Blackwell Publishing

Asian J Androl 2005; 7 (4): 399–404
DOI: 10.1111/j.1745-7262.2005.00052.x

AJA

·*Complementary Medicine*·

Aphrodisiac potentials of the aqueous extract of *Fadogia agrestis* (Schweinf. Ex Hiern) stem in male albino rats

M. T. Yakubu, M. A. Akanji, A. T. Oladiji

Medicinal Plants Research Laboratory, Department of Biochemistry, University of Ilorin, PMB 1515, Ilorin, Nigeria

Abstract

Aim: To evaluate the phytochemical constituents and the aphrodisiac potential of the aqueous extract of *Fadogia agrestis* (Rubiaceae) stem in male albino rats. **Methods:** The aqueous stem extract of the plant was screened for phytochemical constituents. Male rats were orally dosed with 18 mg/kg, 50 mg/kg and 100 mg/kg body weight, respectively, of the extract at 24 h intervals and their sexual behavior parameters and serum testosterone concentration were evaluated at days 1, 3 and 5. **Results:** Phytochemical screening revealed the presence of alkaloids and saponins while anthraquinones and flavonoids are weakly present. All the doses resulted in significant increase in mount frequency, intromission frequency and significantly prolonged the ejaculatory latency ($P < 0.05$) and reduced mount and intromission latency ($P < 0.05$). There was also a significant increase in serum testosterone concentrations in all the groups in a manner suggestive of dose-dependence ($P < 0.05$). **Conclusion:** The aqueous extract of *Fadogia agrestis* stem increased the blood testosterone concentrations and this may be the mechanism responsible for its aphrodisiac effects and various masculine behaviors. It may be used to modify impaired sexual functions in animals, especially those arising from hypotestosteronemia. *(Asian J Androl 2005 Dec; 7: 399–404)*

Keywords: *Fadogia agrestis*; aphrodisiacs; sexual behavior; testosterone; erectile dysfunction

1 Introduction

Male impotence or erectile dysfunction (ED) is a significant problem that may contribute to infertility [1]. There has been a worldwide increase in the incidence of ED, probably due to aging populations and other risk factors such as the presence of chronic illnesses (e.g. heart disease, hypertension, diabetes mellitus), smoking, stress, alcohol, drug abuse and sedentary lifestyles. ED is defined as the consistent inability to achieve an erection sufficient for the purpose of satisfactory sexual intercourse, or the inability to ejaculate, or both [2]. Management therapies include the use of psychotherapy, vacuum devices, surgery, penile implants and drugs [2]. Some of these are too expensive and not easily affordable.

In many localities in Nigeria, *Fadogia agrestis*, a shrub with a yellowish stem and leaves, 1–3 feet high, is one of several plants commonly used in the management of ED [3].

However, the validity of the claimed aphrodisiac activity (the ability to arouse sexual desire [4]) has not been proven scientifically. This study was carried out to provide information on its acclaimed aphrodisiac properties.

Correspondence to: Dr M. T. Yakubu, Medicinal Plants Research Laboratory, Department of Biochemistry, University of Ilorin, PMB 1515, Ilorin, Nigeria.
Tel: +234-803-3578-658, Fax: +234-31-221-593
E-mail: tomuyak@yahoo.com
Received 2004-09-24 Accepted 2005-03-21

Previous workers [5, 6] had shown that male sexual behavior parameters (mount frequency, mount latency, intromission frequency, intromission latency and ejaculatory latency) and serum testosterone levels could be used to assess the aphrodisiac potential of the plant extract, hence these indices were used in the present study.

