Effect of *Moringa oleifera* leaf meal dietary substitution of Groundnut cake on broiler chick performance

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Summary

Two hundred unsexed broiler chicks were used in a completely randomized design feeding trial, to study the effect on growth performance of chicks, by substituting groundnut cake by *moringa oleifera* leaf meal at 2%M, 4%M, and 6%M. Moringa fed chicks consumed significantly more dry matter, metabolizable energy, and crude protein than the control (0%M) chicks, as a result; they gained significantly more weight gain. Dry matter intake and weight gain increased progressively with increasing Moringa leaf meal concentration in the feed, from 2%M to 6%M inclusive. The rise in weight gain and weight conversion rates, were attributed to a possible Moringa leaf meal protein quality effect.

Introduction

It has been observed that the rapid growth of human and livestock populations with increasing demand for food and feed, particularly in developing countries. Consequently, alternative feed resources must be identified and evaluated, importantly those from non-conventional sources (Odunsi 2003). Hence, any cheap high protein yielding feed that could substitute conventional Groundnut cake, Sesame meal or imported Soybean meal is desirable. Such a potential source of cheap high protein as the leaf meal of some tropical browse plants. Though utilization of leaf meal could be constrained by anti-nutritional compounds, and deficiency of some amino acids. Interest is growing in planting Moringa (*M.oleifera*), for use of leaf meal as protein feed source to animals (Makkar and Becker 1997; Sarwatt *et al*., 2002). Despite, the high protein content of Moringa leaf meal, there is few available data on its use as an alternative protein supplement in broiler production. The present study aimed at investigating of partially replacing Groundnut cake with Moringa leaf meal in broiler ration; whereas growth performance and the nutritional value of the constituted feed were intended.

Materials and Methods

Experimental feeds

Twigs of *M. oleifera* were collected from a plantation farm in Khartoum, dried under shade and aerated conditions. Dried leaves were separated, hand crushed, sieved and mill-ground. The leaf meal was included in the experimental feed in the proportions 2, 4, and 6%, to substitute Groundnut cake in the control feed (0%). The formulated feeds (**Table 1**) were pelleted before use. The feeds were approximately iso-calorific and iso-nitrogenous, and were adjusted to meet recommended NRC (1984) nutrient requirements for broiler production. Proximate components and amino acids composition were analysed according

to A.O.A.C. methods (1990). Performance data were statistically analysed using ANOVA analysis of variance method. Significant means were separated by Duncan's multiple range tests, (Duncan 1955).

Feeding trial

Two hundreds, one day old, unsexed broiler chicks (Cobb 500), of uniform body weight (38 g), were reared for 45 days in a deep littered wire-netting wall and open-sided house. 24-hour continuous artificial lightening was provided. The feeds and water were freely available at all time. The chicks were distributed into the four treatment feed groups, in a completely randomized design. In each treatment, there were five replicates each containing 10 chicks. During the course of the experiment, the chicks were weighed weekly, before the feed was offered in the morning, (Beitake 2012).

Digestibility trial

During the last week of the feeding trial, one bird was randomly selected from each replicate (5 birds per treatment), for the digestibility trial .Excreta were collected on nylon sheets covering floor, which were daily replaced each by a new clean another one. Feed remaining in each replicate unit and excreta collected, and dried before analysis was done. Digestibility values were calculated for dry matter (DM), organic matter (OM), crude fibre (CF), and ether extractives (EE). The digestibility of crude protein (CP) was calculated according to Bolton and Blair (1974).

Results and Discussion

The composition of experimental diets and nutrient contents of feeds and *Moringa oleifera* leaf meal (MOLM) are shown in **Table 1.** It shows that the values (g/kg DM), for crude protein (CP=278.7), crude fibre (CF=130), and ether extractives (EE=22) of MOLM were within the range of values obtained by Booth and Wickens (1988); 27.1%, 19.2% and 2.3%, Makkar and Becker (1996); 25.1%, 21.9% NDF and 5.4%, and Oduro, *et al.*, (2008); 27.51%,19.23% and 2.23% respectively. Though the present sample had less fibre compared to those above mentioned, possibly because our leaf meal was processed from tender shoots of low fibre content.

Table 1. Feed ingredients (%), chemical composition (g/Kg DM), and metabolisable energy (Kcal/Kg DM)

	Feeds				
Ingredient	Control	2% M	4% M	6% M	MOLM
Sorghum grain	63	63	63	62	-
Groundnut cake	26	25	23.4	23	-
MOLM	0	2	4	6	-
Common salt	0.2	0.2	0.2	0.2	-
Limestone	1.5	1.5	1.5	1.5	-
Di-calcium phosphate	0.5	0.5	0.5	0.5	-
Broiler's concentrate	5	5	5	5	-
Grit	3.2	2.3	1.9	1.3	-
Anti-mycotoxin	0.2	0.2	0.2	0.2	
Organic acid	0.1	0.1	0.1	0.1	-
Lysine	0.1	0.1	0.1	0.1	-
Methionine	100	100	100	100	-
Total Chemical composition (g/Kg DM)	924	928	931	925	942
Dry matter	104.5	97	95.7	88.7	142
Ash	240	230	237.5	237.5	278.7
Crude protein	36	38	36	36	22
Ether extractives	60	64	66	68	130
Crude fibre	3163	3127	3148	3146	2626
Metabolisable energy (Kcal/ Kg DM)	63	63	63	62	-

