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The Book of Abstracts



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**VIII Mediterranean Poultry Summit of the WPSA
Split - Croatia
September 27 – 30, 2026**

Book of abstracts

The Mediterranean's Poultry Conference Journal

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**Hosted by the:
Croatian Branch of the
The World Poultry Science Association**



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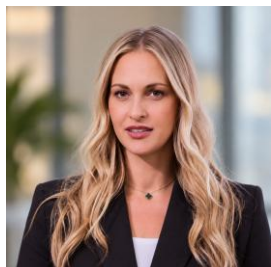
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Welcome Address from the Chairperson of the VIII Mediterranean Poultry Summit of the WPSA, Split 2026



Dear colleagues, dear friends,

It is my great pleasure and honor to welcome you to the **8th Mediterranean Poultry Summit**, held in Split, Croatia, from 27 to 30 September 2026.

On behalf of the Organizing Committee and the Croatian Branch of the World's Poultry Science Association, I am delighted to welcome scientists, researchers, professionals, representatives of the poultry industry, and young colleagues from many countries to Croatia.

This Summit is particularly special for us, as it is the **first Mediterranean Poultry Summit to be held in Croatia**.

Since its establishment in 2008, the Mediterranean Poultry Network has provided an important platform for scientific cooperation, knowledge exchange and the development of professional connections across the Mediterranean region and beyond. We are proud that Split now becomes part of the history of the Mediterranean Poultry Summits, following previous meetings held in Greece, Turkey, Egypt, Lebanon, Italy and Spain.

The scientific programme of the 8th MPS covers a broad range of current topics in poultry science and production, including nutrition, health, genetics and reproduction, meat and egg quality and safety, production and management, sustainability, economics, and new technologies. Through plenary lectures, oral presentations and poster sessions, the Summit offers an excellent opportunity to share recent research findings, exchange ideas and discuss the challenges facing the poultry sector today.

I am especially pleased that the Summit provides opportunities for **young scientists and researchers to present their work**, meet colleagues from different countries and establish new scientific collaborations. Supporting the next generation of poultry scientists is essential for the future of our scientific community.

I would like to express my sincere gratitude to the members of the Organizing and Scientific Committees, the Mediterranean Poultry Network, WPSA and the European Federation, our sponsors and supporters, invited speakers, authors, reviewers, students and everyone who contributed to making this Summit possible.

Above all, **thank you to all of you for joining us in Split.** I hope that the 8th Mediterranean Poultry Summit will provide not only valuable scientific discussions and new professional connections, but also an opportunity to enjoy Split, the Mediterranean atmosphere and Croatian hospitality.

I wish you a successful, inspiring and memorable Summit.

Welcome to Split and welcome to the 8th Mediterranean Poultry Summit!

Prof. Dr. Nives Marušić Radovčić

Chairperson of the 8th Mediterranean Poultry Summit of the WPSA

Welcome Address from the President of the Croatian Branch of WPSA



Dear colleagues and friends,

On behalf of the Croatian Branch of the World's Poultry Science Association (WPSA-CRO), it is my great pleasure to welcome you to the 8th Mediterranean Poultry Summit in Split, Croatia.

For the Croatian Branch, hosting this important international meeting is both an honour and a continuation of our long-standing commitment to promoting poultry science, strengthening professional cooperation, and connecting research, education and industry.

WPSA-CRO brings together experts from different areas of poultry science and production, creating strong links between universities, research institutions, veterinary and agricultural professionals, and the poultry industry. We firmly believe that such interdisciplinary cooperation, together with active participation in the international WPSA community, is essential for addressing the challenges facing modern poultry production.

Over the years, the Croatian Branch has been actively involved in organizing major international scientific meetings in Croatia, including the European Poultry Genetics Symposium in Dubrovnik in 2005, the European Poultry Conference in Dubrovnik in 2018, and EggMeat 2025 in Zadar. We are therefore especially proud that Croatia is now hosting the Mediterranean Poultry Summit for the first time.

The Mediterranean Poultry Summit represents an important opportunity to bring together colleagues from different countries, exchange scientific knowledge and professional experience, and create new connections within the poultry community. We are particularly pleased that the Summit encourages the participation of young scientists and provides them with an opportunity to present their research, meet established experts and develop future international collaborations.

I would like to express my sincere appreciation to the Mediterranean Poultry Network, WPSA, the European Federation, the Organizing and Scientific

Committees, invited speakers, sponsors and supporters, as well as everyone whose contribution has made this Summit possible.

I hope that the 8th Mediterranean Poultry Summit will be a stimulating and rewarding scientific meeting and that your time in Split will bring not only new knowledge and professional collaborations, but also many pleasant memories.

Welcome to Split, and I wish you a successful and enjoyable 8th Mediterranean Poultry Summit.

Prof. Emerita Dr. Estella Prukner-Radovčić

President of the Croatian Branch of the World's Poultry Science Association (WPSA-CRO)

Welcome Address from the President of the Mediterranean Poultry Network of the WPSA



Dear colleagues and friends,

It is a real pleasure, as President of the Mediterranean Poultry Network of the World's Poultry Science Association, to welcome you to the 8th Mediterranean Poultry Summit, held in Split, Croatia, from

27 to 30 September 2026.

For many of us, the Mediterranean Poultry Summit is much more than another scientific meeting. Over the years, it has become a place where colleagues from different countries meet again, where new collaborations begin, where young researchers present their work for the first time, and where scientific discussions continue well beyond the lecture rooms.

Bringing this community together has not always been easy. In recent years, the Summit has had to adapt to circumstances far beyond the control of its organisers, including postponements, changes of venue and difficult international contexts. The fact that we are meeting again in Split is therefore particularly meaningful. It reflects not only the commitment of the organising team, but also the resilience of a scientific community that has continued to find ways to remain connected and move forward.

Since the first Summit in Greece in 2008, the MPS has travelled across the Mediterranean, bringing together a community that is very diverse in its production systems, resources and challenges, but also closely connected by common interests and by a long tradition of cooperation.

Today, poultry production in our region faces increasingly complex challenges. Climate change, sustainability, animal health and welfare, feed and resource efficiency, food safety, product quality and the economic viability of production systems are all closely linked. There are rarely simple answers to these questions, and this is precisely why meetings such as the

MPS remain so valuable: they allow us to exchange evidence, experiences and different perspectives, and to learn from one another.

This Book of Abstracts reflects that diversity. It brings together work from many areas of poultry science and from researchers at very different stages of their careers. I am particularly pleased to see the strong participation of young scientists. Giving them the opportunity to present their work, meet colleagues from other countries and become part of our scientific community is one of the most important things we can do for the future of poultry science in the Mediterranean region.

I would like to express my sincere gratitude to the Croatian Branch of WPSA, the local and scientific organising committees, the University of Split, the invited speakers, sponsors, and everyone who has worked to make this Summit possible. I would also like to acknowledge the support of the European Federation of WPSA and the Italian and Spanish Branches, which have helped facilitate participation in the Summit by covering registration fees for a number of attendees, as well as the support provided through the WPSA Speakers Bureau towards the travel costs of some invited speakers. These contributions have helped make the meeting more accessible and have strengthened its international and Mediterranean character.

Above all, I would like to thank all of you for being here. A scientific meeting only becomes meaningful when people come together, share their work openly, ask questions, discuss, disagree constructively, and create new connections. I hope that these days in Split will give us all the opportunity to do exactly that.

I also hope you will find some time to enjoy the city, the Mediterranean atmosphere and, above all, the company of colleagues and friends.

Welcome to Split, and welcome to the 8th Mediterranean Poultry Summit.



Prof. Carlos Garcés-Narro

President

Mediterranean Poultry Network – WPSA

VIII Mediterranean Poultry Summit

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PLENARY SESSIONS

Ordered chronologically by Slot (Time of presentation)

Avian taste mechanisms and their implications for feed formulation and acceptability

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Avian taste has long been underestimated in poultry nutrition. This view has been reinforced by the specialization of the avian brain for vision and flight, the relatively low number of taste buds compared with mammals, and the marked anatomical and behavioural differences between birds and mammalian models. However, chickens possess a functional and specialized gustatory system, with taste buds mainly located in the palate and around salivary gland openings, and neural connections integrating taste and smell. Birds are sensitive to bitter, umami, salty and sour stimuli, and may also respond to fatty acids and calcium-related cues. Sweet taste perception is more complex: birds lack the T1R2 subunit involved in classical mammalian sweet taste, although some avian lineages sense sugars through other modified receptors. These sensory mechanisms influence the acceptance or rejection of feeds that may be nutritionally adequate but have a poor sensory profile. Bitter compounds and off-flavours, umami synergy, salt preference and rejection thresholds, sourness related to fermentation or organic acids, fatty acid profile and free fatty acid content, and the possible role of calcium sensing in laying hens are therefore relevant aspects of poultry nutrition. Feed acceptability, however, cannot be explained by taste alone. Palatability is a multimodal concept integrating taste, smell, texture, particle size, dustiness, visual cues and post-ingestive effects. Early-life experience, maternal diet and in ovo exposure may shape later feeding preferences, while the first days after hatch are critical for stable feed intake. This highlights the need for rigorous palatability testing to distinguish true sensory preference from transient or post-ingestive responses. The biological basis of taste perception in poultry therefore has direct implications for feed formulation and acceptability. Understanding avian taste does not mean adding flavours indiscriminately; rather, it provides a framework for formulating feeds that are nutritionally balanced, acceptable, consistent and resilient to changes in raw materials. This is especially relevant as poultry production increasingly incorporates alternative ingredients, by-products and functional additives whose sensory properties may affect intake, performance and welfare.

Keywords: avian taste; palatability; feed formulation; poultry nutrition; feed acceptability

Nutritional Targeting of Molecular Mechanisms to Enhance Heat-Stress Resilience in Poultry: From Trace Minerals to Phytochemicals

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Heat stress is a major challenge in modern poultry production, impairing growth, feed efficiency, intestinal integrity, immune function, and product quality through interconnected oxidative, inflammatory, and metabolic disturbances. Nutritional strategies can enhance thermotolerance not only by supporting antioxidant capacity but also by targeting specific molecular pathways involved in the cellular stress response. This lecture will discuss the molecular basis of nutritional mitigation of heat stress, with particular emphasis on trace minerals such as chromium and zinc, selected micronutrients including boron, and bioactive phytochemicals. We will consider their effects on redox homeostasis, mitochondrial function, Nrf2-mediated antioxidant defense, NF-κB-regulated inflammation, heat-shock proteins, intestinal barrier integrity, and insulin/metabolic signaling. We will integrate evidence from our studies and the broader literature to show how mechanism-based and precision nutritional approaches may improve resilience, health, welfare, and productive performance in poultry under increasing thermal challenges.

Keywords: heat stress; poultry nutrition; oxidative stress;; inflammation; molecular nutrition

Chicken genetic resources around the Mediterranean area and diversification of poultry production systems

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My presentation will review the history and current diversity status of domestic chickens, found on each side of the Mediterranean sea. We will then examine how this history and diversity are shaping management programs of chicken populations and their current economic value. The mediterranean area was populated by domestic chickens around 2000 years ago, from several routes of migration, by the sea or the continent. North-Africa may have been populated a bit later than Europe. On the Northern bank of Mediterranean sea, chicken diversity started to be structured in breeds from the Middle-Age period, with each country having its own subset of breeds, as documented nowadays by molecular studies in Italy, France, Spain ... On the Southern bank of Mediterranean sea, a few breeds were differentiated, as for example the Fayoumi or the Dandarawi in Egypt, whereas local chickens in villages from Tunisia, Algeria or Morocco still exhibit high variability in feather colour without any breed organization. In the 18th century, asiatic breeds of large body size were imported in Europe, for meat production, and some local breeds, of the ancient 'mediterranean' type, were crossed with asiatic breeds. Two groups of breeds can be distinguished in France by molecular markers, depending on this introgression. In the 20th century, highly productive commercial lines have superseded local populations of chickens which became at risk of extinction. Different conservation strategies have been followed on each side of the Mediterranean sea. In Southern Europe, local breeds are either maintained by fancy breeders for ornamental purposes or are being exploited for niche markets with high-quality product sold at a high price. The level of diversity differs among breeds, depending on their management program. In Northern Africa, local chickens are preferred by consumers, but do not benefit from management programs. Recent studies showed that these local chickens represent an original gene pool, with little introgression from commercial lines, a rather high level of diversity, but little information about possible exchanges between Northern breeds and Southern village chickens. Several strategies can be proposed to value chicken genetic diversity in Northern Africa, considering errors or success stories from Southern Europe. A combination of pure-breeding and cross-breeding would appear to be the best choice to combine adaptive traits of local chickens with improved performance.

Keywords: genetics; indigenous chickens; biodiversity; adaptation; breeding; value chain;

Strain-dependent effects of incubation temperature on muscle fiber histomorphology, meat quality, and myopathy susceptibility in broilers**S. Yalcin¹**¹Ege University, Izmir, TurkeyPresenting author: servet.yalcin@ege.edu.tr

Genetic selection has significantly improved poultry productivity by enhancing economically important traits such as body weight, feed efficiency, carcass yield, and breast muscle weight. As a result, breast muscle yield has increased from approximately 9% of live body weight in the 1960s to nearly 21% today. However, this rapid increase in breast muscle growth has also been associated with a higher incidence of muscle abnormalities and myopathies that negatively affect meat quality. The development of muscle starts during the embryonic stage. Optimal embryonic development is critical for the formation of muscle tissues that directly influence meat quality traits such as tenderness, water holding capacity, and color. Recent studies have shown that environmental conditions during incubation affect not only hatching performance and chick quality, but also muscle histology and subsequently meat quality. Temperature is one of the most important factor during this stage. It was demonstrated that higher incubation temperatures such as 38.5 and 39.5C daily between 3 to 12 h during the critical period of incubation increase myoblast proliferation, muscle fiber development, muscle fiber area, and breast weight. This critical period and its effects are closely associated with physiological and endocrine pathways regulating muscle growth, including hormones such as triiodothyronine (T3), hypothalamic growth hormone-releasing hormone (GHRH), growth hormone (GH), and insulin-like growth factor-1 (IGF-1), which regulate satellite cell proliferation, muscle cell proliferation, and differentiation. In addition, muscle-specific transcription factors such as MyoD and myogenin (MyoG) play essential roles in satellite cell proliferation, muscle cell differentiation, and muscle maturation. Incubation temperature may also influence the susceptibility and severity of muscle myopathies, thereby affecting overall meat quality. However, the response to incubation temperature appears to be strain-dependent, suggesting a significant interaction between genetic background and incubation conditions. Current evidence indicates that incubation temperature can modify muscle development, vascularization, oxidative balance, and meat quality characteristics differently among broiler strains. Therefore, further research is needed to determine strain-specific optimal incubation temperature programs that maximize muscle growth while minimizing the risk of myopathies and meat quality defects.

Keywords: Incubation temperature, broiler strain, muscle

The Use of Microalgae in Sustainable Poultry Production

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Rising global demand for poultry products, combined with pressure to reduce feed-food competition and environmental impact, has driven interest in alternative feed ingredients that can support both productivity and sustainability. Microalgae have emerged as a promising candidate, offering high protein content (40–70% of dry matter, depending on species), a favorable essential amino acid profile, and preformed long-chain omega-3 fatty acids not readily available from conventional plant-based ingredients. This presentation reviews current evidence on the nutritional and functional value of microalgae in poultry diets, with particular emphasis on protein quality and its downstream effects on growth performance, feed efficiency, and docosahexaenoic acid (DHA) deposition in meat and eggs. Several microalgal species show amino acid scores exceeding 1, indicating protein quality comparable to conventional high-value protein sources, while species such as *Schizochytrium* spp. substantially increase omega-3 concentrations in broiler tissue at inclusion levels of 0.1–7.4%. Beyond growth and feed efficiency, microalgae supplementation has been associated with improved bird health, including enhanced antioxidant enzyme status (superoxide dismutase, catalase, glutathione peroxidase), modulation of immune responses, and support for gut integrity and microbiota balance — effects that may reduce reliance on synthetic antioxidants and antibiotics. Microalgae also contribute bioactive pigments that improve oxidative stability, shelf life, and the sensory quality of eggs and meat. The talk further addresses transfer efficiency — the proportion of dietary DHA ultimately deposited in edible tissue — and the practical need to balance omega-3 enrichment against oxidative stability. Key limitations, including production cost, variable biomass composition, and digestibility barriers linked to microalgal cell walls, are discussed alongside research priorities for commercial-scale adoption. Overall, microalgae are positioned as multifunctional feed ingredients capable of simultaneously improving bird health and performance, product quality, and the sustainability of poultry production systems.

Keywords: amino acid; Microalgae; sustainability; microbiota balance

Contribution of Poultry Industry to Protein Supply in the Mediterranean Region

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Poultry meat and eggs have contributed significantly to protein availability in the Mediterranean region since the 1960's. This increase has varied across countries and regions. In this study, data obtained from FAOSTAT were used to calculate: 1) animal protein supply as a percentage of total protein, 2) protein available from poultry meat and eggs as a percentage of total protein, and 3) protein available from poultry meat and eggs as a percentage of animal protein. Results showed that animal protein supply as a percentage of total protein averaged about 40% in the Eastern Mediterranean and ranged between 16% and 33% in Northern Africa. In Southern Europe, it varied from 40% to 60%. Regarding poultry products, egg protein supply as a percentage of total protein remained relatively stable over the years. In contrast, poultry meat protein increased markedly, ranging from 36% to 63% in the Eastern Mediterranean, 17% to 64% in North Africa, and 14% to 30% in Southern Europe. The correlation between poultry products' production and population growth in the Mediterranean region was highly significant, with only few exceptions during the period (1961-2023). In the Eastern Mediterranean and Northern African regions, the correlation remained highly significant, while in Southern Europe it was highly significant until 1980, after which it dropped. Linear regression results showed that high coefficient of determination (R^2) for the whole Mediterranean region: 0.873 for eggs, 0.952 for chicken meat and 0.897 for turkey meat, reflecting a positive future trend at the 95% confidence interval. For the Eastern Mediterranean, R^2 values were: 0.966 for eggs, 0.874 for chicken meat, and 0.757 for turkey meat. In Southern Europe, eggs showed a moderate $R^2 = 0.464$, compared with 0.684 for chicken meat, and 0.770 for turkey meat. In Northern African region, R^2 were 0.946 for eggs, 0.966 for chicken meat, and 0.743 for turkey meat. In conclusion, poultry meat and eggs provide a significant portion of high-quality protein and contribute to improved nutritional status to all Mediterranean region consumers.

Keywords: Mediterranean region, consumers, turkey meat, chicken meat, eggs, protein availability, protein supply

Economics of Animal Welfare in the Poultry Sector

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Animal welfare is becoming an increasingly important component of sustainable poultry production. Drivers are retail demand, consumer expectations and legislation. In many countries, especially in Europe there are growing societal concerns regarding production systems related to animal welfare. However, improving welfare often involves additional costs related to extra labour input, change in production performance (production, feed intake), higher investment in housing and equipment, additional enrichment material etc. Economists have to evaluate the implication of changes on the farms and calculate the additional costs and the benefits. In my presentation I explore the economics of animal welfare in the poultry sector, focusing on the relationship between welfare improvements, production performance, farm profitability, and market value. While some welfare interventions may increase production costs or reduce technical efficiency, they may also generate economic benefits through improved bird health, reduced mortality, lower medication use, and potentially higher market value. In the EU there are many regulations on several topics. To be mentioned environmental protection, food safety and animal welfare. In poultry the EU legislation to improve animal welfare has a focus on lower mortality and density of broilers. In layers the focus is on housing system such as enriched cage and alternative non cage systems. However, the first step in improving animal welfare is to look for win-win situations in which better animal welfare is combined with lower costs or higher revenues. The farms can directly implement these improvements. In my presentation I give attention to the next step which is housing of hens in barn systems and the introduction of slower growing broilers in the poultry meat production. What are the additional costs at farm level and in the production chain? A key challenge is that the economic impact of welfare improvements is highly dependent on the extra costs for the farmer on one side and the extra benefits on the products. The willingness to pay for animal welfare is crucial. The position of packing stations, processors, retailers, food service and consumers has to be included in any economic assessment.

Keywords: economics, production costs, animal welfare, market, housing system.



SHORT ORAL

COMMUNICATIONS

Ordered chronologically by Slot (Time of presentation)

Balancing performance and welfare in broilers: response of both sexes to reduced crude protein diets with varying amino acid supplementation**B. Jimenez-Moya¹, J. Bonet², G. Farré³, X. Soldevila³, M. Verdú³**¹IRTA, Animal Nutrition, Constantí, Tarragona, Spain, ²Grupo Vall Companys, Lleida, Spain, ³bonÀrea Agrupa, Department of Animal Nutrition and Feed Industry, Guisona, Lleida, SpainPresenting author: beatriz.jimenez@irta.cat

Reducing dietary crude protein (CP) in poultry formulations is a strategy to improve litter quality, animal welfare, and decrease Europe's reliance on soybean imports. However, mitigating potential drops in broiler performance requires precise amino acid (AA) supplementation. This study evaluated the effects of three dietary treatments varying in CP and AA levels on growth performance, water consumption, carcass yield, litter quality, and pododermatitis in male and female broilers. The 2x3 factorial design in randomized complete blocks evaluated 2 sexes and 3 diets: a high-CP/AA control (HP-HAA), reduced-CP with high AA (LP-HAA), and low-CP/AA (LP-LAA). LP diets were formulated to contain 0.8–1.8 percentage points less CP than control; HAA diets to maintain 107%–114% higher digestible Lysine than LAA. Each treatment had 10 floor-pen replicates/sex (29 females or 25 males/pen; Ross 308), reared from day 1 to 40 under a 4-phase feeding program. Data were analysed using SAS (v9.4). Performance and carcass traits were evaluated via PROC MIXED (fixed effects: diet, sex, and their interaction; random effect: block). Litter quality and pododermatitis scores were analysed using PROC GLIMMIX and PROC MIXED (after PROC RANK), respectively. No significant diet*sex interactions were observed for any of the evaluated parameters ($P > 0.05$). Males exhibited higher BW, average daily gain-ADG, and average daily feed intake-ADFI than females throughout the study ($P < 0.001$). Regarding diets, HP-HAA achieved the lowest feed conversion ratio-FCR (1.459) but highest water-to-feed ratio (WFR 2.18; $P < 0.001$). LP-HAA impaired FCR by 1.7% (1.485) but maintained ADG and breast yield comparable to control, whereas significant drops (-3.7% and -5.7%, respectively) occurred in LP-LAA ($P \leq 0.001$). Furthermore, both LP strategies (LP-HAA and LP-LAA) reduced WFR by 5.4% and 4.8% respectively ($P < 0.001$), improved litter quality ($P = 0.002$), and reduced pododermatitis ($P < 0.001$) vs. control, with LP-HAA achieving 90.8% lesion-free birds (Score 0). In conclusion, while HP-HAA maximizes performance, LP-HAA offers a superior balance between production and welfare by ensuring competitive growth and breast yield while moderating water intake, preserving litter, and improving footpad health.

Keywords: Reduced-protein diets; Amino acids; Broiler performance; Carcass yield; Footpad dermatitis

The effect of a complex feed additive supporting intestinal health on productivity, litter quality and gastrointestinal lesions in broiler chickens**A. Van Ooijen¹, A. Sirvydis², A. Racevičiūtė-Stupelienė³, M. Nutautaitė³, V. Vilienė³**¹FF Chemicals BV, Werkendam, Netherlands, ²Centrinis parkas, Neringa, Lithuania, ³Institute of Animal Rearing Technologies, Veterinary Academy, Lithuanian University of Health Sciences, Kaunas, Lithuania

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Gut health is an important factor in the welfare, productivity and quality of the housing environment of poultry. Damage to the digestive tract caused by coccidia can impair nutrient absorption, promote diarrhea, increase litter moisture and thus reduce its quality. Poor quality litter increases the risk of footpad damage and impairs broiler welfare. Therefore, alternative nutritional measures are being sought to maintain gut health, which could contribute not only to productivity, but also to better animal welfare. The aim of this study was to evaluate the effect of a complex feed additive on gut health, litter quality and productivity in broiler chickens. The study was conducted under commercial broiler farm conditions in 1–39-day-old ROSS 308 broiler chickens. Birds in the control group (CG) were fed a standard compound feed, and the feed of the experimental group (EG) was supplemented with a complex feed additive (1 kg/t) consisting of phytobiotics, *Aspergillus oryzae* fermentation products, fruit products, organic acids and minerals. Each group included 1600 birds from days 1–21 and 1100 birds after thinning from days 22–39. Productive performance was evaluated at different growth periods. Litter quality, coccidial oocyst counts in pooled fecal samples, and gastrointestinal lesions were assessed at 7, 14, 21 and 35 days of age. Gastrointestinal lesions were evaluated in five birds/group at each sampling time. The EG showed higher litter quality than the CG on day 14 of rearing (76.7% vs. 71.7%, $P = 0.019$). The assessment of intestinal lesions showed a lower intensity of lesions caused by *Eimeria acervulina* and fewer inflammatory changes in the duodenum and small intestine in the EG than in the CG. After coccidiostat withdrawal, more severe small intestinal lesions were detected in the CG (up to 3 score) than in the EG (up to 2 score). Lower coccidial oocyst excretion was observed in the EG than in the CG. Productive performance did not differ significantly between the groups. In conclusion, the complex feed additive contributed to improved litter quality and digestive tract health in broiler chickens. The lower intensity of coccidial lesions and reduced inflammatory changes indicate the potential of the feed additive to support gut health under commercial broiler production conditions.

