



Full Length Research Paper

Nutritional and Anti-nutritional Evaluation and Phytochemical Composition of Aqueous Leaf Extract of *Mucuna pruriens*

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ABSTRACT

The numerous ethno-medicinal properties of *Mucuna* plant have called for a serious research investigation of all the various parts of the plant including the leaves in order to ascertain maximum utilization of the plant. In this prospective study therefore, nutritional and anti-nutritional evaluation and phytochemical composition of aqueous leaf extract of *Mucuna pruriens* were carried out using standard methods in order to determine the potential of this part of the plant. The result of the proximate analysis indicated the presence of the following nutrients: crude lipid(2.2%), protein(35.0%), crude fiber(12.5%), carbohydrate(42.6%) and ash content (7.8%) and the following anti-nutrients: phytate(236.90mg/100g sample), oxalate(43.30mg/100g sample), haemagglutinin(98.4 0HU/mg protein) and trypsin inhibitor(26.30TIU/mg protein) while the energy value was 255.3Kcal/100g sample. The results of the phytochemical analysis revealed the presence of alkaloids, saponins, tannins, flavonoids, glycosides, phenols, anthraquinone, terpenoids, coumarine while steroid was absent. It was also observed from the results that *M. pruriens* contains the following minerals: iron(0.388ppm), magnesium(0.123ppm), calcium(0.925ppm), zinc(0.360ppm), copper(0.468ppm), manganese(0.413ppm), sodium(0.440ppm), potassium(16.430ppm), selenium(0.012ppm) and the following vitamins: vitamin A(40.79mg/100g sample), vitamin B1(29.58mg/100g sample), vitamin C(43.60mg/100g sample) and vitamin E(22.70mg/100g sample). These results have shown that *M.pruriens* leaf extracts have pharmacologically active compounds and high nutritional value and as such could be used in ethno-medicine and as alternative source of feed for animals and could equally be consumed by humans after quality processing in order to remove its anti-nutrient content.

Key words: phytochemical, composition, nutritional, leaf extract, antinutrients

INTRODUCTION

Plants have since ancient times played a very important role in human life. They have been used as food, medicine, fiber and also as fodder for domestic animals (Oko *et al.*, 2012). The increasing

population of many tropical countries has led to the awareness of the importance of some plants as sources of essential nutrients owing to their high vitamins, minerals, essential fatty acids, crude

proteins and fiber content (Iheanacho and Udebuani, 2009; Oko *et al.*, 2012).

Although conventional food plants have the capacities of providing most of the nutrients needed for energy, body building, maintenance and regulation of body processes, the need to explore some seemingly unappealing sources of nutrients have become imperative (Hasan *et al.*, 2007). This is due to the serious threat to growth, development and survival posed by increasing human population, food scarcity, insecurity and economic crises in most developing countries like Nigeria (Hasan *et al.*, 2007). Therefore, the search for wild edible food plants for human consumption has been identified to maintain a balance between population growth and agricultural productivity (Vishwakarma and Dubey, 2011).

Medicinal plants are of great importance to the health of individuals and communities. Edeoga *et al.* (2005) reported that the medicinal values of plants lie on the chemical substances that are present in them which produce definite physiological effects in human system. The authors further observed that the most important of these bioactive components of plants' origin are alkaloids, tannins, flavonoids and phenolic compounds (Edeoga *et al.* 2005). These bioactive compounds, with nutrients and dietary fiber from plants protect the body against diseases (Murugan and Mohan, 2011).

Although plants contain essential nutrients and vitally important bioactive compounds that are useful to both humans and plants, some of these plants equally contain anti-nutrients which have the potential to precipitate adverse effects on both human and animal nutrition (Aberounmand, 2011). These anti-nutrients include toxic amino acids, tannins, phytic acid, oxalate, goitrogen, phytohaemagglutinins (lectins), protease inhibitors (trypsin inhibitors), chlorogenic acid (Tumwebaze, 2011). Most of these anti-nutrients work by complexing nutrients, thus reducing their digestion, bioavailability, bioabsorption and

utilization (Aberounmand, 2011; Hidayathulla *et al.*, 2011; Tumwebaze, 2011). Barbara (2009) reported that these anti-nutrients protect the plant and function as the immune system of the plant, offering protection from sun radiation, foraging by animals and from invasion by bacteria, viruses or fungi and insects.

