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Effects of aqueous extract of *Cnestis ferruginea* (Vahl ex De Cantolle) root on paroxetine-induced sexual dysfunction in male rats

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ABSTRACT

Objective: To determine the effects of the aqueous extract of *Cnestis ferruginea* root on paroxetine-induced sexual dysfunction in male Wistar rats. **Methods:** The extract (13, 26 and 52 mg/kg body weight) and the reference herbal drug, PowmaxM (7.14 mg/kg body weight) were administered orally to paroxetine-induced sexually impaired male rats, once daily for 5 d and their sexual behaviour parameters were monitored and computed. The serum hormones (testosterone, follicle stimulating and luteinizing hormones) were determined at the end of the exposure period. **Results:** Administration of paroxetine to sexually active male rats significantly ($P<0.05$) reduced the mount frequency (MF), intromission frequency (IF), and ejaculation frequency (EF), whereas mount latency (ML), intromission latency (IL), ejaculatory latency (EL) and post-ejaculatory interval (PEI) were increased. The extracts progressively reversed the trends of MF, IF, EF, ML, IL, EL and PEI in the paroxetin-treated animals towards the control values throughout the exposure period. The sexual behaviour parameters compared well with the PowmaxM-treated animals but not comparable to the distilled water administered animals. In addition, all the doses of the extract elevated ($P<0.05$) the levels of serum LH and FSH and decreased testosterone contents. **Conclusions:** The aqueous extract of *Cnestis ferruginea* root at the doses of 13, 26 and 52 mg/kg body weight restored sexual competence at least to a reasonable extent in sexually impaired/sluggish male rats with the highest dose producing the best efficacy. The results support the folkloric claim of the plant for the management of sexual disorder in males.

1. Introduction

Sexual dysfunction (SD) in males is the repeated inability to perform a satisfactory sexual intercourse due to disorder in the normal male sexual response cycle of libido, erection, orgasm, ejaculation and detumescense. It is a serious medical and social symptom that occurs in both males (10%-52%) and females (25%-63%)[1]. SD which has various etiological factors (life style, androgen deficiency, aging, psychological disorders, and side effects of drugs) have been managed with different strategies such as psychological/behavioural counseling, pharmacotherapy, and surgical and non-surgical approaches. Unfortunately, these options are too expensive with some serious side effects like aching in the penis, testes, urethral burning, pain and bleeding, implant extrusion and infections[2]. Therefore, there is the need to search for botanicals with aphrodisiac that will not only increase libido (desire and arousal), sexual potency (effectiveness of erection) and sexual pleasure but also are cheaper, readily available, fast acting and with reduced adverse effects.

Cnestis ferruginea Vahl ex DC (*C. ferruginea*, Connaraceae), also known as Gboyin gboyin or Omu aja (Yoruba), Fura amarya (Hausa), Amu nkita (Igbo), Ukpo-ibieka (Edo) and Usiere ebua (Efik), is a perennial shrub found mainly in the savannah region of tropical West Africa. The plant is about 3.0-3.6 m high with densely, rusty brown, pubescent branches, indecidous leaves with more or less alternate or sometimes opposite, ovate to narrowly oblong leaflets and orange-red fruits. The ovoid follicles are 1-5 in fruit, often united at base and contains one seed each[3].

C. ferruginea has been acclaimed in herbal medicine and some literatures to have diverse therapeutic uses such as the management of conjuctivities, bronchitis, tuberculosis, migraines, sinusitis, and oral infection (fruits); snakebite,

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dysentery, syphilis, gonorrhea, cough, dysmenorrhea, enema, ovarian troubles and aphrodisiac (roots); abortion, constipation, fever and pain (leaves)[4,5].

Studies have shown that aqueous root extract contained alkaloids (24.6 mg/L), flavonoids (14.6 mg/L), saponins (4.6 mg/L), anthraquinones (0.3 mg/L) and tannins (0.1 mg/L)[6]. The fruits have been reported to have anti-microbial effects especially against gram-positive bacteria[7], while the aqueous root extract has been reported to possess anti-stress and laxative activities[6,8]. Also, the methanolic root extract has been reported to possess analgesics and anti-inflammatory activity[9]. The toxicological implications of the crude alkaloidal fraction from *C. ferruginea* root on the liver function indices of male rats as well as the cytotoxic activity of the leaves have been reported[3,10]. The hypoglycemic activity and acute toxicity of the methanolic extract of *C. ferruginea* have also been substantiated with scientific evidence[11].

