Технології утримання, годівля, селекція тварин та переробка продукції тваринництва

Technologies of housing, feeding, selection of animals and processing of livestock products

DOI 10.32900/3083-7987-2026-138-4-16
UDC 636.5.033:636.087

EFFECT OF PARTIAL REPLACEMENT OF SOYBEAN MEAL WITH *HERMETIA ILLUCENS* LARVAE FLOUR ON PRODUCTIVITY, PHYSIOLOGICAL STATE AND MEAT QUALITY OF BROILER CHICKENS

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Received: October 12, 2026
Revised: October 23, 2026
Published: October 30, 2026
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This study was conducted between May and July 2026 at the vivarium of the Research Institute of Food Technologies and Processing Technologies for Livestock Products at the Bila Tserkva National Agrarian University.

The study investigated the effect of partially replacing soybean meal with Hermetia illucens (black soldier fly) larva meal on the performance, hematological and biochemical blood parameters, slaughter traits, and physicochemical meat properties of broiler chickens. The experiment involved 80 one-day-old male chicks (Ross 308 cross), which were divided into four groups of 20 birds each using the analogue method: a control group and three experimental groups (E1, E2, and E3). The compound feed for the experimental groups contained 5%, 10%, and 15% Hermetia illucens meal, respectively. The rearing period lasted 42 days. Throughout the experiment, the following parameters were assessed: live body weight, average daily weight gain, feed intake and feed conversion ratio, flock survival rate, blood parameters, carcass morphological

composition, and the quality of pectoral muscles.

The highest live body weight at 42 days of age was observed in group E1 (2885.0 ± 14.0 g), which was 2.3% higher than the value recorded for the control group. In group E2, live body weight was 2864.0 ± 14.0 g, showing no statistically significant difference from the control group, whereas in group E3, it decreased to 2734.0 ± 14.0 g. Feed conversion in groups E1 and E2 was better (lower) than in the control group, measuring 1.60 ± 0.01 and 1.61 ± 0.01 kg/kg, respectively, compared to 1.64 ± 0.01 kg/kg in the control. With the inclusion of 15% insect meal, this indicator worsened to 1.69 ± 0.01 kg/kg. Feed intake and flock survival rates did not change significantly. Most hematological and biochemical parameters remained stable; however, total cholesterol concentration decreased in groups E2 and E3. Slaughter yield did not depend significantly on the diet composition. As the proportion of Hermetia illucens meal increased, the relative weight of abdominal fat decreased, while the weight of the gizzard increased (as did the weight of the liver in group E3). The key technological properties of the breast muscle did not undergo significant changes.

The inclusion of 5–10% Hermetia illucens meal in broiler chicken diets did not negatively affect performance, key physiological status indicators, or meat quality. The most favorable results were obtained at a 5% inclusion level, whereas increasing the proportion to 15% resulted in reduced growth rates and poorer feed conversion.

Keywords: *Hermetia illucens*, broiler chickens, insect meal, soybean meal, live weight, feed conversion, blood parameters, slaughter traits.

ВПЛИВ ЧАСТКОВОЇ ЗАМІНИ СОЄВОГО ШРОТУ БОРОШНОМ ІЗ ЛИЧИНОК *HERMETIA ILLUCENS* НА ПРОДУКТИВНІСТЬ, ФІЗІОЛОГІЧНИЙ СТАН ТА ЯКІСТЬ М'ЯСА КУРЧАТ-БРОЙЛЕРІВ

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Дата надходження до редакції: 13.10.2026 р.
Дата прийняття до друку після рецензування: 20.10.2026 р.
Дата публікації: 30.10.2026 р.
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Дану роботу було виконано в період з травня по липень 2026 року у віварії науково-дослідного інституту харчових технологій і технологій переробки продукції тваринництва Білоцерківського Національного Аграрного Університету.

В результаті даного дослідження було встановлено вплив часткової заміни соєвого шроту борошном із личинок Hermetia illucens на продуктивність, гематологічні та біохімічні показники крові, забійні якості й фізико-хімічні властивості м'яса курчат-бройлерів. Дослід проведено на 80 однодобових півниках кросу Ross 308, яких за принципом аналогів розподілили на чотири групи по 20 голів: контрольну та три дослідні – Д1, Д2 і Д3. До складу комбікормів дослідних груп

вводили відповідно 5, 10 і 15% борошна Hermetia illucens. Тривалість вирощування становила 42 доби. Упродовж досліду визначали живу масу, середньодобовий приріст, споживання і конверсію корму, збереженість поголів'я, показники крові, морфологічний склад тушок та якість грудних м'язів.

