week live weights and S group was heavier than the K group ($P<0.05$). The hatching weight and live weight were calculated 8.21, 18.26, 38.40, 75.63, 117.81 and 152.92 g for control group, 8.37, 29.30, 62.96, 110.59, 159.18 and 193.28 g for selection group in 5th generation. Significant increases in the weekly live weights were observed in the successive generations for the S group. As a result; the effect of the 5 generation selection according to breeding value of the 5th week live weight on the growth was clearly demonstrated.

Key words: Quail, live weight, selection, growth

P19 Isolation and Characterization of *Listeria monocytogenes* from Chicken Neck Skin Samples

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Abstract

Listeria monocytogenes is a foodborne zoonotic bacteria that causes listeriosis in humans. The bacteria take place on top among foodborne pathogens due to its high mortality rate up to 30%, particularly in the people of risk group. Its widespread availability in nature and capablity of reproduce even under inconvenience environmental conditions make *L. monocytogenes* difficult to control. Besides, poultry meat play an important role in dissemination of *L. monocytogenes* because of pathogenic microorganisms for humans are being found in poultry, they spread rapidly in animal stock and poultry slaughtering technique is open to cross contamination. For these reasons, determining the potential risks and development combat strategies for foodborne pathogens are only possible with good characterization. In this study, 121 chicken neck samples were collected from different poultry slaughterhouses in a one-year period and it was determined that 10 (8.5%) of the samples were contaminated with *L. monocytogenes*. Out of 18 *L. monocytogenes* isolated from 10 sampless, 15 (83.3%) and 3 (16.7%) were identified as serotype 1/2a (3a) and 1/2b (3b), respectively. In addition, fingerprint analysis and clonal relationship between *L. monocytogenes* isolates were determined by ERIC-PCR. Results were subjected to cluster analysis and dendrogram was prepared. According to these findings 10 *L. monocytogenes* isolates had a total of 5 different DNA profiles.

P20 Examination of Probiotics Effects on Intestinal Microbita of Poultry by Monitoring Feces

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Abstract

Effects of probiotics on microbita of poultry intestinal system is monitored by excrement analysis. Broiler are separated in 4 cages with independent water and feed supply. Probiyotic strains, *Bacillus subtilis* DSM 24443 (Bs), *Bacillus cereus* DSM 24442 (Bc) ve *Pediococcus acidilactici* KUEN 1584 (Pa) are dosed into drinking water by $1x10^6$ CFU/ mL and control group without any additive in drinking water. On day 7 of the test, fresh excrement samples are collected and odor, pH, acidity, and microbial analysis are conducted. The results of probiotic samples in comparison to control are decreasing pH and odor, increasing acidity, decreasing number of Total Aerobic Mezofilic and Coliform bacteria and Mould-Yeast groups and increasing number of Lactic Acid bacteria. These results indicate a healthier environment, better feed conversion and protection against intestinal pathogens by use of probiotics in poutry rearing.

Key words: feed additive probiotics, poultry GI system, excrement analysis

P21 An Application of Genome Wide Meta Analyses for Mendeliean Chicken Phenotypes

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Abstract

Genome Wide Association Studies (GWASs) could be used to detect Single Nucleotide Polymorphism (SNP) related with complex traits in poultry. Molecular breeding tools could be employed to obtain optimal genetic achievements for the next generations. Recently meta analyses has described for GWAS. This study investigated how the results of the GWAS could change when we combine mendelian phenotypes and genotypes of multiple chicken breeds using meta analyses. We used three different breeds and associated mendelian phenotypes to conduct meta GWAS. We detected genomic signals from chromosome 3 (GGaluGA209654, =13.25) for the duplex comb, and chromosome 7 (GGaluGA315264, =24.07) for the rose comb. This study showed that genomic signals become more strong when we combine phenotypes and genotypes of multiple chicken breeds using meta analyses.

P[22] Comparison of Susceptibility Level and 16S rDNA Regions in The Metagenomics Analysis of Chicken Cecum Microbiome

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Abstract

In the metagenomic analysis of poultry cecal microbiome with Next Generation Sequencing (IonTorrent), the role of 6 different variable regions and homology threshold of 16S rDNA in the bacterial identification were investigated. Basically, metagenomic analysis was based on minimal 10 copies of readings, 150 base-pair cut off, and homology thresholds at 99% for species and 97% for genus. Of valid readouts from six 16S rDNA variable regions, 60% was obtained from v3, 13% from each v2 and v8, %7 from each v4 and v67 regions. These primers also gave results at same order but lower levels for mapped, unmapped and low copy number readouts. According to the result of consensus of metagenomics analysis, 39 OTUs (operational taxonomic unite) at the family level, 35 OTUs at the genus level and 30 OTUs at the species level were determined. When readouts closest to 0.2% homology level were considered, 3 new OTUs at the family,68 OTUs at the genus and 143 OTUs at the species level were added to bacterial identification. While these all new OTU's were in consensus phyla, 3 new orders and 1 new class were added to taxonomy.

Key words: 16S variable region, metagenomics, cecum, microbiome, chicken

P[23] Evaluation of Discrimination Level of 16S rDNA Variable Regions in Aerobic Bacteria Taxons Originated from Poultry

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Abstract

The role of 16S rDNA variable regions in the metagenomic analysis of next generation sequencing (IonTorrent) for the identification of bacteria isolated from poultry origin was investigated in a mixed bacterial culture. For this purpose, a culture mix was prepared containing different concentrations of various bacterial taxons isolated from chicken visceral organs and base material between 2001-2015 at the routine diagnostic laboratory. Metagenomic analysis was based on minimal 10 copies of readings, 150 base-pair cutoff, and homology thresholds at 99% for species and 97% for genus level. At the taxonomic level, 3 phyla, 4 classes, 9 orders, 14 families, 25 genera and 34 species were determined according to the consensus results. All spiked bacterial genera were identified in the metagenomic analysis. v2, v3, v4, v67, v8 and v9 variable regions involved in the identification of 13, 16, 3, 9, 5 and 5 species, and 8, 13, 3, 6, 5 and 5 genera, respectively. The ratios of v2, v3, v4, v67, v8 and v9 variable regions in the valid reads of sequencing were found as %8.9, %34.7, %11.8, %12.6, %14.2 and %17.5, respectively. In addition, the detection level of each individual taxon by different 16S rDNA regions was analyzed.

P[24] Effects of the Usage of Sepiolite with Water in Broiler Grower Feed on Pellet Quality and Pellet Production Parameters

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Abstract

The aim of this experiment was to evaluate the effects of sepiolite with water on pellet quality and pellet production parameters for broiler grower feed under regular industrial conditions. For this purpose 12 mt pellet feeds for control and treatment groups with 6 batch were produced in a commercial feed factory. Each batch was 2 mt. For the treatment group 1% sepiolite (Exal T) and 1% water was used 'on top' in the mixer. Energy consumption and pelleting duration was increased at the level of 0.87% and 2.5%, respectively. The inclusion of sepiolite in the diet increased the pellet durability index significantly (P<0.001). Therefore it is concluded that sepiolite with water usage into broiler grower feeds would be beneficial in pellet quality.

Key words: Broiler grower feed, pellet quality, pellet durability index

P[25] Effects of Post-Chilling Peroxyacetic Acid (PAA) Applicationon Chicken Carcasses to Extend the Storage Time

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Abstract

This study was conducted to investigate the effects of peroxyacetic acid (PAA) on the storage time of chicken carcasses. In the study, daily fresh chicken carcasses were washed with 230 and 690 ppm PAA in two different times (15 and 30 seconds). The control group (not applied PAA) and the experimental groups were maintained at 4 ° C for 7 days. In the experimental groups, the carcasses washed with a solution of 230 ppm for 15 seconds were labeled as "A", while the carcasses treated for 30 seconds marked with "B". Likewise, samples washed with 690 ppm solution for 15 seconds were grouped as "C", while samples kept for 30 seconds were tagged with "D". The samples were analyzed in terms of Aerobic Mesophilic Bacteria, Aerobic Psychrophilic Bacteria, *Enterobacteriaceae* and Coliform group microorganisms on the 0th, 1st, 3rd, 5th and 7th days and pH analyzes were also performed on the same days. Taking into account the results of the analysis, it was determined that the PAA application, especially 690 ppm for 30 seconds, reduced at least 1 log cfu/g. While the initial count of Aerobic Mesophilic Bacteria was 4.25 log cfu/g in the control group, this count was found to be 2.6 log cfu/g after washing for 30 seconds with 690 ppm PAA. Similarly, while the count of Aerobic Psychrophilic Bacteria in the control group was 3.6 log cfu/g, this count decreased to under 2.3 log cfu/g with the application of 690 ppm PAA for 30 seconds. According to the 7th day results, in the control group the count of Aerobic Mesophilic Bacteria, *Enterobacteriaceace,* Coliform bacteria and Aerobic Psychrophilic Bacteria were determined as 5.92 log cfu/g, 4.79 log cfu/g, 4.7 log cfu/g and 4.78 cfu/g, respectively. When the same day values were taken into account, the count of Aerobic Mesophilic Bacteria, *Enterobacteriaceace,* Coliform bacteria and Aerobic Psychrophilic Bacteria were determined as 3.44 log cfu/g, 2.53 log cfu/g, 2.0 log cfu/g and 3.0 cfu/g, respectively, in group D where PAA effect was most observed. In general, a decrease of 2 logarithm was found in all values of group D at the end of the 7th day. As a result, it was determined that PAA is highly effective on microbiological quality of poultry carcasses even at very low concentration and time.

Keywords: Chicken carcass, peroxyacetic acid, storage time

P26 The Effects of Different Monochromatic Lighting Applications during Embryogenesis on Some Hatching Characteristics

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Abstract

Lighting in poultry is very important environmental factor and researchers have focused on light intensity, light source, lighting period and light color for many years. There have been intensive studies in recent years about monochromatic lighting with LED lamps in different wave lengths. The aim of this study is to determine the effects of dark (control group), green (560 nm) and blue (480 nm) monochromatic lighting on chick weight, hatchability and embryonic mortality (early, late, total) in the entire incubation period for Japanese quail eggs. In the study, total of 328 fertile eggs in control group, 204 fertile eggs in blue LED group and 204 fertile eggs in green LED group were used. There was no statistically significant difference ($P>0.05$) between the experimental groups in terms of live weight, hatchability and total embryonic mortality. However, the lowest early mortality mean (12.37%) was found in green LED lighting group ($P<0.05$), while the lowest late mortality mean (13.59%) was determined in blue LED lighting group ($P<0.05$). As a result, it is possible to say that the application of alternating illumination during embryogenesis in different wave lengths using LED lamps should be investigated for total embryonic mortality.

