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PERFORMANCE AND BLOOD PROFILE OF BROILER CHICKENS FED DIETS CONTAINING GRADED LEVELS OF *Moringa oleifera* SEED MEAL

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ABSTSRACT: A 56-day feeding trial was undertaken to investigate the effects of graded levels of ethanol treated Moringa oleifera seed meal (ETMOSM) on performance, serum and haematological characteristics of broiler chickens. 150-day-old Arbor acre chickens used in this experiment were subjected to five dietary treatments as follows; Diet 1-the control devoid of Moringa oleifera seed meal (0%MOSM), diets 2, 3, 4, and 5 –ETMOSM at graded inclusion levels of 2.5, 5.0, 7.5 and 10.0% level respectively. Results showed that ETMOSM had an effect ($p<0.05$) on the growth performance and blood profiles. There was better performance up to 2.5% MOSM but the performance declined significantly at a higher inclusion level. There was an improvement in the haematological ((PCV, RBC, HB) parameters up to 10% MOSM inclusion. The AST ALP, total protein and albumin increased significantly with the increased level of MOSM while Alkaline phosphatase reduced with the increased level of MOSM: nevertheless, there were no influence ($P > 0.05$) on the urea values. It can be suggested from the findings of this research that ethanol treated MOSM can replace soya bean meal in broiler chick diets up to 10% without deleterious effect on the growth and blood profile.

Key words: Moringa seedmeal; broiler chickens; performance; biochemical; haematological indices

INTRODUCTION

Exorbitant cost of feed is the major challenge to commercial poultry production in Nigeria. Ahaotu and Ekanem (2009) reported that it accounts for 70-85% of total poultry production cost. This is due to competition between man, animals and industry for the available legume and cereal grains which are main sources of plant proteins and energy. As a result of stiff competition for these conventional legumes like soya bean and ground nuts, efforts are being tailored towards the use of non-conventional feedstuffs especially legumes that are cheaper and locally available for livestock feeds. Nwokolo (1986) reported that these alternative feed stuffs are expected to have comparative nutritive values to the conventional ones, easy to cultivate, affordable and easy to propagate. Plant proteins are cheaper and therefore their use in large quantity ensures less expenditure as compared to animal proteins. Some nutrient chemicals however, possess well known toxic properties if consumed in excessive amounts or without adequate processing. The toxic chemicals in feeds when consumed by animals can cause a variety of actions in the body or can react in some adverse ways between the nutrients and toxins *in vivo*. For instance, some feed chemical toxins exert their action by interfering with nutrients retention, availability and some are known to adversely affect the utilization of nutrients while others have been reported to have negative influence on the metabolism of nutrients, all these chemicals which influence the metabolism negatively are called anti-nutritional factors, the anti-nutritional factors present in these feeds include trypsin, chymotrypsin and amylase inhibitors, aflatoxins and polyphenolic compounds which tend to

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inhibit and obstruct the activity of digestive enzymes thereby causing digestive losses (Singh, 1988).One of these potential tree forages is *moringa oleifera* Lam (syns Moring pterygosperm, family Moringaecae),that grows throughout the tropics (Debela and Tolera, 2013). *Moringa oleifera* seeds have been reported as good sources of the main feed ingredient including fats, proteins and minerals (Campore *et al.*, 2011). *M. oleifera* has also been reported to contain anti-nutritional factors that can impact or elicit toxic response in the fed subject due to the presence of the toxic factors (Annongu *et al.*, 2014; Daramola *et al.*, 2014). This study was conducted to investigate the effects of graded levels of ethanol treated *Moringa oleifera* seed meal on growth performance and blood characteristics of broiler chickens.

MATERIALS AND METHODS

The poultry unit of the Teaching and Research Farm, Kwara State University, Malete, Nigeria was used as an experimental site for the feeding trial. *M. oleifera* seed meal was obtained from Moringa Plantation at Afe Babalola University, Ado-Ekiti, Ekiti State of Nigeria. Five experimental diets were formulated made of a corn-soy reference diet (control) and four other diets containing ethanol treated seed meal. Fifteen kilogram (15 kg) of raw *Moringa oleifera* seed meal was soaked in 40 Litres of 80% ethanol for 72 hours. The seed meal was later removed from solution, properly sundried and pulverized into flour to meet the particle size requirement of day-old chicks in diets mixtures (NRC, 1994).

Diets formulation

Five experimental diets were formulated made of a control diet without Moringa seed meal (diet1) and four other diets 2, 3, 4 and 5 contained ethanol treated *Moringa oleifera* seed meal (ETMOSM) at graded levels of 2.5, 5.0, 7.5 and 10.0% respectively. *M. oleifera* seed meal substituted soyabean meal in diets at 2.5, 5.0, 7.5 and 10.0% inclusion levels. The composition of experimental diets as fed to the animals including the calculated nutrient contents of the diets is shown in Table 1.