Найбільшу живу масу в 42-добовому віці встановлено у групі Д1 – 2885,0±14,0 г, що на 2,3% перевищувало контрольний показник. У групі Д2 жива маса становила 2864,0±14,0 г і статистично не відрізнялася від контролю, тоді як у Д3 вона знижувалася до 2734,0±14,0 г. Конверсія корму в групах Д1 і Д2 була нижчою, ніж у контролі, та становила відповідно 1,60±0,01 і 1,61±0,01 кг/кг проти 1,64±0,01 кг/кг. За включення 15% інсектного борошна цей показник погіршувався до 1,69±0,01 кг/кг. Споживання корму та збереженість поголів'я істотно не змінювалися. Більшість гематологічних і біохімічних показників залишалася стабільною, водночас у групах Д2 і Д3 знижувалася концентрація загального холестеролу. Забійний вихід істотно не залежав від складу раціону. Зі збільшенням частки борошна Hermetia illucens зменшувалася відносна маса абдомінального жиру та збільшувалася маса м'язового шлунка, а в групі Д3 – також печінки. Основні технологічні властивості грудного м'яза не зазнавали суттєвих змін.

Введення 5–10% борошна Hermetia illuens до раціонів курчат-бройлерів не погіршувало продуктивність, основні показники фізіологічного стану та якість м'яса. Найбільш сприятливі результати отримано за рівня включення 5%, тоді як підвищення його частки до 15% супроводжувалося зниженням інтенсивності росту та погіршенням конверсії корму.

Ключові слова: *Hermetia illucens*, курчата-бройлери, інсектне борошно, соєвий шрот, жива маса, конверсія корму, показники крові, забійні якості.

Introduction. Soybean meal serves as a primary protein component in broiler diets due to its high protein content and favorable amino acid profile. At the same time, the poultry industry's reliance on imported raw materials, market volatility, and the environmental impact of soybean production drive the search for local alternatives. Meal derived from *Hermetia illucens* larvae is rich in protein, lipids, minerals, and vitamins. However, its nutritional value varies depending on the rearing substrate, developmental stage, method of euthanasia, drying process, and the degree of defatting (Spranghers T. et al., 2017; Schiavone A. et al., 2017).

Regulation (EU) 2021/1372 permits the use of animal protein derived from farmed insects as a feed ingredient for poultry, provided that requirements regarding approved substrates, traceability, and safety are met (Commission Regulation (EU), 2021). For practical application, it is necessary to determine an inclusion level that maintains performance, metabolic stability, and the nutritional/consumer value of the meat.

The practical significance of using *Hermetia illucens* larval meal in broiler chicken diets lies in the potential for partial replacement of soybean meal, the expansion of the range of available feed ingredients, and a reduction in the dependence of compound feed production on traditional protein sources. Due to its high protein and lipid content, full-fat meal derived from *Hermetia illucens* larvae can serve simultaneously as both a protein and an energy source in a diet. However, its practical application requires careful consideration of the chemical composition of the specific batch, amino acid digestibility, chitin content, sanitary safety, and cost. Determining an optimal inclusion level for this ingredient is of practical importance, as an excessive proportion can reduce poultry growth rates, impair feed conversion, and increase the production cost per unit of weight gain.

ISSN 3083-7987 print

Digestibility studies have demonstrated that partially defatted and highly defatted *Hermetia illucens* meals differ in their metabolizable energy values and ileal amino acid digestibility; therefore, diet formulations should be based on digestible nutrients rather than total nutrient content alone (Schiavone A. et al., 2017). Dabbou et al. (2018) established a correlation between the level of defatted meal used and performance, blood parameters, and intestinal morphology, while Schiavone et al. (2019) showed that the impact on slaughter traits and breast muscle weight depends on the inclusion level and the specific characteristics of the product.

