EFFECT OF HYDROALCOHOLIC EXTRACT OF *CAPPARIS DECIDUA* (FORSSK.) EDGEW ON SERUM TESTOSTERONE AND SPERMATOGENESIS IN RATS

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Keywords: *Capparis decidua,* aphrodisiac, serum testosterone level, body weight, secondary sexual organ weight.

The effect of *Capparis decidua(Forssk.)Edgew* aqueous extract on the Wistar rat testes was investigated with a view to evaluating the pharmacological basis for the use of *Capparis decidua* hydroalcoholic extract as an aphrodisiac. Wistar rats were divided in the following experimental groups- control group (1 mL kg^{-1}), sildenafil citrate treated (5 mg kg^{-1}), *C. decidua* (100 mg kg^{-1}), *C. decidua* (200 mg kg^{-1}), per se group (only *C. decidua* 200 mg kg^{-1}). The hydroalcoholic extract of root, stem & leaves of *C. decidua* was studied for their effect on the body and secondary sexual organ weight, spermatogenesis, and serum testosterone level male rats. The animals were allowed free access to drinking solution during the 28 days period of exposure. At the end of the experimental period, rats were sacrificed, testis, epididymis, seminal vesicles and prostate glands were excised and weighed, and serum testosterone level was recorded. The testes underwent histological examination. Oral administration of the extract in Wistar rats showed significant dose-dependent influence on serum testosterone level (P<0.001) and spermatogenic effects in extract treated rats groups by increasing the weights of secondary sexual organs(P<0.001).

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INTRODUCTION

Propagation of one's race is the doctrine of every single living life form. Every living creature endeavour to accomplish this through the procedure of multiplication, which is the essential procedure that empowers animal groups to speak to itself in the accompanying age as its posterity.[1]

Variations from the norm in male regenerative frameworks like impotency, erectile dysfunction and the other way around are one of the principle issues that prompt sterility. An aphrodisiac is a substance that increments sexual intimacy.[2] It has been perceived for quite some time that specific antihypertensive drugs, centrally acting sympatholytic drugs, β-antagonists, antidepressants, antipsychotics, anticonvulsants, drugs with antimuscarinic effects and diuretics, adversely affect sexual working.[3] *Capparis decidua* (Forssk.)Edgew. (Kair) is a multipurpose perennial woody plant, belonging to caper family (Capparaceae), found largely in the hot dry region of different parts of India.[4]

Capparis decidua (Forssk.) Edgew is salt-tolerant and grows along saline hard planes in the Thar Desert of India. Mature plants form extensive root systems that penetrate deeply into the soil. Leaf stipules frame into spines to decrease transpiration. The stem bark is smooth, green when youthful and turns yellow or whitish dark as it develops. The roots, fruits, and various parts of these plants with potential therapeutic advantages have been used since long time. *C. decidua* contains constituents like phenolic compounds, alkaloids, flavonoids, terpenoids, steroids, vitamins, quarternary ammonium compounds and many more phytoconstituents that are responsible for its medicinal value.[5]

Previous studies suggested that the antimicrobial effects of *Capparis decidua* (Forssk.) Edgew may be due to presence of bioactive compounds, like flavonoids, phenolics, polyamine alkaloids, glucosinolates, and vitamins that decrease the growth of microbes.[6] Roots of this plant have been used as expectorant, carminative, sudorific, thermogenic, digestive, aphrodisiac, stimulant, antibacterial, anodyne, anthelmintic and in treating constipation, lumbago, odontalgia, amenorrhoea, arthritis, dyspepsia, and dysmenorrhoea. The root bark is known to be astringent, diaphoretic, alexeteric etc. Powder or infusion of root bark is used in a cough, dropsy, palsy, gout, rheumatism, asthma, intestinal worms and intermittent fever.

Nowadays people are swinging to herbal remedies to improve this infertility issue they are effectively agreeable to normal man. Research is done to discover the plant items that can be utilized to treat this sort of infertility problems.[7]

EXPERIMENTAL

Plant Materials

The complete plant of *Capparis decidua* was collected near fresh from Jaipur, Rajasthan, India. The plant was taxonomically identified and authenticated by Prof. Kailash Agrawal, Convener Herbarium committee, Department of Botany, University of Rajasthan, Jaipur. A voucher specimen was deposited at the herbarium of the Department of Botany, University of Rajasthan, Jaipur, Rajasthan, India. (R.No. RUBL 211645).

Experimental animals

Healthy Albino Wistar rats of both sexes weighing 150-250 g were obtained from Central Animal Facility AIIMS New Delhi. The experimental protocol was approved by Institutional Animal Ethics Committee CPCSEA No. -1149/PO/ERe/07/CPCSEA. Animals were housed under standard conditions of temperature (24±2 ˚C) and relative humidity (30-70 %) with 12:12 light: dark cycle. The animals were given standard pellet diet and water ad libitum.