Despite all these studies and the purported use of the plant root as an aphrodisiac in several African countries, there has not been any information in the open scientific literature that has addressed the aphrodisiac claim of the powdered roots of the plant. Therefore, the present study was an attempt to investigate the effects of the aqueous extract of *C. ferruginea* root in paroxetine-induced sexually impaired male Wistar rats.

2. Materials and methods

2.1. Plant material

Dried roots of *C. ferruginea*, bought from herb sellers at a market (Oja tuntun) in Ilorin, Nigeria, was authenticated by Mr. Bolu Ajayi of the Department of Plant Biology, University of Ilorin, Ilorin, Nigeria. A voucher specimen (I.U.V. No. 007) was deposited in the Departmental Herbarium.

2.2. Rats

Thirty healthy Wistar male rats [(156.24±3.22) g] and the same number of female rats [(135.76±2.84) g] were housed in clean aluminum cages contained in well ventilated housing conditions [temperature: (22±3) °C; photoperiod: 12 h; humidity: 45%-50%].

2.3. Drugs, chemicals and assay kits

Paroxetine hydrochloride was a product of S.C. Europharm (Brasov, Romania), while PowmaxM was from Beijing Kowloon Pharmaceuticals Co., Ltd (Beijing, China). Progesterone was a product of Ningbo Tisun Medic Biochemic Co., Ltd (Ningbo, China), while estradiol benzoate was a product of Sigma Chemical (St. Louis, USA). Assay kits for testosterone, follicle stimulating hormone (FSH) and luteinizing hormones (LH) were products of Inteco Diagnostics UK Ltd (London, UK). All other reagents used were of analytical grade, prepared in distilled water and stored in neat and airtight reagent bottles.

2.4. Preparation of extract

A known weight (300 g) of the root of *C. ferruginea* were washed, sliced, oven-dried and pulverized in a blender (Mikachi Blender, Model MK-1830, China) after which the resulting powder (50 g) was extracted in 200 mL of distilled water for 48 h at room temperature. The extract was filtered with Whatman No. 1 filter paper (Maidstone, England) and the resulting filtrate was concentrated on a steam bath to give a yield of 5.42 g corresponding to a percentage yield of 10.48% (w/w). Calculated amounts were reconstituted in distilled water to give the doses of 13, 26, 52 mg/kg body weight. Information from ethnobotanical survey was put together to arrive at the most frequently mentioned dose of 26 mg/kg body weight while the doses of 13 and 52 mg/kg body weight were half and twice the calculated dose of 26 mg/kg body weight.

2.5. Induction of sexual dysfunction and assessment of mating behaviour indices in male rats

Twenty-five male rats were induced with sexual dysfunction by oral administration of 10 mg/kg of paroxetine suspension [prepared daily in Tween-80 (BDH Chemicals, Ltd.; Poole, England), suspended in 9 g/L saline solution] using a metal oropharyngeal cannula[12,13]. Healthy female rats were made receptive by sequential subcutaneous administration of oestradiol benzoate (10 μg/100 g body weight) and progesterone (0.5 mg/100 g body weight), 48 and 4 h respectively prior to pairing[14]. Oestrous phase in female rats was confirmed by vaginal smears examinations according to OECD-106 guideline[15]. The oestrous female rats were then introduced into the male rats in their respective cages and observed for 30 min for mount frequency (MF), intromission frequency (IF), ejaculation frequency (EF), mount latency (ML), intromission latency (IL), ejaculatory latency (EL) and post-ejaculatory interval (PEI) related to mating behaviour. Male rats which showed minimum of 25% reduction in MF, IF and EF as well as minimum increase of 25% in ML, IL, EL and PEI were considered as sexually impaired and were used for the subsequent study.

