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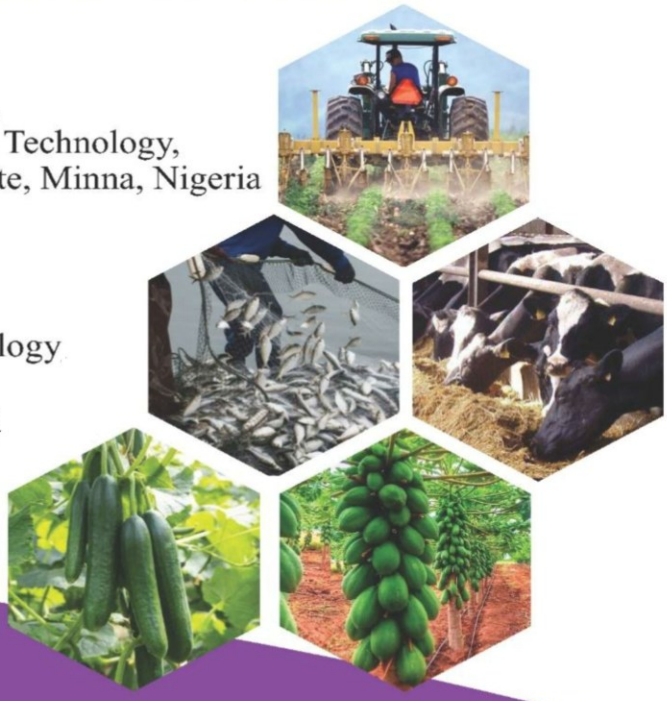

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EVALUATION OF PROXIMATE AND ANTI-NUTRITIONAL COMPOSITION OF *MUCUNA PRURIENS* SEED MEAL SUBJECTED TO COMBINED PROCESSING

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ABSTRACT
Mucuna pruriens is a tropical legume, and a sustainable protein source due to its high protein content (23-35 %). However, its utilization is hindered by anti-nutritional compounds. This study aimed to evaluate the effects of combined processing method (soaking, boiling, and roasting) on the proximate and anti-nutritional composition of *Mucuna pruriens* seed meal. The experiment was conducted at the Federal University of Technology, Minna, Nigeria. *Mucuna pruriens* seeds were obtained from the National Animal Production Research Institute, Kaduna. Seeds were subjected to triple combined treatment and analyzed for proximate and phytochemical composition using standard method. Results showed significant ($p<0.05$) reduction in quantity of anti-nutritional compounds, including saponin (76.32 %), alkaloid (72.72 %), and L-Dopa (74.82 %), while tannin (52.63 %), oxalates (54.63 %), phytates (52.25 %), phenol (61.32 %), and flavonoids (54.76 %) were all reduced below average respectively. Proximate analysis showed changes in nutritional composition, with increased nitrogen-free extract and reduced crude protein and ether extract. The combined treatment improved the overall nutritional value and safety of *Mucuna pruriens* seed meal. It was concluded that combined processing method is an effective method for reducing anti-nutritional compounds and enhancing the nutritional value of *Mucuna pruriens* seed meal, making it a viable alternative feed option for sustainable protein production and contributing to global food security and animal welfare.
Keywords: Velvet beans, Phytochemicals, Sustainable protein, Animal nutrition, Legume utilization

INTRODUCTION
Mucuna, belonging to the Fabaceae family, sub family Papilionaceae, includes approximately 150 species of annual and perennial legumes and belongs to the various under-utilized wild legumes. The velvet bean *Mucuna pruriens* is widespread in tropical and sub-tropical regions of the world. It is considered a viable source of dietary proteins (Janardhanan *et al.,* 2003; Pugalenthi *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 soybean, and lima bean (Gurumoorthi *et al.,* 2003). Mucuna is a valuable plant due to its nutritional potential. (Adepo *et al*., 2016) Comparably, its seeds have equal nutritional quality as soybeans, and lima beans, higher than chickpea, common bean, green pea, pigeon pea, lentils, peanuts, and black beans; hence it is treated as a cheap and alternative source of protein (Jadhav *et al.,* 2022).