Many legumes serve as both sources of nutrients and as medicinal herbs for the treatment of diseases such as Parkinson disease as reported by Murugan and Mohan (2011). *Mucuna*, a genus of legume with many species such as *M. aterima*, *M. nivea*, *M. poggei*, *M. pruriens* etc are used as both sources of nutrients and as medicinal plant (Oko *et al.*, 2012).

Mucuna pruriens (velvet beans) is a vigorous annual climbing, twining leguminous herb with stem up to 18 meters in length (Aguiyi *et al.*, 1997; Oko *et al.*, 2012). It originated from Southern China and Eastern India where it was at one time widely cultivated as a green vegetable crop (Duke, 1981; Wilmot, 1984) but is now found in many parts of the world including Nigeria, where it is mostly found in the Eastern part of the country (Agbafor and Nwachukwu, 2011). Sathiyarayanan and Arulmozhi (2007) have equally reported that *M. pruriens* is found in Asia, America and Africa. They added that it is a popular medicinal plant in India, where it has long been used in traditional Ayurvedic system of medicine for various diseases. It has equally been reported to be found in Nigeria where the seeds (beans) have been prescribed by traditional practitioner as an oral prophylactic for snake bites (Aguiyi *et al.*, 1997; Guerranti *et al.*, 2002).

Mucuna pruriens (velvet bean) is called "Agbara Oko" in Afikpo, Ebonyi State, Nigeria due to its itching sensation when the hairy fruit pod gets in contact with the skin. The leaves of the plant are trifoliate; the leaflet is broadly ovate, elliptic or rhomboid ovate and unequal at the base. The flowers are purple or white in colour. The pods are curved, longitudinally rib

bled, turgid, and densely clothed with persistent pale brown or green irritant bristles that contain up to 7 oblong ellipsoid seed of variable colours each (Oko et al., 2012).

Most rural dwellers in some part of the country especially the Igbos have resorted to oral administration of the crude aqueous extract of the leaves as a cheap source of multi vitamin and blood level booster (Oko et al., 2012). In India, *M.pruriens* is used in traditional medicine for the treatment of many diseases where it has been reported to improve libido exhibit faster hypothermic effect, show anti-parkinsonian activity, decrease body temperature stimulate more sexual activity in male albino rats and in patients suffering from Parkinson's disease (Anantha-Kumar et al., 1994). It has equally been used as cover crop, green manure and as sources of nutrients (Oko et al., 2012).

MATERIALS AND METHODS

Sample Collection

Fresh plant of *Mucuna pruriens* was collected from Ozizza in Afikpo North L.G.A of Ebonyi State, Nigeria and was identified by the curator, Department of Science Laboratory Technology, Akanu Ibiam Federal Polytechnic, Unwana, Afikpo, Ebonyi State. The leaves of the plant were separated from the stalks, and thoroughly washed with distilled water and shed dried for three (3) weeks and then ground to fine powder with blending machine and stored in plastic container. The powder was used in the extraction process while the remaining aliquot part was used for phytochemical screening

Preparation of *Mucuna pruriens* extract

Mucuna pruriens extract was prepared by soaking 300g of the ground leaf powder in 400 ml of distilled water. The container was well covered and shaken vigorously to mix very well and then allowed to stand for 3 days with intermittent daily shaken. After the duration, the mixture was then filtered into a conical flask using filter

paper and funnel and then stored in specimen samples bottles at 0–4°C until analysis.

