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Evaluation of the Potential Aphrodisiac Activity of Aqueous, Chloroform and Alcohol Extract of *Gloriosa Superba* in Male Albino Rat

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ABSTRACT: In the present study, we examined the aphrodisiac activity of aqueous, chloroform and alcohol extract of *Gloriosa superba* tuber in male albino rats. For this study adult male albino rats were divided into 11 groups of 6 animals each. Group I (control) was administered with distilled water 0.5ml/rat, whereas suspension of the *Gloriosa superb* aqueous, chloroform and alcohol extract were administered at the doses of 100, 250, 500 mg/kg body weight to male rats of group II-X for 15 days once daily. Whereas the rats of group XI were administered with Sildenafil citrate (5 mg/kg body weight orally once at 15thday). The sexual behaviour, orientation activity and hormonal assay were studied in male albino rat of control and experimental groups and compared with those administered with the standard reference drug Sildenafil citrate. The stem and leaves extract of the *G.superba* plant showed aphrodisiac activity as evidenced by an increase in sexual and orientation behavior. Clinical toxicity symptoms such as respiratory distress, salivation, weight loss and change in appearance of hair as well as maternal mortality were not observed at any period of the experiment. The administration of 500 mg/kg body weight dose of plant extract produced two fold increase in serum testosterone concentration as compared with the control. The aqueous, chloroform and alcohol extract at the dose of 500 mg/ kg body weight had a pronounced effect on the overall sexual performance of the rats.

Keywords: Aphrodisiac, *Gloriosa superba*, Male albino rat, Sexual behavior, Testosterone.

I. INTRODUCTION

Sexual dysfunction is a very distressing condition for men. It can erode the male essence [1,2]. Male sexual dysfunction (MSD) affects not only sexual relationships, but also the overall quality of life. MSD includes erectile dysfunction (ED), ejaculation dysfunction, and hypogonadism, and represents a serious public health problem [3]. Premature ejaculation (PE) is the most common sexual dysfunction among young men worldwide, with a prevalence of more than 20% [4,5] and is characterized by a short latency time and a lack of control over ejaculation. In men suffering from PE, not only is the latency to ejaculation typically very short (e.g., 1 or 2 min or less), but the man's perceived control of latency and the timing of ejaculation are low or absent [6]. There has been a constant exploration for newer herbal and chemical agents to overcome these age-old problems of sexual dysfunction [7]. The present study was carried out to evaluate scientifically the aphrodisiac activity of *Gloriosa superba* used in the tribal belt.

Gloriosa superba belongs to the genus *Gloriosa* of the family Liliaceae. Originally present in the forest region of tropical Africa and Asia and is under cultivation in fairly large areas of India. According to Ayurveda, tuber is pungent, bitter, acrid, heating, anthemirtic, laxative, alexiteric and useful in ulcers, leprosy, piles, inflommations, abdominal pains, itching and thirst. *Gloriosa superba* is also claimed to be an abortifacient [8], *G.superba* tuber also shows a hepatoprotective activity [9].

However the validity of the tribal claimed aphrodisiac activity of *Gloriosa superba* has not been proven scientifically. Hence this study was carried out to provide scientific support for its purported folkloric usage.

II. METHODOLOGY

A. Collection of plant material

The plant *Gloriosa superba* was collected from Melghat region, identified and authenticated by experts from Botanical Survey of India, Pune, where a voucher specimen with herbarium accession number (SHPAGS6) was deposited.

B. Animal Stock

Healthy wistar male and female albino rats of approximately 8 weeks of age and weighing 100-160 gm were purchased from Sudhakarrao Naik Institute of Pharmacy, Pusad. They were housed in a polypropylene cages, maintained at a temperature of approximately 25 $\pm$ 2 $^{\circ}$C. And a photoperiod of 12 h light and 12 h dark cycle. The animals were provided with a standard pelleted diet (Trimurti Lab Feeds, Nagpur) and water *ad libitum*. They were allowed a 15 day acclimatization period before the experimental session.

All the experimental protocols were met with the approval of institutional Animal Ethics Committee with registration number (1060/ac/07/CPCSEA (IAEC/01/2009).