Therefore, Mucuna seed could help reduce the demand for conventional feed and make more staple food available for human consumption, which is one of the most important goals of developing countries. This need for alternative protein sources for developing countries has led to much research on underutilized legumes and led to the supply of more valuable nutrients. The major drawback for utilizations of these novel plants is their high anti-nutritional factors like trypsin inhibitors, tannins and cyanide (Hussain, & Manyam, 1997). Levodopa (L Dopa), a potentially neurotoxic agent in raw bean has been reported (Ravindran, & Ravindran, 1988). These antinutrient may be poisonous to animal and may interfere with the nutrient availability in the body (Olaleye *et al.,* 2020). To improve nutritional composition and reduce these anti-nutritional factors, several

processing methods have been used such as fermentation by (Obi, & Okoye, 2017). Comparative evaluations of soaked, roasted, boiled, and autoclave by (Nwajagu *et al.,*2021). And double treatments by (Ezegbe *et al.,* 2023). Both single and double treatments of *Mucuna pruriens* seed achieved reduction in antinutritional composition but there is need to have a standard method of processing to encourage utilization of *Mucuna pruriens* as viable alternative feedstuff, while there is limited research regarding how combined triple treatment will affect its proximate composition and reduce the antinutritional content. This gap in knowledge justifies the need for further research in improving the quality and consequently the utilization of *Mucuna pruriens* seed as alternative feed. Hence this study was carried out to evaluate the effects of combined treatments on the proximate and anti-nutritional factors in *Mucuna pruriens* (velvet bean) seed meal.

MATERIALS AND METHODS

Site of Experimental Study

The experiment was carried out at the Federal University of Technology Department of Animal Production, School of Agriculture and Agricultural Technology. Minna has land area of 6784 km, and it is situated between latitude 9° 37 North and South equator and longitude 60 33 East with mean annual temperature of 28 - 40°C and mean annual rainfall of 1000 - 1500mm. (Odegbenro & Ojoye. 2022).

Source of Experimental Material

Mucuna pruriens (velvet bean) seeds were obtained from National Animal Production Research Institute (NAPRI) Kaduna State, Nigeria.

Processing of Experimental Material

The *Mucuna pruriens* seeds were subjected to triple combined treatment by (soaking, boiling and roasting) to reduce its anti-nutritional components before grinding into meal.

250 g of the seeds were soaked in warm water at room temperature for 24 hours, the seeds were washed in two parts of the seed quantity, drained and then boiled for 1 hour and timed from the boiling point of water (100^0C). The boiled seed was sun dried to 90 % dry matter before further subjecting to 15 minutes roasting and thereafter were grounded into meal.

Determination of the Proximate Composition

Proximate composition of velvet bean seeds was evaluated following the description of (AOAC, 2006). Analysis was done triplicate. Parameters were evaluated in triplicate include dry matter, crude protein, crude fibre, ether extract, ash, and nitrogen free extract.

Phytochemical Composition

Antinutritional factors in velvet bean were evaluated following the description of [Ezegbe, *et al.,* 2023). The samples were subjected to triplicate analysis. Parameters were evaluated for L-dopa, saponin, tannin, oxalate, phytates, alkaloids, phenolic acid and flavonoids.

Statistical analysis

Data collected were analyzed using statistical package for social sciences (SPSS). using descriptive statistics (means and percentage). Independent T-test was conducted to know the level of significant between raw and triple treatments.

RESULTS AND DISCUSSION

The proximate compositions of Raw (RT) and Triple Treatment (TT) of *Mucuna pruriens* seed meal are presented in Table 1. The result revealed that RT showed higher crude protein (28.90 %) compared to TT (25.60 %), similar trend was observed for ether extract (9.00 %). while comparably values were observed for crude fibre (91.60 %; 90.40 %), ash (5.00 %; 4.00%), and dry matter (91.40 %; 90.40%) for RT and TT respectively. the result for nitrogen free extract indicates lower values for RT (38.20 %) while TT was observed to have higher values (45.50 %) respectively. The values obtained for crude protein, ash, crude fiber, ether extract, and nitrogen-free extract for both TT and RT collaborate with the findings of (Hussain, G., & Manyam, B. V. 1997; Kalidass *et al.,* 2011), who reported similar range for five varieties of *Mucuna pruriens*. The reduction suggests