Keywords: broiler chickens; litter quality; foot pad lesions; intestinal health; digestive tract lesions

Dietary supplementation with hemp seeds and hemp by-product in laying hen diets: effects on production performance and egg quality**J. Szmek^{1,2}, M. Englmaierová², T. Taubner², E. Pěchoučková^{1,2}, V. Skřivanová²**

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Hemp seed (HS) and hemp by-product (HBP) represent natural sources of bioactive compounds, including tocopherols and carotenoids. This study aimed to evaluate the effects of dietary supplementation with HS, HBP, and their combination, obtained from the non-psychoactive variety Finola, on laying hen performance, egg quality characteristics, and oxidative stability. A total of 240 Lohmann Brown laying hens were randomly allocated to 4 dietary treatments, with 6 replicate cages and 10 hens per cage. The treatments included a control diet without hemp supplementation, a diet supplemented with 40 g/kg HS, a diet supplemented with 40 g/kg HBP, and a diet containing a combination of HS and HBP (20 g/kg each). The HBP consisted of leaves, non-standard HS, HS hulls, and stems. The experiment lasted 14 weeks. Hen-day egg production, egg weight, egg mass, feed intake, feed conversion ratio (FCR), and egg quality were determined. At the end of the experiment, egg yolks were collected for the determination of lipophilic vitamins, carotenoids, and lipid peroxidation products ($n = 6$). The concentrations of bioactive compounds and malondialdehyde (MDA) were quantified using high-performance liquid chromatography. The hens fed HS exhibited the highest daily feed intake ($p < 0.001$) and daily egg mass output ($p = 0.008$). Conversely, supplementation with HBP improved the FCR ($p = 0.047$). Regarding egg quality, the addition of HS and HBP significantly increased egg weight ($p < 0.001$). All hemp-supplemented diets improved Haugh units ($p = 0.023$). The inclusion of HBP significantly enhanced yolk color ($p < 0.001$). All treatments with hemp improved the shell index ($p = 0.002$), whereas shell thickness was increased specifically by HS ($p = 0.033$). The addition of HBP, either alone or in combination with HS, significantly elevated yolk α -tocopherol concentrations ($p < 0.001$), while yolk γ -tocopherol concentrations were increased in all hemp-supplemented groups ($p = 0.001$). Furthermore, HBP supplementation resulted in the highest yolk lutein accumulation ($p < 0.001$). These increased levels of bioactive compounds were associated with reduced lipid peroxidation in fresh eggs, as indicated by lower yolk MDA levels in the HS and HBP groups ($p = 0.001$), suggesting improved oxidative stability. These findings highlight the potential of HS and HBP as functional feed ingredients. This research was supported by the Ministry of Agriculture of the Czech Republic under grant number MZE-RO0723.

Keywords: bioactive compounds; tocopherols; carotenoids; feed conversion ratio; oxidative stability

Growth performance, carcass characteristics and intestinal health responses of broilers to dietary supplementation with *Weizmannia faecalis* under stress conditions

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Modern poultry production seeks to translate growth performance into commercial value through improved feed efficiency and carcass quality. Among several nutritional strategies, probiotics have emerged as promising alternatives to antibiotic growth promoters in broiler diets. *Weizmannia faecalis* DSM 32016 (formerly *B. coagulans*) has shown considerable potential as a multi-functional probiotic since it is a facultative anaerobic, lactic acid and spore-producing bacterium, that also exerts antimicrobial activity against pathogens. The present study evaluated the effects of probiotic *W. faecalis* on growth performance, carcass characteristics and intestinal health of broilers reared under challenging conditions. A total of 320 one-day-old Ross 308 broilers were randomly allocated to two treatments with eight replicate pens per treatment (20 birds/pen): a control group fed a standard commercial diet and a probiotic group receiving the same diet supplemented with the probiotic at 400 g/t feed (1.0×10^9 CFU/kg final feed). Birds were reared for 42 days under conditions of reused litter, to increase pathogen exposure, high stocking density, exceeding 39 kg/m² from day 30 and onwards and mild heat stress, 28°C applied daily for three hours at midday from day 28 to 38. Final body weight at 42 days was significantly higher in probiotic-fed birds compared with controls (2785.6 vs. 2575.4 g; $P < 0.05$), while overall Feed Conversion Ratio was improved (1.62 vs. 1.73; $P < 0.05$). The European Poultry Efficiency Factor increased from 344.9 to 392.2 ($P < 0.05$). During the starter phase, digestibility of crude protein, fat and fiber was significantly enhanced by probiotic supplementation ($P < 0.05$), with improvements in fiber digestibility persisting during the grower phase. Probiotic supplementation also increased the weights of commercially important carcass parts like the thigh, the drumstick and the breast ($P < 0.05$). In terms of Fatty Acid Binding Protein 2, the control group had significantly higher serum concentrations compared with the probiotic supplemented birds at 24 days of age ($P < 0.05$), while, at 42 days, concentrations were similar between treatments. These findings demonstrate that dietary supplementation with *W. faecalis* improves growth performance, feed efficiency, carcass quality and indicators of gut health in broilers exposed to production-related stressors, supporting its use as an effective antibiotic-free nutritional strategy in modern poultry production.

Keywords: probiotics; *Weizmannia faecalis*; performance; carcass composition; intestinal health

Dietary 25 Hydroxyvitamin D₃ preserves vitamin D activation pathway and enhances organ resilience under hepatorenal stress in broiler chickens**E. Perez-Calvo¹, J. Schmeisser², C. Phillips¹, J. Howard³, B. Doupovec³, C. Lozano-Poveda¹**¹dsm-firmenich ANH, Kaiseraugst, Switzerland, ²dsm-firmenich ANH, Village Neuf, France (Metropolitan), ³dsm-firmenich ANH, Tulln, AustriaPresenting author: Jerome.Schmeisser@dsm-firmenich.com

Vitamin D is essential for immune function, skeletal development, and muscle growth, and requires sequential activation in the liver and kidney. This study evaluated, using an ochratoxin A (OTA)-induced hepatorenal challenge model, the effects of hepatic and renal stress on vitamin D metabolism and compared the efficacy of different dietary vitamin D sources in broiler chickens. A total of 256 one-day-old male Ross 308 broilers were allocated to 32 pens and assigned to four treatments for 35 days. The control group received vitamin D₃ (4000 IU/kg, T1), while challenged groups (T2-T4) received OTA-contaminated feed (1000 ppb) and either vitamin D₃ (4000 IU/kg, T2), vitamin D₃ (1240 IU/kg) + 25-hydroxyvitamin D₃ (25(OH)D₃; 69 µg/kg, T3) meaning 4000 bioequivalent IU vit D/kg in total, or vitamin D₃ (4000 IU/kg) + 1,25-dihydroxyvitamin D₃ (1,25(OH)₂D₃; 1 µg/kg, T4). Blood, kidney, and liver samples were collected on days 21 and 35 to assess vitamin D metabolites, biomarkers of liver and kidney function, renal vitamin D-related gene expression, and liver transcriptomics. OTA challenge tended to reduce circulating 1,25(OH)₂D₃ compared with T1, while 25(OH)D₃ supplementation (T3) increased circulating 25(OH)D₃ and 24,25(OH)₂D₃ (P<0.001) and resulted in the highest 1,25(OH)₂D₃ concentration among treatments. In the kidney, CYP2R1 expression, involved in conversion of vitamin D₃ to 25(OH)D₃, was reduced in T2 compared with T1 (P<0.05), indicating impaired renal vitamin D metabolism under OTA challenge. Liver transcriptomics showed 40 and 71 differentially expressed genes on days 21 and 35, respectively, in T2 versus T1, reflecting disruptions related to oxidative stress, inflammation, and mitochondrial dysfunction. These differential gene alterations were reduced to 25 in T3 birds for 35 days compared to T1, whereas T4 birds showed 38 differential gene alteration compared to T1 at day 35. Blood biomarkers associated with renal nitrogen handling, electrolyte balance, protein metabolism, and nutrient status also differed between T1 and T2, supporting the presence of subclinical hepatorenal stress. In conclusion, dietary 25(OH)D₃ was more effective than the other vitamin D sources in preserving vitamin D activation pathways and supporting liver resilience under an induced hepatorenal stress, highlighting its potential to improve physiological stability in broiler chickens exposed to environmental challenges.

Keywords: 25(OH)D₃; hepatorenal stress; vitamin D metabolism; organ protection; transcriptomics

Dietary supplementation with *Aspergillus niger*-fermented orange pomace improves broiler growth performance under heat stress**P. Rodrigues¹, L. Cordeiro¹, J. Lopes¹, A. Lang¹, A. Schiavone², J. Sartori¹**¹São Paulo State University/ Department of Animal Breeding, Botucatu, Brazil, ²University of Turin/ Department of Veterinary Sciences, Grugliasco, ItalyPresenting author: paola.damazio@unesp.br

Orange pomace, which accounts for approximately 35–40% of the whole fruit after juice processing, is a major agro-industrial by-product and a rich source of carotenoids and phenolic compounds. Solid-state fermentation (SSF) has been increasingly explored to enhance the value of this by-product by reducing its fiber content and increasing the availability of bioactive compounds. Therefore, this study aimed to evaluate the effects of dietary supplementation with solid-state fermented orange pomace (FOP), produced by *Aspergillus niger*, on the performance of broiler chickens subjected to cyclic heat stress. A total of 320 one-day-old Cobb 500® male broiler chicks were randomly assigned to a completely randomized 2 × 4 factorial design, consisting of two environmental conditions (thermoneutral-TN and cyclic heat stress-HS) and four dietary treatments: a control diet (CO) or the basal diet supplemented with 0.3% (FOP03), 0.6% (FOP06), or 0.9% (FOP09). Each treatment consisted of ten replicates with four broilers per experimental unit. Data were analyzed by two-way ANOVA using SAS software. No interaction was observed between diets and environmental temperature for weight gain (WG), feed intake (FI), or feed conversion ratio (FCR) ($P > 0.05$). Broilers fed FOP03 (WG: 2997 g; FCR: 1.50), FOP06 (WG: 3076 g; FCR: 1.49), and FOP09 (WG: 2956 g; FCR: 1.48b) exhibited greater WG ($P < 0.0001$) and improved FCR ($P < 0.001$) than broiler with the CO (WG: 2774 g; FCR: 1.55). The broilers fed FOP06 (4527 g) showed greater FI ($P = 0.0299$) than those fed with CO (4309 g), whereas FOP03 (4464 g) and FOP09 (4397 g) presented intermediate values. The improvement in broiler performance observed with FOP supplementation may be associated with the biochemical modifications promoted during the SSF, including partial degradation of structural carbohydrates and enhanced availability of nutrients and antioxidant bioactive compounds, which may improve nutrient utilization and intestinal functionality. As expected, HS reduced WG ($P = 0.003$; HS: 2883 g; TN: 3019 g) and FI ($P < 0.0001$; HS: 4304 g; TN: 4577 g), whereas FCR was not affected ($P = 0.2202$). These results indicate that SSF is an effective strategy to increase the nutritional value of orange pomace and support the use of FOP as a sustainable functional feed additive capable of improving growth performance in broilers under both TN and HS conditions.

Keywords: agro-industrial residue; functional additive; fermentation; poultry

Use of medium-chain fatty acid-rich oils in broiler diets and their influence on the fatty acid composition of the abdominal fat pad

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Using medium-chain fatty acid (MCFA)-rich oils, such as insect oils and palm kernel by-products, as alternatives to conventional vegetable oils in broiler feeding valorizes these by-products and contributes to the circular economy. This study evaluated the effect of replacing soybean oil (SO) with MCFA-rich oils differing in free fatty acid (FFA) content on abdominal fat deposition and fatty acid composition in broiler chickens. A total of 512 one-day-old female broilers (Ross 308) were distributed among four experimental diets, with eight replicates per treatment. Diets based on wheat and soybean meal were supplemented with 4% (0–21 d) and 6% (21–36 d) of soybean oil (SO: 0.00% MCFA, 0.35% FFA), black soldier fly larvae oil (BSFO: 36.18% MCFA, 1.51% FFA), palm kernel oil (PKO: 48.79% MCFA, 2.87% FFA), or palm kernel fatty acid distillate (PKFAD: 49.48% MCFA, 65.64% FFA), a by-product of PKO refining. At 36 d of age, the abdominal fat pad (AFP) was collected to determine its relative weight and fatty acid composition. The AFP relative weight, expressed as percentage of body weight, was not affected by treatment ($P > 0.05$), whereas its fatty acid profile reflected the dietary oil source. Birds fed SO showed the highest proportion of polyunsaturated fatty acids (PUFA) and the lowest proportion of saturated fatty acids (SFA), whereas those fed the MCFA-rich diets were richer in MCFA and long-chain saturated fatty acids (LCSFA), resulting in a lower unsaturated-to-saturated (UFA/SFA) ratio (SO: 2.86 vs. BSFO: 1.26 vs. PKO: 1.07 and PKFAD: 1.06; $P < 0.001$). Among MCFA-rich sources, BSFO presented the highest PUFA content, resulting in a less saturated fat profile compared with palm kernel-derived oils. In contrast, PKFAD, rich in MCFA and FFA, increased LCSFA and reduced lauric acid (C12:0) deposition compared with PKO ($P < 0.001$). These findings indicate that replacing SO with MCFA-rich oils did not affect AFP weight but modified its fatty acid composition, with the changes primarily driven by the dietary fatty acid profile. Specifically, MCFA-rich diets decreased PUFA and increased SFA (MCFA and LCSFA), resulting in a lower UFA/SFA ratio. These oils may therefore represent a viable strategy to diversify fat sources in broiler feeding while modifying carcass fat composition and quality.

Keywords: black soldier fly oil; palm kernel oil; free fatty acids; lauric acid; fat deposition; broilers; abdominal fat pad

Effects of partial replacement of soybean meal with tenebrio molitor larvae meal on growth performance and feed efficiency of broiler chickens**A. Khalil¹, J. Khawand¹, G. Srour¹**¹Faculty of Agronomy and Veterinary Medicine, Lebanese University, Beirut, Lebanon

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The increasing demand for sustainable and locally available protein sources in poultry nutrition has stimulated interest in insect-derived feed ingredients as alternatives to conventional soybean meal. Among these, *Tenebrio molitor* larvae meal has gained attention due to its high protein content, favorable nutritional profile and lower environmental impact. This study evaluated the effects of partial replacement of soybean meal with *Tenebrio molitor* larvae meal on growth performance and feed efficiency in broiler chickens. A total of 108 Ross 308 day-old mixed-sex broiler chicks were randomly allocated to 3 dietary treatments in a completely randomized design with 2 replicates per treatment ($n = 36$ birds/treatment): a control diet based on soybean meal (T1), a diet containing 5% *Tenebrio molitor* larvae meal (T2) and a diet containing 10% *Tenebrio molitor* larvae meal (T3). Birds were reared under standard management conditions for 35 days. Growth performance parameters, including live body weight, body weight gain and feed conversion ratio, were recorded throughout the experimental period. Data were analyzed by one-way ANOVA followed by Tukey's test ($P < 0.05$). Initial body weights were similar among treatments (39.4 ± 2.1 g), confirming adequate randomization. Dietary inclusion of *Tenebrio molitor* significantly improved growth performance ($P < 0.05$). Birds fed the 10% inclusion diet exhibited the highest final live body weight, followed by those receiving 5% inclusion and the control diet (2.31 ± 0.18 kg, 2.24 ± 0.15 kg and 2.18 ± 0.17 kg, respectively). Body weight gain followed a similar trend throughout the rearing period. Feed conversion ratio was significantly improved in T2 and T3 compared with the control group (1.71 ± 0.09 , 1.68 ± 0.11 and 1.78 ± 0.12 , respectively), indicating enhanced feed utilization efficiency. No significant mortality was observed among treatment groups during the trial. Overall, partial replacement of soybean meal with 5% and 10% *Tenebrio molitor* larvae meal improved growth performance and feed efficiency in broiler chickens. These findings support the potential use of *Tenebrio molitor* as a sustainable and effective alternative protein source for poultry production, particularly in countries highly dependent on imported feed ingredients, such as Lebanon.

Keywords: *Tenebrio molitor*; alternative protein; broiler chickens; growth performance; feed conversion ratio; sustainable poultry nutrition.

Effects of Dietary Citric Acid and Feed Restriction on Laying Hen Performance, Egg Quality, and Profitability

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The effect of CA supplemented diet and restricted feeding on laying performance, egg quality, and profitability was studied in ISA Brown laying hens. Total numbers of 126 hens between 55 to 62 weeks of age were randomly divided into seven experimental groups, each containing six replicates of three birds each (total 18 birds per replicate). These groups consisted of control group fed 120 g/day feed, 115 g/day feed, 115 g/day feed + 0.5% CA, 110 g/day feed, 110 g/day feed + 0.5% CA, 105 g/day feed, and 105 g/day feed + 0.5% CA. The feed was given to birds two times a day, while water was freely available. Body weight gain, egg weight, feed intake, hen-day egg production, and FCR were measured weekly. Shape index, yolk index, albumen index, shell thickness, shell percentage, and Haugh units were determined biweekly. Feeding level and FCR were significantly affected by dietary treatment ($P < 0.05$); however, egg weight and egg production remained unaffected by feed supplementation ($P > 0.05$). Hens under a diet that contained 115g/110g feed with 0.5% CA had better FCR values, whereas those hens on 105g/diet consistently had an equal FCR despite the addition of citric acid. Citric acid supplementation significantly increased the thickness of eggshell, percent shell, and Haugh unit when compared to the un-supplemented groups ($P < 0.05$). Restriction in feed allowance in combination with the addition of 0.5% CA resulted in lower feed cost and higher profits, where hens given 105g feed with 0.5% CA provided maximum net benefit.

Keywords: Laying hen, citric acid, egg quality, feed conversion ratio, economic efficiency

Effect of sodium and chloride level on performance and water consumption of broiler chickens**S. Messaoud¹, C. Rougier-Borne¹**¹TECHNA FRANCE NUTRITION, COUERON, France (Metropolitan)

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Several nutritional levers contribute to improving poultry welfare, among which electrolytes play a key role. A trial was conducted at the Euronutrition research station (France) to evaluate the effect of different sodium and chloride levels on the performance and water consumption of broiler chickens from 0 to 35 days of age. Eight groups were tested: four sodium levels (0.11–0.23%) with a fixed chloride level (0.23%) and five chloride levels (0.14–0.35%) with a fixed sodium level (0.15%). The levels were adjusted by modifying the salt and sodium bicarbonate content. Each group included 12 replicates of 4 ROSS 308 broilers. Significant effects were observed during the starter phase (0–10 days) for chloride; the lowest chloride levels impaired feed conversion ratio ($p < 0.05$) and reduced weight at 10 days ($p < 0.05$). No effect of sodium level was observed on performance for any period. While between 21 and 35 days, water intake ($p < 0.05$) and the water/feed ratio ($p < 0.05$) increased with sodium. An over all linear effect of sodium on water consumption was also observed ($p < 0.05$). Conversely, the different chloride levels tested did not affect water consumption or the water/feed ratio. The trial showed that growth performance and feed efficiency were impacted by chloride only during the starter period; sodium, meanwhile, had no impact. Sodium appears to play a more decisive role than chloride in fluid balance and osmotic pressure regulation. Reducing sodium intake after 10 days could help limit litter and droppings moisture. Thus, adjusting sodium represents a relevant nutritional lever to improve poultry welfare. Caution must also be exercised regarding chloride levels during the starter period to avoid impairing zootechnical performance.

Keywords: Chloride, sodium, water consumption, welfare, performance

Alternative plant protein sources for broiler chickens: enzyme strategies to reduce soybean meal inclusion

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Over-dependency of soybean meal (SBM) use in poultry diets emphasizes the need to explore and optimize alternative (Alt) plant protein sources, such as rapeseed (RSM) and sunflower (SFM) meals. As such, this experiment was conducted to investigate the effect of replacing SBM by up to 20, 30 and 40% in the starter (d1–10), grower (d11–21), and finisher (d22–35) phases, respectively, with low (L) or high (H) combinations of RSM, SFM, and peas, with supplemental phytase, xylanase+ β -glucanase and β -mannanase. Seven dietary treatments were evaluated using 1680 Ross 308 broilers in a randomized complete block design with 8 replicate pens of 30 birds each. Diets consisted of T1 (Control, SBM + 1000 FTU/kg phytase), T2 (L-Alt + 1000 FTU/kg phytase), T3 (H-Alt + 1000 FTU/kg phytase), T4 (L-Alt + 1000 FTU/kg phytase and 560 TXU/kg+250 TGU/kg xylanase+ β -glucanase), T5 (H-Alt + 1000 FTU/kg phytase and 560 TXU/kg+250 TGU/kg xylanase+ β -glucanase), T6 (L-Alt + 2000 FTU/kg phytase and 560 TXU/kg+250 TGU/kg xylanase+ β -glucanase), and T7 (H-Alt + 2000 FTU/kg phytase and 560 TXU/kg+250 TGU/kg xylanase+ β -glucanase). In addition, all diets (T1 to T7) contained 800 TMU/kg β -mannanase. Growth performance, production efficiency, mortality, footpad dermatitis, sticky droppings and litter quality were evaluated. The H-Alt diets (T3 and T5) containing 1000 FTU/kg phytase, with or without xylanase/ β -glucanase, consistently exhibited the lowest body weight (BW), average daily gain (ADG), and production efficiency throughout the study ($P < 0.005$). However, increasing phytase supplementation to 2000 FTU/kg in combination with xylanase/ β -glucanase (T6 and T7) restored BW, ADG and production efficiency to levels comparable with the SBM (control). Despite lower average daily feed intake ($P < 0.005$), birds fed the H-Alt diets (T3, T5, and T7) showed a tendency for improved feed conversion ratio during the starter phase relative to the control ($P = 0.066$). Mortality (1.4%), footpad dermatitis and litter quality were unaffected by treatment ($P > 0.05$), whereas sticky droppings at 10 d were greatest in T5 and reduced at higher phytase inclusion (T6 and T7; $P = 0.002$), suggesting improved gastrointestinal function. Overall, the results demonstrate that up to 40% replacement of SBM with RSM, SFM and peas is achievable using an appropriate enzyme program; herein, the superior response to 2000 FTU/kg phytase likely reflects enhanced phytate hydrolysis and complementing action with carbohydrase.

Keywords: plant protein sources; soy replacement; enzymes; performance; broiler chickens

Effects of replacing commercial zinc bacitracin with insect meal on caeca bacteria composition, haematology, and growth performance in commercial broiler chicks at the starter phase**M. Mabelebele¹**¹University of South Africa, Johannesburg, South Africa

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The effects of Macrotermes subhyllanus meal, as a substitute for zinc bacitracin (antibiotic growth promoter [AGP]), on bacteria composition, haematology, and performance parameters were evaluated in broiler chicks during the starter phase. Methods Three dietary treatments, NC (negative control; basal diet only), PC (positive control; basal diet with 0.5 g of zinc bacitracin per kg DM) and InsecM (basal diet with 100 g of insect meal per kg DM) were used in this study. A total of 150 one-day-old broiler chicks were randomly assigned to each of the 3 treatments, with 10 chicks per replicate and 5 replicates per treatment in a completely randomised design. Data on bacteria composition, apparent nutrient digestibility, blood profiles and growth parameters were measured on d 14 and subjected to DADA2 and SAS software for statistical analysis. Results The results revealed that Firmicutes was the predominant ($P<0.05$) phylum, proportionate to Actinobacteriota, Bacteroidota, Cyanobacteria, Proteobacteria, Verrucomicrobiota and Vertebrata in chicks fed an InsecM diet than those on NC and PC diets. Furthermore, an InsecM diet reduced ($P<0.05$) apparent dry matter (83.50%) and crude fibre digestibility (75.62%), while apparent crude protein (CP) digestibility was significantly improved (86.24%) when compared to NC and PC diets. Plasma enzyme alanine aminotransferase was also significantly reduced by an InsecM diet (0.87 U/L). However, uric acid (0.27 mmol/l) was elevated ($P<0.05$) in chicks fed an InsecM diet. Body weight gain (483.28 g/bird) and the feed conversion ratio (1.12) were improved in chicks fed the InsecM diet. Conclusion It is concluded that broiler chicks on a diet having 100g of M. subhyllanus insect meal per kg DM improved caecal bacteria composition, CP digestibility and growth performance, without causing negative effects on the birds' metabolic pathways and health status. However, more studies are encouraged to confirm these findings.

Keywords: Keywords: microbiome composition, insect meal, gut macroflora, blood profile, apparent digestibility

Choice Feeding of Fermented De-Oiled Rice Bran in Broilers: Impacts on Growth, Physiology, Metabolism, and Meat Quality

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This research focuses on how fermentation affects the nutrient content of de-oiled rice bran (DORB) and their suitability as an additional food source for broilers in a free-choice feeding system, particularly identifying the best fermentation period. DORB was fermented in anaerobic conditions with 2% yeast at a temperature of 29 to 33 °C and 60% moisture. After fermentation, the fermented DORB was dried and made into pellets. The experiment involved 192 Arbor Acres broiler chicks over 35 days. These chicks were split into four groups of 48 birds each, with 6 replication and 8 birds per replicate: (1) a standard diet (control), (2) a standard diet mixed with unfermented DORB (which included yeast), (3) a standard diet with DORB fermented for 24 hours, and (4) a standard diet with DORB fermented for 48 hours. The chicks had free access to the diet and DORB, along with unlimited food and water. Fermentation greatly improved the quality of DORB. Crude protein rose from 18.2% to 24.5%, while crude fiber dropped from 19.0% to 15.2% ($p < 0.001$). Metabolizable energy increased with longer fermentation times, reaching a peak at 48 hours (2838 kcal/kg), followed by 24 hours (2610 kcal/kg), in contrast to unfermented DORB (2465–2492 kcal/kg) ($p < 0.001$). Total amino acids improved from 10.46 to between 11.20 and 11.68 g/100 g, with increases in essential amino acids such as leucine, lysine, and isoleucine ($p < 0.001$). Growth performance was similar across all treatments (final body weight: 2196–2336 g; FCR: 1.50–1.55; $p > 0.05$), although groups with fermented DORB had slightly higher gains. Feed intake of fermented DORB peaked at 24 hours. Meat ether extract significantly decreased from 3.33% in the control group to 1.36% at 48 hours, while carcass yield remained stable at 64–67%. Serum analysis showed improved health, including lower cholesterol (notably in the 24-hour group), reduced ALT at 48 hours, and stable mineral levels. In summary, fermentation improved the nutritional value of DORB and confirmed its safety for use in broiler diets. A fermentation time of 24 to 48 hours proved optimal, with 24 hours offering slight benefits in performance and feed use.

