



Effects of Aqueous Leaf Extract of Velvet Bean (*Mucuna Pruriens*) on Reproductive Outcome in Adult Female Wistar Rats

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ABSTRACT: From ancient times in many parts of the world, herbal medications have been used for the treatment of various ailments. *Mucuna pruriens* is a leguminous plant that has various medicinal purposes. Literature reports state that it enhances normal fertility, healthy sperm and ova, proper functioning of the reproductive organs and appropriate genital secretions. This present study was done to study the effects of the aqueous leaf extract of *M. pruriens* on reproductive outcome in adult female Wistar rats. Twenty-four adult Wistar rats were used for this research. These animals were randomly divided into four groups of six (6) rats each. The animals were weighed before commencement and during the period of the experiment. All animals received water and feed *ad libitum*. Group A served as control. Groups B and C received 500mg and 1500mg/kg bodyweight of extract respectively for 10days before mating. Group D comprised of the male animals used for mating the females. After littering, the pups were counted and weighed. The statistical apparatus used for analyzing the data was IBM/SPSS version 20 and the method employed was ANOVA. Results were taken to be statistically significant when $P < 0.05$. Group B showed no significant increase ($P > 0.05$) in bodyweight change of dams as well as in pup weight. Group C on the other hand showed a significant increase ($P < 0.05$) both in the bodyweight change of dams but not in pup weight. A dose dependent increase in reproductive outcome and pregnancy success rate was observed in animals of group B and C. Findings from this study indicate that *Mucuna pruriens* has pro-fertility potential. It is therefore safe to administer extract in experimental animals to enhance their reproductive ability.

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Human use of plants date back from fossil records to the middle Paleolithic age, some 60,000 years ago. From that time, plants have been included as a means of therapy in traditional medical systems (Solecki, 1975). According to the World Health Organisation (WHO), about 65% of the world has included plants in their primary modality of health care. Due to high biodiversity and endemism, the tropical forest is generally considered to be the most likely habitat to discover new pharmaceuticals (Ayensu *et al.*, 1978). According to WHO, the prevalence of usage of medicinal plant remedies is higher in developing countries, with about 65%-80% of the populations using such products (WHO, 2011). It might be expected that plants bioactive compounds would have low toxicity to man. However, some plants may have acute or chronic toxic effects when used (Farnsworth and Daniel, 2001).

Amongst medicinal plants, *Mucuna pruriens* (L) is an important specie that was first discovered about 4500 years ago in India for the treatment of Parkinson's disease. The plant has lots of alkaloids that have actions on the nervous system (Sastry and Kavathekar, 1990; Agharkar, 1991; Singh *et al.*, 1996). The plant

became popular in the international market with the discovery of the presence of L-DOPA (L-3,4-dihydroxyl phenyl alanine) which is an anti-Parkinson's drug in the seeds (Farooqi, 1999).

Mucuna pruriens (MP) belongs to the family of Leguminosae and it has up to 100 species. MP is found in the woodlands of tropical areas especially in Africa, Asia, India and the Caribbean. The hairs on the plant cause itchiness and this is as a result of the presence of mucunain and serotonin (Agharkar, 1991). In Nigeria, the common name is "devil's bean" and its medicinal use is widely prevalent (Ezueh, 1977; Infante *et al.*, 1990; Osei-Bonsu *et al.*, 1995).

On phytochemical analysis, the seeds of MP contain high concentrations of L-DOPA. Other constituents include glutathione, lecithin, gallic acid, beta sitosterol, nicotine, dimethyl tryptamine. The leaves also contain 0.5% L-DOPA (Erowid, 2002). The plant is used against a wide range of conditions which include neurological, menstrual disorders, urinary tract problems, fever, ulcers and constipation. It is also useful as a hypoglycemic, vermifuge, anti-

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hypertensive and carminative agent (Katzenschlager *et al.*, 2004). In addition, it is prevalently useful as an aphrodisiac. The powdered sample of the seeds was also found to increase mating and sexual activity in rats (Amin *et al.*, 1996).

Infertility is regarded as one of the most important reproductive health concern of men and women across the globe (Okonofua, 2003; Megafu, 1988). WHO in 2013 defined infertility as “a disease of the reproductive system defined by the failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse”. Worldwide, about 3%-7% of all couple have unresolved fertility problem (Himmel *et al.*, 1997). The occurrence of infertility varies from region to region around the world, being highest in Africa. The incidence is about 10-15% in developed countries and about 20-46% in developing countries (Idrisa *et al.*, 2005; Alvarez, 2006). The use of herbs in the treatment of infertility as well as other diseases is attributed to the high cost of synthetic drugs, previous notion that herbal medicines are safe and also due to the belief that there is an unscientific cause to such diseases (Fido, 2004; Canter and Ernst, 2004; Qato *et al.*, 2008; Loya *et al.*, 2009; Cohen and Ernst, 2010).

Among fertility herbs used in Nigeria, *M. pruriens* is popularly recommended because it is said to be one of the best reproductive tonics for both men and women. The plant enhances normal fertility, healthy sperm and ova, proper functioning of the reproductive organs as well as appropriate genital secretions (Agbafor and Nwachukwu, 2011). A significant dose dependent increase in follicle stimulating hormone (FSH), progesterone and luteinizing hormone (LH) levels for both male and female rats have been reported (Obasi *et al.*, 2016). The methanolic seed extract slightly raised superoxide dismutase levels in female Sprague-dawley rats and caused a dose dependant increase in the levels of FSH and LH levels with increase in oocyte number (Noah *et al.*, 2014).