Keywords: *Embryogenesis, Monochromatic lighting, Embryonic mortality, Quail, Incubation*

P27 Oxidative Deterioration in Poultry Meat and Its Prevention by Using Antioxidants

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Abstract

From production to consumption in every stages, poultry meats are exposed to oxidative deteriorations due to some factors. Oxidative deteriorations are defined in two ways: lipid oxidation and protein oxidation. Rancid taste and flavor, changes in protein functionality and sensory quality, and decrease in shelf life are the main results of oxidative deteriorations. Additionally, that results affect the consumers' health. With that said, it is crucial to minize or prevent the oxidative reactions in every stages of animal feeding, slaughtering, production and consumption process. In that case, the usage of antioxidants is one of the popular strategies and studies regarding the mitigation or prevention of oxidative reactions in poultry using antioxidants have been still conducting in nowadays.

P28 Effect of High Eggshell Temperature During The First Week of Incubation on Hatchability, Hatch Time and Chick Organ Development

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Abstract

This study was conducted to investigate the effect of increased eggshell temperature (EST) during the first week of incubation on hatchability, hatch time, chick organ development on day of hatch. A total of 1680 eggs were collected from Ross 308 commercial broiler breeder flocks at 37 wk of age. Higher (38.6 ˚C) eggshell temperature (EST) exposed between days 0-3 (A), 4-6 (B), or 0-6 (C) of incubation. A control group was incubated at an EST of 37.8 °C during first 6d of incubation. EST was maintained at 37.8 °C except the periods of groups. Hatching time was determined in each group by counting all chicks that hatched at 480 h (Early), 492 h (Middle), and 510 h (Late) of incubation. Fertile hatchability was significantly better for the Control and A compared to B and C ($P<0.05$) due to decreased early embryonic mortality ($P<0.05$). The percentage of second grade chicks was significantly higher in C than Control and A ($P<0.06$). As expected increased EST during first week of incubation produced higher percentage of early hatch chicks compare to Control with A and B intermediate. Relative yolk sac, heart or proventriculus weight were not affected by groups ($P>0.05$), however relative gizzard weight in C and relative liver weight in A were heavier than control ($P<0.05$). These results suggest that, eggs were exposed to 38.6 °C EST between days 4 to 6 or 0 to 6 of incubation decreased fertile hatchability ($P<0.05$). However increased EST during the first 3d of incubation did not differ with control (37.8 °C) on hatchability and chick quality but hatched earlier.

P29 Potantial Use of Fourier Transform Infrared (FTIR) Spectroscopy in Charaterization of Turkish Salami Produced from Turkey Meat or Beef

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Abstract

In the current study, salami of different brands produced with turkey meat and beef were characterized using Fourier Transform Infrared (FTIR) Spectroscopy. When the spectra were evaluated with naked eyes, bands from all samples appeared to be verysimilar. However, when the zoomed view of obtained spectra were examined in detail, four regions (2980-2800 cm^{-1}, 1760-1710 cm^{-1}, 1210-1140 cm^{-1}, 1140-1000 cm^{-1}) exhibiting visible spectral differences were determined in salami samples produced from 100% beef and 100% turkey meat. The FTIR spectra demonstrate differences according to both raw materials (beef and turkey meat) and brands. After assessing zoomed view spectra by naked eyes, salami products were classified successfully with hierarchical cluster analysis (HCA) and principal component analysis (PCA) by using the absorbance values from spectra. Score plots from PCA and dendograms from HCA showed that salami products were grouped according to both raw materials (beef and turkey meat) and brands. The commercial product-specific spectra determined by this study have potential to be used to determine purity and authenticity.

P30 An Investigation on Possible Use of Myofibrillar and Sarcoplasmic Protein Fractions in Differantiating Pork and Turkey Meats by FTIR Spectroscopy

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Abstract

In this study, sarcoplasmic and myofibrillar proteins were extracted from raw meat mixtures prepared using turkey and pork.FTIR spectroscopy was used to obtain spectra specific to protein extracts.The spectra of sarcoplasmic and myofibrillar protein fractions were quite different from each other due to the differences in proteins present in each fraction. The peaks in the spectra exhibited differences in terms of peak positions and peak intensities.Amide B, amide I, amide II and amide III bands were found in sarcoplasmic protein fractions while the amideA, amide B, amide I, amide II bands were observed in myofibrillar protein fractions.But these bands, like other bands, differed in terms of their position in the spectra and signal heights.

P31 Effect of Eggshell Temperature during Hatching Phase on Hatchability and Broiler Live Performance

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Abstract

This experiment was conducted to determine the effect of eggshell temperatures (EST) during the hatching phase (18.5-21 day) on hatchability of fertile eggs and broiler performance. Eggs were collected from Ross 308 commercial broiler breeder flocks at 40 weeks old. Eggs were incubated at an EST of 37.7°C until d of incubation 18.5. Last 3 d of incubation, embryos were incubated at low (36.7°C), normal (37.7°C) or high (39.0°C) EST. Hatchability of fertile eggs was not affected by EST during hatching phase. European production efficiency index (EPEI) was 352.2, 350.4 and 360.7 in high, normal and low EST groups, respectively. Low EST group had numerically higher EPEI however the differences were not significant among groups. Result of this study emphasized that EST treatment during hatching phase had no effect on fertile hatchability and broiler performance ($P>0.05$).

P32 Effects of Battering Chicken Nuggets With A Dough Contains Corn Flour, Corn Starch and Different Hydrocolloids on Some Quality Characteristics

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Abstract

Chicken nuggets were battered with a dough which contains corn flour (30%), corn starch (5%), and 1% different hydrocolloids (xanthan gum, Na- carboxymethyl cellulose, carrageenan) and deep fried at 180°C for 5 min in sunflower oil. After frying nuggets were subjected to moisture content (%), oil content (%), coating pick up (%), cooking yield (%), coating thickness (mm), penetrometer values (10^{-1} mm), color and sensory properties analyses. Type of hydrocolloids were affected significantly (P<0.05) coating pick up, cooking yield, coating thickness and penetrometer values of chicken nuggets. The highest cooking yield (18.76%) and coating thickness (1.36 mm) were found in carrageenan battered nuggets. Regardless to cooking yield (82.45%) values Na-CMC battered group was found better than others. The uses of hydrocolloids did not change the color values (P>0.05). Due to the sensory analysis the highest overall acceptability point was obtained from Na-CMC sample wit 5.16 points.

Keywords: *Chicken nugget, hydrocolloid, quality, deep fat frying*

P33 Metagenomic Analysis of Butyrate-Producing Bacteria in the Gut Microbiome of Broilers

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Abstract

Taxonomic units and relative abundance of butyrate-producing bacteria in broiler gut were investigated by 16S metagenomic analysis were investigated in this study. Five, 22 and 47 OTUs at the level of family, genus and species level, respectively. The total abundance of butyrate producers in whole microbiome were 29.31%. *Clostridiaceae*, *Eubacteriaceae*, *Lachnospiraceae* and *Ruminococcaceae* families covered almost all of butyrate producing bacteria. The most abundant genus was *Faecalibacterium* (13.6%) and the most abundant species was *Faecalibacterium prausnitzii* (%13.6). It was conluded that butyrate producing bacteria are common in healthy broiler, and sustainability of this colonization is important for poultry health.

P34 Development of Gut Microbiome in Broiler Chickens

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Abstract

In this study temporal changes within gut microbiome of broilers were monitored, and establihment time of almost conctant microbiome were detected. Bacterial 16S rDNA sequences in ceca of chickens were read by Ion Torrent next generation sequencing system and subjected to metagenomic analysis. A total of 67 OTUs were found in 2 day old chicks, 316 OTUs in 14 day old broilers and 322 OTUs in 21 day old broilers at family, genus and species level. Fifteen new family, 81 new genus and 138 new species joined to cecum microbiome within 2 to 14 days. Between 14th and 21th days 2 family and 2 genus were disappeared, however 10 new species were seen. It was conluded that almost complete microbiome of broiler cecum was established at the end of 14 days.

P35 Effect of Organic Material on Antibacterial Activiy of Chlorine Against *Salmonella* Enteritidis, *S*.Typhimurium ve *S*.Infantis Serotypes

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Abstract

The role of organic material on the chlorine effect has been studied. In this experimental model *Salmonella Enteritidis*, *S*.Typhimurium, *S*.Infantis serotypes where exposed to gradual consant-ration of chlorine and viable cell counts were performed at intervals. All serotypes were killed by 10^{-6} diluted chlorine within five minutes. In environment containing organic material was shown to reduce antibacterial activty of chlorine against Salmonella between 4-7 log10. This results showed that it must be kept in mined the notralized effect of organic material on antibacterial activity of chlorine in the field conditions.

P36 Differences in the Gut Microbiome of Conventional Broiler and Free-Range Chickens

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Abstract

This study was performed to compare the gut microbiome of broiler and free-range chickens and evaluate health effects of each one. While Firmicutes was found as dominant phylum (with 95% relative abundance) within six in broilers in, three major phyla (*Firmicutes* 31.9%, *Bacteroidetes* 29.8%, *Proteobacteria* 25.8%) were found in free-range chickens. At a threshold bigger than 0.1% of relatif abundance, 27 genus were detected only in broilers, 17 only in free-range chickens and 6 in both. It was concluded while bacteria with beneficial metabolic and health effects are dominant in broiler microbiome, free-range chickens have unhealthy microbiome.