Keywords: De-oiled rice bran; Broiler chickens; Free-choice feeding; Growth performance; Meat quality

Genetic improvement of the local farm chicken in algeria: creation of two specialized lines "fitness" and "chair" at the algerian technical institute of breeding (itelv) algeria

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The Algerian indigenous chicken is a valuable genetic resource characterized by its hardiness, adaptation to local climatic conditions, and suitability for low-input production systems. To conserve and improve this breed, the Technical Institute of breeding (ITELV) implemented a breeding program to develop two specialized lines: a Fitness line, selected for reproductive performance, viability, and adaptation, and a Growth line, aimed at improving growth and meat production. Founder birds were collected from several regions of Algeria to maximize genetic diversity. Following phenotypic evaluation and genotyping, two generations of selection (G1 and G2) were completed at the Baba-Ali and Tlemcen breeding centers. In G1, approximately 1,300 chicks were produced at each site, allowing the planned selection intensity to be achieved. Selection produced encouraging results. At 12 weeks of age, males selected for the Growth line reached an average body weight of 1,020 g compared with 815 g for candidate males, while selected females averaged 871 g versus 684 g, corresponding to selection differentials of 205 g and 187 g, respectively. In the Fitness line, selection differentials reached 120 g for males and 144 g for females. Reproductive performance showed substantial variation among families, with fertility ranging from 50–80% and hatchability from 40–80%. At the Baba-Ali station, the average laying rate reached 44% in the Growth line and 38% in the Fitness line. Mean egg weights were 57.2 g and 52.7 g, respectively. The first crossbreeding trials between the two lines were conducted in 2025 to assess heterosis. Preliminary results showed no significant advantage in body weight, although further evaluations are in progress. An initial dissemination phase is underway, involving 10 breeders from central, western, and southern Algeria, each receiving 20 females and 4 males, together with an identification and performance recording system. Generation G3 has now been established with approximately 1,500 chicks distributed into four batches aged 2 to 3 months, and performance analyses are ongoing. These results demonstrate the feasibility of a national breeding program for the Algerian indigenous chicken and highlight its potential for genetic improvement while preserving the adaptive traits that make this breed particularly suitable for sustainable, climate-resilient poultry production.

Keywords: algerian chicken; warm climate; genetic improvement; zootechnical performance; breeding; local genetic resources

Effects of increasing heat stress on performance and jejunal gene expression in chickens**K. Guirratí^{2,1}, Z. Pardo², J. Gené³, A. Dunmade², N. París², O. González¹, M. Ballester¹, J. Tarradas²**¹IRTA, Animal Breeding and Genetics, Torre Marimon, Caldes de Montbui, Catalonia, Spain, ²IRTA, Animal Nutrition, Mas Bové, Constantí, Catalonia, Spain, ³IRTA, Efficient Use of Water in Agriculture, Fruitcentre, Lleida, Catalonia, SpainPresenting author: khaoula.guirrati@irta.cat

Poultry production is a major source of dietary protein worldwide but is increasingly challenged by climate change and global warming. Heat stress (HS) affects performance, physiology, metabolism, and gut health in broilers. Also, it results in increased peripheral blood circulation at the expense of gut irrigation, causing hypoxia, intestinal damage and compromised the intestinal integrity. The present study characterizes the impact of different simulated heat wave scenarios on broilers' performance and intestinal gene expression. A total of 1260 broilers were randomly distributed into three rooms (12 floor pens each) under commercial conditions. From 21 to 35 days of age, the different HS challenges were applied daily as follows: T1, control (no HS); T2, moderate HS (28°C for 4h) and T3, severe HS (32 °C for 6h). Performance was assessed at 1, 10, 21 and 35 days of age. At the end of the study, twelve animals per treatment were sampled, and jejunum mucosa were collected for gene expression analysis. The Biomark X platform, with a panel of 48 genes related to intestinal integrity, metabolism, immunity, nutrient transport, and oxidative stress, was used to assess mucosal gene expression. At 35d, T3 animals had the lowest body weight, being -7.9% and -6.5% lower ($p<0.001$) than T1 and T2, respectively, with a similar pattern for the other performance traits. Compared with T1, T2 animals showed an upregulation of AKT and RPS6KB1 ($p<0.05$), suggesting an activation of the mTOR pathway, probably to trigger a metabolic and repair response against HS in the epithelium. In parallel, COX16, MUC2 and FABP2 ($p<0.05$) were downregulated, with a similar trend for MUC5ac, inducing a reduction of epithelial barrier function and nutrient transport capacity. However, in T3 the expression of AKT and RPS6KB1 was not different from T1, and mTOR expression tended to be lower than T2, suggesting a reduced capacity to maintain this metabolic response under severe HS. The nutrient transporter SLC3A1 was specifically downregulated in T3 compared to both T1 and T2, indicating further compromise of nutrient transport capacity under severe HS, which may explain the loss of performance observed in this group. In conclusion, birds appear to activate a metabolic and repair response able to counteract moderate HS; however, this response appears to be diminished under severe HS, with an impairment of nutrient transport, likely contributing to the loss of performance.

Keywords: Poultry; Heat stress; Gut health; Performance

Egg production and environmental resilience in slow growing hens fed diets supplemented with dehydrated black soldier fly larvae: insights from an agroecological low-input system

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Local poultry breeds support agroecological strategies promoting agrobiodiversity and resilience. BSFL provide a sustainable protein source aligned with low-input principles. The Millefiori Piemontese is a slow-growing, dual-purpose Italian breed suited to extensive management. This study characterised egg production, egg weight, egg mass, and feed conversion ratio (FCR) over 36 weeks (January–September 2025) in 10 pens (7 birds/pen) allocated to a control group (C; n=5) receiving a standard commercial diet and an experimental group (EXP; n=5) receiving the same diet supplemented with dehydrated BSFL (15% of expected daily feed intake, three times weekly). Eggs were collected daily and weighed twice a week; growth parameters and FCR were calculated monthly. Henhouse microclimate was continuously monitored (RC-51H datalogger; 6230 hourly observations). Linear mixed models revealed a tendency toward higher laying rate in the EXP group (58.4 vs. 55.3%; SEM=1.24; P=0.078), while egg weight was unaffected by treatment (54.5 vs. 54.5 g; P=0.924) and increased with age (+0.207 g/week; P<0.001; P interaction=0.539). Although overall FCR did not differ significantly between groups across the trial (FCR per kg egg mass: 4.48 vs. 4.96, SEM=0.152, P=0.188; FCR per egg: 5.08 vs. 5.57, SEM=0.162, P=0.146), EXP hens showed numerically better feed efficiency (−10.7% and −8.7%, respectively). Period-by-period analysis revealed consistent and significant improvements in FCR for the EXP group during the central and late laying phases (weeks 39–66), with differences reaching significance in 6 out of 9 periods for FCR per kg egg mass (P ranging from 0.006 to 0.024) and in 5 out of 9 periods for FCR per egg (P ranging from 0.006 to 0.019). Despite wide thermal fluctuations (−3.8 to 38.8°C), hens spent 62% of time within the comfort zone (THI<70), and the apparent correlation between temperature and laying rate (r=0.78) proved spurious once seasonality was accounted for (residual r=0.09; P=0.45). A photoperiod-based model explained 97% of laying-rate variance, confirming that production rhythms are governed by natural day length rather than thermal conditions. These results highlight the adaptability of Millefiori Piemontese to uncontrolled environments and the potential of BSFL supplementation to improve feed efficiency during peak and late lay phases, offering a low-impact nutritional strategy for agroecological systems prioritising animal welfare and reduced external inputs.

Keywords: Autochthonous poultry breeds, Laying rate, Egg production, Temperature-humidity index (THI)

The use of digital technologies in poultry production

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The digitalisation of agriculture in Europe has significant potential to increase efficiency, effectiveness, sustainability and competitiveness across the sector. The European Commission's political guidelines for 2024-2029 highlight this potential by prioritising support for the entire food value chain through investment and innovation on farms, cooperatives and agri-food businesses. Digital technologies in agriculture can increase farm performance by improving sustainability, productivity and resilience, in particular through sensors, data analytics (e.g. based on artificial intelligence) and decision support systems, leading to more tailored and precise farming operations. The European Commission has supported several research and innovation projects (e.g. ATLAS, DEMETER) and deployment measures, such as the Common European Agricultural Data Space, which are shaping digitalisation in EU agriculture. The poultry industry faces complex challenges in meeting the growing demand for meat and eggs. Producing in a sustainable manner, with strict quality control standards and increasing ethical demands. To address these pressures, the sector is undergoing a digital transformation marked by the adoption of data-driven technologies that are changing production practices. Digital poultry production is based on the application of smart, precision equipment and digital platforms to optimize farming, monitor poultry health and increase sustainability. Digital technologies are innovations with a major impact across various economic sectors, encompassing the internet, artificial intelligence, big data, cloud computing, automation and robotics. The Internet network connects devices via the Internet, enabling the collection and exchange of data in real time, optimizing processes and providing insights into every segment of production. In poultry, it enables precise control of the conditions inside the poultry house. Its application improves environmental monitoring and control, which benefits poultry welfare. In poultry industry, artificial intelligence and machine learning can optimize feeding, health monitoring and environmental control processes, improving animal welfare and productivity. Before implementing precision technologies, we should be aware of the potential problems and limitations that may arise during the operation of systems and devices. This can help us in planning, decision-making, and problem-solving. In conclusion, we can say that the challenges facing poultry production will be easier to overcome with the use of digital technology. It is necessary to reform the current education system, especially at higher education institutions, in order to develop skills for working in such a digital environment among students. It is necessary to implement lifelong education for farm workers so that they are ready to use new knowledge and modern digital tools in poultry production.

Keywords: poultry production, digital technologies, artificial intelligence

Palm kernel fatty acid distillates in laying hen diets: effects on egg yolk lipid composition, oxidative stability and consumer acceptance**L. Parro^{2,1}, A. Solinas², S. Vichi^{2,1}, C. Garces³, F. Guardiola^{2,1}, A. Tres^{2,1}**

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Medium-chain fatty acids (MCFA) are known for their rapid absorption and their benefits on gut health. In animal nutrition, there is an interest in identifying sustainable alternatives to conventional fats, with fat-derived by-products emerging as promising options. The aim of this study was to evaluate the effects of palm kernel oil (PKO) and palm kernel fatty acid distillate (PKFAD) as dietary fat sources for laying hens on egg yolk lipid composition, oxidative stability, and sensory acceptance, compared with a soybean oil (SO) control diet. PKFAD is a by-product of the physical refining process, obtained during the deodorization of PKO, and is rich in free MCFA. PKO is also rich in MCFA, but mainly in the form of triacylglycerols. The experimental design consisted of 7 dietary treatments using different mixtures (100/0; 33/66; 66/33; and 0/100, w/w) of SO with PKO or PKFAD. Each diet was offered for 8 weeks to 18 hens distributed in 6 cages. Each cage was considered one replicate. During the last week, 9 eggs were collected and yolks were pooled for analyses under both fresh and cooked (steam oven, 95°C, 28 min) conditions. The determinations carried out in eggs yolks were: i) fatty acid composition and ii) cholesterol by GC-FID (fresh yolks only); iii) tocopherols and tocotrienols by HPLC-FLD; iv) thiobarbituric acid (TBA) values, by a spectrophotometric method after acid aqueous extraction; v) volatile compounds by HS-SPME-GC-MS; and vi) sensory acceptance of cooked eggs yolks, using a nine-point hedonic scale. Compared with the SO diet, eggs from hens fed PKO and PKFAD showed higher saturated and MCFA contents and lower polyunsaturated fatty acid levels, with no differences between PKO and PKFAD treatments. Yolk cholesterol concentration was not affected by dietary treatments. α -Tocopherol was the predominant tocopherol in egg yolk, with higher concentrations in eggs from hens fed SO and PKFAD diets. γ -Tocopherol was present at greater concentrations in eggs from the SO diet. α -Tocotrienol was the most abundant tocotrienol and was significantly increased in eggs from hens fed the PKO and SO:PKO 33:66 diets. Lipid oxidation, assessed by TBA values and volatile compound concentrations, did not differ among treatments in either fresh or cooked eggs. In the hedonic evaluation, consumers were unable to detect significant differences among eggs, indicating that the inclusion of PKO and PKFAD did not negatively affect sensory acceptance. In conclusion, PKO and PKFAD are suitable alternative dietary fat sources for laying hens, improving the MCFA content of egg yolks without compromising oxidative stability or consumer acceptance

Keywords: palm kernel fatty acid distillate; medium-chain fatty acids; egg yolk lipid composition; oxidative stability; consumer acceptance

Housing system modulates the response to dietary *Haematococcus pluvialis* supplementation in laying hensF. Accetta¹, G. Pace¹, M. Albano¹, A. Albergamo², L. Falqui³, V. Lo Turco², V. Chiofalo¹, A. Di Rosa¹¹Department of Veterinary Sciences, University of Messina, Messina, Italy, ²Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, University of Messina, Messina, Italy, ³Di Bella Costruzioni S.R.L., Catania, Italy

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The use of microalgae as functional feed ingredients represents a sustainable strategy to improve the nutritional and functional quality of eggs. However, whether the response to dietary supplementation is influenced by the housing system remains poorly understood. This study evaluated the effects of dietary supplementation with 0.075% dried *Haematococcus pluvialis* (HP) in Lohmann Brown laying hens reared in enriched cages or free-range systems. A total of 200 hens (100 per housing system) were assigned to two dietary treatments: a control diet (CTRL) and the same diet supplemented with 0.075% HP for 60 days. At the end of the trial, yolk colour, total carotenoid and astaxanthin contents, mineral composition of albumen and yolk, and yolk fatty acid profile were determined. Data were analysed by two-way ANOVA considering diet, housing system, and their interaction as fixed effects. Dietary HP supplementation significantly increased yolk pigmentation ($P < 0.0001$). Total carotenoid and astaxanthin contents were significantly affected by diet, housing system, and their interaction ($P < 0.0001$), with carotenoid concentrations ranging from 16.39 to 31.80 mg/kg and astaxanthin reaching 5.21 mg/kg in enriched-cage eggs and 2.50 mg/kg in free-range eggs. HP supplementation also enhanced the deposition of several macro- and trace minerals in both albumen and yolk. Representative examples included albumen Fe (0.92–14.29 mg/kg), albumen P (148.91–585.33 mg/kg), and yolk Mg (143.33–253.61 mg/kg), although the magnitude of these responses varied according to the housing system. Moreover, HP supplementation reduced yolk SFA from 34.27% to 29.47% in enriched-cage hens and from 33.63% to 31.33% in free-range hens, while MUFA increased from 36.71% to 51.19% and from 43.36% to 48.91%, respectively. Diet, housing system, and their interaction significantly affected both SFA and MUFA ($P < 0.001$). These findings demonstrate that dietary *H. pluvialis* supplementation improves egg nutritional quality by enhancing pigment deposition, mineral enrichment, and lipid composition. However, the magnitude of these responses depends on the housing system, highlighting the importance of considering housing conditions when evaluating functional feeding strategies for laying hens.

Keywords: *Haematococcus pluvialis*; laying hens; housing system; egg nutritional quality; carotenoids.

Using machine learning to assess eggshell quality from photos and measurements

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Eggshell quality affects hatchability, storability and industrial use of eggs. Changes in shell color may indicate flock health problems, infectious diseases such as Infectious Bronchitis, or nutritional and management-related issues. In this study, we investigated whether eggshell fragility can be predicted using machine learning models trained on image-derived and physical traits. Eggs were photographed under red light to enhance subtle color differences. Strong white light was used during candling to improve pore visibility. Color features were extracted from images using Fiji software and compared with spectrophotometric measurements (SPM). Egg weight, width, length and shape index were recorded for each egg. Breaking force was measured and used to classify eggs into shell-strength categories. Four same-age hybrids (three white-shell and one brown-shell) were examined. Balanced class-weighted Random Forest models were trained on the complete dataset and separately on white- and brown-shell eggs. Model accuracy was 76-80%. Reliable classification of fragile eggs was limited by the low number of samples below 45 Newton, although non-fragile eggs were consistently identified. Color-related features were among the most important predictors in all models. This was expected in brown-shell eggs, where blue and green color channels were particularly important together with egg length, weight and pore-related traits. Surprisingly, color and brightness features also ranked among the strongest predictors in white-shell eggs, suggesting that subtle shell color differences may contain information related to shell strength. Egg geometry and pore-related traits also contributed to prediction. SPM frequently appeared among the top predictors when included in the models; however, their removal did not reduce classification accuracy. Hybrid type was not among the leading predictors, while location within the hen house appeared as a potential environmental factor in brown-shell eggs. Overall, image-derived features were more informative than SPM. With a standardized camera and lighting setup, image-based monitoring could provide a practical alternative to manual measurements and allow more eggs to be evaluated. These findings should be confirmed using a larger dataset, particularly for fragile eggs. Future studies could explore direct image-based deep learning. Related to project 2023-1.1.1-PIACI_FÓKUSZ-2024-00046.

Keywords: Machine learning; Eggshell quality; Image analysis; Eggshell fragility; Shell color

Infectious bronchitis virus in Spain: diversity, coinfections and emerging trends in poultry**L. Redrado¹, J. Arnal¹, M. Ubieto¹**¹Exopol S.L, Zaragoza, Spain

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Avian infectious bronchitis virus (IBV) is characterised by a high mutation rate, favouring the continuous emergence of new variants. Maintaining adequate protection against emerging field strains remains a major challenge for the poultry industry, as the genetic distance between circulating variants and vaccine strains may compromise vaccine-induced immunity. The aim of this study was to continue the epidemiological surveillance of IBV in Spain, following the previous 2018–2022 study. For this purpose, 82 clinical cases submitted to the laboratory between 2022 and 2025 were sequenced according to the method described by Adzhar et al. (1977), with modifications based on the partial nucleotide sequence of the S1 gene. Cases originated from layers (n = 31), breeders (n = 20), rearing flocks (n = 4), and broilers (n = 2). The production system was not identified in the remaining cases (n = 25). Sequences were classified into genotypes and lineages according to the system proposed by Valastro et al. (2016), and detection frequencies were compared with those from 2018–2022. The detection frequencies were as follows: 793B (GI-13), 55%; IB80 (GVIII), 35%; D1466/V1397 (GII-1), 32%; Mass (GI-1), 12%; QX (GI-19), 11%; Italy02 (GI-21), 2%; and D274 (GI-12), 1%. Overall, these results were similar to those observed in the previous study. However, the detection of IB80 (GVIII) and D1466/V1397 (GII-1) was particularly noteworthy, as both variants showed a clear increasing trend compared with the previous study period. The co-infection rate was higher than that reported in the previous study, increasing from 6.5% to 40%. Among the 33 co-infected cases, dual co-infections were detected in 28 cases, whereas triple co-infections were identified in five cases. The most frequent co-infection patterns were as follows: 793B (GI-13) + D1466/V1397 (GII-1), 21.2%; 793B (GI-13) + Mass (GI-1), 21.2%; D1466/V1397 (GII-1) + IB80 (GVIII), 18.2%; and 793B (GI-13) + IB80 (GVIII), 12.1%. These findings confirm the increasing epidemiological relevance of IB80 (GVIII) and D1466/V1397 (GII-1) in Spain. Given recent methodological advances and their increasing accessibility for diagnostic laboratories, continuous epidemiological data collection is strongly recommended. Updated information on circulating IBV variants in each production system is essential to improve surveillance and support effective control measures.

Keywords: IBV, variants, protection, IB80, Spain

Why It's Time to Move Beyond "Gut Health" — And Toward Gut Homeostasis**M. Kogut¹, M. Fernandez-Miyakawa²**¹Vetanco USA, Saint Paul, United States, ²Vetanco SA, Buenos Aires, ArgentinaPresenting author: mike.kogut@hotmail.com

The term gut health has become deeply embedded in animal agriculture, yet its meaning has drifted toward a vague, marketing driven snapshot of intestinal condition. As production systems grow more complex and animals face continuous environmental, nutritional, and microbial pressures, a static concept no longer captures the biological reality of how the gut functions. Here we argue that replacing "gut health" with the more accurate and mechanistic framework of gut homeostasis. Homeostasis describes a dynamic regulatory process in which the gut maintains function under challenge through sensing, integration, and corrective action. Central to this process is the intestinal epithelial cell (IEC) layer, recently described by Winter & Bäuml (2023) as the gut's "thermostat." IECs detect deviations from the physiological set point, modulate immune and barrier responses, regulate oxygen tension, and tune their own metabolic programs to shape microbial ecology and immune tone. These regulatory mechanisms—not static states—determine resilience, efficiency, and performance in production animals. By shifting the conversation from "gut health" to gut homeostasis, the industry can re center management, nutrition, environment, and stress reduction as the primary drivers of intestinal stability. Feed additives remain valuable tools but no longer define the gut itself. This reframing offers a clearer, more biologically grounded path for improving animal robustness in real world production systems.

Keywords: intestine; homeostasis; intestinal epithelial cells; gut health

Breed-associated signatures in the avian nasal microbiota of fast- and slow-growing chickens reared under controlled conditions

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The nasal microbiota constitutes a first line of defense against respiratory pathogens; yet, whether its composition in poultry reflects host genetic background remains largely unresolved. Most available data derive from field studies, where environmental heterogeneity confounds breed comparisons. Here, we characterize the nasal microbiota of fast-growing (Ross 308, Broiler) and slow-growing (Hubbard JA57, Slow-growth) commercial chicken breeds hatched and reared under strictly controlled biosafety level 3 conditions, providing the first comparison between breeds under identical and highly controlled environmental settings. Five birds per breed were housed in adjacent enclosed pens within a single experimental room from the day of hatch and necropsied at 17 days of age. DNA was extracted from nasal turbinate samples (n = 5 per breed), and the V3-V4 region of the 16S rRNA gene was sequenced using the Illumina MiSeq platform. Reads were processed with QIIME2 and DADA2, and taxonomy was assigned using a SILVA 138.2-trained classifier. Downstream analyses, including diversity metrics, differential abundance, and functional prediction, were performed with MicrobiomeAnalystR, edgeR, and Tax4Fun2. Both breeds shared a broadly conserved core nasal microbiota dominated by Enterobacteriaceae and Lachnospiraceae. Alpha diversity did not differ between groups. Beta diversity revealed a moderate but significant compositional divergence based on Jensen-Shannon distance (PERMANOVA $R^2 = 0.29$, $p = 0.034$), but not Bray-Curtis dissimilarity, indicating qualitative rather than quantitative differences in community composition. Differential abundance analysis identified 34 breed-discriminating amplicon sequence variants. Both breeds harboured members of Lachnospiraceae and Clostridiaceae, but genus-level representation differed: Anaerostipes and Hungatella predominated in Broiler birds, whereas Eisenbergiella and Butyricicoccus were enriched in Slow-growth chickens, mirroring breed-associated patterns previously reported in the caecal microbiota. Functional prediction suggested enrichment of thiamine biosynthesis pathways in Broiler chickens. Overall, these findings indicate that the chicken nasal microbiota is not solely environmentally determined and may partly reflect the host genetic background. Identified taxa and functional pathways warrant further investigation regarding their role in respiratory health and disease resilience in commercial poultry.

Keywords: nasal microbiota; host genetics; broiler breed; 16S rRNA; Slow-growth

Evaluation of innovative emulsion and polymer adjuvants for inactivated H5N8 HPAI virus vaccine

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Introduction: Highly pathogenic avian influenza (HPAI) poses a significant threat to poultry industry, necessitating effective vaccination strategies. This study evaluated the safety, immunogenicity, and efficacy of an inactivated reverse genetics-based H5N8 vaccine, with a focus on different adjuvant technologies. The study aimed to assess the efficacy of H5N8 vaccines adjuvanted with MontanideTM ISA 78 VG, MontanideTM ISA 71R VG (innovative water in oil emulsion adjuvants) and MontanideTM GEL P PR (Polymer-based aqueous adjuvant), in comparison to a commercial vaccine (oil based adjuvant). **Methods:** Four-week-old influenza antibody-negative chickens were vaccinated subcutaneously with 0.5 ml of the H5N8 vaccine adjuvanted with ISA 78, ISA 71 R, GEL P, the commercial vaccine, or the antigen alone. Safety was assessed by monitoring chickens for clinical signs and weight changes for 35 days. Immunogenicity was evaluated by measuring hemagglutination inhibition (HI) antibody titers on days 0, 7, 14, 21 and 28 after vaccination. Efficacy was determined by challenging vaccinated chickens with a H5N1 field virus isolate 35 days after vaccination, and assessing survival and viral shedding for 10 days. **Results:** All adjuvanted formulations were safe, with no local or systemic reactions observed. Chickens vaccinated with ISA 78, ISA 71R, GEL P, and the commercial vaccine developed high HI antibody titers. The ISA-78 group demonstrated superior immunogenicity. Following the challenge, all vaccinated groups demonstrated better protection and reduced viral shedding compared to the control group. **Conclusion:** H5N8 vaccines adjuvanted with MontanideTM ISA 78 VG, ISA 71 R VG, and GEL P PR elicited substantial humoral immune responses. Specifically, MontanideTM 78 VG induced the highest antibody titers, exhibiting superior immunogenicity and positioning it as a potent adjuvant candidate HPAI vaccines. Furthermore, these findings suggest that both oil and polymer-based adjuvants are efficacious for HPAI vaccines formulation.

