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EFFECTS OF OMEPOL 30 ADDITIVE ON TRYPSIN-ANTITRYPSIN SYSTEM, ENDOTOXICOSIS AND EGG PRODUCTION OF QUAILS

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Abstract

This publication presents the results of investigations carried out on 150 Japanese quails (Coturnix japonica). Investigations aimed to highlight the anti-stress and adaptive properties of phytomicrobial additive OMEPOL 30 and bioproductive potential of the quails. All three groups of birds received similar housing, veterinary and feeding conditions, the differences consisted in OMEPOL 30 adiminstration in the doses of 2.5 and 5.0 g/kg, for the experimental groups. During 10 weeks, the quails were monitored, eggs from each group were collected, the blood samples were taken for investigations at the beginning of the study, on the 35th day and the 71st day of the experiment from 5 quails randomly from each group. The tested product was well tolerated by the quails. The biochemical investigations highlighted a decrease of trypsin in the blood, as well as balanced the activity of the trypsin-antitrypsin system. In the experimental groups were found decreases in endotoxicosis indicators, such as molecules with average molecular weight and necrotic substances. Egg production indicators had higher values in the experimental groups compared to control.

Key words: *egg production, endotoxicosis, feed additive, quail, trypsin.*

INTRODUCTION

Worldwide, as well as in the Republic of Moldova, quail is of particular interest for its meat and eggs, demanded by the consumer due to their benefic potential properties (Kiwitt, 2003; Ciftci et al., 2018; Pavlicenco, 2019; Patieva et al., 2023). In addition to being exploited for eggs and meat production, the Japanese quail (*Coturnix coturnix japonica*) is frequently used for experimental research (Martynova & Kornienko, 2019; Baltag, 2020; Hatab et al., 2024).

For laying birds, the laying period, normally 12 months for quails, profoundly impacts health, welfare, and metabolism due to factors such as intense nutritional demands, elevated stress from continuous egg production, and rapid calcium mobilization for eggshell formation. The evaluation of egg production of birds is carried out by daily monitoring (Pistol, 2025). The fast development of the quail breeding sector worldwide, including in the Republic of Moldova, is explained not only by the taste, dietary and curative properties of quail eggs and meat, but also by the biological peculiarities of these birds, such as high growth rate and high egg productivity. (Kiwitt, 2003; Patieva et al., 2023). Recently, a strong correlation between egg productivity of hens and trypsin activity has been established (Vertiprakhov et al., 2023a). In birds trypsin is secreted in the pancreas. In the intestine, it is involved in the hydrolysis of proteins into peptides and amino acids, which subsequently enter the bloodstream and is distributed throughout the body. The presence of trypsin in numerous organs and tissues, as well as the presence of specific PAR receptors indicate its participation in the regulation of various physiological functions. Data obtained on the circulation of trypsin in the bodies of chickens clearly showed that its action, similar to that of hormones, is not limited to pancreatic function but is also aimed at regulating metabolism throughout the body by optimizing the free amino acid levels in various biological media (Vertiprakhov et al., 2023b). The study of the influence of biologically active substances on indices that reflect the functional state of the pancreas and the intensity of catabolic processes in the body is important for assessing the adaptive and anti-stress properties of the tested products (Putin et al., 2020). Birds are sensitive to stress, especially to long-term technological stress (Pistol, 2025). The scientific literature contains numerous data on combating stress and

enhancing immunity through the use of natural remedies, particularly those of plant origin. (Sukhorukova & Kostesha, 2010; Ciftci et al., 2018; Pavlicenco, 2019; Yehmed et al., 2023; Ashour et al., 2025; Deeb et al., 2025). In the context, the development, testing, and implementation in production of new and efficient additives obtained through microbial biotechnologies represent an important and promising scientific direction (Grigore et al., 2025). There is evidence that such products exert a beneficial effect on the productive performance of animals (Grigore, et al., 2022; Ashraf, 2022; Perricone et al., 2022).
Thus, the aim of this study was to evaluate the effect of the Omepol 30 additive on the trypsin-antitrypsin system and the phenomenon of endotoxicosis, reflected in the egg production of quails raised under poultry farm conditions.

