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Performance of broiler chickens fed graded dietary inclusion levels of moringa (*Moringa oleifera*) seed cake

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Abstract

The progressive increase in the cost and scarcity of conventional feedstuffs, especially energy and protein sources has resulted into a continuous effort in researching into the possible utilization of the under - exploited wild legumes in poultry feed formulation. Several Researchers had reported on the utilization of Moringa oleifera leaf meal in poultry diets whereas; few reports exist on the utilization of Moringa seed. Therefore, this study was conducted to evaluate the effect of graded dietary levels of moringa seed cake (MSC) on the performance of broiler chickens. A total of 195, one day old Arbor Acre broiler chicks were randomly assigned into five dietary treatments of moringa seed cake, each treatment having three replicates in a completely randomized design. MSC was included at levels of 0, 5,10, 15 and 20% respectively. Feed and water were given ad- libitum. Proximate composition of MSC showed that it is high in energy, crude protein and ether extract with3304. 39 ME kcals/ kg, 32.49 % and 17.70%, respectively. Birds fed 5% MSC diet were better than the birds on the other levels of MSC diets in terms of growth and carcass characteristics. The results obtained from growth study revealed a significant declined in, final weight, weight gain, feed intake, and feed conversion ratio as the inclusion levels of MSC increased beyond 5% in the diets. The birds on control diet had the best result in terms of final weight , daily weight gain and daily feed intake of 2974g/bird, 52.4g/bird / day and 107.51g/bird/ day respectively followed by those fed diet containing 5% MSC with 2183.4g/bird, 38.24/bird /day and 95.66g/bird /day respectively. whereas, the birds fed 20% MSC had the least (P>0.05) final weight, daily weight gain and daily feed intake of 560 g/bird, 9.26g/bird /day and 33.51g/bird/day respectively. Carcass characteristics followed similar trend as the growth parameters. Hematological indices showed significant differences across the dietary treatments, however, the results were within the normal range except for the white blood cell. It can therefore be, concluded that the inclusion of MSC in broiler chicken diet should not exceed 5% for optimum growth and general performance.

Keywords: Performance, Broiler, chickens, Moringa seed cake, Graded levels

Introduction

The progressive increase in the cost and scarcity of conventional feedstuffs especially energy and protein sources has resulted into a continuous effort in researching into the possible utilization of the under - exploited wild legumes in Nigeria. Adegbenro, *et al.* (2011) had earlier reported the need to exploit underutilized seeds which could be possible replacers for the costly conventional feedstuffs. According to Banjo (2012), the most logical step to solving the shortage and dwindling raw material supply is to direct efforts towards utilizing plant by – products and wastes for feeding poultry birds. In line with this report, the utilization of agro-industrial by-products and other alternative feedstuffs including moringa seed cake becomes expedient. The use of such feedstuffs that are nutritionally competent, locally available, relatively cheaper and has the potential of cutting down the cost of poultry

production become a necessity. Only a fewer number of raw materials are used in poultry feed formulation due to lack of reliable data on their nutritive quality, feeding value and safe or efficient levels of inclusion in various types of poultry feed (FAO, 2011). Therefore, in order to certify the use of any alternative feedstuff it is important to clearly identify its potential in terms of nutritive quality, feeding value and safe levels of inclusion. Over time a lot of Researchers have gone into the exploration of the potentials of different parts of the moringa tree most especially the leaf. (Church, 1991) had earlier proposed the use of moringa seeds as a viable alternative source of proteins, vitamins and minerals for poultry feeding. Taiwo *et al.* (2015) reported that *Moringa oleifera* seed is a good source of edible oil, protein and essential minerals. Its nutritional potentials enable it to be useful in formulations and fortifications of animal feeds. However, the defatted seed is better because of the low anti-nutritional factors. Moyo *et al*. (2011); Mbikay (2012); Idris and Jami (2016) reported that *Moringa oleifera* is a highly valued plant and has an impressive range of medicinal uses, promotes growth and has antimicrobial and antioxidant effects. All parts of the plants are edible and have long been consumed by humans (Fashey, 2005). However, it was reported to be an excellent source of proteins in monogastric animals (Ferreira *et al.,* 2008). Moringa oleifera was reported to contained some anti-nutritional factors, such as protease inhibitors, hemaglutinins, tannins and cyanogenic glycosides, which may interfere with the digestion and utilization of dietary protein and carbohydrates and even alters the availability of some minerals (Ahaota *et al*., 2013). There had been very low response in exploring the moringa seed cake particularly in poultry nutrition. Therefore, this study was designed to evaluate the effect of graded dietary levels of moringa seed cake on the growth, carcass characteristics and hematological indices of broiler chicken diets.