Table 1: Composition (%) of the Experimental Diets

Ingredients	**Inclusion levels (%)**				
	0	**2.5**	**5.0**	**7.5**	**10.0**
Maize	58.25	58.25	58.25	58.25	58.25
SBM	38.40	35.90	33.40	30.90	28.40
ETMOSC	0.00	2.50	5.00	7.50	10.00
Bone meal	1.50	1.50	1.50	1.50	1.50
Oyster shell	0.50	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50	0.50
Lysine	0.10	0.10	0.10	0.10	0.10
DL-methionine	0.25	0.25	0.25	0.25	0.25
*Vit/Min premix	0 .50	0.50	0.50	0.50	0.50
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis					
ME (Kcal/kg)	2954	2959	2943	2958	2946
Crude protein (%)	23	23	23	23	23
Crude fibre (%)	3.20	4.11	3.13	3.58	4.23
Crude fat (%)	4.65	9.13	5.85	6.23	4.67
Methionine (%)	0.49	0.58	0.35	0.48	0.45
Lysine (%)	1.25	1.50	1.10	1.45	1.10

SBM= soybean meal, ETMOSM= ethanol treated Moringa oleifera seed meal, 0.50 premix supplied, per kilogram of diet: vitamin A, 12,000 IU; vitamin D3, 2,000 IU; vitamin E, 50 IU; vitamin B1, 1 mg; vitamin B2, 3 mg; vitamin B6, 1 mg; vitamin B12, 10 µg; vitamin K, 2 mg; copper (cupric sulphate), 75 mg; nicotinic acid, 12 mg; pantothenic acid, 10 mg; iron, 200 mg; cobalt, 0.5 mg; manganese, 40mg; zinc, 90 mg, iodine, 1 mg; selenium, 0.2 mg; calcium, 31.25 g; sodium, 10 g

Test animals and feeding trial

One hundred and fifty Arbor acre broiler chicks at hatch were used for the trial. The experiment was designed as a one-way classification. Each of the five dietary treatments contained three replicates with ten (10) chicks per replicate. The chicks were fed on a conventional diet for a week to get acclimatized to the environment prior to introduction of the experimental diets. The birds were thereafter fed the experimental diets *ad libitum* during a feeding trial that lasted 56-days.

Nutrients Digestibility trial

At the end of the feeding trial, a digestibility study was carried out using INRA reference protocol (INRA, 2004). Fifteen broiler chickens were taken on all the dietary treatments (three birds per treatment) and placed in individual metabolic cage designed for the digestibility study. The birds, similar in weight (P>0.05) were acclimatized for three-days, before fasting for 24 hours. Each bird was supplied 200g of the corresponding diet for 3 days followed by another day of fasting. During the three days of feeding and the last day of fasting excreta was collected from the replicates on all the diets. The quantity of feed served, and the ort (leftover) were weighed. Proximate analysis was carried out on the diets as well as the fecal samples for the determination of nutrient digestibility or nutrient retention. Nutrient digestibility was calculated using the formula:

$$\%\ \boldsymbol{Nutrient\ digestibility} = \frac{(\boldsymbol{Nutrient\ intake - Nutrient\ in\ excreta})}{\boldsymbol{Nutrient\ intake}}\ \boldsymbol{x\ 100}$$

Data Collection

At the end of the experiment, fifteen broilers across all the treatments were taken at random for blood collection by decapitation. Blood for biochemical indices was collected in bottles without EDTA for the analysis of the biochemical parameters such as total protein, albumin, globulin, urea, and transaminase activities (serum aspartate amino transaminase (AST), alanine amino transaminase (ALT) and alkaline phosphatase (ALP)). The blood samples for haematological parameters were pretreated with ethylene diamine tetra-acetic acid (EDTA). Haematological indices examined include White Blood Cell (WBC), Red Blood Cell (RBC), Packed Cell Volume (PCV), Haemoglobin (Hb). Mean Cell Volume (MCV), Mean Cell Haemoglobin (MCH) and Mean Cell Haemoglobin Concentration (MCHC) were calculated from the values of the RBC, PCV and Hb respectively, according to the methods of Jain (1986).

Data analysis

The data obtained from the study were analyzed using One-way ANOVA using the General Linear Model procedure of the Statistical Analysis System (SAS, 2003). Differences between treatment means were separated using Duncan Multiple Range Test (Duncan, 1955) as described by Steel and Torrie (1980).

