Original Research Article

Journal of Drug Discovery and Research (*JDDR*) December 2022; 1(2): 33-38
Journal of Drug Discovery Research Group, Faculty of Pharmacy, University of Uyo, Nigeria
Available online at https://www.ddrg.net

A study on the phytochemical contents and aphrodisiac potentials of methanol root pulp extract of *Musa paradisiaca*

Anwanabasi E. Udoh[1], Aniefiok S. Udobre[2*] and Goodnews E. Charles[2]

1. Department of Pharmacology and Toxicology, Faculty of Pharmacy, University of Uyo, Nigeria
2. Department of Pharmaceutical and Medicinal Chemistry, Faculty of Pharmacy, University of Uyo, Nigeria

***For Correspondence**: **Email**: aniefiokudobre@uniuyo.edu.ng; **Tel**.: +2348027672367*

Reviewed: 09/12/2022 *Accepted: 29/12/2022*

ABSTRACT

Background: In Nigeria primary objective of marriage is procreation. This has failed in most homes due to Erectile Dysfunction (ED). Erectile dysfunction is the inability of man to get and maintain an erection firm enough for sexual intercourse. In Akwa Ibom State, Nigeria the root pulp of *Musa paradisiaca* is claimed to posses aphrodisiac properties. The purpose of this research is to validate and confirm this claim scientifically.

Methods: In this study *Musa paradisiaca* Root pulp were extracted using Methanol. The extract was used to carry out Toxicity study, phytochemical screening, open column chromatography and Thin-layer chromatography. The methanol crude extract was partitioned to obtain the n-hexane, dichloromethane, ethyl acetate, n-butanol and the aqueous fractions were also used for Aphrodisiac Activity study by the sexual indexes' method.

Results: The result revealed that the crude extract contained alkaloids, tannins, saponins, steroidal glycosides, deoxy sugar, polyphenol. The extract and the fractions caused significant increase in Mount Frequency (MF) and a significant decrease in Mount Latency (ML). These are indicators of increase in sexual activity.

Conclusion: The aphrodisiac activities exhibited by the extract are attributed to the chemical constituents of the methanol root pulp extract. This is because the extract increased potency, increased mount frequency and enhanced libido in the experimental animals.

Keywords: Aphrodisiac, Erectile Dysfunction, *Musa paradisiaca*

1.0INTRODUCTION

The World Health Organization (WHO) defines traditional medicine as the sum total of the knowledge, skills and practices based on the theory, beliefs and experience indigenous to different cultures used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness.

An aphrodisiac is defined as food or drug that arouses sexual instinct, brings on desire or increases sexual pleasure or performance. Some medicinal plants with aphrodisiac potential include cannabis sativa, *Dioscorea bulbifera* and panax ginseng [1- 5]. Erectile Dysfunction is the inability to get and keep an erection firm enough for sexual intercourse. It is caused by heart disease, high cholesterol, atherosclerosis (clogged blood vessels) high blood pressures, diabetes, obesity, tobacco use, alcoholism, anxiety and stress [6]. Treatment for Erectile dysfunction. Phosphodiesterase type 5 (PDE) inhibitor is a class of drug taken orally to treat erectile dysfunction. The four major PDE 5 inhibitors are sildenafil, tadalafil, vardenafil and avanafil. All of them function by enhancing the effect of Nitric Oxide (NO). NO is a natural chemical the body produces that relaxes muscles in the penis. These drugs also have fatal side effect like sudden hypertension, hypersensitivity reaction, abnormal vision, suicide tendencies, mental disorders, facial flushing and tremors [7-10]. Mechanism of Penile Erection on sexual stimulation, the para-sympathetic nerves release Nitric Oxide gas (NO). The gas activates the enzyme Granulate Cyclase (GC). The GC converts guanosine triphosphate (GTP) into Cyclic Guanosine Monophosphate (cGMP). The cGMP in turn causes the smooth muscles cells around the penis to relax leading to the dilation of the blood

Journal of Drug Discovery and Research (*JDDR*) December 2022; 1(2): 33-38
Journal of Drug Discovery Research Group, Faculty of Pharmacy, University of Uyo, Nigeria
Available online at https://www.ddrg.net

vessels and increase flow of blood into the penile tissue. This blood is trapped in the penis and this results in an erection [11]

Musa Paradisiaca (Musaceae) (plantain) is cultivated in Sri Lanka, India, Bangladesh, China, Vietnam, Thailand, Malaysia, Philippines and Africa. The leaves, root and fruits have been used traditionally in Nigeria in the management of male sexual inadequacies. ([12-15]. The inflorescence is used as ear- drops to treat ear aches. Lint for ulcer is made from the stem and peduncle fibre. The lint is boiled, cooled and used locally as eye-drops for conjunctivitis. Ashes and the fruit skin, leaf and stem are applied on ulcers [2].

