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Research Article

Effects of dietary beeswax supplementation on growth performance, carcass traits and biochemical parameters of Cobb 500 broiler chickens

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Abstract

Background and objectives: The Cameroonian poultry industry is experiencing significant growth, but it continues to face challenges such as rising feed costs and the excessive use of growth promoters. The present study aimed to evaluate the additive effect of beeswax on production performance, carcass characteristics, and some biochemical parameters in broiler chickens.
Materials and methods: A total of 192 Cobb 500 chicks aged 7 days and weighing an average of 76.57±1.24 g were used and divided into 4 groups: a control group (L0) receiving a basic diet and three experimental groups randomly receiving a basic diet supplemented with 0.25% (L1), 0.50% (L2), and 0.75% (L3) beeswax powder.
Results: The results of this study revealed that incorporating beeswax into the broiler chicken diet significantly improved ($p<0.05$) certain growth parameters (average daily gain and feed conversion ratio). Specifically, 0.25% supplementation (L1) led to a significant improvement in the average daily gain (3%), the average feed conversion ratio (16.17%), and mortality rate (50%). A significant decrease ($p < 0.05$) in feed intake (FI) was observed during the finishing phase (weeks 4–5) for groups L2 and L3. An inclusion rate of 0.25% of beeswax offers the best balance, improving growth performance while reducing feed costs.
Conclusion: Beeswax shows potential as a beneficial feed additive, offering a natural alternative for use in poultry feed.

Keywords: Bee products, feed supplement, growth performance, poultry.

Résumé

Contexte et objectifs : La filière avicole camerounaise connaît une expansion notable, mais elle reste confrontée à des défis tels que la hausse du coût de l’alimentation et l’usage excessif de promoteurs de croissance. La présente étude avait pour but d’évaluer l’effet de la cire d’abeille comme additif alimentaire sur les performances de production, les caractéristiques de la carcasse et quelques paramètres biochimiques chez les poulets de chair.
Matériel et méthodes : Au total, 192 poussins Cobb 500 âgés de 7 jours, pesant en moyenne 76,57 ± 1,24 g, ont été utilisés et répartis en 4 groupes : un groupe témoin (L0) recevant une ration de base, et trois groupes

expérimentaux recevant aléatoirement une ration de base supplémentée avec 0,25% (L1), 0,50% (L2) et 0,75% (L3) de poudre de cire d'abeille.
Résultats : Les résultats de cette étude ont révélé que l'incorporation de cire d'abeille dans l'aliment des poulets de chair améliorait de manière significative (p < 0,05) certains paramètres de croissance (gain moyen quotidien et l'indice de consommation). La supplémentation à 0,25% (L1) de la poudre de cire d'abeille a entraîné une amélioration significative du gain moyen quotidien (GMQ) de poids et de l'indice de consommation moyenne. Par ailleurs, le taux de mortalité était significativement plus faible (p < 0,05) dans les groupes supplémentés par rapport au témoin. Une diminution significative (p < 0,05) de la consommation alimentaire a été observée pendant la phase de croissance (semaines 4–5) pour les groupes L2 et L3.
Conclusion : Un taux d'incorporation de 0,25% de cire d'abeille offre le meilleur compromis, améliorant les performances de croissance tout en réduisant les coûts alimentaires. La cire d'abeille pourrait donc être considérée comme un additif alimentaire potentiellement bénéfique, ouvrant la voie à son utilisation comme alternative naturelle dans l'alimentation avicole.

Mots-clés : produits de la ruche, complément alimentaire, performances de croissance, volaille.

1. Introduction

For centuries, bee-derived products such as honey, propolis, and beeswax have been used as natural therapeutics in folk medicine because of their properties and their high content of bioactive compounds (Martinello and Mutinelli, 2021). Today, interest in apitherapy is renewed because of its ability to prevent and heal wounds, rheumatism, and gastrointestinal disorders (Kocot et al., 2018; Tashkandi et al., 2021).