P37 Effects of Clinoptilolite Added as Top-Dressed on Performance and Some Blood Parameters in Broilers

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Abstract

The purpose of this experiment was to determine the effects of clinoptilolite supplementation as top-dressed on the performance and some blood parameters in broilers. A total of 72 Ross 308 broiler day-old male chicks were used and divided into one control group and two treatment groups each containing 24 chicks. These groups were further divided into four replicates as subgroups, each comprising 6 chicks. Diet of control group had no added clinoptilolite while at the age of one week animals from treatment groups were supplemented with 0.5 and 1% clinoptilolite (Natmin 9000, particle size of 0-1mm) till slaughtering. The experiment lasted for 38 days. The results showed that clinoptilolite supplementation didn't affect the live weight, live weight gain, feed intake and feed conversion ratio. Carcass yield, the relative weight percentages of liver, spleen, heart, bursa Fabricius and abdominal fat were also not affected, however, the relative weight percentage of gizzard in the group fed 1% clinoptilolite was significantly higher ($P<0.05$) than control group. Furthermore, with clinoptilolite supplementation no significant differences were observed in blood parameters including serum total protein, albumin, total cholesterol and triglyceride. In conclusion, this study suggested that supplementation of clinoptilolite (0.5% and 1%) as top-dressed starting at the age of one week till slaughtering had no adverse effects on performance and some blood parameters in broilers. Further research is needed using different particle sizes and higher doses of clinoptilolite than used in this experiment.

Key Words: Clinoptilolite, broiler, performance, carcass yield, blood parameters

Introduction

Clinoptilolite is probably the most commonly found natural zeolite of volcanic origin (1), which like other zeolites belongs to the family of crystalline, hydrated aluminosilicates, derived from the alkali and alkaline earth cations (2). They possess a three-dimensional structure consisting of SiO_4 and AlO_4 tetrahedra having characteristic void spaces responsible for the porosity of clinoptilolite and thus providing many of its benefiting properties (3). Additionally, each oxygen atom within this 3D crystal lattice shared by adjacent tetrahedra is also responsible for its specific cation exchange capacity (4). Thus, different physical and chemical properties attributed to zeolites, most importantly acting as ion exchangers without major change in their structure, having the ability to lose and gain water reversibly and adsorption properties (molecules of specific cross-sectional diameter) have led to their wide range applications in different industrial and agricultural fields (5,6) and particularly in animal nutrition (7). Different studies showed that zeolites have favorable effects on the growth and performance of different species of animals including poultry (6,8,9,10). Clinoptilolite as a feed additive has resulted in positive effects on broiler performance (11,12). The supplementation of diets with clinoptilolite also helps to prevent some diseases and improves the general health of animals (13). The objective of this study was to evaluate the effects of 0-1 mm particle-sized clinoptilolite (Natmin 9000 – Gordes Zeolit Madencilik Sanayi ve Ticaret A.Ş.) on performance and some blood parameters in male broiler chicks when added to their diets as top dressed starting at the age of one week till slaughtering.

Material and Methods

A total of 72 one day-old male broiler (Ross 308) chicks were obtained from a commercial hatchery and equally divided into 3 groups including one control and two treatment groups. These groups were further divided into four replicates, each comprising 6 chicks. The trial lasted for 38 days. All diets were formulated according to the primary breeder management guidelines of broiler chickens (Aviagen Inc., 2014) for starter and grower periods. Group 1 was the control group in which the chicks were fed a diet without clinoptilolite (0%) supplementation. Treatment 1 and Treatment 2 were supplemented with clinoptilolite with a particle size of 0-1 mm (Natmin 9000 – Gordes Zeolit Madencilik Sanayi Ticaret A.Ş.) as top-dressed on the diets at the rates of 0.5% and 1%, respectively and, this supplementation started at the age of one week of age and lasted till slaughtering. Chicks were weighed individually at the beginning of the experimental period and weekly to determine the body weight and body weight gain. Feed consumption was recorded weekly and expressed as grams per bird per week and the feed conversion ratio was calculated as kg feed per kg body weight gain. At 38th day of the experiment, 12 broilers from each group (3 from each replicate) were randomly selected, weighed and then slaughtered. Hot carcass, abdominal fat, liver, heart, spleen, gizzard and bursa of Fabricius were weighed and expressed as percentage of slaughter weight. Blood samples were taken in the tubes with no anticoagulant and then centrifuged. Serum was collected and stored at -20^{o}C for determination of total protein, albumin, total cholesterol and triglyceride using suitable commercial kits.

Statistical Analyses: Data were analyzed as a completely randomized block design, with 3 dietary treatments and 4 replicates using the ANOVA procedure of the SPSS. The effect of graded levels of clinoptilolite on different variables analyzed using polynomial contrasts. Statistical differences were considered significant at P≤ 0.05 (14).

Results and Discussion

Dietary clinoptilolite (Natmin 9000) supplementation at the levels of 0%, 0.5% and 1% as top dressed starting at the age of one week till slaughtering (38th day of age) had no significant effect on body weight, body weight gain, feed intake and feed conversion ratios (Table 1). These results coincided with other researches (15,16). Clinoptilolite supplementation did not affect the carcass yield and relative percentages of bursa Fabricius, heart, spleen and liver and abdominal fat (Table 2). However, gizzard weight in 1% clinoptilolite supplemented groups was significantly higher (P<0.05) than control group. These findings agreed with Schneider et al. (17), who reported that 0.5% zeolite supplementation didn't influence growth performance and carcass yield. Wu et al. (18) also reported that growth performance and relative weights of organs were not affected by clinoptilolite supplementation. No significant differences among groups were observed in blood serum total protein, albumin, total cholesterol and triglyceride (Table 3). Similarly, Tufan et al. (19) reported that clinoptilolite supplementation to the quail diets did not affect blood total protein, triglyceride and total cholesterol levels.

Table 1. Effects of Clinoptilolite (Natmin 9000) Supplementation as Top-Dressed on Performance in Broiler

	Clinoptilolite, %			Pooled standard error of mean	Significance	
	0	0.5	1		Linear	Quadratic
Body Weight, g (day 0)	43.98	43.88	43.96	0.192	0.926	0.854
Body Weight, g (day 38)	2574.50	2663.13	2611.83	16.266	0.091	0.081
Body Weight gain, g (day 0-38)	2530.52	2619.25	2567.87	16.249	0.090	0.079
Feed Intake, g (day 0-38)	4064.11	4094.23	4060.22	13.657	0.814	0.325
FCR, g/g (day 0-38)	1.606	1.564	1.581	0.010	0.151	0.301

n=4, No significant differences among groups.

Table 2. Effects of Clinoptilolite (Natmin 9000) Supplementation as Top-Dressed on Carcass Yield and Internal Organ Weight Percentages in Broilers

	Clinoptilolite, %			Pooled standard error of mean	Significance	
	0	0.5	1		Linear	Quadratic
Carcass Yield, %	70.35	70.71	70.63	0.168	0.409	0.731
Liver Weight, %	1.959	1.922	1.944	0.030	0.736	0.714
Spleen Weight, %	0.107	0.111	0.110	0.003	0.643	0.745
Heart Weight, %	0.473	0.457	0.478	0.008	0.928	0.266
Bursa Fabricius Weight, %	0.208	0.210	0.213	0.006	0.766	0.883
Abdominal Fat Weight, %	1.018	0.939	0.912	0.029	0.141	0.926
Gizzard Weight, %	1.337b	1.420ab	1.451a	0.018	0.006	0.817

n=12, a,b: Means within a row followed by the different superscripts differ significantly (p<0.05).

Table 3. Effects of Clinoptilolite (Natmin 9000) Supplementation as Top-Dressed on Some Blood Parameters in Broilers

	Clinoptilolite, %			Pooled standard error of mean	Significance	
	0	0.5	1		Linear	Quadratic
Total protein, g/dl	2.917	2.900	2.900	0.060	0.902	0.981
Albumin, g/dl	0.992	1.108	1.009	0.047	0.628	0.338
Total cholesterol, mg/dl	97.17	97.42	96.58	1.063	0.898	0.772
Triglyceride, mg/dl	46.08	46.67	50.75	1.188	0.200	0.239

n=12, No significant differences among groups.

Conclusion

In conclusion, clinoptilolite (Natmin 9000) supplementation as top-dressed at the levels 0.5% and 1% starting at the age of one week till slaughtering (38th day of age) had no effect on performance and blood parameters. However, it can be used as a suitable feed additive in broiler diets due to the positive effects on broiler health and performance in suboptimal conditions in the field. It should be noted that, in the current study the environmental conditions were optimum and nutrient requirements of the birds were met adequately. Further research is needed using different particle sizes and higher doses of clinoptilolite than used in this experiment.

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P38 Evaluation of Worms as A Source of Protein in Poultry

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Abstract

Continuous improvement of the genetic potential through breeding studies in poultry has led to an increase in the nutrient density of the feed rations given to these animals. In poultry farming, approximately 70% to 75% of the operating costs constitute feeding costs, of which about 15% are animal proteins. The protein requirement of poultry is provided by feed stuff rations and usually by soy bean meal or fish meal. Limited production opportunities and price increases have led to the need to use alternative feed additives that can be substituted for these products. Research conducted to date suggests that worms, rich in essential amino acids and a high digestible protein source can be used as substitutes. As a source of alternative protein, worms are consumed by their poultry in their natural habitat, while intensive and extensive studies are needed to be used as a sustainable feed additive. In this review, research on the usability of worms as an alternative protein source in poultry diets has been compiled and evaluated.

Key words: Poultry, worm, protein, feed value, nutrition

P39 Effects of Ultrasound Pre-Treatment on Rehydration Properties of Dried Chicken Breast Meat

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Abstract

The objective of this study was to determine the effect of ultrasound pre-treatment on some physical properties such as, color (L*, a*, b* and Browning index) porosity and apperent density of dried chicken breast meat. For this purpose, ultrasonic probe with 20 kHz frequency was used for pre-treatment. Ultrasound pre-treatment applications were made in distilled water with 100 % amplitude during 5 and 10 minutes to the vacuum packed cubes of chicken breast meat. After ultrasound pre-treatment drying was performed by hot air at 0.3 m/s air velocity and at two different air temperatures of 50°C and 80°C. Ultrasound pre-treatment caused changes in L*, a*, b* and browning index values of the samples dried at both of the temperatures. The sample with highest apparent density was found as the sample dried at 80 ^{o}C after 5 min ultrasound pre-treatment with 1.15 kg/m^3 density value. Ultrasound pre-treatment caused decrease in porosity values of the samples dried at 50 °C, however it caused increase in porosity values the samples dried at 80 °C.

