



# Possible Reversal of Diabetes-Induced Erectile Dysfunction by Extracts of Traditional Legume (*Mucuna pruriens*).

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## ABSTRACT

One of the main secondary effects of diabetes is erectile dysfunction. Traditional medicine has favored *Mucuna pruriens*, a leguminous plant known for its anti-diabetic, aphrodisiac, and increasing fertility characteristics. This present study aims to check the possible reversal of diabetes-induced erectile dysfunction by extracts of a traditional legume (*Mucuna pruriens*). For this research, 160–200 kg/b.w albino rats were utilized. Three of the twelve rats utilized in this study were kept as the normal control group. By injecting sildenafil citrate (5 mg/kg body weight) intraperitoneally, the remaining 9 rats became diabetic. They were after that equally divided into 3 groups: Group 2, diabetes-induced or diabetes-control, Group 3, diabetic rats given 200 mg/kg b.w of ethanolic leaf extract of *Mucuna pruriens*, and Group 4, diabetic rats treated 400 mg/kg b.w of leaf extracts. In groups 3 and 4, the ethanolic leaf extracts of *Mucuna pruriens* were administered orally for three days. The animals were sacrificed after 3 days and the blood was collected for further analysis. The result showed a significant reduction in the level of follicle-stimulating hormone (FSH), luteinizing hormone (LH), and testosterone and an increase in the blood glucose level in group 2. In group 3, there was an improvement in hormonal levels when compared to group 2. This study, therefore, supports the usage of *M.pruriens* as a sexual invigorator in diabetic conditions and encourages performing similar studies in men.

## INTRODUCTION

The inability of a man to achieve or sustain a penile erection strong enough for sexual activity is known as Erectile dysfunction (ED). While erection is crucial for a satisfying sexual encounter, it also has deeper symbolic meaning relating to one's self-image, self-esteem, and ideas of one's gender role. [Prakash et al., 2020]. According to estimates, more than 150 million men worldwide already experience ED; by 2025, that number will surpass 322 million [McKinlay,2000]. Despite a significant number of cases, it is challenging to identify the cause of erectile dysfunction.

A metabolic illness called diabetes, which affects more than 100 million individuals globally, is crippling. The illness impacts numerous physiological systems, which also lowers the quality of life and causes patients to suffer cardiovascular issues. [Creager et al, 2003].

In comparison to non-diabetic males, diabetic men are three times more likely to experience erectile dysfunction (ED), with 50–75% of them reporting some level of ED. With the course of diabetes, ED severity rises in diabetic males. The primary factor contributing to the onset of sexual dysfunction is endothelial dysfunction, which develops as a result of excess production of reactive oxygen species (ROS). [Hakim and Goldstein, 1995] [Musicki and Burnett, 2007]

Phosphodiesterase 5 inhibitors (PDE5is), which are used to treat ED, a kind of male sexual problem, has shown to be ineffective in treating diabetes-related sexual dysfunction. It has been suggested that pairing a PDE5i with an antioxidant can boost its effectiveness. [De Young et al., 2004].

The leguminous *Mucuna Pruriens* (Linn) plant of the Fabaceae family is found in the tropical regions of India, Africa, and the West Indies (Rajesh et al., 2016). In Ayurveda, the seeds and leaves of this plant are well-known and frequently used for the treatment of Parkinsonism, epilepsy, and erectile dysfunction (Dalal PK et al, 2013) (Muthu and Krishnamoorthy, 2011. Suresh et al., 2013), among other conditions. The seeds are abundant in antioxidants and fiber (Lampariello et al., 2012). The WHO has advised considering the potential of plants as useful therapeutic agents, especially in countries where contemporary pharmaceuticals are not easily accessible, as the use of complementary medicine has grown significantly in recent years. Even when they are not standardized, herbal medicinal plants are given because of their affordability and relative safety [Majekodunmi et al.,2011].

The purpose of this research work is to check the possible reversal of diabetes-induced erectile dysfunction by extracts of a traditional legume (*Mucuna pruriens*).

