Methane must be reduced – What about rumen performance?

Authors: Valentina Mayorga, Predrag Persak, and Inge Heinzl, EW Nutrition

Every day, dairy cows convert large amounts of feed into milk, but part of that valuable energy is inevitably lost in the form of methane produced during rumen fermentation. This gas not only represents a metabolic inefficiency for the animal but has also become one of the most discussed environmental impacts. Some organizations, such as the Institute for European Environmental Policy (IEEP), state that livestock production in the European Union accounts for approximately 65% of agricultural greenhouse gas (GHG) emissions (Hart et al., 2025). A very high number! As sustainability requirements and pressure from policymakers, processors, and consumers intensify, the dairy industry faces a critical challenge: reducing methane emissions while maintaining rumen health, fermentation efficiency, and productive performance.

Can feed additives master this difficult task?

In response to this challenge, a variety of feed additives and nutritional strategies have been developed to mitigate methane emissions in ruminants. However, methane mitigation must be approached carefully. Some products aim to suppress specific microbial pathways involved in methane formation, potentially altering rumen fermentation dynamics if not properly balanced.

One of the key mechanisms involved in methane mitigation is the redirection of hydrogen within the rumen. During ruminal fermentation, hydrogen produced by microbial activity can follow different metabolic pathways:
1. Traditionally, a significant portion of this hydrogen is utilized by methanogenic archaea to produce

methane
2. However, hydrogen can also be incorporated into alternative pathways, particularly the formation of propionate. When rumen fermentation shifts toward propionate production, less hydrogen becomes available for methanogenesis, resulting in lower methane emissions. This process, often referred to as hydrogen redirection, enables methane reduction without suppressing overall microbial fermentation.

Among the nutritional approaches explored, plant-derived compounds, such as essential oils, have gained increasing attention for their ability to modulate rumen microbial populations. With essential oils, it is possible to influence specific groups of microorganisms involved in rumen fermentation, but also in methane production.

Many methanogens, e.g., are closely associated with rumen protozoa; therefore, reducing protozoal populations may indirectly decrease methane formation while maintaining normal fermentation processes.

Activo Premium trial gives reason for hope

Activo Premium, a blend of carefully selected essential oils, has been evaluated for its effects on rumen fermentation and methane production under controlled experimental conditions.

Trial Design:

Ingredients	g/kg DM
Chopped Tifton hay	500
Ground maize	325
Soybean meal	172
Chemical composition	% in DM
Organic matter	91.8
Crude protein	13.2
Neutral detergent fiber	59.4

The study was conducted at the CENA (University of São Paulo). Nine rumen-cannulated Santa Inês sheep (55 ± 3.7 kg of BW) were divided into three groups and randomly distributed in a 3×3 Latin square design for three consecutive periods of 37 days each.
At the beginning of each trial period, all sheep were fed ad libitum a basal diet without additives for 15 days. After this period, the animals were distributed to three different groups:

Group 1: Control (basal diet without additives)
Group 2: Basal diet with 200 mg product/kg DM
Group 3: Basal diet with 400 mg product/kg DM.

The sheep were fed experimental diets twice daily in equal portions and had free access to fresh water.

Results:

Experimental results showed a significant reduction in protozoa from day 7 after the first application and in methane production.