P40 Evaluation of Turkish Poultry Meat Export Performance within the Case of Brazil

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Abstract

With increasing world population, the amount for nutritional needs and especially animal protein needs has been increased. Poultry meat has an important place in animal protein sources. For this reason, poultry meat trade has a large share in the world meat trade. In this study, the poultry meat production, consumption and export performance of Turkey has been evaluated in the last decade (2005-2014) regarding the poultry meat sector and with (1990-2014), the future production and export trend is estimated. The obtained data is compared to Brazil which is one of the developing countries in world poultry meat exports and which is a priority exporter for some of Turkey's potential markets. At the same time has an economic structure similar to Turkey. In addition, in the light of this knowledge solutions for increasing the share of Turkey in poultry meat exports were also searched.

P41 Comparison of Some Meat Quality Traits of Slow and Fast Grown Male Broiler Chickens Raised in Slat Floor Housing System

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Abstract

This study was made to evaluate quality traits of meat from slow and fast growing broilers raised in slat floor housing systems. Both genotypes were divided into five replicates. Chickens of each genotype were raised in standard conditions until 56 d of age. After slaughtering, 8 carcasses of each genotype group were randomly selected and used to assess quality properties and chemical composition. All quality analysis were carried out on breast meat of broiler. Compared with fast-growing, slower-growing chickens were had a higher protein content and a lower fat content of breast meat ($P<0.05$, $P<0.01$). There was a significant differences for the water holding capacity of the meat belongs to the slow and fast growing broilers ($P<0.002$).

Key Words: Broiler, genotype, floor housing, meat quality.

P42 Effects of Dietary Clinoptilolite Supplementation on Intestinal Histomorphology and Caecum Volatile Fatty Acids in Broilers

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Abstract

The purpose of this study was to determine the effects of adding clinoptilolite as topdressed on intestinal histomorphology and caecum volatile fatty acids in broilers. One control group and two treatment groups each containing 48 broiler male chicks were organized. Diets of groups were supplemented with 0, 1 and 2% clinoptilolite (Natmin 9000, particule size of 0-1mm). The experimental period lasred 42 days. Clinoptilolite addition at 2% as topdressed to the broiler diets increased villus height and the ratio of villus height to crypt depth in duodenum. Numerical improvements both in caecum volatile fatty acids and villus height and the ratio of villus height to crypt depth in jejunum and ileum were observed in groups fed clinoptilolite as topdressed. Therefore as a conclusion clinoptilolite supplementation can improve intestinal development, nutrient digestibility and thus performance in broilers.

Keywords: Broiler, clinoptilolite, intestinal histomorphology, caecum volatile fatty acids

P43 Meat Quality Characteristics in Geese

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Abstract

This review about goose, one of the alternative poultry species, was created to describe meat quality characteristics. Geese are usually grown in extensive and semi-intensive systems for meat, liver, feather and eggs. And is a poultry species that is resistant to cold climates and diseases, does not require expensive equipment and shelter, can consume high feeds of cellulose content and has high fattening ability. The geese are known for delicious and high calorie meats. High energy value due to quite fatty of meat. Knowing meat quality characteristics of geese, which are a traditional production and consumption habit in our country, is important for sustainable production. Because goose meat is an alternative product for consumers and the demand of consumers has increased recently. In this study, the quality characteristics of goose were determined according to consumer demands. As a result, it has been observed that the consumption of animal meats has an important place in terms of quality characteristics.

Keywords: Geese, color, pH, fatty acid, amino acid

P44 Evaluation of Slow-Growing Broiler in Three Rearing Systems: Growth Performance and Animal Welfare

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Abstract

The assessment of welfare in poultry under different rearing systems has gained an increasing importance. At worldwide scale, the organic or free-range rearing systems are examined in relation to improving poultry welfare and the quality of poultry production. In several developed countries the demand for meat from these rearing systems is continually increasing. In this study, an experiment with three rearing systems was conducted to evaluate growth performance and animal welfare of slow growing broiler. In total, 150 one-day-old Hubbar JA-57 slow-growing broilers were randomly placed in indoor system without access to outdoor, indoor with free range access to grassland (free range) and in slatted floor. Each rearing system was represented by 5 replicates containing 10 chickens (50 chickens per rearing system). Rearing system did not affect final body weight, weight gain and feed conversion ratio but did influence feeding intake (P=0.08).The free range and the indoor system had significantly more footpad dermatitis (FPD) than slatted system (P=0.001). However the slatted floor system had significantly more hock burn (P=0.008).Significantly more clean chickens was observed (P=0.03) in slatted floor and free range system. It was revealed that the production system had no impact on the fearfulness (P>0.05).These results demonstrated the free range as the suitable condition of rearing of slow-growing broiler.

Key words: slatted floor, slow growing broiler, welfare, growth performance.

P45 The Effect of Nutrients on Gene Expression Levels of Poultry

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Abstract

Scientists working on the feeding of farm animals have begun to utilize high-throughput technologies that will provide cell-level information on the role of nutrients in the continuation of animal health and performance, widening the boundaries of classical research methods over the last 10 years. An image of cell metabolism is attempted to be generated based on the level of mRNA expression of genes in a cell or tissue versus a specific nutrient. Through these obtained data, the understanding of complex biological functions and interactions in the main organs will be developed and nutritionists will be able to provide information on how the genes in the middle and long term of feeding experts control the interactions with the organism's feed consumption, metabolism, immune system, liver, fat tissue, muscle and digestive tract. In this review, it is aimed to explain the mechanisms of how the nutrient composition can change the mRNA expression level and to present examples from some studies published in the field of poultry nutrition.

Key words: mRNA expression level, mechanism, nutrients, poultry nutrition

P46 Effect of Litter Material on Broiler Performance, Slaughtering Characteristics and House Ammonia Levels

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Abstract

This study was aimed to determine the effects of the usage of wood shavings, rice husk and zeolite (ZETA) as a litter material on the performance, carcass yield, relative internal organ weights, intestinal pH and house ammonia levels in broilers. In this trial, 320 one-day old Ross 308 male broiler chicks were used. Chicks were divided into 4 groups each containing 80 chicks. Each group was placed in one room. Each room was further divided into 4 compartments, containing 20 chicks each. Each compartment was 95 cm wide and 144 cm length. Experimental period was 42 day. The usage of ZETA as a litter material instead of wood shavings or rice husk as a litter material improved the live weight, live weight gain, feed conversion ratio and European Production Efficiency Factor numerically. Different litter materials didn't affect carcass yield and intestinal pH significantly. ZETA as a litter material is very effective in reducing ammonia gas concentrations when compared to conventional litter materials such as wood shavings and rice husks. Therefore, using 6 kg/m^2 of ZETA would be sufficient for the reduction of ammonia and to improve the health and welfare of broilers.

Key Words: Litter, wood shavings, rice husks, zeolite

P47 Effects of Carob Products With Β-1,4 Mannanase Suplementation on Performance, Carcass Characteristics, Intestinal Histomorphology and Caecal Short Chain Fatty Acids in Broiler Diets

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Abstract

The present study was initiated to determine the effects of supplemental carob products and β-1,4 mannanase in diets having on live weight, live weight gain, feed intake, feed conversion ratio, carcass yield, relative internal organ weights, intestinal histomorphology, small intestine pH and caecal short chain fatty acids in broiler diets. In this study 300 one-day old Ross 308 male broiler chicks were used. Chicks were divided into 5 groups each containing 60 chicks. Each group was divided into 5 replicate subgroups containing 12 chicks. Additives having carob products (gum+embrio pieces) and/or β-1,4 mannanase were added to the diets at 0.5%. At the end of the experiment live weight, live weight gain, feed intake and feed conversion ratio were not different among groups significantly. There were no significant differences in carcass yield, relative internal organ weights, intestinal histomorphology and duodenum pH among groups. Mannanase supplementation to carob products increased ph value of jejenum and ileum ($P<0.05$). Levels of branched chain fatty acids were decreased significantly ($P<0.05$) with the addition of mannanase to carob products. It was concluded that mannanase supplementation to the carob products could improve performance and intestinal health.

Key words: Carob products, mannanase, broiler, performance, intestine

P48 Developments in Broiler Breeder Rearing

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Abstract

Progress in broiler breeder rearing is due to the continuation of both genetic breeding and environmental remediation. Especially when selecting breeding animals to obtain progeny groups in which body weight and feed conversion are desired to be sufficient; based on their phenotype for such traits as skeletal integrity, body conformation and condition, morbidity etc. The negative correlation between growth and reproductive characteristics limits the progression to be achieved with a certain level of improvement. Although the work on chicken breeding has been based on a past of about 150 years, the performance increases in production run up over the past 75 years. When we evaluate chicken breeding in terms of genomic selection, it is seen that the first species chicken in the farm animals is genomic sequence.

In this review, the characteristics of rooster and chicken behavior, as well as the reproductive characteristics of sperm and egg quality and breeding methods are discussed in different aspects.

P49 Sectoral Structure in The Scope of Contracted Breeding and Broiler Integration Relations in Chicken Meat Production

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Abstract

Today the world population is approximately 7.4 billion and it is increasing rapidly. One of the main needs of the population is consumption of sufficient and safe food. It is hard to find a safe and cheap food particularly in underdeveloped and developing countries. In order to tackle this problem, alternatives have been sought for red meat, which is expensive and important source of protein, and as a result of this, the production and consumption of poultry meat have emerged. Poultry meat is one of the most preferred products of animal origin for its low fat content, in addition to being cheaper compared to red meat. It is estimated that poultry meat production in our country was approximately 2 million metric tones and domestic consumption of poultry meat per capita was 22,83 kg in 2015. Turkey has increased its exports and production of poultry meat for the foreign markets in the last period, as well as production of poultry meat placed on the domestic market. In 2015, Turkish poultry meat export was 359.223 metric tones. However, contracted production model is mostly used in broiler breeding. It is clearly seen that this system has advantages both contracted firms and independent producers. When poultry enterprises in our country are examined, it is evaluated that, the numbers of enterprises is especially concentrated in Black Sea and Marmara Regions. The concentration ratio of these regions are calculated as 64% of total enterprises in Turkey. In this study, our aim was investigate the certain status of broiler sector and producer-integration relations with regarding actual data.

Key words: Broiler meat, production, integration, contracted breeding.

