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Effect of Labazyme on Growth Performance, Physiological Parameters, and Economic Efficiency of Broiler Chickens

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ABSTRACT

Enzymes have a significant positive effect on nutrient digestion, feed efficiency, and growth rate of poultry. The current experiment aimed to determine the optimal dosage levels of Labazyme as feed additives. A total of 240 one-day-old broiler chickens (Ross 308) were randomly assigned to four groups with three replicates. The feeding experiment was carried out from hatching to day 42 of age. Three experimental groups contained Labazyme at 0.5, 1, and 1.5 mg/kg of the total diet. The control group received a basal diet. Growth performance, European performance efficiency index (EPEI), production index (PI), biochemical and lipid profiles, as well as antioxidant parameters were then measured. The results showed that chickens fed Labazyme supplementation (1 and 1.5 mg/kg) had a higher growth performance than those in the control group. Nonetheless, there was a significant difference between the Labazyme and the control group in terms of feed intake. In addition, Labazyme groups had a significantly positive effect on broiler economic scores. The EPEI and PI of the Labazyme-fed chickens were both higher than the control. There was a non-significant difference in total protein, albumin, globulin, and uric acid. The serum glucose level of the chickens fed Labazyme (1 and 1.5 mg/kg) was lower, compared to the control group. In contrast, chickens that consumed a diet supplemented with Labazyme 1 and 1.5 mg/kg indicated lower serum cholesterol, triglyceride, low-density lipoprotein, and very-low-density lipoprotein levels in broilers, compared to the control group. Serum high-density lipoprotein levels were improved and more pronounced in chickens fed Labazyme, compared to the control group. In conclusion, the results of the current study indicated that supplementation of Labazyme could help the improvement of growth performance, lipid profile, and profitability of broiler chickens.

Keywords: Broiler, Labazyme, Lipid profiles, Production index

INTRODUCTION

Poultry nutrition and the need to improve feeding efficiency have accelerated the use of feed additives and decreased the use of antibiotics in poultry feeding for the past decades. In fact, the goal outlined by the researchers has been to increase production while maintaining poultry health (Hafez and Attia, 2020). Singh et al. (2018) indicated that the use of exogenous enzymes in poultry feeds as a growth promoter is beneficial for improving production parameters and improving the digestibility of nutrients in broiler chickens.

However, the additives are complexes of non-nutrient and nutrient compounds that help to improve feed efficiency and reduce the cost of feed (Abdurofi et al., 2017). Similar results showed that natural growth promoters, such as plant powders, plant extracts, enzymes, probiotics, and multi-enzyme, can be used in the poultry feed to improve production, the immune system, and the microbial population in the gut and reduced oxidative stress. Multi-enzymes with/without probiotics are usually included in the animal feeds to degrade the anti-nutritional factors, and consequently improve nutrient digestibility and the growth performance of poultry (Kiarie et al., 2013; Kiarie et al., 2014).

Several studies have indicated that such enzymes also reduce intestinal colonization by pathogens in poultry (Olukosi et al., 2015; Amerah et al., 2017). On another hand, feed additives, such as enzymes Kaczmarek et al. (2014), probiotics (Fesseha, 2019; Bonilla Carrero, 2021) or enzyme complexes can be attributed to changes in the gut tract that facilitate digestion and absorption of the nutrients as well as animal growth (Kiarie et al., 2013). According to Amerah et al. (2017), there is a need to improve the digestibility of different types of nutrients in a compound feed due to the complex nature of the feed. Feed cost is an important issue in developing countries, such as Iraq, as it can improve the economic efficacy of the poultry industry. Therefore, the present study aimed to investigate the effect of different levels of Labazyme as a feed additive on growth performance, blood parameters, and economical profitability of broiler chickens.

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MATERIALS AND METHODS

Ethical approval

The broiler chickens in the current study were handled according to guidelines passed by the institutional ethics committee for the care of animals and were approved by the Animal Ethics Committee of the Department of Animal Production, Tikrit University, Iraq.

