

Effect of Ethanolic Leaf Extract of *Mucuna pruriens* on Blood Glucose Levels on Normoglycemic Wistar Rats

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Abstract: The present study was undertaken to evaluate the effect of Ethanolic leaf extract of *Mucuna pruriens* on blood glucose levels on normoglycemic Wistar rats. The acute toxicity study of the plant extract was investigated. Different doses of 100, 200 and 400 mg/kg b w of extract were administered orally by gavage to three groups of normal fasted rats and metformin 250 mg/kg was given to a group and served as positive control while a group was given normal saline for a period of 21day and also served as the negative control. A significant decrease ($p < 0.05$) in the blood glucose levels was observed after 6 day with 100 and 400mg/kg b w when compared to control. However, there was a significant change ($p < 0.05$) in the blood glucose levels with all does of the plant extract after 9 and 21 day. The preliminary phytochemical screening of the extract showed the presence of flavonoids, saponins, tannins, cardiac glycosides, steroids, cyanogenetic glycosides and alkaloids. The median lethal dose (LD_{50}) in rats was found to be 2154.0 mg.kg body weight. In conclusion, the findings of the study showed that the Ethanolic leaf extract of *Mucuna pruriens* possess hypoglycemic properties on normoglycemic rats.

Key words: Blood glucose, hypoglycemic properties, metformin, *Mucuna pruriens*, phytochemicals

INTRODUCTION

Regular consumption of plant foods are associated with numerous health benefits rooted in their various physiological effects as a result of their phytochemical and nutritional constituents (Hunter and Fletcher, 2002; Emeka and Onyechi, 2009). It is however, generally known that the consumption of local herbs by man contributes significantly to the improvement of human health, in terms of prevention and/or cure of diseases because plants have long served as a useful and natural source of the therapeutic agents (Chevellier, 1996). Moreover, traditional medicine is greatly relied upon especially by rural dweller, for treatment of various ailments (Friday *et al.*, 2010). Administration of various plant extract for the reduction of blood glucose levels of diabetic comprises an important aspect of the indigenous medical systems of many countries including Nigeria (Goji *et al.*, 2009). *Mucuna pruriens* (MP) belongs to the family *Fabaceae* and has been described as a multipurpose plant which is used extensively both for its nutritional and medicinal properties. All parts of *M. pruriens* possess valuable medicinal properties (Adepoju and Odubena, 2009). It is a twinning and tropical legume known as velvet bean and by a

multitude of common names such as : cowitch and velvet bean (English), Agbara (Igbo), Yerepe (Yoruba), Karara (Hausa), Bengal bean, Mauritius bean, itchy bean, Nescafe, and buffalo bean and many others. The roots are bitter, stimulants, purgative, and diuretic and many others. In history, *M. pruriens* has been used as an effective aphrodisiac (Amin *et al.*, 1996). The seeds have been found to have antidepressant properties when consumed, and it has also shown to be neuroprotective (Manyam *et al.*, 2004). Its analgesic and anti-inflammatory activities have been reported (Adepoju and Odubena, 2009). And it has been studied for various activities like anti-neoplastic, anti-epileptic, anti-microbial (Sathiyarayanan and Arulmozhi, 2007). A clinical study confirmed the efficacy of the seeds in the management of Parkinson's disease by virtue of their L-DOPA content (Manyam *et al.*, 2004). *M. pruriens* has been shown to increase testosterone levels (Amin *et al.*, 1996), leading to deposition of protein in the muscles and increased muscle mass and strength (Bhasin *et al.*, 1996). Its use as a fertility agent (in men) has been documented (Buckles, 1995). Therefore, the study was aimed at evaluating the effect of Ethanolic leaf extract of *Mucuna pruriens* on blood glucose on normoglycemic Wistar rats.

MATERIALS AND METHODS

Plant material: A Sample of fresh leaves of *Mucuna pruriens* were collected from the Institute for Agricultural Research Agronomy farm, ABU Samaru, Zaria in the month of August, 2010. The plant was identified and authenticated by a taxonomist, Mallam M. Musa of the herbarium unit of Biological Sciences Department A.B.U., Zaria where a voucher specimen number (0669) was deposited.