Analytical Procedures

Proximate analysis: The recommended methods of the Association of Official Analytical Chemists (AOAC, 1999) were used for the determination of ash, crude lipid, crude fibre, crude protein and carbohydrate contents as well as the anti-nutrient contents like phytate, oxalate, haemagglutinin and trypsin inhibitors.

Phytochemical screening: A portion of the dried and ground *Mucuna pruriens* leaf sample was subjected to phytochemical screening for the presence of flavonoid, saponins, tannins, glycosides, alkaloid and phenol using the methods as outlined in Harborne (1984).

Mineral element analysis: The selected mineral elements were analyzed using atomic absorption spectroscopy according to the methods as outlined by Subramanian et al. (2012)

Determination of Vitamins: The recommended methods of the Association of Official Analytical Chemists (AOAC, 1990) were used for the determination of vitamin A, vitamin B1, vitamin E and vitamin C

Estimation of energy value: The sample calorific value was estimated (in Kcal) by multiplying the percentage crude protein, crude lipid and carbohydrate by the recommended factor (2.44, 8.37 and 3.57 respectively) used in vegetable analysis (Asibey-Berko and Tayie, 1999)

RESULTS

Proximate composition of *Mucuna pruriens* : The result of the proximate composition of *M. pruriens* is shown in table 1. The results indicated that *Mucuna pruriens* contain appreciable amount of nutrients : crude lipid (2.2%), protein (35.0%), crude fiber (12.5%), carbohydrate (42.6%) and ash content (7.8%) and the following antinutrients: phytate (236.90mg/100g

sample), oxalate (43.30mg/100g sample), haemagglutinin (98.40HU/mg protein) and trypsin inhibitor (26.30TIU/mg protein)

while the energy value is 255.3Kcal/100g sample.

Table 1. Result of proximate composition of *M. pruriens* freshleaves

Parameters	% composition
Ash content	7.80 ± 0.20
Crude fat/oil	2.20 ± 0.15
Protein	35.0 ± 0.08
Crude fiber	12.50 ± 0.16
Carbohydrate	42.55 ± 0.18
Calorific value (Kcal/100gDM)	255.3

Values are based on dry matter basis (DMB).

Table 2: Phytochemical composition of *M.pruriens* leaf extract

Phytochemical	Significant (Result)
Alkaloids	++
Saponins	+
Tannins	+
Flavonoids	++
Glycosides	+
Total Phenol	+
Anthraquinone	+
Terpenoids	+
Cuomarines	++
Steroids	--

+ represents positive test, ++ denotes intense colour, -- represent negative test.

Table 3. Result of selected Mineral Elements of *M. pruriens* leaf extract.

Mineral Elements	Composition (PPM)
Iron (Fe)	0.388 ± 0.001
Magnesium (Mg)	0.123 ± 0.40
Calcium	0.925 ± 0.002
Zinc (Zn)	0.036 ± 0.001
Copper (Cu)	0.468 ± 0.047
Manganese (Mn)	0.413 ± 0.003
Sodium (Na)	0.44 ± 0.001
Potassium (K)	16.43 ± 0.230
Selenium (Se)	0.012 ± 0.001

PPM = Parts per million

Table 4. Result of selected vitamins composition of *M. pruriens* leaf extract.

Vitamins	Composition (mg/100g)
Vitamins A	40.79 ± 0.01
Vitamin B ₁ (thiamin)	29.58 ± 0.20
Vitamin C	43.60 ± 0.55
Vitamin E	22.70 ± 0.04

Phytochemical screening of *Mucuna pruriens*:

The result of the phytochemical screening of the leaf extract of *M.pruriens* is shown in table 2. This result revealed the presence of alkaloids, saponins, tannins, flavonoids, glycosides, phenol, anthraquinone, terpenoids, coumarins while steroids were absent.

Mineral element analysis of *Mucuna pruriens* :

The results of the selected mineral element analysis which is expressed in part per million (ppm) is shown in table 3 which revealed trace amount of the mineral elements analyzed, with potassium having the highest amount while selenium recorded the least amount.