2 Material and methods

2.1 Animals and reagents

Healthy, sexually experienced, white male albino rats (*Rattus novergicus*) weighing 270 g–300 g, aged 5–5.5 months and female albino rats weighing 150 g–180 g, aged 3.5–4 months were obtained from the Small Animal Holding Unit of the Department of Biochemistry, University of Ilorin, Ilorin, Nigeria. They were kept in well-ventilated house conditions (temperature: 28 ºC–31 ºC; photoperiod: 12 h natural light and 12 h dark; humidity: 50 %–55 %) with free access to rat pellets (Bendel Feeds and Flour Mills Ltd., Ewu, Nigeria) and tap water. Estradiol benzoate was purchased from Sigma Chemical (St. Louis, USA) and progesterone from Shalina Laboratories (Mumbai, India). The testosterone assay kit was procured from Immunometrics (London, UK).

2.2 Plant authentication, preparation of plant extract and phytochemical analysis

The plant sample bought from the herb sellers at Kulende Market, Ilorin, Nigeria was authenticated at the Department of Horticulture and Landscape Technology, Federal School of Forestry, Jos, Nigeria with a voucher number 2:108. The plant stem was cut into pieces, oven-dried at 40 ºC to a constant weight. The dried pieces were then pulverized using an electric blender (Blender/Miller III, model MS-223, Taiwan, China) and the powder obtained was stocked in a plastic container from which varying amounts were taken and extracted in distilled water for 48 h at room temperature (26 ºC–28 ºC). This was then filtered using filter paper (Whatman No. 1). The filtrate was then concentrated in stem bath and the resulting brownish black residue was reconstituted in distilled water to give the equivalent dose of 18 mg/kg body weight (value originated from ethnobotanical survey), while higher doses of 50 mg/kg body weight and 100 mg/kg body weight were also used in this study. The reconstituted aqueous extract was administered orally using plastic syringes to all animals in different groups. The aqueous extract was subjected to chemical tests for the qualitative and quantitative analyses of alkaloids, tannins, phlobatannins, anthraquinones, cardiac glycosides, saponins, cardenolides and dienolides, phenolics, flavonoids, caffeine, triterpenes and steroids [7, 8].

2.3 Evaluation of male sexual behavior

A total of 60 male rats of proven fertility were housed individually in metabolic cages of dimensions 33.0 cm × 20.5 cm × 19.0 cm, with cleaning of the cages done once daily. The rats were randomly divided into four groups (A, B, C and D) of 15 animals each. Rats in groups A, B and C were administered with the plant extract (1mL) once daily at 24 h intervals at the dose of 18 mg/kg, 50 mg/kg and 100 mg/kg body weight respectively. Group D served as the control and received appropriate volume (1mL) of the vehicle (distilled water) in a similar manner. Five rats from each of the groups were monitored for sexual behavior after 1, 3 and 5 daily doses respectively.

Sixty female rats were brought to oestrus by the sequential administration of estradiol benzoate (10 μg/100 g) and progesterone (0.5 mg/100 g) through subcutaneous injections, 48 h and 4 h respectively prior to pairing [9]. Sexual behavior studies were monitored in a separate room for 2 h following the administration and were given 20 min adaptation period, after which a primed female was placed in the same cage with the male. On days 1, 3 and 5, sexual behaviors were monitored, including:

- Mount frequency (MF): the number of mounts without intromission from the time of introduction of the female until ejaculation.
- Intromission frequency (IF): the number of intromissions from the time of introduction of the female until ejaculation.
- Mount latency: the time interval between the introduction of the female to the first mount by the male.
- Intromission latency: the interval from the time of introduction of the female to the first intromission by the male.
- Ejaculatory latency: the time interval between the first intromission and ejaculation. This is characterized by longer, deeper pelvic thrusting and slow dismount followed by a period of inactivity [6].

All sexual behavior studies were carried out between 13:00 and 16:00 at room temperature 26 ºC–28 ºC.

2.4 Testosterone assay

The same set of animals used for sexual behavior parameters were also used for the testosterone assay; the animals were sacrificed 24 h after the extract dosing. Under ether anesthesia, the neck areas were quickly cleared of fur and skin to expose the jugular veins. The jugular veins were slightly displaced from the neck region (to prevent contamination of the blood with interstitial fluid) and then cut with a sharp sterile blade. The rats were made to bleed into clean, dry corked centrifuge tubes which were left at room temperature for 10 min. After that, the tubes were centrifuged at 33.5 × *g* for 15 min using uniscope Laboratory Centrifuge (model SM800B, Surgifriend Medicals, England).