P50 Weapons of Immune System: Antimicrobial Peptides-Bacteriocins

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Abstract

Antimicrobial peptides are small biological molecules having activity against bacteria, fungi, protozoa, and some viruses. Found in all organisms, from prokaryotes to human beings, AMPs play an essential role in the innate immunity. Because of their broad spectrum of antimicrobial activity AMP's such as bacteriocins produced from bacteria, have been proposed as alternative to classical antibiotics. In addition, AMPs can be suggested as an alternative for antibiotic growth promotor because of their beneficial effect on maintaining the normal intestinal structure and immun system.

P51 Lipoic Acid and It's Antioxidan Capacity

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Abstract

Lipoic acid (LA), which can be synthesized in many cells and a compound consisting of 8 carbons containing 2 sulfur atoms in the dithiol ring structure. There are two forms of alpha-lipoic acid: oxidized (alpha-lipoic acid, ALA) and reduced (dihydrolipoic acid, DHLA). LA is an antioxidants with feature of solubility in both lipid and water. The antioxidant properties of it is achieved by scavenging free radicals, chelating with metals, regenerating vitamin E, ascorbic acid and glutathione and repairing oxidative damage. In last two decades, LA has been used for prevention and treatment of oxidative stress-related diseases as an antioxidant in food supplements, recently it has drawn attention due to the usage of LA in the field of animal nutrition.

Key words: lipoic acid, dihydrolipoic acid, antioxidant, animal nutrition

P52 Effects of Dietary Levels and Sources of Fiber in Broiler Diets

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Abstract

Dietary fibers cannot be broken down by the endogenous enzymes in poultry. Furthermore, it has already been known that water soluble dietary fibers impaired nutrient utilization and animal health through increasing digesta viscosity in the intestines of poultry. Thus, dietary fiber has been considered a diluent of the diet and an anti-nutritional factor. However, it has been demonstrated, based on research conducted in recent years, that poultry require a certain amount of dietary fiber in diets for proper functioning of the digestive organs and preventing behavioral disorders like feather pecking and cannibalism. Enhancing dietary fiber content in broiler diets may increase digestive secretions and promote gastrointestinal refluxes as a consequence of improving gizzard development. Therefore, feeding diets with increasing level of dietary fibers enhance nutrient utilization resulting in improved growth performance and intestinal health in broilers. On the other hand, the effects of dietary fiber on the development of digestive system, nutrient utilization and intestinal health may vary depending on the inclusion level and source of dietary fiber in the diets.

Key words: dietary fiber, digestive system, nutrient utilization, intestinal health

P53 Effects of Olive Leaf Supplementation to Broiler Diets on Lipid Oxidation of Breast Meats

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Abstract

In this study, we investigated the effects of different levels (0, 5, 10, 20 g/kg) olive leaf supplementation to broiler diets, on lipid oxidation of breast meats which were stored at +4°C during the 11-day storage period. For this purpose 320 one-day-old broiler chicks randomly assigned to four treatment groups (80 birds/each group) each consisting five replicates (16 birds/each replicate). In trial, treatment groups were formed: corn-soy diet without or with 5, 10 and 20 g/kg olive leaf (Control, OL5, OL10 and OL20), respectively. At the end of trial, the lipid oxidation of breast meat was significantly ($P<0.05$) affected by treatment and storage period. The olive leaf supplementation at 10 g/kg level decreased breast meat TBA values (mg MA/kg meat) compared with control group. TBA values were increased with the increase in storage period. As a result, it is possible to say that olive leaf powder demonstrated antioxidant activity linked with olive leaf supplementation level and it can be used at level of 10 g/kg as phytobiotic antioxidant in broiler diets.

Key words: *Olive leaf, broiler, antioxidant, lipid oxidation*

P54 Prevention of Broiler Feed Mill from Salmonella Contamination

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Abstract

Salmonella is an important microbial hazard in broiler feed. Salmonella can sustain its long-term efficacy in a wide range of materials. Due to the variable nature of salmonellas and the difficulty of examining the products present in large quantities, it is difficult to accurately assess the contamination rates. Salmonella can be transmitted in many ways to poultry feeds. Some of these are wild birds, rodents, contaminated additives, inadequate cleanliness within the plant and inadequate biosecurity levels of the operator. Salmonella control guidelines can be divided into three main categories: studies to prevent contamination from entering, studies to reduce microbial growth in the environment, and processes designed to kill pathogens. Prevention of contamination, dust control, control of equipment and human flow, reduction of rodent infestation, prevention of contamination from wild birds, and hygiene of transport vehicles. Reducing Salmonella multiplication in feed production facilities, detecting microbial proliferation points and reducing conditions that cause proliferation. Decontamination of Salmonella from feeds may require heat treatment (pelletizing) or the use of chemical substances. Pelletization has been reported to reduce the rate of Salmonella due to the limited duration of heat treatment and risk of recontamination, but not enough to completely remove it. It has been reported that in pelletizing systems, Salmonella infection is reduced by 105-106 cfu by applying expanaders with 239-257 F ° temperature and 82 atm pressure for 10-12 seconds with different opinions. The chemical compounds used to control Salmonella in the feed primarily include the use of products containing organic acid, formaldehyde or a combination of these compounds. It has been reported that 0.2-2% of the organic acid products used in feeds show the ability to inhibit Salmonella.

Key words: *Salmonella*, broiler feed, feed production facilty, contamination, decontamination.

P55 Effects of Pellet Quality on Broiler Nutrition

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Abstract

Feed processing has a potential to improve broiler performance. Therefore improving nutrient values of feed by processing feeds prior to broiler intake is a major area of research. Although there are many strategies in order to improve feed processing, each of them should be considered thorougly to determine negative effects on animals. Peletting is one of the major heat processing method in poultry feed production. Offering feed to broilers in pelleted form, improves productivity by improving feed intake, growth performance and feed conversion. On the other hand, pelleted diets may also have negative effects on production due to physical and chemical changes which occurs during peletting process. In this review, effects of peletting and pelet quality on broiler performance and nutrients are considered based on recent studies.

Key words:Broilers, pellet quality, starch, pellet conditioning, pellet durability, feed intake, feed conversion

P56 Effects of Vitamin Nutrition in Broiler Breeders on Fertility and Chick Quality

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Abstract

Broiler breeders are grandparents of broilers which producers of fowl meat. Feeding management of broiler breeders affected chick amount, welfare and quality directly. The vitamins, trace amounts in feed take critical role on animal health, act as a coenzyme and take a role on basic function. The provision of vitamins in broiler breeder's feeds is important for the sustainability of metabolic and physiological processes such as growth, development, health and reproduction of breeders and offspring to be obtained because of the duties they have in organism. In this study, the effects of vitamin nutrition to broiler breeders on fertility and chick quality was investigated

Key Words: *Broiler breeders, vitamin nutrition, fertility, offspring performance*

P57 Effects of Mycotoxins on Nutrient Digestibility and Feed Passage

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Abstract

Mycotoxins are structurally diverse low-molecular weight metabolites produced by various molds such as Aspergillus, Penicillium and Fusarium genera and, when the presence of suitable nutrient, moisture, heat and oxygen molds proliferate to produce these metabolites. It has been well known and concerning issue of mycotoxins are causing serious performance, yield, health problems and economic losses in broilers. However, although the digestive system especially the intestinal epitelium is first exposed to mycotoxins when birds eat mycotoxin contamined feeds, effects of different mycotoxins and relationship between toxins and epithelial tissue has not been studied much. Whereas mycotoxins could affect the intestines by causing some morphological changes and reduced of nutrient digestibilty. While aflatoxins can be absorbed at high rates (80%), absorption of other mycotoxins, such as trichothecenes ochratoxins or fumonisins may vary from 1% to 60%. In the case of fuminisin, it's poor intestinal absorption, ranging from 1% to 6% in non-ruminant species, implies that gut epithelium is exposed to a very high proportion of the toxin ingested. On the other hand mycotoxins inhibit protein synthesis and reduce enegy utilisation. Besides nutrient digestion and absorption function of the gastrointestinal tract, it is estimated that up to 70% of the immune defenses of the organism are located in the intestine. Though it is well accepted that mycotoxins are able to modulate immune responses of broilers.

Key words: mycotoxins, gut health, nutrient digestibility, immune systems, broilers

P58 Is There A Benefit of Using an Endotoxin Solution in Broiler Feed That Already Contains a Mycotoxin Binder ?

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Introduction

Mycotoxins are known to suppress the immune system and some of them (DON, T-2) negatively affect gut barrier function. Other stress factors are also reported to increase gut permeability. Together, these stressful events promote leakage of endotoxins into the bloodstream where they provoke strong inflammatory reactions. Therefore, chronic consumption of feed contaminated with mycotoxins, even if it is only slightly, can result in decreased performance. Feed additives containing mycotoxin adsorbents, such as Free-Tox, are often added to the feed to prevent or reduce the negative effects induced by mycotoxins. It was hypothesized that broilers will benefit by consuming Endotoxin in a diet that already contains a mycotoxin binder, knowing that different other stress factors, not related to mycotoxins, can increase gut permeability.

Materials and Methods

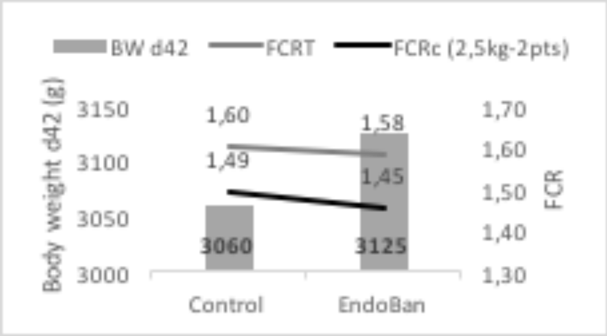
In total, three hundred fifty-two 1-d-old male Ross 308 broilers with an average body weight (BW) of 44 g were grown over a 42-day experimental period. Broiler chickens were kept in an environmentally controlled poultry house at the research facility of the Zootechnical Centre (ZTC, Lovenjoel, Belgium). The experiment was carried out in sixteen pens (100 × 150 cm) with twenty two broilers per pen. On d 14, vaccines against Gumboro and Newcastle disease were added to the drinking water and water was available ad libitum. A commercial corn based diet was formulated to meet all nutrient requirements recommended by Aviagen EPI (Aviagen 2009) for starter (1-14 d of age), grower (15 to 28 d of age) and finisher (28 to 42 d of age) periods. The diet was slightly contaminated with mycotoxins (385 ppm FUM B1+B2 and 1.6 ppb OTA). Two dietary treatments, each with 8 replicates, were tested in a completely randomized design:

1) Control
2) Control diet + 500 mg EndoBan / kg feed

All diets were offered ad libitum, and contained an endo-xylanase (Nutrase Xyla), a mycotoxin binder (Free-Tox), a coccidiostat (salinomycine) and a phytase but no growth factors or antibiotics. Body weight (BW) and feed intake (FI) were recorded on d 14, and 42 with pen as the experimental unit. Average daily gain (ADG), average daily feed intake (ADFI), and feed conversion ratio (FCR) were calculated to determine growth performance.