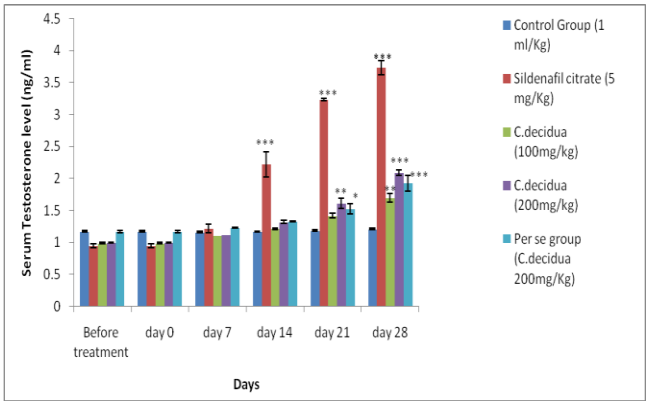

Figure 1. Effect of hydroalcoholic extract of *C. decidua* on serum testosterone level on male Wistar rats.

Preparation of test samples

The hydroalcoholic extract was dissolved in the distilled water and orally administered to the test groups. Sildenafil citrate was procured from the Cadila Pharmaceuticals Limited, Ahmadabad, Gujarat, India as a generous gift.

Experimental design

Adult male albino rats of Wistar strain were used for the experimentation. The animals were divided into 5 groups of 6 animals each and treated as follows. Group I: Control group (1 mL kg^{-1} distilled water p.o), Group 2: Sildenafil citrate treated (5 mg kg^{-1} p.o), Group 3: *C. decidua* (100 mg kg^{-1} p.o), Group 4: *C. decidua* (200 mg kg^{-1} p.o), Group 5: per se group (only *C. decidua* 200 mg kg^{-1} p.o). All the above treatments were given orally for 28 days. The serum testosterone level was determined before treatment, day 0, day 7, day 14, day 21 and 28th day. On the 29th day all the rats were sacrificed and the testis, epididymis, seminal vesicle, prostate were dissected out, surrounding blood vessels and tissues were removed and blotted free of blood and mucous. The tissues were weighed using electronic balance.

Histological studies

The testis and cauda epididymis from the opposite side was settled in Bouine's liquid, inserted in paraffin, sectioned at 5 µm thickness and stained in haematoxylin and eosin and prepared for histological investigations.[8]

Statistical analysis

All the values were reported as mean±S.E.M. Analysis of variance (ANOVA) was employed to analyze the data, while Tukey's multiple comparison tests were used to test for differences between individual treatments groups using Graph pad prism software version 5.0. $P<0.05$ was considered statistically significant.

RESULTS

A dose-dependent increase in serum testosterone concentration were observed on the 21st and 28th day of the study in *C. decidua* extract (100 mg kg^{-1}) ($P<0.01$), *C. decidua* extract (200 mg kg^{-1}) ($P<0.001$), per se group (only *C. decidua* extract 200 mg kg^{-1}) ($P<0.001$). While sildenafil citrate group showed an increase in serum testosterone level on 14th, 21st and 28th day of the study as compared to control group ($P<0.001$) (Figure 1).

The body weight has increased in all the experimental animal groups. This increase is 6.5 % in control rats whereas it is 32.3, 21.61, 25.20 and 14.54 %, respectively in the rats treated with Sildenafil citrate, *C. decidua* extract (100 mg kg^{-1}), *C. decidua* extract (200 mg kg^{-1}), per se group (only *C. decidua* extract 200 mg kg^{-1}). Sildenafil citrate group showed a 7.6 % increase in testis weight, a 6.94 % increase in seminal vesicle weight, an 8.91 % increase in weight of epididymides and a 9 % in prostate gland weight.

Table 1. Effect of hydroalcoholic extract of *C. decidua* on body weight and secondary sexual organ weight on male wistar rats.

