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The Effect of Different Levels of Threonine on Performance and Carcass Characteristics of Broiler Chickens

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ABSTRACT: This study was conducted to investigate the effect of different levels of threonine on performance and carcass characteristics of broilers on 160 mail Ross 308 broiler chicks in a completely randomized design with 4 treatments and 4 replicates for each treatment for forty-two days. Basal diet containing corn, soybeans and wheat was regulated recommendations based catalogs of Ross.Incremental levels of threonine supplementation were added to the basal diet to 4 treatments in a range of 94(control),105,110 and 115 percentage of threonine be provided.Traits major were feed intake ,weight gain, feed conversion ratio, Carcass Characteristics and total cost of nutrition were measured at the end of 42 days.The results of this study indicated that in total period of the breeding,the highest feed intake and weight gain is related to treatments of threonine 110 and 115 percentage,therefore the best feed conversion ratio has been achieved with the use of these treatments.The results of Carcass characteristics indicated that threonine 115 percentage treatment has the highest percentege of carcass and control is minimal.Also,the highest percentaje of abdominal fat related to 115 percentage treatment and the lowest it percentage is related to threonine 105 percentage treatment.The highest relative percentages of heart,bursa fabricius and breast was obtained with threonine 115 percentage treatment ,however , the relative percentages of liver,thigh and gizzard was not affected by different levels of dietary threonine .Finally the lowest feed cost per kg of body weight was observed with threonine 115 percentage treatment.

Keywords: Broilers, Performance, Threonine, Carcass Characteristics.

INTRODUCTION

Protein and amino acids has several functions including biosynthesis of various tissues and animal products. Among the nutrients, protein is the most expensive, however all the amino acids are important and none can be considered trivial but some are more important than others and are known as essential amino acids. Supply of essential amino acids in poultry nutrition is great concern, including threonine, after methionine and lysine is the third limiting amino acid in diets for broilers (Khan et al., 2006). Kerr et al, (1999) reported that adequate levels of threonine are required for optimal growth. Threonine as an important part of protein acts. An important goal of the diets formulation, provided at least limited amounts of amino acids for maintenance and growth needs with minimal cost (kidd, 2000). Khan et al, (2006) found that amino acids make up about 25 percent of total feed costs. Thus, the concentration of amino acids in the diet must be strictly in accordance with maintenance requirements and protein synthesis in tissues of broilers will provide since, Values less than or more than the supply of the amino acid sequence cause decrease performance and increase adverse environmental impacts due to nitrogen excretion. Kidd, (2000) reported that environmental effects of increased nitrogen excretion are increased in the late period, because feed intake increases with age. The results of the experiments by (Ciftci and Ceylan, 2004) indicate that the threonine requirements of broiler chickens at various ages is variable. Factors such as dietary crude protein, breed, sex, age and main bird-forming diet can affect the threonine requirements. Smith et al, (1988) found that the threonine requirements of broiler chickens to improve feed conversion efficiency higher than weight gain. Khan et al, (2006) found that threonine levels around 0.7 percent, weight gain and feed conversion efficiency is improved. Provide sufficient levels of the amino acid threonine in broiler diets is important, therefore the main aim of the present study is investigation the response of broiler growth and its carcass characteristics to different levels of dietary threonine.

MATERIALS AND METHODS

In this study 160-day-old male Ross 308 chicks were studied. After hatching, chicks from incubation center were transferred to the research field. Rations for 3 Phase rearing with different threonine levels were adjusted by software UFFDA. Composition of the diets is shown in table 1. Metabolizable energy content of all experimental diets in all periods of the breeding is similar. Chickens were randomly selected and kept in an open-sided partitioned deep litter pens. Adequate ventilation was ensured to make the birds comfortable. The floor was covered with wood shavings to act as absorbent for the faecal droppings. The feeding and water troughs were cleaned daily to ensure there was no contamination. All the necessary prophylactic and vaccination schedules were followed.

Location of the Study

The research was conducted at the Agricultural Research Station, University of Guilan. The experiment was lasted 42 days. Experiment was the same rearing conditions and management and water and feed consumption during the breeding was ad libitum.