Materials and method

Proximate analysis of Moringa seed cake

Sample of moringa seed cake was taken to the Biochemical Laboratory of the Department of Animal Science, Ahmadu Bello University, Zaria for Proximate analysis. The analysis was done according to the standard procedures of A.O.A.C. (2012).

Location of the experiment and experimental design

The study was conducted at the Livestock section, Samaru College of Agriculture; Division of Agricultural Colleges, Ahmadu Bello University, Zaria. A total of 195 day-old unsexed Arbor acre broiler birds were used for the starter and finisher phase of the study. The birds were randomly allotted into five treatment groups in a completely randomized design. Each group was replicated thrice with 13 birds per replicate. Five experimental diets were formulated to contain moringa seed cake at 0,5,10,15 and 20% levels (Tables 2 and 3). The birds were raised on deep litter pen with feed and water provided *ad libitum*. The initial weight of the birds was taken on arrival while record of feed intake, body weights were taken weekly. These values were then used to determine daily feed intake/ bird, weight gain / bird and feed conversion ratio. Mortality was recorded as it occurred. The study lasted for period of 56 days.

Haematology assay

Two mL of blood samples were collected from three birds per treatments into a sterilized sample bottles containing EDTA and taken to the clinical pathology laboratory of the Ahmadu Bello University Teaching Hospital for haematological study.

Carcass evaluation

At the end of the feeding trial, one bird per replicate with weight closest to the average

of the group was selected, weighed slaughtered and allowed to bleed thoroughly. The carcass was de- feathered, cleaned and eviscerated and dissected. The cut parts (drumsticks, thigh, breast, back and wings) and organs such as liver, kidney, heart, gizzard and lungs were weighed on a sensitive digital scale. Prime cut parts were expressed as percentage of the carcass weight while organs weight was expressed in relative to percentage of the liveweight.

Statistical analysis

All the data obtained were subjected to analysis of variance (ANOVA) and significant differences were compared using Duncan's Multiple Range Test of SAS (SAS, 2008) at 5% level of significance.

