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Male Sexual Dysfunction and Methods used in Assessing Medicinal Plants with Aphrodisiac Potentials

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ABSTRACT

Sexual dysfunction, that is the repeated inability to achieve normal sexual intercourse, which include various forms like premature ejaculation, retrograded, retarded or inhibited ejaculation, erectile dysfunction, arousal difficulties (reduced libido), compulsive sexual behaviour, orgasmic disorder and failure of detumescence, are on the increase world wide because of aging population and other increasing etiological factors. Several management options employed are associated with some serious side effects not readily available and are expensive. The search for natural supplement from medicinal plants is being intensified probably, because of its reduced side effect, its ready availability and reduced cost. Therefore, the increasing search for medicinal plants with aphrodisiac potentials has necessitated the need to review methods available for screening medicinal plants with aphrodisiac potentials in males.

KEYWORDS: Aphrodisiac, Medicinal plants, Sexual dysfunction

INTRODUCTION

One of the main aims of marriage is the procreation (reproduction) and more importantly for sexual fulfilment of both partners. For life to continue, an organism must reproduce itself before it dies. In *Homo sapiens*, reproduction is initiated by the mating of a male with a female in sexual intercourse which facilitates the coming together of sperm and egg for the purpose of fertilization (1). For there to be a normal sexual intercourse and sexual fulfilment in males, the male sexual organs (the copulatory organ, the penis) and factors relating to erection must function normally. Inability to perform this function effectively is a major problem facing the reproductive process. This is known as sexual dysfunction (2). This condition which is of various types can be managed by the use of aphrodisiacs. An aphrodisiac can therefore be described as any substance that enhances sex drive and/ or sexual pleasure. Aphrodisiac can also be viewed as any food, drug, scent or device that can arouse or increase sexual drive or libido (3). Several plants like *Terminalia catappa* seeds (almond fruit), *Syzygium aromaticum* flower bud (Clove), *Fadogia agrestis* stem (Black aphrodisiac) have been found to have aphrodisiac activities in male rats (4, 5, 6). The increasing incidence of male sexual dysfunction is necessitating more and rapid search into plants with aphrodisiac potentials. This review is intended to provide adequate information on the various methods that can be used to screen medicinal plants with sex enhancing potentials since attention is now being focussed on the use of medicinal plants in the management of this high rising incidence of sexual dysfunction.

Male sexual function

Sexuality is a complex, multi-dimensional phenomenon that incorporates biological, psychological, interpersonal and behavioural dimensions. Sexual behaviour in male rats consists of three distinct phases:

- **Mount:** the animal assumes the copulatory position, but does not insert its copulatory organ (the penis) into the vagina
- **Intromission:** the copulatory organ enters the vagina during a mount
- **Ejaculation:** forceful expulsion of semen

Sexual stimulation of the human male results in a series of psychological, neuronal, vascular, and local genital changes. At least three different classifications for these changes have been described. Some authors (7) described a psychosexual response cycle that consists of four phases: excitement, plateau, orgasm, and resolution. Another classification by (8) based on penodynamic changes during the sexual cycle divides each of the psychosexual phases into two interrelated events as excitement into latency and tumescence; plateau into erection and rigidity; orgasm into emission and ejaculation; and resolution into detumescence and refractoriness. The third classification by (9) focuses on the functional activities during the sexual cycle by adding an initial phase of desire or libido. Thus, the normal male sexual response cycle can be functionally divided into five interrelated events that occur in a defined sequence: libido, erection, ejaculation, orgasm, and detumescence.

1. Libido or sexual desire- Libido is defined as the biological need for sexual activity (the sex drive) and frequently is expressed as sex-seeking behaviour. Its intensity is variable

between individuals as well as within an individual over a given time. Higher serum testosterone appears to be associated with greater sexual activity in healthy older but not younger men (10).

2. Erection- Erection is the enlarged and rigid state of the sexually aroused penis sufficient enough for vaginal penetration. It results from multiple psychogenic and sensory stimuli arising from imaginative, visual, auditory, olfactory, gustatory, tactile, and genital reflexogenic sources.