The sera were thereafter collected using Pasteur pipettes into clean, dry, sample bottles and were then stored frozen overnight [1] before being used for the testosterone assay.

The serum testosterone concentration was quantitatively determined using the direct human serum testosterone enzyme immunoassay kit as outlined in the manufacturer's protocol. The determination was based on the principle of direct assay of a limited (competitive) type following the general antibody-antigen reaction based on enzyme linked immunoabsorbent assay as described by Tietz [10] using Serozyme I™ Serono (Diagnostics, Freiburg, Germany). The serum testosterone concentration was then interpolated from a standard calibration curve.

2.6 Statistical analysis

Data were presented as the mean ± SD (n = 5). Statistical analyses used one-way analysis of variance (ANOVA) to account for the different treatments and were complemented with unpaired t-test. Differences were considered statistically significant at $P < 0.05$ [11].

3 Results

3.1 Phytochemical analysis

Phytochemical screening of the aqueous extract of *Fadogia agrestis* stem showed the presence of alkaloids and saponins, while anthraquinones and flavonoids are present in a small amount (Table 1). All other phytochemicals analyzed were not detected.

Table 1. Qualitative and quantitative chemical analyses on crude aqueous extract of the *Fadogia agrestis* stem. ND, not detected.

Phytochemicals	Inferences	Concentration (%)
Alkaloids	Present	0.32 ± 0.06
Saponins	Present	2.08 ± 0.07
Tannins	Absent	ND
Phlobatannins	Absent	ND
Phenolics	Absent	ND
Flavonoids	Weakly present	0.09 ± 0.00
Triterpenes	Absent	ND
Anthraquinones	Weakly present	0.09 ± 0.00
Steroids	Absent	ND
Cardiac glycoside	Absent	ND
Caffeine	Absent	ND

3.2 Male sexual behavior

Increase in the sexual vigor of MF (Figure 1) and IF (Figure 2) were observed in all three dosed groups (namely 18 mg/kg, 50 mg/kg and 100 mg/kg body weight) in a dose dependent manner that was statistically significant ($P < 0.05$) when compared with the control. By the last day of the experimental period (day 5) in the

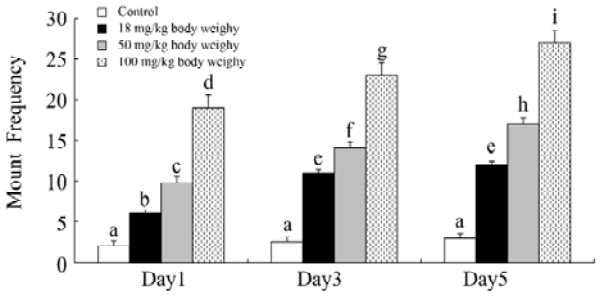

Figure 1. Effect of administration of aqueous extract of *Fadogia agrestis* stem on the mount frequency (MF) of male rats. Bars carrying letters different from their controls on each day (i.e days 1, 3 and 5) are significantly different at $P < 0.05$; bars carrying letters different for the same dose group at different days are significantly different at $P < 0.05$; bars carrying letters different from other dose groups are significantly different at $P < 0.05$.

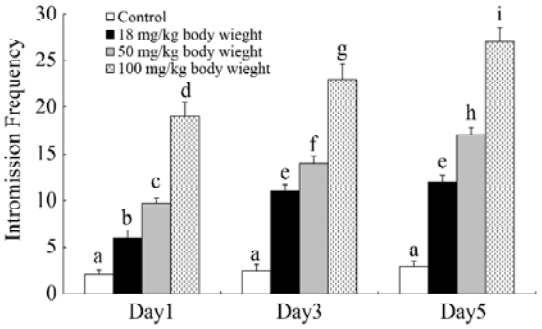

Figure 2. Effect of administration of aqueous extract of *Fadogia agrestis* stem on the intromission frequency (IF) of male rats. Bars carrying letters different from their controls on each day (i.e days 1, 3 and 5) are significantly different at $P < 0.05$; bars carrying letters different for the same dose group at different days are significantly different at $P < 0.05$; bars carrying letters different from other dose groups are significantly different at $P < 0.05$.