Beeswax is a natural substance produced by the wax glands of worker bees and is used in the hive to construct the honeycomb for storing honey, pollen, and brood. It has been recognized for its physiological and biochemical properties, including antimicrobial, antioxidant, anti-inflammatory, and healing properties (Bogdanov, 2017). In recent years, with the large-scale development of beekeeping, hive products have been widely utilized in livestock and poultry production. Numerous studies have shown that the use of bee byproducts as feed additives can increase the growth and productive performance of animals. Gaafar et al. (2023) demonstrated that supplementing the diet of Assaf lambs with 4 g of beeswax per day for 90 days significantly improved their average daily weight gain, nutrient digestibility, rumen fermentation, and blood parameters (total proteins, globulins, glucose; cholesterol, transaminases, and urea) while reducing the cost of feed production. Similarly, Song et al. (2022) reported that supplementing yellow bantam chickens with 0.1%, 0.15%, or 0.2% honeycomb extract (including wax and propolis) for 60 days increased average daily weight gain (ADG), a reduction in the feed conversion ratio (FCR), improved carcass yields, and stimulation of immune and antioxidant functions. Furthermore, in Shanma laying ducks, Chen et al. (2023) reported that supplementation with 1.5 g/kg of feed with honeycomb extract led to an increase in total protein and amino acid content in eggs, a decrease in cholesterol, and an improvement in blood antioxidant and immune status, as well as positive effects on the lipid composition of the eggs.

Despite the extensive applications of bee by-products, few studies have investigated the effects of using pure wax in animal feed, particularly in poultry. This study aimed to determine the effects of beeswax supplementation on growth performance, carcass characteristics, biochemical parameters, and economic efficiency in broiler chickens.

2. Material and methods

2.1. Study area

The present study was conducted on a private farm located in the suburban area of the city of Ngaoundere (Latitude 7.4317486; Longitude 13.5625778) in the Adamaoua region of Cameroon between March and August 2025. Ngaoundere is a transitional zone between the lowlands of the north and the southern plateaus of Cameroon. This position grants it a Sudano–Guinean climate with an eight-month rainy season from April to November and a four-month dry season from December to March. The vegetation consists of Sudano-Guinean shrub savannas. The annual precipitation ranges from 900 to 1500 mm, and the average temperature varies between 23 and 25 °C.

2.2. Animal material and housing

A total of 192 seven-day-old Cobb 500 chicks with an average weight of 77.06 ± 1.54 g were used in this study over 35 days. The birds were distributed in a completely randomized design that consisted of 4 experimental treatments of 48 chickens each, which were repeated 3 times with 16 chicks each. The chicks were reared under uniform conditions on white wood shavings at a density of 10 chicks/m².

2.3. Processes for obtaining beeswax powder

Beeswax was obtained in February 2025 from a beekeeper in the city of Ngaoundere, Cameroon. The beeswax was then frozen (-10 °C) for a period of 72 hours and then finely grated using a manual grater. The resulting powder was then incorporated into the experimental diets.

2.4. Experimental diets

The experimental diets were formulated according to the needs of the animals and on the basis of their age. A sample (100 g) of the feed was then sent to the laboratory at the Production and Nutrition Research Unit of the Faculty of Agronomy and Agricultural Sciences at the University of Dschang for analysis. These analyses were performed using the method proposed by AOAC (2000). The centesimal composition of the ingredients and the chemical composition of the experimental diet are presented in Table 1.

Table 1: Centesimal and chemical composition of the experimental diets

Ingredient	L0	L1	L2	L3
Corn	55	55	55	55
Fish Meal	7	7	7	7
Soybean Meal	15	15	15	15
Peanut Meal	12	12	12	12
Concentrate (5%) Meat	5	5	5	5
Bone Meal	4	4	4	4
Beeswax	0	0.25	0.5	0.75
Total	**100**	**100.25**	**100.5**	**100.75**
Nutritional values				
Dry Matter (%)	96.59			
Moisture (%)	3.41			
Crude Fibre (% DM)	5.85			
Crude Ash (% DM)	9.78			
Protein (% DM)	23.45			
Organic Matter (% DM)	90.22			
Fat (% DM)	8.15			
Metabolizable Energy (kcal/kg DM)	3476.8			

L0, L1, L2, and L3 = treatment with successively incorporated levels of beeswax at 0%, 0.25%, 0.50%, and 0.75% in the feed, respectively; DM: Dry matter.