3. Ejaculation- Ejaculation is the act of ejecting semen. It is a reflex action that occurs as a result of sexual stimulation. It is made up of two sequential processes. The first process called emission is associated with deposition of seminal fluid into the posterior urethra while the second process is the true ejaculation, which is the expulsion of the seminal fluid from the posterior urethra through the penile meatus.

4. Orgasm- This is the climax of sexual excitement. The entire period of emission and ejaculation is known as the male orgasm (11).

5. Detumescence- This is the subsidence of an erect penis after ejaculation (12).

Male sexual dysfunction

Sex disorders of the male are classified into disorders of sexual function, sexual orientation, and sexual behaviour. In general, several factors must work in harmony to maintain normal sexual function. Such factors include neural activity, vascular events, intracavernosal nitric oxide system and androgens (2). Thus, malfunctioning of at least one of these could lead to sexual dysfunction of any kind.

Sexual dysfunction in men refers to repeated inability to achieve normal sexual intercourse. It can also be viewed as disorders that interfere with a full sexual response cycle. These disorders make it difficult for a person to enjoy or to have sexual intercourse. While sexual dysfunction rarely threatens physical health, it can take a heavy psychological toll, bringing on depression, anxiety, and debilitating feelings of inadequacy. Unfortunately, it is a problem often neglected by the health care team who strive more with the technical and more medically manageable aspects of the patient's illness (13).

Sexual dysfunction is more prevalent in males than in females and thus, it is conventional to focus more on male sexual difficulties (2). It has been discovered that men between 17 and 96 years old could suffer sexual dysfunction as a result of psychological or physical health problems (14). Generally, a prevalence of about 10% occurs across all ages. Because sexual dysfunction is an inevitable process of aging, the prevalence is over 50% in men between 50 and 70 years of age (15). As men age, the absolute number of Leydig cells decreases by about 40%, and the vigour of pulsatile luteinizing hormone release is dampened. In association with these events, free testosterone level also declines by approximately 1.2% per year. These have contributed in no small measure to prevalence of sexual dysfunction in the aged (2).

Male sexual dysfunction (MSD) could be caused by various factors. These include: psychological disorders (performance anxiety, strained relationship, depression, stress, guilt and

fear of sexual failure), androgen deficiencies (testosterone deficiency, hyperprolactinemia), chronic medical conditions (diabetes, hypertension, vascular insufficiency (atherosclerosis, venous leakage), penile disease (Peyronie's, priapism, phimos, smooth muscle dysfunction), pelvic surgery (to correct arterial or inflow disorder), neurological disorders (Parkinson's disease, stroke, cerebral trauma, Alzheimer's spinal cord or nerve injury), drugs (side effects) (anti-hypertensives, central agents, psychiatric medications, antiulcer, antidepressants, and anti-androgens), life style (chronic alcohol abuse, cigarette smoking), aging (decrease in hormonal level with age) and systemic diseases (cardiac, hepatic, renal pulmonary, cancer, metabolic, post-organ transplant) (2, 16, 17).

Sexual dysfunction takes different forms in men. A dysfunction can be life-long and always present, acquired, situational, or generalized, occurring despite the situation. A man may have a sexual problem if he:

- Ejaculates before he or his partner desires
- Does not ejaculate, or experiences delayed ejaculation
- Is unable to have an erection sufficient for pleasurable intercourse
- Feels pains during intercourse
- Lacks or loses sexual desire.

Male sexual dysfunction can be categorized as disorders of desire, disorders of orgasm, erectile dysfunction, disorders of ejaculation and failure of detumescence.

A. Disorders of desire: Disorders of desire can involve either a deficient or compulsive desire for sexual activity. Dysfunctions that can occur during the desire phase include:

(i) Hypoactive sexual desire (HSD), defined as persistently or recurrently deficient (or absent) sexual fantasy and desire for sexual activity leading to marked distress or interpersonal difficulty. It results in a complete or almost complete lack of desire to have any type of sexual relation (18).