Keywords: *HPAI*, *avian vaccine*, *emulsion adjuvant*

Intestinal epithelial metabolism as the central regulator of inflammatory homeostasis in poultry**M. Fernandez-Miyakawa¹, M. Kogut²**¹Vetanco SA, Buenos Aires, Argentina, ²Vetanco USA, Saint Paul, United StatesPresenting author: mmiyakawa@vetanco.com

Gut inflammation is generally regarded as a detrimental condition that should be minimized in poultry production. However, increasing evidence indicates that controlled inflammatory activity is an essential physiological component of intestinal homeostasis. The objective of this study was to develop a mechanistic framework integrating current knowledge on intestinal epithelial biology, inflammatory regulation, mitochondrial metabolism, and host–microbiota interactions to redefine the role of inflammation in poultry gut health. Published evidence on epithelial immune sensing, inflammatory signaling, mitochondrial function, metabolic reprogramming, and disease tolerance was critically analyzed and organized according to the sequential phases of the inflammatory response described by Medzhitov. This integrative approach identified the intestinal epithelial cell (IEC) as the central regulatory node coordinating immune activation, metabolic adaptation, and microbial interactions. The resulting framework proposes that epithelial mitochondrial metabolism governs the transition from physiological inflammatory responses required for tissue maintenance to persistent inflammation associated with impaired nutrient allocation and reduced productive performance. Furthermore, the model highlights mitohormesis as a potential mechanism linking epithelial metabolic fitness with inflammatory resolution and resilience. These findings provide an epithelial-centered conceptual framework that integrates immunity, metabolism, and microbiota into a unified model of intestinal homeostasis and identifies new nutritional and management strategies to improve health, disease tolerance, and productivity in poultry raised under reduced-antibiotic production systems.

Keywords: gut; inflammation; cell metabolism; mitochondria, hormesis

Molecular Surveillance of Re-emerging Virulent Newcastle Disease Virus in Poultry in Libya (2013–2025)

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Since its first description in 1926, Newcastle disease (ND) has remained one of the most important viral diseases affecting domestic and wild birds worldwide, causing substantial economic losses due to high morbidity and mortality. This presentation highlights the re-emergence of virulent Newcastle disease virus (NDV) in Libyan poultry, with emphasis on the clinical features of recent outbreaks and the genetic evolution of the circulating virus. Genotype VII NDV circulating in poultry in Libya was first isolated and molecularly characterized in 2013 based on partial sequencing of the fusion (F) gene. Ten years later, in 2023, the F gene was sequenced again and compared with previously identified Libyan isolates and representative international strains. The 2023 isolates shared 86–91% nucleotide identity with European isolates detected between 2020 and 2022, as well as with isolates from Asia and Africa, and 97% identity with Libyan strains identified in 2013 and 2016. A notable genetic difference was observed at amino acid position 111 of the F protein cleavage site, where lysine (K) replaced the arginine (R) found in the earlier Libyan isolates. This amino acid substitution resulted from a nucleotide change from AGA in the 2013 and 2016 strains to AAG in the 2023 strains. Importantly, this substitution lies outside the polybasic cleavage site that defines velogenic avian orthoavulavirus 1 (AOAV-1) strains, which is characterized by multiple basic amino acids beginning at position 112 and a phenylalanine (F) residue at amino acid position 117 at the N-terminus of the F1 protein, according to the World Organisation for Animal Health (WOAH, formerly OIE) criteria. Although this substitution lies outside the canonical cleavage site, its biological significance remains to be determined. Previous studies have also demonstrated that regions of the F protein beyond the polybasic cleavage site may contribute to NDV virulence. Following another wave of disease in 2025, the re-emerging NDV was again detected and genetically characterized. The 2025 isolate showed nucleotide identities of 97.01%, 96.42%, and 95.82% with strains previously reported from Turkey, North Macedonia, and Libya (2013), respectively. These findings confirm that Newcastle disease remains a major threat to the poultry industry in Libya. Comprehensive nationwide epidemiological surveillance involving representative sampling from all regions is urgently needed to better understand the distribution and evolution of circulating NDV strains. Continuous molecular monitoring of genotype VII viruses is strongly recommended to detect emerging variants and to support the development of autogenous vaccines based on locally circulating field isolates, thereby improving disease control and vaccination effectiveness.

Keywords: NDV, genotype VII, Poultry, Libya, Molecular Monitoring

Enforcement of Biosecurity Measures in Poultry Farms and Related Facilities**M. Freiji¹**¹Tanmia, Said Freiha street - Camelia 3 bldg - Hazmieh - Beirut, LebanonPresenting author: mfrei@tanmia.com.lb

Musa Freiji 1957 graduate of the Faculty of Agriculture, American University of Beirut, Beirut, Lebanon. The emergence and continued circulation of highly pathogenic avian influenza (HPAI) and other viral diseases pose major challenges to poultry health, productivity and, potentially, public health. Inadequate biosecurity remains an important factor facilitating disease introduction and transmission, particularly in rural and backyard poultry systems where monitoring, movement control and compensation mechanisms may be limited. This study aims to identify the essential biosecurity measures required across the poultry production and processing chain and to determine which measures require government legislation and enforcement rather than voluntary compliance. The study reviews biosecurity requirements for poultry farms, hatcheries, slaughterhouses, meat-processing facilities and egg-grading and processing facilities, considering farm location and separation distances, housing and construction, control of poultry types and age groups, personnel and vehicle movement, feed and water management, pest and wild-bird control, vaccination and immunity monitoring, manure and waste management, cleaning and disinfection, surveillance, and HACCP-based verification. It also examines measures applicable to rural, backyard and free-range poultry and considers relevant international and industry initiatives. The findings indicate that effective biosecurity is most successful when implemented as a coordinated system across the entire poultry chain rather than as isolated farm-level practices. Critical measures include appropriate separation between poultry facilities, controlled movement of live birds, equipment and personnel, effective surveillance, vaccination where necessary, secure housing of rural and free-range poultry, management of manure and waste, regulation of live-bird markets and movement, and fair and prompt compensation during disease-control measures. The study further shows that several high-impact controls cannot be achieved by individual farmers acting independently and therefore require enforceable national standards, competent veterinary authorities, monitoring, training and stakeholder cooperation. Biosecurity should consequently be regarded as national animal-health and public-health infrastructure rather than an optional farm-management practice. Establishing risk-based, auditable and enforceable standards across the poultry chain can strengthen disease prevention, reduce viral circulation and mutation opportunities, improve outbreak response and align the interests of producers and authorities.

Keywords: Biosecurity; Avian influenza; Poultry health; Disease surveillance; Risk-based regulation

Effects of Dietary Supplementation with *Lactobacillus plantarum* and *Yarrowia lipolytica* on Cortisol Levels and Physiological Health of Broiler Chickens

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The gut microbiota plays a fundamental role in poultry health, productivity, and resilience to environmental and physiological stressors. Consequently, dietary supplementation with probiotics and prebiotics has emerged as a promising strategy to improve animal health and welfare while supporting sustainable poultry production. The aim of this study was to evaluate the effects of two novel microorganisms, *Lactobacillus plantarum* and *Yarrowia lipolytica*, on physiological responses and health of broiler chickens. A total of 108 Ross 308 male broilers were randomly allocated to three dietary treatments, reared under commercial farming conditions for 29 days, and monitored throughout the production cycle. Stress-related responses were assessed through cortisol measurements in blood serum and feathers. Blood and feather samples were collected from broilers on days 13 and 41 of age ($n = 30/\text{group}$). Feather samples were washed, dried, and fragmented in PBS saline. Both serum and feather samples were subjected to diethyl ether extraction, and cortisol concentrations were quantified using a commercial ELISA kit (DiaMetra, #DKO001). Hematological and biochemical analyses were performed using an automated analyzer (Mindray BC-2800Vet). While serum cortisol concentrations did not differ among treatments, feather cortisol levels were reduced in both probiotic groups, indicating lower chronic stress and improved welfare. Hematological analyses revealed pronounced effects of *L. plantarum* supplementation, which increased white blood cell ($p \leq 0.05$), lymphocyte ($p \leq 0.001$), and monocyte counts ($p \leq 0.05$), together with reduced heterophil counts ($p \leq 0.001$), suggesting enhanced immune competence and reduced physiological stress. Biochemical analyses demonstrated that probiotic supplementation supported protein metabolism and overall metabolic health, as evidenced by increased total protein, albumin, and globulin concentrations ($p \leq 0.01$), indicating improved protein synthesis and potential immune stimulation. In addition, probiotic supplementation enhanced mineral balance, maintained normal lipid profiles, and reduced glucose concentrations. Overall, the results demonstrate that these novel strains can improve growth performance, welfare, stress resilience, immune status, and metabolic efficiency in broiler chickens without adverse effects on health. This work was co-funded by the European Union's Horizon Europe Project 101136346 EUPAHW (SOA18, Task 4).

Keywords: Probiotics; *Lactobacillus plantarum*; *Yarrowia lipolytica*; Animal welfare; Stress resilience

Effect of Dietary Supplementation of Butyric Acid on Growth Performance, Gut Histology, drooping moisture and meat quality of broiler chickens**R. Sadek¹, G. Srour¹**¹Lebanese university - faculty of agronomy & veterinary medicine , Beirut , Lebanon

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This study evaluated the effects of graded levels of butyric acid (BA) supplementation on growth performance, health status, carcass traits, and meat quality of broiler chickens. A total of 150 one-day-old ROSS 308 broilers were reared for 30 days and randomly assigned to three dietary treatments (50 birds/group): a control diet without BA (Group C), 0.08% BA (Group B), or 0.10% BA (Group A). Growth performance, litter moisture, intestinal histology, carcass yield, organ weights, and breast meat quality (pH, colour, water-holding capacity, tenderness, and intramuscular fat) were evaluated. At slaughter, birds receiving 0.10% BA had significantly lower live body weight than those in Groups B and C. Feed conversion ratio did not differ among treatments. Feed intake was 2.7% higher in Group B and 7.5% lower in Group A than in the control. At 14 days, intestinal morphology was slightly altered only in the 0.10% BA group, with shorter villi and greater villus density. Litter moisture was lower in BA-supplemented groups than in the control. Group B showed the highest carcass yield, differing significantly from Group A but not from the control. Breast muscle, thigh and drumstick yield, abdominal fat, liver yield, and water intake were unaffected by BA supplementation ($p > 0.05$). Heart yield was significantly greater in birds fed 0.10% BA ($p < 0.05$). Breast muscle pH, intramuscular fat, drip loss, thawing loss, and tenderness were not affected by BA supplementation ($p > 0.05$). At 24 h post-mortem, meat colour did not differ in lightness (L^*) or redness (a^*), whereas yellowness (b^*) was lower in Group A. At 48 h, Group A showed the lowest L^* values, while a^* increased over time in all groups. Cooking loss was higher in Group A ($p < 0.05$), whereas intramuscular fat remained unchanged. In conclusion, supplementation with 0.08% BA had no adverse effects on growth performance or meat quality, whereas 0.10% BA reduced growth performance while improving intestinal morphology and litter quality. Further studies are warranted to determine the optimal dietary inclusion level of BA.

Keywords: broiler chicken; butyric acid; intestinal absorption; quality; carcass; performance.

Evaluation of three Bacillus strains for promoting gut health**C. Maupin¹, L. Verhaeghe¹, L. Pineau¹, J. Schulthess¹**¹Phileo by Lesaffre, 137 rue Gabriel Péri, 59700 Marcq-en-Barœul, France (Metropolitan)Presenting author: j.schulthess@phileo.lesaffre.com

Maintaining intestinal barrier integrity is critical for poultry health, performance, and welfare, yet broilers face persistent challenges from pathogens that disrupt gut homeostasis, leading to systemic infections and economic losses. Probiotics, such as Bacillus-based strains, offer a promising strategy to enhance gut resilience. This study evaluated the effects of three Bacillus strains (*B. licheniformis* NRRL B-67649, *B. pumilus* NRRL B-67648, and *B. velezensis* NRRL B-67647) and their combination on epithelial barrier function and immune modulation in broilers, both under steady-state conditions and during inflammatory challenge. Using complementary in vitro (human intestinal epithelial cells) and ex vivo (poultry ileal biopsies) models, we assessed strain-specific effects on barrier integrity, cytokine responses, and antimicrobial defense. Under steady-state conditions, *B. pumilus* significantly upregulated the anti-inflammatory cytokine IL-10, while *B. licheniformis* and *B. pumilus* enhanced tight junction proteins (occludin, claudin-1), reinforcing barrier function. Following flagellin-induced inflammation, the strain combination mitigated pro-inflammatory IL-8 while promoting IL-10, occludin, and avian β -defensins (avBD1/4), demonstrating protective and anti-inflammatory properties. Notably, *B. pumilus* exhibited the broadest immunomodulatory versatility, priming the gut for microbial challenges without excessive inflammation. These findings highlight the synergistic potential of this Bacillus blend in enhancing intestinal resilience, positioning it as a promising tool to improve gut health and mitigate pathogen-induced losses in poultry production.

Keywords: Gut Health, Bacillus strains, *B. licheniformis*, *B. pumilus*, *B. velezensis*

Effects of Dietary Phytogetic Supplementation on Intestinal Barrier Integrity and Production Performance of Broiler Chickens Fed Two Different Diets

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Maintaining intestinal integrity is critical for efficient nutrient utilisation, optimal health, and sustainable poultry production. Phytogetic feed additives have attracted considerable attention as natural tools for supporting gut function; however, their efficacy across different dietary protein sources remains insufficiently documented. The present study investigated the effects of a phytogetic blend on intestinal barrier integrity, gut permeability and production performance in broiler chickens fed soybean meal (SBM)- or rapeseed/sunflower meal (RSM)-based diets. Five hundred one-day-old Ross 308 broilers were randomly assigned to four dietary treatments. Birds received either an SBM- or an RSM-based diet supplemented with or without a phytogetic blend (200 g/t feed). Each treatment comprised five replicate pens of 25 birds, and the experiment lasted 42 days. Salinomycin was included in all diets. On day 28th, intestinal integrity was evaluated by analysing the expression of the tight junction genes CLDN-3, OCLN, ZO-1 and ZO-2, alongside intestinal permeability biomarkers, including diamine oxidase (DAO), secretory IgA and ovotransferrin. Productive performance and litter ammonium nitrogen concentration were also assessed. The phytogetic supplementation consistently improved intestinal barrier function regardless of dietary protein source. Expression of all analysed tight junction genes increased significantly in birds belonging to both dietary groups ($p = 0.001$), indicating enhanced epithelial integrity. At the same time, secretory IgA and ovotransferrin concentrations were significantly reduced, while DAO concentration decreased in birds receiving the RSM-based diet ($p = 0.014$) with a similar trend in the SBM treatment. These changes were accompanied by ammonium nitrogen reduction in the litter (23% and 40% in SBM and RSM diets, respectively; $p \leq 0.001$). Although final body weight remained unchanged, birds receiving the phytogetic blend showed improved feed conversion and a higher European Production Efficiency Factor. Collectively, these findings demonstrate that dietary phytogetic supplementation reinforces intestinal barrier function by enhancing tight junction integrity and reducing biomarkers associated with intestinal permeability. The improvement in production efficiency and reduction of nitrogen losses further highlights the phytogetic blend potential as an effective strategy to support gut health and sustainability in modern broiler production.

Keywords: broiler; gut health; tight junction genes; intestinal permeability biomarkers

Saccharomyces boulardii supplementation in broilers: linking production performance, intestinal morphometry, and microbiome-focused molecular profiling**A. Dodovski¹, B. Angjelovski¹, I. Celeska¹, K. Blagoevska¹**¹Ss Cyril and Methodius University, Faculty of veterinary medicine Skopje, Skopje, MacedoniaPresenting author: katerinab@fvm.ukim.edu.mk

Background: Probiotic yeast supplementation has gained significant attention as a sustainable alternative to antibiotic growth promoters in poultry production. Previous studies have demonstrated that *Saccharomyces boulardii* supplementation at 500 g/1000 kg of feed improves body weight, feed conversion ratio (FCR), European Production Efficiency Factor (EPEF), villus height, and intestinal microbial balance in broilers. **Objectives:** This study extends the evaluation by integrating production performance with deeper microbiome and metagenomic characterization to elucidate the underlying biological mechanisms. **Methods:** Broilers were reared under commercial conditions over a 35-day cycle. Treatments consisted of an untreated control group and an *S. boulardii* supplemented group in feed at an optimized dose. Production parameters, including body weight, feed intake, FCR, and EPEF, were assessed using standard protocols. For molecular profiling, fecal and tissue samples underwent microbial DNA and total RNA extraction using combined mechanical and chemical lysis via spin-column methods. Fecal microbiome profiling was conducted by sequencing the V3-V4 region of the 16S rRNA gene. Operational taxonomic unit (OTU) assignment was subsequently performed using DC-MEGABLAST and the QIIME software package. **Results:** The probiotic-supplemented group is expected to yield the strongest improvements in growth efficiency, alongside a shifted intestinal microbiome favoring beneficial taxa while reducing undesirable populations. These integrated outcomes will provide higher-resolution evidence of probiotic efficacy, supporting reproducible validation strategies for yeast-based probiotics in broiler production. **Conclusion:** This work strengthens the scientific foundation for antibiotic reduction in poultry, promoting sustainable production systems with measurable benefits on performance, gut health, and microbial ecology.

Keywords: broilers; *Saccharomyces boulardii*; microbiome; metagenomics

Impact of dietary *Lactobacillus plantarum* and *Pediococcus acidilactici* on the performance, immunity and gut health of male broiler chickens**M. El Mekdad¹, M. Farran¹, H. Shaib²**¹Department of Agriculture/Faculty of Agricultural and Food Sciences, American University of Beirut, Beirut, Lebanon, ²American University of Beirut, AUB, Beirut, Lebanon

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As the use of antibiotic growth promoters in poultry, especially broilers, continue to pose danger to chickens and humans alike through the rise of antibiotic resistant bacteria; the search for safe alternatives is required. Probiotics have emerged as a possible replacement. This study aimed to elucidate the effects of the dietary supplementation of two probiotic strains, *Lactobacillus plantarum* and *Pediococcus acidilactici*, on broiler growth performance, immunity, and gut health. A total of 800 male birds of Ross 308 strain were equally subdivided into 4 groups. Group 1, the control, was fed a probiotic-free diet, while birds of Groups 2, 3, and 4 were continuously given a diet supplemented with *Lactobacillus plantarum*, *Pediococcus acidilactici* or their combination, respectively. Performance parameters were tested at market age, while gut health parameters, were assessed at 19 days and market age. Group 4 showed marked improvement of gut health markers at day 33 including significant reduction of birds showing feed passage in small intestine (0%), and numerical decrease in percentage of birds with watery intestinal content (13%), abnormal intestinal wall thickness (13%) and gizzard erosion (26.7%). These scores were further reflected in the intestinal inflammatory gene expression assessment whereby the IL-1, IL-6 were significantly reduced (70% reduction in comparison to the Control group, $p < 0.05$) while IL-4 expression was significantly increased. No experimental groups showed marked differences in live body weight. These results highlight the beneficial use of a dietary mix of *Lactobacillus plantarum* and *Pediococcus acidilactici* in improving the gut health of broilers reared under commercial conditions.

Keywords: Broilers; *Pediococcus acidilactici*; *Lactobacillus plantarum*; performance; gut health

A Novel Lipid-Based Formulation for Avian Influenza Prevention and Control**Z. Lai^{2,1}**¹Manuka Biotech Sdn Bhd, Johor, Malaysia, ²Singao (Xiamen) Agribusiness Development Co., Ltd., Xiamen, Fujian, China

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Highly Pathogenic Avian Influenza (HPAI) poses a severe threat to the global poultry industry—even New Zealand, previously regarded as “the last paradise”, has suffered HPAI incursions. While frequent mutations of avian influenza (AI) viruses are well documented, the lipid bilayer of the viral envelope, originating mainly from host cell membranes, remains structurally conserved. This gives rise to a research hypothesis: disrupting the integrity of the enveloped virus’s lipid membrane could attenuate HPAI pathogenicity. Accordingly, a novel lipid-based formulation was developed for avian influenza prevention and control. Four test substances, namely A (lauric acid), B (α -GML), C (modified GML), and D (the compound formulation consisting of short- and medium-chain fatty acids with micrometer-sized particles), were applied to A549 cells cultured in a 24-well plate, with three biological replicates per treatment. Hemagglutination assays and qRT-PCR quantification both confirmed the formulation’s potent inhibitory activity against H1N1 virus. A field trial was conducted on a 60,000-head duck farm experiencing an H5N1 outbreak. The nano-lipid formulation was administered three days following the initial detection of dead ducks. The overall mortality rate caused by H5N1 infection was recorded at 8.7%, with losses concentrated primarily among young ducklings.

Keywords: Avian influenza; H5N1; Lipid formulation; Short- and medium-chain fatty acids; Nano-lipid; Poultry disease.

Feed-grade fenugreek improves growth performance, intestinal health, and nutrient digestibility in Sasso broiler chickens**M. Adande¹, W. Pitala¹**¹Centre d'Excellence Régional sur les Sciences Aviaires / Université de Lomé, Lomé, Togo, Ecole Supérieure d'Agronomie / Université de Lomé, Lomé, TogoPresenting author: stephaneadande92@gmail.com

In a context of reduced antibiotic use as growth promoters in poultry farming, the search for natural alternatives is a priority for sustainable production. Fenugreek (*Trigonella foenum-graecum*), thanks to its richness in bioactive compounds, presents interesting potential as a phytogenic additive in animal nutrition. However, its effects on zootechnical performance, physiological parameters, the gut microbiota, and the quality of poultry products remain poorly documented in Sasso broiler chickens. This study aimed to evaluate the potential of fenugreek seeds incorporated into feed as a natural alternative to improve the production performance of Sasso broiler chickens. The experiment was conducted at the Regional Center of Excellence for Poultry Science (CERSA) on 400 day-old Sasso chicks divided into four treatments: a control group (T0) receiving a feed without fenugreek and three experimental groups incorporating 5, 10, and 15 g of fenugreek seeds per kilogram of feed, respectively (T5, T10, and T15). Zootechnical performance, physiological parameters, nutrient digestibility, gut microbiota, and carcass characteristics were evaluated after 12 weeks of rearing. The results showed that the incorporation of fenugreek seeds did not influence feed intake, indicating good ration acceptability. However, the incorporation levels of 10 and 15 g/kg significantly improved growth performance and feed efficiency compared to the control and the lower levels. Furthermore, the apparent digestibility of nutrients was significantly improved at the **10 g/kg (T10)** incorporation level compared to other treatments, indicating better digestive utilization of feed. This improvement could be linked to the bioactive compounds in fenugreek, particularly saponins and phenolic compounds, which can stimulate digestive secretions, promote enzymatic activity, and optimize nutrient absorption. The absence of changes in the relative weights of the main internal organs further suggests harmonious body development without any apparent negative effects. The incorporation of fenugreek also promoted a balanced gut microbiota by increasing beneficial bacteria and reducing undesirable bacteria, thus contributing to improved digestive health. It also improved carcass yield in the animals. In conclusion, the incorporation of fenugreek seeds, particularly at doses of 10 and 15 g/kg of feed, represents a promising nutritional approach to improving zootechnical performance, nutrient digestibility, gut health, and productivity in Sasso broiler chickens.

Keywords: Fenugreek (*Trigonella foenum-graecum*); Sasso broiler chicken; Zootechnical performance; Nutrient digestibility; Gut microbiota; Phytogenic additive.

Processes of economic legitimation: insights from a comparative case study of the French export-broiler and turkey products

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Rising poultry demand across the European Union, coupled with a rebound in poultry imports since 2020, has made the economic and social legitimacy of European poultry production an increasingly strategic issue for food sovereignty. A central question is how to encourage firms to prioritize locally produced poultry and convince consumers to favor domestic meat, which the industry can advance by legitimizing its value against foreign competitors. This research investigates the core mechanisms underlying processes of legitimation and analyzes how economic actors exploit specific institutional and contextual conditions to build legitimacy across time and space. By conceptualizing legitimation as an evolutionary and historically contingent process, we contribute to understanding the dynamics between firm-level agency and institutional change. A historical comparative case study on the French broiler export and turkey industries drew on 20 comprehensive interviews, supplemented by archives (technical reports, industry press, policy documents, trade and production data). Results show that legitimation was achieved when leading private firms articulated strategies and narratives aligned with national and regional public development policies and with civil society expectations. In the French case, this development served France's agenda for Brittany's economic catch-up, curbing rural exodus through job creation, securing farmers' incomes, and improving the region's trade balance. Such alignment reflected a strategic coupling between institutional needs for regional economic development and firms' interests in value creation and profitability. Conversely, delegitimation occurred when private and public actors' objectives were no longer aligned. In our case study, macro-economic shifts such as the GATT agreements and rising intra-EU trade flows, together with civil society concerns over health and environmental issues, played a decisive role in this delegitimation and thus the industries' decline. These findings imply that industry strategies and narratives must evolve with consumer expectations, and that counter-narratives should be weighed to identify workable compromises. Policymakers should account for the diversity of legitimation strategies before legislating, since a mismatch between laws and narratives risks confusing both industry and consumers. Strengthening interprofessional collaboration and its links with decision-makers could help avert delegitimation.