Experimental design

A total of 240 one-day-old Ross-308 broiler chickens were purchased from a hatchery in Samarra, Iraq. The chickens were housed in a cage (2 cm^2) at the graduate department of the animal station, at the College of Agriculture, Tikrit University, Tikrit, Iraq. The temperature was 35°C in the first week and then gradually decreased to 25°C at the end of the third week. The chickens were providing a 24-hour photoperiod of light. Food and water were provided *ad libitum*. The chickens were also supervised daily in the morning and evening. The chickens were divided into four groups and each group contained three replicates (20 chickens each). The diets were designed according to the recommendations of the NRC's requirements for broiler chicks (NRC, 1994). Chickens in the control group received a basal diet with no supplementation, and the experimental groups of E_1, E_2, and E_3 received Labazyme supplemented in the basal diets at 0.5, 1.0, and 1.5 mg/kg, respectively.

Labazyme composition

The product was purchased from a local market in Baghdad, Iraq, and the composition for Multi-enzyme and Probiotics Labazyme^{100gm} (each 1 kg contains) was indicated in the company label as *Lactobacillus acidophilus* 2.75×10 CFU, *Streptococcus faecium* 8.25×10 CFU, *Bacillus subtilis* 1.1×10 CFU, protease 2.750 CSU, amylase 5.500 SLU, and cellulose 275 FPUI.

Growth performance

At the start of the experiment, body weight was measured, and it was repeated weekly. Body weight gain was calculated by subtracting the body weight at the start of each week from body weight at the end of the same week. Feed intake was calculated weekly for each group by subtracting the weight of food left at the end of the week from the weight of given food at the start of the same week. Every week, the feed conversion ratio was calculated using the Formula 1. The mortality of chickens was recorded until the end of the study.

Feed conversion ratio = feed ingested (g) / weight gain (g) Formula (1)

Blood collection and biochemical analysis

Blood samples were randomly collected from four chickens in each pen at the end of the experimental periods. Approximately 3-5 ml blood samples were collected from the wing vein using a 5 ml syringe with a 22-gauge needle and transferred into non-heparinized tubes. The clotted blood samples were centrifuged at 3000 rpm for 15 minutes and the clear serum was separated and stored in a -20°C freezer for the biochemical analysis. Serum glucose was determined by the glucose oxidase method prescribed by Trinder (1969). Total protein and albumin serum were determined using spectrophotometric methods (Biolabo, 2011).

Globulin concentration was calculated using the Formula 2:
Globulin = Total protein – albumin Formula (2)

Alanine aminotransferase (ALT) and Aspartate aminotransferase (AST) were determined using spectrophotometric methods (Biolabo, 2014). Cholesterol, triglyceride, and high-density lipoprotein (LDL) cholesterol were determined with a kit (SPIN800, Spain). Low-density lipoprotein and very-low-density lipoprotein (VLDL) were also calculated to fit this equation as LDL = cholesterol- (High-Density Lipoprotein [HDL] + VLDL) using the Formula 3 of Friedewald et al. (1972) as below:

VLDL = 5/triglyceride Formula (3)

Economic evaluation

The economic evaluation was determined by considering feed cost per chicken (USD), total income from the chicken (USD), and growth efficiency according to Gondwe and Wollny (2005). The total return (TR) was calculated according to Shehata et al. (2018). The European performance efficiency index (EPEI) was evaluated according to Panda et al. (2006). The production index (PI) was calculated during the experimental growing period.

