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Effect of Cooking Periods on the Nutrient Composition of Velvet Beans (*Mucuna pruriens*)

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Abstract: The nutritive value of raw and processed velvet beans (*Mucuna pruriens*) was investigated using the following parameters-proximate composition, gross energy, mineral composition and anti-nutritional factors. The raw and processed seeds were dried, milled and chemically analysed. Values for crude protein, ether extract and ash for the raw seeds were similar to the values for seeds cooked for 30 min but significantly ($p<0.05$) higher than the seeds cooked for 60 and 90 min. The gross energy content for the raw had significantly ($p<0.05$) higher values than all. For mineral contents (macro and micro) seeds cooked for 90 min had the highest value that were significantly ($p<0.05$) higher than all with exception of Sodium that did not follow a specific pattern. Also, seeds cooked for 90 min had the highest percentage reduction in all the anti-nutritional factors with 100% reduction in trypsin inhibitor, 69.62% in hydrogen cyanide and 27.05% reduction in tannin. With appreciable value of crude protein (22.82%), energy content of 4.23 kcal g^{-1}, highest values for both macro and micro minerals and highest percentage reduction in all the anti-nutritional factors for the seeds cooked for 90 min. Ninety minutes of cooking is therefore, recommended for usage in livestock and poultry ration.

Key words: Effect, cooking periods, nutrient composition, velvet beans (*Mucuna pruriens*)

INTRODUCTION

Livestock and poultry farmers, especially those in Nigeria and neighbouring countries are faced with the problem of continual inadequacy of feed stuffs. This has been blamed on the rising needs of man for the same livestock/poultry feedstuffs for his food and industrial raw materials use (Duruna *et al*., 2006). This has led to escalating cost of conventional feed stuffs (maize, soyabean, groundnut e.t.c.) resulting in feed cost being 70-80% of the total cost of production (Akinmutimi, 2006). The resultant effect of high demand and rising costs is scarcity. Thus, existing farmers are unable to meet the feed requirements of those livestock/poultry. Consequently, they are forced to close their farms or run at a very low level of stock (Duruna *et al*., 2006). The over all effects of the above is shortage of animal protein production and hence shortage of animal protein intake due to scarcity and high cost of animal products (Akinmutimi *et al*., 2006).

There is therefore, the need to source for an alternative feed stuff that is cheap, available and less competed for by man and industry (Akinmutimi, 2004a). One of the envisaged alternative feed stuff is *Mucuna pruriens* (Ravindran, 1988). It belongs to the family Fabaceae. It is adapted to wide variety of soils, relatively free of pests and diseases. Average yield of seed of about 1.8-2.29 t ha^{-1} has been reported. It is a good source of crude protein and fats with relatively favorable amino acid composition and certain minerals such as Ca and Fe. Like other mucuna species, L-Dopa, a major anti nutrient has been reported of which much has been reported to be up to 3-5% of seed. When eaten raw or not properly processesed, its conversing to dopamine result in nausea vomiting, anxiety, agitation, nervousness, anorexia, insomnia and vivid dreams. This occurs because dopamine is a neuro transmitter involving in the replication of the heart, vascular system (Standaert and Young, 1999; Dolley, 1998; Milton *et al*., 2000). Presence of other numerous anti-nutritional compounds (tannin, trypsin inhibitors and cyanogenic glycosides have been reported (Milton *et al*., 2000). The need then for processing before use. Heat treatment is an acceptable, common and major means of detoxification among both urban and rural dwellers in Nigeria. This calls for its use in this study.

The objective of this study, is to determine the nutritive value of raw *Mucuna pruriens* seeds and seeds that have been subjected to different durations of cooking using proximate composition, gross energy, mineral composition and anti-nutritional factors.

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MATERIALS AND METHODS

Mucuna pruriens seeds were gotten from Abia state University (Umuahia campus). Sample A was the raw seed sample while samples B, C and D were *Mucuna pruriens* seeds cooked at about 100°C for 30, 60 and 90 min, respectively. The samples were dried, milled, sieved with a 1.55 mm mesh-sieve and chemically analyzed.

Analytical procedure: Proximate composition, mineral composition and gross energy determination. The proximate constituents of both processed and the raw seeds were determined by the method of the association of official analytical chemist (AOAC, 1990). The sodium and potassium contents were determined by flame photometry while phosphorus was determined by the vanodo-molybdate method (AOAC, 1990). The other mineral elements were determined, after wet digestion with a mixture of nitric acid, H_2SO_4 and HCL using Atomic Absorption spectro-photometer. Gross energy of the dried materials were determined using bomb calorimeter (AOAC, 1990). Determination of hydrogen cyanide tannin and trypsin inhibitors were carried out using the method of Knowles *et al.* (1990), Maga (1982) and Kakade *et al.* (1974), respectively.

