GROWTH PERFORMANCE AND GUT MORPHOLOGY OF BROILER PRESTARTER CHICKS FED L-THREONINE SUPPLEMENTED DIETS

***Kamil, M. F., Babajide, M. I, Alli, M. E., Adewara P. R., Adeola, E. A. and Agboola A. F.**
Department of Animal Science, University of Ibadan, Ibadan, Oyo State, Nigeria.
*Corresponding author: adefahiz@gmail.com; +2349165168605

ABSTRACT
Threonine is considered as the third limiting amino acid in corn-soybean meal-based diets, following methionine and lysine, and is crucial for optimal growth and development of poultry birds. This study was designed to determine the influence of dietary L-threonine supplementation greater than National Research Council (NRC) recommended level on growth performance and gut morphology of broiler chickens. In a 14-day feeding trial, one hundred and sixty (160) one-day old Abor Acre chicks were allotted into four dietary treatments with five replicates with eight birds per replicate in a completely randomised design. Treatment 1 was the basal diet with no L-threonine supplementation (control), while treatments 2, 3 and 4 were basal diet supplemented with 10, 20, and 30% L-threonine greater than NRC recommendation, respectively. Data was subjected to descriptive statistics and ANOVA at α0.05. Growth performance indices were measured. At day 14, samples from the jejunum were collected for histomorphology. There were no significant (p>0.05) differences in the growth performance indices measured across the experimental treatments. Birds fed L threonine diet >10% NRC (114.00 µm) and >30% NRC (119.20 µm) had shallow crypt depth compared to control (161.40 µm). However, birds fed >30% NRC (5.62) had higher villus height/crypt depth ratio compared to control (3.91). In conclusion, L-threonine supplementation had no influence on growth performance of broiler chickens. However, L-threonine supplementation 30% greater than NRC recommendation improved the gut morphology of the birds.
Keywords: Broiler chicks, Growth response, Gut morphology, L-Threonine

INTRODUCTION

In the poultry industry, there have been enhanced production efficiency over the years due to genetic improvements, nutrient maximisation and progressive management. Threonine supplementation has been extensively studied for its effects on the growth performance of broiler chickens (Qaisrani *et al*., 2018; Kamel and Jameel, 2022). Threonine is recognised as the third limiting amino acid in corn-soybean meal-based diets, following methionine and lysine, and is crucial for optimal growth and development in poultry (Qaisrani *et al*., 2018). The positive impact of threonine on growth performance can be attributed to its role in enhancing intestinal health, which is vital for nutrient absorption and overall growth efficiency (Kamel and Jameel, 2022). The effects of threonine on feed conversion ratio (FCR) in broiler chickens are also noteworthy (Ng'ambi *et al*., 2017). Studies indicate that threonine supplementation can lead to improved nitrogen utilisation and reduced protein requirements in broilers, thereby enhancing FCR. The optimal level of threonine supplementation appears to vary depending on the specific dietary formulation and the growth stage of the chickens. Research indicates that increasing dietary threonine concentrations to around 0.74% can maximize growth performance in broiler chickens (Rezaeipour *et al*., 2012). Recent advancements in genetic modifications of broiler chickens necessitates the need to review their nutritional requirements. Hence, this study investigated the impact of dietary L-threonine supplementation above the NRC recommendation on growth performance and gut morphology of broiler chicks, with the objective of providing valuable insights to optimise threonine nutrition and further enhance production efficiency.

MATERIALS AND METHODS

Experimental site

The study was conducted at the Poultry Unit, Teaching and Research Farm, University of Ibadan. The experiment was conducted in compliance with the Animal Care and Use Research Ethics of the University of Ibadan.

Experimental animals, diets, design, and management

A total of one hundred and sixty (160) one-day old Abor Acres broiler chicks were randomly assigned to four dietary treatment groups, with five replicates of eight birds per replicate in a completely randomised design. The experimental diets were formulated 10, 20 and 30% above the NRC (1994) recommended level. The basal diets consisted of metabolisable energy, crude protein and threonine levels of 2963.98 kcal/kg 23.11% and 0.80%, respectively. Feed and water were offered to the birds *ad libitum*. Other management procedures were carried out in accordance with routine practices. The study lasted for 14 days.

Experimental layout

Treatment 1: Basal diet + no threonine supplementation
Treatment 2: Basal diet + 10% > NRC threonine recommendation

Treatment 3: Basal diet + 20%> NRC threonine recommendation
Treatment 4: Basal diet + 30%> NRC threonine recommendation.

Data Collection

Body weight was measured weekly, and weight gain was calculated by subtracting the initial weight from final weight. Feed intake was calculated based on the difference between feed offered and leftover, while feed conversion ratio was calculated as the ratio of feed intake to body weight. At day 21, birds were sacrificed for gut morphological measurement. Jejunal samples were collected and immersed in a phosphate-buffered formalin solution. Transverse sections (3µm) were cut, stained by hematoxylin-eosin, and analysed under a light microscope to determine morphometric indices. Villus height, crypt depth, and villus width were measured, while the ratio of villus height to crypt depth was calculated.

