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Effect of Quantitative Substitution of Cooked *Mucuna utilis* Seed Meal for Soybean Meal in Broiler Finisher Diet

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Abstract: This work was undertaken to assess the effect of quantitative substitution of cooked *Mucuna utilis* Seed Meal (CMSM) for soyabean meal in broiler finisher ration. Seventy-five; 4-week-old Anak broiler birds were used in this trial. The birds were divided into five treatments groups of 15 birds each in a Completely Randomized Design (CRD).The treatments had soyabean meal quantitatively substituted at 0, 22.42% (5%),44.84% (10), 67.26 (15%) and 89.68 (20%) respectively by cooked *Mucuna utilis* Seed Meal (CMSM). There were significant (P<0.05) differences between treatment means for feed intake, weight gain and feed conversion ratio. They decreased as the dietary levels of *Mucuna utilis* inclusion increased in the diet. The cost /kg weight gain for test diets were significantly (P<0.05) better than that of control diet. Cut-parts and organ proportions presented as a percentage dressed weight showed no significant (P>0.05) differences. Considering the lower feed conversion ratio for all (CMSM) diets, favourably comparable market weight of the birds fed (CMSM) even at 20% dietary level of inclusion, good cut-parts and organ weights and better cost per Kg weight gain of the test diets, 20% dietary level of substitution (CMSM) for soyabean meal is recommended in broiler finisher ration.

Key words: Mucuna, seed meal, substitution, soybean meal, broiler finisher diet

Introduction

The protein intake of Nigerians has been on a decline as a result of the ever increasing population. This level of animal protein consumption has direct influence on the general well being and health of the populace (Bamigbose *et al*., 2002). Poultry production, especially the broiler chicken remains one of the veritable ways of achieving sustainable and rapid production of high quality protein to meet the increasing demand of the Nigerian teeming populace (Apata and Ojo, 2000) due to short generation interval of broiler chicken (Akinmutimi and Onwukwe, 2002).

Feed cost alone in poultry enterprise is about 70% of the total cost of production (Ogunfowora, 1984), which has been attributed to over-dependence on the conventional feedstuffs such as soyabean and groundnut cake, (Emenalon and Udedibie, 1998). A high demand for these feed ingredients has resulted in an increase in their prices and consequently, cost of poultry feed and its products (Akinmutimi *et al*., 2002). Hence, the need to source for alternative but promising feedstuffs. One of them is *Mucuna utilis* (Iyayi and Egharevba, 1998; Anele, 2002). It is a widely available leguminous seeds that thrives well where others fail due to excellent adaptability to extreme climatic conditions. It yields about 2- 4 tonnes of seed per hectare. It has crude protein of about 33.4% and carbohydrate content of 47.9% on a dry matter basis (Iyayi and Egharevba, 1998; Anele, 2002).

One of the major problems with legume utilization is the presence of anti-nutritional factors (Oke *et al*., 2002). *Mucuna utilis* seeds have been reported to contain anti-nutrients like tannins, phytins, L-Dopa, cyanogenic glycosides, etc (Iyayi and Egharevba, 1998; Ukachukwu *et al*., 1999 and Anele, 2002). Carew *et al*. (1998) reported poor performance of birds when fed raw *Mucuna utilis*. Cooking is a conventional method of detoxification among the rural dwellers. It was against this backdrop that this study was embarked upon to quantitatively substitute cooked *Mucuna utilis* seed meal for soyabean meal in broiler finisher ration.

Materials and Methods

This experiment was conducted at the poultry unit of the Teaching and Research farm of the Michael Okpara University of Agriculture, Umudike. *Mucuna utilis* seeds were purchased from Nsukka, Enugu State while other feed ingredients were bought in Umuahia, Abia State. The raw *Mucuna utilis* seeds were cooked with firewood for 90 minutes at about 100°C; dried at 60°C in the oven; milled and then incorporated into the diets.