2. MATERIALS AND METHODS

2.1 Materials

2.1.1 Biological materials

Sixty sexually matured (active) male albino rats weighing between 160 to 200 grams were chosen at random.

2.1.2 Equipment:

Analytical balance (Ohaus)

2.1.3 Chemicals and Reagents :

Fehling's solution A & B, Mayers reagent, Draggendorff reagent, distilled water, Methanol n – hexane, dichloromethane, ethyl acetate, n- butanol (BDH) and testosterone .

2.2 Methods

2.2.1 Collection and Identification of Plant Material

The root pulp of *Musa Paradisiaca* was obtained from Obot Akara Local Government Area of Akwa Ibom State. It was identified and authenticated by Professor (Mrs) Margaret Bassey of the department of Botany and Ecological studies of the University of Uyo, Uyo. The root pulp Specimen was assigned an herbarium number U.U.H. 6443 and deposited in the department of Pharmacognosy and natural Medicine, university of Uyo.

2.2.2 Processing of the Plant Material

The root pulp of *Musa paradisiaca* was washed with tap water, cut into pieces and dried. The dried pulp was then pulverized into a coarse powder and weighed.

1.0kg of the pulverized plant material was extracted with 7 litres of 70% methanol in a closed vessel and allowed to stand for 72 hours, with occasional shaking. It was then filtered and the filtrate concentrated in water bath at 40^{o}C. The crude methanol extract was partitioned successively to obtain the following extracts: n-Hexane, Dichloromethane, Ethyl acetate, n-Butanol and Aqueous.

2.2.3 Phytochemical Screening

The crude methanol extract and its fractions were subjected to phytochemical screening using the standard method [16].

2.2.4 Determination of median Lethal Dose (LD_{50})

Twenty-one (21) mice of both sexes weighing between 20-25g were brought from the University of Uyo animal house of the Department of Pharmacology and Toxicology. The mice were chosen at random, placed in neat cages and allowed for two weeks to acclimatize. They were nurtured under standard condition which entails 12-hours light and 12-hours dark schedule. They had free access to water and feed. The standard method was used to estimate the LD50. [18] This involve intra peritoneal administration of different doses of the extract to group of three mice per group. The mice were observed for physical signs of toxicity which include writhing, decreased motor activity, paw licking, restlessness, decreased respiration and death [18]. The number of death in each group within 24hours was recorded and the LD_{50} calculated as the geometrical mean of the maximum dose producing Zero (0) percent mortality and the minimum dose zero (0) percent mortality and the minimum dose producing hundred (100) percent mortality:

$$LD_{50} = \sqrt{(AxB)}$$

Where A = maximum dose that produce 0% mortality (750 mg/kg).

Journal of Drug Discovery and Research (*JDDR*) December 2022; 1(2): 33-38
Journal of Drug Discovery Research Group, Faculty of Pharmacy, University of Uyo, Nigeria
Available online at https://www.ddrg.net

B = Minimum dose that produce 100% Mortality (1000 mg/kg)

LD_{50} = 750 x1000 = 866.03 mg/kg

Based on the above result, Low dose, median dose and high dose were calculated as follows:
Low dose = 10% of LD50= 10% of 866.03 mg/kg = 86.60 mg/kg
Median dose = 20% of LD50 = 20% of 866.03 mg/kg = 173.21 mg/kg
High dose = 30% of LD50 =30% of 866.03 mg/kg = 259.81 mg/kg.

2.2.4.1 Experimental Procedure
Sixty (60) sexually matured male Wister albino rats weighing between 160-209 g were randomly divided into ten (10) groups. Each group contained six (6) rats.
Group 1 served as negative control and received 10 ml/kg body weight of distilled water.
Group 2 served as positive control and received 1mg/kg body weight of testosterone [19]
Group 3, 4 and 5 received 86.60, 173.21 and 259.81 mg/kg body weight of the methanol crude extract of *Musa paradisiaca* respectively.
Group 6,7,8,9 and 10 received 173.21mg/kg body weight of their respective fraction:
n-Hexane (6), Dichloromethane (7), Ethyl acetate (8)
n-Butanol (9) and Aqueous (10).
All treatment were administered as a single daily dose orally for 14 days.