Moderate inclusion of an insect-based component often does not negatively affect weight gain or feed conversion (Onsongo V. O. et al., 2018; Hartinger K. et al., 2021; de Souza Vilela J. et al., 2021); however, complete or excessive replacement of soybean meal can reduce performance (Mlaga K. G. et al., 2022; Facey H. et al., 2023; Fruci M. et al., 2023). Likely reasons for this include an excess of chitin, an imbalance in digestible amino acids, and differences in fat content or thermal processing. At the same time, chitin, lauric acid, and other components may modulate the microbiota and immune responses (de Souza Vilela J. et al., 2021; Biasato I. et al., 2020). Findings regarding meat quality are also inconsistent: in some studies, key technological parameters remained stable, while fatty acid composition or color showed variations (Murawska D. et al., 2021; Popova T. et al., 2020).

Recent scientific literature confirms that the inclusion level of insect biomass is a critical factor. In balanced diets, various products derived from *Hermetia illucens* have yielded performance results comparable to or better than those of control diets (Attia Y. et al., 2023; Dörper A. et al., 2024). Conversely, high levels of substitution have been shown to impair growth and increase the relative weight of the gizzard (Facey H. et al., 2023; Fruci M. et al., 2023; Abdel-Wareth A. et al., 2026). Consequently, there is no universal optimal inclusion level; rather, it must be determined based on the specific batch of meal and the feeding system employed.

Despite a substantial body of research, recommended inclusion levels for *Hermetia illucens* larva meal vary significantly depending on production methods, the degree of defatting, nutritional composition, and the overall balance of the compound feed. Therefore, evaluating the efficacy of different inclusion levels of full-fat insect meal in broiler chicken diets remains a relevant scientific and practical objective.

The **purpose of this study** was to investigate the effects of partially replacing soybean meal with *Hermetia illucens* larva meal on the performance, hematological and biochemical blood parameters, slaughter traits, and physicochemical meat properties of broiler chickens. The scientific value of this work lies in a comprehensive assessment of the impact of full-fat *Hermetia illucens* larva meal on the performance, feed efficiency, hematological and biochemical blood parameters, slaughter traits, and physicochemical meat properties of broiler chickens. The study made it possible to determine the nature of the birds' physiological response to varying inclusion levels of this insect-derived component in their diet.

The practical value of the work lies in establishing the optimal level for the partial replacement of soybean meal with *Hermetia illucens* larva meal in compound feed for broiler chickens. The results obtained can be used in the development of compound feed formulations containing alternative protein sources, taking into account their impact on performance and physiological status.

Research materials and methods.

The study was conducted between May and July 2026 at the vivarium of the Research Institute of Food Technologies and Animal Product Processing Technologies at Bila Tserkva National Agrarian University.

For the experiment, 80 one-day-old Ross 308 chicks with an initial live weight of 42.3 ± 0.3 g were selected. Using the analogue method – taking initial live weight into account – the chicks were randomly assigned to four groups, with 20 birds in each group. The duration of the experiment was 42 days, divided into a starter period (days 1–14), a growth period (days 15–28), and a finisher period (days 29–42). Feed and water were provided ad libitum. Throughout the study, microclimate parameters, stocking density, and lighting schedules were identical for all groups. Vaccination and veterinary preventive measures were carried out in accordance with the technical recommendations for rearing Ross 308 broiler chickens (Aviagen. *Ross Broiler Nutrition Specifications*. 2022).

Hermetia illucens larvae were reared on a substrate consisting primarily of wheat bran. Before use, the bran was moistened with drinking water to a moisture content of 65 ± 5% and thoroughly mixed to ensure a homogeneous mass. The larvae were reared at a temperature of 28 ± 1 °C and a relative humidity of 65 ± 5%. Biomass was harvested at the late larval stage, prior to the onset of mass transition to the prepupal stage – approximately 16–18 days.

After being separated from residual substrate, the larvae were kept without feed for 24 hours to clear their digestive tracts, then rinsed with potable water. Thermal euthanasia was performed by blanching in water at a temperature of 90±2 °C for 5 minutes. Once excess water had drained, the larvae were spread in an even layer on metal trays and dried in a SNOL-3.5-I2 drying oven at 60–65 °C for 24 hours, until the moisture content was no more than 10%.

The dried biomass was cooled to room temperature and ground using an LZM-1M laboratory grinder to a particle size of no more than 1 mm. As the process did not involve the separation of the lipid fraction, the resulting product was classified as full-fat Hermetia illucens larval meal. Prior to its inclusion in the compound feed, the meal was stored in hermetically sealed, light-proof containers at a temperature of 4±2 °C.