Determination of Vitamins: The results of vitamin determination of *M.pruriens* as shown in table 4 indicated that the leaf extract of *M. pruriens* contain appreciable amount of vitamins : vitamin A (40.79 mg/100g sample), vitamin B1(29.58mg/100g sample), vitamin C (43.60mg/ 100g sample) and vitamin E (22.70mg/100g sample). These values of course can meet the recommended daily allowance (RDA) for both children and adults.

DISCUSSION

Proximate and phytochemical analyses are very useful in the evaluation of some bioactive and biological components of fruits, seeds, leaves and other parts of plants. This present study assessed the proximate composition, phytochemical potential as well as the mineral elements and vitamins content of *Mucuna pruriens* leaves. The results of the proximate analysis (table 1) indicated that *M. pruriens* had appreciable amount of nutrients with 35.0 % protein and 42.55% carbohydrate. This crude protein content of the leaves of *M. pruriens* is similar to that of three different seeds of the plant (32.48%, 28.80% and 29.40%) from three different geographical locations in India as analyzed by Fathima *et al.* (2010).

However, the little discrepancy observed in the two results could be as a result of plant species, genotype, environmental factors as well as other physiological condition under which the analyses were carried out. These results have shown that *M.pruriens* could serve as alternative source of feed for animals and could equally be consumed by humans after quality processing in order to remove its anti-nutrient content.

The result of the phytochemical screening revealed the presence of alkaloids, saponins, tannins, flavonoids, glycosides, phenol, anthraquinone, terpenoid, coumarins, while steroids were found to be absent(table 2). These findings agreed with an earlier report by Nwaoguikpe *et al.*(2011) who recorded similar results for the seed extract of the plant. The invaluable pharmaceutical properties reported for *Mucuna pruriens* may be attributed to the presence of these bioactive compounds such as alkaloid, flavonoids etc(Aguwu *et al.*, 2010; Adimoelja, 2000; Ezeamuzieji *et al.*, 1994). Epidemiological studies have shown that flavonoids intake, is inversely related to mortality from coronary heart diseases and other incidences of heart attacks (Shills and Young, 1992). It has been reported that most of the pharmacological activities of alkaloids may include; antibiotic activity, hypotensive effect, antithrombotic effect, uterotonic effect etc.(Sheu,1999; Robert and Wink, 1998).

The result of the selected mineral elements analyses (table 3) revealed the presence of the following; Fe, Mg, Ca, Zn, Cu, Na, K, Mn and Se. It has been reported that potassium is important in maintaining intracellular fluid osmolarity and together with sodium, maintains the resting membrane potential necessary for generation of action potential and calcium which functions as a secondary messenger, plays a major biochemical role in muscle

contraction and blood clotting(Okaka and Okaka, 2001; Nelson and Cox, 2008). Iron, selenium, zinc and manganese are known to strengthen the immune system as antioxidants(Talwar *et al.*, 1989) and magnesium, zinc and selenium have been investigated to prevent cardiovascular myopathy, muscle degeneration, growth retardation, dermatitis, immunological dysfunction, impaired spermatogenesis and bleeding disorder (Chaturvedi *et al.*, 2004).

Our result on vitamins determination (table 4) shows that the leaf extract of *M. pruriens* contains appreciable amount of vitamins. Vitamin A and its various forms function as hormones and as visual pigments and vitamin A, C and E have antioxidant properties and hence *M. pruriens* leaves are said to have some biochemical and physiological effects (Solomon *et al.*, 2004; Nelson and Cox 2008).

CONCLUSION

From the findings in this prospective study, suffice to say that leaf extract of *M. pruriens* is nutritionally potent. Therefore it could serve as alternative source of feeds for animals and could equally be consumed by humans after quality processing in order to remove its anti-nutrient content. Phytochemical screening shows that the sample contains useful bioactive components (alkaloids, saponins, flavonoids, tannins) which are responsible for its antioxidant and antimicrobial effects and hence supports the efficacy of the plant as a potential medicinal plant.

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