Keywords: "legitimation", "strategic coupling", "geographical political economy", "firms' strategy", "poultry product"

Effect of Mopane worm (*Gonimbrasia belina*) meal supplemented with multienzymes as a feed ingredient on growth and economic performance in broiler production**M. Chipa^{1,1,1}, D. Kolobe¹, E. Malematja¹, B. Sekhonyana¹, M. Mabelebele¹**¹University of South Africa, Department of Agriculture and Animal Health, Florida, 1710, South Africa., South AfricaPresenting author: jonas.chipa@gauteng.gov.za

Mopani worm meal (MWM) can be incorporated into broiler feed as a protein source and a natural antibiotic. Mopani worms were harvested from November until January and from early March to May. The study aimed to evaluate the impact of using MWM with multienzymes on growth and economic value. A total of 300 Ross 308 broiler chicks were randomly allocated to five dietary treatments using a CRD. Treatment was replicated five times, with 12 birds per replicate. Diets were as follows: T1: Control diet without MWM and multienzymes, T2: 12% MWM+250g/50kg multienzymes, T3: 14% MWM+250g/50kg multienzymes, T4: 16% MWM+250g/50kg multienzymes and T5: 18% MWM+250g/50kg multienzymes. Body weight was recorded at hatch and biweekly thereafter after feeding starter, grower, and finisher diets. Growth and economics data were analysed using the GLM procedure in SAS (2010). Treatment means were separated using the DMR test ($P < 0.05$). The cost of MWM was R6.50/kg, while SBM was R6.91/Kg. In the starter phase, broilers fed T1 showed higher FI, FCR, and MR ($P < 0.05$). Birds provided with T4 recorded higher ($P < 0.05$) LW. Feeding chickens with T3, T4, and T5 resulted in similar EPEF values ($P > 0.05$). The TFC, CFC, TPC and TPC/B were lower ($P < 0.05$) when feeding T1. The SB were higher ($P < 0.05$) when feeding broilers with T3, T4 and T5. The GP, GP/B, GPM, CBR, and ROI were higher ($P < 0.05$) when feeding mopani worm. Lower returns in T1 could result from high MR and low SB. Grower diet increased ($P < 0.05$) FI and reduced ($P < 0.05$) LW in T1 with higher ($P < 0.05$) FCR. EPEF, TFC, CFC, and TPC were higher ($P < 0.05$) when feeding chicken with MWM. Birds offered T1 had higher CBR and ROI ($P < 0.05$). High TPC and CFC in MWM, along with minimum MR, could reduce CBR and RI. Chicken fed T5 during the finisher phase had higher FI and better FCR ($P < 0.05$) than T1. Birds given T4 and T5 had more ($P < 0.05$) LW, while those on T3 and T4 had similar ($P > 0.05$) EPEF. Feeding chickens with MWM increased ($P < 0.05$) TFC, CFC, TPC and TPC/B. However, the SB of chickens fed MWM was higher ($P < 0.05$) than that of T1. The GP, GP/B, and CBR were higher ($P < 0.05$) when feeding birds with MWM. Broilers provided with T2 and T1 had the same ($P > 0.05$) SB (GPM and ROI; $P > 0.05$). High LW, lower MR, and more SB might result in better ROI when feeding MWM with multienzymes. It can be concluded that 16% of MWM with 250g/50kg of multienzymes is recommended.

Keywords: Feed intake, Mopani worm, Feed conversion ratio, cost benefit ratio, return of investment

MDPI Poultry and MDPI's Journal Cluster of Animal Science

Presenting author:

Poultry (ISSN 2674-1164) is a bimonthly open access journal focusing on poultry health, welfare, and productivity. Poultry is indexed within ESCI (Web of Science), Scopus, EBSCO, and other databases. It is ranked JCR Q2 in “Agriculture, Dairy and Animal Science”, with an Impact Factor of 2.5, and CiteScore Q2 in Veterinary (miscellaneous) with a CiteScore of 3.7. All articles published in Poultry are published in full open access format. An article processing charge (APC) of CHF 1200 (Swiss francs) applies to papers accepted after peer review. Manuscripts are peer-reviewed and a first decision is provided to authors approximately 22.1 days after submission. Poultry is part of MDPI's Journal Cluster of Animal Science that is designed to serve as a dynamic hub for cutting-edge research, fostering a comprehensive understanding of the animal kingdom and its vital role in our world. Our mission extends beyond simply publishing; we aim to accelerate the dissemination of discoveries that drive advancements in animal health, welfare, sustainable management, and conservation. This cluster offers authors diverse publishing options, ensuring their research finds the most relevant and impactful audience within the diverse landscape of animal science. This presentation highlights the journal's development and invites researchers to contribute to advancing poultry science.

Keywords: WORKSHOP

The multifactorial implications of reducing stocking density in broiler chickens**E. Basili¹, L. Star¹, F. Molist¹, R. R. Santos¹**¹Schothorst Feed Research, Lelystad, NetherlandsPresenting author: ebasili@schothorst.nl

To improve broiler health and welfare, reductions of up to four-fold below EU standards (33–42 to 11 kg/m²) have been proposed, but broader implications remain underexplored. This study evaluated effects of moderate density reductions on broiler performance, health, welfare, economics, and environmental impact. Day-old male Ross 308 broilers were reared at one of four densities (40, 35, 30, 25 kg/m²; six pens/treatment) to 37 days of age under identical conditions except stocking density. Growth performance, litter, footpad lesions, and excreta metabolomics were measured and compared. Economic outcomes and environmental impact were calculated per treatment simulating barn-level conditions, not pen-level replicate data, and were not statistically tested. Reducing density had limited effects on growth, with overall BWG ($P=0.26$) and final BW (3065 g average, +402 g vs. breeder targets; $P=0.24$) unaffected, but improved feed efficiency at the lowest densities, driven mainly by lower feed intake during D30–37 (−78 g at 30, −125 g at 25 vs. 1354 g at 40 kg/m²), which improved overall (D0–37) FCR at 30 and 25 kg/m² (1.349, 1.338) vs. 40 and 35 kg/m² (1.393, 1.388; $P<0.001$). Mortality (3%, $P=0.14$), litter quality, and footpad health (no lesions) were unaffected by density. Preliminary excreta metabolomics comparing 25 vs. 40 kg/m² suggested improved fatty and amino acid absorption, though not mono/triglycerides, at lower density, alongside higher dopamine levels, possibly suggesting reduced stress or a gut microbial shift. Economic returns declined markedly with decreasing density: 100% at 40 kg/m² vs. 86%, 80%, and 65% at 35, 30, and 25 kg/m. Environmental impacts were broadly similar across densities: carbon emissions shifted from 100% (2.98 kg CO₂-eq/kg live weight) at 40 kg/m² to 101%, 96%, and 98% at lower densities, and land, fossil resource, and water use showed a similar pattern (101%, 96%, 102%). Under the conditions of this study, reducing density had limited effects on growth and improved feed efficiency at the lowest densities, with small, mixed effects on environmental impact, but substantially reduced economic returns, highlighting trade-offs between welfare and profitability. Ongoing microbiota and behavioural analyses will further quantify these trade-offs to support evidence-based recommendations for sustainable broiler production. Study supported by TKI (Project LWV24058 – "Pecking the future")

Keywords: broiler chickens; stocking density; animal welfare; sustainability

European ring test on the differentiation of wild-type *Mycoplasma synoviae* and the MS-H vaccine strains in clinical samples**C. Martin Jimenez¹, Z. Kreizinger^{2,3,4}, M. Gyuranecz^{2,3,4}, P. Cargill¹**¹Pharmsure Veterinary Products Europe Ltd., Bray, Ireland, ²HUN-REN Veterinary Medical Research Institute, Budapest, Hungary, ³MolliScience Kft, Budapest, Hungary, ⁴University of Veterinary Medicine, Budapest, Hungary
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The control and prevention of *Mycoplasma* (M.) *synoviae* infections have been significantly improved by the use of the MS-H live vaccine strain. This vaccine has been used globally for decades; therefore, many technical approaches have been published or commercialized for the differentiation of MS-H from field strains. However, key problems have been identified related to DIVA (differentiating infected from vaccinated animals) testing and monitoring of vaccination in many European laboratories and poultry farms. To address these concerns, the reliability of protocols for the differentiation of the MS-H vaccine and wild-type M. *synoviae* strains from clinical samples was assessed with the blind participation of 16 European laboratories using various techniques. Three pools of samples were sent to each laboratory containing equal amounts of either just MS-H vaccine or a field strain, or the mix of the two strains. The results highlight the challenges in live vaccine strain differentiation, as only 84.4 % (n = 38/45) of the samples were correctly identified. The present study also revealed a variability in the specificity between laboratories using the same technique, which indicates the influence of the operator and differences in the evaluation of raw data also. Sample pools containing both strains showed the highest failure rate in strain differentiation. Therefore, results obtained from laboratory testing should ideally be confirmed using an alternative appropriate technique and interpreted in consultation with the responsible veterinarian, taking into account the clinical history before making decisions with potentially high economic impact.

Keywords: "DIVA" "Inter-laboratory comparison" "MS-H" "*Mycoplasma synoviae*" "Unreliable molecular assay"

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DIGITAL POSTERS

SESSIONS

Ordered chronologically by Slot (Time of presentation)

Strain-dependent effects of *Campylobacter coli* on broiler chicken gut microbiota

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Campylobacter is the leading cause of human gastroenteritis in the European Union, with poultry as the main source of infection. Although birds have traditionally been considered asymptomatic carriers, increasing evidence indicates that *Campylobacter* may cause strain-dependent intestinal damage. Understanding the host response is important to support the development of targeted control strategies, such as gut microbiota modulation to enhance resilience to *Campylobacter* colonization. Therefore, we investigated changes in the cecal microbiota of broiler chickens following infection with strains of differing pathogenic potential of the less-studied *C. coli*. The study consisted of 4 experimental groups with 100 birds per group (4 independent rooms, 5 pens/room, with 20 birds each). One uninfected (control group), and 3 infected groups at 21 days of age, each with a different *C. coli* strain: B group, a potentially benign strain, recovered from a flock with a low feed conversion ratio (FCR); H group, a potentially harmful strain recovered from a flock with a high FCR; and I group, an invasive strain recovered from the liver's internal tissue. On 2, 7 and 14 days post-infection (dpi), 10 birds per group were necropsied, and cecal samples were collected. Total DNA was submitted for 16S full-length sequencing with PacBio. Microbiota analyses were performed using in-house pipelines using Qiime2 platform, and RStudio was used to generate plots and perform statistical analysis. At 2 dpi, B group had the lowest number of colonized animals (7/10), whereas at 7 and 14 dpi, all animals in all groups were colonized. While lower α -diversity was only observed at 7 dpi in colonized animals compared to control (Chao-1, Shannon, and Pielou), β -diversity analyses indicated differential microbial community composition between groups across all three time points, with Jaccard's index showing a similar effect size to Bray-Curtis. These results suggest that *C. coli* strains with different pathogenic potential induce distinct alterations in chicken intestinal microbiota composition, a finding with relevant implications beyond the traditional assumption of *C. coli* as a mere colonizer. The microbial networks underlying the differences in the cecal microbiota due to different *C. coli* strains, together with the associated functional changes, warrant further investigation as potential targets for microbiota-based control strategies.

Keywords: *Campylobacter* ; Poultry ; Cecal microbiota ; Pathogenicity ; Food safety

Effect of inclusion of *Tenebrio molitor* meal in layers' diet on the morphology and quality of eggs**T. Popova¹, E. Petkov¹, K. Dimov², D. Vlahova-Vangelova³, N. Kolev³, D. Balev³, S. Dragoev^{3,4}**¹Agricultural Academy, Institute of Animal Science-Kostinbrod, Kostinbrod, Bulgaria, ²Agricultural Academy, Institute of Cryobiology and Food Technologies, Sofia, Bulgaria, ³University of Food Technologies, Plovdiv, Bulgaria, ⁴Bulgarian Academy of Sciences, Sofia, BulgariaPresenting author: t_popova@ias.bg

The study aimed to investigate the effect of the inclusion of *Tenebrio molitor* meal (TM) as partial replacement of soybean meal in the diet of layer hens on the morphology and quality characteristics of eggs. The trial included 90 layers (34 w old) allocated to 5 dietary groups. Each group consisted of 6 replicate cages with 3 layers per cage. The birds were fed a basal diet (C) and diets including TM in amounts of 1% (T1), 2% (T2), 3% (T3), and 4% (T4) for a period of 10 weeks. The TM meal incorporated in the diets was derived from larvae and contained 56.07% crude protein and 24.16% crude fat. On the last day of the experiment 12 eggs of each group were collected and subjected to analysis. The morphological traits of the egg (weight, width and length), albumen (weight, length, width and height), yolk (weight, height and diameter), and shell (weight and thickness) were assessed. The weights of the egg and its components were measured by digital scales, the lengths and widths of the egg and albumen, diameter of the yolk and thickness of the shell-using vernier caliper, while the height of albumen and yolk were measured by micrometer. The dimensions were further used to calculate the indices of the egg shape, albumen and yolk as well as the Haugh units, considered important quality parameters. The colour of the yolk was measured using Roche fan and Minolta Chromameter. The effect of the dietary TM inclusion on the examined traits was statistically evaluated through one-way ANOVA and subsequent post-hoc comparisons (Tukey HSD). The dietary incorporation of TM affected significantly the egg weight ($P<0.0001$), the weight of the albumen ($P<0.0001$) and yolk ($P=0.0008$) as the three parameters were higher in the control group compared to all the groups fed TM. The insect meal had considerable effect on the egg width ($P=0.0378$) and the length and width of the albumen ($P<0.0001$), which were lower in all the treated groups compared to the control. The latter had lower albumen height ($P=0.0002$). The incorporation of the TM affected ($P<0.0001$) the shell weight and thickness, as they displayed higher values in the control group. The egg shape index and the index of the yolk remained unchanged by the dietary TM, however the albumen index increased significantly in all the experimental groups ($P<0.0001$). The inclusion of dietary TM affected the Haugh units ($P<0.0001$), which were significantly lower in the control group in comparison to all the treatment groups. However, the values of this parameter were within the range indicative for good quality. The incorporation of TM lead to significantly darker colour of the yolk that was observed in group C, corresponding to the considerably lower L^* ($P<0.0001$) and higher a^* ($P<0.0001$) of the yolk in this group. The results of the study show that although not changing the quality of the eggs, the incorporation of TM in the diet of layers in amounts 1-4% had certain negative effect on their morphological parameters.

Keywords: *Tenebrio molitor* meal; layers; eggs; morphology; quality

Effect of a combination of xylanase and β -glucanase on broiler performance, nutrient digestibility and digesta viscosity**F. Bravo de Laguna¹, J. Trautwein², P. Ader², B. Jiménez-Moya³**¹BASF Española SLU, Barcelona, Spain, ²BASF SE, Ludwigshafen, Germany, ³Animal Nutrition, IRTA, Constantí, Tarragona, SpainPresenting author: julia.trautwein@basf.com

Exogenous carbohydrases are widely used in wheat-based diets to improve nutrient utilization by reducing intestinal viscosity and enhancing energy availability in broilers. This study evaluated the effects of a xylanase/ β -glucanase complex (Natugrain TS; NG, BASF SE, Germany) supplementation on performance, ileal digesta viscosity and nutrient utilization in broiler chickens. A total of 264 Ross 308 male broilers were used in two consecutive runs with 144 and 120 birds lasting from day 14 to 21 and 25 to 35 of life, respectively were conducted. Birds were kept in cages with 6 (run 1) and 5 (run 2) birds per cage and received either a nutrient-reduced control diet (61% wheat, 24% SBM, 4% RSM, 4% SFM; ~2,845 kcal AME/kg; 21% CP, -4% amino acids) or the same diet with added NG at 100 g/ton (560 TXU and 250 TGU/kg). All diets contained 1000 FTU/kg (Natuphos E 10000 G, BASF SE, Germany), considering its nutrient equivalency matrix. Body weight (BW), average daily gain (ADG) and feed intake (ADFI) as well as feed conversion ratio (FCR) were measured. Ileal viscosity, nitrogen-corrected apparent metabolizable energy (AMEn) and apparent total tract digestibility (ATTD) of nitrogen were determined at the end of each run. Data were analyzed by SAS for Windows V.9.4 (SAS Institute) according to an analysis of variance with dietary treatment as main effect. NG supplementation reduced ileal digesta viscosity in run 1 and run 2 by 52.3% and 46.5%, respectively ($P < 0.001$). Energy utilization was significantly improved, with AMEn increasing by 4.2% (from 2591 to 2699 kcal/kg) in run 1 ($P < 0.001$) and by 4.7% (from 2561 to 2682 kcal/kg) in run 2 ($P < 0.001$). ATTD of N was not impacted by the treatments. Feed conversion ratio was lowered by 4.5% ($P < 0.01$) by supplementation of NG in run 2. In conclusion, NG supplementation improved FCR and energy utilization in broilers fed wheat-based diets. These benefits are likely based on the strong reduction in digesta viscosity, contributing in general to a better nutrient digestibility.

Keywords: broiler, xylanase, β -glucanase, AMEn, digesta viscosity

Choice feeding of fermented rice polish in broilers: impacts on growth, physiology, metabolism, and meat quality**S. Islam¹, R. Chowdhury¹, M. Rahman¹, J. Aktar¹, J. Zentek², K. Islam¹**¹Department of Animal Nutrition, Bangladesh Agricultural University, Mymensingh, Bangladesh, ²Institute of Animal Nutrition, Freie University, Berlin, Germany

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This study looked at how fermentation affects the nutritional quality of rice polish and its role as a supplementary feed for broilers in a free-choice feeding system. The goal was to find the best fermentation duration. Rice polish (RP) was fermented with 2% yeast at 60% moisture in an anaerobic condition between 29 and 33°C. After fermentation, RP was dried and made into pellets. 192 broiler chicks were randomly assigned into four groups, each with 48 birds having 6 replications of 8 birds per cage: (1) control (commercial diet, CD), (2) CD plus unfermented RP, (3) CD plus RP fermented for 24 hours, and (4) CD plus RP fermented for 48 hours. Fermented RP was provided separately and allowed unlimited access. Fermentation significantly improved the nutritional composition of rice polish ($P < 0.001$). Crude protein increased from 15.6% in raw rice polish to 20.6% after 48 h of fermentation, while crude fibre decreased from 11% to 7.4%. Metabolisable energy was highest in the 48 h group (3737 kcal/kg), followed by 24 h (3530 kcal/kg) and unfermented rice polish (3321 kcal/kg). A progressive decline in pH was observed with increasing fermentation (6.74 in raw RP to 5.23 in FRP-48). Total amino acids increased from 12.57 to 14.42 g/100 g, with several significant changes in essential amino acids ($P < 0.01$) and significant boosts in non-essential amino acids like γ -aminobutyric acid and ornithine ($P < 0.001$). Growth performance was comparable among the control, UFRP, and FRP-24 groups, with FRP-24 showing the highest body weight gain (2212 g). In contrast, FRP-48 resulted in reduced performance (2167 g; $P = 0.017$) despite higher intake of fermented feed. Meat ether extract decreased significantly from 2.70% in the control to 1.21% in FRP-48 ($P < 0.001$), whereas carcass yield remained unaffected ($P > 0.05$). Serum analysis indicated increased calcium, albumin and glucose and reduced alkaline phosphatase activity, HDL and AST in fermented groups ($P < 0.01$). Digestibility improved significantly in the FRP-24 group compared to the control ($P < 0.001$). Economically, FRP-24 resulted in the lowest production cost and highest profit, outperforming the control, while FRP-48 increased production cost and reduced profitability ($P < 0.001$). Fermentation for 24 hours seems optimal, supporting better growth while keeping feed quality high. This suggests that fermented rice polish can be a promising and sustainable supplementary feed for broilers.

Keywords: rice polish; fermentation; broiler; free-choice feeding; nutritional enhancement; performance

From Butyric Acid to Glyceride Derivatives: Advances in Targeted Delivery for Gut Health and Performance in Poultry

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Butyric acid is a well-established short-chain fatty acid involved in intestinal epithelial energy metabolism, gut barrier integrity, immune regulation, and microbial homeostasis in poultry. Despite its recognized biological benefits, the direct use of free butyric acid in feed is limited by its strong odor, corrosiveness, volatility, and rapid absorption in the upper gastrointestinal tract, which reduces its availability in distal intestinal regions. The present review was undertaken to examine the evolution of butyrate delivery technologies and to compare their potential for targeted gastrointestinal release. Early supplementation strategies relied primarily on sodium and calcium butyrate, which improve handling characteristics but are characterized by rapid dissociation and limited distal gut delivery. Encapsulation technologies were subsequently developed to enhance stability and delay release; however, their effectiveness may vary according to coating integrity and processing conditions. More recently, glyceride derivatives have attracted considerable attention due to their distinct metabolic pathways and controlled release characteristics. Monobutyryn allows pH-independent absorption and intracellular release of butyrate, whereas tributyrin undergoes progressive enzymatic hydrolysis, providing sustained release along the gastrointestinal tract. Evidence from poultry studies indicates that butyrate supplementation may support intestinal morphology, nutrient utilization, microbial balance, and resilience during enteric challenges, with responses influenced by formulation type and dosage. Current knowledge suggests that glyceride-based forms offer advantages in achieving more consistent butyrate delivery throughout the intestine compared with conventional salt forms. The progression from free butyric acid to advanced glyceride derivatives reflects an important development in feed additive design aimed at improving gut functionality and production efficiency. Future comparative studies under standardized conditions are required to better quantify formulation-specific effects and to explore opportunities for application beyond poultry, particularly in rapidly expanding sectors such as aquaculture.

Keywords: butyric acid; monobutyryn; tributyrin; glycerides; poultry nutrition

Choice Feeding of Fermented Rice Bran Improves Broiler Body Weight Gain, Feed Efficiency, and Profitability

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The present study was conducted to investigate the effects of choice feeding fermented rice bran (RB) on the growth performance of broilers offered corn-soybean based basal diet. Rice bran from BRRI Dhan49 was combined with 5.0% (DM basis) baker's yeast (*Saccharomyces cerevisiae*), hydrated at a 1:1 ratio, and fermented anaerobically for 48 hours at ambient temperature. The fermented product was either sun-dried or maintained in a moist state for feeding. A total of 240 Indian River day-old chicks were randomly distributed into four dietary groups (three cages of 20 birds each) consisting of: (1) Control diet; (2) Control diet plus unfermented RB; (3) Control diet plus dried fermented RB; and (4) Control diet plus moist fermented RB. Control diet contained 20.55% crude protein and 2950 kcal ME/kg. All diets were given ad libitum. After 35-day trial blood samples from 10 birds per group were collected. Fermentation improved crude protein from 15.86% in unfermented RB to 20.47% in dried fermented RB and 21.03% in moist fermented RB. Ash content also increased from 9.13% to 10.38% and 10.76%, respectively. Birds consumed a lower amount of unfermented RB (5 g DM/bird) compared to dried and moist fermented RB (543 g and 232 g; $p < 0.05$). Total feed intake was similar in all the groups (1853-1893 g/bird). Growth performance was significantly enhanced with fermented RB. Birds in the dried and moist fermented RB groups gained 1095 g and 1112 g, respectively, representing a 10-12% increase over the control (993 g) and unfermented RB group (998 g). The feed conversion ratio (Feed intake/Live weight gain) was significantly superior in both fermented RB groups (1.70) to that of the control (1.89) and control plus unfermented RB group (1.86). Management cost was not different among the groups, while profit per kilogram of live weight gain was doubled in the fermented RB groups (USD 0.16-0.18) compared with the control and unfermented RB groups (USD 0.08-0.09; $p < 0.05$). Blood protein and mineral indices did not differ among groups. Conclusively, the supplementation of yeast-fermented RB in both dry and moist forms with the standard diet was seen to enhance the growth, feed efficiency, and profitability of broilers without affecting the blood biochemical parameters. Fermented RB should be further tested at the field levels before the commercial sector considers adopting it in their systems, where carcass yield, gut morphology, and microbial ecology would be considered.

Keywords: Rice bran, yeast, fermentation, farm, broiler

Effect of bioactive vitamin D3 metabolite from Solanum glaucophyllum on the productivity, eggshell quality and mineral metabolism of laying hens**V. Slausgalvis¹, A. Racevičiūtė-Stupelienė², M. Nutautaitė², V. Vilienė²**¹Innov ad nv/sa, Essen, Belgium, ²Institute of Animal Rearing Technologies, Veterinary Academy, Lithuanian University of Health Sciences, Kaunas, LithuaniaPresenting author: virgis.consult@gmail.com

As laying hens age, eggshell quality often deteriorates, laying intensity and efficient use of minerals decreases. One of the possible nutritional strategies to address these problems is the use of a biologically active form of vitamin D3 in feed. Vitamin D3 metabolites naturally occurring in *Solanum glaucophyllum* are characterized by high biological activity and can improve calcium and phosphorus metabolism. The aim of this study was to evaluate the effect of bioactive vitamin D3 metabolite from *Solanum glaucophyllum* on the productivity, eggshell quality and blood biochemical parameters of laying hens during the late laying period. The study was conducted under commercial conditions using 10,000 H&N Brown (Brown Nick) laying hens aged 55–67 weeks, housed on deep litter. The hens were allocated to a control group (CG; n = 5,000) fed a standard wheat–soybean diet and an experimental group (EG; n = 5,000) fed the same diet supplemented with 1,25-dihydroxycholecalciferol glycosides derived from *Solanum glaucophyllum* (500 g/t feed). Productivity, feed conversion ratio and mortality were evaluated at flock level. Eggshell quality was assessed at the beginning, middle and end of the trial (50 eggs/group at each time point), while blood biochemical parameters were determined at the beginning and end of the experiment (20 hens/group). Supplementation with bioactive vitamin D3 had a positive effect on eggshell quality and mineral metabolism. At the end of the trial, eggshells from the EG were heavier (6.45 vs. 6.05 g; $P > 0.05$), thicker (0.422 vs. 0.389 mm; $P < 0.05$), and had a higher shell proportion (10.19 vs. 9.18%; $P > 0.05$) than those from the CG. At the end of the experiment, higher blood concentrations of calcium (8.85 vs. 7.99 mmol/L), phosphorus (2.63 vs. 2.26 mmol/L) and vitamin D (80.28 vs. 77.38 nmol/L) were found in the EG than in the CG ($P < 0.05$). However, no improvement in laying performance or feed conversion efficiency was observed in the EG. These findings indicate that supplementation with bioactive vitamin D3 extracted from *Solanum glaucophyllum* improved eggshell quality and enhanced mineral metabolism in late-laying hens and may therefore represent a promising nutritional strategy for maintaining shell quality during the late laying period. However, these beneficial effects were not reflected in improvements in overall productive performance.