## MATERIALS AND METHODS

Preparation of plant extract: After the fresh leaves had been dried in the shade, a fine powder was formed from them, when ground with a lab mortar and pestle. At room temperature, 70% ethanol and 30% distilled water were used to macerate 200 grams (g) of powder for 72 hours. This was filtered using filter paper (Whatman size no.1).

Source of materials: Fresh leaves of *Mucuna pruriens* were procured from the Medicinal Garden of the National Centre for Genetic Resources and Biotechnology, Ibadan, Nigeria. Botanical identification and authentication were performed.

Twelve (12) adult Wistar rats with an average weight of 160 to 200kg were procured from the Department of Anatomy at the University of Ibadan, Nigeria.

The animals underwent seven days of acclimatization under typical environmental circumstances with a 12-hour cycle of light and darkness while being fed regular food (vital feed) and water. The Institutional policies on the handling and use of experimental animals were strictly followed during all processes.

Diabetes induction: Rats in the study groups were kept apart from the diabetic control group. The basal blood glucose level was assessed before the experimental group developed diabetes. The rats were allowed to fast all night before receiving sildenafil citrate injections. The rats were then given a dose of 5mg of sildenafil citrate intraperitoneally per kg of body weight to induce diabetes. Following induction, the same food and water were made available to the rats without restriction. Blood samples were drawn from the rat tail tips and used to check for diabetes and other hormone biomarkers after 72hours later.

Experimental protocol: Twelve (12) male Albino rats weighing between 160 - 200 kg were divided into four (4) groups as follows: Group 1: Control, Group 2: Diabetes-induced (sildenafil citrate at a dose of 5 mg/kg body weight), Group 3: Diabetes-induced (sildenafil citrate + a dose of 200mg/kg b.w of *Mucuna pruriens*) rats, and Group 4: Diabetes-induced (sildenafil citrate + a dose of 400 mg/kg b.w of *Mucuna pruriens*) rats. The rats were sacrificed and submitted to further analysis after receiving a single oral dose of *Mucuna pruriens* each day for three days.

The statistical data analysis was carried out by using the SAS package.

## RESULTS

**Table 1: Duncan's multiple range test for possible reversal diabetes-induced erectile dysfunction by extracts of traditional legume (*Mucuna pruriens*).**

GROUP	GLUCOSE (mg/dl)	FSH (miu/ml)	LH (miu/ml)	TESTOSTERONE (nmol/l)
GP 1	67.55 <sup>bc</sup>	1.40 <sup>a</sup>	1.90 <sup>a</sup>	4.80 <sup>b</sup>
GP 2	190.15 <sup>a</sup>	1.05 <sup>ab</sup>	1.35 <sup>c</sup>	4.75 <sup>bc</sup>
GP 3	77.53 <sup>b</sup>	0.30 <sup>bc</sup>	1.50 <sup>bc</sup>	5.70 <sup>a</sup>
GP 4	35.45 <sup>c</sup>	0.25 <sup>c</sup>	1.60 <sup>ab</sup>	1.25 <sup>c</sup>

**Table 2: Mean and standard error showed possible reversal of diabetes-induced erectile dysfunction by extracts of traditional legume (*Mucuna pruriens*).**

GROUP	GLUCOSE (mg/dl)	FSH (miu/ml)	LH (miu/ml)	TESTOSTERONE (nmol/l)
GP 1	67.55 ± 8.85	1.40 ± 0.50	1.90 ± 1.00	4.80 ± 1.00
GP 2	190.15 ± 13.55	1.05 ± 0.15	1.35 ± 0.55	4.75 ± 2.15
GP 3	77.53 ± 10.13	0.30 ± 0.10	1.50 ± 0.40	5.70 ± 2.20
GP 4	35.45 ± 22.75	0.25 ± 0.05	1.60 ± 1.30	1.25 ± 0.35

Follicle-stimulating hormones (FSH), luteinizing hormone (LH), Testosterone, Glucose

## DISCUSSION

Numerous men experience diabetic ED, which has a detrimental effect on their health and quality of life due to an increasing number of cases of diabetes. The majority of reported cases of ED have organic origins (around 80%), whereas the remaining occurrences are caused by psychological factors. Organic reasons for ED may include changes in hormone (testosterone), injury to the penile nerve supply (from an accident or surgery in the pelvic area), smoking, illnesses (such as diabetes and high blood pressure), etc. Impaired penile arterial inflow, corporal Venous-occlusive dysfunction, or abnormal corporal tone are the pathologies that lead to the development of ED. (Sumanta et al.,2014). Given these facts, the purpose of this study is to examine the possibility of reversing diabetes-induced erectile dysfunction using extracts of traditional legumes (*Mucuna pruriens*).