Results

Supplementation of endotoxin to the feed improved final body weight by 2.1% and FCRc by 2.7% ($p > 0.05$, graph). There were no significant differences between the treatments considering mortality.



Conclusion

Endotoxin improved broiler performance when supplemented to feed that already contained a mycotoxin binder. It is hypothesized that this effect can be due to a reduced transfer of endotoxins from the gut lumen to the bloodstreamduring stressful periods such as transport, handling and changes in dietary composition and improved liver function, in case potential negative effects of mycotoxins were alleviated by using toxin binder.

P59 Searching and Optimizing of Chicken Gelatin Production Conditions by Chicken Mechanically Deboned Meat (MDM) Residues in Acidic Mediums

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Abstract

In this research, it was aimed to obtain gelatin from the chicken MDM (Mechanically Deboned Meat) residue, which is a by-product in chicken slaughterhouses, and to optimize the conditions of the production. The optimization was performed by analysing the yield and some physicochemical properties of gelatins obtained by some chemical (acidic) extraction methods and some thermal processes by using Central Composite Design of Response Surface Methodology. In conclusion, related to the acidic extraction procedure, the optimum extraction conditions was found as 5.5-7.1% HCl concentration, 76-82°C extraction temperature and 194-237 minutes as extraction period. Espacially, the effects of extraction temperature on the yield and some rheological properties as gel strenght (bloom), gelling and melting temperatures were found to be significant (P<0,01).

Keywords: Chicken Gelatin, MDM (Mechanically Deboned Meat) Residue, Acidic Extraction, Gel Strenght, Rheological Properties of Gelatin, Response Surface Methodology.

P60 Effects of Black Cumin and Flaxseed on Various Physical, Chemical, Technological, Sensorial and Textural Properties of Spent Hen Patties and Modelling These Effects with Response Surface Methodology

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Abstract

This study was done to determine effects of black cumin and flaxseed on various physical, chemical, technological, sensorial and textural properties of spent hen patties and to model these effects with Response Surface Methodology by using Central Composit Design Model.

In this research, chicken patties were prepared by using 64-week-old spent hen meat as raw material and combinations of spices, black cumin (0-4%) and flaxseed (0-4%). Various physical-chemical, technological, sensorial and textural analysis were before cooking, after cooking and after 2 months storage made on these chicken patties.

It was found that the usage of flaxseed power was effective on pH, moisture, TBA and colours parameters values (L*, a*, b*) for producing chicken patties. It was found that L*, a*, b* had crucial effects on the physical-chemical properties such as pH, moisture, peroxide, TBA and lipolysis, on the sensorial properties such as appearance, elasticity, juiciness, flavor and on the color parameters of the black cumin powder which were used as additive on the manufacturing of the chicken patties.

Keywords: Spent Hens, Chicken Patties, Black Cumin Flour, Flaxseed Flour, Response Surface Methodology.

P61 Consumer Opinions for Processed Meat Products Consumption: Bolu Example

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Abstract

In this study, consumption habits of processed meat products of consumers, living in Bolu and between 15-50 years age, were investigated. The survey sample consisted of 1397 participants in 2015 and 2016. As a result of the study, 827 female and 570 male consumers stated 50 grams and over of consuming of fermented and/or emulsion products once a week mostly. While the preferences of the respondents were mainly red meat in fermented and emulsified products, the percentage of those who prefer white meat was around 33%. Women specified to prefer poultry meat more than men for both fermented and emulsified product groups. 66% of the respondents indicated that they prefer the brand they always buy whatever the price, while 34% stated that they prefer whichever is economical in buying.

Key words: processed meat products, poultry meat, consumption preferences

P62 Effect of An Algae-Clay Mix on the Use By Broiler Chickens of a Diet Containing Corn DDGS

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Abstract

This study was set up to evaluate the effect of supplementing an algae-clay mix on zootechnical performance of broiler chickens fed with corn DDGS.

414 day-old chicks were randomly distributed to eighteen pens, allocated to one of three groups receiving different diets: the standard diet (C-), the test diet (T-), containing corn DDGS at the level of 10%, and the test diet supplemented with 0.1% of algae-clay mix (T+). Three different feeds were distributed from D0-D9, D9-D18 and D18-D31. Group weighing of the animals (D0, D9, D18 and D31) and litter quality scoring (D18) were performed. Results were submitted to analysis of variance.

Results show a significant decrease of ADWG in the finishing period (-8.61%, $P = 0.04$) and the total period (-7%, $P = 0.02$) in the T- group compared to the control. In finishing and total periods, the ADWG of the T+ group is significantly higher than in the T- group (respectively +11.72%, $P = 0.02$ and +7.13%, $P = 0.03$) and is similar to the control. On the other hand, in the starter period, C- and T- groups show a significantly higher ADWG than the T+ group. Mortality was non-significantly lower in the T+ group than in C- and T- groups. No visible impact was observed on litter quality.

In the end, this study shows a positive effect of the algae-clay mix on growth performance of broiler chickens fed with the test diet, raising the interest of its use in the utilization of such diets.

Introduction

With an increasing competition worldwide, the poultry industry is more than ever pushed to improve its productivity. Meanwhile, the supply of raw materials is changing, both from an economic point of view (high prices volatility) and a quality point of view (emergence of new raw materials and by-products, which use is not always optimized). In this context, feed supplementation with specific additives or premixes can contribute to improve the use of diets containing low digestible ingredients (Shalash et *al*, 2009; Ouhida et *al*, 2000), while maintaining high levels of performance and productivity. In the last years, several studies highlighted the ability of clays to improve feed digestibility (Tauquir and Nawaz, 2001; Reichardt, 2008; Habold et *al*, 2009). This way, Olmix developed a product associating algae extracts (*Ulva sp* and *Solieria chordalis*) and clay (bentonite), which aims at the better use of diets containing by-products. The objective of the present study was to evaluate the effect of this algae-clay mix (MFeed+) on the growth performance of broiler chickens fed a diet containing by-products and raised under field conditions.

Materials and methods

The study was conducted in a commercial broiler farm in Brittany, France. A total of 414 day-old chicks (ROSS PM3) were selected and randomly distributed to 18 pens of 1.03 m² lined up along the building. Randomization was done per block of 3 pens taking into account broilers initial weight. Pens were randomly allocated to one of the three groups, differing by their diet composition (Table 1): the standard diet (C-), the test diet (T-), containing corn DDGS at the level of 10%, and the test diet supplemented with 0.1% of algae-clay mix (T+). All broilers received three successive feeds: a starter feed (D0-D9), a grower feed (D9-D18) and a finisher feed (18-D31), manufactured specifically for the trial. The standard diet and the test diet were formulated to be isoenergetic and iso-digestible amino acids for each stage. Feed was distributed *ad libitum* manually by the farmer (one feeder per pen) and water was distributed via the usual drinking system. Housing system was a Colorado type with concrete floor and dynamic ventilation. Litter was composed of straw during the trial. Chicks were vaccinated with a coccidiostat at one day-old, by spraying on the feed, prior to their allocation to the different groups. The rest of the building was used to raise chickens of the same age, following the standard management of the farm.

Table 1. Composition of the diets

	Starter D0-D9		Grower D9-D18		Finisher D18-D31	
	Standard	**Test**	**Standard**	**Test**	**Standard**	**Test**
Composition (%)						
Corn	32.00	33.52	36.70	51.21	40.20	59.82
Wheat	25.00	18.60	26.50	5.60	26.50	-
Corn DDGS	-	10.00	-	10.00	-	10.00
Sodium bicarbonate	0.20	-	0.20	-	0.10	-
Soyabean meal	36.00	30.70	30.00	25.10	26.50	21.90
Dibasic calcium phosphate	1.65	1.58	1.20	1.25	1.15	1.20
Sepiolite	-	-	0.50	0.50	1.00	0.99
Sodium chloride	0.20	0.27	0.20	0.26	0.25	0.26
Crude soy oil	2.00	2.83	2.20	3.50	2.00	3.41
DL-Methionine	0.25	0.22	0.20	0.20	0.15	0.20
Lysine HCl	0.10	0.18	0.20	0.28	0.10	0.17
Choline	0.30	0.30	0.30	0.30	0.30	0.30
Mineral premix	1.00	1.00	1.00	1.00	1.00	1.00
Vitamins premix	0.80	0.80	0.80	0.80	0.75	0.80
Theoretical nutritional value (%)						
Crude fat	4.50	4.50	6.00	6.00	6.00	6.00
Crude fiber	3.50	3.50	3.50	3.50	3.00	3.00
Crude protein	21.50	21.50	19.00	19.00	18.00	18.00
Methionine	0.56	0.56	0.50	0.50	0.45	0.45
Lysine	1.24	1.24	1.15	1.15	1.00	1.00
Ash	6.50	6.50	6.00	6.00	6.50	6.50
Calcium	1.00	1.00	0.90	0.90	0.90	0.90
Phosphorus	0.70	0.70	0.60	0.60	0.50	0.50
Sodium	0.14	0.14	0.14	0.14	0.14	0.14
Metabolizable energy (kcal/kg)	2849	2849	2981	2981	3049	3049

Animals were group weighed (per pen) at day 0 and at the end of each feeding period (D9, D18 and D31). Refused feed was weighed at the end of each feeding period to measure the feed intake (FI) and calculate the feed conversion ratio (FCR) for each period (D0-D9, D9-D18, D18-D31 and D0-D31). Calculation of the Average Daily Weight Gain (ADWG) was also made for each period for the different groups. Mortality was taken into account: date of deaths was used to assess an average number of present birds per period and weight of dead birds was used to adjust the ADWG per pen and per period. A qualitative scoring was given to the litter at day 18 for each pen, using the scoring system described by Aubert et al., (2011):

- score 1: dry and crumbly,
- score 2: crumbly but slightly damp,
- score 3: crumbly but partly caking,
- score 4: caking with crumbly litter when digging,
- score 5: completely caking or damp.