The objectives of this study was to investigate the effects of aqueous leaf extract of *Mucuna pruriens* on pregnancy success rate and reproductive outcome on adult female Wistar rats.

MATERIALS AND METHOD

This research was conducted with the aid of the following materials; Cages, Gloves, Scale, Dissecting set, Plastic specimen bottles, Knife, Embedding mould, Spatula, Disinfectant, Calibrated Syringes, Micropipette, Cotton wool, Refrigerator, Light microscope, Rotary microtome, Laboratory coat, Slides, Orogastric tube, Pencil, Slide rack, Weighing

balance, Oven, Water bath, Electric weighing balance, Hand gloves, 10% formal saline, Hematoxylin, Eosin, Ethanol, Xylene, Paraffin wax, Normal saline.

Animals: Twenty four (24) adult Wistar rats with mean weight of 220g were bred in the Department of Anatomy University of Benin and maintained under standard condition for the use of laboratory animals (National institute of Health Guide for the use and Care of Laboratory Animals). During this period, the animals were fed with Growers' mash, manufactured by Premier Feed Mills Co. Ltd (a subsidiary of Flour Mills of Nigeria Plc.) and water *ad libitum*.

All animals were maintained at room temperature with approximate light/dark cycle of 12:12 hours. The animals were randomly divided into four groups of six (6) animals each.

Group A was the control and the animals received feed and 1ml of distilled water daily to compensate for stress of administration incurred in the treated groups.

Groups B and C were administered 500mg and 1500mg/kg body weight of the extract respectively for 10days before mating.

Group D was the male animals of same standard of proven fecundity used to mate the females.

All administration was done through oral route with the aid of an orogastric tube. The animals were weighed weekly throughout the period of the experiment.

Data Analysis: Data obtained was tested for significant variance between the values obtained from the test groups and the control. The significant difference in the mean values of all parameters was determined using one-way analysis of variance (95% confidence interval). Post-hoc test was also carried out for all the groups. All statistical analysis was carried out using Statistical Package for Social Sciences (SPSS), version 20, manufactured by International Business Machine Corporation (IBM) in Armonk, New York.

RESULTS AND DISCUSSION

Change in Body weight: The change between the initial and final body weight of dams in the showed no significant increase ($P > 0.055$) for rats treated with 500mg/kg body weight (group B1) of MP for 10days before mating when compared to control. There was however significant increase ($P < 0.002$) between rats treated with 1500mg/kg body weight (group B2) when compared with the control.

Pregnancy Success Rate: The pregnancy success rate for the control was 83.3%, the low dose had 100% while the high dose also had a success rate of 83.3%.

Litter Size: There was no significant difference ($P>0.467$) when the litter size was compared between the low dose and control. However, there was a

significant ($P<0.010$) increase in the litter size when comparing the high dose and the control.

Pup Weight: Comparing the birth weight of the pups, it was observed that there was no significant increase ($P>0.121$; $P>0.06$) when the low and high dose was compared with the control.

Table 1. Weight and litter size

Parameters	Control	Treated Groups	P-Value
Weight Change (g)	(39.50±1.00)	Low Dose (48.25±5.44)	0.055
	(39.50±1.00)	High Dose (56.00±8.00)	0.002*
Litter Size	(7.00±1.00)	Low Dose (7.75±1.50)	0.467
	(7.00±1.00)	High Dose (10.67±1.15)	0.010*
Pup Weight (g)	(5.92±0.19)	Low Dose (5.75±0.29)	0.121
	(5.92±0.19)	High Dose (6.17±0.50)	0.060

Values are represented as Mean ± SEM for each group; n=6/group; *indicates significant difference ($P<0.05$) compared to control.

The herb under investigation in this study has been used in many cultures across the world for its revitalizing and fertility enhancing effects. Pregnancy success rate was same in control and high dose (83.3%) whereas the low dose had a 100% success rate. Thus the low dose is more efficient in fertility purpose. The reproductive outcome with the use of *M. pruriens* was markedly increased. Considering the litter size, a dose dependent increase was observed as the higher dose produced an average of 10 pups while the low dose produced 8 pups, in contrast with the control that had an average of 6 pups. The increase in the number of oocytes released at ovulation with the use of MP has also been reported in previous report by using the seed (Noah et al., 2014). It can be attributed to the presence of L-Dopa in the leave (Misra and Wagner, 2006). Increase in dopamine, a metabolite of L-Dopa has been reported to stimulate gonadotrophin releasing hormone (GnRH), which in turn activates the secretion of follicle stimulating hormone (FSH), resulting in the increase in oocyte number. This increase in oocyte number is thus evident as the corresponding increase in the reproductive outcome as seen in this study. It can therefore be said that the use of *M. pruriens* increases fertility and can be used as a potent medication in females. However, since the pregnancy success rate is higher for the low dose than the high dose, it is assumed that the high dose that greatly increased the reproductive outcome does not have a corresponding aphrodisiac effect.

It was also shown that *M. pruriens* caused a dose dependent increase in weight in treated animals. This increased bodyweight is possibly due to the higher litter size observed in the treatment groups when compared with the control. The pups also did not show significant increase in the birth weight when the treatment groups were compared with control. The use of some other herbs such as *Echinacea* has also been

documented to have insignificant effect on infant birth weight and gestational age in a retrospective study in Canada (Gallo et al., 2000).

Conclusion: From the results of this study, it is clearly seen that *M. pruriens* is safe at various doses and the occurrence of over dose is almost infinitesimal. Also, the report of its pro-fertility effect has been re-affirmed and it is recommended that the low dose has an overall beneficial effect than the high dose.

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