Experimental Design

One hundred and sixty (160), day-old male Ross 308 chicks were assigned to a Completely Randomized Design experiment with four treatments and four replications, in 16 experimental units with ten birds in each replicate.

Table 1. Composition and analysis of experimental diets

Ingredient(%)	starter diets				grower diets				finisher diets			
	control	105	110	115	control	105	110	115	control	105	110	115
Corn[1]	48.6	48.6	48.6	48.6	55.83	55.83	55.83	55.83	53.73	53.73	53.73	53.73
Wheat	10	10	10	10	10	10	10	10	10	10	10	10
Wheat braun	-	-	-	-	-	-	-	-	9.12	9.12	9.12	9.12
Soybean meal[2]	35.49	35.44	35.40	35.35	30.11	30.07	30.03	29.99	23.48	23.45	23.58	23.55
Soybean oil	1.65	1.65	1.65	1.65	0.37	0.37	0.37	0.37	0.15	0.15	0.15	0.15
Oyester shell	1.29	1.29	1.29	1.29	1.04	1.04	1.04	1.04	1.03	1.03	1.03	1.03
Dicalcium phos.	1.79	1.79	1.79	1.79	1.46	1.46	1.46	1.46	1.32	1.32	1.32	1.32
Salt	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.15	0.15	0.15	0.15
Premix[3]	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.15	0.15	0.15	0.15
D L-Methionine	0.17	0.17	0.17	0.17	0.25	0.25	0.25	0.25	0.21	0.21	0.21	0.21
L-Threonine	0.12	0.17	0.21	0.26	0.05	0.09	0.13	0.17	0.05	0.08	0.12	0.15
Anti coccidiosis	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sodium bicarbonate	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.21	0.21	0.21	0.21
Calculated analysis: AME_n (kcal/kg)	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900
CP(%)	21.09	21.09	21.09	21.09	19.33	19.33	19.33	19.33	17.21	17.21	17.21	17.21
Cf(%)	3.85	3.85	3.85	3.85	3.63	3.63	3.63	3.63	3.62	3.62	3.62	3.62
Linoleic acids (%)	2.1	2.1	2.1	2.1	1.58	1.58	1.58	1.58	1.47	1.47	1.47	1.47
Ca (%)	1	1	1	1	0.82	0.82	0.82	0.82	0.77	0.77	0.77	0.77
$P_{available}$ (%)	0.48	0.48	0.48	0.48	0.41	0.41	0.41	0.41	0.38	0.38	0.38	0.38
Na(%)	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14
Cl(%)	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.14	0.14	0.14	0.14
K(%)	0.9	0.9	0.9	0.9	0.81	0.81	0.81	0.81	0.71	0.71	0.71	0.71
Met(%)	0.49	0.49	0.49	0.49	0.54	0.54	0.54	0.54	0.48	0.48	0.48	0.48
Met+Cys(%)	0.83	0.83	0.83	0.83	0.87	0.87	0.87	0.87	0.78	0.78	0.78	0.78
Lys(%)	1.33	1.33	1.33	1.33	1.19	1.19	1.19	1.19	1.02	1.02	1.02	1.02
Arg(%)	1.11	1.11	1.11	1.11	0.98	0.98	0.98	0.98	0.83	0.83	0.83	0.83
Tre(%)	0.9	0.95	0.99	1.02	0.76	0.79	0.83	0.87	0.67	0.7	0.73	0.77
Try(%)	0.3	0.3	0.3	0.3	0.26	0.26	0.26	0.26	0.23	0.23	0.23	0.23

[1]- 8.5% cp.-[2]-44% cp.-[3]-provided per kg of diet : vitamin A , 9 , 000 Iu ; vitamin D_3 , 1,500 Iu ; vitamin E , 10 Iu; vitamin K_3 , 5 mg ; vitamin B_{12} , 0.007 mg ; thiamin , 0.4 mg ; riboflavin , 6 mg ; folic acid , 1 mg ; biotin , 0.15 mg ; pantathenic acid , 12 mg ; niacin , 35 mg ; pyridoxine , 4 mg ; choline , 1 , 000 mg ; Mn , 60 mg ; Cu , 5 mg ; Zn , 50 mg ; Se , 1 mg ; I , 0.35 mg ; ethoxyquin , 1,25 mg