RESULTS AND DISCUSSION

Table 2 presents data on performance characteristic of broilers fed ethanol treated *Moringa oleifera* (MOSM) diets. The final live weights of the birds were significantly (P<0.05) affected as the dietary ethanol treated MOSM diet increased. The final weights decreased with a corresponding increase in the dietary inclusion of the ethanol treated MOSM for the replacement of soyabean as protein source. The average daily weight gains of the birds were significantly (P<0.05) affected by the dietary inclusion of the ethanol treated MOSM diet. The feed intake values were very significantly (P<0.05) affected by the dietary replacements of soyabean with ethanol treated MOSM. There was a linear decrease in the feed intake values per day as the level of treated MOSM increased in the diet. The feed conversion ratio of the birds was significantly (P<0.05) affected by the increase in the dietary inclusion of the ethanol treated MOSM in the diet of the birds. The feed conversion ratio favoured the birds on the 2.5% diet. There was no mortality recorded during the course of this trial.

Table 2: Performance Characteristics of Broiler Chickens Fed Ethanol Treated *Moringa Oleifera* Seed Meal based Diets

Parameters	Inclusion levels of ETMOSC (%)					
	0	**2.5**	**5.0**	**7.5**	**10.0**	**SEM**
Daily weight gains (g/bird/day)	51.92^{c}	66.05^{a}	65.35^{ab}	61.04^{b}	57.26^{b}	1.72
Feed intake(g/bird/day)	108.62^{c}	118.45^{a}	113.22^{ab}	110.78^{b}	104.30^{c}	1.65
Feed conversion ratio	1.87^{b}	1.73^{a}	1.83^{ab}	1.84^{a}	1.84^{a}	0.05

SEM= Standard error of mean*=P<0.05Means with different superscript along the same rows are significantly (P<0.05); ETMOSM=Ethanol treated *Moringa oleifera*. Seedmeal

Growth performance characteristics: The improved growth performance of birds fed with the ethanol treated moringa seed meal in the diets of the birds indicates the efficiency of the feedstuff in poultry feeding. The result of this study revealed that MOSM in the diets of the broiler chickens significantly (P<0.05) enhanced their daily feed intake, weight gain, nutrient digestibility and feed conversion ratio. Birds on 2.5 % MOSM inclusion level had the highest (P<0.05) feed intake (118.45g), weight gain (66.0g) compared with other treatment groups.

Journal of Arid Agriculture. 2026, Vol. 27 (1): 67 – 72

The observed gain in body weight in this study could be attributed to the decrease in anti-nutritional factor of the ethanol treated MOSM that enhanced palatability and easy digestion and assimilation of the fed diet. The result of this research agrees with the report of Ochi *et al.* (2015) who mentioned that the inclusion of *Moringa oleifera* seed powder (MOSP) at levels 0.5, 1 and 2% in the diet of the broilers significantly enhanced their body weight, body weight gain and feed intake. However, the report from Ferreira *et al.* (2008) depicts those higher levels of MOSM increased feed consumption in the broiler chickens which is contrary to the findings in this study which gave higher feed intake at lower inclusion levels of MOSM. It also disagrees with the report of Du *et al.* (2007) and Ferreira *et al.* (2008) who reported no significant effect of MOSM supplementation at 2.5%, 5% or 7.5% in the diets of broiler chickens on growth rate. The results of daily feed intake, daily weight gain showed that birds on 2.5% MOSM diets had highest (P<0.05) values across dietary treatment groups.

Digestibility of nutrients (crude protein, fat and fibre) in the experimental birds is presented on Table 3. The digestibility of nutrients on the control diet was comparable with that of the diets containing 2.5% ethanol treated MOSM (P > 0.05) while digestibility of the nutrients for birds on higher level of inclusion (10%) was lower (P > 0.05).

Table 3: Nutrient Digestibility of broilers Fed Ethanol Treated *Moringa Oleifera* Seed Meal based Diets

	Levels of ETMOSM (%)					
Indices (%)	0	2.5	5.0	7.5	10.0	SEM
Crude protein	78[a]	77[a]	76[a]	75[a]	61[b]	2.6
Crude fat	73[a]	76[a]	73[a]	73[a]	58[b]	2.4
Crude fibre	66[a]	66[a]	65[a]	64[a]	52[b]	2.2

SEM= Standard error of mean*=P<0.05Means with different superscript along the same rows are significantly (P<0.05); ETMOSM=Ethanol treated *Moringa oleifera*. Seed meal

Table 4: Haematological Indices of Broiler Chickens Fed Ethanol Treated *Moringa Oleifera* Seed Meal based Diets