(ii) Compulsive sexual behaviours (CSBs) constitute a wide range of complex sexual behaviours that have strikingly repetitive, compelling, or driven qualities. They usually manifest as obsessive-compulsive sexuality (e.g. excessive masturbation and promiscuity), excessive sex-seeking in association with affective disorders (e.g. major depression or mood disorders), addictive sexuality (e.g. attachment to another person, object, or sensation for sexual gratification to the exclusion of everything else), and sexual impulsivity (failure to resist an impulse or temptation for sexual behaviour that is harmful to self or others such as exhibitionism, rape, or child molestation) (19).

B. Erectile dysfunction (ED): This is a problem with sexual arousal. ED can be defined as the difficulty in achieving or maintaining an erection sufficient for sexual activity or penetration, at least 50% of the time, for a period of six months (20). It results in significant psychological, social and physical morbidity (21), and annihilates his essence of masculinity (22).

C. Disorders of ejaculation: There exists a spectrum of disorders of ejaculation ranging from mild premature to severely retarded or absent ejaculation. These include:

(i) Premature ejaculation which is the most common male sexual dysfunction (23) and can be any of the following: a) persistent or recurrent ejaculation with minimum sexual stimulation that occurs before, upon, or shortly after penetration and before the person wishes it; b) marked distress or interpersonal difficulty; and c) the condition does not arise as a direct effect of substance abuse. Premature ejaculation and sexual desire disorders were the frequent reported problems in young adult males with adverse familial relationship (24).

(ii) Painful ejaculation which results from side effect of tricyclic antidepressants (25) is a persistent and recurrent pain in the genital organs during ejaculation or immediately afterwards.

(iii) Inhibited or retarded ejaculation: This is when ejaculation does not occur at all.

(iv) Retrograde ejaculation: This is when ejaculation is forced back into the bladder rather than through the urethra and out of the end of the penis at orgasm.

D. Disorders of orgasm: Male orgasmic disorder is defined as a persistent or recurrent delay in, or absence of orgasm after a normal sexual excitement phase during sexual activity (18).

E. Failure of detumescence: is a prolonged erection usually lasting for between 4 h or greater. It is painful and always unaccompanied by sexual desire despite the fact that it is often preceded by usual sexual stimuli. Diagnostic options for male sexual dysfunction include: patient's history which embodies medical history (evaluating historical events like chronic disease, pharmacological agents, endocrine disorders, surgeries and trauma), psychological history (assessing individual's upbringing relationships, early sexual experiences, inadequate sexual information and general psychological health), sexual history (to ascertain the time and manner of onset, its course, current status, and associated medical or psychological problems), physical examination (entails general and systemic evaluation, assessment of gonadal function, vascular competence, neurological integrity, and genital organ normalcy), diagnosis testing (include blood tests, vascular assessment, sensory testing and nocturnal penile tumescence and rigidity testing) (2, 17).

Management options of MSD include:

psychological/behavioural (therapy with a trained counsellor aimed at helping people to address feelings of anxiety, fear and guilt that may have an impact on sexual function); drug therapy (use of testosterone replacement therapy for cases of androgen insufficiency and other pharmacological agents); non surgical devices which include vacuum pump (expands the penis and reduces pressure within the cavernous sinusoidal space) and constrictive rings (external device used for managing erectile dysfunction in patients with mild to moderate venous leakage); surgical treatment which include venous ligation (used to correct leakage of blood from the veins); penile prosthesis (creates adequate space within the tissue of each cavernosal body); penile implants (involves inserting a malleable or rigid substance into the penis to effect a semi-rigid state) and phytotherapy (involves the use of herbs (medicinal plants)) (26, 27, 28).

Aphrodisiac

Aphrodisiac was named after *Aphrodite*, the Greek goddess of sexual love, beauty and fruitfulness identified in Roman Mythology with the goddess Venus, who was the daughter of Zeus and Dione (29). However, the Greek word 'aphros' means 'foam' and according to the tradition recounted by Hesoid, Aphrodite arose from the foam generated when the severed genitals of Uranus personification of Heavens were thrown into the sea. Several ancient authorities agreed that she was the wife of the lame blacksmith, Hephaestus (30).