Protozoa

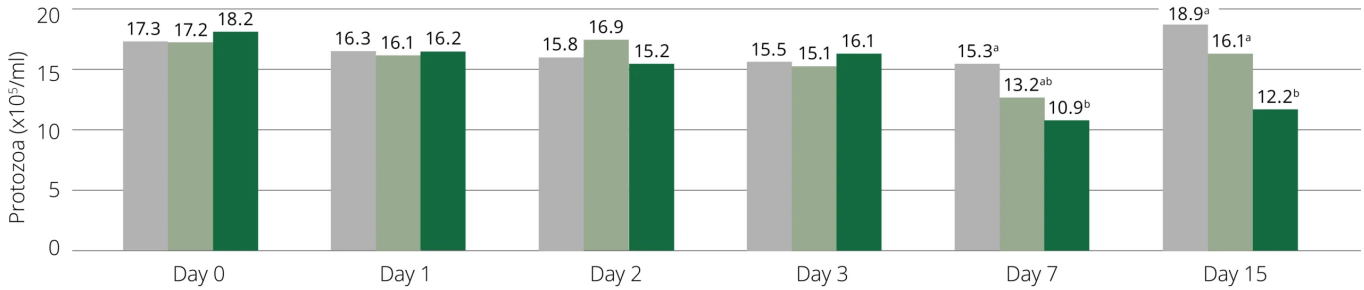


Figure 1: Decreasing levels of protozoa with increasing dosage of Activo Premium

Methane produc

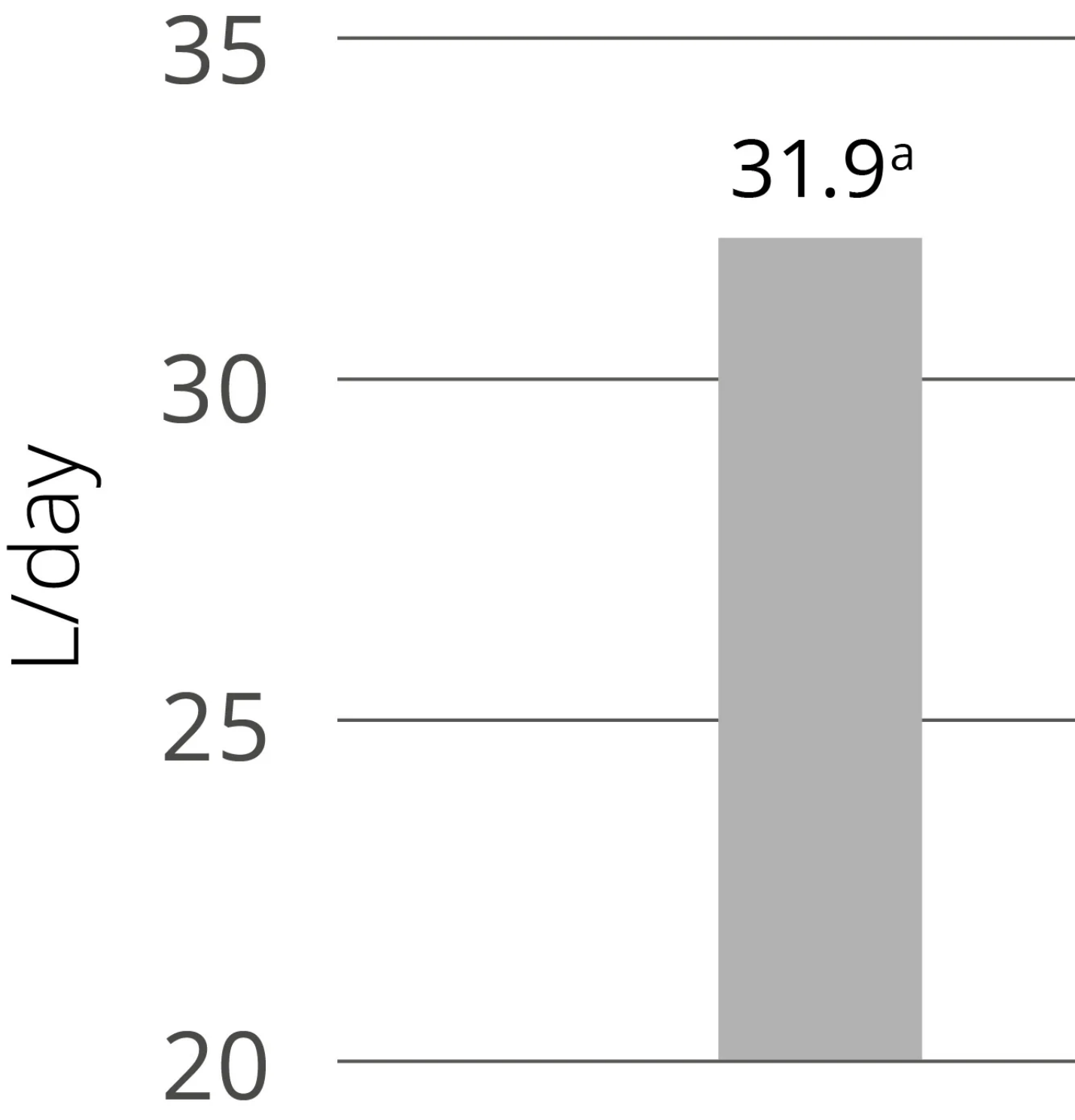


Figure 2: Decreasing methane production due to the application of Activo Premium

Furthermore, propionate levels increased. The shift in SCFA towards propionic acid indicates that hydrogen, which methanogenic bacteria would have otherwise used for methane production, can now be used by rumen bacteria to produce bacterial protein, which then can serve as a nutrient for the sheep.

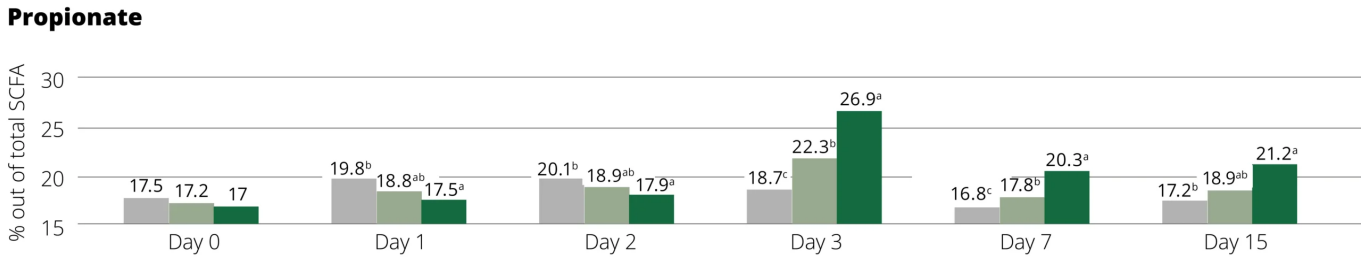


Figure 3: Shift of SCFA towards propionate with increasing dosage of Activo Premium

Phytomolecules are an optimal tool for methane reduction

Reducing greenhouse gas emissions has become a global responsibility to protect the future of our planet. Among agricultural sources, methane production from ruminants is considered one of the major contributors to greenhouse gas emissions. Therefore, effective nutritional strategies are increasingly important for sustainable livestock production. Phytomolecules-based products, such as Activo Premium, represent a promising approach to reducing methane formation by modulating rumen fermentation while maintaining animal productivity. This offers benefits for both farmers and the environment.

References

Hart, K., Tremblay, L.-L., Durrant, L., Scheid, A., Pazmiño, J., & Riedel, A. (2025, September 30). Leveraging the common agricultural policy to accelerate livestock emission reductions. Institute for European Environmental Policy (IEEP) & Ecologic Institute. https://ieep.eu/publications/leveraging-the-common-agricultural-policy-to-accelerate-livestock-emission-reductions/

Rapetti, L., & Colombini, S. (n.d.). Evaluation of the effects of a blend of essential oils (named ACTIVO PREMIUM) on in vivo rumen microbiota and in vitro fermentation profile: Final report of the experimental trial. Università degli Studi di Milano, Department of Agricultural and Environmental Sciences.

Want better poultry performance? Focus on gut health

by **Ruturaj Patil**, Product Manager Phytogenic Liquids, EW Nutrition

Commercial poultry operations have undergone enormous changes in production practices over the last 50 years. Genetic selection for high production rates, along with upgraded management techniques and dietary measures, have led to increased performance standards in all poultry operations (Kogut et al., 2017). However, it is sensible to now look into whether poultry performance may soon reach a ceiling due to genetic and/or physiological limits. So, aiming at further performance optimization, poultry researchers and producers are now focusing on gut health.