Keywords: laying hens; *Solanum glaucophyllum*; bioactive vitamin D3 metabolite; eggshell quality; mineral homeostasis

Influence of defatted winged termite (*Macrotermes natalensis*) inclusion levels in diets on gut bacterial community of Ross 308 broiler chickens**S. Kolobe¹, J. Ng'ambi¹, T. Mafuna², M. Mabelebele¹**¹University of South Africa, Department of Agriculture and Animal Health, Florida Park, Johannesburg, South Africa, ²University of Johannesburg, Department of Biochemistry, Auckland Park, Johannesburg, South Africa

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The present study was conducted to evaluate the effect of defatted winged termite meal (WTM) as a partial replacement for soyabean meal (SBM) on gut bacterial community of Ross 308 broiler chickens at the starter, grower, and finisher periods. A total of 150 one-day-old, unsexed broiler chicks were assigned to 3 dietary treatments in a completely randomized design (CRD), replicated 5 times, each replica holding 10 chickens. Three iso-nitrogenous and iso-energetic experimental diets were formulated as follows: WTM0 = a control diet without WTM; WTM5 = commercial broiler diet with 50g/kg of WTM; WTM10 = commercial broiler diet with 10% of WTM as a replacement for SBM. At the end of each growth phase on days 14 (starter), 28 (grower) and 42 (finisher), chickens were slaughtered for bacterial activity analyses using 16S targeted gene sequencing. The study outcomes showed that WTM inclusion in diets significantly influenced ($p < 0.05$) gut bacterial community in the caeca segment of broilers in each growth phase. Firmicute phylum counts were higher ($p < 0.05$) in chickens having WTM diets than those on control diet at starter phase. In contrast, broilers on both WTM diets had lower Bacteroidota abundance than those fed WTM0. At grower phase, Firmicutes and Cyanobacteria were dominant ($p < 0.05$) in broilers having WTM5 whilst Bacteroidota was abundant ($p < 0.05$) in WTM10 compared to chickens on a control diet. Similarly, genera *Lactobacillus* and *Subdoligranulum* genera were predominantly higher ($p < 0.05$) in birds on WTM5 whilst those on WTM10 showed higher ($p < 0.05$) counts of Bacteroidota as well as *Alistipes*, *Clostridia_vadinBB60_group*, *Gastranaerophilales*, and *Romboutsia*. However, at finisher phase, the counts of Bacteroidota and *Alistipes* were higher ($p < 0.05$) in birds on control diet than those having WTM5 and WTM10, respectively whereas Firmicutes and Cyanobacteria as well as *Clostridia_vadinBB60_group*, *Gastranaerophilales*, *Lactobacillus* and *Subdoligranulum* were predominantly higher ($p < 0.05$) in broilers fed WTM5 than the other two groups. It could be concluded that WTM of up to 10% supplementation in broiler chicken diets improved diversity and abundance of bacteria spp. in the caeca, particularly at grower phase but only reduced the counts of phylum Bacteroidota at starter and finisher phases.

Keywords: Bacterial diversity, broiler chickens, gut health, insect meal, termite alates

Effects of alternative diets based on local feed resources on environmental sustainability in local and commercial broilers**S. Özkan¹, S. Martinez Miro², M. Cömert Acar¹, J. Madrid², A. Montalban², S. Yalçın¹**¹Ege University, Faculty of Agriculture, Department of Animal Science, İzmir, Turkey, ²University of Murcia, Veterinary Faculty, Animal Production Department, Murcia, SpainPresenting author: sezen.ozkan@ege.edu.tr

In animal protein production, the poultry industry plays a crucial role in meeting global protein demand. From an environmental sustainability perspective, chicken meat production is generally considered more eco-friendly than other livestock farming. However, soybean, a key component of chicken diets, is associated with high greenhouse gas emissions, particularly due to its production and transportation, leading to increased interest in local feedstuffs. The sustainability approach also considers small scale poultry producers where locally produced, slow-growing chickens may take a part. This study evaluated the environmental impact of broiler diets in which imported ingredients, such as soybean meal and corn, were partially replaced with locally produced alternatives. Broiler chickens (252/breed) from a local slow-growing breed (Anadolu-T dam line) and a commercial breed (Cobb-500) were reared for 55 and 40 days, respectively. Using a three-phase feeding program, chicks were randomly assigned to one of the three iso-energetic, iso-nitrogenic diets: a soybean-corn based Control diet, an alternative (ALT) diet containing sunflower meal, brewers' dried grain, and wheat middlings, and ALT+BSF diet in which 5% black soldier fly (BSF) larva meal was added to ALT. The reduction in soybean meal in the diets was 24.85 for ALT and 42.2% for ALT+BSF diet, compared to control. For analyzing potential environmental impact, a Life Cycle Analysis was conducted using the ILCD Midpoint and ReCiPe Endpoint methods with the SimaPro v.9 software to assess the impact of the experimental diets on four categories: global warming potential (CO₂ equivalent), human-health, ecosystems, and resource use. A two-way ANOVA was applied to data with a model including diet, breed, and interaction. ALT and ALT+BSF diets reduced impact per kg live weight in all categories ($P < 0.01$). Although the local breed showed 31% higher impact per kg live weight than the commercial breed ($P < 0.01$), alternative diets achieved similar levels of reductions in both breeds. Overall, the impact reductions per kg live weight were 38-39% for kg CO₂ eq emissions, 34% for human-health, 23-27% for ecosystems, and 36-38% for resource use compared to the Control diet. In conclusion, partial replacement of imported soybean meal and corn with locally sourced alternatives and BSF larva meal, substantially reduced environmental impacts and improved the sustainability of broiler production, regardless of the breed used.

Keywords: Broiler; sustainability; soybean meal; local feed ingredients; black soldier fly larvae

Dietary phytase with benefit on nutrient utilization in broilers beyond phosphorus**P. Ader¹, J. Trautwein¹, H. Kim², S. Adedokun²**¹BASF SE, Ludwigshafen, Germany, ²Department of Animal and Food Sciences, University of Kentucky, Lexington, United StatesPresenting author: julia.trautwein@basf.com

Phytase is added to broiler feeds mainly with the intention of improving phosphorus (P) digestibility whereby beneficial consistent effects on the digestibility of other nutrients, e.g. crude protein (CP), amino acids (AA) and energy (E), are still often questioned. The present study was set up to document the positive impact of that enzyme on the apparent ileal digestibility (AID) of nitrogen (N), AA and E. One-day-old Cobb 500 male broiler chicks (initial BW = 39.1 g) were randomly assigned to 2 dietary treatments in a completely randomized set up, with 12 replicate cages each and 7 birds/cage. One basal, enzyme-free crumbled starter diet was offered to all chicks from day 0 to 7 ad libitum. Thereafter birds received the two corn-soybean-meal based pelleted test feeds (AME: 3024 kcal/kg, 20.33% CP), consisting of control (C) or an experimental (EXP) diet supplemented with 1000 FTU phytase/kg (Natuphos® E 5000 G; BASF SE). Test feeds did not contain any inorganic P and 0.5% of indigestible marker titanium dioxide was added. Phytate-P level was at 0.24%. Growth performance parameters were determined for the trial period (day 7 to 25) after adjusting for mortality. On day 25 all birds were euthanized. Tibia bones were taken for analysis of ash content and ileal digesta was collected from the distal half of that part of the gut for determining AID of P, E, N and AA. The MIXED procedure of SAS was used for data analysis with dietary treatment considered a fixed effect, and the cage as experimental unit. EXP increased daily weight gain from 51.3g (C) to 67.5g ($p < 0.001$) while feed conversion ratio decreased from 1.648 to 1.509 ($p < 0.001$), respectively. AID of P and tibia ash content were 22.1% ($p < 0.001$) and 56.8% ($p < 0.001$) higher in EXP fed birds. AID of E was numerically improved by 79 kcal/kg as fed ($P = 0.076$). AID of N was improved by 5% by EXP ($p < 0.001$) with an increase of AID for all indispensable and dispensable AA by 4.6% ($P < 0.001$). In conclusion, 1000 FTU of phytase/kg of broiler feed improved bone mineralization as well as AID of P, E, N and AA. The benefits on performance parameters were not only based on improved P utilization but also on enhanced utilization of dietary nutrients.

Keywords: phytase, broiler chicken, growth performance, nutrient utilization

Comparative effects of phytase, xylanase, mannanase and proteases on performance and nutrient digestibility in broilers**P. Ader¹, T. Zuber¹, R. Aslam², S. Kaczmarek²**¹BASF SE, Ludwigshafen (Rhein), Germany, ²Poznan University of Life Sciences, Poznan, Poland

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Enzymes in broiler diets are expected to improve digestibility of nutrients and increase bird performance. The study aimed to compare the effects of phytase (Phy), xylanase (Xyl) and mannanase (Man) with two proteases (Pro) and to evaluate potential additive benefits of the latter. A total of 192 one-day-old male broiler chicks were randomly assigned to 8 treatments (T), with 12 replicates/T and 2 chicks/replicate. From d1 to 14, the chicks received a commercial crumbled diet. From d14 to 26, experimental pelleted diets were offered. Treatments were: T1 (control diet with crude protein (CP) and amino acids 12.5% below Aviagen's specification), T2 (T1 + 1500 FTU of Natuphos® E (BASF SE)/kg), T3 (T1 + 50g of Ronozyme® ProAct360 (DSM)/MT), T4 (T1 + 250g of Cibenza® DP 100 (Novus)/MT), T5 (T2 + 800 TMU of Natupulse® TS (BASF SE)/kg), T6 (T5 + 560 TXU of Natugrain® TS (BASF SE)/kg), T7 (T6 + 50g Pro1/MT) and T8 (T6 + 250 g Pro2/MT). Composition of T1 was [%]: maize (45.6), wheat (20.0), soybean meal, (19.9), sunflower meal (4.0), rapeseed meal (3.0), oil/lard (3.2). On d26, birds were euthanized and mid-ileum digesta was taken and frozen at -80°C until analyses for N, TiO₂ and gross energy (GE). The initial body weight of birds was 42.7 g. No differences in performance parameters were found between the treatments during the pre-experimental phase. During the experimental phase, body weight gain was significantly higher with the use of Phy, Xyl and Man (T6) than with T3 (only Pro1) ($p < 0.05$). Feed conversion ratio was highest in T1. Combined use of Phy, Xyl and Man (T6) improved FCR (T1: 1.558 vs. T6: 1.405; $p < 0.01$). No effect was found by addition of Pro (T6: 1.405 vs. T7: 1.418 and T8: 1.413, $p > 0.05$). Apparent ileal digestibility (AID) of CP (CPAID) was the lowest in T1 (73.7%) and was not impacted by Phy (T2) and Pro alone (T3, T4) ($p > 0.05$) but by T5 (Phy + Man) and T6 (Phy + Xyl + Man (78.5% and 79.8%, ($p < 0.05$)), respectively. Addition of Pro resulted in no further increase of CPAID (T7: 78.3%, T8: 77.4%). AID of GE (GEAID) was recorded for T1 at 68.9%. No effect on GEAID was observed by T2, T3 and T4, while it was improved to 73.9% and 74.1% ($p < 0.05$) by T5 and T6, respectively. GEAID was not further improved by addition of Pro (T7: 72.1%, T8: 72.2%). In conclusion, the combination of Phy, Xyl and Man outperformed Pro on broiler performance, CP- and GEAID. Addition of Pro to that enzyme combination did not result in further improvements.

Keywords: broiler; phytase; xylanase; mannanase; protease; performance; digestibility

Characterization and oxidative stability of *Hermetia illucens* larvae oil for poultry nutrition

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Insects represent a sustainable source of feed ingredients by converting low-value organic waste into high-value nutritional biomass, thereby partially or totally replacing some conventional feedstuffs. The production of defatted insect meals generates a lipid-rich fraction that can be valorized as an alternative dietary energy source for poultry. Among the most promising species is *Hermetia illucens*. Accordingly, the present study aimed to obtain, characterize, and evaluate the oxidative stability of *H. illucens* larvae oil. The oil was recovered from the lipid fraction generated after mechanical pressing of dried larvae fed with a substrate rice by-product and clarified by centrifugation to 37°C. Physicochemical properties, fatty acid composition, and oxidative stability were evaluated during two months of storage at 4 and 25 °C and after heat treatment at 120 °C for 15 min. Analyses were performed using official American Oil Chemists' Society (AOCS) methods, either directly or with appropriate adaptations. Clarification by centrifugation yielded an oil with 97.28% lipid content. The oil exhibited a melting range of 32–37 °C, density of 0.8958 g/cm³, moisture content of 0.51%, acidity value of 1.690 mg KOH/g, ash content of 0.14%, and 1.52% unsaponifiable matter, indicating good initial quality. FTIR-ATR analysis detected no absorption bands associated with advanced lipid oxidation products. The fatty acid profile was dominated by lauric acid (C12:0, 41.52%), with saturated fatty acids representing 66.37% of total fatty acids, resembling coconut and palm kernel oils. However, the relatively low linoleic acid content (C18:2 n-6, ≈11%) should be considered particularly in laying hen diets, where supplementation with linoleic acid-rich sources, such as soybean oil, may be required. The oil also exhibited high oxidative stability, with peroxide values remaining below 8 meq O₂/kg under all storage and heat treatment conditions and a low p-anisidine value (0.89) after heating. Overall, *H. illucens* larvae oil exhibited physicochemical, fatty acid profile, and oxidative stability characteristics that support its potential use as a feed ingredient for poultry. Nevertheless, further *in vivo* studies are required to confirm its practical applicability in poultry diets. This work is part of OLIVA (Grant Agreement No. 2432), funded by PRIMA-MED Foundation and the European Union.

Keywords: *Hermetia illucens*; insect oil; oxidative stability; characterization oil; laying hens

Impact of dietary alfalfa meal and fibre degrading enzymes on energy and nutrient availability when fed to laying hens**V. Pirgozliev¹, I. Whiting¹, S. Mansbridge¹, Z. Janjecic², K. Kljak², S. Rose¹**¹National Institute of Poultry Husbandry, Harper Adams University, NEWPORT, Shropshire, United Kingdom,²Department of Animal Nutrition, Faculty of Agriculture, University of Zagreb, Zagreb, Croatia (Hrvatska)*Presenting author:*

The aim of this study was to establish the possibility of using exogenous fibre degrading enzymes (FDE) to improve the nutritive value of alfalfa meal (AM) for laying hens. Six diets in total were used; a wheat-soybean meal basal diet (control, C) containing 11.56 MJ/kg metabolisable energy (ME) and 172 g/kg crude protein was prepared; two more diets, containing 950 g/kg of the C and 50 g/kg AM (diet C + 5% AM) and 900 g/kg of the C and 100 g/kg AM (diet C + 10% AM) were also mixed; the three diets were then split each on two parts and one of the parts was supplemented with FDE, providing per kg feed 216 U endo-1,4-beta-xylanase, 56 U endo-1,3(4)-beta-glucanase and 64 U endo-1,4-beta-glucanase. All diets contained acid insoluble ash as indigestible marker. A total of 96 Hy-Line Brown laying at 30 weeks of age were randomly allocated to 48 enriched colony cages, two birds in a cage. Each diet was fed for 4 weeks to eight replicated cages following randomisation. Excreta were collected at the end of the study at 34 weeks of age. Comparisons among the studied variables were performed by two-way ANOVA using a 2 × 3 factorial design (FDE × AM inclusion rate). Orthogonal polynomials were used to compare treatment differences for linear (L) relationships with increasing AM inclusion. Dietary FDE or AM did not change ($P > 0.05$) the percentage of cracked or double-yolk eggs, eggshell weight, or thickness, yolk pH, or Haugh unit (HU). Feeding FDE increased dietary N-corrected ME (MEn) ($P < 0.001$), dry matter retention (DMR; $P < 0.001$), nitrogen retention (NR; $P < 0.001$), fat retention (FR; $P = 0.001$), and neutral detergent fibre digestibility (NDFD; $P = 0.004$). Increased AM inclusion reduced ($P < 0.001$; $L < 0.001$) MEn, DMR, and NDFD but did not affect ($P > 0.05$) NR and FR coefficients. Dry matter of fresh excreta was reduced ($P = 0.001$; $P < 0.001$) with increased AM inclusion, i.e. increased AM inclusion led to increased excreta moisture, which coincided with reduced NDFD. Thus, suggesting an increase in potential foot health problems of birds reared on the floor. This study demonstrated that moderate inclusion of AM and FDE supplementation can influence dietary energy and nutrient utilisation in laying hens. Overall, the findings highlight the potential of FDE supplementation to mitigate fibre-related limitations of AM containing diets. Further research on long-term impacts on economic effect on poultry production is warranted.

Keywords: alfalfa meal; fibre degrading enzymes; metabolisable energy; nutrient retention; laying hens

Comparative effects of protected sodium butyrate and a tributyrin-based synergistic blend on broiler performance and carcass qualityC. El Ghobry¹, W. El khoueiry^{1,†}, R. El Rammouz¹, C. Lahoud¹¹Lebanese University faculty of agronomy, Beirut, Lebanon

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The restricted use of antibiotic growth promoters in poultry production has necessitated the development of nutritional alternatives that enhance broiler performance without affecting meat quality. This study compared the effects of dietary supplementation with protected sodium butyrate (PSB) and a synergistic blend of organic acids, tributyrin and essential oils (oregano, thyme and cinnamon oils) (TRB) on growth performance and carcass quality in broiler chickens. A total of 99 Ross 308 broiler chicks were randomly allocated to 3 dietary treatments ($n = 33/\text{treatment}$) with three replicates of 11 birds each in a completely randomized design: a control (CON) diet, a diet supplemented with 0.1% PSB and a diet supplemented with 0.1 - 0.15% TRB. Growth performance, including live body weight and feed conversion ratio, was monitored over a 32-day trial and 8 birds per treatment were evaluated at slaughter for carcass traits, visceral organs, tibia morphometry, intestinal histomorphometry and meat quality. Data were analyzed by one-way ANOVA followed by Tukey's test ($P < 0.05$). PSB and TRB significantly enhanced growth performance ($P < 0.05$). Birds fed TRB exhibited the highest live body weight, followed by PSB and CON groups (2301.00 ± 282.17 g, 2002.16 ± 129.01 g and 1880.79 ± 221.29 g, respectively). Feed conversion ratio decreased from 1.57 ± 0.02 in controls to 1.51 ± 0.02 and 1.50 ± 0.03 in the PSB and TRB birds, respectively. Flock uniformity, hot carcass weight, carcass yield and breast muscle weight and yield were significantly increased ($P < 0.05$) with the greatest responses observed in the TRB group. Supplemented diets also increased liver and heart weights, enhanced tibia development and improved intestinal histomorphology by increasing villus height (1200.00 ± 33.38 μm to 1550.00 ± 42.09 μm), decreasing crypt depth (202.50 ± 12.25 μm to 150.00 ± 4.72 μm) and increasing villus height-to-crypt depth ratio (5.95 ± 0.51 to 10.35 ± 0.56) ($P < 0.05$), indicating better nutrient absorption. No significant differences were observed in abdominal fat deposition, ultimate muscle pH, breast meat color (L^* and b^*) and drip loss. Overall, dietary supplementation with protected sodium butyrate and the tributyrin-based synergistic blend improved broiler growth performance, carcass characteristics, skeletal development and intestinal morphology compared with the control diet, without adversely affecting the meat quality traits evaluated. Although both additives were effective, birds receiving the tributyrin-based blend consistently showed the greatest numerical improvements in growth and carcass-related parameters. Further analyses of cooking and thawing losses, tenderness and intramuscular fat are ongoing to complete the meat quality evaluation.

Keywords: Broiler chickens; protected sodium butyrate; tributyrin; growth performance; intestinal histomorphometry; carcass quality

Utilisation of sorghum-canola-based diets in indigenous chicken breeds: Implications for growth performance, digestibility, carcass yield and meat quality

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In recent years, maize and soybean meal (SBM) have made poultry feed expensive; hence, there is a need to eliminate them from the diets. This study hypothesised that substituting maize with sorghum and SBM with canola meal (CM) in poultry diets would not compromise growth performance, carcass traits, and meat quality. Indigenous chickens of different breeds were randomly allotted into two iso-nitrogenous and iso-energetic treatment diets with 5 replicates each ($n = 4$ chickens/replicate). The two diets were formulated to meet the nutritional requirements recommended by the National Research Council as follows: 1) A maize-soybean diet (CON) is a commercial broiler grower diet, and 2) a sorghum-CM diet (SCBD) totally replaces maize with sorghum and SBM with CM in broiler grower diets. The diets were fed to different breeds for 90 days to assess growth performance, carcass traits, and meat quality. Different breeds (40 breeds) of indigenous chickens, 4 weeks old, were allotted to 50 experimental units (pens). The diet did not significantly affect the growth performance of indigenous chickens from week 1 to 6. Overall performance showed that indigenous chickens fed the SCBD diet (sorghum replaced maize and CM replaced SBM in indigenous chickens) had significantly lower average feed intake (FI), weight gain (WG), feed conversion ratio (FCR), and protein consumption (PC) compared to those fed the commercial diet. Potchefstroom Koekoek (PK) and Sussex breeds had significantly higher feed intake as compared to other breeds when fed the SCBD diet. Sussex breeds had the best gain and growth efficiency when exposed to the SCBD diet. This study also reported PK, Rhode Island Red (RIR), and Sussex breeds to be higher in protein efficiency ratio when fed SCBD diets. The PK breeds had more yellow meat with lower temperatures. Higher meat temperature and peak force were observed in Sussex breeds. Cooking loss was also reported to be higher in the RIR breed as compared to other breeds when fed SCBD diets. Based on overall performance, it was concluded that replacing maize with sorghum and CM with SBM in commercial grower diets results in adverse effects on growth performance but not carcass characteristics and meat quality.

Keywords: Breeds, canola meal, feed intake, sorghum, soybeans.

Effects of different lentil varieties inclusion in broiler diet on breast and thigh meat colour parameters, fatty acids and lutein composition**T. Panaite¹, G. Cornescu¹, A. Cismileanu¹, A. Untea¹**¹National Research - Development Institute for Animal Biology and Nutrition, Balotesti, RomaniaPresenting author: tatiana.panaite@ibna.ro

Finding alternative protein sources represents a priority in animal nutrition to substitute soybean meal (SBM), the dominant source of protein in poultry diets. The present study evaluated the effects of different lentil varieties inclusion in broiler diet on breast and thigh meat colour parameters, fatty acids composition and lutein content. Five types of lentils were tested: yellow (E1), red (E2), green (E3), black (E4), and a mix of all types (E5) at a 20% dietary inclusion rate. As alternative to soybean meal the content of protein ranged from 23.94% to 26.19%, the lentil being included up to 50% of soybean meal protein. A 42-day trial was conducted on 300, day-old ROSS 308 chicks assigned to 6 groups (C; E1; E2; E3; E4; E5) kept in an experimental hall on permanent wood shaves litter. During the starter stage (1-10 days) all chicks received a conventional compound feed (C). For chicken breast samples, the a* parameter showed significant values ($p=0.011$) for E3 group compared to E4 group, whereas for thigh samples the highest values ($p=0.0001$) were registered on C and E2 groups compared to E1, E3, E4 groups. The b* parameter was significant higher ($p=0.006$) for chicken breast on E4 and E5 groups compared to E1 group, whereas for thigh samples, the highest ($p=0.0001$) registered value was noticed to C and E5 groups compared to E1, E2, E3 and E4 groups. Omega-3 ($\Omega 3$) polyunsaturated fatty acids show the highest value for breast ($p=0.0001$) and for thigh ($p=0.001$) samples in group E2 compared to all other groups. These results of E2 groups were corroborated with the lowest $\Omega 6/\Omega 3$ ratio value, for breast ($p=0.08$) and thigh ($p=0.004$) samples, being considered the best $\Omega 6/\Omega 3$ ratio balance compared to other groups. The chicken breast lutein content was highest ($p = 0.043$) in E2 (2.39) and E5 (2.42), while for chicken thigh, the highest ($p = 0.001$) were registered in E2 (2.33) and E1 (2.33), compared to all other groups. In conclusion, the inclusion lentils in the birds' diet, specifically red lentils, significantly modified meat quality parameters by increasing $\Omega 3$ fatty acids, lutein content and decreasing the $\Omega 6/\Omega 3$ ratio value, which can be considered beneficial, with positive effects on human health.

Keywords: lentil; broiler; color parameters; fatty acids; lutein;

Impact of Moringa oleifera leaf meal supplementation on the growth, nutrient digestibility, and meat quality of quails fed sorghum-canola-based dietsN. Sebola¹, T. Kujoana¹, H. Mokoboki², M. Mabelebele¹¹University of South Africa, Agriculture and Animal Health, 28 Pioneer Ave, Florida park, 1709 Johannesburg, South Africa, Roodepoort, South Africa, ²North-West University, Animal Science, Private Bag X2046, Mmabatho, 2735 Mafikeng, South Africa, Mafikeng, South AfricaPresenting author: sebolan@unisa.ac.za

Sorghum and canola meal contain relatively low concentrations of the carotenoid pigments associated with egg-yolk colour. Moringa oleifera leaf meal (MOLM) may therefore offer a locally available phyto-genic supplement for sorghum–canola diets. This study evaluated the effects of MOLM supplementation on nutrient digestibility, growth, egg production, carcass traits and breast-meat quality in Japanese quails. In Experiment 1A (4–8 weeks of age), 84 unsexed quails were assigned to either an unsupplemented maize–soybean diet (MBD0) or a sorghum–canola diet (SCD0). Each diet had seven replicate cages of six birds. In Experiment 1B (9–12 weeks), 54 unsexed quails received one of six diets: MBD0, MBD25, MBD50, SCD0, SCD25 or SCD50. The diets contained 0, 25 or 50 g MOLM/kg, with three replicate cages of three birds per treatment. The cage was the experimental unit. Data were analysed as a completely randomised design using SAS, and differences were considered significant at $P \leq 0.05$. In Experiment 1A, weight gain (51.46 vs 44.80 g/bird; $P = 0.14$) and egg production (89.46% vs 88.11%; $P = 0.83$) were comparable between SCD0 and MBD0. However, SCD0 resulted in a higher protein efficiency ratio at week 8 (0.20 vs 0.10; $P = 0.002$). In Experiment 1B, quails fed MBD25 gained more weight than those fed SCD25 and SCD50 (38.1 vs 19.1 and 16.5 g/bird; $P < 0.0001$) and recorded the highest egg production (55.0%; $P = 0.03$). Crude-protein digestibility was highest with MBD50 (85.3%) and lowest with SCD25 and SCD50 (73.9% and 72.1%, respectively; $P = 0.021$). Diet did not affect carcass traits, meat lightness, yellowness or ultimate pH ($P > 0.05$), although meat redness differed among treatments ($P = 0.02$). The unsupplemented sorghum–canola diet supported performance comparable to the maize–soybean diet from 4–8 weeks. However, adding 25 or 50 g MOLM/kg did not improve the utilisation or productive value of the sorghum–canola diet during weeks 9–12.