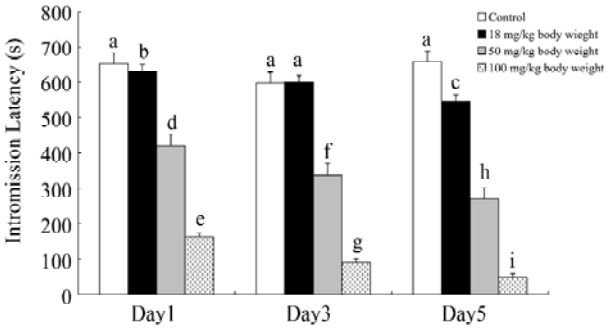

Figure 4. Effect of administration of aqueous extract of *Fadogia agrestis* stem on the intromission latency of male rats. Bars carrying letters different from their controls on each day (i.e days 1, 3 and 5) are significantly different at $P < 0.05$; bars carrying letters different for the same dose group at different days are significantly different at $P < 0.05$; bars carrying letters different from other dose groups are significantly different at $P < 0.05$.

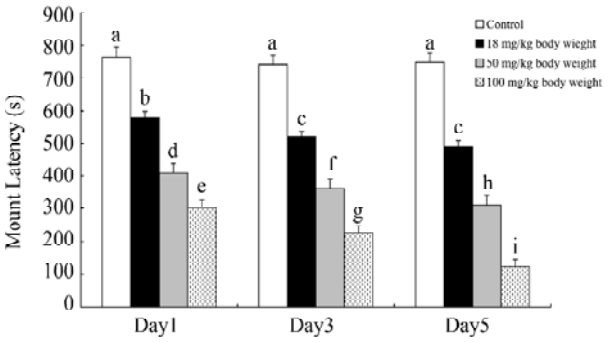

Figure 3. Effect of administration of aqueous extract of *Fadogia agrestis* stem on the mount latency of male rats. Bars carrying letters different from their controls on each day (i.e days 1, 3 and 5) are significantly different at $P < 0.05$; bars carrying letters different for the same dose group at different days are significantly different at $P < 0.05$; bars carrying letters different from other dose groups are significantly different at $P < 0.05$.

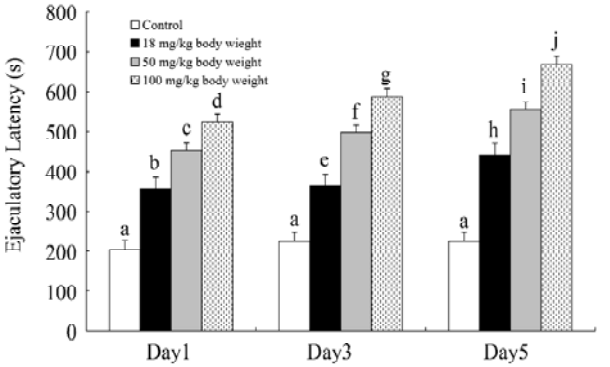

Figure 5. Effect of administration of aqueous extract of *Fadogia agrestis* stem on the ejaculatory latency of male rats. Bars carrying letters different from their controls on each day (i.e days 1, 3 and 5) are significantly different at $P < 0.05$; bars carrying letters different for the same dose group at different days are significantly different at $P < 0.05$; bars carrying letters different from other dose groups are significantly different at $P < 0.05$.

highest dosed group (100mg/kg), both MF and IF had increased to 3.7 times of their respective control values. In addition, pre-copulatory behavior such as anogenital sniffing and nosing were less prominent with the 100 mg/kg body weight group while chasing was more pronounced. In contrast, the mount latency (Figure 3) and intromission latency (Figure 4) decreased significantly with the doses and as the experimental period increased ($P < 0.05$). There was also statistically significant prolongation of ejaculatory latency ($P < 0.05$) following the administration of various doses of the plant stem extract (Figure 5).