Preparation of plant extract: The fresh leaves were dried under shade and then ground into fine powder using laboratory mortar and pestle. The powder (460 g) was macerated in 70% of ethanol and 30% of distilled water at room temperature for 72 h. This was then filtered using a filter paper (Whatmann size no. 1) and the filtrate was evaporated to dryness on water bath at 60°C to a brown dry residue of 24 g and kept in an air tight bottle until used.

Chemical used: All chemicals and drugs used were obtained commercially and of analytical grade. Alloxan was purchased from (Sigma chemical Company St. Louis U.S.A.).

Phytochemical screening of the plant extract: Preliminary phytochemical screening of the ethanolic leaf extract of *Mucuna Pruriens* was carried out by methods of analysis described by Trease and Evans (1983).

Acute toxicity studies of the plant extract: This was carried out by method described by Lorke (1983). In the initial phase, rats were divided into 3 groups of 3 rats each and were treated with the plant extract at doses of 10mg, 100 mg and 1000 mg/kg body weight orally. The animals were observed for 24 h for signs of toxicity including death. Based on the results of phase one, three fresh rats were divided into 3 groups of one rat each, and were treated with 1600, 2,900 and 5,000 mg/kg body weight.

Animals grouping and experimental design: A total of thirty healthy Wistar albino rats of both sexes between the ages of 8-10 weeks old and weighing between 150-200 g were used for the study. The animals were kept in well aerated laboratory cages in the Department of Human physiology animal house and were allowed to acclimatize to the laboratory environment for a period of 2 weeks before the commencement of the experiment. They were maintained on standard animal feeds and drinking water *ad libitum* during the stabilization period. After this period, the experimental animals were subjected to oral

administration of various doses of the plant extract once daily for a period of twenty one (21) days as follows:

- Group 1:** Normal control rats and were administered with normal saline, orally.
- Group 2:** Normal and received 100 mg/kg body weight of *Mucuna pruriens* orally.
- Group 3:** Normal and received 200 mg/kg body weight of the *Mucuna pruriens* orally
- Group 4:** Normal and received 400 mg/kg body weight of the *Mucuna pruriens* orally.
- Group 5:** Normal and received 250 mg/kg body weight standard dose of metformin orally.

Statistical analysis: Data of the blood glucose were expressed as mean±SEM. The data obtained were statistically analyzed using one-way analysis of variance (ANOVA) with Turkey's multiple comparison post hoc tests to compare the level of significance between control and experimental groups. The values of $p < 0.05$ were considered as significant (Duncan *et al.*, 1997).

RESULTS

Preliminary phytochemical screening of the plant extract: The results of preliminary phytochemical screening of ethanolic leaf extract *Mucuna pruriens* revealed the presence of flavonoids, tannins, saponins, cardiac glycosides, reducing sugars, steroids and/or triterpenoids and glycosides.

Acute toxicity studies: Signs of toxicity of were first noticed after 4-5 h of the extract administration. There were decreased locomotor activity and sensitivity to touch and pain, including decreased feed intake, tachypnoea and prostration after 12 h of extract administration and subsequently deaths were recorded. The LD₅₀ was thus calculated as 2154 mg/kg.

Effect of oral daily doses of ethanolic leaf extract of *Mucuna pruriens* on blood glucose levels on normoglycemic wistar rats: The study revealed that there was no significant change ($p > 0.05$) in the blood glucose levels in the groups administered with the extract at dose concentrations of 100, 200 and 400 mg/kg b w and Metformin 250 mg/kg b w after the 3rd day, when compared to the control group. There was also no significant difference ($p > 0.05$) in the blood glucose level in the group treated with 200 mg/kg and metformin 250 mg/kg b w. Whereas, there was a significant change ($p < 0.05$) in the blood glucose levels in the groups treated with extract concentrations of 100 and 400 mg/kg b w