Keywords: Quails, nutrient digestibility, growth performance, egg, meat, canola meal, Moringa oleifera leaf meal

Effects of Dietary Supplementation with *Lemna minor* on Growth Performance, Haematological and Serum Biochemical Indices, and Intestinal Morphology of Broiler Chickens

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The increasing cost and limited availability of conventional feed resources have intensified the search for sustainable and cost effective alternatives in poultry production. This study evaluated the effects of dietary supplementation with *Lemna minor* on growth performance, haematological and serum biochemical indices, and intestinal morphology of broiler chickens. A total of 128 day old Arbor Acres broiler chicks were randomly allotted to four dietary treatments containing 0.0, 0.5, 1.0, and 1.5% *Lemna minor* in a completely randomized design with four replicates of eight birds each for 42 days. All diets were formulated to be isonitrogenous and isocaloric according to NRC (1994) recommendations. Growth performance, haematological parameters (PCV, Hb, RBC, WBC, lymphocytes, neutrophils, monocytes, and eosinophils), serum biochemical indices (total protein, albumin, globulin, glucose, urea, creatinine, AST, ALT, total cholesterol, and triglycerides), and intestinal histomorphometry and histopathology were evaluated. Growth performance differed significantly ($P < 0.05$), with control birds recording the highest body weight gain (2,414.00 g) and feed intake (4,956.00 g), while birds fed 0.5% *Lemna minor* achieved the best feed conversion ratio (2.01). Haematological and serum biochemical indices remained within normal physiological ranges ($P > 0.05$). Histopathological examination revealed no lesions, whereas histomorphometric analysis demonstrated significant ($P < 0.05$) diet dependent differences in villus height, villus width, crypt height, crypt width, and smooth muscle thickness without evidence of impaired intestinal integrity. Dietary supplementation with *Lemna minor* up to 1.5% is safe for broiler chickens, while 0.5% optimizes feed efficiency and supports its potential as a sustainable feed supplement.

Keywords: *Lemna minor*; broiler chickens; dietary supplementation; growth performance; haematology; serum biochemistry; intestinal histomorphometry.

Valorisation of *Hermetia illucens* pupal exuviae as a sustainable feed ingredient for laying hens: effects on feed efficiency and egg quality compared with purified chitin**F. Accetta¹, M. Albano¹, R. Armone¹, N. Addeo², M. Lanzieri², A. Di Rosa¹**¹Department of Veterinary Sciences, University of Messina, Messina, Italy, ²Department of Veterinary Medicine and Animal Production, University of Napoli Federico II, Napoli, Italy

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The rapid expansion of insect farming has increased the availability of by-products requiring sustainable valorisation within circular livestock production systems. Among these, *Hermetia illucens* pupal exuviae have emerged as a promising functional ingredient for poultry nutrition. This study evaluated the effects of dietary supplementation with *H. illucens* pupal exuviae (EXU) and purified chitin (CHIT) on productive performance, egg quality and yolk fatty acid profile in ISA Brown laying hens. A total of 120 laying hens were randomly assigned to one of three dietary treatments: CTRL (basal diet), EXU (2.5 g/hen/day, corresponding to approximately 1 g of chitin), and CHIT (1 g/hen/day), over an 11-week experimental period. Data were analysed by one-way ANOVA considering dietary treatment as a fixed effect. Dietary treatments had no effect on most productive performance traits. However, the feed conversion ratio (FCR) was significantly improved in hens receiving the EXU diet compared with the control group (2.70 vs. 3.15 g/g; $P = 0.021$), indicating greater feed utilization efficiency. The chemical composition of whole egg and albumen remained unaffected, whereas only limited effects were observed on egg quality traits. Shell deformation was higher in the EXU group than in the control group ($P < 0.05$), whereas vitelline membrane strength was greater in the CHIT group than in both the CTRL and EXU groups ($P < 0.01$), suggesting improved yolk membrane integrity. Yolk height was lower in the EXU group than in the control group ($P < 0.05$). Only minor changes were observed in the yolk fatty acid profile. Compared with CTRL, both supplemented groups showed lower palmitoleic acid (C16:1) levels ($P < 0.01$), whereas CHIT increased heptadecanoic acid (C17:0) and reduced total MUFA content ($P < 0.05$). No significant differences were found for the remaining fatty acids or lipid nutritional indices. Overall, *H. illucens* pupal exuviae represent a promising sustainable feed ingredient for laying hens, improving feed efficiency without compromising egg quality. Their use may contribute to the valorisation of insect-farming by-products within more circular poultry production systems.

Keywords: *Hermetia illucens* pupal exuviae; chitin; laying hens; feed efficiency; egg quality

Comparison of conventional and pelletized straw bedding in broiler chicken production

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In intensive broiler chicken production, the type of bedding material used plays a critical role in animal welfare. An increasing number of modern farms are using crushed straw pellets, which have the key advantage of enhanced moisture absorption. In addition to its physical properties, it differs from chopped straw technology in terms of its practical application; its use reduces labour requirements, simplifies scattering and storage, and improves not only the health of the flock but also the economic efficiency of rearing. The aim of the study is to compare conventional straw bedding with modern pellet technology in deep-litter broiler chicken production, with particular attention to the rate of footpad lesion development, mortality and body weight (weekly and slaughter). The experiment was conducted with 5400 ROSS 308 meat-hybrid broiler chickens (19.64 bird/ m²), divided into two groups during their 6-week rearing period: group with straw pellet bedding (1.8 kg/m²) and group with conventional straw bedding. The four-phase forage (prestarter, starter, growth and finisher) was sourced from the commercial market. Forage and water were available ad libitum. There was no significant difference in mortality between straw pellet (3.3%) and conventional straw (3.5%) bedding groups. The average body weight differed significantly each week. The slaughter weight was significantly higher in conventional straw bedding group (2.6 kg) compare to straw pellet group (2.3 kg). Footpad lesion development showed no significant differences between groups (71% in conventional straw bedding and 74% in straw pellet bedding), hock dermatitis was 1% in each group. In the case of straw pellet bedding, the bedding replacement interval may be reduced, but it is not possible to add extra bedding because of its high absorbency; therefore, the bedding consistency could be adjusted by completely replacing the bedding material or by increasing ventilation. Further investigations are needed in modern barns equipped with heat-insulated floors and walls or using underfloor heating systems to determine the optimal humidity, ventilation and bedding dry parameters. This study was funded by 2020-1.1.2-PIACI-KFI-2021-00323 and National Talent Program (NTP-SZKOLL-26-0035).

Keywords: straw pellet; bedding; footpad lesion

Monitoring broiler chicken behaviour: from manual video analysis to artificial intelligence

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Continuous monitoring of animal behaviour can improve production efficiency, health status, and animal welfare. Changes in behavioural patterns can often serve as early indicators of stress, environmental impacts or certain diseases. 40 COBB 500 broilers were reared in a deep-litter housing system and were monitored using video recordings. Behavioural observations were analysed in the initial (days 5–14), middle (days 21–25) and final (days 35–37) stages of rearing. During the 18-hour light period, the number of birds engaged in feeding, drinking, resting, or social interactions was recorded 10-second „time-window” every 5 minutes by pausing the video and counting the individuals performing each behaviour. The data were evaluated as daily averages, expressed as the relative frequency (%) of the observed behaviours. As the rearing period progressed, the time spent on feeding (from 26.4% to 9.1%, $p < 0.001$) and drinking (from 5.4% to 3.9%, $p < 0.001$) decreased significantly. At the same time, the proportion of time spent resting increased significantly (from 45% to 83.6%, $p < 0.001$), while social interactions virtually disappeared by the end of the rearing period (from 0.12% to 0%, $p < 0.001$). The observed changes indicate that chicken behaviours differ markedly during rearing, clearly demonstrates the importance of behavioural monitoring. Video-based observation methods allow detailed analysis of animal behaviour; however, manual evaluation of recordings requires considerable time and labour. Furthermore, these methods do not provide real-time information, which is essential for behaviour-based disease detection systems. To address these challenges, an artificial intelligence-based monitoring system is currently being developed, and the annotation and model training phases are underway. The goal of the system is to enable the artificial intelligence to recognize and distinguish between different behavioural patterns in animals that are healthy and those suffering from various diseases. The comprehensive system is designed to differentiate between healthy and diseased birds in real time, thereby enabling immediate intervention, minimizing production losses, and improving the overall welfare of animals. This work was supported by grant 2024-1.1.1-KKV_FÓKUSZ-2024-00052.

Keywords: artificial intelligence; broiler chicken; video recording;

Improving male fertility in broiler breeders: effects of a phytogetic feed additive on semen quality**R. Montanhini Neto¹**¹Cargill Animal Nutrition and Health, Micronutrition & Health Solutions, Crevin, France (Metropolitan)

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Male fertility is a critical factor influencing the productivity of poultry breeder flocks, as it directly affects the number of day-old chicks produced per hen. The quality of sperm, and consequently the successful fertilization of eggs, is impacted by the antioxidant systems present in spermatozoa. PhytoGENICS are essential for providing both direct and indirect protection to spermatocytes by enhancing cellular antioxidant mechanisms and regulating reproductive hormone metabolism, particularly by optimizing testosterone production. Biostrong™ Fertile (PFA; Delacon Biotechnik GmbH, Engerwitzdorf, Austria) is a proprietary formulation comprising essential oils, flavonoids, and saponins, specifically developed to enhance fertility in roosters. A controlled experimental assessment was carried out at Zootests SAS (Ploufragan, France), involving 80 male Hubbard GP broiler breeders aged 42-63 weeks, which were individually housed in cages. At 49 weeks of age, the roosters were fed either a control diet, a standard formulation based on wheat, corn, and soybean, or the same diet supplemented with PFA at 750 g/MT. Semen samples were manually collected from the roosters at the beginning of the experimental treatment and again after 7 and 14 weeks, corresponding to the ages of 49, 56, and 63 weeks, respectively. Data on the effect of PFA addition were analyzed using the Mann-Whitney test in Statistica 13 (StatSoft-TIBCO, Palo Alto, USA). At the onset of the treatment, roosters in the PFA group displayed notably inferior semen quality compared to those in the control group across all assessed parameters. Nevertheless, results at the end of the evaluation period indicated significant improvements ($P < 0.05$) in the PFA group compared with the control, including a 14.8% increase in semen volume, a 22.7% increase in sperm count, and a 19.6% increase in sperm motility score. Although semen concentration naturally declines over time in both groups, the PFA diet consistently outperformed at 56 and 63 weeks of age, resulting in a 6.7% increase at the end of the trial ($P < 0.10$). The findings of this study indicate that the evaluated PFA substantially enhances semen quality parameters in roosters, thereby supporting improved male fertility during the critical age range of 42 to 63 weeks. This innovative solution represents a promising approach to optimizing reproductive performance in breeding programs.

Keywords: Male fertility; Broiler breeders; PhytoGENICS; Semen quality; Antioxidant capacity

Present a detailed study on the evolution, genetic value, and socioeconomic role of Egyptian chicken breeds for Mediterranean sustainability and species conservation**I. Elkhaat¹, Y. Eid¹**¹Department of Poultry Production, Faculty of Agriculture, Kafrelsheikh University, Kafr Elsheikh, EgyptPresenting author: ibrahim.elkhaat@agr.kfs.edu.eg

Indigenous Egyptian chicken breeds (e.g., Fayoumi, Dandarawi, Sinai and regional strains) are locally adapted genetic resources with documented genetic diversity and resilience that can reduce input dependence, improve smallholder livelihoods, and strengthen regional food security under climate stress. The Mediterranean poultry sector faces climate variability, feed-price volatility, and disease risks that threaten production stability. Egypt's poultry industry is a major national protein source and is sensitive to feed imports and price shocks. Recent economic analyses show production and consumption dynamics strongly influenced by feed (corn) prices and broiler numbers, underscoring the need for resilient local genotypes. To document phenotypic and molecular evolution of Egyptian chicken breeds, quantify their genetic diversity and population structure, evaluate performance under low-input conditions, and propose conservation to use pathways that align with Mediterranean sustainability goals. Combined approach using longitudinal field performance trials (feed conversion, growth, mortality), disease-resilience screening, and molecular genotyping (microsatellites and SNP markers) to estimate heterozygosity, allelic richness, and population clusters. Comparative trials contrasted local strains with commercial hybrids under representative smallholder management. Egyptian strains show high within population diversity and distinct clustering, with some lines (e.g., Al Salam, Mandarah) demonstrating superior growth or resilience traits in low input systems. Genetic analyses reveal meaningful allelic richness suitable for targeted improvement without severe loss of diversity. These traits can reduce reliance on imported inputs and buffer economic shocks. Implications for sustainability and conservation integrating community-based breeding, and marker assisted selection can raise productivity while preserving genetic variation. Policy measures should incentivize smallholder adoption, support genetic resource registries, and fund foundation breeding flocks' conservation to maintain adaptive potential across the Mediterranean. Recommendations of pilot community breeding programs linking research stations and rural producers, standardized monitoring of diversity, incorporate local breeds into climate smart value chains with market incentives for low input, resilient poultry products are needed.

Keywords: indigenous breeds; Egyptian poultry; genetic diversity; sustainability; conservation; community breeding.

Assessment of heavy metals and microplastics in feed samples of broiler chicken**R. Yasmeen^{1,2}, Y. Khan¹**¹Lahore Garrison University, Lahore, Pakistan, ²The University of Newcastle, Newcastle, Australia

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The contamination of broiler poultry feed with heavy metals and microplastics poses potential risks to animal and human health. This study aimed to assess the occurrence and levels of heavy metals and microplastics in broiler feed samples collected from nine poultry farms in Lahore and Muridke. A total of 27 samples, including starter, grower, and finisher feeds, were analyzed. Heavy metals (Pb, Cr, Cu, and Cd) were determined using atomic absorption spectroscopy, while microplastics were characterized using Fourier transform infrared spectroscopy (FTIR) and X-ray diffraction (XRD). Results showed that Pb, Cu, and Cr were detected in all samples, whereas Cd was not detected. Pb (1.2–2.2 µg/g) and Cu (2.1–5.1 µg/g) were within acceptable limits set by the Food and Agriculture Organization and World Health Organization, while relatively higher Cr concentrations (16.5–56.2 µg/g) may require further monitoring. Statistical analysis indicated significant variation ($p < 0.05$), though differences among feed types were not significant ($p = 0.063$). FTIR confirmed the presence of multiple microplastic polymers across all feed types, and XRD analysis indicated predominantly amorphous structures. Overall, the presence of heavy metals and microplastics highlights the need for regular monitoring. Further long-term studies with larger sample sizes are required to better assess potential risks and ensure feed safety.

Keywords: Atomic Absorption Spectroscopy; FTIR; XRD; Microplastics; Heavy Metals; Broilers

Integration of blood transcriptomics and health-related quantitative trait loci prioritizes six long non-coding RNA candidates in native and commercial chickens**J. Fayazi¹, M. Askari Manesh¹, A. Sadr²**¹Department of Animal Science, Agricultural Sciences and Natural Resources University of Khuzestan, Ahwaz, Iran, ²Centre for Evolution and Cancer, Division of Cancer Biology, The Institute of Cancer Research, Sutton, United KingdomPresenting author: jfayazi@asnrukh.ac.ir

Long non-coding RNAs (lncRNAs) may contribute to genetic differences in poultry health and environmental adaptation, but candidate regulatory loci remain poorly defined in native chickens. This study integrated blood RNA-seq profiles from 48-day-old Isfahan native and commercial broiler chickens with health-related quantitative trait loci (QTLs). Six birds per population were sampled, and equal amounts of RNA from three birds were pooled to generate two sequencing libraries per population. Paired-end 150-bp sequencing produced 68.3 million reads, of which more than 92% aligned to the chicken reference genome. Transcript assembly and stringent coding-potential filtering identified 568 lncRNAs; 116 showed nominal differential expression between populations ($P \leq 0.05$). Their genomic coordinates were compared with records in Chicken QTLdb. Thirty-eight lncRNA-QTL overlap records were detected within 12 QTLs on 10 chromosomes, covering body temperature, relative right ventricular weight, pericardial fluid accumulation and liver colour. Cross-referencing the QTL-overlap set with the differentially expressed lncRNAs prioritized six candidates. MSTRG.10062, MSTRG.7272 and MSTRG.7307 mapped to body-temperature QTLs, whereas MSTRG.1709, MSTRG.4907 and MSTRG.6866 mapped to QTLs for relative right ventricular weight. Four candidates were intergenic and two were intronic. Integrating expression evidence with genomic location reduced a broad transcriptomic catalogue to a focused set of candidates potentially relevant to thermoregulation and cardiopulmonary function.

Keywords: long non-coding RNA; quantitative trait loci; native chicken; thermoregulation; poultry genetics

Heavy Metal Accumulation in Liver and Thigh Meat of Japanese Quail (*Coturnix japonica*) During the Fattening Period

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Japanese quail (*Coturnix japonica*) production is expanding as an important source of affordable, high-quality animal protein; however, monitoring heavy metal accumulation in edible tissues is essential to ensure food safety. This study evaluated the concentrations of essential metals (iron, Fe; zinc, Zn; nickel, Ni) and toxic metals (cadmium, Cd; lead, Pb) in liver and thigh meat of Japanese quail at different stages of the fattening period (days 1, 15, 30, and 45). Birds were obtained from a commercial farm in Lahore, Pakistan. Tissue samples were acid-digested using nitric and perchloric acids, and metal concentrations were quantified using Atomic Absorption Spectroscopy (AAS) and expressed in $\mu\text{g/g}$ (mean $\pm$ SD). In liver samples, Zn concentrations ranged from $40.35 \pm 1.05 \mu\text{g/g}$ (day 15) to $94.05 \pm 0.15 \mu\text{g/g}$ (day 30), while Fe showed a progressive increase from $54.15 \pm 0.45 \mu\text{g/g}$ (day 1) to $128.40 \pm 0.60 \mu\text{g/g}$ (day 45). Ni concentrations remained comparatively lower, ranging from 9.15 ± 0.15 to $12.75 \pm 0.45 \mu\text{g/g}$ across the experimental period. Significant temporal differences were observed for Zn ($p = 0.0006$), Fe ($p < 0.0001$), and Ni ($p = 0.009$). Among essential metals, Fe dominated in later stages (days 15–45), while Zn was relatively higher at early and mid-stages. For toxic metals, Cd was not detected (below detection limit) in any liver sample throughout the study, indicating negligible exposure to cadmium in the rearing environment. Hepatic Pb concentrations varied significantly over time ($p = 0.01$), with the highest level observed on day 15 ($16.80 \pm 0.60 \mu\text{g/g}$), followed by a decline on day 30 ($13.80 \pm 0.90 \mu\text{g/g}$) and day 45 ($7.20 \pm 0.60 \mu\text{g/g}$). In thigh meat, Zn was consistently the dominant element, followed by Fe and Ni, while Cd was detected only at day 45 in trace levels (below quantifiable limits of AAS). Pb in thigh meat showed a gradual increase with age. Overall, metal accumulation varied significantly with tissue type and rearing period, with most essential metals showing significant temporal variation, while Pb accumulation indicated potential bioaccumulation risk in edible tissues over time. These findings suggest that although essential metal levels remained within biologically relevant ranges, monitoring of Pb accumulation is necessary to ensure food safety. Further studies should investigate long-term exposure, bioaccumulation pathways, and associated histopathological changes to better understand heavy metal metabolism in Japanese quail.

Keywords: Japanese quail (*Coturnix japonica*); Heavy metals; Atomic Absorption Spectroscopy (AAS); Food safety; Metal accumulation

Influence of different basil cultivars in laying hen diets on egg lipid composition and oxidative stability**N. Marusic Radovic¹, I. Jukic¹, K. Kljak², H. Medic¹**¹University of Zagreb Faculty of Food Technology and Biotechnology, Zagreb, Croatia (Hrvatska), ²University of Zagreb Faculty of Agriculture, Zagreb, Croatia (Hrvatska)Presenting author: nmarusic@pbf.hr

Basil (*Ocimum basilicum* L.) is a rich source of bioactive compounds and unsaturated fatty acids that may improve egg nutritional quality and oxidative stability. Due to compositional differences among basil cultivars, their dietary inclusion may differently affect egg quality. Therefore, this study evaluated the influence of three basil cultivars on egg fat content, fatty acid profile, lipid oxidation, and antioxidant activity. A total of 105 Lohmann Brown laying hens were assigned to seven dietary treatments (7 treatments × 5 cages; 3 hens per cage) during a 6-week trial. The control group received a diet supplemented with canthaxanthin (8 mg/kg), while experimental groups were fed diets containing 3 or 5% dried basil leaf powder from *O. basilicum* 'Genovese' (B1), *O. basilicum* var. *purpurescens* (B2), and *O. basilicum* 'Dark Opal' (B3). Eggs collected during the final three weeks were analyzed for fat content, fatty acid composition, TBARS values, and DPPH antioxidant activity. Basil supplementation significantly affected egg yolk fatty acid composition, particularly monounsaturated, polyunsaturated, and n-3 fatty acids, while saturated and n-6 fatty acids were not affected. The observed changes depended on basil cultivar and inclusion level, indicating the potential of basil as a natural strategy for modifying egg lipid composition. In addition, eggs from basil-supplemented groups showed improved antioxidant activity, whereas TBARS values remained unchanged, indicating maintained lipid stability. Overall, basil cultivars may represent promising phytogetic feed additives for improving egg nutritional and functional quality.

Keywords: basil cultivars; laying hens; egg quality; fatty acid profile; oxidative stability

Egg quality assessment in Late laying period across three brown-egg genotypesA. Mereu¹, B. Danveau¹, D. Varescon², A. Sacy¹¹Lallemand SAS, Blagnac, France (Metropolitan), ²L'œuf gascon, Damazan, France (Metropolitan)

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The extension of laying cycles is a major trend in the egg industry, raising concerns about the ability of hens to maintain egg quality at the end of production. This study compared egg quality traits in three brown-egg genotypes during late lay (> 70 weeks) under identical conditions. We hypothesized that genotype is a key driver of shell resistance, egg freshness and consistency at the end of lay. A total of 90 eggs (30 per genotype) were collected from three genotypes at the end of the laying cycle (>70 weeks) on a single aviary farm and analysed the day after collection. Measured parameters included egg weight, shell traits (specific gravity, shell weight and proportion, shell index, breaking strength), Haugh units, and component distribution. Data were analysed by one-way ANOVA after checking for normality and outliers. Egg weight ranged from 61.6 ± 4.3 g to 64.3 ± 5.1 g and remained homogeneous across groups. Specific gravity exceeded 1.08 in all genotypes (1.084–1.086), indicating overall good shell quality; however, the proportion of eggs below this threshold differed substantially, from ~7% in genotype C to ~23% in genotype A, highlighting differences in shell quality consistency. Significant differences ($p < 0.05$) were observed across key traits. Genotype B showed lower shell weight (8.1 ± 0.6 g) than genotypes A and C (~8.8 g). Shell resistance varied markedly, with breaking strength ranging from 3069 ± 706 g (genotype A) to 3456 ± 902 g (genotype B). Albumen quality also differed, with Haugh units ranging from 64.4 ± 17.7 in genotype B to >75 in genotypes A and C. In contrast, egg component proportions remained stable (shell ~13–14%, albumen ~59%). In conclusion, maintaining egg quality remains a key challenge in extended laying cycles. Genotype-dependent differences in shell resistance, egg freshness and consistency highlight the importance of robust nutritional strategies at the end of lay. These results establish reference values for late-lay egg quality and position targeted nutrition, particularly interventions supporting calcium metabolism and gut health, as a key lever to sustain egg quality and performance in extended production systems.

Keywords: egg quality; late laying cycle; shell quality; haugh units; nutrition

Effect of a natural phosphatidylcholine source on laying performance and egg quality in commercial laying hens**R. AVI¹, M. Devlikamov¹, F. Neher¹**¹Nuproxa Europe GmbH, Weinheim, GermanyPresenting author: rahul.avi@nuproxa.ch

Choline is an essential dietary nutrient that supports vital biological functions including hepatic lipid metabolism, methyl-group transfer, and neurotransmission in poultry. In laying hens, this nutrient is critical for preventing fatty liver syndrome and ensuring optimal nutrient utilization to support continuous egg production. Although synthetic choline chloride (SCC) is widely used, it is highly hygroscopic and can react with vitamins in the feed. Therefore, plant-derived phosphatidylcholine sources are being investigated as potential alternative choline sources. The present study evaluated the effects of a plant-derived phosphatidylcholine source (PDCL) in comparison with SCC in commercial laying hens. A total of 57 Lohmann Brown hens (37 weeks of age) were randomly assigned to three dietary treatments for five weeks: a non-supplemented control diet (957 mg total choline/kg feed), a diet supplemented with 1.2 kg SCC (50%)/t feed (1,400 mg total choline/kg feed), and a diet supplemented with 200 g PDCL/t feed (960 mg total choline/kg feed). Diets were based on faba beans, maize, and oats and were formulated to provide relatively low dietary choline and natural pigment levels. Laying performance, egg weight, egg composition, yolk pigmentation, egg choline concentration, and organoleptic characteristics were evaluated. Hens fed PDCL showed a higher laying rate than the control groups (94.1% vs. 77.7% and 81.8%; $P < 0.05$) and a lower proportion of small eggs (1.86% vs. 4.69% and 2.23%; $P = 0.027$). Average egg weight was numerically higher in the PDCL group (61.7 g vs. 58.4 g and 58.3 g; $P > 0.05$). Yolk pigmentation was higher in the PDCL group (YolkFan score 7.57 vs. 6.04 and 5.24; $P < 0.001$). Egg choline concentration did not differ among treatments (310, 298, and 306 mg/100 g for PDCL, control, and SCC, respectively; $P = 0.70$). No significant differences were observed in taste, odor, yolk creaminess, or egg white texture between PDCL and SCC treatments ($P > 0.05$). Under the conditions of this five-week study, PDCL produced productive performance and egg quality comparable to SCC, while improving yolk pigmentation and reducing the proportion of small eggs. These findings indicate that PDCL is a promising natural choline source for laying hens and merits further evaluation in larger and longer-term studies.

