EFFECT OF PARTIAL REPLACEMENT OF SOYBEAN MEAL WITH MEAT AND BONE MEAL SUPPLEMENTED WITH LIMITING AMINO ACIDS ON GROWTH PERFORMANCE OF BROILER CHICKEN

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ABSTRACT
This study determined the effect of partial replacement of soybean meal with meat and bone meal supplemented with limiting amino acids on growth performance of broiler chickens, 240 day-old broiler chicks were allotted to 6 dietary treatments in a completely randomised design (CRD) with four replicates of 10 birds per replicate, resulting in a total of 40 birds per treatment. The experimental diets were T1 (Soybean meal (+ve) control), T2 (Meat bone meal (MBM) without supplement (-ve) control), T3 (Meat bone meal (MBM) + lysine), T4 (Meat bone meal (MBM) + methionine), T5 (Meat bone meal (MBM) + lysine + methionine), T6 (Meat bone meal (MBM) + limiting amino acid). Growth parameters measured over six weeks included final body weight, weight gain, average daily gain, feed intake, and feed conversion ratio (FCR). The result shows that, the growth parameters were not significantly ($p > 0.05$) influence by amino acid supplementation in meat and bone meal (MBM)-based diets. Final body weight ranged from 1634.5 g (T6) to 1900.8 g (T5). The average daily weight gains were 43.76, 43.12, 42.02, 42.07, 44.22 and 37.88 g in T1, T2, T3, T4 and T5 respectively. Feed intake varied between 2870.2 g (T2) and 3017.9 g (T1), while the FCR ranged from 1.58 and 1.84 in T2 and T6 respectively. It was concluded that 10% MBM can partially replace SBM in broiler chicken's diets without compromising performance, provided amino acid is appropriately balanced.
Keyword: Cost, Nutrient utilization, Threonine, Protein source, Lysine

DESCRIPTION OF PROBLM

The rising global demand for poultry products increases the need for efficient and cost-effective production [1]. Broiler chicken production is a major source of animal protein, but feed accounts for 70–80% of production costs, with soybean meal (SBM) as a primary protein source due to its high crude protein content and well-balanced amino acid profile [2]. In broiler chicken production, soybean meal being a key protein source is limited by competition with human-edible protein and market price volatility, necessitates the search for alternative feed proteins [3].

Meat and bone meal (MBM) a by-product of meat processing, offers a cost-effective alternative. MBM which is rich in protein, calcium and phosphorus can partially replace SBM in broiler chicken diets and help reduce feed costs [4]. However, its amino acid profile may lack essential amino acids required for optimal broiler chicken growth [5]. Methionine is often the first limiting amino acid, followed by lysine and threonine, with deficiencies reducing growth, feed efficiency and carcass quality [6]. Supplementation with these limiting amino acids can mitigate deficiencies and support growth performance [7]. Therefore, while MBM is a viable and economical protein source, proper supplementation of limiting amino acids is necessary for optimizing growth and ensuring sustainable broiler chicken production. This study was conducted to evaluate the effect of partial replacement of soybean meal with meat and bone meal, supplemented with limiting amino acids, on the growth performance of broiler chickens.

MATERIALS AND METHODS

Experimental Site

The experiment was be carried out at the Poultry Unit of the Directorate of University Farms of the (DUFARMS), Federal University of Agriculture, Abeokuta (FUNNAB), Ogun State, Nigeria. a tropical rain forest vegetation zone of South-Western Nigeria, within latitude 7^0 9' 20.56" N and longitude 3^0 20' 40" E, elevation of 415 feet and altitude of 75 – 77 m above sea level.

Experimental Design and Management

Two-hundred-and-forty-day-old broiler chicks were allotted to six dietary treatments in a completely randomised design (CRD). Each treatment consisted of 4 replicates of 10 birds per replicate, resulting in a total of 40 birds per treatment. The feeding trial lasted six weeks. Standard management practices were observed, including brooding, vaccination and routine medication. Feed and water were offered *ad libitum* throughout the trial.

Table 1: Description of the treatment

Treatments	Ingredients
Treatment 1	Soybean meal (+ve) control
Treatment 2	Meat bone meal (MBM) without supplement (-ve) control
Treatment 3	Meat bone meal (MBM) + lysine
Treatment 4	Meat bone meal (MBM) + methionine
Treatment 5	Meat bone meal (MBM) + lysine + methionine
Treatment 6	Meat bone meal (MBM) + lysine + methionine + threonine

Table 2: Gross composition of experimental diets

Parameters	T1	T2	T3	T4	T5	T6
Maize	58	58	58	58	58	58
Meat and bone meal (MBM)	0	10	10	10	10	10
Soybean meal (SBM)	33	23	23	23	23	23
Palm kernel oil	3	3	3	3	3	3
Bone meal (BM)	2	2	2	2	2	2
Limestone	2.75	3.2	2.7	2.7	2.2	2
Methionine	0.3	-	-	0.5	0.5	0.5
Lysine	0.15	-	0.5	-	0.5	0.5
Threonine	-	-	-	-	-	0.2
Salt	0.3	0.3	0.3	0.3	0.3	0.3
Premix	0.5	0.5	0.5	0.5	0.5	0.5
Total	100	100	100	100	100	100