2.5. Experimental design

For this study, 192 one-day-old chicks with an average weight of 33.02 ± 0.54 g were heated in a single batch until they were 7 days old in a brooding house made of tarps and were given a starter diet according to the recommendations of a conventional broiler production system. One hundred and ninety-two (192) subjects, aged 7 days and with an average weight of 77.06 ± 1.54 g, were divided into 4 groups of 48 birds corresponding to the 4 treatments in a completely randomized design. Each group was further divided into 3 groups of 16 birds each (8 males and 8 females), each corresponding to group repetitions. The feed was distributed twice a day at regular intervals: in the morning between 6:30 AM and 7:30 AM and in the evening between 5:30 PM and 6:30 PM, and water was provided *ad libitum*.

2.6. Growth characteristics

Feed intake: Feed was weighed at the beginning of the week and distributed daily. The remains of each experimental unit were also weighed every 7 days, using a 1 g precision electronic scale with 5000 g capacity, and subtracted from the amount of feed distributed to obtain the feed intake.
Body weight: At the beginning of the trial and every 7 days thereafter, all the birds were weighed between 8 and 10 a.m. using an electronic balance with a 500 g capacity and 0.01 g accuracy. Weekly weight gain was obtained by calculating the difference between two consecutive body weights. The feed intake and weight gain data were used to calculate the feed conversion ratio by dividing the feed intake by the weight gain during the same period.

Feed intake (g) = quantity of feed distributed (g) – leftovers (g)

$$\text{Daily weight gain } (g/day) = \frac{\text{weekly weight gain (g)}}{7}$$

$$\text{Feed conversion ratio} = \frac{\text{feed intake (g)}}{\text{Body weight gain (g)}}$$

2.7. Carcass characteristics

At 42 days, 12 chickens per treatment were randomly selected, fasted for 24 hours, weighed, slaughtered, plucked, and eviscerated to evaluate and record the carcass yield, following the method proposed by Kana et al. (2017). Based on the collected data, the following parameters were calculated:
Carcass weight = Body weight - (head + legs + blood + feathers + viscera) weight.

$$\text{Carcass yield (\%} = \frac{\text{Carcass weight (g)}}{\text{Body weight (g)}} X\ 100$$

$$\text{R} = \frac{\text{Weight of parts or organs (g)}}{\text{Body weight (g)}} X\ 100$$

With R= Relative weight of parts or organs (%)

2.8. Biochemical parameters

At the end of the trial (42 days), blood samples from the slaughtered birds were collected in nonheparinized tubes, and serum was collected to determine the levels of ASAT, ALAT, creatinine, glucose, urea, total protein, total cholesterol, and triglycerides. The ASAT and ALAT levels were evaluated using the nicotinamide adenine dinucleotide hydrogenase (NADH) oxidation reaction method. Serum levels of creatinine and urea were evaluated by the colorimetric method described by Bergmeyer and Wanlefeld (1980), and the results are expressed in mg/dL. The total serum protein content was determined by the Biuret method, and serum cholesterol was measured by the enzymatic colorimetric method (Doumas et al., 1979; Allain et al., 1974).

2.9. Ethics approval

This study was conducted in accordance with relevant guidelines and regulations and approved by the scientific research and ethics committee of the School of Veterinary Medicine and Sciences of the University of Ngaoundere, Cameroon (Ref. No. 2024/02/UN/D-ESMV/DAACRS of 27 March 2024).

2.10. Statistical analysis

Data on growth performance, carcass characteristics, and biochemical parameters were analysed using one-way (level of beeswax) analysis of variance (ANOVA). When there was a significant difference between treatments, Duncan's multiple range test at a 5% threshold was used to separate means. SPSS 20.0 (Statistical Package of Social Sciences) software was used for the analyses.

3. Results

3.1. Effects of beeswax incorporation rate on feed intake

As shown in Table 2, which presents data on feed intake (FI) as a function of the beeswax incorporation rate in the diet, the incorporation of different levels of beeswax into the diet did not significantly ($p > 0.05$) affect feed intake between the 1st to 4th weeks of the study. However, at the 5th week, a significant decrease in feed intake was observed among the subjects receiving diets containing 0.5% (L2) and 0.75% (L3) beeswax. Similar observations were made regarding the average feed intake.