MATERIALS AND METHODS

Object of study

The research was carried out on 150 Texas quails (The Northern Bobwhite females), staying in full egg-laying process, in conditions of the poultry farm of SRL "Mihailorina-COM", Corlăteni village, Râșcani district, Republic of Moldova. The birds used in the experiment were similar in physiological status, age, body mass and origin. The quails at the beginning of the study were 32 weeks old, the study lasted another 71 days. The quails from all three groups involved in the experiment were housed under similar conditions (housing, with the same hygienic and technological indicators, including microclimate parameters, nutrition, watering and veterinary care, which ensured their hygiene and welfare).

Feed rations

The quails were divided into three groups: the control group (CG) and the experimental groups 0.25% EG and 0.5% EG, the feed ration of which was supplemented with 0.25 and 0.5% additive, respectively. The birds in all groups were fed with the standard compound feed used on the farm, in accordance with current requirements. The additive was administered to quails with food, separately for each experimental group, according to the experimental scheme showed in Table 1.

Table 1. Scheme of administration of the Omepol 30 additive to quails

Group	No. of birds	Route of administration	Dose, g kg^{-1} feed	Dosing regimen
CG	50	-	-	-
0.25% EG	50	per os	2.5	daily
0.5% EG	50		5.0	

Development of Omepol 30 additive

The phytomicrobial feed additive, coded Omepol 30 (Barley+Carrot+ Exopolysaccharides) is composed of: dry barley biomass from beer industry wastes - 75%, dry carrot biomass from food industry wastes - 25%, exopolysaccharides of pigmented yeast *R. mucilaginosa* CNMN-Ys-10 of 30 mg g^{-1}d.w.
Barley biomass is obtained from barley wastes remaining after beer production by mixing the biomass (waste) with distilled water in the 1:1 v/v ratio, autoclaving the mixture at temperature of 115°C, 0.5 atm. for 30 minutes, then separating the supernatant (barley water extract, used for microbial biotechnologies as nutrient medium) from the sediment (barley biomass) by centrifugation at 3000 rpm for 10 minutes. The sediment is subsequently dried at 50±1°C until a constant mass is achieved. Carrot biomass is obtained from carrot wastes (peels) from the food industry, remaining after carrot processing, by repeatedly washing the peels to remove impurities, shredding them to sizes of 0.5-1.0 cm, and mixing the carrot peels with distilled water in the 1:1 v/v ratio, autoclaving the mixture at temperature of 115°C, 0.5 atm. for 30 minutes, then separating the supernatant (carrot water extract) from the sediment (carrot biomass) by centrifugation at 3000 rpm for 10 minutes, then sterilizing the supernatant (carrot water extract) in an autoclave at temperature of 115°C, 0.5 atm. for 30 minutes. The sediment (carrot biomass) is subsequently dried at 50±1°C until a constant mass is achieved. The water carrot extract, with a pH of 5.6 and a residual sugar concentration of 5.0°Bx, was used as a nutrient medium, a sole source of nutrition, for the submerged cultivation of the yeast strain *R. mucilaginosa* CNMN-Ys-10 at the temperature of 27-28°C, under shaking conditions of 200 rpm for 120 hours in order to obtain exopolysaccharides in the culture liquid. The Omepol 30 additive is obtained by mixing dry barley biomass with dry carrot biomass in the 3 (750 g):1 (250 g) ratio and gradually soaking the resulting mixture (in several rounds)

with the 4 L of culture liquid containing 8.15±1.47 g d.w. L^{-1} exometabolites from the *R. mucilaginosa* CNMN-Ys-10, in order to obtain an exopolysaccharide concentration of 30 mg g^{-1}d.w. After each round the mixture is dried at temperature of 50±1°C to remove excess moisture. Following the final round, the product was dried at the same temperature until a constant mass was reached. The concentration of exopolysaccharides in the culture liquid was determined gravimetrically by sedimentation with 96° ethyl alcohol, culture liquid: ethyl alcohol ratio 1:4 (Ma W.J. et al., 2018), obtained from culture liquid remaining after cultivated the strain *R. mucilaginosa* CNMN-Ys-10 on carrot extract nutrient medium.