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Table 1. Ingredients and chemical composition of the basal diet

Ingredients (%)	Starter (1-21 days)	Finisher (21-42 days)
Yellow maize	46.18	53.88
Wheat	9.92	9
Soybean 44%	36.9	29.5
Vegetable oil	2.8	4.2
Primix[1]	2.5	2.5
Di-calcium phosphate	1	0.2
Salt	0.3	0.5
Methionine	0.1	0.1
Lysine	0.3	0.12
Chemical Composition*	100	100
ME (Kcal/Kg)	3027.74	3202.42
Crude Protein (%)	23.02	20.02
Lysine (%)	1.48	1.12
Methionine (%)	0.57	0.54
Methionine+cysteine (%)	0.92	0.85
Calcium (%)	0.97	0.83
Phosphor (%)	0.61	0.45

* The Premix (1 kilogram of Premix): Vitamin E (500 IU), Vitamin B_{12} (0.06 mg), Vitamin B_1 (67 mg), Vitamin A (334000 IU), Vitamin D_3 (67000 IU), Vitamin B_2 (1000 mg), Vitamin B6 (0.66 mg), Folic acid (17 mg), Choline (17000 mg), N (1000 mg), Magnesium (3.334 mg), Zinc (334 mg), Iron (1.667 mg), Copper (10 mg), Iodine I (17 mg), Methionine (27000 mg), Phosphor (10.6%), Selenium (0.20 mg). * Starter, growth, and finisher diets were formulated according to the requirement for broiler chickens as outlined by National Research Council (NRC, 1994).

Statistical analysis

The data were subjected to analysis of variance for each parameter using the SAS statistical package (version 9, 2016). One-Way ANOVA followed by Duncan's multiple range test was used to compare the means of the groups (Duncan, 1955). The economic evaluation and biochemical parameters were subjected to the analysis of variance and graphing using GraphPad Prism (version. 8.0.1., Graph Pad Software, San Diego, California, USA). P-value less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Growth performance

The effect of Labazyme on broiler performance is presented in Table 2. On days 7, 14, 21, 28, 35, and 42 body weight varied between groups. Except for day 7, significant differences were observed during the experiment (42 days) among broiler fed the diet supplemented with 0.5, 1, and 1.5 mg/kg Labazyme, compared to the control groups ($p < 0.05$) in terms of body weight. In other words, body weight was higher in experimental chickens, compared to the control. Regarding body weight gain, there were significant differences between all groups on days 7, 14, 21, and 28, but there was no significant difference between the Labazyme and control groups on days 35 and 42. During days 1-42, the broiler chickens fed Labazyme recorded a higher weight, compared to the control group. Table 2 shows the results of feed intake and feed conversion ratio. The present result indicated that significant differences were observed between control and experimental groups on days 7, 14, 21, 28, 32, and 42. The Labazyme-fed broiler chickens had significantly the lowest feed and best feed conversion ratio, compared to the control ($p < 0.05$). Chickens in the experimental groups consumed significantly the least amount of food over the total period of 1-42 days. Meanwhile, the supplementation of Labazyme in broiler feed resulted in significant differences in the feed conversion ratio compared to the control on days 7, 14, 21, 28, and 42. The broilers fed Labazyme showed a better feed conversion ratio throughout the 1-42 days period.

The results showed improved growth performance in broiler chickens fed Labazyme due to the underlying improvement in digestibility of the feed ingredients. Labazyme has a synergistic effect since it contains probiotics (*Lactobacillus acidophilus*, *Streptococcus faecium*, and *Bacillus subtilis*) and a group of digestive enzymes (protease, amylase, and cellulase) capable of forming complexes with essential nutrients and the releasing these nutrients. This could improve nutrient utilization in the feed and have a positive impact on the growth and reduce the feed intake with a better feed conversion ratio. There are several mechanisms by which enzymes can remove alkylglycerone phosphate synthase and reduce the risks associated with their use which affects the endogenous enzyme in the broiler gut tract not being readily tapped, or perhaps, the Labazyme reduces the viscosity of the gut tract, which is a faster throughput speed. The results of the current experiment were supported by previous studies on the use of enzymes or multienzymes with or without probiotics to improve growth performance, reduce feed intake, and achieve the best value for feed conversion ratio in broiler feed supplementation with enzymes (Guo et al., 2014; Siadati et al., 2017). As a result, the inclusion of

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exogenous enzymes in poultry feed has become common practice to improve broiler production and performance (Allcorn, 2016). According to Siadati et al. (2017), chickens fed exogenous multienzyme complexes could benefit from improved performance, as well as enhanced fat and crude protein digestibility. Askelson (2013) reported that exogenous enzymes could increase the nutrients available to the broiler by hydrolyzing non-digestible feed components while reducing the anti-nutritional effects of plant-based feed components.