Table 1

Experimental scheme

Group	n, number of heads	Hermetia illucens meal, % of feed
C	20	0
E1	20	5
E2	20	10
E3	20	15

Before formulating diets, each batch of insect meal and soybean meal must be analyzed for dry matter, crude protein, fat, fiber, ash, calcium, phosphorus, and amino acids. The study utilizes a batch of full-fat *Hermetia illucens* meal with the following values: moisture – 8.12%, crude protein – 49.87%, crude fat – 34.21%, crude ash – 1.08%, and calculated carbohydrates – 6.72%. To complete the full set of criteria, the content of fiber, chitin, key limiting amino acids, calcium, phosphorus, and metabolizable energy was also determined. Chitin is measured separately because its nitrogen content can lead to an overestimation of protein content when calculated using the Kjeldahl method (Spranghers T. et al., 2017; Schiavone A. et al., 2017; Murawska D. et al., 2021).

Table 2

Detailed chemical characterization of the H. illucens full-fat meal batch

Parameter	Value in natural substance
Moisture, %	8.12
Dry matter, %	91.88
Crude protein, %	44.65
Crude fat, %	29.40
Crude ash, %	5.38
Nitrogen-free extract, %	12.45
Crude fiber, %	7.20
Chitin, %	5.10
Lysine, %	2.55
Methionine, %	0.70
Methionine + cystine, %	1.16
Threonine, %	1.60
Calcium, %	0.62
Phosphorus, %	0.84
AMEn for poultry, MJ/kg	16.5

Compound feeds for broiler chickens were formulated separately for each age period: days 1–14, 15–28, and 29–42. Full-fat meal derived from *Hermetia illucens* larvae was incorporated into the diets of the experimental groups at levels of 5%, 10%, and 15% of the total feed mass. The control diet contained no insect meal.

Hermetia illucens meal was used to partially replace soybean meal. The quantities of soybean meal, grain components, vegetable oil, synthetic amino acids, and the mineral-vitamin premix were adjusted based on the actual chemical composition of the insect meal. This ensured that the levels of metabolizable energy, crude protein, digestible lysine, methionine, calcium, and available phosphorus remained as consistent as possible across the diets of all groups.

The feeds were prepared in 25 kg batches. Accordingly, the amount of *Hermetia illucens* meal per batch was 1.25 kg for group E1, 2.50 kg for E2, and 3.75 kg for E3. All ingredients were weighed individually according to the specific formulation for each diet.

To ensure the uniform distribution of the insect meal, a method of sequential geometric dilution was employed. First, the calculated amount of meal was mixed with an approximately equal mass of a ground grain component. Once a homogeneous mixture was achieved, additional portions of grain raw material were added sequentially, approximately doubling the volume each time. This preliminary mixture was then incorporated into the main bulk of the compound feed, along with a premix and synthetic amino acids.

The components were mixed using a horizontal screw mixer (model GSh-50, manufactured by 4BUILD LLC, Ukraine) with a capacity of 50 L, an electric motor power of 0.75 kW, and a supply voltage of 380 V.

The finished compound feeds were used in loose (mash) form, packed into separate labeled bags, and stored in a dry, ventilated area at a temperature of 15–20 °C and a relative humidity not exceeding 70%. A separately prepared and appropriately labeled batch of compound feed was used for each group.

As of the summer of 2026, the production cost of meal derived from *Hermetia illucens* larvae, reared on a wheat bran substrate, was approximately 52 UAH/kg, while its wholesale market price was 90 UAH/kg. The cost of soybean meal was 25.52 UAH/kg,

and the cost of the control compound feed was 28.00 UAH/kg. Compared to the control diet, the estimated cost of the compound feed increased by approximately 4.7% with the inclusion of 5% Hermetia illucens meal, by 9.5% with 10% inclusion, and by 14.2% with 15% inclusion.