Five experimental diets were formulated. Diet 1 was purely soybean-based diet (control diet) while the test feedstuff (cooked *mucuna* seed meal) quantitatively replaced soyabean in diets at 22.42% (5%), 44.84% (10%), 66.26% (15%), 89.68% (20%) dietary level of inclusion, respectively (Table 1). Seventy-five (75), four-week-old broiler chicken were used for the trial. They were divided into five groups of 15 birds each; each treatment had 3 replicates and 5 birds per replicate in a Completely Randomized Design (CRD). Each replicate

Table 1: Percentage Composition of the Experimental Diets Showing the Inclusion levels of Mucuna utilis Seed Meal

	Diet 1 (Control	Diet 2 (5%)	Diet 3 (10%)	Diet 4 (15%)	Diet 5 (20%)
Maize	54	54	54	54	54
Soyabean	22.3	17.3	12.3	7.3	2.3
Mucuna	-	5	10	15	20
Blood meal	3	3	3	3	3
Fish meal	3	3	3	3	3
Palm Kernel Cake	14	14	14	14	14
Bone meal	1	1	1	1	1
Oyster shell	2	2	2	2	2
*Vitamin/premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.1	0.1	0.1	0.1	0.1
Methionine	0.1	0.1	0.1	0.1	0.1
Total	100	100	100	100	100
Calculated composition					
ME (kcal/g)	2.917	2.915	2.913	2.91	2.907
CP (%)	21.19	20.18	19.17	18.16	17.15

*1kg of vitamin-premix contains: vitamin A 4,800.000IU, vitamin C 100.00g; vitamin D3 8000.000IU; Biotin 0.00g; vitamin E12.00g; chlorinechloride 80.00g; vitamin k 0.80g; vitamin B2 1.60g; zinc 60.00g; calcium D-pautohenate- 400g; copper 10.00g; vitamin B6 1.20g; iodine 0.30g; vitamin B12 8.00mg; cobalt 0.30g; folic acid 0.80g. selenium 0.04g.

Table 2: Proximate composition of experimental diets and the test ingredient.

Determined analysis	Diet 1 (Control)	Diet 2 (5%)	Diet 3 (10%)	Diet 4 (15%)	Diet 5 (20%)	CMSM
Dry matter (%)	94.65	94.25	94.5	94.2	94.3	88.18
Crude protein (%)	17.94	17.06	17.91	17.36	17.53	21.8
Ether Extract (%)	2.25	3.56	2.48	3.25	7.1	1.94
Ash (%)	28.65	25.3	26.45	26.3	27.05	4.29
Carbohydrate	45.86	50.5	46.94	48.34	46.76	11.75
Gross Energy (kcal/g)	2862	2887	2897	2873.1	2852	48.4

was housed in 2m x 4m floor compartments. Feed and water were provided ad-libitum throught the experiment that lasted for 28 days. Data were collected weekly on feed intake, weight gain and were used to calculate feed - to- gain ratio. The cost / kg weight gain was calculated according to the procedure of Sonaiya *et al.*(1986) and Ukachukwu and Anugwa (1995).

Carcass quality and organ weights were carried out as described by Ojewola and Longe (2000). Samples of the diets and the test ingredient were analyzed for proximate composition according to the procedure of A.O.A.C (1980). Also, the raw and cooked *Mucuna utilis* seed meal were analyzed for Tannin, Phytin and Cyanogenic glucosides as described by Akinmutimi and Onwukwe (2000). Data collected were analyzed statistically, using the analysis of variance (ANOVA) according to Steel and Torrie (1980). Differences between treatment means were determined with Duncan's New Multiple Range Test (Duncan, 1955).

Results and Discussion

The proximate composition of the diets and the test ingredient is as shown in Table 2. There was slight variation in the value of crude protein among the experimental diets. This is expected since the diets were not formulated to be iso-nitrogenous. The proximate composition of the cooked *Mucuna utilis* shows that it contains 21.80% crude protein, 1.94 ether extract, 4.29% crude fibre, 11.75% and 48.4% nitrogen free extract. The gross energy is 3.223 kcal/g. The above proximate composition is slightly at variance with the findings of Agbede and Aletor (2001). Various factors ranging from processing method, the type of soil on which the crop was grown and species difference could be responsible for the variations (Ojewola *et al.,* 2005). The gross energy value of 3.223Kcal/g for the seeds cooked for 90 minutes is an appreciable energy value in relation to the values of other grain legumes, such as groundnut cake, with 2.64Kcal/g boiled jack bean with 2.97Kcal/g and cooked sword bean with 3.060Kcal/g as reported by Ogbonna *et al.* (2000); Ewa (1999); Izundu (1999) respectively. This suggests the potentiality of the seeds as energy supplements.