Table 2. Effect of dietary treatment of Labazyme on growth performance of broiler chickens

	Chickens age	Groups*				P-value
		Control	E_1 (0.5 g/km)	E_2 (1 g/km)	E_3 (1.25 g/km)	
Body weight (kg)	Day 1	43.00	43.00	43.00	43.00	-
	Day 7	140.13 ± 0.72^{ab}	139.11 ± 1.46^{ab}	138.23 ± 0.88^{b}	141.82 ± 0.89^{a}	0.118
	Day 14	327.56 ± 10.47^{b}	356.23 ± 5.49^{a}	349.56 ± 1.45^{ab}	356.88 ± 6.35^{a}	0.047
	Day 21	662.11 ± 5.84^{b}	723.72 ± 10.14^{a}	746.82 ± 8.70^{a}	739.49 ± 17.77^{a}	0.003
	Day 28	1092.92 ± 40.3^{b}	1250.13 ± 8.1^{a}	1248.85 ± 7.78^{a}	1257.27 ± 9.27^{a}	0.001
	Day 35	1553.06 ± 17.93^{c}	1693.99 ± 8.9^{b}	1710.81 ± 6.4^{a}	1751.64 ± 20.59^{a}	0.000
	Day 42	2252.42 ± 28.90^{b}	2447.48 ± 40.62^{a}	2453.96 ± 32.45^{a}	2463.54 ± 28.28^{a}	0.005
Body weight gain (g)	Day 7	96.13 ± 0.72^{ab}	96.11 ± 1.46^{ab}	95.23 ± 0.88^{b}	98.82 ± 0.89^{a}	0.118
	Day 14	186.43 ± 10.49^{b}	217.12 ± 4.08^{a}	211.33 ± 1.05^{a}	215.06 ± 5.83^{a}	0.030
	Day 21	334.55 ± 9.38^{b}	367.49 ± 5.90^{b}	397.26 ± 7.89^{a}	382.61 ± 9.33^{a}	0.039
	Day 28	430.80 ± 43.86^{b}	526.40 ± 15.32^{a}	502.02 ± 1.026^{a}	517.77 ± 8.54^{a}	0.074
	Day 35	460.14 ± 55.46	453.86 ± 16.98	461.96 ± 10.14	494.37 ± 29.38	0.748
	Day 42	699.35 ± 12.55	753.48 ± 31.94	743.15 ± 36.16	711.90 ± 43.07	0.632
	Total 7-42	2209.42 ± 8.90^{b}	2404.48 ± 40.62^{a}	2410.96 ± 32.45^{a}	2420.54 ± 28.28^{a}	0.0052
Feed intake (g/chicken)	Day 7	153.31 ± 3.43^{a}	127.12 ± 3.25^{b}	133.41 ± 2.24^{b}	132.78 ± 2.66^{b}	0.001
	Day 14	359.98 ± 5.90^{a}	320.01 ± 2.66^{b}	307.89 ± 4.15^{b}	305.43 ± 16.10^{b}	0.008
	Day 21	691.57 ± 22.28^{a}	593.58 ± 25.10^{b}	584.31 ± 20.16^{b}	547.82 ± 27.73^{b}	0.015
	Day 28	825.53 ± 8.02^{a}	732.50 ± 23.56^{b}	808.03 ± 6.95^{b}	667.38 ± 7.97^{c}	0.000
	Day 35	1000.80 ± 31.40^{a}	832.18 ± 8.34^{b}	859.44 ± 17.41^{b}	879.80 ± 20.44^{b}	0.002
	Day 42	1247.61 ± 17.27^{a}	1102.83 ± 30.39^{b}	1063.32 ± 13.80^{b}	1043.62 ± 36.21^{b}	0.002
	Total 7-42	4278.84 ± 59.23^{a}	3708.23 ± 67.52^{b}	3666.41 ± 34.75^{b}	3576.84 ± 85.10^{b}	0.000
Feed conversion ratio	Day 7	1.56 ± 0.04^{a}	1.32 ± 0.05^{b}	1.40 ± 0.03^{b}	1.34 ± 0.01^{b}	0.009
	Day 14	1.94 ± 0.09^{a}	1.47 ± 0.01^{b}	1.46 ± 0.02^{b}	1.42 ± 0.11^{b}	0.003
	Day 21	2.07 ± 0.11^{a}	1.61 ± 0.05^{b}	1.47 ± 0.03^{b}	1.43 ± 0.04^{b}	0.000
	Day 28	1.95 ± 0.19^{a}	1.39 ± 0.08^{b}	1.43 ± 0.01^{b}	1.29 ± 0.03^{b}	0.010
	Day 35	2.24 ± 0.27^{a}	1.88 ± 0.08^{ab}	1.86 ± 0.07^{ab}	1.79 ± 0.08^{ab}	0.236
	Day 42	1.78 ± 0.01^{a}	1.47 ± 0.08^{b}	1.43 ± 0.06^{b}	1.47 ± 0.03^{b}	0.007
	Total 7-42	1.93 ± 0.03^{a}	1.54 ± 0.03^{b}	1.52 ± 0.00^{b}	1.47 ± 0.01^{b}	0.000