Data Collection

This study was conducted to investigate the effect of different levels of amino acid threonine on performance and carcass characteristics of broilers for 42 days. Experimental treatments is include of four levels of threonine (94, 105, 110, 115%) of the recommended training manual. The chicks weighed at the beginning and at the end of experimental period (42 days). To calculate the average daily weight gain of chicks the method was used of chicken day until died chicks during the experiment be considered and carefully tested does not reduce. With chickens weighing, the amount of feed consumed per experimental unit after deducting the residual value at the end of the feed were weighed from at the beginning of the period and to calculate the average daily intake of poultry was used in the same way until feed intake of chicks during the experiment be considered and carefully experiment does not reduce. After these steps feed conversion ratio of each experimental unit was determined. Then at the age of 42 days from each experimental unit 2 chicks close to the average weight of herd selected and after installing a number starved for 10 to 12 hours until to be emptying gastro intestinal tract and then kill the chickens and were feather picking. Heads, feet and intestines isolated but the heart, liver and gizzard after emptying their contents has been into the abdominal cavity and all of them as a set percentage of carcass weight. Simultaneous determination of carcass efficiency percentage, abdominal fat around the heart, liver, gizzard and intestines were collected for physical and the percentage of abdominal fat based on live weight was calculated. To calculate the average percent relative weights of liver, gizzard, thigh, heart, bursa fabricius and breasts in 42 days the birds are slaughtered, begining each weight of these organs weight in grams and the its relative percentage based on live weight was calculated. Feed cost per kg weight gain was calculated using the following formulas.
Feed cost per kg weight gain = Feed cost per unit × FCR

Statistical Analysis

The SAS (2001) software was used for data analysis and Duncan (1955) test was used for average comparison at the 5% level of significance. Excel software also was used to draw the graphs. The linear model below was used for the data analysis.

$Y_{ij} = \mu + T_i + \varepsilon_{ij}$

Where Y_{ij}= the value of each observation
μ= overall general mean common to all observations
T_i= the effect of ith treatment (i = 1, 2, 3,4)
ε_{ij} = random error effects peculiar to each observation

RESULTS AND DISCUSSION

Average indices measured the entire period is presented in table 2. The results of this study showed that statistically Feed intake, body weight gain and feed conversion between the experimental groups were significantly affected by different levels of dietary threonine ($p<0.05$). Accordingly most of the feed consumption is related to the treatments containing threonine 110 and 115 percent**.** Process weight gain of the experimental treatment, in the different periods of the breeding such that in whole period chickens fed diets containing high levels of threonine (especially threonine 115% higher than the Ross catalog) higher weight than other experimental and control groups, respectively. According to table 2 be noted that among treatments for feed conversion there is a difference ($p<0.05$) and at the whole period, treatment (thr 115% higher than the catalog) the lowest (best) feed conversion and control (94% Recommended Catalog) has the highest (worst) feed conversion. The percentage of carcass efficiency significant difference was observed between treatments ($p<0.0$), and treatment of the thr 115 percent, the highest percentage and control the lowest percentage of carcass demonstrated. The highest abdominal fat in treatment of thr 115% and lowest abdominal fat in treatment of thr 105% was observed. The relative weight of the heart and bursa fabricius, treatment of the Thr 115% is the highest weight. The relative weight of the breast meat also with the addition of threonine up to 115% to the experimental diets represents a substantial increase compared to the control treatment. However, the percentage of relative liver, gizzard and thigh were not affected by different levels of dietary threonine. The lowest feed cost per kg of body weight was observed with threonine 115 percentage treatment.

Table 2. The effect of different levels of threonine on performance and carcass characteristics of broilers