Keywords: phosphatidylcholine; laying hens; egg quality; choline chloride replacement; pigmentation

Effect of an egg albumen-based biopolymer coating on internal and external quality traits of table eggs during ambient storage**R. Kartaltepe¹, Ç. Şeremet¹**¹Faculty of Agriculture / Department of Animal Science, Izmir, TurkeyPresenting author: cigdem.seremet@ege.edu.tr

Maintaining the internal quality of table eggs during storage under ambient conditions continues to be a major challenge for the poultry industry. In this context, natural biopolymer coatings have emerged as promising alternatives for extending egg shelf life while supporting sustainable food preservation practices. The present study investigated the effectiveness of a glycerol-plasticized egg albumen-based biopolymer coating in preserving the internal and external quality traits of table eggs stored under ambient conditions (approximately 25 °C) for six weeks. A total of 420 intact table eggs were randomly allocated to three experimental groups: an uncoated Control group, a washed group coated with the albumen–glycerol biopolymer after washing (W), and a non-washed group directly coated with the albumen–glycerol biopolymer without prior washing (NW). The coating was applied directly to the eggshell surface to evaluate whether preserving the natural cuticle enhances the protective effect of the albumen-based coating during storage. Egg quality traits, including egg weight, yolk index, albumen index, Haugh unit (HU), shell weight, shell ratio, and average shell thickness, were evaluated at weeks 0, 3, and 6 of storage. Data were analyzed using a two-way analysis of variance (Two-Way ANOVA), with treatment, storage period, and their interaction included in the statistical model. As expected, storage period significantly affected all internal egg quality parameters ($P < 0.001$), whereas shell weight and shell thickness remained unchanged throughout storage ($P > 0.05$). No significant differences were observed among the experimental groups at the beginning of the study (week 0; $P > 0.05$). However, the beneficial effects of the coating became evident as storage progressed. At week 3, the NW group exhibited a significantly higher yolk index than both the W and Control groups ($P = 0.0006$). By the sixth week of storage, the NW treatment proved to be the most effective in preserving internal egg quality ($P < 0.001$), maintaining significantly higher Haugh unit (68.63 ± 0.93), yolk index (35.28 ± 0.71), and albumen index (5.07 ± 0.15) values compared with both the Control and W groups. Furthermore, a significant treatment $\times$ storage period interaction ($P < 0.01$) demonstrated that direct application of the albumen-based coating effectively delayed the deterioration of internal egg quality throughout storage, most likely by reducing moisture loss and limiting gas exchange through the eggshell. In contrast, none of the coating treatments significantly affected the evaluated external egg quality traits ($P > 0.05$). Overall, direct application of the egg albumen-based biopolymer coating without a washing step offers a practical, sustainable, and environmentally friendly approach for preserving internal egg quality and extending the shelf life of commercial table eggs during ambient storage.

Keywords: Egg quality; Egg albumen; Biopolymer coating; Shelf life; Ambient storage

Meat nutritional value and sensory attributes of Ross 308 broiler chicken fed different inclusion level of mopani worm meal supplemented with multienzymes**M. Chipa¹, E. Malematja¹, D. Kolobe¹, B. Sekhonyana¹, M. Mabelebele¹**¹University of South Africa, Department of Agriculture and Animal Health, Florida, 1710, South Africa., South AfricaPresenting author: jonas.chipa@gauteng.gov.za

Nutritional analysis and sensory attributes play a significant role in ensuring the meat provided to humans has the required nutrients while maintaining economic efficiency. Broiler feed mostly affects the nutritional content of chicken meat, including sensory attributes. The current study evaluates the use of mopani worm meal as a dietary ingredient, supplemented with a multienzyme. Mopani worm meal may pose various nutritional and metabolic challenges during the growing period. Five experimental diets were formulated, such as a control diet without multienzymes or mopani worm meal (T1). Other diets include mopani worm meal at different inclusion rates with a constant multienzyme level of 250g/50kg, such as 12% (T2), 14% (T3), 16% (T4), and 18% (T5). Each experimental diet was randomly replicated five times. A total of 300 day-old mixed-sex Ross 308 broiler chicks were randomly assigned to each experimental diet with 12 birds per replicate. Each experimental diet was assigned 60 birds. On day 43, a total of three birds per replicate were slaughtered. Moisture concentrations were higher ($P<0.05$) in breast meat from broilers fed T2 and T1, while no difference ($P>0.05$) in thigh meat. Dry matter of breast meat was higher ($P<0.05$) when feeding T5, T3 and T4. Protein in breast meat was higher ($P<0.05$) when feeding broilers with T4, T3, T5 and T2. However, feeding chickens with T4, T2, T3 and T5 resulted in a higher ($P<0.05$) concentration of protein in thigh meat. Amount of fats from both breast and thigh meat were lower ($P<0.05$) when feeding T2, T3, T4 and T5. The levels of myristic, palmitic, linoleic, SFA, n-6, and n6/n3 were reduced ($P<0.05$) in breast meat supplemented with a mopani worm diet containing multienzymes. Amounts of myristic, myristoleic, palmitic, margaric, stearic, α -Linolenic, eicosadienoic, MUFA and n-3 were higher ($P<0.05$) in thigh meat. The CA were higher on day 7 during the sensory evaluation. Acceptability of broiler meat was higher ($P<0.05$) across different storage periods from birds offered mopani worm diets supplemented with multienzymes. First bite toughness of meat from broilers fed T3 and T4 was higher ($P<0.05$) on day 14 of storage, while T1, T2, and T5 were similar ($P>0.05$). The metallic aroma and the amount of connective tissue in broiler meat from birds fed mopani worm were higher ($P<0.05$) on day 14 of storage. The meat chicken flavour from birds fed T3, T4 and T5 were the same ($P>0.05$). However, higher ($P<0.05$) than those fed T1 and T2, as were similar ($P>0.05$). Feeding broilers with mopani worm diets enriched with multienzyme increases the nutritional value of chicken meat without affecting sensory attributes. It can be concluded that feeding broilers 16% mopani worm with 250g/kg multienzymes increases meat nutritional values and yields high consumer acceptability.

Keywords: Mopani worm meal; fatty acids; protein; dry matter; breast; thigh

Lipid oxidation, pH and color in chicken meat as affected by high pressure processing—a meta-analysis**K. Dimov¹**¹Agricultural Academy, Institute of Cryobiology and Food Technologies, Sofia, Bulgaria

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A meta-analysis of the effect of High Pressure Processing (HPP) on acidity (pH) and instrumental color characteristics (lightness - L*; redness - a* and yellowness - b*), as well as product of secondary lipid oxidation (TBARS), in chicken meat was performed. A total of 16 studies were included, each of which addressed at least one of the investigated parameters. The number of independent experiments according to the covariates (pressure magnitude and processing duration) varied between 7 and 28 for the individual parameters. The high heterogeneity between studies determined the choice of a random effects model to be applied to the raw means (effect size) in the data analysis. The results of the meta-analysis showed that HPP treatment of chicken meat was associated with a significant increase in all the studied parameters: pH (P=0.018), L* (P<0.001), a* (P=0.035), b* (P<0.001) and TBARS (P=0.025). When examining the influence of covariates, we found that increasing pressure, led to increased pH (P=0.003) and L* (P=0.031) of the chicken meat. In regard to TBARS, a trend in the same direction was observed (P=0.061). It should be mentioned that in all the studies involved in the meta-analysis except one, the values of TBARS remained within the reference limits (<2.0 mg MDA/kg meat). An effect of processing duration was found only for the pH of chicken meat, with increased processing duration leading to higher values of this indicator (P=0.013).

Keywords: chicken meat, high pressure processing, quality

Pathological, epidemiological features, and statistical study of histopathological changes in chicken transmissible viral proventriculitis**M. Djamel eddine ¹, Z. Mourad¹**¹university of chadli ben djedid eltaref, algeria , eltaref, Algeria

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Transmissible viral proventriculitis (TVP) is a chicken disease of unclear etiology. This study describes the histopathological, macroscopic, and epidemiological characteristics associated with possible new etiological agents, based on samples collected from 62 broiler farms, four laying hen flocks, and three broiler breeder flocks. Disease identification relied on detecting proventricular thickening confirmed by histopathological examination using Hematoxylin and Eosin staining. Diverse poultry populations were sampled under standard vaccination regimes, and prevalence, clinical signs, gross lesions, and epidemiological features were analyzed. Microscopic findings identified three health statuses: TVP, characterized by lymphocyte infiltration, necrosis, and hyperplasia of the glandular epithelium; Lymphocytic Proventriculitis (LP), defined by lymphocytic infiltration without necrosis; and Without Proventriculus (WP), marked by the absence of both lymphocytic infiltration and necrosis. The prevalence of TVP, LP, and WP was 23.6%, 52.8%, and 23.6%, respectively, with an overall disease prevalence of 20.9% affecting flocks aged 15 to 40 days, a mortality rate ranging from 0.1% to 0.5%, and 4.3% of cases involving birds weighing less than 1.7 kg. Infectious agents appear to contribute to TVP and LP, while non-infectious factors are associated with WP. The proventricular hypertrophy observed in TVP and LP suggests that infectious agents exacerbate pre-existing conditions rather than being the primary cause of the disease.

Keywords: Transmissible viral proventriculitis; Lymphocytic proventriculitis; Without proventriculitis; Histopathology; Proventriculus.

Antimicrobial resistance profiles of Isolated bacterial strains from ducks**T. Amšel Zelenika¹, M. Berendika¹, M. Balenović¹, F. Krstulović¹, M. Sokolović¹**¹Croatian Veterinary Institute, Poultry Centre, Zagreb, Croatia (Hrvatska)Presenting author: t_amsel-zelenika@veinst.hr

With the increasing number of ducks being raised and consumed, it is crucial to monitor the presence of multidrug-resistant (MDR) bacteria in duck farming. Waterfowl, such as ducks, can contribute to the rapid spread of antibiotic resistance genes (ARGs). Aim of this study was to evaluate antimicrobial resistance profile of bacteria isolated from swabs sampled from ducks in a scope of the NextGenerationEU project Comprehensive Research on the Impact of Plant Extracts against resistant *Staphylococcus* (CRISP). From one hundred of analysed cloacal swabs, isolated were (opportunistic) pathogens: *Aerococcus viridans* (n=3), *Bacillus licheniformis* (n=15), *Bacillus* sp. (n=8), *Corynebacterium* sp. (n=3), *Enterococcus faecalis* (n=2), *Enterococcus* sp. (n=49), *Lactobacillus* sp. (n=2), *Proteus* sp. (n=5), *Staphylococcus aureus* (n=6) and *Staphylococcus* sp. (n=8). Antimicrobial resistance profiles were determined for 38 isolated strains using disk method. The results showed that 35 of tested strains were resistant to three or more of tested antimicrobials. The highest level of resistance was determined for penicillin (n=38), oxacillin (n=37), ceftiofur (n=24), fusidic acid (n=21), doxycycline (n=20), tiamulin (n=19) and kanamycin (n=15). Results of this study indicate that healthy ducks can harbour multi-drug-resistant bacteria and thus can have an important role in sharing of antimicrobial resistance genes among animals, humans and environment. Understanding the level of resistance among (opportunistic) pathogens will aid in development of methods and protocol for preventing the spread of multidrug-resistant bacteria.

Keywords: ducks, antimicrobial resistance, disk-diffusion

Diformates and uneven medium chain fatty acids in poultry production - A holistic eubiotic approachC. Lückstädt¹, C. Hutter¹¹ADDCON, Bitterfeld-Wolfen, Germany

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Gastrointestinal diseases pose a serious threat to commercial poultry production. However, animal production is viewed critically for its antibiotic usage, both from consumers and regulatory authorities. Organic acids, particularly salts of organic acids, have been reported to enhance growth performance in the absence of antibiotic growth promoters (AGPs) in poultry sustainably. Sodium diformate (NDF), a patented formic acid double-salt, has been shown to improve poultry performance for more than a decade. A recent meta-analysis consisting of 28 global trials found that the European Broiler Index (EBI) improved significantly due to the inclusion of NDF ($P < 0.0001$). However, the main impact of NDF is directed against Gram-negative pathogenic bacteria and digestibility improvements (mainly protein and minerals). Furthermore, controlling both Gram-negative and Gram-positive pathogenic bacteria in the digestive tract would lead to a healthier gut environment and better utilization of nutrients from feed, allowing healthy birds to show their full genetic potential in terms of production performance, even in comparison with positive controls, including AGP. This hypothesis was tested in a recent trial in Israel. Performance of 1,908 male broiler (Ross), equally divided into 2 groups and fed either a eubiotic diet (EUD), combining sodium diformate with uneven medium chain fatty acids (Formi NDF and pwrPlanz EMC) at 0.10% inclusion and a positive control (with an AGP) at 0.11%, over a period of 36 days. Birds were raised in floor pens (53 chicks per pen) with ad libitum access to feed and water throughout the trial. Average daily gain (ADG), feed intake, feed efficiency (FCR), mortality and EBI were recorded at the end of the trial. Data were analysed and a confidence level of 95% considered as significant. ADG and FCR of EUD tended ($P < 0.1$) to be improved by 0.8% and 1.8% for ADG and FCR, respectively. A numerical reduction of mortality by ~19% (3.0 vs. 2.5%) in the EUD group was noticed. EBI was significantly ($P < 0.05$) improved for the EUD-birds (449 vs. 435). To summarize, the eubiotic concept of using diformate and uneven fatty acids can improve overall performance when compared against antibiotic usage. The EUD can be a tool in antibiotic reduction strategies – thus supporting sustainable animal production. Therefore, the concept could be a part of the “One Health” approach for reducing the risk of antimicrobial resistance.

Keywords: sodium diformate; uneven medium chain fatty acids; broiler performance; eubiotic

Effects of dietary phytogetic feed additives on growth performance, carcass characteristics, and immune response in broilers**M. Abuamirah^{2,1}, H. ²**¹Cargill, Amman, Jordan, ²Department of Animal Production, Faculty of Agriculture, The University of Jordan, Amman, Jordan

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Four hundred and eighty (day-old) broiler chicks were used in the experiment to evaluate the effect of dietary phytogetic feed additives (PFA) on growth performance, carcass characteristics, and immune response in broilers. Chicks were randomly assigned to four dietary groups: control diet with zero PFA (T1), PFA diet with 1000 grams per ton (T2), PFA diet with 500 grams per ton (T3), and PFA diet with 250 grams per ton (T4). Standard pelleted diets based on corn and soybean meal, which met the nutritional requirements of broilers, were offered with the three nutritional phases: starter (0-14 d), grower (15-28 d), and finisher diet (29-35 d), and each dietary group has 3 replicates. Commercial PFA powder containing 1% cinnamaldehyde and 1% thymol was top-dressed onto the experimental diets. The chicks were randomly assigned to twelve pens with forty chicks in each pen. Antibody titers were measured following vaccination against Newcastle disease virus (NDV), infectious bronchitis virus (IBV), and avian influenza virus (AIV). Results showed that there were no significant ($P>0.05$) effects of different levels of dietary phytogetic feed additives (PFA) on broilers' performance (feed intake, daily weight gain, body weight, feed conversion ratio, and mortality rate), carcass characteristics (live weight, carcass yields, giblets weight, thigh and breast weight, and abdominal fat). Antibody titers for NDV and IBV were improved ($P<0.05$) when 250 g per ton of PFA (T4) was added to the diet, while no effects ($P>0.05$) on antibody titers for AIV were noted.

Keywords: Phytogetic feed additives; Carcass characteristics; Broiler chickens; Cinnamaldehyde; Thymol.

Transition to cage-free laying hen housing in Latvia: animal welfare, biosecurity and economic adaptation challenges**L. Proskina¹, S. Cerina²**

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The transition from cage systems to cage-free laying hen housing is one of the key issues in European debates on animal welfare policy and the sustainability of food production. Cage-free systems provide laying hens with greater opportunities to express natural behaviours, including locomotion, nesting, perching, foraging and dust bathing. However, the European Food Safety Authority emphasises that a change in housing system alone does not guarantee higher welfare unless it is accompanied by appropriate flock management, pullet rearing, litter quality, health monitoring and disease prevention measures (EFSA AHAW Panel et al., 2023). The aim of this study is to analyse the main animal welfare, biosecurity and economic adaptation challenges associated with changes in laying hen housing systems in Latvia. The study is based on secondary data and document analysis, drawing on information from the European Commission, the Central Statistical Bureau of Latvia, the Ministry of Agriculture of the Republic of Latvia and EFSA. This topic is particularly relevant in the Latvian context, as the laying hen sector still has a comparatively high proportion of enriched cage capacity. European Commission data show that in 2025, 45.6% of laying hen places in Latvia were in enriched cage systems, 45.6% in barn systems, 8.6% in free-range systems and 0.3% in organic systems (European Commission, DG AGRI, 2026). In 2024, the number of laying hens in Latvia increased by 5.2%, while egg production increased by 1.1% (Central Statistical Bureau of Latvia, 2025). Transitioning to cage-free systems may improve animal welfare, but it also increases management complexity. Particularly important challenges include floor eggs, litter moisture, injurious pecking, mortality, parasites and biosecurity risks related to avian influenza. From an economic perspective, the transition requires investment in building conversion, aviary and nest technologies, ventilation, lighting and labour organisation. Therefore, an effective transition requires a clear policy framework, investment support, and a scientifically grounded cost-benefit assessment.

Keywords: laying hens; cage-free housing; animal welfare; biosecurity; economic adaptation

The structure of laying hen housing systems in Latvia in the context of European Union animal welfare policy

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Changes in laying hen housing systems have become an increasingly important issue in European Union animal welfare, food market and agricultural policy debates. This development is driven by the evolution of EU animal welfare policy, growing public concern about the ethical dimensions of food production, and changes in procurement policies among market actors. The European Citizens' Initiative "End the Cage Age" brought renewed attention to the need to reconsider the use of cages in farm animal production, including in the laying hen sector (European Commission, n.d.). The importance of public attitudes is also reflected in Special Eurobarometer 533, which shows that 84% of EU citizens believe that the welfare of farmed animals in their country should be better protected (European Commission, 2023). The aim of this study is to characterise the structure of laying hen housing systems in Latvia and to assess its alignment with broader EU animal welfare and market development trends. The study applies secondary data analysis, drawing on the European Commission's egg market monitoring data, publications of the Central Statistical Bureau of Latvia, and the scientific opinion of the European Food Safety Authority. According to European Commission data, in 2025, 45.6% of laying hen places in Latvia were in enriched cage systems, 45.6% in barn systems, 8.6% in free-range systems and 0.3% in organic systems. In the EU as a whole, the share of enriched cage systems was 36.1% (European Commission, DG AGRI, 2026). At the same time, in 2024 the number of laying hens in Latvia increased by 5.2%, while egg production increased by 1.1% (Central Statistical Bureau of Latvia, 2025). The findings indicate that the structure of laying hen housing in Latvia is in transition. Although barn system capacity has already become significant, the share of enriched cage systems remains above the EU average. Further transition will require assessment of investment needs, market demand, biosecurity risks and the implications for the competitiveness of egg production.

Keywords: laying hens; housing systems; enriched cages; cage-free housing; animal welfare

Effects of cold incubation manipulations applied during late embryogenesis on whole-body composition of broiler embryos and chicks**H. Tiryaki Cankurtaran¹, H. Güler¹**¹Faculty of Agriculture / Department of Animal Science, Van, Turkey

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Embryonic thermal manipulation during incubation has been proposed as a strategy to improve physiological adaptation and thermoregulatory capacity in broiler chickens. Whole-body composition provides important information on nutrient deposition and energy utilization during embryonic and early posthatch development. However, limited information is available regarding the effects of prenatal cold exposure during late embryogenesis on whole-body composition during embryonic and early posthatch development. Therefore, this study evaluated the effects of different cold incubation treatments applied during late incubation on the whole-body chemical composition of broiler embryos and chicks. A total of 900 fertile Ross 308 eggs obtained from a commercial hatchery were used. Eggs were weighed and randomly allocated to six trays containing 50 eggs each, which were distributed among three incubators. All eggs were incubated under standard conditions (37.6 °C) until embryonic day 16. One incubator served as the control group (CTRL), whereas the other two were subjected to continuous (CONT; 34.6 °C) and cyclic (CYC; 34.6 °C for 4 h daily) cold treatments, respectively, from embryonic day 16 to 18. Data were analyzed using factorial analysis of variance (ANOVA), with incubation treatment (CTRL, CYC, and CONT), sampling day (EA16, EA17, EA18, EA19, hatch, and posthatch day 7), and their interaction included in the statistical model. Whole-body composition was determined according to AOAC official methods by measuring dry matter, moisture, crude protein, and crude fat. None of these components was significantly affected by cold incubation treatments in either embryos or chicks ($P > 0.05$). In contrast, sampling day significantly influenced all whole-body composition traits ($P < 0.0001$), reflecting normal developmental changes throughout embryonic and early posthatch development. No significant treatment $\times$ sampling day interactions were detected for any whole-body composition parameter ($P > 0.05$). Overall, prenatal cold exposure during late incubation did not alter the whole-body composition of broiler embryos or chicks. Changes in whole-body composition primarily reflected normal developmental progression rather than the applied cold incubation treatments.

Keywords: broiler embryo; cold incubation; whole body composition; posthatch development

The association between egg weight, hatchability and chicken quality**A. Kryeziu¹, M. Kamberi¹, X. Ramadani¹, A. Murati¹**¹University of Prishtina, Prishtina, AlbaniaPresenting author: alltane.kryeziu@uni-pr.edu

Production efficiency in poultry farming depends on critical factors such as incubation performance and hatching success. This study examines the relationship between egg weight, egg weight loss during incubation, hatching results, and post-hatch chick quality. The aim of this research was to analyze whether initial egg weight influences egg weight loss during incubation and how this weight change affects hatching results and chick quality. A total of 190 chicken eggs were used for this research, classified by weight into different experimental groups: I (≤ 50.00 g), II (50.01–55.00 g), III (55.01–60.00 g), IV (60.01–65.00 g), V (65.01–70.00 g), and VI (> 70.00 g). During the incubation period, egg weight loss was measured at 7, 14, and 18 days, relating these results to hatching success, quality, and chick yield. Eggs in Group V showed significantly higher weight loss at all three measurement times (Day 7: 2.30 g, Day 14: 4.53 g, and Day 18: 5.64 g) compared to the group with the lowest egg weight, Group I (Day 7: 1.70 g, Day 14: 3.41 g, and Day 18: 4.33 g). The highest fertility rate of set eggs was found in Group III (32.10%), while the lowest (2.63%) was found in Group VI. Group II resulted in the best chick yield (73.94%), followed by Group III (72.59%), Group I (72.27%), and Group V (71.65%), while the lowest chick yield resulted from Group IV (71.51%). The data obtained from this experiment suggest that optimizing incubation conditions based on initial egg weight can significantly improve hatching results and chick quality. This study provides practical recommendations for hatchery managers to adjust incubation parameters in accordance with the physical characteristics of the eggs.

Keywords: egg weight; incubation; egg weight loss; hatching success; chicken quality

Potential for producing foie gras without force-feeding using postbiotic supplementation

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The production of goose foie gras is a controversial practice from an animal welfare perspective; however, there continues to be significant market demand for the product. Geese are naturally capable of reversible liver enlargement associated with increased feed intake, which may provide a physiological basis for foie gras production without force-feeding. Postbiotics can improve intestinal function, nutrient utilization and may contribute to the development of foie gras production without force-feeding. A total of 180 Integrál MB-09 liver-type geese were divided into three equal groups (n = 60): control (no supplementation), Post0.2 (0.2 g postbiotic/kg feed), and Post1 (1 g postbiotic/kg feed). The rearing period lasted 8 weeks, during which the birds were fed ad libitum. Subsequently, the geese were kept for an additional 6 weeks without force-feeding using a restricted feeding regimen. The frequency of feeding was gradually increased from twice daily during the initial two weeks to three times daily during the subsequent two weeks and four times daily during the final two weeks. Body weight was recorded before slaughter, while foie gras weight, texture and CIELAB colour parameters were measured after slaughter. No significant differences were found among the groups in live weight parameter before slaughter (control: 5936±1086g, Post0.2: 6111±1077g, Post1 6216±986g). There were no significant differences in foie gras weight between control (104.7±42.7 g), Post0.2 (109.4±35.0 g) and Post1 (101.0±34.4 g) groups. In the case of quality parameters, no significant differences were detected. Although distinctly fatty livers were not produced by the end of the fattening period without force-feeding and no significant differences were detected among the groups, initial signs of hepatic steatosis were observed in some birds. The results suggest that further studies are needed to optimize feed portions, fattening duration and to investigate different postbiotic doses. This work was supported by grant 2024-1.1.1-KKV_FÓKUSZ_2024-00079.

Keywords: postbiotic; goose; foie gras, production

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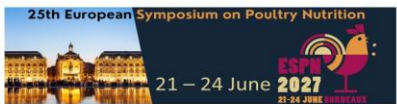


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