$^{a\,b\,c}$ mean within the same row followed by different superscripts are significantly different ($p < 0.05$). *Groups: Control: 0.0, E1: 0.5 mg /kg Labazyme, E2:1 mg /kg Labazyme and E3:1.5 mg /kg Labazyme in broiler diet.

Biochemical levels and lipid profiles

The effect of Labazyme supplementation on glucose, total protein, albumin, globulin, and uric acid is shown in Table 3. The obtained results showed a significant difference between all groups in terms of glucose level ($p < 0.05$). Results revealed that chickens fed with different doses of Labazyme in E_2 and E_3 groups had the lowest level of glucose, compared to the control. However, there were non-significant differences between the groups regarding total protein, albumin, globulin, and uric acid ($p > 0.05$). There was a significant ($p < 0.05$) between-group effect in the lipid profile levels in the broiler chickens (Figure 1). On day 42, there was a significant decrease in serum cholesterol, triglycerides, LDL, and VLDL in all dietary supplemented groups, compared to the control group. There was an increase in serum high-density lipoprotein in the Labazyme supplemented groups, compared to the control group. Total protein, albumin, globulin, and uric acid concentrations were not significantly different among the groups. According to Siadati et al. (2017), feed additives should be effective and safe for broiler chickens. The results are consistent with the idea that the exogenous enzymes can be safely used in poultry nutrition without affecting the function of vital organs. The effect of Labazyme on concentrations of lipid profiles is consistent with previous studies indicating that multienzymes decrease lipid profile properties due to the changes in the composition of intestinal bacterial flora, through which probiotics ferment to reduce short-chain fatty acids in the gut and then reduce the systemic blood lipids and cholesterol (Zhao and Yang, 2005). However, some probiotic bacteria can interfere with cholesterol absorption in the gut by de-conjugating bile salts or assimilating cholesterol directly (Kumar et al., 2012).