Monitored parameters

During the experiment, the birds were monitored and examined continuously, according to standard procedures, and their physiological state, behavior and possible adverse reactions associated with the administration of the additive were evaluated.

Blood collection from quails was performed via the jugular vein, preferably on the right side. After firmly restraining the bird, a few feathers were plucked from the venous area, and the site was disinfected with 70% alcohol. Pressure was applied at the base of the neck to visualize the vein, after which the needle was inserted at a slight angle. Blood was slowly aspirated (approximately 1.5-2.0 mL) and promptly transferred into standard test tubes. The obtained blood serum was stored at -20°C in a freezer. Blood samples for biochemical examinations were collected in three stages: at the beginning of the study (from 5 quails randomly), at the 35th day of the experiment (first sampling) and at the end of the study, on the 71st day from the beginning of the experiment (second sampling), from 5 quails from each experimental group.

The quails were subsequently sacrificed using cervical dislocation as the stunning method. This procedure was performed by trained farm staff.

Samples collected from birds were analyzed for the determination of essential biochemical parameters, such as: trypsin, α_1-antitrypsin, α_2-macroglobulin (α_2-MG), molecules with average molecular weight (AMW), necrotic substances (NS), histidine dipeptides (carnosine). The determinations were performed by spectrophotometric methods, using commercial ELITEH kits (France). The tests were performed in the Laboratory of Biochemistry, at Nicolae Testemitanu State University of Medicine and Pharmacy, according to protocols optimized for use with the Synergy H1 Hybrid Reader multimodemicroplate spectrophotometer, (BioTek Instruments, Winooski VT, USA).

Egg production was monitored from the start of laying until the end of the experiment, the laid eggs were counted and weighed for each group separately.

Statistical indices

Statistical processing of the results was performed using the MO Excel and Statistics 9.0 software suite. The results were expressed by calculating the mean, standard deviation and confidence interval for an average of three repetitions. All differences were considered statistically significant for P ≤0.05, P ≤0.01 and P ≤0.001.

RESULTS AND DISCUSSIONS

The laying quails tolerated the additive well, administered to both experimental groups simultaneously with the feed, no adverse reactions were detected. At slaughter, in order to collect samples of biological substrates (blood, liver and muscle tissue), no morphological changes in the carcasses or in the organs of the thoraco-abdominal cavity were observed. The results of the assessment of the quantity of the marker indices of the trypsin-antitrypsin system in the serum of quails are presented in the Table 2.

Table 2. Quantitative indices of the trypsin-antitrypsin system in the serum of quails from different groups

Indices	Debut	Group		
		CG	0.25% EG	0.5% EG
Trypsin, µmol L^{-1}	1.98±0.03	1 (samp.) 2.9±0.1*** 2 (samp.) 2.7±0.12	1 (samp.) 2.2±0.1** 2 (samp.) 2.3±0.04*	1 (samp.) 2.20±0.06*** 2 (samp.) 2.44±0.14
α_1-antitrypsin, µmol L^{-1}	29.3±0.8	1 (samp.) 28.92±2.42 2 (samp.) 33.43±0.35	1 (samp.) 29.93±2.60 2 (samp.) 32.92±2.20	1 (samp.) 34.93±2.34 2 (samp.) 32.75±2.14
α_2-MG, g L^{-1}	1.3±0.06	1.24±0.01 2 (samp.) 1.82±0.15**	1.12±0.06* 2 (samp.) 1.41±0.03*	1.31±0.04 2 (samp.) 1.24±0.08**