FI, FCR and ADWG were submitted to an analysis of variance. Mortality data were compared with Pearson Chi-2 test. Systat® software was used to conduct all statistical analyses with a significance level of 5%.

Results

Average initial weight of the animals did not differ among the groups (P=0.771) and so the groups are comparable at the start of the trial.

Feed intake, feed efficiency and growth rate performance are displayed in table 2. Results show a significant decrease of FI and ADWG in the finishing and total periods in the T- group compared to the control. In finishing and total periods, FI of the T+ group is significantly higher than in the T- group (respectively +8.1%, $P < 0.01$ and +5.5%, $P < 0.01$) and is similar to the control. ADWG follows the same evolution: +11.6% ($P = 0.03$) in finisher and +7.1% ($P = 0.04$) in total period in favor of the T+ group compared to T-, and similar values between C- and T+ groups. On the other hand, in the starter period, C- and T- groups show a significantly higher ADWG than the T+ group. The FCR is higher in the starter period in T+ group compared to C- and T- groups ($P < 0.01$). However, it tends to be lower in the other phases. In the total period, the lowest FCR is obtained with the supplemented test diet (T+).

Cumulated mortality over 31 days varies between 1.5 and 5.1% among the three groups, with the lowest value for the supplemented group (T+). Main causes of mortality were associated with sudden death and regular sorting by the farmer of broilers with late growth or locomotive troubles. No visible impact on litter quality was observed.

Table 2. Zootechnical performance of the animals.

	C-	T-	T+	Effect[1]
Average feed intake (g/chicken)				
Starter	301.6	289.1	289.3	
Grower	726.7	693.2	704.3	
Finisher	1821.4[b]	1661.1[a]	1796[b]	D**, S**
D0-D31	2849.5[b]	2645.1[a]	2790.5[b]	**D**, S***
Average Daily Weight Gain (g/chicken)				
Starter	27.8[b]	26.8[b]	25.6[a]	S*
Grower	51.9	49.0	51.4	
Finisher	74.3[b]	67.9[a]	75.8[b]	D*, S*
D0-D31	54.3[b]	50.5[a]	54.1[b]	D*, S*
Feed conversion ratio				
Starter	1.21[a]	1.20[a]	1.26[b]	S**
Grower	1.56	1.58	1.52	
Finisher	1.89	1.88	1.82	
D0-D31	1.69	1.69	1.66	

[1] From the analysis of variance, taking into account the effect of the diet (D) and the effect of the supplementation (S). *$P \leq 0.05$; **$P \leq 0.01$. [a, b] On a same line, different letters indicate a significant difference.

Discussion

The study shows a negative effect of the incorporation of corn DDGS in the diet on zootechnical performance of the birds. The lower feed intake and growth rate observed with this test diet are compensated by the supplementation with the algae-clay mix. This positive effect could be explained by the incorporation of the algae-clay mix in the diet. Indeed, Reichardt (2008) and Habold et *al.* (2009) mention the ability of clays to enhance the contact between enzymes and nutrients and highlight the presence of enzymatic cofactors in clays, through the presence of metallic ions, allowing an increased activity of enzymes. Metallic ions such as zinc and copper actually have the capacity to activate some enzymes (Niederhoffer, 2000; Jondreville et *al*, 2002; Williams, 1960). This way, the presence of Montmorillonite and *Ulva sp* and *Solieria chordalis* macroalgae in the tested mix, significant sources of metallic ions (Kim, 2012), may have favored the activity of some digestive enzymes and thus contributed to the increased performance of the broilers fed the supplemented diet.

Conclusion

This study shows the zootechnical efficacy of the algae-clay mix in diets of broilers raised up to 31 days, at 0.1% in a corn-wheat diet containing 10% of corn DDGS, and highlights its interest for the valorization of such diets. In a context where the high volatility of cereals prices pushes towards the use of alternative ingredients, this algae-clay mix may be used to reduce the feed cost while maintaining a standard level of performance.

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P63 Influence of Algae-Based Complex on Broilers Performances

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Abstract

During the first week of life, immune depression and stress are very challenging for the development of chicks. The aim of this trial is to test the efficacy of two algae-based complexes (ABC) developed by Olmix, on broilers performance. The study was carried out on 450,202 day-old chicks distributed in eight farms. In each farm, one house was used as control and one house was used as test using algae-based complexes. The test houses received the first algae-based complex (ABC1) between 24 or 36 hours of setting up and the second algae-based complex (ABC2) the day before and two days after Gumboro vaccine. Daily weight gain (DWG), feed conversion ratio (FCR), mortality and condemnation rates were recorded to measure the efficacy of ABC on performance. Blood samples were collected in 6 farms on 20 broilers per group, to measure the efficacy of ABC2 on vaccine response. The combined use of ABC1 and ABC2 tends to reduce mortality and condemnation rate comparing to control group (4.36 % versus 3.39 % and 0.65% versus 0.56% respectively). No differences were observed for FCR and DWG. Coefficients of variation of Gumboro titers were significantly improved in 3 farms and tend to improve in 1 farm. This trial illustrates the potential of algae based complexes in reducing mortality. This reduction in mortality may be explained by the immunomodulatory ability of this complex, allowing a better vaccine protection, this hypothesis needs to be validated with further experiments.

Introduction

During the first two weeks of life, the maternal immunity of day-old chicks (DOC) decreases progressively and the animals are subjected to various challenges that alter their health and performance. In this context, Olmix has developed two algae-based complexes (ABC) mainly composed of Marine Sulfated Polysaccharides selected for their biological properties. Both ABC were distributed through drinking water. The first algae-based complex (ABC1) was selected for its capacity to reduce digestive troubles by increasing mucin production by goblet cells, as described by Barceló *et al.* (2000). ABC1 is used in a final product developed by Olmix and called SeaLyt. The second algae-based complex (ABC2) was selected for its capacity to reinforce natural defenses as demonstrated by Berri *et al.* (2016). ABC2 is used in a final product developed by Olmix and called Searup. The aim of this study is to measure the efficacy of the simultaneous use of ABC1 and ABC2 on broilers performance, in commercial conditions.

Material and methods

Experimental design : Eights farms were used in this study. In each farm, one house was used as control group and one house was used as trial group. ABC1 and ABC2 were used only in the trial group in addition to the standard prophylaxis applied in the control group. In each

farm control and trial groups were started on the same date, all conditions were identical apart from the ABC supplementation. A total of 452,202 day-old chicks (DOC) were involved in the study. In the trial group, ABC1 was distributed at day one at 45g/500 liters of drinking water, and ABC2 was distributed 1 day before and 2 days after Gumboro vaccination (day 14) at 80g/1000 liters of drinking water.

Measurements : Daily weight gain (DWG), feed conversion ratio (FCR), mortality and condemnation rates were recorded for each group. Blood samples were collected in 6 farms on 20 broilers per group, to measure the efficacy of ABC2 on vaccine response. Gumboro antibody titers were quantified on each blood sample thanks to the kit biocheck, IBD. Coefficients of variation were calculated per group per farm.

Statistics: Variation due to the different treatments in performance and coefficients of variation were calculated using Mann-Whitney test test. R software was used to conduct all statistical analyses with a significant level of 5%.

Results

Performance : Figure 1 shows that the combined use of ABC1 and ABC2 tends to reduce mortality and condemnation rate comparing to control group (4.36 % versus 3.39 % and 0.65% versus 0.56% respectively). No differences were observed for FCR and DWG, as shown

Figure 2.

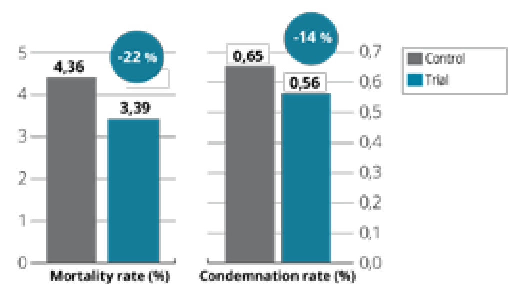

Figure 1. Average mortality and condemnation rate at slaughtering, of the eight farms

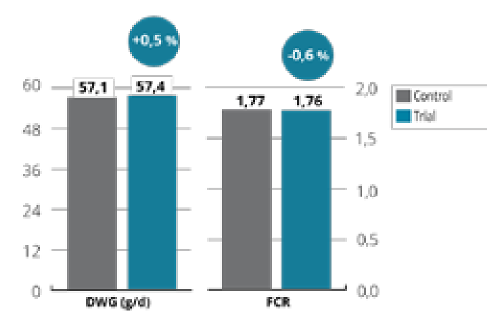

Figure 2. Average daily weight gain (DWG) and feed conversion ratio (FCR) at slaughtering, of the eight farms

Gumboro antibody titers

The average coefficient of variation of Gumboro titers was significantly improved in 3 farms and tended to improve in one farm when using ABC2 (Figure 3).

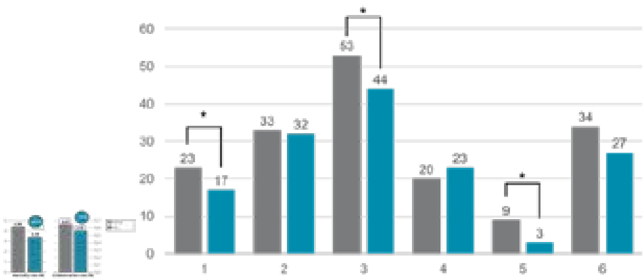

Figure 3. Average Gumboro antibody titers coefficients of variation per group per farm

Discussion and Conclusion

The biological activity of marine sulfated polysaccharides used in algae-based complexes shows interest to improve broilers performance. In fact, the ability of specific MSP to increase mucin production by goblet cells, permits to obtain a thicker mucus layer. The thicker mucus layer participates to reduce digestive problems caused by the degradation of the intestinal mucosa integrity (Barceló *et al.*, 2000). The effect of marine sulfated polysaccharides on mucin production may participate to the tendency to reduce mortality and condemnation when using ABC1. The immune-modulating action of MSP composing ABC2 contributes to a better immune response thanks to the activation of specific receptors of the innate immune system (Berri *et al.*, 2016). Out of 6 farms, 3 farms showed a significant reduction of the average Gumboro antibody titers coefficients of variation, which illustrates the potential of ABC to provide a more homogeneous vaccine response in the trial group compared to the control group. The immuno-modulation obtained with ABC2 may also participate to reduce mortality and condemnation rates. The low number of houses, eight per group, didn't permit to obtain a significant difference in mortality and condemnation ($P < 0.2$). Another study with a higher number of houses would permit to confirm the impact of ABC on mortality and condemnation. Improvement of DWG and FCR were obtained in the trial group but it was not significant. On the contrary to the control group, none of the trial groups needed antibiotic treatment. The combined used of ABC1 and ABC2 tends to reduce mortality and condemnation rate with no reduction of DWG and FCR and without antibiotic treatments in comparison to control group.