An aphrodisiac can therefore be described as any substance that enhances sex drive and or sexual pleasure. Aphrodisiac can also be viewed as any food, drug, scent or device that can arouse or increase sexual drive or libido (3). Most aphrodisiacs also heighten other aspects of sensory experience such as light, touch, smell, taste and hearing; and this enhanced sensory awareness contributes to sexual arousal and pleasure (30).

Through history, a wide range of characteristics has qualified different substances as aphrodisiac (31). However, two possible approaches include the cultural and scientific. Several primary non-scientific themes have arisen that have echoed through multiple cultures and times. First, the genitals have often been deemed to be aphrodisiacs. Another popular belief by hunters of those eras was consumption of specific parts of their prey in order to gain characteristics of those organs (3).

The Kama Sutra suggested that one boils the testicle of a ram or goat and add milk and sugar before consumption (31). In England, it was believed that plants with any phallic-like features such as asparagus, parsnips and carrots were likely to be aphrodisiac in their effect (32). Ukrainians celebrate carrots and celery as folk aphrodisiac. In Chinese culture, much of the aphrodisiac power of ginseng and rhinoceros horn comes from their appearance rather than their chemical composition (32).

Based on their mechanism of actions, aphrodisiacs can be divided into three categories which include:

a. Aphrodisiacs that simply provide a burst of nutritional value, thereby improving the immediate health or well being of the consumer and consequently improving sexual performance and libido. This simple improvement in general health can lead to a burst of energy and translate into an increased sexual appetite (33). For example, in Chinese tradition, the use of rhinoceros horn as an aphrodisiac may lie in the fact that rhino horn consists of fibrous tissue with large proportions of elements like calcium and phosphorus; beyond the fact that rhino horn resembles an erect penis. Deficiency in these elements could lead to muscle weakness and general fatigue while large doses of these elements could lead to general increased vigour and stamina (31).

b. The second group are those with specific physiological effect. They may affect blood flow; mimic the burning of fire of sex and intercourse and increase the duration of sexual activity. An example is Spanish fly made of dried and crushed beetles of the *cantharis* and *mylabris* genus. The active ingredient in Spanish fly, a crystallized lactone, cantharidin (30), when applied topically, causes burning sensation at the

point of blistering (29). Its consumption has also been reported to cause increased blood flow in the body (29). Other physiologically active drugs used to sustain erection help to limit the influence of sympathetic nervous system. e.g. Sildenafil citrate (viagra) and yohimbine from *Pausinystalia yohimbe* (30).

c. The third group of biologically active aphrodisiacs are those that are psychologically active in nature. They actually cross the blood brain barrier and mimic or stimulate some areas of sexual arousal. Examples include hormones, pheromones and a wide variety of neurotransmitters (34).

Medicinal plants

A medicinal plant can be described as any plant in which one or more of its organs contain substances that can be used therapeutic purposes or which are precursors for the synthesis of useful drugs (35). Examples include food, spices, perfumery plants, microscopic plants like fungi, actinomycetes used for isolating drugs especially antibiotics, fibre plants like cotton, flax, and jute used for preparing surgical dressings.

Medicinal plants are very ancient and only true natural medicines that have been found useful in several ways. They can be used directly or in other extracted forms for the management of various ailments because of the presence of many phytochemicals. They can also be used as agents or starting materials in the synthesis of drugs.