LOWRES IMG

Gut health management is key to sustainably improve poultry performance

The caveat, of course, is that, due to concerns about antimicrobial resistance, antimicrobial growth promoters (AGPs) no longer offer the easy answer to gut health issues they once were. To preserve antibiotics' efficacy for cases where they are indispensable, gut health-oriented performance enhancement needs to come from other sources. This article reviews the principles of gut health management in poultry and shows how Activo liquid, a phytomolecules-based in-water solution, strengthens poultry performance by targeting gut health.

Gut health: the cradle of poultry performance

Gastrointestinal health in poultry birds encompasses three dimensions: microflora balance, gut structural integrity, and immune system status. The gut plays a vital and diverse role as it hosts most microorganisms in the body, contains more than twenty different hormones, digests and absorbs the nutrients, and accounts for 20% of body energy expenditure (Choct, 2021). When gut health is compromised, digestion and nutrient absorption are affected, with likely detrimental effects on feed conversion, followed by economic loss and greater disease susceptibility. Disease resistance and nutrient utilization largely depend on maintaining a beneficial gut antioxidant status, improving gut integrity, and modulating the gut microbiota (Oviedo-Rondón, 2019).

In birds, the gut is separated into five distinct regions (Figure 1): crop, proventriculus, gizzard, small intestine (duodenum, jejunum, and ileum), and large intestine (ceca, cloaca, and vent). Each of these regions has a specific role in the secretion of digestive juices and enzymes, the grinding of feed particles and then the digestion and absorption of nutrients (Bailey 2019).

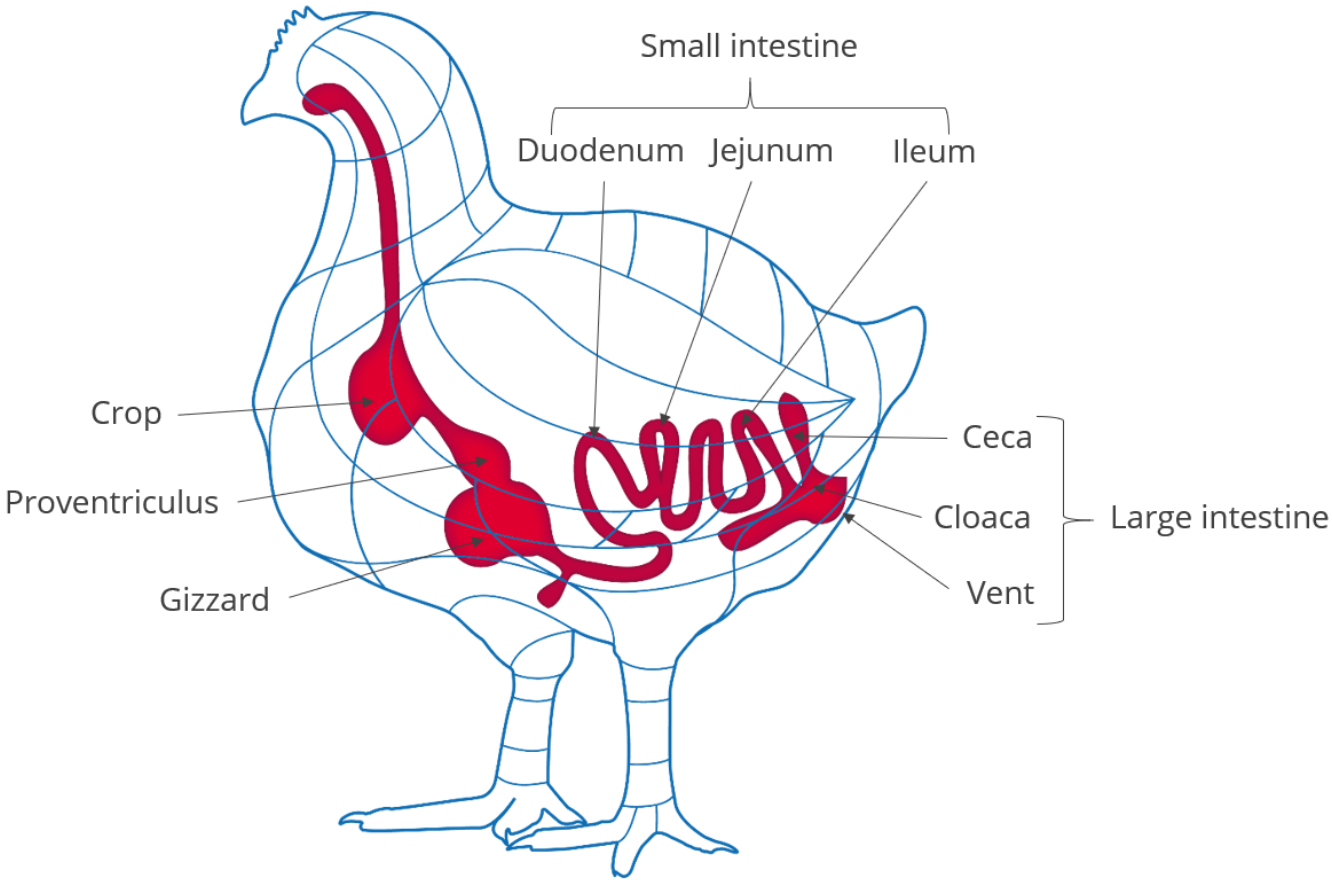


Figure 1: Schematic overview of poultry gastrointestinal tract

Factors affecting gut health

Gut health is influenced by the balance between the physiological health status of host, the gut microbiota, and a range of specific factors, all of which producers need to consider. From a management perspective, key factors encompass deprived gut health, biosecurity, and production stress, which is elevated during certain critical stages (see table 1). Environmental factors include humidity, temperature, and ventilation. Dietary factors, such as feed and water quality, feed composition, and mycotoxin contamination, also impact the development and ongoing state of poultry birds' intestinal microbiota.