2.2.5 Ethical Approval
Approval for the use of the animals for the study was obtained from the Animal Ethics of the faculty of pharmacy, University of Uyo Nigeria. All animal experiments were conducted in accordance with internationally accepted Laboratory Animal use and Care 1966 as adopted and promulgated by the National Institute of Health (NIH publication No. 85 (23), revised 1996,based on Helsinki Convention and guidelines.

2.2.6 Determination of Sexual Behaviour
The female rats were brought to estrous cycle by subcutaneous administration of 10mg/10g body weight of 17-β-estradiol 48 hours before the experiment. Later 0.5mg/100g body weight progesterone was also administered subcutaneously to the same rats 4 hours before the experiment. The female rats were screened with sexually experienced male rats [17]. Mating behaviour studies were carried out in a separate room under red illumination according to the standard procedure. Healthy male albino rats showing brisk sexual activity and female rats showing regular oestrous cycle were selected for the study. The male rats were placed in a rectangular plexi-glass chamber; 10 minutes before the introduction of a primed female to allow the male rat acclimatize to the chamber condition. The primed female was then introduced into the chamber with one female to the male ratio and the mating behavior observed. The following mating behavioural parameters were recorded:
Mount Latency (ML) is the time interval between the entrance of the female and the first mount by the male.
Intromission Latency (IL) is the time from the entrance of the female to the first intromission (vaginal penetration) by the male.
Ejaculation Latency (EL) is the time interval between the first intromission and ejaculation. It is characterized by longer, deeper pelvic thrusting and slow dismount followed by the period of inactivity.
Post Ejaculation Interval (PEI) is the time interval between ejaculation and the next intromission.
Mount Frequency (MF) is the number of mounts without intromission from the time of introduction of the female until ejaculation.
Intromission Frequency (IF) is the number of the intromissions from the time of introduction of female until ejaculation
Ejaculation Frequency (EF) is the number of ejaculations in a copulatory series.

2.3 Statistical Analysis
Result was analyzed using statistical package for social sciences (SPSS) version 20.0 and expressed as mean ± SEM. The significance of difference between mean was determined by one way analysis of variance (ANOVA) and the results were regarded as significant at $P<0.05$.

Original Research Article

Journal of Drug Discovery and Research (*JDDR*) December 2022; 1(2): 33-38
Journal of Drug Discovery Research Group, Faculty of Pharmacy, University of Uyo, Nigeria
Available online at https://www.ddrg.net

3. RESULTS

Table 1: Results of Acute Toxicity Test

Dose of Extract (mg/kg)	Mortality rate	% Mortality
5000	3/3	100
2000	3/3	100
1000	3/3	100
900	2/3	66.67
800	1/3	33.33
750	0/3	0
500	0/3	0

Table 2: Result of Phytochemical Screening of the Methanol Crude Extract of Musa Paradisiacal

Test	Inference
Saponin	+
Tannins	+
Flavonoids	+
Alkaloids	+
Terpenes	+
Cardiac glycosides	+

+ = present

Table 3: Effect of Methanol Extract of Musa Paradisiaca

Dose Treatment (mg/kg	Mount Latency	Mount Frequency	Intromission Latency	Intromission Frequency	Ejaculation Latency	Post Ejaculation Interval	Erection Frequency	Penile Erection
Distilled Water Control (10ml/kg)	2.36±0.02	6.50±0.55	2.37±0.02	5.00±1.55	5.33±0.01	12.51±0.04	1.67±0.52	12.48±0.05
Low Dose (86.60 mg/kg)	1.05±0.04^{c}	16.17±1.47^{c}	1.10±0.03^{c}	13.50±1.87^{a}	5.45±0.08^{b}	11.07±0.26^{c}	1.83±0.41^{a}	10.97±0.32^{c}
Middle Dose (173.21 mg /kg)	0.58±0.02^{c}	24.50±1.05^{c}	0.60±0.02^{c}	23.17±0.75^{b}	5.11±0.11^{b}	11.26±0.14^{c}	2.67±0.52^{a}	11.23±0.14^{c}
High Dose (259.81 mg/kg)	0.32±0.04^{c}	28.50±1.05^{c}	0.33±0.05^{c}	27.00±1.26^{c}	6.87±0.02^{c}	9.44±0.20^{c}	4.17±0.75^{c}	9.41±0.22^{c}
Testosterone (mg/kg)	0.13±0.02^{c}	31.17±0.75^{c}	0.14±0.02^{c}	30.33±1.03^{c}	6.55±0.18^{c}	11.51±0.03^{c}	4.50±0.55^{c}	11.49±0.03^{c}