Parameter	Dietary treatments% (different levels of threonine) Control(Recommended catalog)	105	110	115	SEM
Daily Feed Intake (gr/bird) 0 to 42 d	122.57 [b]	121.1 [b]	129.73 [a]	129.05 [a]	1.38
Daily weight Gain (gr/bird) 0 to 42 d	56.76 [c]	58.84 [c]	63.28 [b]	67.82 [a]	0.88
Feed Conversion (gr/gr) 0 to 42 d	2.16 [a]	2.05 [b]	2.05 [b]	1.9 [c]	0.02
Carcass Percentage 42 d	67.07 [b]	69.23 [b]	68.37 [b]	74.77 [a]	1.67
Abdominal Fat Percentage 42 d	0.78 [b]	0.45 [c]	0.92 [a]	0.94 [a]	0.02
Heart Percentage 42 d	0.45 [b]	0.55 [ab]	0.48 [b]	0.6 [b]	0.78
Bursa Fabricius percentage 42 d	0.7 [c]	0.85 [c]	1.15 [b]	2.22 [a]	0.02
Breast Percentage 42 d	18.32 [c]	20.75 [b]	21.32 [b]	23.79 [a]	1.27
Liver Percentage 42 d	2.53 [a]	2.5 [a]	2.27 [a]	2.62 [a]	0.20
Thigh Percentage 42 d	19.57 [a]	19.97 [a]	19.27 [a]	19.9 [a]	0.49
Gizzard Percentage 42 d	3.13 [a]	2.82 [a]	2.87 [a]	2.85 [a]	0.17
Feed Cost per kg body weight 0 to 42 d	25956.16 [a]	24711.75 [b]	24597.74 [b]	22833.94 [c]	36.11

[a-c] Value within a row with no common superscripts are significantly different ($p<0.05$)

Discussion

In the present study, increasing dietary threonine (110 and 115% higher than the required catalog) compared with other treatments the highest feed intake is achieved. It appears that the addition of dietary essential amino acid threonine leading to increased growth and breast muscle weight gain and this creates the possibility that animals need to consume more feed in order to achieve rapid growth is stimulated that this issue is cause to increased feed intake with increasing levels of dietary threonine in this research. The results of the experiment by (Khan et al., 2006) to study the effect of different levels of threonine and protein in the starter and growth period on performance and carcass characteristics of broilers showed that feed intake will not be affected by the levels of dietary threonine, that to results of this study are contrary. Contrary to this, (Ciftci and Ceylan, 2004) reported that threonine significant effect on feed intake that is the results of this study correspond. The results of this experiment with the results of the study by (Kidd et al.,1996) has been inconsistent. Gain obtained in the present study in birds of fed diets containing high threonine (treatments 110 and 115%) by improving nitrogen retention and threonine intake is high which leads to chickens performance are better. In fact, significant differences in mean body weight gain among the various experimental treatments more due to is the level of dietary threonine thus, the response of broilers to dietary protein most affected is the limiting amino acid. Chung et al, (1995) found that body weight increases with the addition of dietary threonine, these findings correspond with the results of the present study. Khan et al, (2006) to evaluate the effect of different levels of threonine and protein on broiler performance found that the interaction between these two factors on all functional traits is significant. According to study by (Kidd, 2000) to evaluate the digestible threonine requirement at growth period of broilers it was found that feed conversion ratio was significantly is affected by different levels of dietary threonine that is consistent with the present results. Based on the its results addition of threonine to diets to improve feed conversion. In the present experiment, adding up to 115% of threonine decreased feed conversion. (Kidd and kerr, 1996) reported that threonine supplementation to diets of broilers no effect on FCR, which is contrary with this study.

Due to higher feed intake and consequently more weight gain in the 115% treatment (Thr surplus to requirements catalog) carcass percentage was higher in this treatment compared to other groups. Khan et al, (2006) found that supplementing diets with different levels of threonine has a significant effect on carcass weight which is consistent with the findings of the present study.

According to same energy diets at different periods of rearing, one reason for the increase in carcass fat in chicks fed high levels of threonine, is the increase amount of essential amino acids because, excess amino acid carbon skeletons when the body's metabolism to become acetyl coenzyme A and this combination also to aceto acetyl coenzyme A, and finally is converted into fat and stored in the body. Whereas consumer demand has caused breast meat production to be the first goal breeding of broilers, genetic selection done by poultry breeding companies is leads to a relative increase in breast meat and lower organs non-beneficial and abdominal fat. In this study the increase in essential amino acids, increased storage of nitrogen in the carcass and improved efficiency in the body and the result is an increase in meat breast. (Ciftci and Ceylan, 2004) reported that threonine-protein interactions has no effect on abdominal fat. Corzo et al, (2003) found that lysine and threonine on breast meat production are interaction. Lysine and threonine, respectively, are the first and second limiting amino acid for breast meat and fed with high levels of lysine regardless threonine breast meat production is limited. Addition of threonine to the diet of broilers will lead to improved breast meat which is consistent with the results of this study. The comparison of the percent relative heart, lowest in the control treatment and highest percentage of relative heart was observed in 115% treatment. Because the highest weight gain was observed in 115% treatment.