2.6. Animal grouping and extract administration

A total of 30 male rats which were acclimatized for 2 wk were completely randomized into six groups (A-F), with each group comprising five animals. Rats in group A (control group) were orally administered 0.5 mL of distilled water, once daily for 5 d, with the aid of a metal oropharyngeal cannula. Animals in groups B, C, D, E and F (test groups) were treated like those in group A except they were induced with sexual dysfunction, and in addition received 0.5 mL

each of distilled water, 7.14 mg/kg of PowmaxM (a reference herbal drug), 13, 26 and 52 mg/kg body weight of the extract respectively instead of distilled water. After 30 min post the dosing, the sexually impaired male rats were monitored on Day 1, 3 and 5 between the hours of 20:00 and 02:00 under dim light condition at room temperature as previously described. The animals were allowed free access to rat pellets (Premier Feeds, Ibadan, Nigeria) and tap water. The study was conducted following the guidelines on the care and use of laboratory animals of the Ethical Committee of the Department of Biochemistry, University of Ilorin as well as that of the National Academies, Washington DC, USA[16].

2.7. Preparation of serum

The serum was prepared according to the procedure described by Yakubu *et al*[17].

2.8. Determination of serum hormones

The serum hormone concentrations were quantitatively determined following the instructions/procedures outlined in the manufacturer manual contained in the assay kits. The serum hormone concentrations were then interpolated from their respective calibration curves.

2.9. Statistical analysis

Data were expressed as the mean±SEM of five determinations. Means were analyzed using Duncan's multiple range test and complemented with Student's *t*-test. Statistical Package for Social Sciences, version 16.0 (SPSS Inc., Chicago, USA) was used for statistical analyses. Differences were considered statistically significant at $P<0.05$.

3. Results

The sexual behaviour parameters of MF, IF and EF were decreased significantly ($P<0.05$), while the ML, IL, EL and PEI were significantly prolonged following the administration of paroxetine to sexually active animals. The changes in all these sexual behaviour parameters investigated in the present study were more than 25% (Table 1).

The extract at the doses of 26 and 52 mg/kg body weight significantly ($P<0.05$) improved the impaired sexual behaviour of MF, IF and EF of the paroxetine-treated animals (Tables 2 and 3). As the days progressed, the improvement became comparable with the reference drug, PowmaxM (Tables 2 and 3). This however contrasts the sexually dysfunction rats administered 13 mg/kg body weight where the indices compared well with the animals treated with paroxetine alone. Sexual activity in all the treated groups did not compare with those of the normal, distilled water control animals. Furthermore, the doses of 26 and 52 mg/kg body weight significantly decreased the ML of the sexually impaired paroxetin-treated animals (Table 3). The change in ML did not compare favourably with the

Table 1
Effect of paroxetine administration on sexual behaviours of male rats.

Parameters	Control	Paroxetine treated rats	Percentage change (%)
Mount frequency (MF)	14.75±0.25^{a}	7.00±0.23^{b}	52.52$^{\#}$
Intromission frequency (IF)	11.00±0.41^{a}	6.05±0.22^{b}	45.00$^{\#}$
Ejaculatory frequency (EF)	1.75±0.25^{a}	1.10±0.11^{b}	37.14$^{\#}$
Mount latency (ML) (s)	83.75±3.95^{a}	125.10±1.65^{b}	49.37^{+}
Intromission latency (IL) (s)	132.14±2.37^{a}	201.30±1.90^{b}	52.34^{+}
Ejaculatory latency (EL) (s)	139.80±2.46^{a}	173.74±2.66^{b}	31.43^{+}
Post-ejaculatory interval (PEI) (s)	153.66±4.28^{a}	213.86±4.01^{b}	39.18^{+}

Data are mean of five determinations±SEM. Values carrying superscripts different from the control for each parameter are significantly different ($P<0.05$). $^{\#}$ means percentage reduction in parameter. $^{+}$ means percentage increase in parameter.

Table 2
Effect of aqueous root extract of *Cnestis ferruginea* on mount frequency and intromission frequency of rats.

Treatments	Mount frequency			Intromission frequency		
	Day 1	Day 3	Day 5	Day 1	Day 3	Day 5
Distilled water (control)	14.50±0.29^{a}	14.75±0.85^{a}	14.50±0.29^{a}	11.25±0.48^{a}	10.75±0.48^{a}	11.00±0.41^{a}
Paroxetine-treated	6.25±0.25^{b}	6.75±0.48^{b}	7.25±0.25^{b}	5.75±0.25^{b}	7.00±0.41^{b}	7.25±0.25^{b}
Paroxetine + PowmaxM	7.75±0.85^{b}	9.00±0.91^{c}	9.25±0.75^{c}	6.75±0.63^{c}	7.50±0.65^{b}	8.25±0.48^{b}
Paroxetine + 13 mg/kg of extract	6.75±0.25^{b}	7.25±0.25^{bc}	7.75±0.25^{bc}	5.25±0.25^{d}	5.50±0.29^{c}	6.00±0.41^{c}
Paroxetine + 26 mg/kg of extract	7.25±0.63^{b}	7.75±0.25^{bc}	8.25±0.25^{bc}	6.00±0.41^{bc}	6.50±0.29^{b}	7.00±0.41^{b}
Paroxetine + 52 mg/kg of extract	7.75±0.49^{b}	8.50±0.65^{bc}	9.00±0.41^{d}	7.25±0.48^{c}	7.25±0.48^{b}	7.75±0.48^{b}