3.3 Serum testosterone

The administration of various doses of the plant extract resulted in a significant increase in serum testosterone concentration throughout the period of administration ($P < 0.05$). The various doses (18 mg/kg, 50 mg/kg and 100 mg/kg body weight) produced two-, three- and six-fold increases compared with the control by the end of the experimental period (Figure 6).

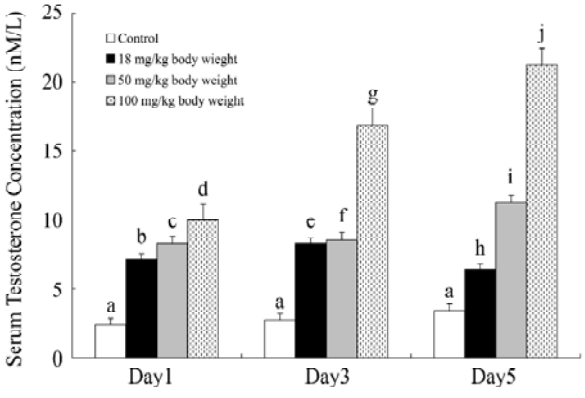

Figure 6. Effect of administration of aqueous extract of *Fadogia agrestis* stem on the serum testosterone concentration. Bars carrying letters different from their controls on each day (i.e days 1, 3 and 5) are significantly different at $P < 0.05$; bars carrying letters different for the same dose group at different days are significantly different at $P < 0.05$; bars carrying letters different from other dose groups are significantly different at $P < 0.05$.

4 Discussion

Since many people are now relying on herbal medicines for health care [12], possibly because the other treatment options available are becoming more expensive and often carry serious side effects, there should be scientific dissemination of information on the therapeutic efficacy of these plants. The aqueous extract of *Fadogia agrestis* stem has been in use by many people in our local population as a means of treating sexual inadequacy and stimulating sexual vigor even without recourse to the scientific validity of the claim. Aphrodisiacs are substances that enhance sex drive and/or sexual pleasure or can arouse sexual desire or libido [4]. They are also agents that can be used to modify impaired sexual functions.

Phytochemical screening can help to reveal the chemical constituents of the plant extract and the one that predominates over the others. It may also be used to search for bioactive agents for starting products used in the partial synthesis of some useful drugs [13]. Phytochemical screening of the plant stem showed the presence of major metabolites of alkaloids and saponins, while anthraquinones and flavonoids are weakly present (Table 1). Saponins have been implicated as possible bioactive agent responsible for the aphrodisiac effect in *Tribulus terrestris* extract [6].

The significant increase in the indices of sexual vigor (i.e. mount and intromission frequency [Figures 1, 2]) and the significant decrease in mount and intromission latencies (Figures 3, 4) are indications of the aphrodisiac potential of *Fadogia agrestis* stem extract. In this study, the marked effects on the sexual behavior parameters, compared with the control, are indications of stimulation in the desire component of sexuality. Apart from the desire that is essential for initiation of sex, penile tumescence and rigidity as well as the accessory muscles that help in providing additional penile rigidity and ejaculation are dependent on testosterone for normal sexual activity [6]. Such increase in the frequency of mount and intromission suggests that libido, sexual vigor and sexual performance were unimpaired [5]. The prolonged ejaculatory latency indicates enhancement of sexual function and suggests an aphrodisiac action.

It has been documented previously that sexual behavior and erection are dependent on an androgen that may be acting both centrally and peripherally [14]. Testosterone supplementation has previously been shown to improve sexual function and libido [15], in addition to the intensity of orgasm and ejaculations which might also be expected to improve [16]. The continued administration of the plant extract for five days at various doses which led to the significant increase in serum testosterone may be responsible for the marked effect on sexual behavior indices of the male rats. Increase in testosterone levels in the present study may thus account for the observed masculine behavior.