Note: * – p<0.05; ** p<0.01; *** p<0.001

The results indicate that at the first sampling, serum trypsin activity shows a significant increasing trend compared to the initial values in all groups included in the experiment, the increase being more pronounced ($p<0.001$) in the CG by 45.5%. In the 0.25% EG and 0.5% EG the increase in serum trypsin was markedly lower compared to the initial values, constituting only 9.6-11.1% ($p<0.05$). At the same time, under the influence of the tested additive, the content of this enzyme in the experimental groups was significantly lower by 23.6-24.7% ($p<0.01$ for 0.25% EG; $p<0.001$ for 0.5% EG) compared to the CG. These trends highlight the possible anti-stress properties of the additive under the experimental conditions. This hypothesis was confirmed at the end of the experiment (second sampling), when the trypsin content in the experimental groups was lower by 9.3-13.0% compared to the CG and constituted of 2.34±0.04-2.44±0.14 μmol L^{-1}, although these values were increasing by 7.8-10.9% compared to the values from the first sampling (Table 2).

In the complex process of regulating and controlling the activity of tissues and organs involving proteolytic enzymes, enzyme inhibitors play an important role. The interactions between proteolytic enzymes and their inhibitors represent a complex biological phenomenon that largely depends on internal and external factors constantly acting on the living organism (Solcan, 2011; Pistol, 2025). The obtained results established that the serum α1-antitrypsin value in birds from the CG at the first sampling, was 28.92±2.42 μmol L^{-1}, showing an insignificant decrease of 1.4% compared to the initial value. In contrast, in the experimental groups was observed an increasing trend, with values rising by 2.0-19.1% compared to the initial value, reaching 29.93±2.60 to 34.93±2.34 μmol L^{-1}. At the same time, these values of α_1-antitrypsin in the serum of quails from the experimental groups were 3.5-20.8% higher than those recorded in the CG, but these differences were not statistically significant (Table 2).

This phenomenon can be considered as a favorable one, indicating the establishment of an adequate reactivity in the experimental quails, which allows the normal development of physiological processes involving proteolytic enzymes. At the second sampling, the level of α_1-antitrypsin in the CG was 33.43±0.35 μmol L^{-1}, in insignificant increase by 15.6% compared to the value from the first sampling, a tendency also observed in the 0.25% EG, in which the increase constituted approximately 10% compared to the previous values. In contrast, in quails from 0.5% EG (maximum dose), a slight decrease of 6.2% of this parameter was recorded, compared to the value recorded at the first sampling (Table 2). Compared to the control group at the second sampling, the content of α_1-antitrypsin in the experimental groups was insignificantly reduced, by 1.5-2.0%, that indicates the adaptive and anti-stress properties of the additive during the period of intense metabolic stress. Similar results regarding the dynamics of serum α_1-antitrypsin were also reported following the administration of the ZooBioR product to laying quails (Macari et al., 2024).

At the beginning of the research, the content of α_2-macroglobulin (α_2-MG) in quails was 1.34±0.06 g L^{-1}. At the first sampling, a negative dynamic of this indicator compared to the initial values was recorded in all groups. In the CG the decrease was 7.5%, and in the experimental groups of 2.2-16.4% (for the 0.25% EG $p<0.05$). At the second sampling, the content of α_2-MG showed a tendency to increase in quails from the CG by 46.8% ($p<0.01$) compared to the values established at the first sampling. A similar increase was observed in the 0.25% EG, where the values increased by 25.9% ($p<0.01$) compared to the first sampling. Trends in the increase of α_2-MG in the blood of animals, as a result of the administration of biologically active substances, have also been reported in other studies (Putin et al., 2020; Pistol, 2025). It is important to note that in the 0.5% EG, which consumed the maximum dose of additive, a slight decrease in α_2-MG value by 5.3% was observed at the second sampling compared with the first sampling. A comparative analysis between groups at the end of the experiment revealed a reduction of α_2-MG in the experimental groups by 22.5-31.9% compared to the CG (for the 0.25% EG $p<0.05$, for the 0.5% EG $p<0.01$). Based on the obtained results, interpreted in the context of data from the scientific literature, it can be summarized that the tested additive, administered to quails exploited for meat and egg production, significantly influences the content of the enzymes of the trypsin-antitrypsin system and exhibits its modulating properties. However, more extensive investigations are required to establish a definitive conclusion.