Critical stages		**Signs and symptoms**
Broilers • Vaccination • Feed change • Heat/cold stress • Finisher stage	Layers/breeders • Vaccination • Feed change • Transition from grower to laying house • Point of lay to peak production • Late laying phase	• Diarrhea • Undigested feed in feces • Subclinical necrotic enteritis / cocci • Wet litter condition / food pad lesions • Increased mortality

Table 1: Critical stages for gut health issues in poultry birds

The future is here: antibiotic reduction through improved gut health

There is a strong trend towards antibiotic-free (ABF) poultry production, fueled by AGP bans in certain regions (such as the European Union) and increasing consumer interest in avoiding products containing traces of AGPs. ABF systems can be profitable as long as the prices for the final ABF products can cover the investment costs necessary to produce these products. Larger-scale, sustainable ABF production will depend on developing a more profound understanding of intestinal health alongside the development of practical applications that foster gut health throughout each step of the production system.

Feed additive solutions to support birds during challenging situations

Feed additive manufacturers are looking into accessible alternatives to mitigate the need for antibiotics in ABF systems, requiring enormous research and development efforts. At EW Nutrition, our approach is to offer a holistic antibiotic reduction program for gut health management in poultry. The program comprises feed- and water-based solutions to support gut health during high-challenge periods. Activo liquid, an in-water solution containing standardized amounts of selected phytomolecules, is a key component of our program. Based on its three-fold mode of action, Activo liquid provides gut health support that improves livability and feed efficiency:

- **Antimicrobial** activity hinders the growth of potential pathogens
- **Better gut integrity and positive microbiota** optimize feed efficiency and gut health
- **Antioxidant** activity at the gut level prevent free radical formation and oxidative stress

As a water-based solution, Activo liquid provides a quick and flexible option for gut health control on poultry farms. The benefits of Activo liquid supplementation have been demonstrated through several scientific and field studies globally.

Activo liquid reduces mortality and improves feed conversion in broilers

Numerous field studies for antibiotic-free broilers across different countries and breeds show: on average, the inclusion of Activo liquid reduces mortality by 0.6% and improves FCR by 5%, compared to non-supplemented control groups (Figure 2).

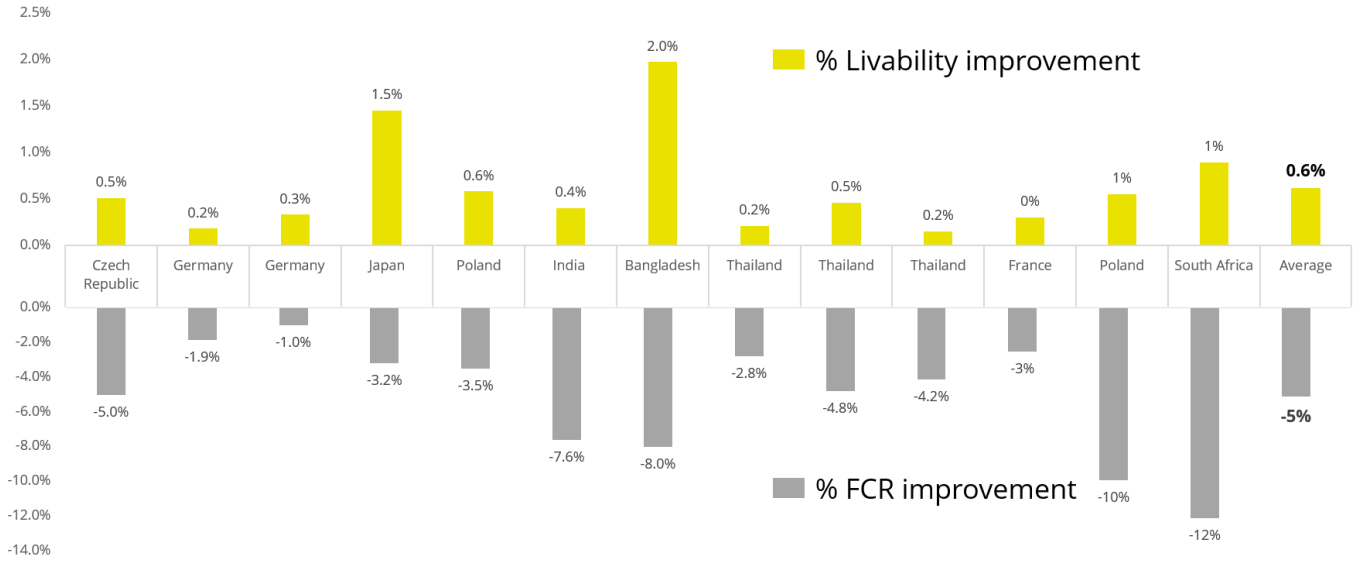


Figure 2: Changes in livability and feed conversion rate in Activo liquid-supplemented broilers

Activo Liquid supports broiler breeders from start of lay to pre-peak production

Broiler breeders are prone to gut-related issues from the start of lay to pre-peak production (age 24 to 32 weeks). This period is characterized by sudden changes in feed consumption and high production stress. Field studies from Thailand show that Activo liquid supplementation in this phase leads to improved livability and higher laying rates.

A of 34,000 female broiler breeders during the first 9 weeks of production found that for the group receiving Activo Liquid (200 ml / 1000 L, 5 days per week, 6 hours per day):

- The average laying rate/HH increased by 7.2 % during the trial period,
- Nearly 3 more hatching eggs per hen housed and about 5 more hatching eggs than the genetic standard were produced, and
- Mortality decreased by 0.2 % points compared to the control.

Another study, again evaluating the first 9 weeks of production using 20,000 birds, also found that broiler breeders supplemented with Activo Liquid show reduced mortality, a higher laying rate, and more hatching eggs per hen housed (Figure 3).