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Table 3. Effect of dietary treatment of Labazyme on biochemical parameters of broiler chickens

Variable	Groups*				P value
	Control	E_1 (0.5 g/km)	E_2 (1 g/km)	E_3 (1.25 g/km)	
Glucose (mg/dL)	233.43 ± 12.87[a]	204.59 ± 6.50[ab]	195.69 ± 4.26[b]	190.34 ± 5.35[b]	0.010
Total protein (g/dL)	2.97 ± 0.34	2.80 ± 0.07	3.29 ± 0.35	3.10 ± 0.29	0.690
Albumin (g/dL)	1.56 ± 0.13	1.82 ± 0.17	1.99 ± 0.08	1.76 ± 0.09	0.168
Globulin (g/dL)	1.41 ± 0.38[a]	0.98 ± 0.15[ab]	1.29 ± 0.28[a]	1.34 ± 0.38[a]	0.790
Uric acid (mg/dL)	2.59 ± 0.62[a]	1.73 ± 0.21[ab]	2.23 ± 0.19[a]	1.53 ± 0.22[ab]	0.202

[a and b] mean within the same row followed by different superscripts are significantly different ($p < 0.05$). *Groups: Control: 0.0, E1: 0.5 mg /kg Labazyme, E2:1 mg /kg Labazyme and E3:1.5 mg /kg Labazyme in broiler diet.