** MOLM = Moringa oleifera leaf meal, and :*
2%M, 4%M, 6%M = MOLM percentage in the feed.

The amino acids composition of *Moringa oleifera* leaf meal in the present study is presented in **Table2**. When compared with skim milk powder as a reference standard (Williams *et al.,* 1955), MOLM appears to be deficient in both lysine and methionine, which are essential for broiler production. It had 0.31 lysine and 0.15 methionine of the reference values. Moreover, lysine/methionine ratio was 2:1 as opposed to 3:1 ratio in the skim milk. However, when compared with Booth and Wickens (1988) MOLM sample, it appears to have also lower values. Variation in chemical composition and amino acids contents may be caused by differences in agro-climatic conditions, or due to different age

of trees, as well as different stages of maturity of the shoot cut. It is to be reminded that tender shoot leaves were selected for use in the present study.

Table 2. Essential Amino acids composition of *M. Oleifera* leaf meal (MOLM)

	MOLM					
	This study		Booth & Wickens 1988)[1]		Skim milk powder[3]	
Amino acid	(g/100g)	(g/16g N)	(g/100g)	(g/16g N)	(g/100g)	(g/16g N)
Arginine	0.736	2.73	1.325	4.89	1.04	3.15
Histidine	0.386	1.43	0.613	2.26	0.81	2.45
Isoleucine	0.769	2.85	0.825	3.04	2.40	7.27
Leucine	1.299	4.81	1.956	7.22	3.25	9.85
Lysine	0.873	3.23	1.325	4.89	2.78	8.42
Methionine	0.122	0.45	0.350	1.29	0.81	2.45
Phenylalanine	1.057	3.92	1.388	5.12	1.47	4.45
Threonine	0.654	2.42	1.188	4.38	1.42	4.30
Tryptophan	-	-	0.450	1.66	0.39	1.18
Valine	0.987	3.66	1.063	3.92	2.09	6.33

[1] MOLM dried powder.
[2]{ g amino acid/16g N= 100x 16/N(feed)} - [Maynard&Loosli 1962, McGRAW-HILL, N.Y., P104].
[3]Williams,H.H., et al (1955). The essential amino acid composition of animal feeds. Cornell Univ. Agr. Expt. Sta. Mem. 337.:Cited in: Maynard &Loosli, in ANIMAL NUTRITION, 5th,edition,P104.

Inclusion of MOLM in chicks ration at all levels, positively affected the chick performance, as shown in **Table 3**. The chicks fed MOLM diets consumed ($P<0.05$) more dry matter, metabolizable energy as well as more crude protein than those fed the control diet (0%M); as a result they gained ($P<0.05$) more weight. However, within MOLM fed groups dietary intake and weight gain increased as MOLM concentration in the diet, raised from 2%M up to 6%M. Generally in the present study, the tendency for feed consumption and chick performance to improve with increasing dietary MOLM concentration agrees with various reports from other studies; notably those by Duo *et al.*, (2001),

Olugbem *et al.*, (2010), Onuand Aniebo (2011), and Melesse *et al.*, (2011), who used *M. stenopetala.* They indicated that performance improvement was associated with leaf meal dietary inclusion rate not exceeding 5-6%.
Moringa dry matter and crude protein intakes had positively increased body gain and gain conversion rates, in an increasing progressive trend. This improvement could likely be attributed to MOLM protein quality effect.

Table 3. Broiler chicks growth performance on *Moringa* oleifera leaf meal supplemented; 2%, 4%, and 6% diets

Item	Treatments				Effect		
	Control	2%M	4%M	6%M	SEM	Feed	Week
Dry matter intake (g):							
Weekly	402.7[a]	661.9[b]	814.4[c]	1044.3[d]	10.91	-	***
Total	2725.0[a]	3039.6[d]	2980.0[c]	2948.4[b]	10.91	**	-
Energy intake(Mcal):							
Weekly	2.155[a]	2.375[b]	2.345[b]	2.319[b]	0.0336	***	-
Total	8.619[a]	9.503[b]	9.381[c]	9.276[bc]	0.0336	*	-
Body weight gain (g):							
Total	1434.4[a]	1635.8[b]	1688.2[b]	1615.2[b]	53.49	*	-
Daily	51[a]	58[b]	60[b]	58[b]	2.7	*	-
Period (days)	28	28	28	28	-	-	-
Feed conversion ratio - FCR	1.92	1.85	1.77	1.83	0.07	NS	-
Total CP intake (g)	654.0[a]	699.4[b]	707.8[b]	700.3[b]	2.44	*	***
PER - (gain/CP intake)	2.35	2.35	2.39	2.31	0.09	NS	-
Moringa intake (g):							
MOLM	-	60.79[a]	120.81[b]	176.90[c]	2.669	***	**
MOLM CP intake (g/g)	-	16.94[a]	33.67[b]	49.30[c]	0.744	***	**
Body gain/	-	56.00[a]	29.92[b]	18.53[c]	2.886	***	**
Moringa intake (g/g)							
Body gain/ MOLM CP intake (g/g)	-	139.20[a]	100.65[b]	66.48[c]	9.130	***	**
Mortality (%)	12	10	12	8	0.24	NS	-

