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Effects of Different Processing Methods on Proximate Composition of Mucuna Pruriens

[1]Alaye, S.A., [2]Layade, K.T., [1]Omole, E.B., [1]Onihunwa, J.O., [1]Joshua, D.A. and [3*]Akande, O.A

[1]Federal College of Wildlife Management, Forestry Research Institute of Nigeria, P.M.B.268, New Bussa, Niger State Nigeria.

[2]Onigambari Research Station, Forestry Research Institute of Nigeria, P.M.B.268, Ibadan, Oyo State, Nigeria.
[3]Department of Zoology, Ahmadu Bello University Zaria, Kaduna State Nigeria

Abstract – The effects of different processing methods on proximate composition of *Mucuna pruriens* seeds was investigated. The *Mucuna* seeds were sorted, cleaned and processed into raw, boiled, fermented and toasted. Processed *Mucuna* seed was dried and ground with Kenwood food blender, the powdered sample was kept in a refrigerator at –4^{0}C prior to use. The powdered sample were analyzed for proximate composition using standard analytical methods. All data obtained were carried out in triplicates and subjected to analysis of variance and Duncan Multiple Range Test was used to separate the means. The proximate composition of the samples showed that the *Mucuna pruriens* seeds had a range of moisture, 8.62-13.01%, ash content, 4.15-6.47%, crude fibre, 2.24-3.92%, crude protein, 29.19-32.28%, crude fat, 2.74-4.87% and carbohydrate, 42.06-53.47% respectively. , the raw seeds had the highest values of moisture content, ash contents, crude fat and carbonhydrate (13.01±0.14, 6.47±0.24, 4.87±0.56 and 53.47±1.48 respectively). Different processed technique significantly ($p<0.05$) increased the crude protein content of the Mucuna seeds samples from 29.19±0.14 to 32.28±0.24 for raw seed and Boiled seed. There was no significant ($p>0.05$) difference between raw mucuna seed and fermented mucuna seed. Considering the crude fibre the raw seed had the highest value 3.92% while the fermented had the least (2.83%), in term of crude fat, the boiled seed had the highest, (4.87%) while the fermented had the least (2.74%). The study recommends that the seeds, when properly processed, have high nutritional values that can be exploited and considered as an alternative source of nutrients to reduce malnutrition among economically weaker categories of people in the developing countries.

Keywords – *Mucuna pruriens,* Proximate composition, Methods, Processing.

I. Introduction

Mucuna pruriens are annual or perennial, herbaceous, vigorous climbers vines, with fleshy nodulated roots, slender long trailing stems and numerous trifoliate leaves on short, hairy petioles (1). The seed pods are wrapped with tiny velvety trichomes that can results into itchy blister if it had contact with the skin. The itching beans *Mucuna pruriens* is an underutilized legume species grown predominantly in Asia, Africa and in parts of America (2, 1). The wild legume *Mucuna* consists of about 100 varieties which are in great demand as food, livestock feed and pharmaceutically valued products (3). *Mucuna* seeds are relatively high in protein, carbohydrate, crude fibre, minerals and vitamins but low in fat content (4). Grain legumes are major sources of dietary proteins in the developing countries, as animal proteins are expensive (5, 6). In addition to their protein contributions, legumes are also rich in other nutrients such as starch, dietary fibre, phytochemicals, vitamins and mineral. Indigenous legumes are used as an alternative to protein to people in many tropical countries especially in Africa where they are predominantly consumed. However, the use of legumes as protein source is limited by the presence of anti-nutrients or toxic substances which interfere with digestive processes and prevent efficient utilization of their proteins (7). Anti-nutrients are those natural or synthetic substances which by themselves or through their metabolic products arising in living systems interefere with food utilization, causes certain physiological responses and affect the health and productivity of man and animal (8, 7).

The utilization of raw *Mucuna* bean as human food is limited by the presence of naturally occurring anti-nutritional factors such as phytic acid (phytate), tannins, cyanogenic glucoside (cyanide), oxalate and gossypol. These factors negatively affect the nutritive value of the beans through direct and indirect reactions by inhibiting proteins and carbohydrate digestibility (6).Anti-nutritional compounds reduce food intake and nutrient utilization in animals and lower the nutrient value of grain legumes (9). According to Duke (10) the major anti-nutritional compound in *Mucuna pruriens* is a non-protein amino acid, 3, 4-dihydroxy-Lphenylalanine (L-Dopa). Increased serum level of L-Dopa from consumption of *Mucuna pruriens* leads to high concentration of dopamine in peripheral tissue inducing anti-physiological effects such as nausea, vomiting, anorexia, paranoid delusions, hallucinations, delirium, severe depression and unmasking dementia (11). Since the average L-Dopa content in mucuna bean is 3.1 - 6.7% (9), Mugendi *et al.* (12) reported that to improve nutritional quality and effectively utilize dry legumes to their full potential as food, inactivation or removal of antinutritional factors by adopting economically viable processing techniques is required. Physical and biochemical methods used to process dry legumes include soaking, cooking, selective filtration, irradiation, enzymatic treatments, germination and fermentation (12).