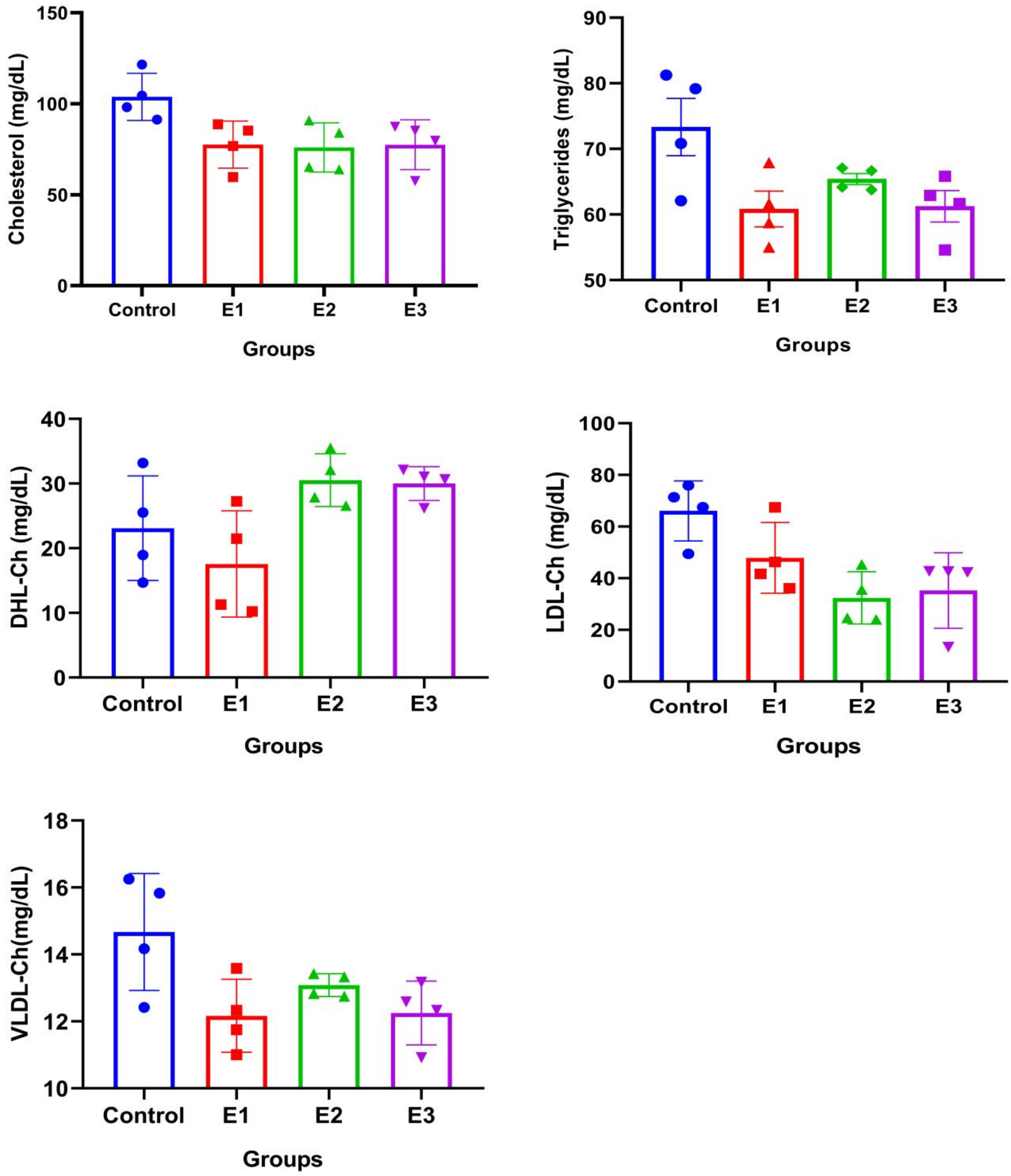

Figure 1. Serum lipid profile of broiler chickens fed Labazyme. Groups: Control: 0.0, E1: 0.5 mg /kg Labazyme, E2:1 mg /kg Labazyme and E3:1.5 mg /kg Labazyme in broiler diet. The Plot: Mean with standard error mean , $p < 0.05$

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Economic evaluation

The economic impact of using Labazyme as a feed additive for broiler chickens is shown in Figure 2. Regarding feeding cost (FC), there was a highly significant difference between Labazyme groups and the control group ($p < 0.05$, Figure 2A), meaning that the cost of one ton of feed was reduced in groups E_2 and E_3 Labazyme, saving 2.18 and 2.18/ton, compared to 2.50/ton for the control group. Further, similar results found in TI and TR indicated a highly significant difference between the Labazyme groups and the control group ($p < 0.05$, Figures 2B and 2C). The highest values of 5.72 and 5.75 TI and 1.54 and 1.60 TR were respectively recorded for the E_2 and E_3 groups compared to the lowest value of the control as 5.25 TI and 0.75 TR. The economic evaluation, EPEI, and PI were highly significant in broiler chickens fed a Labazyme supplement, compared to control (Figure 3). The highest TR and the highest profitability from the sale of broiler chickens were achieved with Labazyme supplemented, as there was a significant increase in the final body weight ($p < 0.05$). These results are consistent with those of Shehata et al. (2018) indicating that feed costs decreased and enzyme levels increased (Haque et al., 2017).