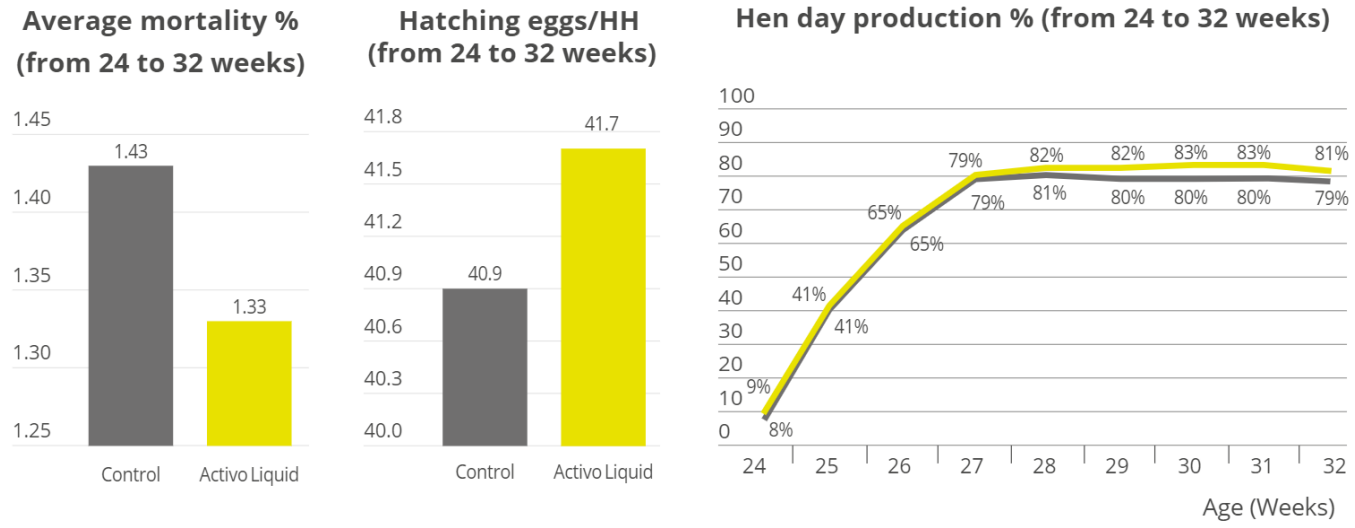


Figure 3: Performance results from Cobb broiler breeders, Activo liquid supplementation vs. control

Activo program improves layer productivity

Commercial layers often becomes challenged due to stress originating from management issues, gut pathogens, and an improper assimilation of nutrients. The negative impact on gut health can result in poor uniformity, low livability, and impaired body weight gain. The Activo program (a combination of Activo powder and liquid) has been found to improve layer performance, likely because its phytogenic components foster better intestinal integrity and microbiome diversity.

A study of 8 replicates with 36 Hy-line brown laying hens was conducted in China, for instance, testing the inclusion of both Activo (100 g / MT of feed) and Activo Liquid (250 ml / 1000 L for 4 days, every 2 weeks, from week 15 to week 25). It found that the Activo program can effectively support the animals in coping with NSP-rich diets (Figure 4). Supplemented layers showed 3.36% higher egg production, representing more than 3.5 eggs and more than 150 grams of additional egg mass per hen housed during the period. Better gut health in the Activo Program gut was evidenced by a better hen body weight, as well as higher yolk color, lower FCR, and improved intestinal morphology parameters.

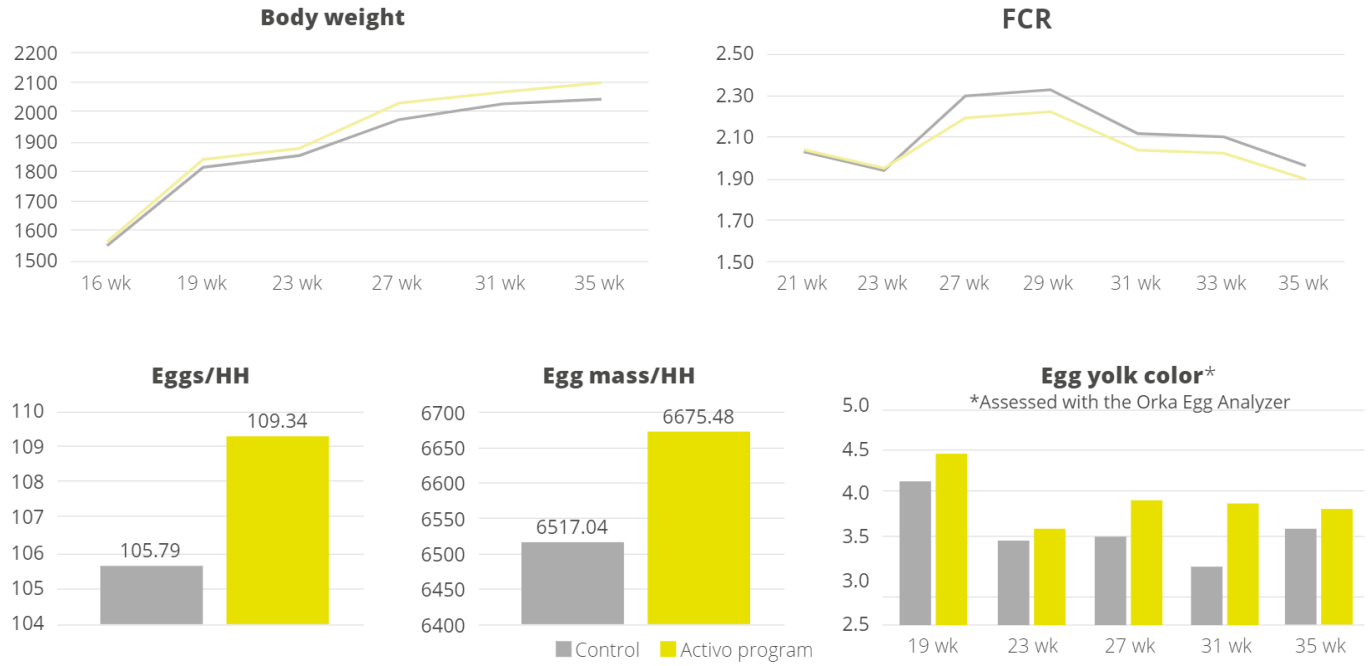


Figure 4: Performance results from Hy-line layers, Activo program vs. control

Conclusion: future improvements in poultry performance will come from the gut

As the trend towards ABF poultry production gains momentum, a concerted focus on supporting birds' gut health is key to achieving optimal performance. Multiple field studies of Activo liquid application demonstrate that, due to their antimicrobial and antioxidant properties, the phytomolecules present in Activo liquid effectively support birds' intestinal health during challenging periods.