Table 1: Effect of ethanolic leaf extract of *Mucuna pruriens* on percentage change in fasting blood glucose levels on normoglycemic wistar rats administered with

Treatment given	% Change in fasting blood glucose levels (mg/dL)							
	0 Day	3 rd Day	6 th Day	9 th Day	12 th Day	15 th Day	18 th Day	21 st Day
Control	0	- 3.41	- 4.73	- 2.33	- 1.97	- 1.43	- 1.80	- 0.89
Normal + Ethanolic extract (100 mg/kg)	0	- 4.73	- 13.09	- 20.91	- 30.92	- 36.00	- 40.00	- 30.37
Normal + Ethanolic extract (200 mg/kg)	0	- 7.41	- 10.56	- 15.19	- 20.19	- 24.81	- 32.97	- 39.08
Normal + Ethanolic extract (400 mg/kg)	0	- 3.70	- 11.86	- 20.19	- 25.37	- 27.78	- 30.92	- 33.89
Normal + Metformin (250 mg/kg)	0	- 5.05	- 9.53	- 21.13	- 31.40	- 33.27	- 37.76	- 39.44

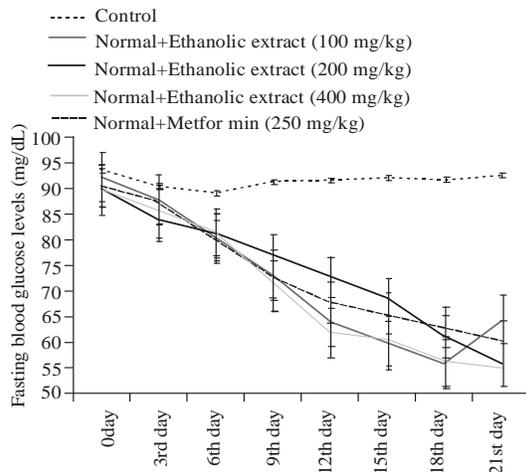


Fig. 1: Effect of daily oral doses of ethanolic leaf extract *Mucuna pruriens* on blood glucose levels on normoglycemic Wistar rats. Values are presented as mean±SEM; Values are statistically significant compared to control group at ^a: p<0.05; ^b: p<0.01; ns: not significant

after the 6th day, when compared to the control group. The study also showed that administration of the extract at dose concentration of 100, 200 and 400 mg/kg and Metformin 250 mg/kg b w, resulted to a significant decrease (p<0.05) in the blood glucose level after 9th, 12th, 15th, 18th and 21 day, when compared to the control group, with a maximum reduction (p<0.01) in the blood glucose levels recorded with 100 mg/kg b w after 15th and 18th day, 200 mg/kg b w after the 21 day and metformin 250 mg/kg b w after 15th, 18th, and 21 day when compared to the control group as shown in Table 1 and Fig. 1.

DISCUSSION

Plants generally have varied chemical compositions, called phytochemicals depending upon species. A good number of plants are known to be of economic and medicinal value. Those that are of medicinal value are often used as herbal remedy for the restoration and maintenance of good health. Some herbs have been

considered as drugs and therefore generally safe and effective (Treasure, 2000; Friday *et al.*, 2010). Most herbs have been associated with broad actions on a number of physiological systems in concert unlike the pharmaceutical drugs which are usually designed to elicit a specific effect. Some researchers on medicinal plants are of the opinion that some herbal plants are usually oriented in the same general therapeutic direction and are complementary or synergistic, often non-specific but very rarely adverse (Treasure, 2000) The current study evaluated the effect of ethanolic leaf extract of *Mucuna pruriens* on the levels of blood glucose on normoglycemic rats. The findings showed that plant extract at all doses had a significant (p<0.05) change on the blood glucose concentration in a dose dependent fashion. The preliminary phytochemical screening of plant extract revealed the presence of flavonoids, tannins, saponins, cardiac, glycosides, reducing sugars, steroids and/or triterpenoids and glycosides. A number of researchers have shown that flavonoids, triterpenoids, tannins and a host of other secondary plant metabolites possess hypoglycemic activity in experimental animal models (Akah and Okafor, 1992; Marles and Farnsworth, 1995). Therefore, the potential and hypoglycemic activity of Ethanolic leaf extract of *Mucuna pruriens* may be related to the presence of phytochemicals either as individual or a group which may be responsible in the stimulation of the beta-cells and subsequent secretion of preformed insulin.