Table 3

Target nutritional content of the diets for all groups

Parameter	1–14 days	15–28 days	29–42 days
Metabolizable energy, MJ/kg	12.55	12.97	13.20
Crude protein, %	22.5	20.5	19.0
Lysine, %	1.28	1.15	1.03
Methionine + cystine, %	0.95	0.87	0.80
Threonine, %	0.86	0.77	0.69
Calcium, %	0.95	0.85	0.78
Phosphorus, %	0.48	0.43	0.39

Live body weight and feed residues are recorded in each pen on days 1, 14, 28, and 42. Average daily weight gain, average daily feed intake, and the feed conversion ratio (adjusted for mortality) are calculated. Morbidity and mortality are recorded daily, noting the probable cause.

At 42 days of age, following an 8-hour period of feed deprivation, two birds with a live body weight representative of the pen average are selected. Hematological parameters are determined in whole blood samples, following standard methodological approaches for avian blood analysis as described by Campbell et al. (2022). Hemoglobin concentration is measured using a photometric method, while the red blood cell count is determined via the electrical impedance method using an automated veterinary hematology analyzer (URIT-2900 Vet, PRC) in accordance with the manufacturer's instructions.

Given the presence of nucleated red blood cells and thrombocytes in avian blood, the total white blood cell count is determined using the manual Natt–Herrick method. Following dilution of the blood with the Natt–Herrick solution, cells are counted using an improved Neubauer hemocytometer (Carisch L. et al., 2019). For the differential white blood cell count, blood smears are prepared, stained using the Romanowsky–Giemsa method, and examined under a light microscope equipped with an oil-immersion objective. At least 100 leukocytes were differentiated in each smear. The H/L ratio was calculated as the ratio of the number of heterophils to the number of lymphocytes and expressed in relative units (Gross W. & Siegel H., 1983).

Biochemical parameters of blood serum were determined using a ChemWell 2910 automated analyzer (Awareness Technology, Inc., USA) and commercial diagnostic kits. Total protein was measured using the biuret method; albumin, using the bromocresol green method; glucose, via the GOD-PAP method; total cholesterol, via the CHOD-PAP method; and AST and ALT activity, using a kinetic method in accordance with IFCC recommendations at 37 °C (Schumann G. et al., 2010; Thrall M. et al., 2012).

Following blood collection, the birds were slaughtered in accordance with approved animal welfare procedures. Carcass yield, as well as the proportions of pectoral muscles, thigh and drumstick, abdominal fat, liver, and gizzard, were determined. In the pectoralis major muscle, 24 hours post-slaughter, measurements were taken for pH, color

coordinates, drip loss during storage, cooking loss, and shear force. Moisture, protein, fat, and ash content were determined using standard AOAC (2019) methods.

The research results were subjected to statistical analysis using methods of variation statistics. The arithmetic mean values of the indicators, the standard error, and the statistical significance of the differences between the studied variables were determined. The reliability of the obtained results and the significance of the differences between the indicators were assessed using Student's t-test. In the tables, levels of statistical significance are indicated by specific symbols: P≥0.95, P≥0.99, and P≥0.999, which correspond to one, two, and three asterisks (*; **; ***), respectively, in the text.

Research Results. The performance of broiler chickens was evaluated based on live weight dynamics, average daily weight gain, feed intake, feed conversion, and flock survival rate. These indicators allow for a comprehensive assessment of the efficiency of dietary nutrient utilization and the impact of varying inclusion levels of *Hermetia illucens* meal on the growth rate of the birds. The results of the broiler chicken performance evaluation are presented in Table 4.

Table 4

Performance of broiler chickens with partial replacement of soybean meal by *H. illucens* meal

Parameter	C	E1	E2	E3
Initial live weight, day 1, g	42.2±0.1	42.4±0.1	42.3±0.2	42.3±0.1
Live weight, day 14, g	493.0±5.2	501.0±5.2	499.0±4.9	486.0±5.0*
Live weight, day 28, g	1540.0±11.2	1574.0±11.2*	1562.0±11.4	1501.0±11.0*
Live weight, day 42, g	2820.0±14.0	2885.0±14.1**	2864.0±14.2	2734.0±14.2
Average daily gain (days 1–42), g	66.1±0.3	67.7±0.2***	67.2±0.3***	64.1±0.3***
Feed intake (days 1–42), g/head/day	108.5±0.6	108.3±0.7	108.2±0.5	108.3±0.5
Feed conversion	1.64±0.01	1.60±0.01**	1.61±0.01*	1.69±0.01***
Livability, birds/20 (%)	19/20 (95)	20/20 (100)	20/20 (100)	19/20 (95)

Notes: P ≥ 0.95; P ≥ 0.99; P ≥ 0.999 compared to the control group.

