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Effect of levels of methionine supplementation on processed Mucuna sloanei seed meal based broiler chicken diets

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Target Audience: *Feed producers and poultry farmers.*

Abstract

A feeding trial was conducted with 150 Marshal Broiler chicken from day-old to 8 weeks to assess the effect of levels of methionine supplementation on processed Mucuna sloanei seed meal in broiler chickens diet. The trial lasted for 56 days. Mucuna sloanei seeds were soaked for 24 hours, and then boiled for 30 minutes after decanting the water used for soaking; oven dried and milled using the hammer mill (2.00 mm sieve). Five experimental diets were formulated (T_1 - T_5). T_1 was control diet, and contained neither Mucuna sloanei seed meal nor methionine supplementation. T_2 contained only Mucuna sloanei seed meal without methionine supplement, T_3–T_5 had 6% Mucuna sloanei seed meal quantitative replacement of soybean meal each, with methionine supplementation at 0.10%, 0.20% and 0.30% respectively. The feed conversion ratio of T_5 was the lowest, and so indicates better conversion than the rest. For cut parts, there were significant differences ($P<0.05$) for all the parameters measured. Diet 5 was better than the others. The organ weights showed no significant difference ($p>0.05$). Diet 5 had the least cost/kg weight, highest revenue and gross margin, and hence recommended.

Key Words: *Mucuna sloane*i; Methionine; supplementation; soaking; boiling.

Description of Problem

Some conventional feed ingredients such as soy bean meal and groundnut cake have become expensive and eventually scarce – not reaching the common man because of their costs. *Mucuna sloanei* is cheap and available, (about ₦5.22/kg as at the time of this research) but information about its proximate composition and anti-nutritional factors are still being investigated. The method of making good use of *Mucuna sloanei* as a conventional feedstuff is still being investigated and reported. The levels of methionine supplementation that will enhance productivity - (growth rate and/or feed conversion ratio) need to be determined. The aim of this investigation was to reduce the cost of broiler chickens diet and the cost of broiler chickens production. To achieve this, the proximate, gross energy, and some anti-nutrients in soaked and boiled *Mucuna sloanei* seed meal had to be determined. Also the effect of methionine supplementation on the processed *Mucuna sloanei* seed meal in broiler chickens diet was determined at the recommended inclusion level (13), and the economics of the experimental diets so fed to the broiler chickens was evaluated. Grain legumes are quite low in methionine content especially *Mucuna sloanei*. Methionine is an essential amino acid that cannot be synthesized in the animal's body, and so must be present in feed in required measure. Methionine is the main precursor of the amino acid cysteine, which is

in turn converted to glutathione, the main detoxification agent in the body (19). Methionine is the essential amino acid that assists in the breakdown of fats, thus helping prevent a build-up of fat in the liver and arteries that might obstruct blood flow to the brain, heart, and kidneys (20). It could affect collagen property and myoglobin status in the final formation of meat characteristic and level of the recommendation by National Research Council (NRC) should be suggested for better lean meat deposition and meat tenderness (21). Requirements are influenced by interactions between methionine and cystein. If cystine, or its metabolically active form cystein, is deficient in the diet, it is synthesized by the animal from methionine. The requirement for methionine is therefore partially dependent on cystine (or cystein) content of the diet (22). The methionine found for optimum growth performance of 3 to 6 week-old broilers raised under moderate temperature stress was 0.44% which is higher than the NRC recommended level of 0.38% (14).

Materials and Methods

The research was conducted at the Poultry Unit of the Teaching and Research Farm of Michael Okpara Unuiversity of Agriculture, Umudike. Umudike is located within latitude 5^0 29^l North and longitude 7^0 33^l (1). The processing of *Mucuna sloanei* involved soaking for 24 hours and boiling for 30 minutes after decanting the water used in soaking it, oven dried and milled using hammer mill (2.00 sieve size) mm. One hundred and fifty birds were allotted to 5 treatment diets with 3 replicates per treatment. Proximate, gross energy, methionine composition of the diet and *M. sloanei* were carried out accordingly (2). Hydrogen cyanide, saponin, phytic acid, oxalate and L- 3, 4 – dihydroxyphenylalanine (L-DOPA) were determined respectively (3) (4) (5) (6) (2). Growth performance and carcass evaluation was carried out as outlined (7). Economics of the diet was computed following the given description (8) and report as illustrated by Ekwu (9). The experiment was carried out in a completely randomized design (CRD) in which a fixed number of treatments (i.e. five) were assigned to the experimental units completely at random but, with constraints, each treatment with 30 birds in three replicates, the data collected were subjected to analysis of variance (10). The significant means were separated using Duncan's Multiple Range Test accordingly (11).