that TT has an effect on nutritional composition, which agrees with (Nwajagu *et al.,* 2021), who reported that the method of processing has a significant effect on the proximate composition of *Mucuna pruriens*. This observation is consistent with the reports of (Ezegbe *et al.,* 2023), who noted that cooking and soaking significantly ($p<0.05$) reduced all the proximate parameters. The nutritional compositions observed in this study for crude protein (25.90 %), ash (4.0 %), fiber (10.5 %), and ether extract (5 %) are comparable to those reported by (Ekpo *et al.,* 2022), who reported values of 25.45 %, 6.16 %, 10.06 %, and 6.98 %, respectively. However, the value observed for nitrogen-free extract for both RT and TT (38.20;45.50 %) is not in line with (Ekpo *et al.,* 2022) and (Ezegbe *et al.,* 2023), who reported higher values of 51.35% and 49.22-54.94% respectively. this difference may be attributed to species, and stage of plant maturity. The increase in nitrogen free extract may be attributed to the triple treatment (TT) in this present study, independent T-test indicate significant difference ($p<0.05$) were observed crude protein, ether extract, ash, and nitrogen free extract while no significant difference ($p>0.05$) was observed for dry matter and crude fibre. This observation is consistent with the study of (Ezegbe *et al.,* 2023) and this affirm, that processing methods affects the nutritional composition of *Mucuna pruriens*. It was observed that TT reduce crude protein and ether extract compositions, while there was an increasing in nitrogen free extract.

Table 1: Effect of Combined Processing on Proximate Composition of *Mucuna pruriens Seed Meal (MPSM)*

Proximate (%)	**Raw (RT)**	**Triple Treatment (TT)**	**PV**
Dry matter	91.60	90.40	0.45
Crude Protein	28.90	25.90	0.00
Crude fibre	10.50	10.00	0.87
Ether extract	9.00	5.00	0.00
Ash	5.00	4.00	0.00
Nitrogen free extract	38.20	45.50	0.00

PV: Probability value

Table 2 The results of the phytochemical composition of Raw treatment (RT) and Triple Treatment (TT) of *Mucuna pruriens* meal indicate that RT contains 0.38 g/100g saponin, 0.38 g/100g tannin, 0.11 g/100g oxalate, 1.55 g/100g phytate, 1.98 g/100g alkaloids, 2.12 g/100g phenol, 1.68 g/100g flavonoids, and 6.83 g/100g L-dopa. In contrast, TT contains 0.09 g/100g saponin, 0.18 g/100g tannin, 0.05 g/100g oxalate, 0.74 g/100g phytate, 0.84 g/100g alkaloids, 0.82 g/100g phenol, 0.76 g/100g flavonoids, and 1.72 g/100g L-dopa. This shows that the phytochemical composition was reduced by the TT, which is consistent with the report of (Ezegbe *et al.,* 2023), who stated that different processing methods have a significant level of reducing phytochemical composition.
The results show that all the phytochemical composition was reduced below average with saponin, alkaloid and L-dopa having greater percent reduction of 76.32 %, 72.72 % and 74.82 respectively. while tannin, oxalates, phytates, phenol and flavonoids were reduced above average with 52.63 %, 54.63 %, 52.25 %, 61.32 %, and 54.76 % respectively.

Anti-nutritional compounds are toxic, and non-palatable which decrease the bioavailability of nutrients by inhibiting the activity of digestive enzymes such as α-amylase, trypsin, chymotrypsin and lipase, complex formation of phenolic with iron resulting in rupture of the mucosal cell wall of the digestive tract (Chinapolaiah *et al.,* 2019). This will reduce the digestibility of carbohydrates, and proteins, and will result in poor animal performance if not reduced to minimum and levels. independent T-test indicate significant difference ($p<0.05$) for all the parameter. This observation is in tandem with (Ezegbe *et al.,* 2023), who report that combined processing method were observed to affect nutritional composition. While this study affirms that TT treatment maybe safe method to reduces these antinutrient to greater percent and thus making the nutrient available to animal without affecting the performance and welfare of animal.

Table 2 Effect of Combined Processing on Antinutritional Composition of *Mucuna pruriens Seed Meal (MPSM)*

Phytochemical (g/100g)	RT	(TT)	(%) Reduction	PV
Saponin	0.38	0.09	76.32	0.01
Tannin	0.38	0.18	52.63	0.02
Oxalate	0.11	0.05	54.55	0.04
Phytate	1.55	0.74	52.25	0.02
Alkaloid	1.98	0.54	72.72	0.01
Phenol	2.12	0.82	61.32	0.02
Flavonoids	1.68	0.76	54.76	0.02
L-Dopa	6.83	1.72	74.82	0.01

RT: Raw Treatment, TT: Triple Treatment, PV: Probability value

CONCLUSION

Based on this study the use a combined method of (soaking, boiling, and roasting), can effectively reduce the antinutritional compounds in *Mucuna pruriens* seeds, which will thus make its a more viable alternative feed option. This study indicates that combined treatment may be a standardized processing method, to improve the utilizations of this novel seed meal as a potential option for sustainable protein, by reducing the demands on conventional feedstuff, thereby contributing to global food security and animal welfare

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