RESULTS AND DISCUSSION

Table 1 showed the data on the proximate composition of the raw and processed *Mucuna pruriens* seeds. There were significant differences ($p<0.05$) between the raw and the processed seeds for all the parameters considered except for dry matter content. The crude protein content ranges between 23.66% (raw seeds) to 22.82% (cooked for 90 min). The value of 23.66% confirmed its potential as protein source (Akinmutimi *et al.*, 2006).

Like other grain legumes, raw is deleterious when fed to both man and non ruminant animals, hence, the attention given to processed seeds in this study. The value of processed crude protein decreased as the duration or cooking increased. It became significantly different ($p<0.05$) from the raw seeds for seeds cooked for 60 and 90 min, respectively. The decrease in crude protein content is in agreement with the report of Akinmutim (2004b). The decrease has been attributed to the leaching of nutrients as a result of cooking (Akinmutimi, 2006). This accounts for the longer the duration of cooking the more the lost of nutrients. This explains the lowest value of 22.60% for crude protein for seeds cooked for 90 min and the highest value of 23.60% crude protein for seeds cooked for 30 min. The

Table 1: Proximate composition of raw and cooked mucuna prurient seed (% air dried basis)

	Duration of cooking (min)				
Constituents	Raw	30	60	90	SEM
Dry matter	90.20	90.25	91.51	91.63	8.33
Crude Protein	23.66^a	23.60^a	22.82^b	22.60^c	0.03
Ether Extract	1.57^a	1.61^a	1.24^b	1.15^b	0.02
Ash	4.31^c	4.13^d	4.80^b	4.95^a	0.03
NFE	55.29^d	55.51^c	56.73^b	57.10^a	0.04
DM	90.20	90.25	91.51	91.63	8.33
Gross Energy	4409.50^a	4388.00^b	4271.50^c	4259.00^c	3.57

Means with no common superscript differ significantly ($p<0.05$)

23.66% crude protein obtained compared favorably with the value obtained in a closely related grain legume, *Mucuna utilis* by Akinmutimi (2004b) who reported 26.01% crude protein content for cooked *Mucuna utilis*. When compared with other grain legumes such as cooked lima bean, boiled jacked bean and boiled sword bean having protein content of 21.5, 25.88 and 25.83%, respectively reported by Akinmutimi (2004b), the seeds fall within the range of alternative protein source for monogastric animals. There was general decrease in crude fibre value and became significantly different ($p<0.05$) for seeds cooked for 60 and 90 min. The decrease in the value of crude fibre as duration of cooking increased for the processed seeds is in line with the report of Akinmutimi (2004b) who reported same in another grain *Mucuna* specie. The highest value obtained for the processed seeds was 5.41 (30 min) is lower to the range of value obtained both for other *Mucuna* species (Agbede and Aletor, 2001; Akinmutimi, 2004b) and other grain legumes (Akinmutimi, 2004b). It falls within the range of crude fibre values when compared with conventional grain legumes such as groundnut cake and soyabean meal with 5.0 and 6.5% CF, respectively (PNMP, 1995). The lower the value tends to be advantageous to monograstic animals having known to have little ability to handle fibrous materials. The ether extract value showed that seeds cooked for 60 min had the highest value of 1.61% that was significantly different ($p<0.05$) from the values obtained for other processed seeds. The value also fall within the range of ether extract values for conventional protein sources such as soyabean (1.5%) and groundnut (3.2%) (Olomu, 1995). The ash values showed that seeds cooked for 90 min had the highest value that was significantly different ($p<0.05$) form raw and from other processed seeds. This value is slightly higher than the value obtained for both mucuna utilis and *Mucuna pruriens* as reported by Agbede and Aletor (2001) but lower than the value reported for soyabean (6.4%), a conventional protein source. This implies that its use in ration formulation can reduce the quantity of the conventional mineral supplement thereby reducing the cost of production.

Table 2: % Mineral constituents of raw and cooked seeds

	Duration of cooking (min)				
Contents	Raw	30	60	90	SEM
Na	0.015	0.50	0.022	0.03	0.14
K	1.05^{d}	1.10^{c}	1.210^{b}	1.26^{a}	00.00
Ca	0.09^{c}	0.09^{c}	0.100^{b}	0.11^{a}	00.00
Phosphorus	0.31^{c}	0.34^{c}	0.460^{b}	0.52^{a}	00.00
Zinc	62.35^{d}	66.80^{c}	73.550^{b}	79.35^{a}	0.98
Mn	20.15^{d}	22.85^{c}	26.000^{b}	27.50^{a}	0.14
Fe	59.15^{c}	60.20^{c}	60.450^{b}	72.50^{a}	1.03
Cu	5.85^{c}	6.10^{c}	7.000^{b}	7.80^{a}	0.15