Values are expressed as mean ± SEM significance relative to control: ^{a}P<0.05; ^{b}P<0.01; ^{c}P<0.001; n = 6

Table 4: Effect of Methanol Extract of Musa Paradisiaca

Treatment Dose (mg/kg	Mount Latency	Mount Frequency	Intromission Latency	Intromission Frequency	Ejaculation Latency	Post Ejaculation Interval	Erection Frequency	Penile Erection
Distilled Water Control (10ml/kg)	2.31±0.02	6.45±0.55	2.32±0.02	4.50±1.55	5.28±0.01^{a}	12.46±0.04	1.62±0.52	12.43±0.05
n-Hexane (173.2)	1.34±0.03^{b}	12.67±0.52^{c}	1.35±0.03^{c}	11.17±1.17c	5.53±0.02^{a}	11.30±0.02^{c}	1.67±0.52^{a}	11.26±0.01^{c}
Dichloromethane (173.2)	0.79±0.01^{c}	21.50±0.84^{c}	0.81±0.01^{c}	20.33±1.03c	5.75±1.64^{a}	10.03±0.01^{c}	2.50±0.55^{a}	11.00±0.02^{c}
Ethyl acetate (173.2)	0.33±0.01^{c}	26.33±0.82^{c}	0.35±0.03^{c}	25.00±0.89^{c}	5.81±0.02^{a}	11.41±0.01^{c}	3.17±0.41^{a}	11.40±0.01^{c}
n-Butanol (173.2)	0.25±0.01^{c}	30.17±0.75^{c}	0.27±0.02^{c}	29.17±1.17^{c}	6.23±0.02^{a}	11.61±0.01^{c}	3.67±0.52^{a}	11.59±0.01^{c}
Aqueous (173.2)	1.60±0.02^{b}	19.45±0.75^{c}	1.65±0.02^{c}	18.62±1.03^{a}	5.63±0.02^{a}	11.63±0.02^{c}	2.62±0.52^{a}	11.60±0.02^{c}
testosterone	0.13±0.02^{c}	31.17±0.75	0.14±0.02^{c}	30.33±1.03^{c}	6.55±0.18^{c}	11.51±0.03^{c}	4.50±0.55^{c}	11.49±0.05

Values are expressed as Mean ± SEM significance relative to control: ^{a}P<0.05; ^{b}P<0.01; ^{c}P<0.001; n = 6

4.0 DISCUSSION

Journal of Drug Discovery and Research (*JDDR*) December 2022; 1(2): 33-38
Journal of Drug Discovery Research Group, Faculty of Pharmacy, University of Uyo, Nigeria
Available online at https://www.ddrg.net

The phytochemical screening of the methanol root pulp extract of *Musa Paradisiaca* revealed the presence of Saponin, Tannins, Flavonoids, Alkaloids, Terpenes and Cardiac Glycosides. The median Lethal Dose (LD_{50}) of the extract determined was 866.03mg/kg. The doses administered were classified as follows: Low dose (10% of LD50 i.e. 86.60mg/kg, middle dose (20% of LD50 i.e. 173.20mg/kg, high dose (30% of LD50) i.e. 259.81mg/kg. The parameters measured in the sexual behaviour of the experimental animals include Mount Latency (ML), Intromission Latency (EL), Post Ejaculatory Interval (PEI), Mount Frequency (MF), Intromission Frequency (IF) and Ejaculation Frequency (EF). [5,6]. Any medicinal plant with aphrodisiac potentials should produce significant increase in Mount Frequency (MF) and also a significant decrease in the Mount Latency (ML), which are all indicators of arousability, motivation and vigour. In this study, the observed decrease in ML and IL implies that the extract and its fractions caused sustained increase in sexual activity. The observed increase in EL suggests the methanol crude extract and its fractions caused delay in ejaculation, prolonged coital period and improved sexual activity. PEI is an index of potency, libido and a parameter used to measure the rate of recovery from exhaustion in early mating series. The decreased PEI observed in the treated group signifies less exhaustion, increased potency and enhanced libido [5].

5.0 CONCLUSION

This study was done to find out if the methanol root pulp crude extract and fractions of *Musa paradisiaca* possess aphrodisiac activity as claimed by the people of Akwa Ibom State, Nigeria. The result revealed that the crude extract and its fractions increased sexual performance in albino Wister rats. These aphrodisiac properties may be attributed to the phytochemical constituents of the plant material.