3.2. Effects of beeswax incorporation rate on the average daily weight gain

The average daily weight gain of the subjects was significantly ($p > 0.05$) influenced by the level of beeswax incorporation in the diets during the 1st and 5th weeks of the study (Table 3). The same observation was true regarding the average for the entire study period. However, the greatest average daily weight gain was recorded in subjects receiving the diet containing 0.25% beeswax.

3.3. Effects of incorporation rate of beeswax on feed conversion ratio

The feed conversion ratio of the subjects based on the beeswax incorporation rate is presented in Table 4. It appears that the FCR was not significantly ($p > 0.05$) influenced by the different treatments from the 2nd to the 5th week of the study. Conversely, in the 1st week, a significant decrease ($p < 0.05$) in the FCR was recorded in subjects receiving diets containing 0.25% and 0.75% beeswax.

3.4. Effects of the beeswax incorporation rate on the carcass characteristics of broiler chickens

The live weight, carcass weight, and carcass yield were not significantly ($p > 0.05$) influenced by the amount of beeswax incorporated into the diet of the broiler chickens (Table 5).

3.5. Effects of beeswax incorporation rate on the relative proportion of broiler chickens

The relative proportion of organs was not significantly ($p > 0.05$) affected by the different experimental diets except for the proportions of head and legs (Table 6).

3.6. Effects of the incorporation rate of beeswax on the feed production cost

Figure 1 shows the feed cost per unit of live weight as a function of the levels of beeswax incorporated into the diet. The results indicate that the feed cost per unit of live weight was not significantly ($p > 0.05$) influenced by the levels of beeswax incorporated into the diet. Nevertheless, the lowest feed cost of production was recorded in the subjects receiving the diet containing 0.25% beeswax (L1), and the highest was recorded in the subjects receiving the control diet.

3.7. Effects of beeswax incorporation on mortality rate

The mortality rate based on the levels of beeswax incorporation is presented in **Figure 2**, indicating that the mortality rate of the subjects significantly ($p < 0.05$) decreased with increasing levels of beeswax incorporation in the diets of the broiler chickens.

3.8. Effects of incorporation rate of beeswax on biochemical parameters

The studied biochemical parameters were not significantly ($p > 0.05$) influenced by the level of beeswax incorporation in the diets of the subjects, except for glucose and ASAT, where significant variations ($p < 0.05$) were observed (Table 7). The highest glucose level was observed in subjects receiving the L3 diet, while the highest ASAT level was found in the control group (L0).

Table 2: Additive effects of beeswax on feed intake (g/animal/day)

	Diets				*p* value
	L0 (n=48)	**L1 (n=48)**	**L2 (n=48)**	**L3 (n=48)**	
Week 1	29.04±1.89[a]	31.89±0.22[a]	32.46±0.68[a]	31.15±1.42[a]	0.29
Week 2	89.76±6.91[a]	86.24±3.33[a]	91.424±4.29[a]	85.72±3.19[a]	0.78
Week 3	96.48±0.63[a]	95.37±0.83[a]	94.51±3.24[a]	87.90±3.28[a]	0.11
Week 4	136.49±7.93[a]	147.36±0.89[a]	132.00±3.54[a]	123.79±5.92[a]	0.07
Week 5	114.68±4.34[b]	113.70±2.54[b]	100.61±1.39[a]	99.54±5.64[a]	0.03
Average	**93.28±0.46[b]**	**94.88±1.14[b]**	**90.19±0.93[ab]**	**85.62±3.35[a]**	**0.03**

[a,b]: Means followed by different letters within the same row are significantly different ($p < 0.05$). L0, L1, L2, and L3 = treatments with successively incorporated levels of beeswax at 0%, 0.25%, 0.50%, and 0.75% in the feed, respectively.

Table 3: Additive effects of beeswax on average daily weight gain (g/animal/day)

	Diets				*p* value
	L0 (n=48)	**L1 (n=48)**	**L2 (n=48)**	**L3 (n=48)**	
Week 1	14.3 ± 0.56[a]	18.7±1.02[b]	14.8±0.42[a]	17.2±0.67[a]	0.01
Week 2	32.9 ± 0.60[a]	33.9±1.38[a]	31.9±1.15[a]	35.3±1.35[a]	0.27
Week 3	57.3 ± 0.65[a]	60.4±1.09[a]	59.4±2.76[a]	55.5±3.61[a]	0.49
Week 4	46.5 ± 12.31[a]	57.8±3.71[a]	56.9±0.41[a]	56.6±7.85[a]	0.68
Week 5	63.2 ± 1.60[a]	74±0.76[b]	55.5±5.07[a]	49.7±8.37[a]	0.04
Average	**42.8 ± 1.93[a]**	**49±0.63[b]**	**43.7±0.12[a]**	**42.8±2.91[a]**	**0.04**