Source of Ingredients/Feedstuffs

Mucuna sloanei pods were purchased from markets of Uzuakoli, Bende Local Government Area and Ariam Elu-elu, Ikwuano Local Government Area both in Abia State, Nigeria. The others were purchased at JOCAN Farms and allied products at Umuahia, Abia State Nigeria.

Results and Discussion

The crude protein (CP) of the diets fell within the normal range for broiler chicks (12) for a straight diet. The CP (23.89) and gross energy (4.59 Kcal/g) indicated that the test ingredient (*M. sloanei meal*) is a potential feed ingredient (Table 1), since the anti-nutritional factors did not pose any threat at this level of inclusion (13), and this processing method used whereby *Mucuna sloanei* is soaked for 24 hours and boiled for 30 minutes before oven-drying and crushing reduced the anti-nutritional contents of *M. sloanei* to the least/minimum amounts.

It is also noted that the inclusion level that produces the safest and best non-toxic performance of soaked and boiled *M. sloanei* seed meal in broiler feed production as used is 6.00% (13), and since legumes in general and *M. sloanei* especially is poor in methionine content, the supplementation becomes necessary in feed formulation.

Methionine content of T_2 (the diet with *Mucuna sloanei* seed meal and without methionine supplementation) was lower than the recommended level for broiler chickens (0.44%) (14), supporting the fact that grain legumes are low in methionine (Table 1).

The breast cut of birds placed on diets 3, 4, and 5, (Table 4) were the meatiest, which is probably due to efficient utilization of nutrients in terms of digestion, absorption and assimilation (16) and due to high level of methionine content (17).

For the back cut, diets 1, 3, 4 and 5 competed with one another, showing that these diets support tissue disposition for back than diet 2 (18) From Table 3, it could be seen that diet 5 became the best diet due to high level of methionine supplementation while diet 2 without methionine supplementation (containing *M. sloanei* only) became the worst diet due to low level of methionine in the diet. Diet 5 had superior weight gain and better feed conversion.

Considering the higher value in birds fed diet 5 (with 0.30% methionine) for dressed weight and favourable comparison with birds fed control diet for other parameters, diet 5 became the choice diet (Table 4). This highest value for dressed weight obtained from diet 5, signify good formation of glutathione enzymes that help detoxify chemicals and free radicals (15).

Diet 5 had the least cost/weight gain, highest revenue and highest gross margin, supporting its superiority over others (Table 6).

Conclusion and Applications

1. Soaked and boiled *Mucuna sloanei* seed meal with crude protein content of 23.89% is a possible alternative protein source.
2. Diet 5 containing *Mucuna sloanei* seed meal with 0.30% methionine supplementation, had the least feed conversion ratio and compared favourably with birds fed control diet for dressed weight and prime cut parts.
3. Diet 5 had the least cost/kg weight gain, highest revenue and highest gross margin, making it more economically viable than others.
4. Therefore, diet 5 (with 0.30% methionine supplementation) enhanced a high quality protein production at reduced cost hence, recommended.

Table 1: Composition of experimental diets and other parameters Methionine content of the diets and test ingredient (SBMS)

Ingredients	Diets					
	T_1	T_2	T_3	T_4	T_5	SBMS
Maize	49.00	49.00	48.90	48.80	48.70	-
Soybean meal	25.50	19.50	19.50	19.50	19.50	-
Mucuna sloanei	-	**6.00**	**6.00**	**6.00**	**6.00**	-
Palm kernel cake	12.00	12.00	12.00	12.00	12.00	-
Wheat offal	5.75	5.75	5.75	5.75	5.75	-
Fish meal	2.00	2.00	2.00	2.00	2.00	-
Blood meal	2.00	2.00	2.00	2.00	2.00	-
Bone meal	3.00	3.00	3.00	3.00	3.00	-
Palm oil	0.15	0.15	0.15	0.15	0.15	-
Lysine	0.10	0.10	0.10	0.10	0.10	-
Methionine	-	-	**0.10**	**0.20**	**0.30**	-
Salt	0.25	0.25	0.25	0.25	0.25	-
Vitamin/min premix	0.25	0.25	0.25	0.25	0.25	-
Total	100.00	100.00	100.00	100.00	100.00	-
Determined Proximate contents of diets (%)						
Moisture	8.56	9.12	8.13	7.92	7.89	8.48
Crude Protein	21.29	21.12	21.13	21.28	21.66	23.89
Crude Fat	3.84	3.59	3.61	3.64	3.79	2.87
Crude Fibre	4.08	3.66	3.61	3.56	3.53	9.79
Ash	7.39	6.78	7.44	7.68	7.76	6.38
NFE	55.54	55.73	56.08	55.92	55.35	48.59
Gross Energy (Kcal/g)	4.11	4.09	4.12	4.12	4.12	4.59
Methionine content	0.45	0.31	0.46	0.47	0.48	0.22

