



Research Article

STUDIES ON THE SERUM PARAMETERS FOR THE EFFECT OF DIETARY SUPPLEMENTATION OF SALTS OF DIFFERENT LEVELS OF ORGANIC ACIDS MIXTURE OF LAYING HENS

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Abstract: The present study was carried out to determine the effect of dietary organic acids mixture supplementation on serum parameters in laying hens. A total 24 week old 140 white leghorn laying hens which were randomly distributed to seven dietary treatment groups, each containing 20 hens. The hens were fed (18% CP% and 2697 Kcal Kg⁻¹ ME) i.e., Supplemented with T1 (0 % control), T2 (0.5% sodium-butyrate), T3 (1.0% sodium-butyrate), T4 (1.5% sodium-butyrate), T5 (0.5% calcium-propionate), T6 (1.0% calcium-propionate) and T7 (1.5% calcium-propionate). Serum parameters (Total proteins, albumin, globulin, calcium, magnesium and phosphorus) were significantly ($P<0.05$) increased and cholesterol level in serum was significantly ($P<0.05$) reduced by supplementing the diets with salts of organic acids.

Keywords: Calcium-propionate, dietary organic acids, dietary treatments, egg quality, laying hens and sodium butyrate

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Introduction

Antibiotics have been widely used in poultry production for decades to improve growth rate and feed conversion efficiency, however, their use as growth promoters in the poultry industry has been intensively controversial because of the development of bacterial resistance and potential consequences on the human health [1]. In response to this apparent threat, the European commission (EC) decided to ban (1st January, 2006) the marketing and use of antibiotics as growth promoters in feed [1]. Organic acids and their salts are generally regarded as safe and have been approved by most member states of European union (EU) to be used as feed additives in the animal production [3]. The advantage of salts over acids is that they are generally odourless and easier to handle in the feed manufacturing process owing to their solid and less volatile form [4]. Organic acids can serve as a meaningful tool to controlling all enteric non-pathogenic and pathogenic especially acid-intolerant bacteria like *Escherichia coli*, salmonella and campylobacter species [5]. On the other hand, only few data on blood parameters in laying hens supplemented with organic acids are available. The aim of this study was to investigate the effects of organic acid mixture at different levels of supplementation in the diet of laying hens on nutrients metabolizability and serum parameters of laying hens.

Materials and Methods

Experiment and data structure

All the experimental procedures have been conducted in accordance with the guidelines laid down by the Institutional Ethics Committee. The investigation was conducted at poultry farm, Department of Animal Genetics and Breeding, College of Veterinary sciences, LUVAS, Hisar for the year 2016. For this study one hundred and forty single comb white leghorn laying hens at 24 weeks of age were randomly distributed to seven dietary treatment groups i.e., T1 (control), T2 (0.5% sodium-butyrate), T3 (1.0% sodium-butyrate), T4 (1.5% sodium-butyrate), T5 (0.5% calcium-propionate), T6 (1.0% calcium-propionate) and T7 (1.5% calcium-propionate), consisting of five replications of four birds each in each treatment.

Based upon the proximate composition and metabolizable energy of feed ingredients the layer's control ration having maize grain as energy source was formulated as per BIS (2007) [6]. All the diets were analysed for proximate principles [7] and were randomly divided into 7 groups in Completely Randomized Design (CRD). The hens were housed individually in cages. All the diets were prepared to be isocaloric and nitrogenous. They were reared under identical conditions of environment and management of light, water, disease control etc. Feed and water were supplied ad lib. The different dietary treatments were, as given below:-T1, Basal diet (Control) as per BIS (2007) [6] Standard; T2, Basal diet + Sodium butyrate @ 0.5%; T3, Basal diet + Sodium butyrate @ 1.0%; T4, Basal diet + Sodium butyrate @ 1.5%; T5, Basal diet + Calcium propionate @ 0.5%; T6, Basal diet + Calcium propionate @ 1.0% and T7, Basal diet + Calcium propionate @ 1.5%. Feed additives and supplements were premixed and then mixed with weighed quantity of feed ingredients to make a homogenous mixture of rations. The cost of different experimental diets T1 (control), T2, T3, T4, T5, T6 and T7 were Rs. 22.23, 22.68, 23.13, 23.58, 22.65, 23.08 and 23.50/kg, respectively.