Statistical analysis

Data were subjected to descriptive statistics and ANOVA using JMP (2017) statistical software. Treatment means were compared using Tukey's HSD test at P<0.05.

RESULTS AND DISCUSSION

Growth performance of broiler chicks fed L-threonine supplemented diets

The results of the growth performance of broiler chicks fed L-threonine supplemented diets are shown in Table 1. There was no significant (p>0.05) difference observed in the average daily weight gain, feed intake, and feed conversion ratio. This is consistent with the findings of (Rezaeipour *et al*., 2012), who reported that dietary threonine supplementation in excess of NRC supplementation did not improve body weight gain, feed intake and feed conversion ratio of broiler chickens. Similar observations were also reported by (Chee *et al*., 2010). The results obtained from this study imply that the recommended threonine level by NRC was optimum in supporting the growth of the birds.

Table 1: Growth performance of broiler chickens fed L-threonine supplemented diets

Parameters	CON	10%>NRC	20%>NRC	30%>NRC	SEM	P-value
IW (g/b)	42.45	43.90	42.73	44.71	0.53	0.46
ADWG (g/b)	12.96	11.94	13.16	12.82	0.48	0.84
ADFI (g/b)	19.52	18.95	20.50	20.34	0.36	0.43
FCR (g/b)	1.54	1.59	1.60	1.60	0.04	0.96

Means on the same row with different superscripts are not significantly (P>0.05) different. CON = control; NRC = national research council recommendation. IW: Initial Weight; ADWG: Average Daily Weight Gain; ADFI: Average Daily Feed Intake; FCR: Feed Conversion Ratio; SEM: Standard Error of Mean.

Gut morphology of broiler chicks fed L-threonine supplemented diets

Gut morphological indices of broiler chicks fed L-threonine supplemented diets are presented in Figures 1-4. Significant (p<0.05) differences were observed in the crypt depth and villus height/crypt depth ratio of the birds. Birds fed threonine 10%> NRC (114.00 µm) and 30%> NRC (119.20 µm) had shallow crypt depth compared to control (161.40 µm). This is in line with findings of (Qaisrani *et al*., 2018) who reported that threonine supplementation in the diets of broiler chickens decreased crypt depth. However, birds fed threonine 30%> NRC (5.62) had higher villus/crypt depth ratio compared to control (3.91), suggesting that the intestinal mucosal had good differentiation which could enhance the digestive and absorptive capacity of the birds (Izadi *et al*., 2013).

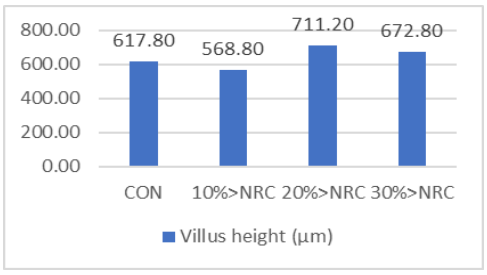

Fig. 1. Villus height (µm) of birds fed L-threonine diets

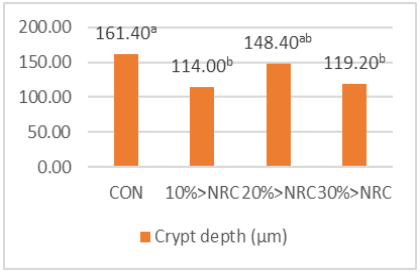

Fig. 2. Crypt depth (µm) birds fed L-threonine diets

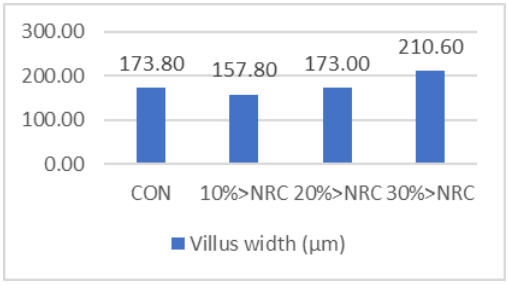

Fig. 3: Villus width (µm) birds fed L-threonine diets

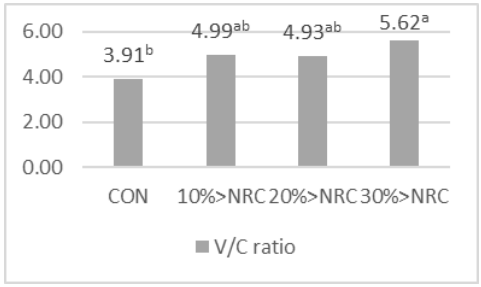

Fig. 4: V/C ratio birds fed L-threonine diets

CONCLUSION AND RECOMMENDATION

In conclusion, the results of this study showed that L-threonine supplementation 30% greater than NRC (1994) recommendation improved the gut morphology of the birds in the diets of broiler chickens. However, L-threonine supplementation had no influence on the growth performance of the birds. Future research should explore other continue to aim towards the understanding of threonine requirements for enhanced broiler chicken production.

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