Treatment groups	Body weight (g)		Weight of organs on 28th day (mg 100 g^{-1} of body weight)			
	Day 0	Day 28	Testes	Seminal vesicle	Epididymides	Prostate
Control Group (1 mL kg^{-1})	107.5	114.5±0.76	950.83±0.6	415±1.42	746.16±0.47	281.33±0.8
Sildenafil citrate (5 mg kg^{-1})	103.16	136.5±0.67***	1023.66±0.71***	443.83±1.08***	812.66±0.88***	306.66±0.49***
C. decidua (100 mg kg^{-1})	101	122.83±0.6***	1014.5±0.76***	434.33±1.28***	797.16±0.6***	296.83±0.6***
C. decidua (200 mg kg^{-1})	103.83	130±0.57***	1024.83±0.6***	449±1.53***	814.5±0.76***	316.5±0.76***
Per se group (*C. decidua* 200 mg kg^{-1})	103.16	118.16±0.94*	970.16±0.87***	419.83±0.94	762±0.96***	289±0.96***

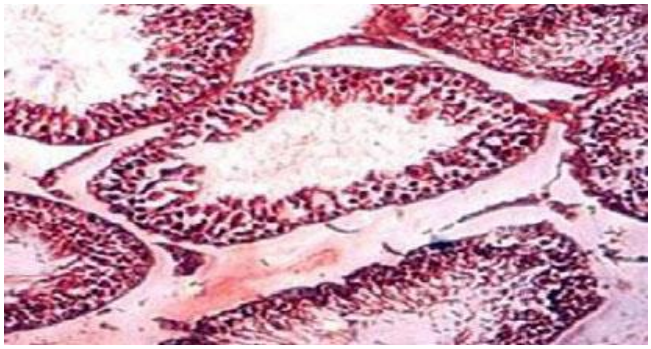

Figure 2. Control rat showing normal seminiferous tubules with normal spermatogenesis.

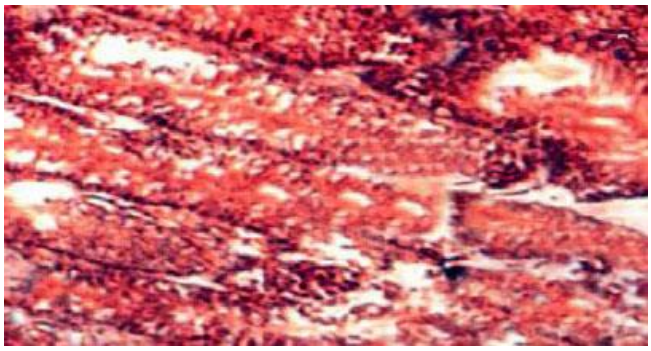

Figure 3. Sildenafil citrate treated rats showing increase in the size of seminiferous tubules, increase in the spermatogonia, spermatocytes and spermatids and spermatozoa.

The *C. decidua* extract (100 $mgkg^{-1}$) group showed an increment of 6.69 % in testis weight, a 4.65 % increase in seminal vesicle weight, a 6.83% increase in the weight of epididymides and a 5.50 % increase in prostate gland weight. Likewise, the *C. decidua* extract (200 $mgkg^{-1}$) group showed an elevation of 7.78 % in testis weight, an 8.19% increase in the weight of the seminal vesicle, a 9.15 % increase in the weight of the epididymides and a 12.50 % increase in prostate gland weight. Per se group (only *C. decidua* extract 200 $mgkg^{-1}$) showed an increment of 2.03 % in testis weight, a 1.16 % increase in seminal vesicle weight, a 2.12 % increase in the weight of epididymides and a 2.72 % increase in prostate gland weight after 28 days of treatment compared to the control group (Table 1).

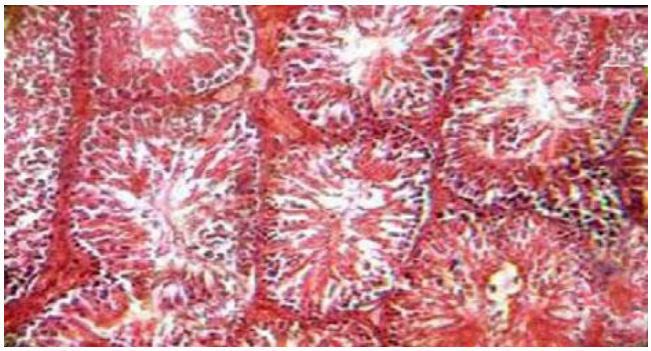

Figure 4. *C. decidua* (100 $mgkg^{-1}$) hydroalcoholic extract treated rat showing all types of spermatogenic elements and spermatozoa in the lumen.

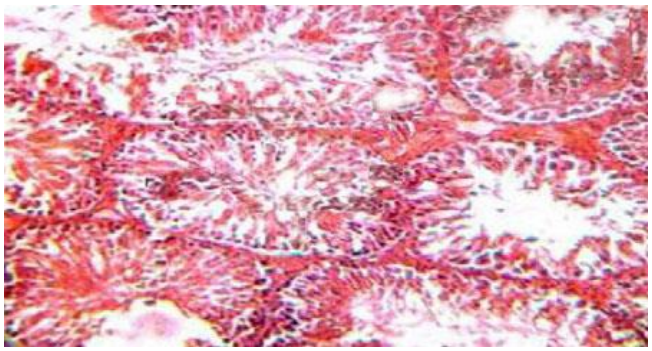

Figure 5. *C. decidua* (200 $mgkg^{-1}$) hydroalcoholic extract treated rat showing increased number of spermatogonia, spermatocytes and spermatids and more number of spermatozoa in lumen.