In combination with good dietary, hygiene and management practices, phytomolecules offer a potent tool for reducing the use of antibiotics. The inclusion of Activo liquid in their birds' diets allows poultry producers to achieve better gut health and, thus, stronger performance results in a sustainable way.

References

Bailey, Richard A. “Gut Health in Poultry: the World within – Update.” The Poultry Site, July 6, 2021. https://www.thepoultrysite.com/articles/gut-health-in-poultry-the-world-within-1.

Choct, Mingan. “The Importance of Managing Gut Health in Poultry.” Poultry Hub Australia, November 26, 2014. https://www.poultryhub.org/importance-managing-gut-health-poultry.

Kogut, Michael H., Xiaonan Yin, Jianmin Yuan, and Leon Bloom. “Gut Health in Poultry.” CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources 12, no. 031 (October 1, 2017): 1–7. https://doi.org/10.1079/pavsnnr201712031.

Oviedo-Rondón, Edgar O. “Holistic View of Intestinal Health in Poultry.” Animal Feed Science and Technology 250 (2019): 1–8. https://doi.org/10.1016/j.anifeedsci.2019.01.009.

Phytomolecules: Boosting Poultry Performance without Antibiotics

Antimicrobial resistance (AMR) is a major threat to global public health. It is largely caused by the overuse of antibiotics in human medicine and agriculture. In intensive poultry production most antibiotics are used as antimicrobial growth promoters and/or used as prophylactic and metaphylactic treatments to healthy animals. Reducing such antibiotic interventions is crucial to lowering the incidence of AMR. However, antibiotic reduction often results in undesirable performance losses. Hence alternative solutions are needed to boost poultry performance. Phytomolecules have antimicrobial, digestive, anti-inflammatory and antioxidant properties, which could make them key to closing the performance gap.

Poultry performance depends on intestinal health

Poultry performance is to a large extent a function of intestinal health. The intestines process nutrients, electrolytes and water, produce mucin, secrete immunoglobulins and create a barrier against antigens and pathogens.

In addition, it is an important component of the body's immune defense system. The intestine has to identify pathogens and reject them, but also has to tolerate harmless and beneficial microorganisms. If the intestines do not function properly this can lead to food intolerance, dysbiosis, infections and diseases. All of these are detrimental to feed conversion and therefore also to animal performance.

Antibiotics reduce the number of microorganisms in the intestinal tract. From a performance point of view this has two benefits: first, the number of pathogens is reduced and therefore also the likelihood of diseases; second, bacteria are eliminated as competitors for the available nutrients. However, the overuse of antibiotics not only engenders AMR: antibiotics also eliminate probiotic bacteria, which negatively impacts the digestive tracts' microflora.

Products to boost poultry performance may be added to their feed or water. They range from pre- and probiotics to medium chain fatty acids and organic acids to plant extracts or phytomolecules. Especially the latter have the potential to substantially reduce the use of antibiotics in poultry farming.

Phytomolecules are promising tools for antibiotic reduction

Plants produce phytomolecules to fend off pathogens such as moulds, yeasts and bacteria. Their antimicrobial effect is achieved through a variety of complex mechanisms. Terpenoids and phenols, for example, disturb or destroy the pathogens' cell wall. Other phytomolecules inhibit their growth by influencing their genetic material. Studies on broilers show that certain phytomolecules reduce the adhesion of pathogens such as to the wall of the intestine. Carvacrol and thymol were found to be effective against different species of *Salmonella* and *Clostridium perfringens*.

There is even evidence that secondary plant compounds also possess antimicrobial characteristics against antibiotic resistant pathogens. In-vitro trials with cinnamon oil, for example, showed antimicrobial effects against methicillin resistant Staphylococcus aureus, as well as against multiresistant E. coli, Klebsiella pneumoniae and Candida albicans.

Importantly, there are no known cases to date of bacteria developing resistances to phytomolecules. Moreover, phytomolecules increase the production and activity of digestive enzymes, they suppress the metabolism of pro-inflammatory prostaglandins and they act as antioxidants. Their properties thus make

them a promising alternative to the non-therapeutic use of antibiotics.

Study design and results

In order to evaluate the effect of phytomolecules on poultry performance, multiple feeding studies were conducted on broilers and laying hens. They were given a phytogenic premix (Activo, EW Nutrition GmbH) that contains standardized amounts of selected phytomolecules.

To achieve thermal stability during the feed processing and a targeted release in the birds' gastrointestinal tract, the product is microencapsulated. For each , the studies evaluated both the tolerance of the premix and the efficacy of different dosages.

Study I: Evaluation of the dose dependent efficacy and tolerance of Activo for broilers
Animals: 400 broilers; age: 1-35 days of age
Feed: Basal starter and grower diets
Treatments:
– No supplement (negative control)
– 100 mg of Activo /kg of feed
– 1.000 mg of Activo /kg of feed
– 10.000 mg of Activo /kg of feed
Parameters: weight gain, feed intake, feed conversion ratio, health status, and blood parameters

Results: The trial group given the diet supplemented with 100 mg/kg Activo showed significant improvements in body weight gain during the starter period (+4%) compared to the control group. Additional significant improvements in feed conversion ratio (FCR) in the growing period (+4%) resulted in an overall improvement in FCR of 3%. At a 1.000 mg/kg supplementation, a significant improvement in FCR of 6% was observed over the entire feeding period. Hematological parameters were within the reference range of healthy birds when feeding up to 10,000 Activo/ kg of feed.