In assessing the effects of feed additives on birds, it is also of interest to investigate the marker parameters of endotoxicosis, which may indicate the presence in the animal body of substances with a negative impact on general homeostasis (Mihalciuc, 2017; Rotaru, 2016). The results of the evaluation of these parameters in quails from different groups, as well as the changes induced by the administration of the additive, are presented in Table 3.

Table 3. Endotoxicosis indices in the serum of quails from different groups

Indices	Debut	Group		
		CG	0.25% EG	0.5% EG
AMW, c/u	20.50±1.36	1 (samp.) 23.34±1.16 2 (samp.) 22.32±0.90	1 (samp.) 20.46±0.99 2 (samp.) 19.31±0.75*	1 (samp.) 22.76±1.23 2 (samp.) 21.12±0.84
NS, c/u	4.15±0.37	1 (samp.) 4.31±0.43 2 (samp.) 4.14±0.09	1 (samp.) 4.61±0.37 2 (samp.) 3.51±0.38	1 (samp.) 4.46±0.35 2 (samp.) 3.99±0.18
Histidine dipeptides, μmol L^{-1}	89.95±3.60	1 (samp.) 85.96±3.73 2 (samp.) 89.08±2.36	1 (samp.) 91.76±2.76 2 (samp.) 89.55±1.63	1 (samp.) 90.20±1.74 2 (samp.) 89.28±2.00

Note: * – p<0.05.

The scientific literature mentions that, in industrial conditions of exploitation and animal breeding or in the case of the occurrence of pathological conditions, various disorders of metabolism and functional state of the liver, as well as of other organs and systems, may occur. These changes may lead to early tissue damage, accompanied by the formation of necrotic substances (NS), average molecular weight substances (AMW) and other compounds (Belko & Bogomoltseva, 2011; Kolberg et al., 2010). In the conducted study, it was established that the substances with average molecular weight (AMW) in the blood of quails at the beginning of the experiment constituted 20.50±1.36 c/u. At the first sampling, results in quails from the CG and 0.5% EG AMW showed a clear tendency to increase by 13.9% and 11.0%, respectively compared to the initial values. In the 0.25% EG statistically significant changes compared to the initial values were not established (Table 3). This fact highlights the potential beneficial properties of the additive tested under conditions of stress and increased metabolic demand. Comparative analysis of the serum level of AMW among groups confirmed this observation. At the first sampling the value of this parameter in the 0.25% EG was 12.3% lower than in the CG and 10.1% lower than in the 0.5% EG. Towards the end of the study, at the second sampling, the serum AMW level showed a general decreasing tendency in all groups, the CG exhibiting a 4.4% reduction compared with the first sampling. At the same stage, the AMW content in the experimental groups was lower compared with the CG, by 5.4 in the 0.5% EG and by 13.5% (p≥0.05) in the 0.25% EG (Table 3). It is considered that the reduced level of AMW in the blood reflects the favorable action of the tested product, suggesting a reduction in catabolic processes in the bird body, which may also positively influence the meat quality (Rotaru, 2016; Aslam et al., 2020). Some authors have reported lower AMW values in clinically healthy young calves compared with higher values observed in enteropathies, suggesting that this parameter can serve as an integral indicator in the evolution of endogenous intoxication, reflecting the intensity of catabolic processes occurring in the body. (Belko & Bogomoltseva, 2011). In the context of these findings, other authors report that the AMW index manifests neurotoxic activity, inhibits protein biosynthesis and the activity of several enzymes, deregulates oxidative processes, induces a state of secondary immunosuppression, and exerts toxic effects on erythropoiesis as well as on the main homeostatic systems (Nazarenko & Kishkun, 2006; Mohi-Ud-Din et al., 2019).