Table 3 reveals some of the anti-nutritional factors in raw and cooked *Mucuna utilis* seeds. They are phytic acid, tannin and cyanogenic glycosides. There was a general reduction in the quantity of anti-nutrients due to cooking. The observed result confirms the report of earlier workers (Ukachukwu *et al.*, 1999 and Anele, 2002) who reported the presence of the above anti-nutrients in *Mucuna utilis* seeds. Also, reduction in the quantity of anti-nutrients as a result of cooking confirms the report of earlier reporters that wet heat treatment reduces anti-nutrients, especially heat labile anti-nutrients (Udedibie and Carlini, 1998; Ewa, 1999 and Akinmutimi, 2004).

Table 4 shows growth performance of broiler finisher

Table 3: The % Anti-Nutritional Factors In raw and cooked *Mucuna utilis*

	Raw	Cooked	% Reduction
Phytic (%)	2.17	1.35	37.78%
Tannin (Mg/g)	1.07	0.77	28.03%
Cyanogenic glycosides (%)	0.00881	0.00604	31.75%

birds fed *Mucuna utilis* seeds. There were significant (P<0.05) differences between treatment means for feed intake, weight gain and feed conversion ratio. For feed intake, T1 and T2 were significantly (P<0.05) different from T3, while T3 was significantly (P<0.05) different from T4 and T5. The feed intake decreased significantly (P<0.05) as dietary levels of inclusion of Cooked Mucuna Seed Meal (CMSM) increased. For weight gain, T1, T2 and T3 were significantly (P<0.05) different from T4 and T5 (Table 2). Also, the weight decreased as the dietary levels of (CMSM) increased.

The feed conversion ratio followed similar pattern in that it decreases from T1 to T5. T1 had the highest value while T4 and T5 had the lowest values (Table 2). No mortality was observed throughout the experimental period.

The decrease in the feed intake as the dietary level of inclusion of (CMSM) increased could be attributed to the effect of residual anti-nutritional factors which becomes pronounced as the dietary level of test feedstuff increased. This further led to lower feed intake (Ologhobo *et al*., 1993; Akinmutimi, 2001). The result observed could have been due to presence from anti-nutritional factor such as Tannin, L-Dopa, etc. For example, Tannin has been reported to cause poor palatability in high Tannin diet due to its astringent property as a result of its ability to bind with protein of saliva and mucosa membranes (Melansho *et al*., 1987; D'mello and Devendra, 1995). Also, L-Dopa another toxic component has been recorded to reduce appetite in the animal (Carew *et al*., 1998; Anele, 2002) and hence lower feed intake observed.

The lower values of weight gain observed as dietary levels of (CMSM) increased could be due to several factors such as the lower feed intake (Melansho *et al*., 1987; D'mello and Devendra, 1995; Carew *et al*., 1998; Anele, 2002) as well as the effect of toxic components such as Cyanogenic glycosides, which on hydrolysis release Hydrogen Cyanide (HCN) which has been reported to have the ability to cause marked weight change (Aletor and Fetuga, 1988; Aletor, 1993). The Cyanide detoxification route in man and animals is through Cyanide Thiocyanate sulphur-transferase (Rhodenase pathway) which generally requires organic sulphur donors in the form of Methionine and Cysteine, thereby precipitating methionine deficiency in an otherwise balance diet (Aletor and Fasuyi, 1997). It is this methionine deficiency that results in poor growth. Phytin on the other hand, has the ability to chelate certain mineral elements, especially Ca, Fe, and Zn, thereby rendering them unavailable for metabolism of nutrients with resultant effect such as depression in growth (Aletor and Fasuyi, 1997). Tannins also have the ability to bind dietary proteins and digestive enzymes into complexes that are not readily digestible (Melansho *et al*., 1987; D'mello and Devendra, 1995).