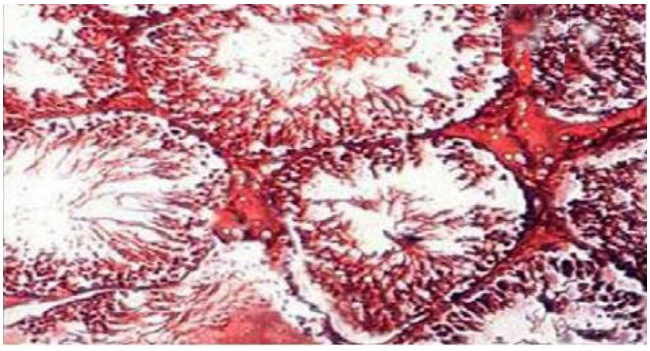

Figure 6. Per se group (200 $mgkg^{-1}$ of hydroalcoholic extract of *C. decidua*) showing moderate number of spermatogenic elements.

Histological examination demonstrated the control group with typical testicular structures, in confirmation with spermatogenesis. A noteworthy impact on spermatogenesis was noted following 28 days of treatment with the extract. The weight and size of the testis were found more in the plant extract treated groups. The germinal epithelium cells seemed, by all accounts, to be hyperactive. Substantial quantities of various cells at various phases of spermatogenesis were apparent. Sertoli cells were enlarged, highly processed, and rich in nutrients as appeared by very granulated cytoplasm. The expanding in the volume of the two cells and nuclei was strongly suggestive of steroid synthesis under the direct or indirect impact of the extract. The blood vessels of testis were slightly enlarged. Expanded spermatogenesis was obvious from the vast number of spermatozoa in the seminiferous tubules and was additionally appeared by the expansion in spermatogenic components compared with control group. (Figure 2-6).

DISCUSSIONS

In the present study administration of *C. decidua* extracts have stimulated the activity of testis and accessory organs. A significant ($P<0.001$) increase in testosterone level was found in the extract treated animals compared with control. It demonstrates that the extract has an impact at the endocrine level. Testosterone is the significant male gonadal hormone, and it is created by the interstitial Leydig cells in the testis. It is additionally the real factor for androgenicity.

A specific concentration of androgens is required for the initiation and maintenance of spermatogenesis and for the start and support of spermatogenesis and for the incitement of development and the working of the prostate and original vesicles. The expansion in testosterone level may improve androgen-dependent parameters such as mating behavior and the maintenance of spermatogenesis.[9-12]

Out of three extracts administered *C. decidua* (200 $mgkg^{-1}$) extract proved to be profoundly stimulant, *C. decidua* (100 $mgkg^{-1}$) extract is a medium stimulant and Per se group (*C. decidua* extract 200 $mgkg^{-1}$) is less stimulant in increasing the weight of testis and male reproductive accessory organs. There is likewise an advance in spermatogenesis as found in the expansion of spermatogenic components in the testis which might be because of the higher accessibility of pituitary follicle stimulating hormone (FSH), as FSH is known to invigorate the spermatogenesis. Both FSH and LH are important for meiosis and generation of spermatids. The possible increment in the number of spermatogonia, spermatocytes, and spermatids might be credited because of the expanded accessibility of FSH and LH in *C. decidua* extracts treated rats. The androgen synthesis in the testis is dependent on pituitary LH and FSH. The expanded weight in the accessory organ in treated rats demonstrates the extract may stimulate the FSH and LH release and testosterone production.[13,14]

Past phytochemical examines have demonstrated the *C. decidua*plant extract contains alkaloids, steroids, phenolic compounds, terpenoids, tannins, glycosides, flavonoids, and saponins. Saponins have been appeared to be responsible for endothelium-dependent nitric oxide release causing relaxation of the rat aorta. Nitric oxide is a noteworthy physiological boost for penile vasculature and trabecular smooth muscles, all necessary for penile erection.[15]

In this study, the investigation of different sexual parameters has approved the customary faith in the viability of the root, stem, and leaves of *C. decidua* for treating sexual dysfunctions. The outcomes additionally show the conceivable utilization of extract of *C. decidua* as an herbal alternative to the allopathic medicines that are gaining popularity for the treatment of sexual dysfunction.

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