In legume processing, where a method is not effective in removing antinutritional compounds, a combination of two or more methods is used (13). *Mucuna pruriens* seeds contain other antinutritional compounds such as protease inhibitors, phenolic compounds and phytates. The presence of protease inhibitors in foods results in decrease in protein digestibility, pancreatic hypertrophy, growth inhibition and increase in demand for sulphur containing amino acids (14,7). The prevailing population pressure in Nigeria as in other less–developed countries has resulted in an increasing demand for wild underexploited nutritious plant products with aesthetic appeal in the daily diet (15). The common edible portions of most underutilized plants are the seeds, which in some cases are cooked or roasted and eaten directly as snack foods while some are cooked and fermented for use as soup and source ingredients (16). It is of paramount importance and worthwhile to carry out a study that would reveal the effect of different processing method on nutrients and anti-nutritional composition of *Mucuna* seed in order to provide preliminary information towards effective utilization of this legumes in various food applications in Nigeria and other parts of the world.

II. Methodology

Collection of Samples

Healthy seed of *Mucuna pruriens* were obtained from International Institute of Tropical Agriculture (IITA), Ibadan, Oyo State Nigeria.

Processing of Mucuna pruriens

The processing treatments used were Boiling, fermentation and toasting. The seeds were divided into two portions. One portion received no treatment (Raw mucuna) while the other portion are treated

Untreated seeds

Mucuna seed was dried and ground with Kenwood food blender, the flours of the seed sample was kept in a refrigerator at –4^{0}C prior to use.

Boiled seeds

Boiled mucuna seed were cooked in distilled water (100°C) on a hot plate for 2 hours. The beans seed became soft and ready for dehulling. *Mucuna* was boiled for 1hours and the seeds dehulled. After dehulling, the seeds was grinded into five particle size using mortal and pestle before taking for laboratory analysis.

Fermented seeds

After boiling the seeds, it was fermented for 4 days, dried in the Oven at 40^{o}C and ground with Kenwood food blender. The sample flours was kept in a refrigerator at -4^{o}C prior to use.

Toasted seeds

After soaking with hot water and proper washing of the *Mucuna* seed, it was roasted in the Oven at 35^{o}C and ground with Kenwood food blender. The sample flours was kept in a refrigerator at -4^{o}C prior to use.

Proximate Chemical Composition

All samples were analysed in triplicates for crude protein, moisture, crude fat, ash, crude fibre and

Carbohydrate as chemical analysis followed methods of AOAC (17).

Phytochemicals Chemicals Analysis

Phytochemical test involved the simple chemical test to detect the secondary metabolites using standard method of Trease and Evans (18).

Statistical Analysis

All data obtained were carried out in triplicates and subjected to analysis of variance (ANOVA) and Duncan Multiple Range Test was used to separate the means. The level of significance was set at $p \leq 0.05$. The analysis was carried out using SPSS version 20.0.

Results and Discussion

Table 1 shows how effects of different method of processing on the the nutritional value of *Mucuna pruriens,* the raw seeds had the highest values of moisture content, ash contents, crude fat and carbonhydrate (13.01±0.14, 6.47±0.24, 4.87±0.56 and 53.47±1.48 respectively). Different processed technique significantly ($p<0.05$) increased the crude protein content of the Mucuna seeds samples from 29.19±0.14 to 32.28±0.24 for raw seed and Boiled seed. There was no significant ($p>0.05$) difference between raw mucuna seed and fermented mucuna seed. Considering the crude fibre the raw seed had the highest value 3.92% while the fermented had the least (2.83%), in term of crude fat, the boiled seed had the highest, (4.87%) while the fermented had the least (2.74%).

Table 1: Mean proximate analysis of the nutritional components of different processed *Mucuna pruriens*

	Processed Seeds			
Proximate Composition	**Raw Seeds**	**Boiled Seeds**	**Fermented Seeds**	**Toasted Seeds**
Moisture content %	13.01 ± 0.14^{a}	12.97 ± 0.54^{b}	9.39 ± 0.87^{c}	8.62 ± 0.23^{c}
Ash content %	6.47 ± 0.24^{a}	5.52 ± 0.17^{b}	5.47 ± 0.15^{b}	4.15 ± 0.48^{c}
Crude fibre	3.92 ± 0.27^{a}	3.28 ± 0.45^{a}	2.83 ± 0.32^{b}	2.24 ± 0.04^{c}
Crude protein %	29.19 ± 0.14^{c}	32.28 ± 0.24^{a}	29.61 ± 0.27^{c}	31.97 ± 0.67^{b}
Crude fat %	3.12 ± 0.39^{b}	4.87 ± 0.56^{a}	2.74 ± 0.42^{c}	2.59 ± 0.62^{c}
Carbohydrate %	53.47 ± 1.48^{a}	49.37 ± 1.43^{c}	51.54 ± 1.28^{b}	42.06 ± 1.26^{d}