Results and discussion

Moringa seed cake could be a potential source of energy and protein as shown in Table 1, with 3304. 39 ME kcals/kg and 32.49 % crude protein. The high value recorded for Metabolizable energy could be as a result of the high ether extract contents (17.70%). This result confirms the report of (Taiwo *et al*., 2015) who reported that *Moringa oleifera* seed is a good source of edible oil, protein and essential minerals. And also, the crude protein was higher than the value (23.42%) reported by (Bridgemohan, 2014). The growth performance of broiler chickens (0-8weeks) fed graded dietary levels of moringa seed cake (MSC) is shown in Table 3. The result showed a significant ($P<0.05$) differences on the final weight, total weight gain, feed intake and feed conversion ratio across dietary treatments. Generally, there was a significant ($P<0.05$) decrease in the final weight, weight gain and feed intake as the levels of moringa seed cake increases in the diets. Feed intake is one of the major factors that influences both weight gain and feed conversion ratio in meat-type poultry. The significantly ($P<0.05$) low feed intake and poor feed conversion ratio observed as the level of MSC increases in the diet could be as a result of poor acceptability of the MSC based diets or due to the unpleasant taste of the diets. This observation is in consonance with the report by (Gentle, 1975; Nidaullah, *et al*., 2010) who reported that chickens have an acute sense of taste. Changes in taste and also, the oily nature (17.70%) of the MSC as shown in Table 1 could also have contributed to the astringent taste of the MSC based diets, due to the fact that the oil content would have undergone oxidative reaction before the use of MSC, especially when the oil extraction is mechanically done. Birds fed 5% moringa seed cake-based diet had significantly ($P<0.05$) higher final weight and weight gain followed by those on the control diet. This suggests that at the starter phase, 5% dietary inclusion of MSC can significantly ($P<0.05$) improve the performance of broiler chickens. However, dietary inclusion levels of MSC beyond 5% resulted in significant ($P<0.05$) declined in final weight and weight gain. This suggests that inclusion of MSC beyond 5% can suppress the growth performance of broiler chickens. It is possible that both MSC and moringa leaves meal might contain some antinutrients which may be responsible for depressed growth in broiler chickens. This observation conforms with the findings of Olugbemi, *et al*. (2010) who reported that inclusion of moringa leaf meals in broiler diets beyond 5% results in depressed performance. Mortality rate recorded during the study may be due to the depressive effects of the MSC on feed intake, digestion and absorption of nutrients which might have resulted into the breakdown of the immune systems of the birds resulting in death. If the moringa seeds were processed by boiling, toasting or fermentation before inclusion into the diets, perhaps the antinutrients and oil contents could have been brought to a threshold level hence, possibility of improvement in the taste and acceptability of the MSC by the birds.

Table 1: Proximate composition of moringa seed cake (MSC)

Parameters	Moringa seed cake
Metabolizable energy (Kcal/kg)	3304.39
Crude protein (%)	32.49
Dry matter (%)	94.58
Ash (1%)	3.85
Crude fibre (%)	9.47
Ether extract (%)	17.70
Nitrogen free extract (%)	31.07

Table 2: Composition of broiler starter diet (0-4weeks)

Ingredients	Levels of moringa seed cake (%)				
	0	5	10	15	20
Maize	58.60	50.00	45.00	44.00	41.00
GNC	10.00	10.00	10.00	10.00	10.00
SBC	27.65	25.00	21.25	20.75	17.50
MSC	0.00	5.00	10.00	15.00	20.00
Maize offal	0.00	6.75	10.00	6.50	7.75
Bone meal	2.50	2.00	2.50	2.50	2.50
Limestone	0.50	0.50	0.50	0.50	0.50
Common salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.00	0.00	0.00	0.00	0.00
Vit. Premix	0.25	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated composition of diets					
ME (Kcal/kg)	3002.52	3006.97	3000.77	3019.80	3064.46
Crude protein (%)	18.58	19.05	19.60	20.18	20.00
Crude fibre (%)	3.97	4.36	5.06	5.14	5.52
Calcium (%)	1.05	1.15	1.16	1.16	1.16
Phosphorus (%)	0.50	0.50	0.51	0.51	0.52
Methionine (%)	0.54	0.55	0.56	0.57	0.57
Lysine (%)	0.85	0.88	0.93	1.22	0.96
Cost/Kg (₦)	145.97	135.40	124.85	119.85	110.75

Table 3: Gross composition of broiler finisher diets (5-8 weeks)