Numerical increase in digestibility values of CP and CF up to 6% inclusion level of MOLM were obtained, but there were no differences (P>0.05) among tested groups in apparent retention of all nutrients examined, as can be observed in **Table 4** .

Table 4. Nutrient digestibility (%) of *Moringa oleifera* leaf meal diets fed to broiler chicks.

	Dietary treatment					
	Control	2%M	4%M	6%M	SEM	Sign.
Nutrient						
Dry matter	68.03	64.58	66.02	64.94	2.99	NS
Organic matter	72.91	68.75	69.74	71.65	2.59	NS
Crude protein	88.67	87.28	88.72	90.09	1.12	NS
Ether extractives	79.72	75.01	73.45	71.20	4.86	NS
Crude fibre	21.7	24.44	19.14	33.11	6.90	NS

Data of slaughter , and carcass characteristics, (**Table 5**) indicated significant differences ($P<0.05$) in slaughter weight, carcass weight, breast weight, abdominal fat and dressing percentage in chicks fed MOLM than those fed the control feed (0%M). Thigh, drumstick, giblet, wing and neck tend to increase in weight with inclusion of MOLM in the diet, but without significant differences ($P>0.05$) among tested groups. These results are in line with report by Iheukwumere *et al.,* (2008), and disagree with the results reported by Abdelmulalab (2005).

Table 5. Carcass analysis of broilers fed *Moringa oleifera* leaf meal diets

	Dietary treatments					
	Control	2%M	4%M	6%M	SEM	Sign.
Parameter						
Slaughter weight (g)	1840^{a}	2065^{b}	2060^{b}	2000^{ab}	63.42	*
Carcass weight (g)	1305^{a}	1505^{b}	1515^{b}	1450^{ab}	52.03	*
Dressing %	70.67^{a}	72.92^{b}	73.34^{b}	72.46^{ab}	0.70	*
Back (g)	280	310	325	300	15.92	NS
Breast (g)	440^{a}	496^{b}	510^{b}	470^{ab}	18.29	*
Drum stick (g)	190	195	200	205	4.86	NS
Wing (g)	155	155	151	155	5.73	NS
Giblets (g)	104.00	114.87	113.33	109.68	3.96	NS
Thigh (g)	276	290	295	290	11.07	NS
Neck (g)	89.95	99.68	100.02	93.4	3.43	NS
Abdominal fat (g)	18.43^{ab}	22.62^{ab}	24.83^{b}	16.39^{a}	2.35	*

It can be concluded that *Moring oleifera* leaf meal protein could be partially used to substitute for groundnut cake in broiler feeds. Minor deficiencies in Lysine, Methionine, Therionine and possibly Tryptophan may be ameliorated by modulating their supplementation rates in the compounded feed.

The constraints to enhanced utilization of MOLM reside chiefly with factors such as fibre content, and the presence of anti-nutritive compounds, observed at inclusion rates higher than 6%, which need further investigation.

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أثر استبدال كسب الفول السوداني في الغذاء بمسحوق ورق نبات

المورينقا أوليفيرا علي نمو الكتاكيت اللاحمة

سعاد جعفر بتيك, عفاف عبد الرحيم مبروك-, نهاء حامد طالب و يوسف رزق الله سليمان

الملخص:

أستخدمت مائتى كتكوت لاحم غير مجنس في تخطيط تجريبي عشوائي تام لدراسة التأثير علي النمو في الكتاكيت عند أستبدال كسب الفول السوداني في غذائها بمسحوق ورق نبات المورينقاأوليفيرا بنسب 2% ، 4% و6%. إستهلكت الكتاكيت التي أطعمت ورق المورينقا من المادة الجافة ، الطاقة الممثلة والبروتين الخام ، كميات أكبر من أستهلاك مجموعة كتاكيت الشاهد (0%) نتيجة لذلك كان لها الكسب الأعلي في النمو.

أرتفع أستهلاك المادة الجافة والوزن المكتسب أرتفاعآ مضطردآ بأرتفاع تركيز مسحوق ورق المورينقا في الغذاء بالتوالي من 2% إلي 6%. عزي الأرتفاع في الوزن المكتسب ومعدل التحويل الغذائي (معدل تحويل الوزن) ربما إلي أثر جودة بروتين ورق نبات المورينقا.