Data are mean of five determinations±SEM. Values carrying superscripts different from the control down the group for each day and parameter are significantly different ($P<0.05$).

distilled water treated animals. The 13 mg/kg body weight of the extract produced ML that was not significantly different from the animals treated with paroxetine only (Table 3). In addition, the pre-coital mating behaviour (chasing, nosing, anogenital sniffing, genital grooming and attempted clasping and mounts) observed from the cage side were pronounced in the 52 mg/kg body weight and PowmaxM treated animals and similar to those normal, distilled water treated control animals.

Except for the single dose of 13 mg/kg body weight of the extract (Day 1), all the other doses of the extract (26 and 52 mg/kg body weight) significantly reduced the IL of the sexually impaired animals throughout the exposure period compared to the paroxetine alone treated animals (Table 4). This trend of reduction was extended to the EL which commenced right from the start of the experiment at all the doses and was sustained throughout the exposure period in the sexually impaired animals. Again, all these changes did not compare well with the distilled water treated control animals (Table 4).

Only the 52 mg/kg body weight of the extract significantly reduced the PEI of sexually impaired animals ($P<0.05$), whereas the 13 and 26 mg/kg body weight of the extract produced PEI that compared favourably with the paroxetin-treated animals throughout the exposure period (Table 5). The PEI produced by the 52 mg/kg body weight was not significantly different from the sexually impaired animals administered the PowmaxM. All these changes were not comparable to the normal rats treated with distilled water (Table 5).

The suppressed level of serum testosterone in the paroxetin-treated animals was only enhanced significantly ($P<0.05$) in the sexually impaired animals administered 52 mg/kg body weight of the extract (Table 6). The other doses of the extract (13 and 26 mg/kg body weight) and the PowmaxM produced testosterone concentration that

Table 3

Effect of aqueous root extract of *Cnestis ferruginea* on ejaculation frequency and mount latency of rats.

Treatments	Ejaculation frequecncy			*Mount latency (s)		
	Day 1	Day 3	Day 5	Day 1	Day 3	Day 5
Distilled water (control)	2.00±0.00^{a}	2.50±0.29^{a}	2.25±0.25^{a}	85.65±2.32^{a}	86.54±1.84^{a}	82.76±2.64^{a}
Paroxetine-treated	1.25±0.25^{a}	1.50±0.29^{b}	1.50±0.29^{a}	122.93±3.21^{b}	124.95±2.47^{b}	121.01±1.62^{b}
Paroxetine + PowmaxM	1.50±0.29^{a}	1.50±0.29^{b}	1.75±0.25^{a}	114.78±5.84^{b}	116.91±2.56^{b}	114.38±2.75^{bc}
Paroxetine + 13 mg/kg of extract	1.25±0.25^{a}	1.50±0.29^{b}	1.50±0.29^{a}	115.73±3.99^{bc}	117.39±3.19^{b}	113.00±2.31^{c}
Paroxetine + 26 mg/kg of extract	1.25±0.25^{a}	1.50±0.29^{b}	1.75±0.25^{a}	109.24±3.51^{c}	102.68±2.48^{c}	95.95±2.15^{d}
Paroxetine + 52 mg/kg of extract	1.75±0.25^{a}	1.75±0.25^{b}	1.75±0.25^{a}	118.35±3.18^{bc}	105.98±3.66^{c}	97.29±2.75^{d}

Data are mean of five determinations±SEM. Values carrying superscripts different from the control down the group for each day and parameter are significantly different ($P<0.05$).

Table 4

Effect of aqueous root extract of *Cnestis ferruginea* on intromission latency and ejaculatory latency of rats.

