



Effects of Different Processing Methods on the Chemical Compositions of *Mucuna pruriens* Leaves.

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ABSTRACT

The study was to evaluate the effects of different processing methods on the proximate and anti-nutritional contents of *Mucuna pruriens* leaf meal. The *Mucuna pruriens* leaves were collected and processed by Air-dried *Mucuna* Leaf Meal (AMLM), Soaked *Mucuna* Leaf Meal in Cold Water (CMLM), Soaked *Mucuna* Leaf Meal in Hot Water (HMLM) and Fermented *Mucuna* Leaf Meal (FMLM). Proximate analysis showed that FMLM had the highest value ($25.94 \pm 0.94\%$), while the lowest recorded in the CMLM ($23.00 \pm 0.00\%$). The analysis of anti-nutritional factors showed that hydrocyanic acid, oxalate, phytate, saponin, reduced significantly ($P < 0.05$) after processing the *Mucuna* Leaf Meal.

Keywords: *Mucuna pruriens* leaves, proximate composition, anti-nutrients, air-dried, soakings, fermented.

INTRODUCTION

The *Mucuna pruriens* belongs to the family Fabaceae and the plant has been described to have many purpose which is used extensively both for its nutritional and medicinal properties (Adepoju and Odubena, 2009). It is a tropical legume known as velvet bean and common names such as: cow-itch, cowhage, bengal beans and itchy bean, while it's called Agbara (Igbo), Yerepe (Yoruba) and Karara (Hausa) (Manyham *et al.*, 2004). The itching bean *M. pruriens* is an underutilized legume species grown predominantly in Africa, Asia and in parts of America (Vadivel and Janardhanan, 2000); the seeds have been found to be rich in minerals such as potassium, calcium, magnesium and phosphorus which are essential for growth performances. It is one of the most popular green crops currently known in the tropics; velvet beans have great potential as both food and feed as suggested by experiences worldwide (Lampariello *et al.*, 2012). The leaves of *M. pruriens* are used as remedy for various diseases such as diabetes, arthritis, dysentery, and cardiovascular diseases (Barrows *et al.*, 2008). The velvet bean has been traditionally used as a food source by certain ethnic groups in a number of countries. For instance, it is cultivated in Asia, America, Africa, and the Pacific Islands, where its pods are used as a vegetable for human consumption, and its young leaves are used as animal fodder (Lampariello *et al.*, 2012). It is considered a viable source of dietary proteins as reported by Pugalanthi *et al.* (2005), due to its high protein content (23-35%) in addition to its digestibility, which is comparable to that of other pulses such as soyabean. The presence of anti-nutritional factors limiting the uses of the plant. These factors include polyphenols, trypsin inhibitors, phytate, cyanogenic glycosides, oligosaccharides, saponins, lectins, and alkaloids. Polyphenols (or tannins) are able to bind to proteins, thus lowering their digestibility. The factors interfere with the utilization of dietary nutrients in a series of ways including reducing protein digestibility, binding to various nutrients and thereby reducing digestive efficiency (Karoly, 2011).

Although information on the chemical and phytochemical composition of *M. pruriens* have been reported (Tavares *et al.*, 2005; Ifemeje 2016), however, little or no information could be obtained in relevant to the effects of different processing methods chemical contents. The present study is therefore aimed at providing information on the effects of different processing methods on the proximate and anti-nutritional contents of *Mucuna* Leaf Meal to assess its nutritional potentials of been utilized as a sources of protein and energy for animals.

MATERIALS AND METHODS

3.1 Collection and preparation of *Mucuna pruriens* leaf meal

Mucuna pruriens leaves were obtained from Hanwa Area of Zaria and authentication was carried out in the Department of Botany, Faculty of Life Sciences, Ahmadu Bello University Zaria. Then the leaves were washed using tap water to remove the dust and different methods of processing were employed to prepare the leaf meal and thereafter the proximate analysis and anti-nutrients of the samples was determined. The samples of leaves were subjected to the following processing techniques:

- i. The *Mucuna pruriens* leaf was air-dried (AMLM) at room temperature for a week,
- ii. The *Mucuna pruriens* leaf weighing 1 kilogram was soaked in cold water at 1 kilogram leaf per 5 litre of water (CMLM) for 36 hours. The leaf were then collected by losing the water and then air-dried at room temperature for a week. The leaf was later milled for further use
- iii. The *Mucuna pruriens* leaf weighing 1 kilogram was soaked in 60°C hot water (HMLM) and was allowed to cool down for 24 hours. The leaf were then collected by losing the water and air-dried at room temperature for a week. The leaf meal was later milled for further use.
- iv. The *Mucuna pruriens* leaf weighing 1 kilogram was fermented with yeast (*Saccharomyces cerevisiae*) of 2g in airtight container for 72 hours at room temperature (Padmavathy and Shobha, 1987).