Acknowledgements: We acknowledge the Laboratory Technologists, Mrs. Ekaete Dennis Umoh (Department of Pharmaceutical and Medicinal Chemistry) and Mr Nsikan Malachy (Department of Pharmacology and Toxicology) for their technical assistance;

Conflict of interest: There is no conflict of interest in this work among the authors.

Authors' Contribution: Anwanabasi E. Udoh did the Pharmacology work. Aniefiok S. Udobre did the Acute Toxicity study and the Statistical Anlysis. Goodnews E. Charles did the Phytochemical screening.

6.0 REFERENCES

[1] Meena, KA (2009). Plant Herbal wealth as a Potential Source of Ayuverdic Drugs. *Asian Journal of Traditional medicine* 4(4) 152-170.

[2] Singh BG and Kumar D (2010). Pharmacological Potential of Plants used as Aphrodisiac. International Journal of Pharmaceutical Science Review and Research 5 (1) 104-113

[3] Alok S. and Moiphy L. (2013). Natures aphrodisiac: A review of current scientific literature. *International Journal of Recent Advances in Pharmaceutical Research* (5) 1-20, Pubmed).

[4] Singh and Kumar, W. R. (2012). Traditional and medical uses of plantain *Journal of Pharm. Phyto Chemistry* (1) 51 – 63.

[5] Yakubu MT,Akanji M and Oladiji AT (2007). Male Sexual dysfunction and Methods used in assessing Medicinal plants with Aphrodisiac potentials. Pharmacognosy Reviews 1 (1) 49-56

[6] Salonia A, Castagna G, Sacca A, Ferrari M, Capitanio U, Castiglone F Rochini L, Briganti A, Rigatti p, Montos F (2012). Is Erectile Dysfunfion a reliable proxy of general male health status . The Case for the International Index of Erectile dysfunction. Erection dysfunction domai. Journal of Sex Medicine 9 (10)1 2708-2715

[7] Chen L, Staubli SE, Shneider MP, Kessel AG, Ivic S, Bachmann LM, Kessler TM (2015). Phosphodiestersase-5-Inhibitors for the treatment of Erectile dysfunction a Trade-off Network Meta Analysis .European Urology 68 (4): 674-680

[8] Chowdhary SH. and Johnson K. (2007). Comparison of TCM and western medicine, diagnose and treatment strategies for Erectile dysfunction. *Chinese Canadian Journal of Human Sexuality* (26)23 – 26.

Journal of Drug Discovery and Research (*JDDR*) December 2022; 1(2): 33-38
Journal of Drug Discovery Research Group, Faculty of Pharmacy, University of Uyo, Nigeria
Available online at https://www.ddrg.net

[9] Montage DK. (2005). The Management of Erective Dysfunction. *Journal of Urology* 174(1) 230-239.

[10] Maio G. and Scally AV (2010). Physical Activities and PDE-5 Inhibition in the Treatment of Erectile Dysfunction. *Journal of Urology* (5) 17-27.

[11] Hamit HA, Zuberyir H, Sekan Y, Yildiray B, Levent E, Mehmet RS (2017). The Effect of PDE-5-Inhibitors on Bone and Oxidative damage in ovariectomy-induced Osteoporosis. Experimental Biology and Medicine 424 (10):1051-1061

[12] Scrinivas C. (2005). Some observations on hypoglycemic Activity of Musa paradisiaca. India Med. Res. 48(4) 471-475.

[13] Nimala M. and Macdougall DC. (2012). Bioactive compounds in Musa paradisiaca. Health benefits and prospect for developing functional foods. *International Journal of Food science and Technology* 49(6) 1-7.

[14] Guptha and Swath (2011). Traditional and Medicinal uses of plantain. *Journal of Pharmaceutical phyto Chemistry* (1) 51 – 63 (pubmed).

[15] Haque V. (2011). A Peer Review of General Literature on musa paradisiaca. Commercial Medicinal Plant. International Drug Development Res. 3 (1) 140 – 155.

[16] Trease GE and Evans WC (2009). Pharmacognosy(16th Edition). English Language. Book Society, Bailliere, Tindall, Britain Pp 386-480

[17] Yakubu MT, Akanji M, and Olajidi AT (2007). Male Sexual dysfunction and Methods used in assessing medicinal plants with Aphrodisiac potentials . Pharmacognosy Reviews 1 (1) 49-56

[18] Lorke DA. (1983). New Approach to practical Acute Toxicity Testing Arch. Toxic DI(54) 275-287 Crov ref (Pubmed)

[19] Cunningham, G. R. (2018). Conclusions about testosterone therapy and Cardiovascular risk. *Asian Journal of Andrology* 20 (2): 152 – 153.