In conclusion, the study clearly demonstrated that the ethanolic leaf extract of *Mucuna pruriens* in normoglycemic wistar rats have hypoglycemic activity at all doses of the plant extract. How all doses of the extract appeared to be effective.

REFERENCES

Adepoju, G.K.A. and O.O. Odubena, 2009. Effect of *Mucuna pruriens* on some haematological and biochemical parameters. J. Med. Plant Res., 3(2): 073-076.
 Akah, P.A. and C.L. Okafor, 1992. Blood sugar lowering effect of *Veronia amygdalina* (Del) in an experimental rabbit model. Phytother. Res., 6: 171-173.

- Amin, K.M.Y., M.N. Khan and S. Zillur-Rehman, 1996. Sexual function improving effect of *Mucuna pruriens* in sexually normal male rats. J. Study Med. Plant. Fitoterapia, 67(1): 53-68.
- Bhasin, S., T.W. Storer, N. Berman, C. Callegari, B. Clevenger, J. Phillips, T.J. Bunnell, R. Tricker, A. Shirazi and R. Casaburi, 1996. The effects of supraphysiologic doses of testosterone on muscle size and strength in normal men. N. Engl. J. Med., 335: 1-7
- Buckles, D., 1995. Velvet Bean: A new plant with a history Econ. Bot., 40: 13-25.
- Chevellier, A., 1996. The Encyclopedia of Medical Plant. Dorling Kindersley Ltd, London, Retrieved from: <http://www.chclibrary.org/plant.html>.
- Duncan, R.C., R.G. Knapp and M.C. Miller, 1997. Test of Hypothesis in Population Means. In: Introductory Biostatistics for the Health Sciences. John Wiley and Sons Inc., NY, pp: 71-96.
- Emeka, E.J.I. and O. Onyechi, 2009. Some biochemical, hematological and histological responses to a long term consumption of telferia occidentalis-supplemented diet in rats. Pak. J. Nut., 8(8): 1199-1203.
- Friday, E.U., E.O. Iniobong and B.E. Moses, 2010. Effect of aqueous extract of psidium guava leaves on liver enzymes, histological integrity and hematological indices in rats. Gastroenterol. Res., 3(1): 32-38.
- Goji, A.D.T., A.A.U. Dikko, A.G. Bakari, A. Mohammed, I. Ezekiel and Y. Tanko, 2009. Effect of Aqueous-Ethanol stem bark extract of Commiphora Africana on blood glucose levels on Normoglycemic Wistar rats. Int. J. Animal Vet. Adv., 1(1): 22-24.
- Hunter, K.J. and J.M. Fletcher, 2002. The antioxidant activity and composition of fresh, frozen, jarred and canned vegetable. Innv. Food Sci. Emerg. Technol., 3: 399-406.
- Lorke, D., 1983. A new approach to practical acute toxicity testing arch. Toxicol., 54: 275-287.
- Manyham, B.V., M. Dhanasekaran and T.A. Hare, 2004. Neuroprotective effects of the antiparkinson drug of *Mucuna pruriens*. Phytother. Res., 18(a): 706-712.
- Marles, R.J. and N.R. Farnsworth, 1995. Antidiabetic plants and their active constituents. Phytomedicine, 2: 137-187.
- Sathyanarayanan, L. and S. Arulmozhi, 2007. *Mucuna pruriens*. A comprehensive review. Pharmacog Rev., 1(1): 157-162.
- Trease, G.E. and M.C. Evans, 1983. Text Book of Pharmacognosy. 13th Edn., Baillier Tindal, London, pp: 247-762.
- Treasure, J., 2000. Medical Herb. Retrieved from: <http://www.herbiological.com>.