The proximate analysis of leaf meals were determined followed methods described by the AOAC (1990). Proximate components such as moisture, crude protein, crude lipid and ash were analyzed. Tannins were determined by using colorimetric approach while gravimetric was employed to determine saponins as described by AOAC (1990). The presence of oxalate, phytate and hydrocyanic acid were determined as described by AOAC (1990).

Data Analysis

The data was subjected to analysis of variance (ANOVA) to test the significance among treatment means. Where there was significant difference, Duncan Multiple Range Test (DMRT) was applied to rank treatment means ($P < 0.05$). All statistical analyses were computed using SPSS (IBM) Statistical package Version 20 for Windows.

RESULTS AND DISCUSSION

Proximate Composition of Raw and Processed *Mucuna pruriens* leaf

The proximate Composition of Raw and Processed *Mucuna pruriens* leaf are presented in Table 1. The dry

matter percentages ranged from 93.23 ± 0.22 to 94.33 ± 0.33 while the crude protein percentages ranged from 23.00 ± 0.00 to 25.94 ± 0.94 . The highest crude protein a value (25.94%) was recorded in fermented mucuna leaf meal and the lowest values (23.00%) was recorded in soaked mucuna leaf meal in fresh water. The highest value of ether extract was obtained in raw mucuna leaf meal (20.17 ± 0.17) while the least (14.31 ± 0.31) was obtained in air-dried mucuna leaf meal. The ash content percentages ranged from 21.26 ± 0.26 to 24.89 ± 0.89 while the crude fibre percentages ranged from 21.26 ± 0.26 to 24.89 ± 0.89 .

The proximate composition of raw *Mucuna pruriens* leaf obtained from this work differs to that reported by Ifemeje (2016) where he examined the nutritional and phytochemical composition of *Mucuna pruriens* leaves obtained from Umuoma village in Ihiala Local Government Area of Anambra State, South Eastern Nigeria, and he reported the percentage proximate composition as 8.30%, 34.16%, 2.30%, 5.80%, 16.94%, and 32.50% for moisture, crude protein, crude fat, ash content carbohydrate and crude fibre respectively. The carbohydrate, ash and ether extract obtained in this study was higher than that reported by Ifemeje (2016), while the crude protein and crude fibre recorded a lower value. The differences observed in the proximate composition of raw *Mucuna pruriens* leaf from these studies are probably as a result of factors, such as

geographical location of the plant, soil and climatic conditions of cultured environment (FAO, 2004), which stated that these factors directly affect the composition of plant physiological and chemical structures. It could be observed that the crude protein of fermented *Mucuna pruriens* leaf meal differed from that of the soaked in both cold and hot water. The observed difference may be attributed to leaching of soluble protein into the water. This suggestion agrees with the observation of Ani (2008) that showed that *Mucuna* bean seeds soaked in an aqueous solution of potassium bicarbonate at room temperature for 24 hours led to the solubilization and removal of some nitrogenous substance in the bean. The proximate composition of the fermented *Mucuna pruriens* leaf meal indicates a significant increase in the crude protein composition of the leaf (25.94%). The increased level of crude protein is consistent with the findings of Ramachandran *et al.* (2005) who reported that increase in protein value with fermentation could be attributed to net synthesis of protein by fermenting of the leaf, which might have resulted in the production of some amino acids during protein synthesis. Lipid contents were found to be significantly lower in the fermented *Mucuna pruriens* leaf than in raw leaf. This decrease in lipid contents might be attributed to the increased activities of the lipolytic enzymes during fermentation which hydrolyses fat components in to fatty acid and glycerol (Chinma *et al.*, 2009).

Table 1: Proximate Composition of Raw and Processed *Mucuna Pruriens* Leaf Meal

Parameters	Leaf Meal				
	RMLM (%)	AMLML (%)	CMLM (%)	HMLM (%)	FMLM (%)
Dry matter	94.33 ± 0.33^a	94.09 ± 0.09^a	93.84 ± 0.84^a	93.23 ± 0.23^a	93.31 ± 0.31^a
Crude protein	24.88 ± 0.88^{ab}	24.38 ± 0.38^{ab}	23.00 ± 0.00^b	23.94 ± 0.94^{ab}	25.94 ± 0.94^a
Ether extract	20.17 ± 0.17^a	14.31 ± 0.31^c	17.06 ± 0.06^b	17.67 ± 0.67^b	17.00 ± 0.00^b
Ash content	10.55 ± 0.55^a	7.64 ± 0.64^{bc}	9.33 ± 0.33^{ab}	7.33 ± 0.33^{bc}	5.88 ± 0.88^c
Crude fibre	24.89 ± 0.89^a	23.78 ± 0.78^{ab}	23.94 ± 0.94^{ab}	22.99 ± 0.99^{ab}	21.26 ± 0.26^b
Nitrogen free extract	19.51 ± 0.51^c	29.89 ± 0.89^a	26.67 ± 0.67^b	28.07 ± 0.07^{ab}	29.92 ± 0.92^a