Treatments	Intromission latency (s)			Ejaculatory latency (s)		
	Day 1	Day 3	Day 5	Day 1	Day 3	Day 5
Distilled water (control)	132.55±3.48^{a}	129.85±2.83^{a}	135.29±3.47^{a}	148.85±3.44^{a}	133.07±2.59^{a}	137.87±2.67^{a}
Paroxetine-treated	193.91±2.38^{b}	197.19±2.47^{b}	190.64±1.65^{b}	173.27±5.50^{b}	170.29±4.69^{b}	167.70±3.40^{b}
Paroxetine + PowmaxM	163.69±2.38^{c}	168.63±5.12^{c}	181.15±3.06^{c}	155.66±6.00^{a}	168.08±5.89^{b}	163.36±6.88^{b}
Paroxetine + 13 mg/kg of extract	197.86±3.52^{d}	189.08±1.17^{d}	180.69±2.32^{c}	155.48±2.90^{a}	156.02±3.71^{c}	150.22±2.49^{cd}
Paroxetine + 26 mg/kg of extract	185.83±3.86^{e}	179.01±1.73^{e}	174.56±0.97^{c}	154.59±2.21^{a}	165.62±2.53^{b}	140.39±3.94^{ac}
Paroxetine + 52 mg/kg of extract	168.55±5.49^{c}	165.83±9.07^{c}	173.22±8.59^{c}	150.37±2.72^{a}	144.29±2.38^{d}	156.25±2.25^{bd}

Data are mean of five determinations±SEM. Values carrying superscripts different from the control down the group for each day and parameter are significantly different ($P<0.05$).

Table 5

Effect of aqueous root extract of *Cnestis ferruginea* on post-ejaculatory interval of rats.

Treatments	Post-ejaculatory interval (s)		
	Day 1	Day 3	Day 5
Distilled water (control)	157.54±5.29^{a}	143.12±6.07^{a}	153.06±2.98^{a}
Paroxetine-treated	189.52±7.49^{b}	193.39±9.13^{b}	184.57±5.80^{b}
Paroxetine + PowmaxM	181.60±7.27^{c}	163.85±3.99^{c}	177.67±4.35^{c}
Paroxetine + 13 mg/kg of extract	187.93±6.47^{b}	184.66±6.27^{bc}	181.96±6.59^{b}
Paroxetine + 26 mg/kg of extract	186.32±4.45^{b}	183.69±3.84^{d}	182.53±3.35^{b}
Paroxetine + 52 mg/kg of extract	183.70±7.76^{c}	160.67±7.38^{c}	168.23±6.16^{c}

Data are mean of five determinations±SEM. Values carrying superscripts different from the control down the group for each day and parameter are significantly different ($P<0.05$).

Table 6
Effect of aqueous root extract of *Cnestis ferruginea* for 5 d on serum hormone concentrations.

Treatments	Testosterone (nmol/L)	Follicle stimulating hormone (mIU/mL)	Luteinizing hormone (mIU/mL)
Distilled water (control)	4.20±0.34[a]	3.50±0.29[a]	1.65±0.09[a]
Paroxetine-treated	3.50±0.58[b]	4.98±0.03[b]	4.50±0.29[b]
Paroxetine + PowmaxM	3.70±0.17[b]	2.50±0.29[c]	3.50±0.29[c]
Paroxetine + 13 mg/kg of extract	3.60±0.23[b]	3.75±0.43[d]	5.50±0.27[d]
Paroxetine + 26 mg/kg of extract	3.50±0.06[b]	4.25±0.14[e]	4.50±0.25[b]
Paroxetine + 52 mg/kg of extract	4.50±0.05[c]	4.95±0.03[b]	4.10±0.64[b]

Data are mean of five determinations±SEM. Values carrying superscripts different from the control down the group for each hormone are significantly different (P<0.05).

compared well with the paroxetine treated animals. All the treatments except the animals administered 52 mg/kg body weight reduced testosterone levels when compared with the distilled water control. Furthermore, the FSH increased in all the treatment groups except the animals administered 13 mg/kg body weight of the extract, whereas the treatments increased the LH levels (Table 6).

4. Discussion

The present investigation reveals that the aqueous extract of *C. ferruginea* roots gradually enhanced male sexual activity in sexually impaired male rats.