Another marker of endotoxicosis is the biochemical index represented by necrotic substances (NS), whose values at the beginning of the experiment were 4.15±0.37 c/u. At the first sampling NS showed an increasing trend in all groups by 3.9% in the CG, 7.5% in the 0.5% EG and 11.1% in the 0.25% EG compared to the initial values (Table 3). At the same time, at the first sampling, the NS levels in both experimental groups were 3.5-7.0% higher than in the CG, although the differences were not statistically significant. At the second sampling, serum NS levels decreased compared with the first sampling in quails from all groups, which can be explained by the adaptation of the birds to the new experimental conditions. Thus, in the

CG the decrease was 14.0%, and in the 0.25% EG and 0.5% EG of 23.9% and 10.5% respectively, compared to the values from the first sampling. The lower NS values in birds from the 0.25% EG and 0.5% EG by 15.2 and 3.6% respectively, compared to the CG, indicate the beneficial effect of the additive in reducing the endotoxicosis in quails during the experimental period. Similar trends in the manifestation of endotoxicosis marker parameters (AMW and NS) were also reported in broilers that were prophylactically administered the BioR product (Putin, 2014), as well as by other authors in different pathological states (Gudumac & Prisăcaru, 2012; Muhamed, 2005; Mihalciuc, 2017; Kuzminova et al., 2023).

A special role in the evaluation of metabolism and, in particular, of anabolic processes belongs to histidine dipeptides, especially carnosine, which is considered a marker of anabolic processes in the body (Lackner et al., 2021). The conducted research determined that at the beginning of the experiment, the concentration of histidine dipeptides in quails was 89.95±3.60 μmol L^{-1}. At the first sampling, this value in the CG decreased by 4.4% compared to the beginning values.

At the same stage, the tested additive not only prevented the decline of this biochemical indicator, but on the contrary, resulted in a slight increase, by 0.3-2.0% in the experimental groups compared to the initial values. Also, at the first sampling, the level of histidine dipeptides in the experimental groups was 4.9-6.7% higher compared to the values established in the CG (Table 3). Considering two essential aspects: the use of clinically healthy birds in the experiment and the relatively constant level of the investigated indicator in blood serum, it can be noted that the increase, even insignificant, of the histidine dipeptides in the blood represents a favorable and biologically relevant result. At the second sampling, no statistically significant differences among the groups in the content of histidine dipeptides were observed, the values varying at the level of 89.08±2.36 - 89.55± 1.63 μmol L^{-1} (Table 3). Similar results, characterized by higher values of histidine dipeptides in animals treated prophylactically with various biologically active products, have been reported in other studies (Kopec et al., 2013; Kopec et al., 2020).

The above results confirm that the Omepol 30 feed additive was well tolerated by the birds, which maintained a good and uniform health throughout the experiment. In addition, the tested product exerts a positive effect on metabolic processes, demonstrating the ability to stimulate anabolic function and reducing catabolic processes. This effect is expressed through a mechanism aimed at reducing endotoxicosis parameters in the bloodstream.

Currently, the breeding and exploitation of laying birds are oriented at obtaining high-quality products with maximum economic efficiency (Covaşă & Cofas, 2016; Bobyleva, 2017; Pistol et al., 2023; Pistol, 2025; Fisinin, 2025). The synthesis of data from the scientific literature and the results of our own research on biologically active substances in birds highlight that productive indices have particular significance in the objective confirmation of the clinical, hematological, and biochemical parameters obtained during the investigation of these substances (Pistol, 2025). These indicators are also of major importance in substantiating the dose and administration regimen of the tested products. The dynamics of egg production and other indicators associated with this physiological process in quails from the CG and those under the tested additive are presented in Table 4.

Table 4. Productive and feed conversion indices in laying quails from different groups

Indices	Group		
	CG	0.25% EG	0.5% EG
Number of birds at the debut, head	50	50	50
Egg production, first day, un.	37	36	37
Laying intensity/debut, %	74.0	72.0	74.0
Average weight of an egg (debut), g	13.5±0.4	13.5±0.2	13.5±0.3
Average weight of an egg (at 35th day of the study), g	12.9±0.46	13.7±0.20	13.5±0.34
Egg production /1-71st days of the study, un.	2247	2422	2308
Average weight of an egg (at 71st day of the study), g	12.4±0.29	12.9±0.19	12.7±0.17
Average weight of an egg during the study, g	12.9±0.21	13.4±0.18	13.2±0.15
Egg mass production /period, kg	28.99	32.45	30.43
Quantity of feed consumed by birds (total study), kg	142.50	138.65	141.25
Feed consumed per 100 produced eggs, kg	6.34	5.72	6.12
Feed consumed per 10 produced eggs, kg	0.63	0.57	0.61
Feed consumed per 1 kg egg mass, kg	4.96	4.27	4.64

According to these data, the number of eggs collected on the first day of the experiment was 36-37 units per group, and the laying intensity was 72.0-74.0%, similar values for all groups. Furthermore, the egg weight on the first day of the study was practically identical in all three groups of quails involved in the experiment (Table 4).