Different superscript a, b, c within the same row are significantly different ($p<0.05$)

The Nitrogen Free Extract (NFE) values obtained for seeds cooked for 90 min was the highest (57.10%) and was significantly different ($p<0.05$) from both the raw and other processed seeds. The values obtained generally was slightly higher than the value obtained for both cooked and roasted *Mucuna pruriens*. This may be due to different sources of the seeds and processing method (Apata, 1990). When compared with conventional protein sources such as GNC with 23.84% NFE and Soya bean meal (28.6%) as reported by Olomu (1995), respectively for GNC and soyabean meal, it has higher value. This implies higher total digestible nutrient (Akinmutimi, 2004b).

For gross energy value, seeds cooked for 30 min had the highest value that was significantly different ($p<0.05$) from other processed seeds. The least value of gross energy occurred in seeds cooked for 90 min. This decrease could be attributed to leaching of nutrients as a result of cooking. This accounts for the longer the duration of cooking the more the loss of nutrient (Akinmutimi, 2004).

Gross energy value of 4.39 kcal g^{-1} for the seeds cooked for 30 min is an appreciable energy value in relation to the values of the other grain legumes such has groundnut cake 2.97 kcal g^{-1} and cooked lima bean with 4.12 kcal kg^{-1} as reported, by Ogbonna *et al.* (2000) and Akinmutimi (2004b), respectively. This suggests the potentiality of the seeds as energy supplements.

Table 2 shows the result of mineral composition of the raw and processed *Mucuna pruriens* seeds. There were significant differences ($p<0.05$) between the raw and the processed seeds. For macro minerals (ca, k and p) seeds cooked for 90 min has the higher values that were significantly different ($p<0.05$) from both raw and processed seeds.

The value for sodium did not follow any specific pattern but a seed cooked for 30 min had the highest value. The value obtained for calcium and Phosphorus were slightly higher than what Agbede and Aletor (2001) reported for calcium and phosphorus, respectively while the value for potassium obtained in this study is lower than the value reported by Agbede and Aletor (2001). The slight disparity may be due to different sources of the seeds as well as processing methods (Akinmutimi, 2004).

For micro minerals, the result followed similar pattern like that of macro minerals in that seeds cooked for 90 min had the highest value for Fe, Cu, Mn and Zn. The values obtained for the micro minerals were higher than the value obtained for a closely related legume, *Mucuna utilis* and *Mucuna pruriens* as reported by Agbede and Aletor (2001) and Akinmutimi (2004b), respectively. This indicates that its usage in formulation of rations for livestock and poultry will go along way to effect good metabolic processes of the body and also help to reduce the cost needed for conventional mineral sources.

Table 3 shows the results of anti-nutritional factors present both in raw and processed seeds. Presence of anti-nutritional factors such as tannin, trypsin inhibitors and hydrogen cyanide are confirmed (Milton *et al*., 2000) Processing significantly reduces the anti-nutritional factors generally. The reduction increases as the duration in cooking increased. This is in agreement with the report of Akinmutimi (2004b) who reported similar trend for *Mucuna utilis* subjected to different duration of cooking. He also reported that this trend may be due to higher ability of hydrolyzing the anti-nutrients as duration of cooking increased. The highest percent reduction occurred in seed cooked for 90 min with 100% reduction in Ti followed by Hydrogen Cyanide (HCN) of about 69.62% reduction and the least reduction in tannin of about 27.5% reduction. The least reduction in tannin content is in consonance with the report of Akinmutimi (2004b) who reported same in a closely related legume, *Mucuna utilis*. This he attributed to thermo stability of tannin. He also reported the existence of intramolecular force within tannin. The poor reduction in tannin content even at 90 min indicates the inability of cooking to overcome this intramolecular force. This implies that the chance of complex linkage formation with protein is high when seeds cooked for 90 min is used to formulate ration and its attendant problem, loss of protein and amino acid resulting in poor growth (Akinmutimi, 2004a). The 69.02% reduction observed in tannin content is appreciable better than 33.01% reduction in hydrogen cyanide (Akinmutimi, 2004b) for *Mucuna utilis*, a closely related legume. This implies that the use of *Mucuna pruriens* cooked for 90 min will require less metahionine for detoxification of HCN (Rhodenase path way) when used to formulate ration instead of *Mucuna utilis*. This will also allow better growth (Aletor and Fasuyi, 1997; Akinmutimi, 2004a, 2006). The 100% reduction of trypsin inhibitor as a result of cooking for 90 min confirms the thermo liability of tannin in *Mucuna pruriens* (Akinmutimi, 2004a). This follows a similar report of (Akinmutimi, 2006) who reported same in Jack fruit

