Research Article

EFFECT OF SUPPLEMENTING HIGHER LEVEL OF DIETARY L-ARGININE ON SERUM PARAMETERS IN BROILER CHICKEN

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Received: January 31, 2018; Revised: February 23, 2018; Accepted: February 24, 2018; Published: February 28, 2018

Abstract- The objective of this study was to investigate the effect of higher levels of dietary L- arginine supplementation on the serum parameters of the broiler chicken with special reference to Serum triglyceride, total cholesterol, uric acid, total protein, albumin and globulin. A total of 150 day old Cobb 400 broiler chicks were randomly allocated to 5 treatment groups viz., T₁(100 % of arginine requirement), T₂ (125 % arginine), T₃ (175 % arginine), T₄ (125 % arginine for finisher period only) and T₅ (175 % arginine for finisher period only). The serum total protein and globulin levels were significantly higher ($P < 0.05$) in the birds fed with 175 % L- arginine in both starter and finisher period. The uric acid value was significantly higher in all the treatments supplemented with arginine when compared to control. There was numerical decrease in total cholesterol and triglycerides in all supplemented groups compared to control.

Key Words- Broiler Chicken, L-Arginine, Serological Parameters, Serum Protein.

Citation: Sathyapriya A., et al., (2018) Effect of Supplementing Higher Level of Dietary L-Arginine on Serum Parameters in Broiler Chicken. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 10, Issue 4, pp.-5180-5182.

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Academic Editor / Reviewer:

Introduction

The excess fat presence in broiler chicken is undesirable due to its effect on reducing feed efficiency and a major human health concern. Studies revealed that arginine supplementation reduced carcass fat content and increased meat production in poultry which were evaluated through serum lipid profile. Arginine is essential for productive performance in broilers where inclusion of L-arginine at the level of 2.5 % resulted in a significant increase in total protein concentration in serum [1]. Moreover, the inclusion of L- arginine in broiler chicken diets at the level of 250 % of their requirement from 1 to 49 days of age significantly reduced the concentration of triglyceride and total cholesterol and improved in serum urea and uric acid at 49 days of age. Regarding total cholesterol, triglyceride and total lipids, these levels were significantly decreased in chicks produced from eggs injected with L- arginine [2]. In addition to that [3] reported that 21 days old broiler chicken diets were supplemented with L-arginine at the levels of 0.25 %, 0.50 %, or 1.00 % for 3 weeks reduced plasma triglyceride and total cholesterol concentrations. Levels of serum alkaline phosphatase, alanine aminotransferase, aspartate aminotransferase and creatinine did not differ between groups, while blood urea nitrogen in the experimental group in which diet supplemented with 10 % L- arginine was lower than other groups on day 0-10 [4]. In addition to that 0.25 % L- arginine supplementation in the diets of broiler chickens reduced the blood plasma, total cholesterol and triglyceride concentrations [5]. Recent evidences about arginine supplementation were reported by [6] that lowered total serum cholesterol and triglyceride levels in the hens supplemented with 8.5 mg L- arginine / kg diet than those of hens in the 0 mg L-arginine / kg diet. Hence, the study was designed and evaluated by supplementing different levels of arginine on serum biochemical parameters in broiler chicks.

Materials and Methods

The chicks were distributed randomly to the 5 experimental groups with equal sex

ratio with 3 replicates of 10 chicks were maintained for each treatment. Two types of diets were used over the period of experiment; starter diet was used from 1 to 21 days and finisher diet till the end of the experiment (22-42 days). The control diet consisted (T₁) of 100 % arginine for starter and finisher period as per the [7] requirement and four treatment groups with 125 % (T₂) and 175 % (T₃) arginine level compared to control during both starter and finisher periods and 125 % (T₄) and 175 % (T₅) arginine level during finisher period only compared to control. The required amount of L- arginine (free base) extra pure was purchased from Sisco Research Laboratory (SRL). The experimental diet was formulated as per [8]. The feed ingredient composition (%) of the broiler chicken starter diet (0-3 weeks) and finisher diet (4-6 weeks) were depicted in the [Table-1] and [Table-2] respectively. At the end of experimental period, 6 birds from each group (2 birds / replicate) were randomly selected and culled. Blood samples were collected into non-heparinized tubes and serum was collected by centrifugation (at 3000 rpm for 20 minutes). Serum samples were analysed for concentrations of triglyceride, total cholesterol, uric acid, total protein and albumin concentrations and were determined by using an automatic analyzer with standard chemicals. All the standard reagents were purchased from Agappe diagnostics Ltd, Ernakulam, Kerala.