On the 35th day of the study, the egg average weight in the experimental groups was 0.54-0.76 g, or 4.2-5.9%, higher compared to the values recorded in the CG. The correlation between the tested product and egg production in the experimental groups was maintained throughout the study. Thus, during the experiment, a total of 2247 eggs were collected from birds in the CG, corresponding to an average of 44.9 eggs per quail. This indicator was higher in the experimental groups, reaching 48.4 eggs per quail in the 0.25% EG and 46.2 eggs per quail in the 0.5% EG. In percentage terms, the level of egg production was higher by 7.8% in the 0.25% EG and by 2.9% in the 0.5% EG compared to the CG. The increase in egg productivity in the experimental groups and the lower trypsin values observed in these groups, compared with the CG, are consistent with results showing a significantly lower level of trypsin in the serum of laying hens compared with that observed in broiler chickens (Vertiprakhov et al., 2023a).

At the same time, the total egg production in the 0.25% EG exceeded that in the 0.5% EG by 114 eggs or 4.94% (Table 4). The egg average weight during the study in the experimental groups was higher by 0.29-0.47 g, or 2.2-3.6%, compared to the CG. These differences in egg weight, correlated with the total number of eggs, resulted in an increase in total egg mass production to 32.45 kg in the 0.25% EG and 30.43 kg in the 0.5% EG, compared with 28.99 kg in the CG, representing increases of 11.9% and 5.0%, respectively (Table 4). In this context, from an economic perspective, it is important to evaluate the amount of feed used in the breeding and exploitation of birds in the different groups. Thus, it was established that the amount of feed consumed for the production of 100 eggs (feed conversion) was 6.34 kg of feed in the CG, while in the experimental groups this indicator was 4.4-10.6% lower. The amount of feed consumed for the production of 1 kg of egg mass in the CG was 4.96 kg, and in the experimental groups this amount was 6.5-13.9% lower (Table 4). Comparable findings regarding the enhancement of bird productive performance through the use of various biologically active products have been documented by multiple authors (Khazaei et al., 2021; Miao et al., 2021; Pistol, 2025). The obtained results are clearly favorable and indirectly indicate the beneficial effects of the tested product on the health, welfare, and metabolic processes of quails in the experimental groups, especially the birds in the 0.25% EG, supplemented with the additive in the minimum dose.

CONCLUSIONS

In conclusion, we can mention that the Omepol 30 feed additive was well tolerated by quails. The additive demonstrated regulatory effects on the trypsin-antitrypsin system, preventing the increases in serum trypsin activity and ensuring the stability of this parameter over the course of the study. The observed serum α_1-antitrypsin levels reflect appropriate physiological reactivity, facilitating the proper functioning of proteolytic enzyme-dependent processes in experimental quails. Consequently, Omepol 30 manifests adaptive and anti-stress properties. In addition, the additive positively influences metabolic processes by stimulating anabolic activity and reducing catabolic processes, via a specific mechanism, that reduces endotoxicosis parameters in the blood, reflected by lower values of AMW and NS markers, especially during periods of increased metabolic demand. Research demonstrates that supplementing feed with the additive at 0.25% and 0.5% improves the productive performance of laying quails compared with the CG, increasing both egg number and egg mass. The maximal effect was observed at the lower dose (0.25%), accompanied by improved feed conversion efficiency, reflected in reduced feed consumption per kg of egg mass. These results highlight the potential of the additive as a practical solution for optimizing poultry production, with positive economic implications, additional validations under industrial-scale farm conditions and detailed statistical analyses needed to confirm significant differences.

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