[a,b]: Means followed by different letters within the same row are significantly different ($p < 0.05$). L0, L1, L2, and L3: treatments with successively incorporated levels of beeswax at 0%, 0.25%, 0.50%, and 0.75%, respectively, in the feed.

Table 4: Feed conversion ratio of the subjects based on the beeswax incorporation rate

	Diets				*p* value
	L0 (n=48)	**L1 (n=48)**	**L2 (n=48)**	**L3 (n=48)**	
Week 1	2.01±0.52[b]	1.70±0.89[a]	2.18±0.23b	1.80±0.16[a]	0.01
Week 2	2.71±0.16[a]	2.53±0.06[a]	2.86±0.13[a]	2.42±0.04[a]	0.09
Week 3	1.68±0.10[a]	1.57±0.16[a]	1.59±0.87[a]	1.59±0.15[a]	0.83
Week 4	3.56±1.21[a]	2.56±0.15[a]	2.31±0.68[a]	2.23±0.19[a]	0.44
Week 5	1.81±0.10[a]	1.53±0.25[a]	1.83±0.013[a]	2.08±0.27[a]	0.20
Average	**2.35±0.23[a]**	**1.97±0.02[b]**	**2.15±0.03[a]**	**2.02±0.06[a]**	**0.04**

[a,b]: Means followed by different letters within the same row are significantly different ($p < 0.05$). L0, L1, L2, and L3 = treatments with successively incorporated levels of beeswax at 0%, 0.25%, 0.50%, and 0.75%, respectively, in the feed.

Table 5: Live weight, carcass weight, and carcass yield of the subjects according to treatment

	Diets				*p value*
	L0 (n=12)	**L1 (n=12)**	**L2 (n=12)**	**L3 (n=12)**	
Live Weight (g)	1493.33±54.90	1642±46.90	1437±75.9	1488±118.11	0.31
Carcass Weight (g)	1038.16±36.9	1164.80±37.20	1037.8±57.7	1085.10±104.50	0.48
Carcass Yield (%)	69.64±1.71	70.90±0.74	72.10±0.86	72.80±3.47	0.69

L0, L1, L2, and L3: treatments with successively incorporated levels of beeswax at 0%, 0.25%, 0.50%, and 0.75%, respectively, in the feed.

Table 6. Relative proportion of organs according to the treatment

Organs	Diets				*p value*
	L0 (n=12)	**L1 (n=12)**	**L2 (n=12)**	**L3 (n=12)**	
Gizzard	2.81±0.13[a]	2.64±0.11[a]	2.94±0.12[a]	3.04±0.22[a]	0.32
Head	2.51±0.95[a]	2.48±0.06[a]	2.90±0.08[b]	2.64±0.06[a]	0.01
Legs	4.14±0.26[a]	4.38±0.16[ab]	5.05±0.12[c]	4.90±0.24[bc]	0.01
Heart	0.62±0.08[a]	0.54±0.02[a]	0.56±0.02[a]	0.53±0.02[a]	0.55
Liver	2.34±0.20[a]	2.36±0.16[a]	2.41±0.09[a]	2.25±0.11[a]	0.90
Abdominal fat	1.02±0.11[a]	2.25±1.55[a]	0.85±0.09[a]	0.80±0.24[a]	0.53
Kidney	0.40±0.02[a]	0.37±0.01[a]	0.40±0.01[a]	0.40±0.02[a]	0.53
Intestinal mass	5.00±0.08[a]	5.83±0.84[a]	6.20±0.37[a]	5.29±0.53[a]	0.40
Intestinal length	11.59±0.22[a]	10.78±0.37[a]	13.21±0.74[a]	11.45±1.57[a]	0.29

[a, b]*: Means followed by different letters within the same row are significantly different ($p < 0.05$). L0, L1, L2, and L3: treatments with successively incorporated levels of beeswax at 0%, 0.25%, 0.50%, and 0.75%, respectively, in the feed.*