Premix contains vitamin A: 12,000,000 IU, Vit D3: 2, 5000,000 IU, Vit K: 2,000 mg, Vit B1: 2,250 mg, Vit B2: 6,000 mg, Vit B6: 4,500 mg, Vit B12: 15 mg, Niacin 40,000 mg, Pantothenic acid: 15,000 mg, Folic acid: 1,500 mg, Biotin: 50 mg, Choline chloride: 300,000 mg, Manganese: 80,000 mg, Zinc: 50,000 mg, Iron: 20,000 mg, Copper: 5,000 mg, Iodine: 1,000 mg, Selenium:200 mg, Cobalt: 50 mg, Antioxidant: 125,000 mg

Data Collection

Growth performance characteristics

Data on feed intake was recorded daily and body weights were measured weekly. From these measurements, total weight gain (TWG), total feed intake (TFI) and feed conversion ratio (FCR) were calculated.

Data Analysis
All data were subjected to Analysis of Variance (ANOVA) using SPSS statistics version 27. Significant differences between treatment means were determined using Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

The effects of partial replacement of soybean meal (SBM) with meat and bone meal (MBM), supplemented with limiting amino acids, on broiler chicken growth performance from 0 to 6 weeks is as shown in Table 3. Initial weights were comparable across treatments (42.40–44.88 g), ensuring uniformity at the onset of the study. Final weight, total weight gain, daily weight gain, feed intake and feed conversion ratio were not significantly ($p > 0.05$) affected by the dietary treatment. Birds fed meat and bone meal (MBM) diets supplemented with lysine and methionine (T5) recorded the highest ($p>0.05$) final weight (1900.75g) and weight gain (1857.49g), suggesting that the amino acids play a crucial role in protein synthesis and growth [8]. In contrast, birds fed diet supplemented with lysine, methionine and threonine (T6) had the lowest weight gain (1591.13g) and average daily weight gain (37.88g), indicating that amino acid imbalance or oversupply may compromise growth according to wu [7]. This aligns with [9], who reported that MBM can support growth when coupled with adequate amino acid supplementation.

Average daily feed intake (ADFI) and total feed intake were consistent across all treatments ($P > 0.05$), ranging from 68.33 to 74.51 g/day and 2870.17 to 3129.47 g, respectively. This suggests that MBM, with or without amino acid supplementation, did not alter feed consumption patterns. Feed conversion ratios (FCR) also remained similar among treatments ($p > 0.05$), with values ranging from 1.58 to 1.84, which fall within the expected range for broiler chicken (1.4–1.9) [10]. The lowest FCR was observed in diet T2 (MBM without amino acid supplementation), although this difference was not significant ($p>0.05$). Overall, partial replacement of SBM with 10% MBM maintained growth performance and feed conversion, with no significant differences ($p > 0.05$) among treatments. This outcome suggests that amino acid supplementation did not alter feed conversion ratio. Lysine and methionine supplementation enhanced growth trends, while supplementation with threonine reduced performance, emphasizing the importance of balanced amino acid formulation. These results highlight the potential of MBM as a cost-effective protein source where soybean availability is limited.

Table 3: Effect of partial replacement of soybean meal with meat and bone meal (MBM) supplemented with limiting amino acids on growth performance of broiler chicken (0-6 weeks)

Parameters	T1	T2	T3	T4	T5	T6	SEM	P-Value
Initial Weight (g)	44.88	42.40	44.40	43.21	43.26	43.37	0.169	
Final Weight (g)	1883.00	1854.00	1809.25	1810.50	1900.75	1634.50	34.02	0.251
TWG (g)	1838.12	1811.56	1764.85	1767.29	1857.49	1591.13	34.01	0.252
ADWG (g)	43.76	43.12	42.02	42.07	44.22	37.88	0.809	0.252
ADFI (g)	71.85	68.33	74.51	70.07	70.78	69.16	1.119	0.712
TFI (g)	3017.85	2870.17	3129.47	2943.25	2973.12	2904.75	47.03	0.712
FCR	1.64	1.58	1.77	1.66	1.60	1.84	0.029	0.051

SEM= Standard Error of Means, ADWG= Average Daily Weight Gain, ADFI= Average Daily Feed Intake, FCR= Feed Conversion Ratio, TFI= Total Feed Intake, TWG= Total Weight Gain

CONCLUSION AND APPLICATITION

Partial replacement of soybean meal with 10% meat and bone meal (MBM), with or without supplementation of limiting amino acids, did not significantly affect growth performance, feed intake, or feed conversion ratio in broiler chickens. Supplementation with lysine and methionine tended to enhance growth, whereas inclusion of threonine at the tested level did not provide additional benefits, emphasizing the importance of balanced amino acid formulation. These findings suggest that poultry producers can safely incorporate MBM up to 10% of the diet as a substitute for soybean meal, provided that amino acid levels are carefully adjusted to maintain optimal performance.

ACKNOWLEDGEMENT

The authors wish to appreciate the management and staff of Agro-Merit Limited for supporting this research work with the supply of the Meat and Bone Meal (MBM) used in this study.

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