Paroxetine, which is a selective serotonin reuptake inhibitor that delays or abolishes orgasm, inhibits nitric oxide synthase activity (the enzyme responsible for the synthesis of nitric oxide), increases EL and reduces the number of ejaculations in male rats[18-21]. Therefore, the decreases in MF, IF and EF as well as the prolonged ML, IL, EL and PEI confirm that the animals have been sexually impaired. Malviya *et al.* proposed that male rats must show a minimum of 25% reduction in sexual behaviours before they can be declared sexually impaired[13]. Therefore, the computed percent alterations in these sexual behaviour indices (more than 25% in each case) further suggest that sexual dysfunction was induced in the animals by the paroxetine. The loss of libido (as evidenced by reduction in MF, IF and EF) by paroxetine may be due to reduction of mesolimbic dopaminergic activity as a result of inhibitory serotonergic midbrain raphe nuclei projections or inactivatory role of 5-HT1A receptor-mediated norepinephrine neurotransmission[21].

Increase in MF reflects sexual motivation, whereas a similar increase in IF and EF could indicate efficiency of erection of the male organ, adequate penile orientation and the ease by which ejaculatory reflexes are activated[22]. The reversal of these sexual behaviour indices with days from the pattern in the paroxetine-treated animals towards the distilled water control animals suggests progressive enhancement of sexual behaviour by the extract. It is worthy of note that the enhancement of sexual behaviour in the extract treated animals was more prominent with the highest dose, 52 mg/kg body weight. It is possible that the component(s) of the extract previously reported by Yakubu *et al.*[6] such as saponins, flavonoids and alkaloids might have acted centrally by increasing the blood concentrations of testosterone and/or antagonizing gamma amino butyric acid; and peripherally by enhancing the synthesis of nitric oxide and the release of nitric oxide, dilating the blood vessels and relaxing the corpus cavernosum smooth muscles of the male copulatory organ, and/or decreasing or inhibiting further accumulation of serotonin in the synapse of the animals by paroxetin which led to the enhanced sexual behaviour including EF in the present study[21,23]. These sexual behaviours were preceded by proceptive and precopulatory behaviours in the animals. For example, the ear-wiggling, darting, hopping and lordosis by the receptive female rats in this study implied intense proceptivity and receptivity, whereas the precopulatory behaviour by the extract-treated male rats also suggested that the animals were generally aroused[23]. The pursuit of the female animals (the males running behind the female animals in close contact) suggested imminent copulation[23].

The pattern obtained for the ML and IL (indicators of sexual motivation) as well as EL (index of libido) and PEI (indicator of rate of recovery from exhaustion after the first series) following the administration of the extract further corroborates enhanced sexual appetitive behaviour in the animals. The extract has progressively reversed sexual sluggishness in the animals treated with paroxetine to sexual competence and may achieve complete reversal if the duration of exposure is extended beyond the 5 d in the present study. From the foregoing, it has shown that the extract is capable of improving desire and arousal, potency and pleasure components of sexual behaviour.

The use of paroxetine model to study sexual stimulant activities of chemical compounds including plant extract may mimic age- and disease-related sexual dysfunctions, since decrease in sexual behaviour is mostly associated with reduced testosterone levels. Paroxetine which reduced the testosterone content of the animals in the present study was however attenuated by the extract. A concern that arises with the sustained elevation of testosterone levels is the feedback inhibition of gonadotropin release[24], more so, since the gonadotropins were equally increased in the present study by the extract. Studies have shown that sexual behaviours could be enhanced by elevated testosterone levels probably via an increase in its metabolites such as Δ^4-androstenedione, dihydrotestosterone and dehydroepiandrosterone and thus trigger libido enhancing effects[23,25,26]. Therefore, the

enhanced sexual stimulant activity of the extract, most especially the highest dose of 52 mg/kg body weight could be attributed to the androgen. Furthermore, paroxetine exhibited feedback inhibition of gonadotropin since increase in testosterone resulted in decrease in the gonadotropins. The absence of similar feedback inhibition in the extract treated animals is not immediately known, but may not be unconnected with an initial diminished hormonal status or could be that the extract possesses gonadotropin (LH and FSH) releasing property.

Overall, the present study has given credibility to the ethno-medical belief that *C. ferruginea* root could increase sexual invigoration in males. The best activity was observed with the highest dose of 52 mg/kg body weight. The sexual stimulant activity which may be acted via central and peripheral mechanisms could be due to the presence of phytochemicals such as saponins, flavonoids and alkaloids.

Conflict of interest statement

We declare that we have no conflict of interest.

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