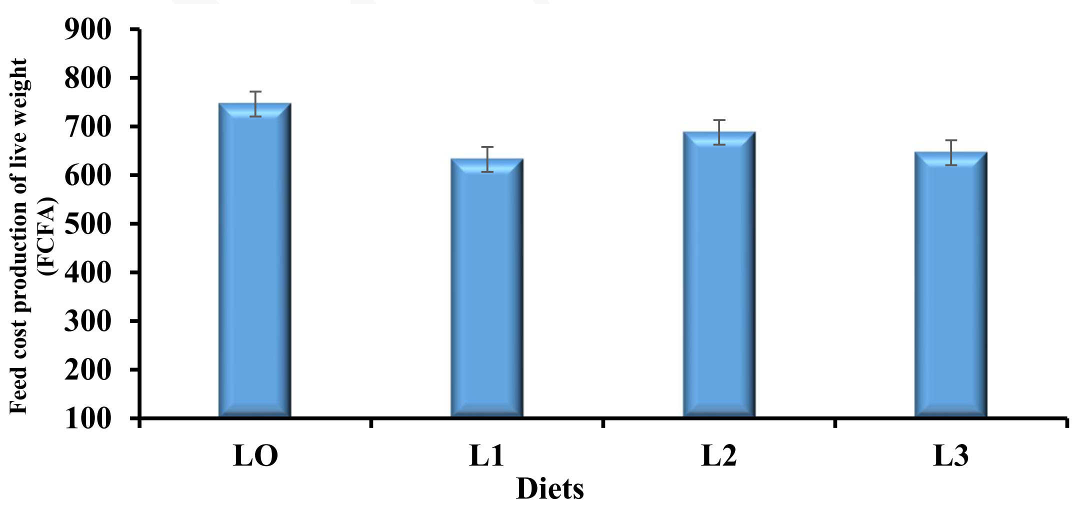

Figure 1: Feed and production cost of broilers according to treatment
L0, L1, L2, and L3: treatments with successively incorporated levels of beeswax at 0%, 0.25%, 0.50%, and 0.75%, respectively, in the feed.

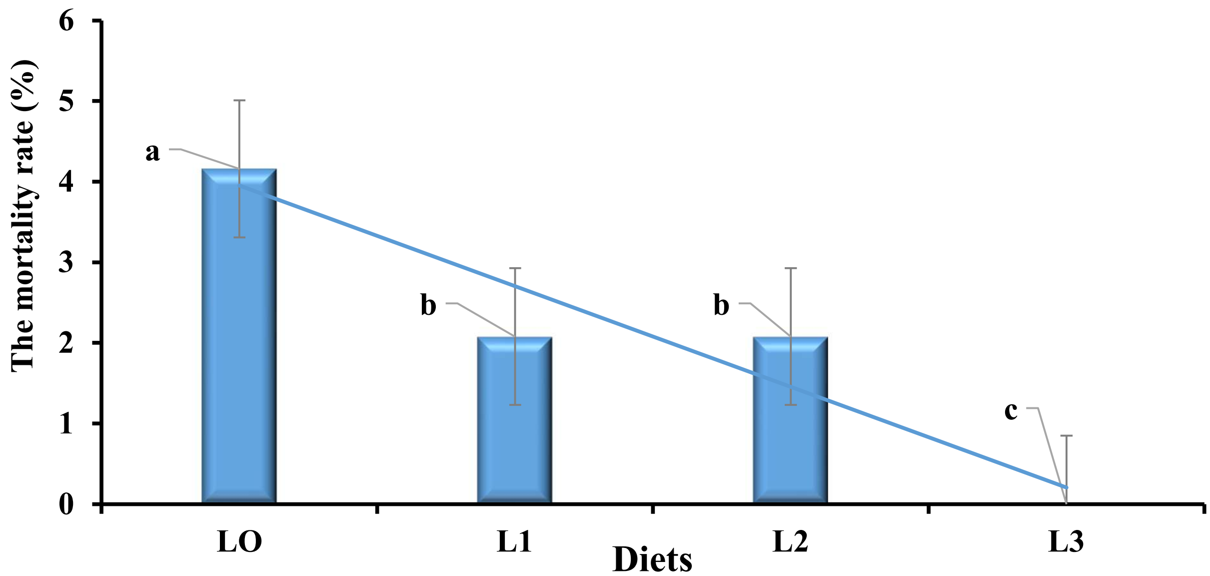

Figure 2: Mortality rate of broiler chickens according to treatment.
a,b, c Means with different superscripts differ at p<0.05. L0, L1, L2, and L3: treatments with successively incorporated levels of beeswax at 0%, 0.25%, 0.50%, and 0.75%, respectively, in the feed.