NFE: Nitrogen Free Extract; SBMS: Soaked and Boiled *Mucuna sloanei*

Table 2: Anti-Nutritional factors in soaked and boiled *Mucuna sloanei* seed

Anti-Nutritional Factors	Measurements
Trypsin Inhibitor $_{(TIU/mg)}$	1.86
Hydrogen Cyanide (Mg/kg)	2.58
Saponin (%)	0.24
Phytic Acid (%)	0.16
Oxalate (%)	0.06
L – DOPA: L – 3, 4, - dihydroxyphenylalanine (%)	3.11

Table 3: Growth performance of broiler chickens fed experimental diets

Parameters (g)	T_1Control	T_2	T_3	T_4	T_5	SEM
Initial weight/bird	41.15	41.22	41.20	41.21	41.12	0.03
Final weight/bird	1551^{c}	1249^{d}	1561^{bc}	1580^{b}	1621^{a}	7.52
Weight gain/bird	1509.9^{b}	1207.8^{c}	1519.8^{b}	1538.8^{b}	1579.9^{a}	67.1
Daily weight gain	26.96^{b}	21.57^{c}	27.14^{b}	27.48^{b}	28.21^{a}	1.19
Feed intake/bird	5113^{e}	5654^{a}	5241^{b}	5181^{c}	5163^{d}	1.32
Feed intake/bird/day	91.30^{a}	100.96^{a}	93.59^{b}	92.52^{c}	92.19^{d}	0.03
Feed conversion ratio	3.39^{b}	4.68^{a}	3.45^{b}	3.37^{b}	3.27^{c}	0.26

$^{a-e}$ means treatment within rows with different superscripts are significantly different ($P < 0.05$). SEM = Standard Error of Means.

Table 4: Carcass cut parts of broiler chickens fed experimental diet (expressed as % dressed weight)

Parameters (%)	T_1(Control)	T_2	T_3	T_4	T_5	SEM
Dressed weight	90.32^{d}	88.00^{e}	92.31^{b}	91.77^{c}	93.83^{a}	0.37
Breast cut	25.20^{b}	22.42^{c}	27.16^{a}	26.29^{a}	26.48^{a}	2.60
Drumstick	18.28^{b}	20.22^{a}	17.28^{c}	17.67^{c}	17.54^{c}	0.28
Back cut	23.15^{a}	22.36^{b}	23.14^{a}	22.99^{a}	23.09^{a}	0.96
Thigh	18.18	17.98	17.58	18.17	17.91	0.54
Wing	15.03^{a}	16.62^{a}	14.74^{b}	14.87^{a}	14.95^{a}	0.55

$^{a-d}$ means treatment within rows with different superscripts are significantly different ($P < 0.05$). SEM = Standard Error of Means.

Table 5: Organ weights of broiler chickens fed experimental diets (expressed as % dressed weight)

Parameters (%)	T_1 Control	T_2	T_3	T_4	T_5	SEM
Intestine	10.22	10.38	10.39	10.42	10.40	0.16
Proventriculus	0.75	0.76	0.77	0.78	0.78	0.01
Liver	3.01	3.16	3.12	3.26	3.26	0.09
Gizzard	4.45	4.60	4.61	4.61	4.48	0.10
Heart	0.79	0.79	0.80	0.78	0.80	0.06
Lungs	0.88	0.89	0.90	0.91	0.91	0.03
Kidney	1.10	0.96	1.05	0.99	0.98	0.04
Spleen	0.20	0.22	0.21	0.24	0.22	0.01

Table 6: Economics of broiler chickens fed experimental diets (*M. sloanei*)

Parameters (₦)	T_1 Control	T_2	T_3	T_4	T_5	SEM
Cost/kg feed	90.44^{b}	86.66^{d}	87.98^{c}	89.30^{c}	90.63^{a}	0.00
Cost of feed consumed	463.32^{c}	489.97^{a}	461.10^{d}	462.66^{c}	467.92^{b}	0.44
Cost /kg weight gain	342.95^{b}	467.30^{a}	338.50^{b}	335.27^{b}	329.36^{b}	1.79
Cost of production	483.32^{c}	509.97^{a}	481.10^{d}	482.66^{c}	487.92^{b}	0.52
Revenue	1215.90^{c}	944.10^{d}	1224.90^{c}	1242.00^{b}	1278.90^{a}	7.10
Gross margin	732.58^{c}	434.13^{d}	743.80^{bc}	779.34^{b}	790.98^{a}	6.02

$^{a-d}$ means treatment within rows with different superscripts are significantly different ($P < 0.05$). SEM = Standard Error of Means.

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