Ingredients	Levels of moringa seed cake (%)				
	0	5	10	15	20
Maize	60.50	56.50	49.25	48.50	46.75
GNC	10.00	10.00	10.00	10.00	10.00
SBC	18.00	16.00	14.00	12.50	8.50
MSC	0.00	5.00	10.00	15.00	20.00
Maize offal	8.00	8.75	13.00	10.00	11.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Limestone	0.25	0.50	0.50	0.50	0.50
Common salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.00	0.00	0.00	0.00	0.00
Vit. Premix	0.25	0.25	0.25	0.25	0.25
	100.00	**100.00**	**100.00**	**100.00**	**100.00**
Calculated composition of diets					
ME (Kcal/kg)	3002.52	30006.97	3007.77	3019.80	3064.46
Crude Protein (%)	18.58	19.05	19.60	20.18	20.00
Crude Fibre (%)	3.97	4.36	5.06	5.14	5.52
Calcium (%)	1.05	1.15	1.16	1.16	1.16
Available Phos. (%)	0.50	0.50	0.51	0.51	0.52
Methionine (%)	0.54	0.55	0.56	0.57	0.57
Lysine (%)	0.85	0.88	0.93	1.22	0.96
Cost/Kg (Ɛ)	135.30	127.15	117.85	114.05	102.25

Table 4: Effect of moringa seed cake on the growth of broiler chickens (0-8wks)

	Graded levels of moringa seed cake (%)					
Parameters	**0**	**5**	**10**	**15**	**20**	**SEM**
Initial weight (g/bird)	40.00[b]	42.200[a]	41.665[a]	41.110[a]	41.665[a]	0.90
Final weight (g/bird)	2974.4[a]	2183.4[b]	800.6[c]	598.5[d]	560.0[d]	50.60
Weight gain (g/b/day)	52.40[a]	38.24[b]	13.55[c]	9.95[d]	9.26[d]	50.35
Feed intake (g/b/day)	107.51[a]	95.66[b]	42.62[c]	37.07[d]	33.51[e]	73.54
Feed conversion ratio	2.05[d]	2.50[c]	3.15[b]	3.73[a]	3.61[a]	0.08
Cost/Kg gain, (Ɛ)	276.89	243.32	382.55	451.01	415.63	
Mortality (%)	0.00[c]	0.67[b]	0.50[b]	3.00[a]	3.00[a]	0.33

[a b c] means on the same row with different superscript are significantly different at 5% ($p<0.05$)

The effect of graded dietary inclusion levels of MSC on broiler chickens is as shown on Table 5. Most of the parameters measured were within the normal reference values as reported by Mitruka and Rawnsley (1997); Simrak *et al*. (2004). Normal range of RBC, MCV, MCH and lymphocyte is an indication that the health of the birds was not compromised. However, High WBC recorded is an indication of the attempts to resist diseases. Thus, animals with low white blood cells are exposed to high risk of disease infection, while those with high counts have high degree of resistance to diseases and enhanced adaptability to local environmental and disease prevalent conditions. This observation is in line with the report by several researchers such as Kabir *et al. (*2011); Okunlola *et al.* (2012); Iwuji and Herbert (2012); Soetan (2013) and Isaac *et al.* (2013). The effect of graded levels of moringa seed cake on the carcass characteristics of broiler chickens is shown in Table 6. Moringa seed cake had a significant ($p<0.05$) effect on all the prime cut and organs of broilers chickens. Birds fed control diet had significant ($p<0.05$) highest live weight, dressed weight and dressing percentage values followed by those fed 5% dietary level of MSC, beyond which there was a significant ($P> 0.05$) decreased. However, birds fed 10, 15 and 20% dietary MSC were statistically similar in terms of live weight, dressed weight and dressing percentage. The size of the liver was observed to increase progressively with inclusion levels of the MSC. This may be as a results of underlying health challenges or due to some phyto-chemicals that might be present in the MSC which the liver was unable to detoxified. Postmortem examination on some of the dead birds revealed fowl typhoid, hence in agreement with the findings of Chris *et al.* (2008) who reported that enlargement of liver may be due to chronic bacterial infections. The trend observed in the liver enlargement followed a similar pattern with the rate of mortality recorded across the dietary treatments, hence suggesting the possible causes of the mortality recorded during the period of the study.