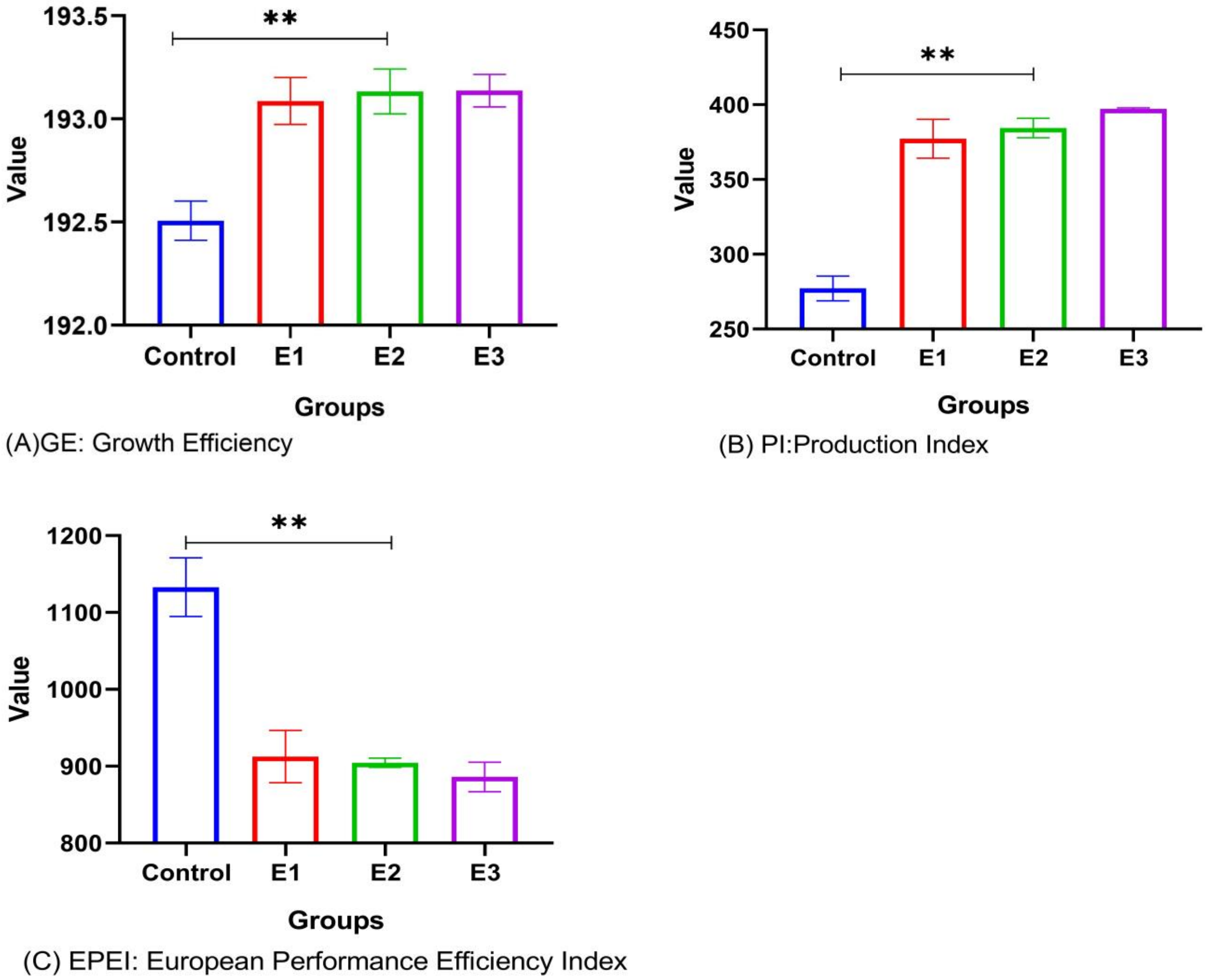

Figure 3. Growth efficiency, European performance, efficiency index and production index of broiler chickens fed Labazyme. Control: 0.0, E1:0.5, E2:1 and E3:1.5 mg /kg Labazyme in broiler diet. The Plot: Mean with standard error mean , $p < 0.05$.

CONCLUSION

Under the current study conditions, due to the content of Labazyme, including *Lactobacillus acidophilus*, *Streptococcus*, *Bacillus subtilis*, protease, amylase, and cellulase, the synergistic effect of Labazyme appeared to be beneficial in the experimental groups, compared to the control group. Labazyme could optimize digestion in a way that improves feed conversion ratio, production, and high-density lipoprotein, as well as reducing cholesterol and triglycerides. Present results from this study showed that supplementing broiler feed with Labazyme is economically helpful. It can be concluded that using a Labazyme in broiler diets as a feed additive can be of great help.

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DECLARATIONS

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Authors' contribution

Arkan Mohammed and Tariq Aljumaily was the coordinator of the research and analyzed and interpreted the data. Arkan Mohammed, Ammar Abdulwahab, and Samah Raouf in the study were the supervisor of data collection and wrote draft manuscripts, Ammar, Tariq and Samah were assistants in the collection of data. All authors read and approved the final manuscript.

Competing interests

The authors have not declared any conflict of interest.

Ethical consideration

All authors have checked the ethical issue such as plagiarism, consent to publish, data fabrication and falsification, and redundancy.

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