Study II: Evaluation of the dose depending efficacy and tolerance of Activo for laying hens

Animals: 200 hens; age: 20 to 43 weeks
Feed: basal diet for laying hens
Treatments:
– No supplement (negative control)
– 100 mg of Activo/ kg of feed
– 250 mg of Activo/ kg of feed
– 500 mg of Activo/ kg of feed
– 5.000 mg of Activo/ kg of feed
Parameters: weight gain, feed intake, feed conversion ratio, health status, and blood parameters

Results: Inclusion levels from 100 mg/kg of Activo onwards improved laying performance, egg mass and egg weight and reduced FCR compared to the control group. Results recorded for hematological parameters were within the reference range of healthy birds when feeding up to 5.000 mg Activo/ kg of feed.

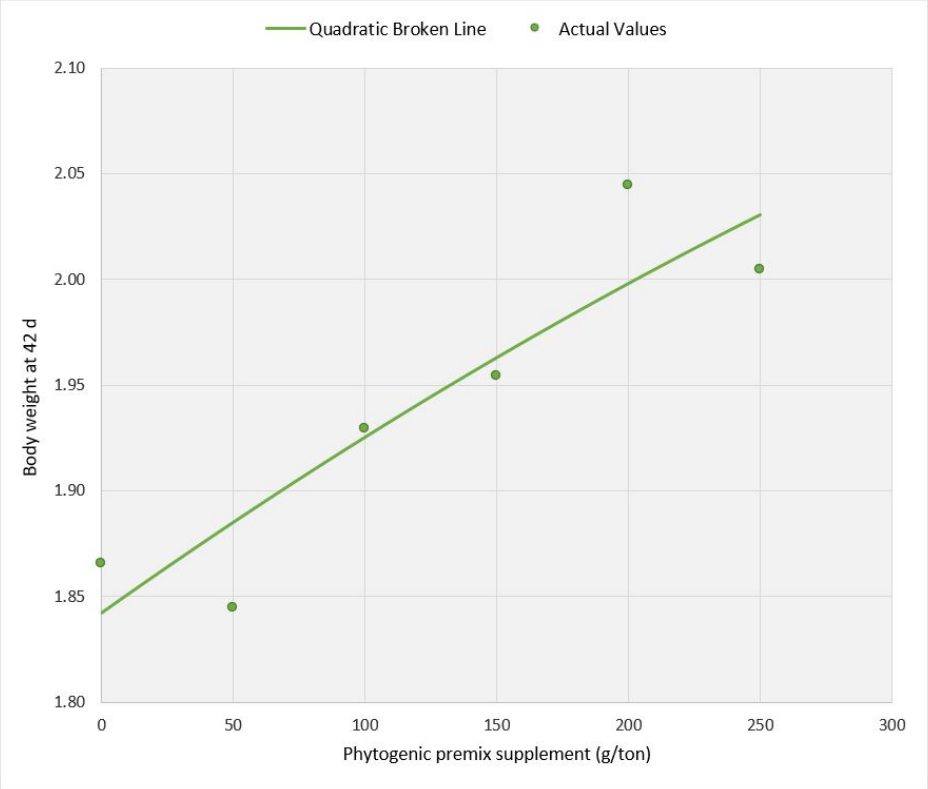
Study III: Evaluation of the dose-dependent effects of Activo for coccidiosis vaccinated broilers

Animals: 960 broiler chickens; age: 42 days
Feed: Standard starter and finisher feed
Treatments:
– No supplement (negative control)
– 50 g of Activo /US ton of feed
– 100 g of Activo /US ton of feed
– 150 g of Activo /US ton of feed
– 200 g of Activo /US ton of feed
– 250 g of Activo /US ton of feed
– Antibiotic growth promoter (AGP)(positive control)
Parameters: weight gain, feed efficiency
Specific: In order to represent field conditions, the birds were challenged with used, homogenized litter.

Results: A clear dose response for both body weight gain and feed efficiency was observed (see Figure 1):

the more phytogenic premix given, the better the birds' performance. The group with 200g of Activo /US ton of feed showed similar performance levels than the positive control group supplemented with AGP.

Figure 1: Dose-dependent effects of for coccidiosis vaccinated broilers



Study IV: Evaluation of the dose-dependent effects of Activo for laying hens

Animals: 40 hens; age: week 20 to 43
Feed: basal diet for laying hens
Treatments:
– No supplement (negative control)
– 100 mg of Activo/ kg of feed
– 250 mg of Activo/ kg of feed
– 500 mg of Activo/ kg of feed
– 5.000 mg of Activo/ kg of feed
Parameters: weight gain, feed intake, egg production, feed conversion ratio, health status
Duration: 168 days of feeding period

Results: The laying hens showed a higher laying rate when fed with a higher concentration of phytomolecules (Figure 2). Similarly improved results were observed for the feed efficiency. The more phytogenic premix added to their diet the better feed efficiency (Figure 3).