Results

The results of the effect of dietary supplementation of L-arginine on serum biochemical parameters viz., total protein, albumin, globulin, total cholesterol, triglycerides and uric acid contents of broiler chicks are furnished in [Table-3]. The serum total protein and globulin levels were significantly higher ($P < 0.05$) in the birds fed with 175 % L- arginine in both starter and finisher period. The uric acid value was significantly higher in all the treatments supplemented with arginine when compared to control. No significant ($P > 0.05$) difference were observed on the levels of serum albumin, total cholesterol and triglycerides.

However, numerical reduction was noticed in the total cholesterol and triglyceride values which agrees with the findings of [2,9,1,3,6].

Table-1 Feed ingredient composition (%) of the broiler chicken starter diet (0-3 weeks)

Ingredient	T ₁	T ₂	T ₃	T ₄	T ₅
Maize grain	53.00	53.00	53.00	53.00	53.00
Soyabean meal	33.68	33.68	33.68	33.68	33.68
Dry fish	5.00	5.00	5.00	5.00	5.00
Palm oil	4.00	4.00	4.00	4.00	4.00
Mineral mixture*	2.00	2.00	2.00	2.00	2.00
Common salt	0.25	0.25	0.25	0.25	0.25
L – Lysine	0.09	0.09	0.09	0.09	0.09
DL – Methionine	0.20	0.20	0.20	0.20	0.20
L – Arginine	0.00	0.39	1.17	0.00	0.00
Feed additive**	0.61	0.61	0.61	0.61	0.61
Saw dust	1.17	0.78	0.00	1.17	1.17
Calculated nutrient density					
ME (kcal / kg)	3086	3086	3086	3086	3086
Crude protein (%)	22.22	22.22	22.22	22.22	22.22
Calcium (%)	1.01	1.01	1.01	1.01	1.01
Available phosphorous (%)	0.53	0.53	0.53	0.53	0.53
Lysine (%)	1.30	1.30	1.30	1.30	1.30
Methionine (%)	0.58	0.58	0.58	0.58	0.58
Arginine (%)	1.56	1.95	2.73	1.56	1.56

***Mineral mixture:** each kg of diet supplied with 6.40 g Calcium, 1.20 g Phosphorous, 55 mg Manganese, 2 mg Iodine, 52 mg Zinc, 2 mg Copper and 20 mg Iron,

****Feed Additives:** Vitamin AB₂D₃K – 0.03 %, Ultra Vit-M – 0.05 %, Coccidiostat – 0.050 %, Perivac plus (each 200 g contains Vitamin E 20 g, Biotin 160 mg, Selenium 50 mg and carrier) – 0.050 %, Choline chloride – 0.40 %, Probiotic – 0.03 %.

Table-2 Feed ingredient composition (%) of the broiler chicken finisher diet (4-6 weeks)

Ingredient	T ₁	T ₂	T ₃	T ₄	T ₅
Maize grain	57.00	57.00	57.00	57.00	57.00
Soya bean meal	28.00	28.00	28.00	28.00	28.00
Dry fish	5.50	5.50	5.50	5.50	5.50
Palm oil	5.50	5.50	5.50	5.50	5.50
Mineral mixture*	2.00	2.00	2.00	2.00	2.00
Common salt	0.25	0.25	0.25	0.25	0.25
DL – Methionine	0.18	0.18	0.18	0.18	0.18
L – Arginine	0.00	0.34	1.02	0.34	1.02
Feed additive**	0.55	0.55	0.55	0.55	0.55
Saw dust	1.02	0.68	0.00	0.68	0.00
Calculated nutrient density					
ME (kcal / kg)	3228	3228	3228	3228	3228
Crude protein (%)	20.02	20.02	20.02	20.02	20.02
Calcium (%)	1.01	1.01	1.01	1.01	1.01
Available phosphorous (%)	0.54	0.54	0.54	0.54	0.54
Lysine (%)	1.12	1.12	1.12	1.12	1.12
Methionine (%)	0.54	0.54	0.54	0.54	0.54
Arginine (%)	1.37	1.71	2.40	1.71	2.40

***Mineral mixture:** Each kg of diet supplied with 6.4 g Calcium, 1.2 g Phosphorous, 55 mg Manganese, 2 mg Iodine, 52 mg Zinc, 2 mg Copper and 20 mg Iron.