The use of herbs is very common in developing countries, particularly in rural settings. However, during the last

decade, an increase in the use of plants has been observed in metropolitan areas of developed countries (36). Plants are extensively used to relieve sexual dysfunction. Ginseng, for example, is an essential constituent in traditional Chinese medicine (37) and at least 6 million Americans use the root of this slow-growing perennial (38). Another root, known as Maca (*Lepidium meyenii*), has traditionally been used by Peruvian inhabitants living at high altitudes as a nutrient, an energizer, as aphrodisiac and/or fertility-enhancing agent. It has been proved to be effective in improving sexual desire in men (39), and sexual behaviour in male rats and mice (40, 41, 42). Similarly, other authors (6) have lend scientific credence to the use of *Fadogia agrestis* (English: black aphrodisiac, Hausa: Baakin gagai) stem as an aphrodisiac by increasing the concentration of serum testosterone made possible by its saponin content. Traditional herbs have also been a revolutionary breakthrough in the management of sexual inadequacies (sexual dysfunction) and have become known world wide as an “instant” treatment (43). Some of these herbs include *Terminalia catappa* seeds (Almond fruit), root of *Garcinia kola* Heckel (Yoruba: orogbo), stem bark and twig of *Carpolobia albe* (Yoruba: osunsun, osun), whole plant of *Euphorbia hirta* L (Yoruba: egele) and leaves, roots and fruits of *Musa paradisiaca* L (plantain) (4, 44, 45, 46). Other indigenous medicinal plants, which have been claimed to improve potency, are depicted in Table 1.

Table 1: Some plants used in the management of sexual dysfunction in Nigeria

Sl.No	Botanical Names	English Name	Local Names	Parts used	Geographical Use
1.	<i>Garcinia kola</i> Heckel	Bitter Kola	Orogbo, Adi, Edun	Stem bark, Root	West and East
2.	<i>Musa paradisiaca</i> L.	Plantain	Ogede, Ayaba, Ogadejioke	Leaves, Roots, Fruits	All parts of Nigeria
3.	<i>Terminalia catappa</i> L.	India almond, Umbrella tree	--	Stem bark, Kernel (Seeds)	West and East
4.	<i>Euphorbia hirta</i> L.	Asthma weed, Cat's hair	Egele, Nonan kurchiya, Odane inenmili	Whole plant	All parts of Nigeria
5.	<i>Carpolobia alba</i> G. Don	--	Osunsun, Osun	Stem bark, Twig	Western Nigeria
6.	<i>Pausinystalia johimbe</i>	--	Idiagbon	Bark	Western Nigeria
7.	<i>Tribulus terrestris</i>	Devil's thorn, Small calthrops	Dagunro, Tsidau	Whole plant	Northern Nigeria
8.	<i>Massularia acuminata</i>	--	Pako ijebu, Orin ijebu	Stem bark, Root	Southern Nigeria
9.	<i>Maytenus senegalensis</i>	--	Na mijin tsada, Tultulde, Momfofoji, Shepolohun	Leaves, Stem, Root	Northern and Western Nigeria
10.	<i>Rauwolfia vomitoria</i>	Rauwolfia, Serpent wood	Asofeyeje, Ira, Ira-igbo, Wadda, Akata	Root bark, Leaves	All parts of Nigeria

Sources: (46, 47)

Methods used in Assessing Medicinal Plants with Aphrodisiac Properties

A. Physical Methods

1. Mating Behaviour Test

The mating behaviour tests could be carried out by the methods of (48) and (49), modified by (50). Briefly, healthy and sexually experienced male albino rats that show brisk sexual activity should be selected for the study. After extract administration at various concentration to various groups of the animals depending on the experimental design and objective(s) of the study, the male animals should be brought to the laboratory and exposed to dim light (in 1 w fluorescent tube in a laboratory of 14' × 14') at the stipulated time of testing daily for some days (3-6 days) before the experiment. The female animals should be artificially brought into oestrus (heat) as the female rats allow mating only during the oestrus phase by administering either suspension of ethinyl oestradiol orally at the dose of 100 µg/animal 48 h prior to the pairing and subcutaneous administration of progesterone at the dose of 1 mg/animal 6 h before the experiment or alternatively by the sequential administration of estradiol benzoate (10µg/100g body weight) and progesterone (0.5mg/100g body weight) through subcutaneous injections, 48 h and 4 h respectively prior to pairing (50, 51). The receptivity of the female animals should be confirmed before the test by exposing them to male animals, other than the control and test animals. The most receptive females should then be selected for the study. The experiment could be carried out on some days depending on ethnobotanical information on the posology of the plant being investigated after the commencement of the treatment of the male animals. The experiment should be conducted at 20:00 h in the same laboratory and under light of same intensity. The receptive female animals should be introduced into the cages of male animals in the ratio 1 female to 1 male. The observation for mating behaviour should commence immediately and continued for first 2 mating series. The test should be terminated if the male failed to evince sexual interest. Any female animal that do not show receptivity should be replaced by another artificially 'warmed' female. The occurrence of events and phases of mating may be called out to be recorded on audio-cassette as soon as they appeared. Their disappearance should also be called out and recorded. Later, the frequencies and phases should be determined from cassette transcriptions. The parameters of male sexual behaviour that should be monitored should include:

i. Mount frequency

Mounting is defined as the climbing of one animal by another usually from the posterior end with the intention of introducing one organ into another. Mount may also be operationally defined as the male assuming the copulatory position but failing to achieve intromission. Mount Frequency (MF) is therefore defined as the number of mounts without intromission from the time of introduction of the female until ejaculation (52).

ii. Intromission frequency

Intromission is the introduction of one organ or parts into another. e.g. the penis into the vagina. Intromission

Frequency (IF) is therefore defined as the number of intromissions from the time of introduction of the female until ejaculation.

iii. Mount latency

Mount Latency (ML) is defined as the time interval between the introduction of the female and the first mount by the male (52).

iv. Intromission latency

Intromission Latency (IL) is the time interval from the time of introduction of the female to the first intromission by the male. This is usually characterized by pelvic thrusting, and springing dismounts (52).

v. Ejaculatory latency

Ejaculation is the act of ejecting semen brought about by a reflex action that occurs as the result of sexual stimulation. Ejaculatory Latency (EL) is defined as the time interval between the first intromission and ejaculation. This is usually characterized by longer, deeper pelvic thrusting and slow dismount followed by a period of inactivity or reduced activity (52).

vi. Post-ejaculatory interval

Post-ejaculatory interval (PEI) is the time interval between ejaculation and the first intromission of the following series

vii. Index of libido

Index of Libido is defined as the ratio of number mated to number paired expressed in percentage. This can be expressed mathematically as:

$$\% \text{ Index of Libido} = \frac{\text{Number mated} \times 100}{\text{Number paired}} \quad (4)$$

viii. Computed Male Sexual Behaviour Parameters

Using the above parameters of sexual behaviour, the following can thus be computed:

$$(a) \% \text{ Mounted} = \frac{\text{Number Mounted} \times 100}{\text{Number Paired}}$$

$$(b) \% \text{ Intromitted} = \frac{\text{Number of Intromissions} \times 100}{\text{Number Paired}}$$

$$(c) \text{ Intromission ratio} = \frac{\text{Number of Intromission}}{\text{Number of mounts} + \text{Number of intromissions}}$$

$$(d) \% \text{ Ejaculated} = \frac{\text{Number of Ejaculations} \times 100}{\text{Number Paired}}$$

$$(e) \text{ Copulatory Efficiency} = \frac{\text{Number of Intromissions} \times 100}{\text{Number of Mounts}}$$

$$(f) \text{ Intercopulatory Efficiency} = \text{Average time between intromissions} \quad (51).$$

*Any medicinal plant with aphrodisiac tendencies should produce statistically significant increase in the indices of sexual vigour and intromission frequencies, significant decrease in mount and intromission latencies. These indices are indicators of stimulation of sexual arousability, motivation and vigour (4, 6). The significant decrease in mount and intromission latencies as well as significant increase in computed male sexual behaviour parameters of %mounted, %intromitted, %ejaculated and the reduction in intercopulatory efficiency are indications of sustained increase in sexual activity and aphrodisiac property inherent in the plant extract (51).