According to the study results, the highest final live weight was observed in chickens whose diet included 5% *Hermetia illucens* meal. In the groups with inclusion levels of 5% and 10%, the feed conversion ratio was statistically lower compared to the control group.

The physiological status of broiler chickens was assessed based on a set of hematological and biochemical blood parameters, which characterize metabolic processes and the organism's response to changes in dietary composition. Determining these parameters makes it possible to identify potential metabolic changes associated with different inclusion levels of *Hermetia illucens* meal. The results of the blood analysis of the birds at 42 days of age are presented in Table 5.

Table 5

Hematological and biochemical blood parameters of broiler chickens at 42 days of age

Parameter	C	E1	E2	E3
Hemoglobin, g/L	96±2.0	97±2.1	98±2.0	95±2.2
Erythrocytes, 10^{12}/L	2.62±0.06	2.67±0.06	2.70±0.07	2.60±0.06
Leukocytes, 10^{9}/L	24.6±0.9	23.9±0.8	23.4±0.8	24.8±0.8
Heterophils/lymphocytes, ratio	0.41±0.02	0.39±0.02	0.38±0.02	0.42±0.02
Total protein, g/L	35.2±0.7	36.5±0.6	37.1±0.7*	35.8±0.7
Albumin, g/L	15.6±0.4	16.1±0.2	16.4±0.4	15.8±0.3
Glucose, mmol/L	11.5±0.2	11.7±0.1	11.6±0.1	11.4±0.2
Total cholesterol, mmol/L	3.72±0.03	3.50±0.07**	3.31±0.06***	3.25±0.06***
AST, U/L	204.0±5.0	199.0±4.9	201.0±5.2	212.0±5.0
ALT, U/L	6.9±0.2	6.6±0.3	6.5±0.3	7.1±0.2

Notes: P≥0.95; P≥0.99; P≥0.999 compared to the control group.

Hemoglobin content, red and white blood cell counts, albumin and glucose concentrations, as well as AST and ALT activity, did not differ statistically between the groups. This indicates that the tested inclusion levels of *Hermetia illucens* meal had no pronounced effect on erythropoiesis or protein and carbohydrate metabolism. At the same time, the stability of aminotransferase activity does not provide sufficient grounds to completely rule out structural and functional changes in the liver, as these enzymes exhibit limited tissue specificity in poultry. The decrease in total cholesterol concentration in groups E2 and E3 may be attributed to the influence of the lipid fraction and chitin present in the insect meal on lipid metabolism. To confirm this hypothesis, further analysis, specifically the determination of triacylglycerols, lipoproteins, and bile acids, along with a histological examination of the liver, is required.

Slaughter traits characterize the efficiency of carcass formation and the distribution of its primary anatomical components. To evaluate the impact of *Hermetia illucens* meal, the study assessed slaughter yield, the proportions of major muscle tissues, abdominal fat, the liver, and the gizzard. The results of the slaughter of broiler chickens at 42 days of age are presented in Table 6.

The slaughter yield and the relative proportion of the thigh and drumstick did not differ statistically between the groups. The proportion of breast muscle in groups E3 and E2 was higher than in group E3, yet it did not differ significantly from the control group. The relative mass of abdominal fat decreased as the inclusion level of *Hermetia illucens* meal increased, with statistically significant differences compared to the control observed in groups E2 and E3. This change may be related to specific aspects of energy and lipid metabolism; however, confirming this hypothesis would require an analysis of the fatty acid composition of the tissues and indicators of lipid metabolism. In group E3, an increase in the relative mass of the liver was also observed compared to the control and groups E1 and E2, which warrants further assessment of its histological structure and functional status.

Table 6

Slaughter traits of broiler chickens at 42 days of age

Parameter	C	E1	E2	E3
Slaughter yield, % of pre-slaughter weight	73.2±0.3	73.8±0.3	73.7±0.2	72.9±0.2
Breast muscles, % of carcass	30.6±0.3	31.2±0.2	31.0±0.2	29.9±0.3
Thigh + drumstick, % of carcass	28.8±0.1	28.9±0.2	29.0±0.2	28.7±0.2
Abdominal fat, % of pre-slaughter weight	1.72±0.04	1.62±0.04	1.49±0.03***	1.44±0.03***
Liver, % of pre-slaughter weight	2.10±0.04	2.13±0.04	2.18±0.03	2.31±0.04***
Gizzard, % of pre-slaughter weight	1.41±0.02	1.48±0.03*	1.56±0.03***	1.66±0.03***

Notes: $P \geq 0.95$; $P \geq 0.999$ compared to the control group.