Table-1 The ingredients and chemical composition of control diet.

Ingredient composition	
Ingredients	(Kg/100kg feed)
Maize	50
Soybean meal	13
Groundnut cake	7
DORP	12
Rice Polish	5
Fish Meal	6
Mineral Mixture	3
Salt	1
Shell Grit	3
Total	100

Table-1 Body weight changes (g) of layers during the experimental period under different dietary treatments

Treatments	Initial body weight (g)	Final body weight (g)	Body weight gain (g)
T ₁	1442.50±19.76	1642.00±27.50	199.50±25.55
T ₂	1463.50±25.93	1681.50±27.60	218.00±21.13
T ₃	1446.50±24.27	1661.00±43.96	214.50±30.16
T ₄	1478.50±33.73	1691.00±42.45	212.50±19.53
T ₅	1490.50±36.63	1714.50±50.47	224.00±29.80
T ₆	1507.54±26.89	1742.04±46.43	234.50±25.47
T ₇	1502.50±34.69	1748.50±44.21	246.00±30.58

Table-2 Mean values of serum parameters of different dietary treatments in laying hens

Parameters/ Treatments	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇
T.P(g/dl)	3.92 ^a ±0.14	4.26 ^b ±0.11	4.98 ^c ±0.10	4.72 ^c ±0.11	4.04 ^a ±0.11	4.88 ^c ±0.09	4.51 ^{bc} ±0.10
Al(g/dl)	1.97 ^a ±0.09	2.23 ^b ±0.10	2.66 ^c ±0.13	2.30 ^b ±0.13	1.89 ^a ±0.11	2.58 ^c ±0.13	2.15 ^b ±0.12
Gl(g/dl)	1.95 ^a ±0.04	2.03 ^a ±0.11	2.32 ^b ±0.17	2.42 ^b ±0.20	2.15 ^a ±0.13	2.30 ^b ±0.16	2.36 ^b ±0.21
Ca(mg/dl)	19.43 ^a ±0.07	21.35 ^b ±0.14	23.88 ^d ±0.25	22.09 ^c ±0.36	21.68 ^b ±0.14	24.10 ^d ±0.19	22.62 ^c ±0.36
Mg(mg/dl)	4.02 ^a ±0.11	4.31 ^a ±0.19	5.13 ^c ±0.17	4.73 ^b ±0.20	4.36 ^a ±0.20	5.24 ^c ±0.18	4.80 ^b ±0.21
P(mg/dl)	6.19 ^a ±0.17	6.29 ^a ±0.18	7.02 ^b ±0.26	6.67 ^{ab} ±0.24	6.36 ^a ±0.17	7.14 ^b ±0.25	6.76 ^{ab} ±0.22
Cho(mg/dl)	177.14 ^b ±3.41	176.30 ^b ±3.63	171.08 ^a ±2.51	171.88 ^a ±4.78	176.55 ^b ±3.67	171.40 ^a ±4.14	172.14 ^a ±3.90

The mean values in same row with different superscripts differ significantly ($P < 0.05$)

Feed additives included Spectromix-10g and Spectromix-BE-10g per 100kg feed. The study was undertaken from 24 to 40 weeks of age of layers in first phase of production cycle. The entire duration of study was divided into eight periods of 14 days each.