In this current research work, we discovered that the Wistar rat in group 1 (the control group) had blood sugar levels that were typical or standard for the Wistar rats utilized in this experiment. When compared to group 1 (the control group), the blood glucose level in group 2 (the diabetic-induced rats) significantly increased. However, when compared to group 2 (the diabetes-induced group), groups 3 and 4 were treated with 200 mg/kg and 400 mg/kg of *Mucuna pruriens*, shown in Tables 1 and 2 respectively, displayed significantly lower blood sugar levels. Nevertheless, at a greater dose of 400 mg/kg, the ethanolic leaf extract's impact is better and more apparent. (Anukwu et al.,2023).

### Follicle-stimulating hormone (FSH)

In this study, FSH levels were measured in four distinct groups of male Wistar rats. Group 1 exhibited the highest

FSH level with a value of (1.40 ± 0.50) followed by Group 2 with a significant reduction in the FSH level with a value of (1.05 ± 0.15). Subsequently, FSH levels dropped significantly in Group 3 and Group 4 reaching (0.30 ± 0.10) and (0.25 ± 0.05) respectively. The decreasing trend in FSH levels across the groups could indicate a potential dose-response relationship, suggesting that certain factors might be influencing FSH production or regulation. While Group GP 1 demonstrated the highest FSH levels, Group GP 4 exhibited the lowest levels, suggesting that there might be a relationship between the experimental conditions and FSH production. These variations could be attributed to HPG axis abnormalities (Jee-Young et al.,2000), which influence insulin and leptin levels, GnRH pulses from the hypothalamus, FSH secretion from the pituitary, testosterone production from the Leydig cells, and sperm quality

### Luteinizing Hormones (LH)

Luteinizing Hormone (LH) is crucial for male reproductive health, stimulating testosterone production in the testes. There was a significant reduction in the LH level of Group 2 (1.35 ± 0.55) Wistar rats when compared to Group 1(1.90 ± 1.00). Group 3 and Group 4 showed distinct changes, with Group 3 having a lower LH level of (1.50 ± 0.40) and a higher LH level in Group 4(1.60 ± 1.30), potentially impacting testosterone production and reproduction. The variations in LH levels could be indicative of complex hormonal interactions and regulatory mechanisms. The fact that LH levels did not decrease consistently, as FSH levels did, suggests that different factors might influence LH production or response. Hormonal feedback loops involving the hypothalamus-pituitary-gonadal axis could be at play, influencing LH secretion more intricately. (Agbai et al., 2021).

## Testosterone

Testosterone, a key male sex hormone, in Group 2 ( $4.75 \pm 2.15$ ) showed a significant reduction ( $P > 0.005$ ) in the testosterone level when compared to Group 1 ( $14.80 \pm 1.00$ ). This may be caused by insulin resistance (Jee-Young et al., 2000). Men with impaired glucose tolerance had significantly lower levels of total testosterone levels, according to research [Goodman et al., 2000]. Low testosterone levels may indicate that Type 1 diabetes impairs testosterone levels in patients with poor control, which may limit spermatogenesis [Erica et al., 2012]. Following the administration of a varying dosage of *M. pruriens* to the induced diabetes rats, testosterone levels increased in group 3 ( $5.70 \pm 2.20$ ). Group 4 has the lowest mean testosterone ( $1.25 \pm 0.35$ ). The effect on the testosterone level is well pronounced at a dose of 200mg/kg, as shown in (Tables 1 & 2).

## CONCLUSION

This research work, reveals that ethanolic leaf extract of *M. pruriens* has the potential to enhance sexual behavior with androgenic and anti-diabetic effects in the sildenafil citrate-induced diabetic male rats.

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