The birds placed on diets containing Mucuna seeds meals had better feed conversion ratio than the control diet. This implies that the (CMSM) diets were better utilized than the control diet. Failure to justify this in weight gain may be due to lower feed intake. The birds fed both the control diet and CMSM diets had the final weights that fell within the normal standard (Obioha, 1992; Oluyemi and Roberts, 2000). Also, there was no mortality recorded for all the treatments throughout the experimental period. Considering the zero mortality for all the treatments, better feed conversion ratio of the birds placed on treatment diets containing (CMSM) as compared to that of control diet, good market weight for finisher broiler birds placed on test diets up to 20%, 20% dietary level of inclusion of (CMSM) is acceptable for growth performance.

Table 5 reveals the economics of cooked *Mucuna utilis* meal as a substitute for soya bean meal in broiler diets. There was significant (P<0.05) difference for all the parameters considered. The cost/kg feed(#), cost of feed consumed by bird in (#) an d the cost of kg/ weight gain was significantly (P<0.05) reduced as the percent substitution of cooked *Mucuna utilis* meal increased from 22,42 (5%) to 89.68 (20%) in the diet. Although the test diets were significantly (P<0.05) lower than the control diet, diet 3 seem to be the most economically advantageous. The least cost per Kg of feed observed for diet 5 is as a result of lower cost of cooked *Mucuna* seed meal which also resulted in the lower cost of feed consumed. Diet 3 became the most advantageous diet as a result of moderate cost per Kg of feed, moderate cost of feed consumed and good weight gain. This cumulatively made the cost per Kg weight gain of diet 3 to be significantly (P<0.05)lower than others and hence the most economically advantageous (Ojewola, 2005).

The cut-parts as a percentage dressed weight of broiler finisher birds fed both control and (CMSM) based diets is as shown in Table 6. There was no significant (P>0.05) difference between the treatment means both for the control and CMSM diets for all parameters. There was high dressing percentage for all the treatment means. This non-significance implies that any of the diets is a good choice. The high dressing percentage results imply that the observed final weight is not due to the visceral or waste such as shank, feather, etc (Oluyemi and Roberts, 2000). The mean weight of organs as a percentage dressed weight followed a similar pattern in that there was no significant (P>0.05) difference in all the parameters measured (Table 6).

Table 4: Mean Values for Growth Performance of Broiler Finisher Fed Varying Level Of *Mucuna utilis* Seed Meal

Performance index	Diet 1 (control)	Diet 2 (5%)	Diet 3 (10%)	Diet 4 (15%)	Diet 5 (20%)	SEM
Initial weight (kg)	0.64	63.00%	0.64	0.66	0.66	0.01
Final weight (kg)	2.07	1.97	203.00%	1.91	1.83	0.4
Daily feed intake (g)	150^{a}	145.36^{a}	141.42^{b}	139.79^{c}	137.50^{c}	2.2
Daily weight gain (g)	51.07^{a}	47.86^{a}	49.64^{a}	44.64^{b}	41.97^{b}	1.69
Feed conversion ratio	2.16^{a}	2.07^{a}	1.95^{b}	1.95^{b}	1.95^{b}	0.05
Mortality	0	0	0	0	0	0

Table 5: Economics of *Mucuna utilis* meal as a substitute for soya bean meal in broiler diet (28 days).

Performance index	Diet 1 (control)	Diet 2 (5%)	Diet 3 (10%)	Diet 4 (15%)	Diet 5 (20%)	SEM
Cost/kg of feed (N)	52.02^{a}	50.72^{b}	48.92^{c}	47.12^{d}	45.32^{e}	0.02
Cost of feed consumed (N)	220.58^{a}	206.43^{b}	193.70^{c}	181.40^{d}	174.47^{e}	0.01
Cost/kg of weight gain	154.25^{a}	154.05^{b}	139.35^{e}	145.12^{d}	147.06^{c}	0.01

Table 6: Carcass Characteristics and organ weights Of Birds Fed Varying Levels Of *Mucuna utilis* Seed Meal