Serum parameters

At the end of the experimental period, blood samples were collected by venipuncture from the sub-wing vein and placed in non-additives blood collection tubes to produce serum from sub-samples of 5 randomly selected laying hens from each treatment group to estimate the serum parameters. Samples were centrifuged at 3000 rpm for 10 min (within 1 hour of collection) to separate the serum which was stored at -20°C until the analysis. Serum samples were analyzed by using commercially available "ERBA Kit" in ERBA-EM-200 automatic analyzer (Erba Mannheim, Germany).

Statistical analysis

The statistical analysis of data was performed using SPSS 21.0 version of Microsoft [8]. One way ANOVA was used for the differences between groups. When the p values were significant ($p < 0.05$), a Duncan's multiple range test was performed [9]. All the data were expressed as mean±standard errors.

Results and Discussion

Based upon the proximate composition and metabolizable energy of feed ingredients the layers' control ration was formulated as per BIS (2007) [6]. The ingredients and chemical composition of diet fed to layers in control group (T₁) is presented in [Table-1]. The contents of crude protein, crude fibre, ether extract, nitrogen-free extract, and organic matter of basal diet (T₁) were 18.04%, 4.34%, 3.61%, 66.21% and 92.20%, respectively. The calculated value of ME was 2697.17 kcal/kg feed.

Serum parameters

The results of the present study revealed that concentrations of various serum parameters (Total proteins, albumin, globulin, calcium, magnesium and phosphorus) were significantly ($P < 0.05$) improved by supplementation of salts of organic acids in the diets of layers. This could be attributed to the favourable environment in intestinal tract due to supplementation of salts of organic acids, reducing pH of gastro-intestinal tract which increased the digestibility of proteins

and facilitates the uptake of minerals from gut into the blood stream [10]. In the present study also, it was observed that increased dry matter metabolizability and retention of nutrients might be responsible for increasing the concentrations of these serum parameters. These findings are in accordance with Soltan, (2008) [10] and Yesilbag and Colpan, (2006) [11] who observed a linear increase of serum calcium concentration with the inclusion levels of organic acids mixture in the diets of laying hens and significantly increased the serum total proteins and albumin concentrations ($P < 0.01$ and $P < 0.05$, respectively). Moreover, Kaya, *et al.*, (2013) [12] found that the acidic anion has been shown to complex with Ca, P and Mg, which resulted in an improved digestibility of these minerals. By contrast, Nourmohammadi, *et al.*, (2010) [13] found a significant ($P < 0.05$) reduction in serum albumin and calcium contents compared with the control group. However, they reported that there was no significant effect on total proteins and phosphorus levels in laying hens receiving diets supplemented with zeolite and organic acid mixture. Moreover, Kamal and Ragaa, (2014) [14] found a significant ($P < 0.05$) reduction in phosphorus level but had no significant effect on calcium and magnesium concentrations in serum. Cholesterol level was significantly ($P < 0.05$) reduced by supplementing the diets with salts of organic acids in laying hens. This reduction might be due to dietary organic acidification which was reported by [13]. Similarly, Yesilbag and Colpan, (2006) [11] and Kaya, *et al.*, (2013) [12] found a significant ($P < 0.05$) reduction in serum cholesterol level by supplementing the diets with organic acids as compared to control diet. In contrary to these findings, Kamal and Ragaa, (2014) [14] and Ozek, *et al.*, (2011) [15] observed no effect of organic acids on serum cholesterol concentration among different dietary treatments.

Conclusion

From the results of investigation, we can conclude that supplementation of sodium butyrate and calcium propionate in the ration of layers, the concentrations of various serum parameters (Total proteins, albumin, globulin, calcium, magnesium and phosphorus) were improved. This could be due to the favourable environment in intestinal tract and reduction of pH of gastro-intestinal tract which increased the digestibility of proteins which may increase the uptake of minerals from gut into the blood stream.

Application of research: The aim of this study was to investigate the effects of organic acid mixture at different levels of supplementation in the diet of laying

hens on nutrients metabolizability and serum parameters of laying hens.

Research Category: Animal Science, Animal Nutrition

Abbreviations: EC- European commission, CRD- Completely randomized design

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