	Dietary treatment					
Parameters	**0**	**2.5**	**5.0**	**7.5**	**10.0**	**SEM**
RBC (x 10^{12}/l)	2.36[ab]	2.52[a]	2.30[b]	2.18[b]	2.24[b]	0.106
Haemoglobin	8.75[a]	9.30[a]	9.00[a]	8.50[b]	8.70[a]	0.415
PCV(%)	31.20[a]	25.60[a]	31.30[a]	29.85[a]	30.60[a]	1.405
Mean Cell Volume (fl)	132.25[ab]	129.60[b]	136.10[a]	137.00[a]	136.55[a]	3.372
MCH (pg)	37.15[a]	36.95[a]	39.15[a]	39.00[a]	38.80[a]	1.216
MCHC (g/dl)	28.05[a]	28.55[a]	28.75[a]	28.50[a]	28.45[a]	0.402
WBC (x 10^{9}/l)	231.00[a]	233.85[a]	229.65[a]	226.10[a]	231.25[a]	4.706

RBC= Red Blood Cell, PCV=Packed Cell Volume, Mean Cell Haemoglobin (MCH) and Mean Cell Haemoglobin Concentration (MCHC), WBC= White Blood Cell, Raw= untreated, SEM= Standard error of mean=P<0.05; Means with different superscript along the same rows are significantly (P<0.05)

The result of haematological parameters (Table 4) shows that the indices were affected (P < 0.05) by the inclusion of MOSM in the feed.The generally higher values of haematological indices observed in MOSM chickens are indicative of better utilization, absorption and assimilation of the nutrients into the circulatory system of the chickens (Onu, 2010). The above observation is similar to that of Basit *et al.* (2020). All the values obtained for MCV and MCHC were statistically similar (P>0.05) irrespective of the inclusion level of the MOSM in the diets. The values for all the haematological and erythrocyte indices obtained in this study are within the acceptable levels for healthy chickens as reported by Bounous and Stedman (2000) and Okeudo *et al.* (2003). Previous workers have attributed the variations in avian haematological blood values to the physiological condition of the birds (Islam *et al.*, 2004; Attia *et al.*, 2015) The result of biochemical indices (Table 5) shows that the parameters were affected (P < 0.05) by the inclusion of MOSM in the diets of the broiler chickens. The reduction in the protein and its fraction could be a result of the anti- nutrients in the test ingredient (Odetola *et al.*, 2012). The total protein and serum albumin, on the other hand, were within normal levels for hens (Meluzzi *et al.*, 1992).

The non-significant (P>0.05) difference in serum urea between the control and the treated group agrees with the results of Eggum (1976); Esonu *et al.*, (2001); Iyayi and Taiwo (2003) who reported that total protein and serum urea contents depend on the quality and quantity of the protein provided in the diet. The increase in albumin and total protein with the inclusion of ethanol treated MOSM in the diets of the birds underscores the nutritional acceptability of treated MOSM in satisfying the protein requirement of the chickens. ALP, AST and ALT decreased with the inclusion of graded levels of ethanol treated MOSM in the diets of the birds.

Table 5: Serum Biochemical Indices of Broiler Chickens Fed Ethanol Treated *Moringa Oleifera* Seed Meal based Diets

Parameters	Dietary treatment 0	2.5	5.0	7.5	10.0	SEM
Urea (mmol/l)	4.657	4.870	4.767	4.727	4.663	0.115
Total protein (g/l)	13.927^{b}	10.230^{c}	12.020^{b}	13.440^{a}	13.003^{a}	0.186
Albumin (g/l)	3.727^{a}	2.463^{b}	3.500^{a}	3.703^{a}	3.667^{a}	0.239
Aspartate Aminotransaminase(U/L)	70.000^{b}	90.030^{a}	62.107^{c}	68.840^{c}	70.843^{b}	6.779
Alanine Aminotransaminase(U/L)	19.480^{b}	20.443^{a}	19.867^{b}	18.037^{c}	19.460^{b}	1.059
Alkaline phosphatase(U/L)	35.680^{b}	36.287^{a}	34.660^{c}	32.540^{c}	30.840^{d}	3.839

SEM= Standard error of mean*=P<0.05Means with different superscript along the same rows are significantly (P<0.05), MOSC=*Moringa oleifera* seed meal.

CONCLUSION AND RECOMMENDATION

From this study, ethanol treated MOSM can be included in the diets of broiler chickens up to 2.5% for improved growth performance, feed conversion ratio without hampering the haematological and serum biochemistry of the chicks. It is recommended that further study should be carried out on other processing methods to remove the effect of anti-nutritional factors inherent in moringa seed.

CONFLICT OF INTEREST

The authors declare no conflict of interest

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