Table 3: Percentage anti-nutritional factors composition of raw and cooked *Mucuna pruriens* seeds

	Duration of cooking (min)						
	Raw	30	Reduction (%)	60	Reduction (%)	90	Reduction (%)
Tannin (%)	0.80[a]	0.78[b]	2.5.0	0.66[c]	17.50	0.58[d]	27.50
TI (mg g^{-1})	34.41[a]	33.70[b]	2.06	00.00[c]	100.00	00.00[c]	100.00
HCN (%)	42.95[a]	42.12[b]	1.93	14.41[b]	66.45	13.05[d]	69.62

Different superscript a, b, c, d within the same row are significantly different ($p<0.05$)

(*Artocarpus heterophylus*) seeds subject to cooking. He also reported that the implication of 100% reduction in trypsin inhibitor was that protein digestibility will not be hampered when heat treated seeds are fed to the livestock and poultry. He also noted that problem of pancreatic hypertrophy due to trypsin inhibitor cannot exist.

CONCLUSION

With appreciable value of 22.60% for crude protein and energy value of 4259 kcal kg^{-1}, better values for both macro and micro minerals and the highest percentage reduction in all the anti-nutritional factors for the seeds cooked for 90 min. Ninty minutes of cooking is therefore recommended.

REFERENCES

Agbede, J.O. and V.A. Aletor, 2001. Characterization and Protein Quality Evaluation of Differently Processed Mucuna seed flour. Proc. 26th Ann. Conf. NSAP., pp: 210-213.

Aletor, V.A. and A.O. Fasuyi, 1997. Nutrient composition and Processing Effect on Cassava leaf (*Manihot esculenta*, Cranzt) anti-nutrient. A paper presented at the 2nd Ann. Conf. Anim. Sci. Assoc. Nig., pp: 15-17.

Akinmutimi, A.H., 2004a. Evaluation of sword bean (*Canavalia gladiata*) as an alternative feed resources for broiler chickens. Ph. D. Thesis Collage of Animal Science and Health. Michael Okpara University of Agriculture, Umudike.

Akinmutimi, A.H., 2004b. Effects of cooking periods on the nutrient composition of *Mucuna utilis* seeds. Nig. Poult. Sci. J., 2: 45-51.

Akinmutimi, A.H., 2006. Nutritive value of raw and processed jack fruit seeds (*Artocarpus heterophillus*): Chemical Anal. Agric. J., 4: 266-271.

A.O.A.C., 1990. Association of official Analytical Chemists method of analysis. 15th Edn. Published by Association of Official Analyzed Chemists Washington D.C.

Apata, D.F., 1990. Nutritional, Biochemical and Haematological Parameters of some Tropical Grain Legumes. Ph. D Thesis, University of Ibadan, Ibadan.

Dolley, C., 1999. Therapeutic drugs. 2nd Edn. Church Hill Livingstone, New York, pp: 139-143.

Duruna, C.A., Abi Udedibie and E.B. Etuk, 2006. Performance and organ characteristics of broiler finisher chicken fed grades levels of Anthonata macro phyla seed meal as replacement of acachis hypogeal emal. Proceedings of 11th annual conference of ASAN (Animal Science Association of Nigeria) 18th-21st September, Institute of Agricultural research and training Ibadan.

Kakade, M.L., J.J. Rachis, J.E. Meghee and C. Puski, 1974. Determination of trypsin inhibitor Activity of soy products: A collaboration analysis of improved procedure. Cereal Chem., 51: 376.

Knowles, Watkins and R.D. Montgomery, 1990. Toxic Constituents of Plant Food Stuffs. 2nd Edn. Academic Press, New York.

Maga, J.A., 1982. Phytate its Chemistry, occurrence, food interaction nutritional significance and method of analysis. J. Sci. Food and Agric., 30: 1.

Milton, F.B., Marjatta Eilitta, Rolf Myhrman, Lyndon B. Carew and Robert J. Carsky, 2000. Food and feed for *mucuna*: Current uses and the way forward. Proceeding of an International Workshop.

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

Olomu, J.M., 1995. Monogastric animal nutrition principle and practice. A Jachem Publication, Nigeria.

PMNP, 1995. Pfizer Master Nutrient plan. Ikeja, Lagos.

Ravindran, V., 1988. Studies of *Mucuna prureins* forage alternative. Intronie countries evaluation of productivity and forage quantity at four different growth stand. Beitrage Trop. Landwirtsh Veterimarmed, 26: 381-386.

Standaert and Young, 1996. Treatment of central nervous system degenerative disorder in goodmen and Gilmaris. The pharmacology base of Therapeutics J.G. Hardman.