Table 7: Biochemical parameters of the subjects based on the level of beeswax incorporated into the diet

	Rations					
Parameters	**L0 (n=12)**	**L1 (n=12)**	**L2 (n=12)**	**L3 (n=12)**	**ESM**	***p value***
Glucose (mg/dL)	174.20±27.98^{a}	206.0±3.39^{ab}	174.10±3.14^{a}	240.50±3.81^{b}		0.03
Proteins (mg/dL)	5.25±0.98^{a}	6.76±0.20^{a}	7.13±0.83^{a}	8.15±0.49^{a}	0.468	0.09
Cholesterol (mg/dL)	96.9±8.54^{a}	146.70±60.10^{a}	144.70±38.45^{a}	110.30±16.7^{a}	17.10	0.72
Albumin (mg/dL)	4.87±0.96^{a}	4.25±0.08^{a}	3.85±0.63^{a}	3.68±0.53^{a}	0.30	0.58
Urea (mg/dL)	14.50±2.23^{a}	14.61±3.05^{a}	10.50±0.51^{a}	12.9±1.99^{a}	1.02	0.53
Triglycerides (mg/dL)	72.30±6.03^{a}	70.42±4.56^{a}	74.10±3.29^{a}	70.9±3.60^{a}	1.99	0.93
AST (U/L)	181.80±6.98^{b}	128.10±17.08^{ab}	90.31±21.69^{a}	144.3±17.6^{ab}	12.20	0.02
ALT (U/L)	10.80±1.33^{a}	21.50±4.87^{a}	20.11±8.34^{a}	17.4±4.64^{a}	2.61	0.54
Creatinine (mg/dL)	0.22±0.02^{a}	0.31±0.02^{a}	0.28±0.04^{a}	0.29±0.07^{a}	0.23	0.61

a, b: Means followed by different letters within the same row are significantly ($p < 0.05$) different. *L0, L1, L2, and L3: treatments with successively incorporated levels of beeswax at 0%, 0.25%, 0.50%, and 0.75%, respectively, in the feed.*

4. Discussion

The inclusion of beeswax in the diets of broiler chickens did not significantly affect individual feed consumption (IFC) between the 1st and 3rd weeks of the study. However, a significant decrease was observed between the 4th and 5th weeks in birds receiving 0.50% and 0.75% beeswax. Such late-onset reductions in intake may reflect a progressive adaptation of broilers to dietary wax constituents and/or time-dependent changes in the gut environment and nutrient utilization efficiency rather than an immediate palatability effect (Attia et al., 2023). In poultry, several hive-derived additives (e.g., propolis and bee products) have been shown to modify gut function and metabolic responses, which can translate into changes in intake and growth performance depending on the inclusion level and product composition (Abd El-Hack et al., 2020). Differences in composition (wax esters and lipid fraction versus minor polar fractions), bird age, and experimental conditions can plausibly explain why some studies in other poultry classes report different intake outcomes (Attia et al., 2023).

The average daily gain (ADG) of the birds was significantly influenced by the level of beeswax incorporation. This performance response supports the idea that beeswax can improve productive efficiency in broilers, likely through mechanisms compatible with avian monogastric digestion, particularly via modification of the gut ecosystem and intestinal function and/or improved effective nutrient utilization (Attia et al., 2023; Naeem and Bourassa, 2025). In broilers, dietary propolis (a different but related hive product) has repeatedly been reported to improve growth performance and/or nutrient digestibility, with effects that depend on inclusion level, extract type, and rearing conditions, which is consistent with the idea that bioactive components from hive products can exert gut and metabolism-mediated effects. (Azza et al., 2026). Therefore, the differences in the ADG observed in the current study can be explained primarily through broiler-related pathways (e.g., gut barrier function, microbial activity, and digestive efficiency), which are known to be modified by hive-derived products (Bava et al., 2025).