Mean values ± standard deviation in a column followed by similar superscripts are not significantly different at (P>0.05)

The table 2 present the presence of different phytochemical components in four different sample of *Mucuna* seed. The table indicated that Alkaloid, Cardiac Glycoside and Tannin is minor in all samples in which they are all in absence of Sterols and phenols. Flavonoids is moderate in the untreated and fermented sample, whereas it is minor in the toasted and boiled sample, the fermented *Mucuna* seed consist of appreciate amount of reducing sugar and saponin while the untreated contained minor, terpenoids is absent in all sample but the untreated.

Table 4.2: Phytochemical Composition of Processed Mucuna Seed

SAMPLE	Boiled	Raw	Fermented	Toasted
ALKALOIDS	+	+	+	+
FLAVONOIDS	+	++	++	+
PHENOLS	-	-	-	-
QUINONE	+	++	+	+
TERPENOIDS	-	+	-	-
REDUCING SUGAR	-	+	+++	-
SAPONIN	+	+	+++	++
TANNIN	+	+	+	+
CARDIAC GLYCOSIDE	+	+	+	+
STEROL	-	-	-	-
TRIRERPENOIDS	-	+	-	+

+++=Appreciate amount, ++= moderate, +=minor, -= complete absence

III. Discussion

The results from the nutritional analysis showed that the values for the major nutrients tested are within the reported values for other legumes (19). The moisture content of the samples was higher in boiled *M. pruriens* seed than in others processed sample. This findings was in accordance with Udensi *et al*. (20) for boiled and soaked *Mucuna flagellipes* flours. The increase could be attributed to the inhibition of large quantity of water by the seeds as a result of boiling during processing (21). The crude fibre content of the raw *M. pruriens* seed recorded the highest, while the crude fibre content of the processed samples reduced by toasting than the boiling and fermentation treatment. The observed decrease in crude fibre content of the sample could be attributed to the thermal decomposition of some fibre components of the seeds due to high heat during toasting temperature (22,21). Protein composition of processed *M. pruriens* seeds is comparable to that found in the seeds of soybean, *Canavalia* ensiformis and cowpea (23), and much higher than that of bambara groundnut. There was a decrease in the amount of ash content of the sample and this may be attributed to leaching of soluble inorganic salts into the boiling water during processing. Obizoba (24), makes similar observation for boiled cowpea flour. The highest carbohydrate was though found in the raw sample but the Carbohydrate level of all the sample is favorably compared within the acceptable range mean values for legumes (20 to 60%) (25), and higher as compared to that of *C. ensiformis,* soybean and *Mucuna utilis* (26). The carbohydrate content of the seed was significantly ($p \leq 0.05$) lower in toasted seed than in the sample processed by raw, boiling and fermentation *M. pruriens* seed. The decrease could be attributed to the breakdown of complex carbohydrates which were bound in the raw sample as a result of toasting during processing. The findings was in line with the report of Udensi *et al*. (20) for boiled and roasted *Mucuna* flours and also Obi and Okoye (21) for boiled and autoclaved *Mucuna Flagellipes* Seed Flours. The carbohydrate content gave an indication that the seeds of *M. pruriens* can be considered as a rich source of energy and is able to supply the daily energy requirements of the body in children and adults as well as animals (26). The study indicated that Alkaloid, Cardiac Glycoside and Tannin is minor in all samples in which there was absence of Sterols and phenols, with this *M. pruriens* can be regarded as a non-toxicant diet because, as ascertain by Aletor, (27) a wide variety of plants are known to be potentially toxic because they contain much, allechemicals like glycosides, tannins, cyanides, alkaloids, phytic acid, hemaggutinins and saponins upon hydrolysis.

IV. Conclusion And Recommendations

Processing methods adopted in this study have been proven to have significant effects on the nutritional and anti-nutritional compositions of the seeds of *Mucuna pruriens.* It was revealed that *M. pruriens* either processed or not is a great source of carbohydrate and crude protein. Protein composition of processed (Boiled) *M. pruriens* seeds is comparable to that found in the seeds of soybean, *Canavalia ensiformis* and cowpea. Most toxicant phytochemicals were found minor or completely absent in all samples which make it to be declared that the seed is not toxicant. The study recommends that the seeds, when properly processed, have high nutritional values that can be exploited and considered as an alternative source of nutrients to reduce malnutrition among economically weaker categories of people in the developing countries.

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