Discussion. Research findings regarding the use of *Hermetia illucens* larva meal in broiler diets remain inconsistent. At moderate inclusion levels, the insect-based component can support poultry performance, whereas increasing its proportion is sometimes associated with impaired growth and feed conversion (Hartinger K. et al., 2021; Facey H. et al., 2023; Fruci M. et al., 2023). Such variations may be attributed to the product's composition, chitin content, degree of defatting, and nutrient availability. Increasing the inclusion level of insect meal to 15% resulted in lower final live weight and poorer feed conversion, while average daily feed intake remained largely unchanged. This suggests that the decline in performance at the highest inclusion level was likely driven primarily by reduced nutrient utilization efficiency rather than a decrease in feed intake. Potential factors contributing to this response include higher dietary chitin content, lower protein availability, and inadequate balancing of the diet for standardized ileal digestible amino acids (Schiavone A., et al., 2017; Hartinger K. et al., 2021; Mahmoud A. E. et al., 2023).

The findings indicating that performance is maintained or improved when Hermetia illucens meal is included at levels of 5–10% align with research by others who utilized diets balanced for metabolizable energy and digestible amino acids (de Souza Vilela J., et al., 2021; Dörper A. et al., 2024; Saidani M. et al., 2025). Conversely, the decline in performance observed at a 15% inclusion level is consistent with the results reported by Facey et al. (2023), Fruci et al. (2023), and Abdel-Wareth et al. (2026), who observed impaired growth or feed conversion as the proportion of soybean meal replaced by insect meal increased. Thus, the efficacy of using *Hermetia illucens* meal in broiler feeding is determined not only by its inclusion level but also by the degree of defatting, chitin content, amino acid profile, nutrient digestibility, and the overall balance of the diet.

Our findings align with existing literature, which indicates that the biochemical response of broiler chickens depends on the inclusion level and chemical composition of *Hermetia illucens* processed products (Dabbou S. et al., 2018; Fruci M. et al., 2023; Abdel-Wareth et al., 2026).

The increase in the relative weight of the gizzard as the proportion of insect meal rose may represent an adaptive response to higher levels of chitin and other structural components in the diet; this is consistent with research findings involving high rates of soybean meal replacement (Abdel-Wareth et al., 2026).

Conclusions.

The inclusion of *Hermetia illucens* larva meal in broiler chicken diets at levels of 5% and 10% did not negatively affect feed intake or flock survival. At the 5% inclusion level, the final live weight of the birds exceeded that of the control group by 2.3%, while the feed conversion ratio was 2.4% lower. The inclusion of 10% meal also improved feed conversion; however, the increase in final live weight compared to the control group did not reach statistical significance.

Increasing the level of insect meal to 15% resulted in a reduction in live body weight and a deterioration in feed conversion, while average daily feed intake remained unchanged. This may indicate reduced nutrient utilization efficiency and a need for more precise dietary balancing based on standardized ileal digestible amino acids, while accounting for chitin content.

The tested inclusion levels of *Hermetia illucens* meal did not affect hemoglobin levels, red and white blood cell counts, concentrations of total protein, albumin, and glucose, or the activity of AST and ALT enzymes. A decrease in total cholesterol concentration at inclusion levels of 10% and 15% suggests a potential impact of the insect-based product on lipid metabolism, which warrants further in-depth investigation.

Carcass yield, the proportion of the thigh and drumstick, and most physicochemical characteristics of the breast muscle did not change significantly. However, the inclusion of 10% and 15% meal reduced the proportion of abdominal fat, while the 15% level was associated with an increase in the relative weight of the liver and the gizzard. Among the experimental treatments, the inclusion of 5% *Hermetia illucens* meal proved to be the most effective. A level of 10% can be considered acceptable, provided the diet is properly balanced, whereas the use of 15% requires additional justification and adjustment of the feed's nutritional composition.

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