Table 5: Effect of graded levels of moringa seed cake on the hematological parameters of broiler chickens

Parameters	**Graded levels of moringa seed cake (%)**					Ref. Value	SEM
	0	**5**	**10**	**15**	**20**		
WBC (10^3/uL)	88.17[b]	84.43[b]	96.90[a]	95.00[a]	79.70[c]	NA	4.187
RBC (10^6/uL)	2.63[b]	2.42[b]	2.96[a]	3.03[a]	2.31[c]	1.59 – 4.10	0.138
HGB (g/dL)	12.20[a]	10.40[b]	12.75[a]	12.80[a]	9.70[b]	7.00-15.00	0.586
Lymph (10^3/uL)	78.10[b]	75.00[b]	85.15[a]	85.50[a]	71.85[b]	40.00-100	3.247
MCV (fL)	144.73[a]	141.43[a]	137.25[b]	136.50[b]	139.70[a]	90 -140.00	2.538
MCH (pg)	46.50[a]	42.80[b]	43.15[b]	42.17[b]	42.00[b]	33 – 47.00	0.586
MCHC (g/dL)	32.13[a]	30.26[b]	31.45[a]	30.90[b]	30.10[b]	26 – 85.00	0.378

a, b, c: Means in the same row not sharing a common superscript are significantly different ($P<0.05$)
SEM: Standard error of the mean; WBC=white blood cell; RBC=red blood cell; Lymph=lymphocites; HGB=haemoglobin; MCV=mean corpuscular volume; MCH=mean corpuscular haemoglobin; MCHC=mean corpuscular haemoglobin concentration; NA = not available

Table 6: Effect of graded dietary levels of moringa seed cake on the carcass characteristics of broiler chickens

Parameters	Graded levels of moringa seed cake (%)					SEM
	0%	5%	10%	15%	20%	
Live wt. (g)	3000.0[a]	2216.7[b]	733.3[c]	616.7[c]	583.3[c]	75.056
Dressed wt. (g)	2516.7[a]	1633.3[b]	466.7[c]	400.0[c]	366.7[c]	63.509
Dressing (%)	83.91[a]	73.58[b]	63.70[c]	65.11[c]	62.88[c]	2.132
Prime cut parts expressed as percentage of carcass weight (%)						
Drumsticks	13.75[b]	14.40[a]	14.53[a]	14.23[a]	13.20[b]	0.356
Thigh	16.45[a]	16.08[b]	15.08[c]	15.07[c]	14.63[d]	0.175
Breast	29.18[a]	30.44[a]	21.66[b]	22.15[b]	20.21[c]	0.807
Neck	7.81[a]	5.24[c]	6.67[b]	6.77[b]	7.37[a]	0.229
Wings	10.76[c]	10.51[c]	11.91[b]	12.13[b]	14.05[a]	0.289
Back	16.86[a]	15.20[c]	16.49[b]	16.54[b]	17.25[a]	0.224
Organs as percentage of liveweight (%)						
Liver	2.01[e]	2.68[d]	2.97[c]	3.37[b]	4.08[a]	0.107
Kidney	0.61[c]	0.95[b]	1.04[a]	0.88[b]	0.94[b]	0.044
Heart	0.45[e]	0.63[d]	0.94[a]	0.86[b]	0.76[c]	0.030
Lungs	0.54[c]	0.74[b]	1.15[a]	0.87[b]	0.44[c]	0.075
Empty Gizzard	1.82[d]	2.67[c]	6.50[a]	6.17[a]	5.36[b]	0.183

a, b, c : Means in the same row not sharing a common superscript are significantly different (P<0.05

Conclusion

The study showed that moringa seed cake processed using the cold press method has high crude protein (32.29%) and Metabolizable energy (3304.4 ME Kcals /kg) content as shown in the proximate analysis, however, the nutrients seems unavailable for general performance of the birds. High inclusion levels up to 20% in broiler chicken diets had a depressive effect on final body weight, weight gain and feed intake of the birds and consequently poor carcass characteristics. Poultry farmers should not exceed 5% inclusion levels in broiler chicken diets.

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