Means with same superscript along row were not significantly different ($P \geq 0.05$)

* RMLM = Raw *Mucuna* Leaf Meal, AMLM = Air-dried *Mucuna* Leaf Meal, CMLM = Soaked *Mucuna* Leaf Meal in Cold Water, HMLM = Soaked *Mucuna* Leaf Meal in Hot Water, FMLM = Fermented *Mucuna* Leaf Meal

Anti-nutritional Compounds of Raw and Processed *Mucuna pruriens* leaf

Anti-nutritional compounds such as hydrocyanic acid, oxalate, phytate, saponin and tannin as presented in Table 2 indicates that all the components determined were greatly reduced after processing methods of the leaf. In raw leaf meal, hydrocyanic acids had the highest value (15.1 ± 0.10) and oxalate had the lowest value (0.34 ± 0.00). In the raw and processed *Mucuna pruriens* leaf meal the values of phytate ranged from 1.63 ± 0.63 to

3.15 ± 0.15 while the saponin ranged from 4.30 ± 0.30 to 8.46 ± 0.46 .

The results of the anti-nutritional factors of the raw *Mucuna pruriens* leaf meal obtained in this work show that tannins, saponin, phytate have higher values, while oxalate recorded lower values than those reported by Ifemeje (2016), this could be as a result difference in environment probably being a determining factor of type of anti-nutrients factors in plant and this may be as a result of plants absorbing substances from their environment. The anti-nutritional factors of the processed *Mucuna pruriens* leaf showed significant

reduction. This significant reduction of the anti-nutritional compounds soaked in cold and hot water and this may be as result of efficacy of water leaching out anti-nutrient in the leaves as reported by Bichi and Ahmad (2010). The anti-nutritional compounds of the fermented *Mucuna pruriens* leaf showed significant reduction. These observations however, agree with the reports of Oseni and Ekperigin (2007) on reduction of phytate by fermentation, when pure strain of *Aspergillus niger* was used to ferment maize cobs, but contradicts the report of

Oladele and Oshodi (2008) who observed an increase in phytate and tannin levels by fermentation; it is however possible that the mode of fermentation and the species of organisms involved play crucial roles in the fermentation processes. Fermentation, or any other treatment has been reported to reduce anti nutrient constituents of plant materials (e.g. seeds, leaves, roots), these offer promise for inclusion of products from plants in animal and fish diets (Makkar and Becker, 1999).

Table 2: Anti-nutritional Compounds of Raw and Processed *Mucuna pruriens* leaf meal

Parameter	Leaf Meal				
	RMLM	AMLML	SMLM	HMLM	FMLM
Phytate	3.15±0.15 ^a	1.79±0.79 ^a	2.44±0.44 ^a	2.06±0.06 ^a	1.63±0.63 ^a
Oxalate	0.34±0.00 ^a	0.33±0.00 ^a	0.16±0.01 ^a	0.16±0.00 ^a	0.11±0.01 ^a
Tannin	2.38±0.38 ^a	2.01±0.01 ^a	0.22±0.00 ^b	0.38±0.00 ^b	0.38±0.01 ^b
Saponin	8.46±0.46 ^a	8.35±0.04 ^a	4.30±0.30 ^c	6.40±0.40 ^b	5.60±0.60 ^{bc}
Hydrocyanic acid	15.1±0.10 ^a	7.60±0.60 ^b	3.20±0.20 ^d	5.40±0.04 ^c	5.40±0.00 ^c

Means with same superscript along row were not significantly different ($P \geq 0.05$)

* RMLM = Raw *Mucuna* Leaf Meal, AMLML = Air-dried *Mucuna* Leaf Meal, CMLM = Soaked *Mucuna* Leaf Meal in Cold Water, HMLM = Soaked *Mucuna* Leaf Meal in Hot Water, FMLM = Fermented *Mucuna* Leaf Meal

CONCLUSION

The result on the processing methods will serves as baseline information on the utilization of *Mucuna pruriens* leaf meal for animals. The fermentation of *Mucuna pruriens* leaf improved the crude protein 25.89% and reduced the crude fibre 21.26% and the anti-nutritional factors also reduced. In view of the study, it appeared that fermented *Mucuna* leaf meal has a potential to be utilized as a sources of protein and energy for animals.

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