****Feed Additives:** Vitamin AB₂D₃K – 0.01 %, Ultra Vit-M – 0.01 %, Coccidiostat – 0.050 %, Perivac plus (each 200 g contains Vitamin E 20 g, Biotin 160 mg, Selenium 50 mg) – 0.050 %, Choline chloride – 0.40 %, Probiotic – 0.03 %

Discussion

The birds fed with 75 % more arginine in both starter and finisher phases of the growth trial (T₃) and only in the finisher period groups (T₅) had significantly higher ($p < 0.05$) serum total protein and globulin content when compared to the control group (100 %) but comparable with the groups had 25 % more arginine in both phases of the growth period (T₂) and only in the finisher period (T₄). The higher concentration of serum total protein in arginine supplemented groups could be possibly associated with higher demand for lean tissue maintenance and turnover [6]. Moreover, increased globulin fraction in arginine supplemented groups might be due to increased immune response [12]. The uric acid value was significantly higher ($p < 0.05$) in the birds fed with higher levels of L-arginine when compared with the control. The increased uric acid level in the excess arginine supplemented

group of birds could be due to the fact that increased arginase activity in the kidneys [13] and the remaining products of arginine catabolism also resulted in increased uric acid in the serum [5]. A numerical reduction in total cholesterol and triglyceride values in arginine supplemented groups observed in this study might be due to the decreased expression of LPL in the liver [10].

Table-3 Effect of dietary supplementation of excess level of arginine on serum biochemical parameter of broiler chicks (Mean $\pm$ SE)

Parameters	Control T ₁	L – arginine supplemented group			
		T ₂	T ₃	T ₄	T ₅
Total protein (g %)	3.15 ^a ± 0.25	3.53 ^{ab} ± 0.07	3.93 ^b ± 0.08	3.55 ^{ab} ± 0.07	3.92 ^b ± 0.14
Albumin (g %)	1.75 ± 0.13	1.86 ± 0.11	2.03 ± 0.07	1.86 ± 0.05	1.98 ± 0.08
Globulin (g %)	1.40 ^a ± 0.13	1.67 ^{ab} ± 0.14	1.90 ^b ± 0.12	1.69 ^{ab} ± 0.06	1.93 ^b ± 0.11
Total cholesterol (mg %)	134.00 ± 5.15	125.17 ± 4.59	120.17 ± 5.08	132.00 ± 6.24	128.83 ± 4.64
Triglycerides (mg %)	31.83 ± 2.01	28.17 ± 1.87	27.50 ± 2.22	28.67 ± 1.25	26.33 ± 2.17
Uric acid (mg %)	3.91 ^a ± 0.25	5.47 ^b ± 0.64	5.57 ^b ± 0.38	5.37 ^b ± 0.21	5.84 ^b ± 0.58

Mean of 6 samples

^{a,b} Means with different superscripts in a row differ significantly ($p \leq 0.05$)

Conclusion

The results revealed that adding 75% more arginine than the recommended level to the broiler chicken diet either from day old or from the finisher period significantly increased ($P < 0.05$) the serum total protein and globulin. There was numerical decrease in total cholesterol and triglycerides in all higher level of arginine supplemented groups compared to control.

Application of research:

1. By using L-arginine in the broiler diet we can have improved body weight gain, breast yield and feed efficiency.
2. We can also reduce the fat deposition in the abdominal region of the broiler.

Acknowledgement: Author are thankful to Department of Animal Nutrition, Madras Veterinary College, Tamil Nadu Veterinary and Animal Sciences University, Chennai, 600 007

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Research project name or number [NIL].

Author Contributions: All author equally contributed.

Author statement: All authors read, reviewed, agree and approved the final manuscript

Conflict of Interest: None declared.

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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