Studies have implicated the saponin component of plants in enhancing aphrodisiac properties due to its androgen increasing property [6]. Saponins present in the aqueous extract of this plant might have assisted in stimulating an increase in the body natural endogenous testosterone levels by raising the level of leutinizing hormones (LH). This LH released normally by the pituitary gland helps to maintain testosterone levels; as LH increases, so does the testosterone [6]. The increase in testosterone seemed to have translated into the male sexual competence observed in this study. Furthermore, this study suggests that the aphrodisiac action may be mediated through a change in the blood testosterone level.

In conclusion, results of this study have provided

evidence to support the acclaimed role of *Fadogia agrestis* as an aphrodisiacs in traditional medicine. It has also provided scientific evidence as to its purported aphrodisiac effect. The aqueous extract of the *Fadogia agrestis* stem may be adduced to increase in the testosterone level of the blood, which may be due to its saponin component. The aqueous extract of the *Fadogia agrestis* stem may thus be used to modify impaired sexual functions in animals, especially those arising from hypotestosteronemia.

References

1 Yakubu MT, Bilbis LS, Lawal M, Akanji MA. Effect of repeated administration of sildenafil citrate on selected enzyme activities of liver and kidney of male albino rats. Nig J Pure & Appl Sci 2003; 18: 1395–400.

2 Ogah G. Impotence. Nig J Gen Pract 1999; 3: 30–41.

3 Irvine FR. Woody plants of Ghana. London: Oxford University Press; 1961. p878.

4 Rosen RC, Ashton AK. Prosexual drugs: empirical status of new aphrodisiacs. Arch Sexual Behav 1993; 22: 521–43.

5 Ratnasooriya WD, Dharmasiri MG. Effects of *Terminalia catappa* seeds on sexual behavior and fertility of male rats. Asian J Androl 2000; 2: 213–9.

6 Gauthaman K, Adaikan PG, Prasad RN. Aphrodisiac properties of *Tribulus Terrestris* extract (Protodioscin) in normal and castrated rats. Life Sci 2002; 71: 1385–96.

7 Sofowora A. Screening plants for bioactive agents. In: Sofowora A, editor. Medicinal Plants and Traditional Medicine in Africa, 2nd ed. Ibadan: Spectrum Books Ltd, 1993. p134–56.

8 El-Olemy MM, Al-Muhtadi FJ, Afifi AA. Experimental Phytochemistry. A Laboratory Manual. Saudi Arabia: King Saud University Press Riyadh; 1994. p3–137.

9 Amin KMY, Khan MN, Rahman SZ, Khan NA. Sexual function improving effect of *Mucuna pruriens* in sexually normal male rats. Fitoterapia 1996; 67: 53–8.

10 Tietz NW. Clinical Guide to Laboratory Tests. 3rd edition, Philadelphia: W. B. Saunders Company; 1995. p578–80.

11 Mahajan BK. Significance of difference in means. In: Methods in Biostatistics for Medical and Research Workers, 6th edn. New Delhi: JAYPEE Brothers Medical Publishers; 1997. p130–55.

12 Griffin PD. In: Diczfalusy E, Griffin PD, Khanna J, editors. Research in Human Reproduction. Geneva, Switzerland: World Health Organization, 1988.

13 Harborne JB. Phytochemical methods: A guide to Modern Techniques of Plant Analysis. London: Chapman & Hall; 1973. p279.

14 Mills TM, Reilly CM, Lewis RW. Androgens and penile erection: a review. J Androl 1996; 17: 633–8.

15 Aversa A, Fabbri A. New oral agents for erectile dysfunction: what is changing in our practice? Asian J Androl 2001; 3: 175–9.

16 Morales A. Androgen supplementation in practice: the treatment of erectile dysfunction associated with hypotestosteronemia. In: Oddens BJ, Vermeulen A, editors. Androgens and aging male. London: Parthenon Publishing Group; 1996. p233–45.