The mean feed conversion ratio (FCR) was significantly influenced by the different levels of beeswax incorporated into the diet. However, a significant decrease in FCR was recorded for subjects receiving diets containing 0.25% beeswax. These findings are consistent with those of Kabiloglu et al. (2025), who reported a reduction in FCR in weaned lambs after oral administration of ethanolic propolis extract. Similarly, Babaei et al. (2016) reported a reduction in FCR in quail supplemented with propolis, pollen, or honey. Gaafar et al. (2023) reported a similar effect in Assaf lambs fed doses of 2 g and 4 g/kg dry matter of beeswax. This decrease may be attributed to the antimicrobial molecules contained in hive products, which could increase feed efficiency as well as food digestibility.

Live weight, carcass weight, and carcass yield were not significantly influenced by the incorporation of beeswax in the diets of the broiler chickens. These results are in line with those of Song et al. (2022), who reported no significant effect on carcass quality in yellow Bantam chickens receiving diets supplemented with 0.1%, 0.15%, or 0.2% bee nest extract. In contrast, studies by Farag-Soha et al. (2021) revealed a significant increase in carcass yield following supplementation with bee bread extract in goats. These contradictions could be related to differences in nutritional levels in the diets provided to the animals.

The relative proportion of organs was not significantly influenced, except for the head and legs, whose values were significantly greater in subjects receiving 0.50% beeswax while remaining within the reference ranges. The absence of an effect on vital organs is partially in agreement with the work of Babaei et al. (2016), who reported no variation in the relative weight of lymphoid organs in quail chicks receiving diets supplemented with propolis, pollen, or honey. These observations suggest that beeswax exerts limited and specific effects on certain body parts, which are likely related to the absorption, metabolism, and distribution of bioactive compounds.

The mortality rate was significantly influenced by the level of beeswax incorporated into the diets of the broiler chickens, with the highest mortality rate observed in the control group. These findings align with those of Klaric et al. (2018), who reported a decrease in mortality in broiler chickens supplemented with propolis and bee pollen. These data suggest a protective effect of beeswax, which is likely related to its antioxidant, antimicrobial, and anti-inflammatory properties.

The economic analysis revealed that the feed costs per kilogram of live weight were lower for the animals fed diets supplemented with beeswax. These findings are consistent with those of Farag et al. (2021), who reported greater economic efficiency with the supplementation of Zaraibi goats with bee bread extract, mainly because of an improvement in the feed conversion ratio.

Dietary beeswax supplementation significantly alters serum glucose and ASAT concentrations in broiler chickens, but other core biochemical indicators are not affected. Specifically, serum parameters such as total protein, albumin, cholesterol, triglyceride, urea, creatinine, and ALAT remained statistically comparable across all the experimental groups. Crucially, all observed values fell safely within the standard physiological reference limits established for healthy broiler chickens (Dana et al., 2025). This baseline stability directly confirms that beeswax is entirely nontoxic when incorporated at the tested levels (Obun et al., 2010; Zálešáková et al., 2025).

The highest glucose level was observed in subjects receiving the diet containing 0.75% beeswax, while the highest ASAT level was noted in the control group. The reduction in ASAT levels observed in the supplemented subjects suggests a hepatoprotective effect of beeswax in poultry.

These findings are consistent with the research of El-Kholi et al. (2023) and similar studies on broiler chickens, which have shown that bee products (such as propolis and honeycomb extracts) significantly reduce liver stress markers due to their potent antioxidant and anti-inflammatory properties (Klarić et al., 2018; Song et al., 2022; Singh et al., 2023).

Conclusion

At the end of this study on the additive effect of beeswax on the zootechnical performance and some biochemical parameters of broiler chickens of the Cobb 500 strain, it appeared that 0.25% beeswax supplementation provides the best overall performance by improving average daily gain (ADG) and feed conversion ratio (FCR), reducing mortality, and lowering feed costs without adverse effects on most carcass or biochemical parameters. Although these results are satisfactory at an inclusion rate of 0.25%, further research is needed to assess its effects on the intestinal microbiota.

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Declaration of interests

The authors declare no conflicts of interest.

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