Parameters	Diet 1 (0%)	Diet 2 (5%)	Diet 3 (10%)	Diet 4 (15%)	Diet 5 (20%)	SEM
Wing	12.81	13.95	13.23	13.04	13.96	0.24
Breast out	27.76	28.51	28.87	27.75	25.36	0.61
Back cut	16.66	17.51	16.61	18.08	19.97	0.56
Drumstick	16.05	14.06	14.41	14.8	13.93	0.38
Thigh	17.67	16.74	17.65	16.61	16.05	0.31
Dressing%	90.95	90.77	90.77	90.28	80.97	
Gizzard	4.4	4.48	4.59	4.65	4.63	0.05
Liver	2.51	2.34	2.43	2.46	2.84	0.09
Proventriculus	0.49	0.61	0.64	0.75	0.75	0.05
Kidney	0.79	0.93	0.81	0.88	0.92	0.03

This shows that the residual anti-nutritional factors do not have observable effects on the organs (Ologhobo *et al*., 1993). The cut-parts, organ weights and high dressing percentage results for all the diets confirm the recommendation of 20% dietary level of inclusion of (CMSM).

Conclusion: Judging from the lower feed-to-gain ratio for all (CMSM) diets, favourably comparable market weight of the birds fed (CMSM) even at 20% dietary level of inclusion, good cut-parts and organ weights and better cost per Kg weight gain of the test diets, 20% dietary level of substitution (CMSM) for soyabean meal is recommended.

References

Agbede, J.O. and V.A. Aletor, 2001. Characterization and protein quality evaluation of differently processed Mucuna seed flour. Proceed. 26th Annual Conf. NSAP, pp: 210-213.

Akinmutimi, A.H., 2001. The effect of potash cooked lima bean (*Phaseolus lunatus*) on broiler starter diets. Niger Agri. J., 32: 109-118.

Akinmutimi, A.H, S.F. Abasiekong and R.O. Izundu, 2002. Effect of processing on metabolisability of energy and protein content of sword bean (*Canavalia gladiata*) using muscovry duck (*Carina muschata*) Trp. J. Anim. Sci., 5: 51-56.

Akinmutimi, A.H. and C.C. Onwukwe, 2002. Effect of cooking with various concentrations of potash on Nutrient composition of lima beans. J. Agri. Biotech, 1: 1-3.

Akinmutimi, A.H., 2004. Evaluation of sword bean (*Canavalia gladiata*) as alternative feed resource for broiler chickens. Ph.D. dissertation, Michael Okpara Universty of Agriculture, Umudike, Abia state.

Aletor, V.A., 1993. Cyanide in garri. An assessment of soma aspects of the nutrition, biochemistry and haematology of rats fed garri containing varying residual cyanide levels. Int. J. Food Sci., Nutr., 44: 289-295.

Aletor, V.A. and B.L. Fetuga, 1988. Some pathological effects of raw lima bean (*Phaseolus lunatus*) fed to growing rats. Legume Res., 11: 21-26.

Aletor, V.A. and A.O. Fasuyi, 1997. Nutrient composition and processing effects on cassava leaf (*Manihot esculenta*, cranzt) anti-nutrients. Proceedings of 2nd annual conference of Animal Science Association of Nigeria. September, 16-17, 1997.

Anele, U.Y., 2002. The effects of raw *Mucuna utilis* extract on broiler birds. B.Sc. Thesis. Michael Okpara University of Agriculture, Umudike.

A.O.A.C., 1980. Association of Analytical Chemists. Official Methods of Analysis. 13th Washington D. C.

Apata, D.F. and Y. Ojo, 2000. Efficacy of the *Trichoderma viride* enzyme complex in broiler starter fed cowpea Testa Based Diets. Proceedings of 25th Annual Conference of Nigerian Society for Animal Production. March 19-23, 2000: 132-134.

Bamigbose, A.M., A. Morenikeji, W.A. Olayemi, A.O. Osafowora, A.O. Oso and O.T. Ojo, 2002. Performance of weaner rabbits fed supplemented Tridax procumbens deits. Proceedings of 7th Annual Conference of Animal Science Association of Nigerian. September, 16th-19th: 69-70.