According to table 2, highest weight of the bursa fabricius with the use of 115% treatment has been achieved. Increase the size of the bursa fabricius is effective in support the immune system and prevent infections. Khan et al., (2006) found that increasing dietary threonine levels with Yeast Saccharomyces significantly increased number of white blood cells and can improve immune function. Among the amino acids threonine through the participate in building of immunoglobulin in immune system and the bird performance has an important role (Ball, 2001). Defa et al, (1999) reported that threonine requirement for immune system higher than requirements for growth. According to studies by (Tenenhouse and Deutsch, 1966) threonine is the most Y- globin in poultry, rabbit and human. Thus, threonine can be effective in Strengthening of immune system.

CONCULSION

Based on the results of this experiment in total period of the breeding most of the feed intake and body weight gain with the use of 110 and 115% treatments has been achieved, thus the best feed conversion ratio is also related to the above treatments. The results of carcass traits showed that threonine 115 percent treated contain the highest carcass percentage and control is minimal. The highest percentage of abdominal fat in the experimental group treated with 115% and the lower percentage in 105% is obtained. The highest relative percentage of heart and breast with the use of 115% treatments has been achieved However, the relative percentage of liver, gizzard and thigh were not affected by different levels of dietary threonine. The lowest feed cost per kg live weight of chickens were found in the experimental group containing threonine 115%, that due to suitability of FCR in this experimental group is compared to other groups. In the present study, using threonine 115% higher than the recommended level of Ross catalog than other threonine levels has shown the best performance.

REFERENCES

Ball RO. 2001. Threonine requirement and the intraction between threonine intake and gut mucins inpigs. Degussa symposium, Banff Pork seminar. January 23,2001, Banff, Alberta, Canada.

Ciftci I and Ceylan B. 2004. Effect of dietary threonine and crude protein on growth performance, carcass and meat composition of broiler chickens. *Br. Pult. Sci*.45.,280-289.

Corzo A. 2003. Added threonine may sustain growth in Low-Protein diets. *Feed stuffs*. 75:12-14.

Chung TK. 1995. Effect of dietary threonine on growth performance and carcass characteristics of broiler chickens raised at high temperature. *Deptt. Anim. Sci*., Faculty of Agri., Khan Keen Univ. ADM Bio-Products, Areher Daniels Midland Co., Singapore, pp 1-3.

Duncan DB. 1955. Multiple range and Multiple F-test Biometrics. 11: 1-42.

Defa L. 1999. Effects of dietary threonine on performance, plasma parameters and immune function of growing pigs. *Feed Sci and Technol*. 78: 179-188.

Khan AR. 2006. Effect of different levels of digestibility threonine on growth performance of broiler chicks. *J. Anim. Sci*: 16(1-2).

Kidd MT and Kerr BJ. 1996. L-threonine for poultry :A review. *J. APPl. poult. Res.* 5:358-36.

Kidd MT. 2000. Nutritional considerations concerning threonine in broiler.*Worlds Poult.Sci.J*.56:139-151.

Kidd MT. 1996. Growth and carcass characteristics of broilers fed low protein, threonine supplemented diets. *J. Appl. Poult. Res*. 5(2): 180-190.

Kerr BJ. 1999. Interactive effects of lysine and threonine on live performance and breast yield in male broilers. *J. Appl. Poult. Sci*. 8: 391-399.

SAS Institute. 2001. SAS User Guide Statics. Version 8.2. Ed. SAS instituteInc; Cary, NC. USA.

Smith N. 1988. Investigation of threonine requirements of broiler chickens fed diets based on grain sorghum and soybean meal. *Poult. Sci*. 67: 108-112.

Tenenhouse HS and Deutsch HF. 1966. Some physical-chemical properties of chicken gammaglobulins and their pepsin and papin digestion product. *Immuno Chemistry*, 3: 11-20.