2. Test for libido

This test could be carried out by the method of (53), modified by (50). Sexually experienced male albino rats should be kept singly in separate cages during the experiment. The female rats should be made receptive by hormonal treatment and all the animals should be accustomed to the testing condition as previously presented in mating behaviour test. The animals should be observed for the Mounting Frequency (MF) on the evening of specific day according to the design of the experiment (likely 7th day) at 20:00 h. The penis should be exposed by retracting the sheath and apply 5% xylocaine ointment 30, 15 and 5 min before starting observations. Each animal should be placed individually in a cage with the receptive female rat in the same cage. The number of mountings should be noted. The animals should also be observed for intromission and ejaculation.

3. Test for potency

The potency of the plant extract at various doses depending on the design may be studied according to the methods described by (54) and (55), modified by (50). The male animals should be kept singly in separate cages during the experiment. The extracts are to be administered at least, 30min-1 h before the commencement of the experiment. On the 8th day, the test for penile reflexes should be carried out by placing the animal on its back in a glass cylinder with partial restraint. The preputial sheath should be pushed behind the glans by means of the thumb and index finger and held in this manner for a period of 15 min. Such stimulation should normally elicit a cluster of genital reflexes. The frequency of the following components of penile reflexes can therefore be recorded:

i. Erections (E) ii. Quick Flips (QF) iii. Long Flips (LF).

From the above listed components of penile erection, the Total Penile Reflexes (TPR) which is the sum total of each of the components of penile erection i.e. E + QF + LF is obtained.

Statistically significant increase in the frequency of penile reflexes suggests a medicinal plant with aphrodisiac potential.

4. Penile microcirculation study

A Laser Doppler Flow Meter may be used to determine penile microcirculation, using the method described by (56). Briefly, the animals should be anesthetized by intravenous administration of 30mg/kg body weight pentobarbital sodium. The central ear artery should be cannulated for continuous monitoring of arterial blood pressure. At the beginning of the test, the penile sheath should be retracted manually, and after 10 min of adaptation to room temperature in the laboratory, the Laser Doppler flow detection probe should be positioned in a holder close (2-3 mm) to the dorsal side of the penis. The result of the test will be based on the average of arbitrary flow units (flux) within 10 min of the test. The probe should be calibrated with flux standard before each test.

5. Intracavernous Pressure (ICP) Study

Twelve hours after giving the last dose of the plant extract, the male animals should be anesthetized by intraperitoneal administration of 50mg/kg body weight of sodium pentobarbital. This should be followed by the incision of the

penile skin and degloving of the prepuce to expose the corpora cavernosa. A 26 gauge needle connected to a polyethylene tube (PE-50) filled with NSS with 100 IU/mL of heparin on one side of the *Corpora cavernosa* is inserted for ICP measurement. Another 22 gauge needle is placed into the right carotid artery connected to a PE-tube for the measurement of Mean Arterial Pressure (MAP). Both tubes should be connected to blood pressure transducers which should also be connected to a data acquisition board via transducer amplifiers. Computers can be used to see real-time display and recording of pressure measurements (mmHg).

Similarly, the major pelvic ganglion, pelvic and cavernous nerves can be exposed by a midline abdominal incision. The cavernous nerve can then be stimulated by using a square pulse stimulator connected to a platinum bipolar electrode positioned on the cavernous nerve using five volts with a frequency of 50 Hertz and duration of 5 min as stimulus parameters. The stimulation may be done three times and the ICP can then be recorded. The ICP should be allowed to return to baseline before the next stimulation.

Statistically significant increase in ICP may imply their role on nitric oxide (NO) and erectile function. Medicinal plants with aphrodisiac potential should be capable of stimulating cavernous nerve which normally should lead to increase in NO and cyclic Guanosine Phosphate (cGMP) signalling in corpus cavernosal smooth muscle relaxation. The subsequent arteriolar dilation leading to increased arterial inflow and impaired venous return (due to engorgement of the cavernosum) builds up a pressure system within the corpora that result in penile tumescence and rigidity (57).

B. Biochemical Methods

1. Determination of Testicular and Serum Cholesterol

Cholesterol is the precursor in the synthesis of many physiologically important steroids such as bile acids, steroid hormones and vitamin D and its requirement for normal testicular activity has been well established (51, 58, 59).