Carew, L.B. Alster and A.G. Gernat, 1998. Consumption of raw velvet beans (*Mununa pruriens*) alters organ weights and intestinal lengths in broiler. Poult. Sci., 77 (suppl.1): 56.

D'mello, J.P.F. and Devendra, 1995. Tropical legumes in Animal Nutrition: United Kingdom, 96-133.

Duncan, D.B., 1955. Multiple Range and Multiple F-tests Biometrics 11: 1-42.

Emenalon, O.O. and A.B.I. Udedibie, 1998. Effect of dietary raw, cooked and toasted *Mucuna pruriens* seeds (velvet bean) on the performance of finisher broiler. Nig. J. Anim. Prod., 25: 115-119.

Ewa, U.E., 1999. Evaluation of the metabolisable energy and true digestibleprotein of jackbean (*Canavalia ensiformes)* using muscovy ducks *(Carina moschata)*. BSc. thesis, Michael Okpara University of Agriculture, Umudike, pp: 25-33.

Iyayi, E.A. and Egharevba, 1998. Biochemical evaluation of seeds of an under utilized legume (*Mucuna utilis*). Nig. J. Anim. Prod., 25: 40-45.

Izundu, R.O., 1999. Effect of processing on energy and protein digestibility of sword bean (*Canavalia gladiata*) using muscovy ducks (*Carina moschata*). BSc. thesis, Michael Okpara University of Agriculture, Umudike, pp: 23-38.

Melansho H., L.G. Butler and D.M. Carlson, 1987. Dietary tannins and salivary proline-rich proteins: interacting induction and defense-mechanisms. Ann. Rev. Nutr., 7: 423-440.

Obioha, F.C., 1992. A Guide to poultry production in the tropics: Acena publishers Nigeria.

Ogunfowora, O., 1984. Structure, cost and rations in feed management. Training workshop, Dept of Agric Economics, University of Ibadan, Nigeria, April 10-May 02.

Ojewola, G.S. and O.G. Longe, 2000. Carcass yield and quality of broiler chicken fed varying protein levels. Global J. Pure and Appl. Sci., 6: 407-411.

Ojewola, G.S., F.C. Okoye and O.A. Ukoha, 2005. Comparative Utilization of three animal protein sources by broiler chickens. Int. J. Poult. Sci., 4: 462-467.

Ogbonna, I.U., A.O. Oredein and A.O.K. Adeshinwa, 2000. Effect of replacing groundnut cake with raw soyabean residue in diet on performance and nutrient digestibilityof cockerel chicks: A preliminary study. Nig. Poult. Sci. J., 1: 23-31.

Oke, D.B., M.O. Oke and O.A. Adeyemi, 2002. Predictions of cowpea seed protein quality through total sulphur determination proceedings of 7th Annual Conference of Animal Science Association of Nigeria Sept. 16-19th: 121.

Ologhobo, A.D., A. Apata, A. Oyejide and R.O. Akinpelu, 1993. A comparison of protein fraction prepared from liam beans (*Phaseolus lunatus*) in starter diets. Animal Resources, 4:13-30.

Oluyemi, J.A. and F.A. Roberts, 2000. Poultry production in warm wet climates, Macmillan Press. Ltd, London.

Sonaiya, E.B., A.R. Williams and S.A. Oni, 1986. A biological and economic appraisal of broiler production up to 16 weeks. J. Anim. Sci. Res., 6:115-125.

Steel, R.G. and J.H. Torrie, 1980. Principles and procedures of statistics 2nd Ed. Mcgrand Hill book company Inc. New York.

Udedibie, A.B.I. and C.R. Carlini, 1998. Crack and cook. a simple and quick process for elimination of concanavalin A (Con A) from canavalia seeds. Anim. Feed Sci. Tec., 74; 179-184.

Ukachukwu, S.N. and F.O.I. Anugwa, 1995. Bioeconomics of feeding raw or heat treated soya beans to broilers. Nig. J. Anim. Prod., 22: 137-147.

Ukachukwu, S.N., F.C. Obioja and N. Amechi, 1999. Toxicity of raw *Mucuna cochinchinesis* extracts on broiler chicks. J. Sust. Agri. Environ., 1: 123-126.