Algae-based complexes show good potential to improve broilers performance in a restricted experimental design. Further studies will permit to confirm these promising results.

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P[64] Effects of Dietary Amino Acid Density on Broiler Chickens

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Abstract

In poultry, 22 amino acids are needed to form body protein which referred to as essential and non essential. Essential amino acids can not be synthesised or synthesised sufficiently in animal tissues and must be supplied by diet. Non essential amino acids must be also supplied by diet to meet N requirements for amino acid synthesises and prevent essential amino acid deficiency. Amino acid requirements must be provided adequately and in proper ratio in order to get maximum performance from broiler chickens. Broiler chicken performances have been improved every year by genetic selection. Modern broiler chickens grow faster, consume less feed for body weight gain, and have higher breast meat yield. Because of these genetical improvements, dietary amino acid density should be set properly to get maximum performance from broiler chickens. Dietary amino acid density have significant effects on meat quality and intestinal development. Environmental pollution related to N excretion can be reduced by proper dietary amino acid density and amino acid balance. Moreover, economical production can be achieved by proper dietary amino acid density for different growth periods.

Key words: amino acid density, genetic selection, meat yield

P65 The Situation of Egg and Chicken Meat Consumption Among Students at the Veterinary Medicine

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Abstract

This research has been made in order to exhibit the consumption of poultry meat and egg the preferences of the students training at the Kafkas University Faculty of Veterinary Medicine. A survey has been carried out over 448 students who were the material of the research conducted in the education period of 2016-2017. The analysis of the obtained data was made through SPSS for Windows 16 software. 33,9 % of the average monthly spent (income) is found as 300-500 TL. There are the following findings in this study: 31,3% consume more than 8 eggs weekly and 34,2% consume 250-500 g chicken meat. On the other hand, the total yearly consumption of chicken meat and egg are determined as 19,5 kg and 260 eggs, respectively. In terms of consumption preferences, first, second and third place are brisket, hip, wing.

Key words: chicken meat and egss, survey , consumption, perception, students


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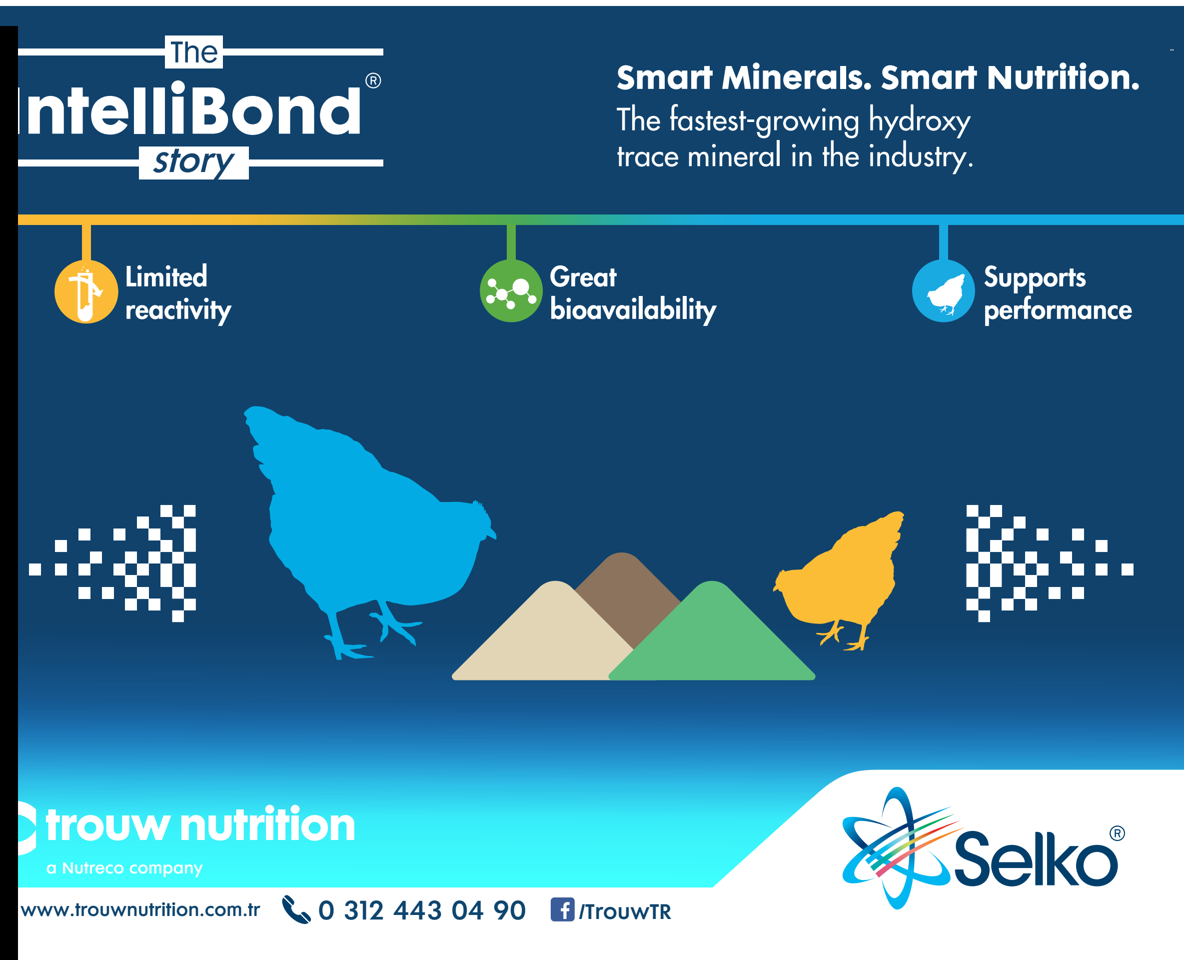
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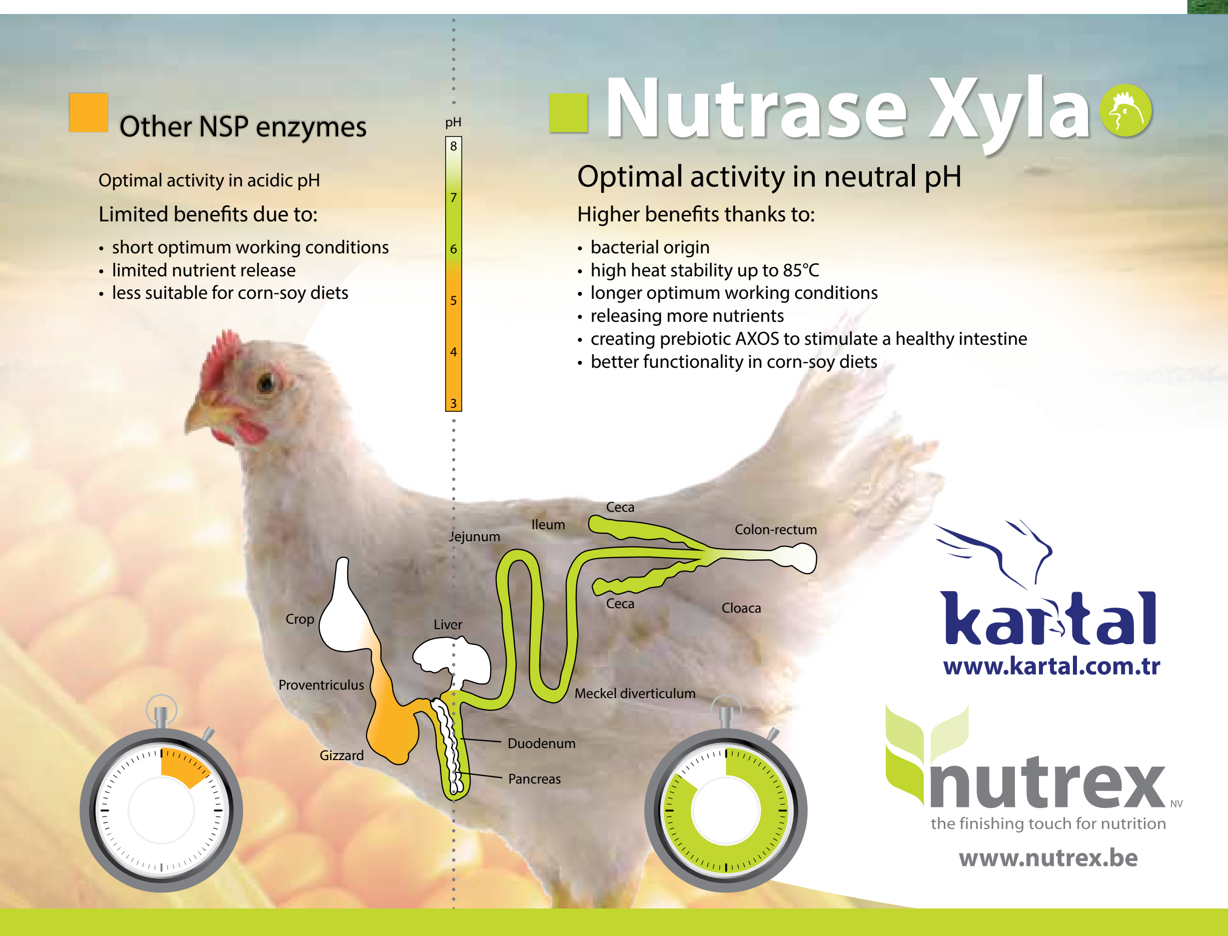
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