Testicular and serum cholesterol concentrations may be determined by the Chod-PAP method as described by (60). Briefly, 0.02cm³ of the sample (testicular homogenate and or serum) is mixed with 2.00cm³ of working reagent and the absorbance of the resulting mixture read after 5min at 546nm wavelength. The blank and standard are composed in a similar way except that they are replaced with 0.02cm³ each of distilled water and standard solution respectively.

A medicinal plant with potential for aphrodisiac should result in statistically significant increase in testicular and or serum cholesterol concentration. Such increase may imply stimulation in the steroid genesis, which may lead to increased testosterone concentration (51). Such increase in testosterone concentration should normally reflect a corresponding increase in libido (6).

2. Hormonal Determination

The positive effects on the indices of male sexual behaviour must have been brought about by the constituents of the medicinal plant on some reproductive hormones. These include testosterone, luteinizing hormone, follicle stimulating hormone and prolactin. Therefore, there is the need to

evaluate the effect of administration of the extract of the plant associated with aphrodisiac potentials on the serum concentrations of these hormones.

Testosterone supplementation has previously been shown to improve sexual function and libido (61), in addition to the intensity of orgasm and ejaculation which is likely to improve (62). Testosterone in the blood exists in three different forms namely: free, albumin-bound and sex-hormone binding globulin (SHBG). While it is generally considered that SHBG-bound testosterone is not available for uptake by tissues, opinion is mixed as to whether the biologically active testosterone is restricted to the small quantity of the hormone that is free (~2%) or includes the larger amount of albumin-bound hormone (20-80%). However, investigations suggest that both free and albumin-bound testosterone is biologically available (63). Generally, elevated testosterone level also enhances the sexual behaviour in humans. Therefore, an increase in testicular and serum free testosterone concentration will confirm aphrodisiac potential inherent in the plant extract.

Luteinizing hormones (LH) and Follicle Stimulating Hormone (FSH) produced by anterior pituitary lobe are necessary for maintaining testosterone levels such that as LH and FSH increases so do the testosterone. Therefore, a medicinal plant acclaimed to have aphrodisiac potential apart from being able to increase the concentration of bioavailable/free testosterone should cause increase in the concentrations of serum LH and FSH. An increase in the concentrations of LH and FSH should normally increase the testosterone concentration.

Normally, prolactin is made by specialized pituitary cells called lactotrophs. Prolactin increases the production of breast milk and suppresses secretion of LH and FSH. The role of prolactin in men is not known. However, high levels of prolactin in men may cause hypogonadism: low blood testosterone levels, and decrease in sex drive (libido) and sexual function. Therefore, any plant associated with aphrodisiac tendency should produce statistically significant reduction in the concentrations of prolactin in males which should enhance the levels of LH and FSH and by extension the testosterone concentration.

3. Assay for Neuronal Nitric Oxide Synthase and Androgen Receptor Protein

Nitric Oxide Synthase (NOS), a calcium/calmodulin dependent enzyme is responsible for the biosynthesis of nitric oxide (NO) from L-arginine. Since nitric oxide is responsible for the relaxation of smooth muscles of the cavernosum which eventually lead to in-flow of blood into the male organ, determination of the activity of NOS in the male copulatory organ and the testes is very imperative as this will lend credence to results that will be obtained from the ICP study. The activity of NOS can be estimated by the use of Western Blot as described by (64). Similarly, analysis of Androgen Receptor (AR) protein will further give an idea of the receptors available for the binding of the androgens notably the free or bioavailable testosterone.

CONCLUSION

Sexual function is an important component of quality of life and subjective well being in humans. Sexual problems are widespread and adversely affect mood, well being, and interpersonal functioning. Sexual problems are related to sexual desire and male erectile dysfunction. Successful treatment of sexual dysfunction may improve not only sexual relationships, but also the overall quality of life. Thus, this review has dealt with various approaches by which the screening of medicinal plants can be achieved. This is very important because of the side effect associated with other treatment options and the readily availability of medicinal plants and now that the world is fast turning into the use of medicinal plants for managing sexual dysfunctions.

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