Figure 2: Dose-dependent effects of Activo on laying rate in laying hens

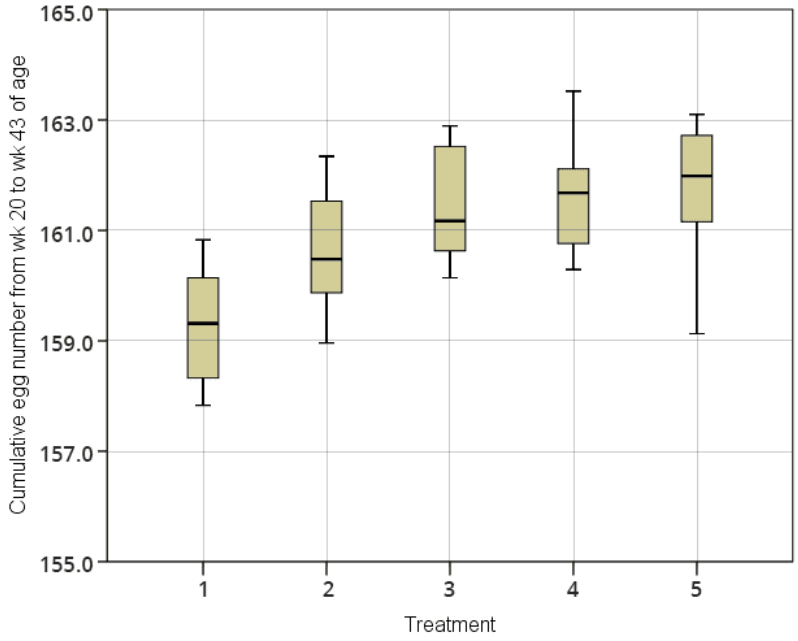
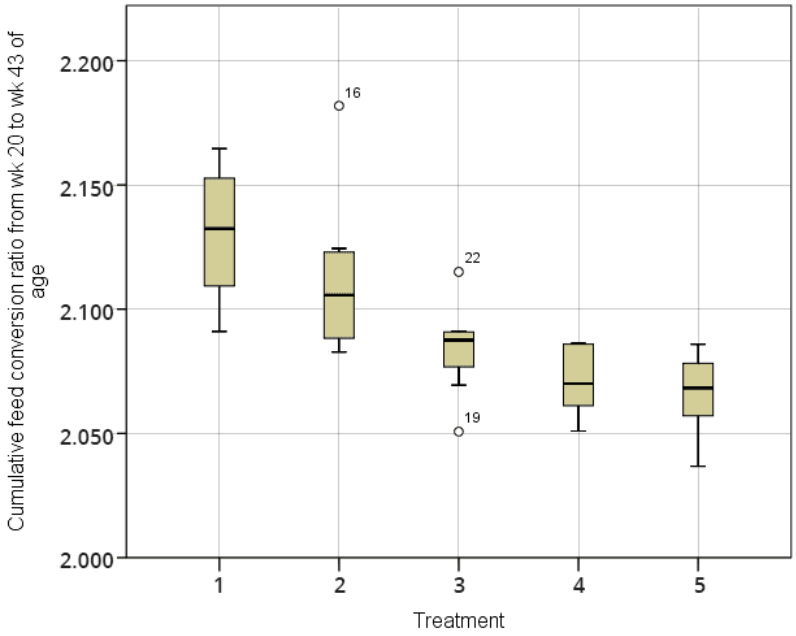


Figure 3: Dose-dependent effects of Activo on feed efficiency in laying hens



In conclusion, all four studies indicate that the inclusion of phytomolecules in broilers' and laying hens' diet improves their performance. Increasing levels of a phytogenic premix (Activo) significantly increased the production parameters for both groups. These improvements might bring performance in antibiotic-free poultry production on par with previous performance figures achieved with antimicrobial growth promoters.

The studies also showed that microencapsulated phytogenic premixes are safe when used in dose ranges recommended by the suppliers. No negative effects on animal health could be observed even at a 100 fold / 50 fold of the recommended inclusion rate in diets for broiler or laying hens, respectively. Thanks to their positive influence on intestinal health, phytomolecules thus boost poultry performance in a safe and effective way.

By Technical Team, EW Nutrition

Literature

Alanis, Alfonso J. "Resistance to Antibiotics: Are We in the Post-Antibiotic Era?" Archives of Medical Research 36, no. 6 (October 08, 2005): 697-705. doi:10.1016/j.arcmed.2005.06.009.

Borda-Molina, Daniel, Jana Seifert, and Amélia Camarinha-Silva. "Current Perspectives of the Chicken Gastrointestinal Tract and Its Microbiome." Computational and Structural Biotechnology Journal 16 (March 15, 2018): 131-39. doi:10.1016/j.csbj.2018.03.002.

Diaz-Sanchez, Sandra, Doris Dsouza, Debrabrata Biswas, and Irene Hanning. "Botanical Alternatives to Antibiotics for Use in Organic Poultry Production." Poultry Science 94, no. 6 (June 2015): 1419-430. doi:10.3382/ps/pev014.

Du, Encun, Weiwei Wang, Liping Gan, Zhui Li, Shuangshuang Guo, and Yuming Guo. "Effects of Thymol and Carvacrol Supplementation on Intestinal Integrity and Immune Responses of Broiler Chickens Challenged with Clostridium Perfringens." Journal of Animal Science and Biotechnology 7, no. 19 (March 22, 2016). doi:10.1186/s40104-016-0079-7.

Gao, Pengfei, Chen Ma, Zheng Sun, Lifeng Wang, Shi Huang, Xiaoquan Su, Jian Xu, and Heping Zhang. "Feed-additive Probiotics Accelerate Yet Antibiotics Delay Intestinal Microbiota Maturation in Broiler Chicken." Microbiome 5, no. 1 (August 03, 2017). doi:10.1186/s40168-017-0315-1.

Khan, Rosina, Barira Islam, Mohd Akram, Shazi Shakil, Anis Ahmad Ahmad, S. Manazir Ali, Mashiatullah Siddiqui, and Asad Khan. "Antimicrobial Activity of Five Herbal Extracts Against Multi Drug Resistant (MDR) Strains of Bacteria and Fungus of Clinical Origin." Molecules 14, no. 2 (February 04, 2009): 586-97. doi:10.3390/molecules14020586.

Manafi, Milad, Mahdi Hedayati, Saeed Khalaji, and Mohammad Kamely. "Assessment of a Natural, Non-antibiotic Blend on Performance, Blood Biochemistry, Intestinal Microflora, and Morphology of Broilers Challenged with Escherichia Coli." Revista Brasileira De Zootecnia 45, no. 12 (December 2016): 745-54. doi:10.1590/s1806-92902016001200003.

Photo source: Aviagen