C. Preparation of plant extract

The stem and leaves of *Gloriosa superba* were collected, shade dried, cut into pieces, pulverized using an electric blender and subjected to soxhlet extraction for 24 h with distilled water (60 °C), chloroform (20 °C) and alcohol (20 °C). The extract was evaporated to near dryness on a water bath, weighed and stored at 4°c in refrigerator until the experimental testing.

D. Preparation of test samples

Aqueous, chloroform and alcohol extract was suspended in 5 ml/kg of distilled water or olive oil (Figaro- refined olive oil, Spain) and administered orally. Ethinyl estradiol (cyclenorm-E –Ethinyl estradiol tablet I.P. 0.01mg) manufactured by India Nutri Pharma) 10 ug/100 g b.w. and progesterone (Susten 100- progesterone I.P.- 100mg) Sun pharmaceutical Industries Limited, Gujarat, India) 0.5 mg/100 g b. w. were administered 48 h and 4 h respectively through subcutaneous injections. Sildenafil citrate suspension was prepared by crushing a tablet of Sildenafil citrate and administered orally at a dose of 5ml/kg in distilled water. Caverta - Sildenafil citrate IP-50mg Ranbaxy, Sirmour, India).

E. Treatement

The male rats were randomized into 11 groups comprising of 6 animals each. The reconstituted aqueous, chloroform and alcohol extract was administered orally using intragastric (ig) soft rubber catheter to all animals in different groups for 15 day at the doses given below.

Group I- administered with distilled water (5 ml/kg) served as control.

Group II-IV- administered with aqueous extract at the dose of 100, 250, 500 mg/kg body weight (b. w.) respectively in distilled water (5 ml/kg).

Group VI-VII- administered with daily dose of chloroform extract 100, 250, 500 mg/kg b. w. respectively in olive oil (5 ml/kg).

Group VIII-X- administered with daily dose of alcohol extract 100, 250, 500 mg/kg b. w. respectively in olive oil (5 ml/kg).

Group XI- given 5 mg/Kg b.w.of Sildenafil citrate suspension

III. EXPERIMENTAL DESIGN

A. Phytochemical analysis

The aqueous, chloroform and alcohol extract of *Gloriosa superba* were subjected to phytochemical and qualitative analysis of alkaloids, tannins, anthraquinone glycosides, saponins, phenolics, flavanoids and steroids [10].

B. Acute toxicity study

The healthy 60 male albino rats, starved for 3- 4 h, the group I was administered with the distilled water (1ml/rat), group II-X was administered with 1000, 2500 and 5000 mg/kg dose of aqueous, chloroform and alcohol extract and subjected to acute toxicity studies. The rats were observed continuously for 2 h for behavioral, neurological and autonomic profiles and for 24 and 72 h for any lethality or death. No death was observed at the highest dose (5000 mg/kg body weight) so it's one tenth (500mg/kg) used for studies as per Organization of Economic Co-operation and Development (OECD) 423 guideline [11].

C. Sexual behavior analysis

To ensure the receptivity female rats were brought to oestrous by the sequential administration of ethinyl estradiol (cyclenorm-E –Ethinyl estradiol tablet I.P. 0.01mg) manufactured by India Nutri Pharma) 10 ug/100 g B.w. and progesterone Susten 100-progesterone I.P.- 100mg Sun pharmaceutical Industries Limited, Gujarat, India) 0.5 mg/100 g b. w. 48 h and 4 h, respectively through subcutaneous injections, prior to pairing [12]. Receptivity was tested by paring with normal male rat before experimental testing and the female which was sexually active was termed as sexually receptive female. Each male rat was placed individually in the observation glass chamber in order to acclimatize it with the cage environment. The sexually receptive female rat was then allowed to enter the test cage silently. On the day 15 of extract treatment the male rats were observed for their activity between 18:00 to 20:00 pm and their sexual behavior was studied.

D. Orientation behavior analysis

The analysis of activity was carried out and analyzed in three segments with little modification [13].

Orientation towards female – (1 for every sniffing and 2 for every licking)

Orientation towards self – (1 for non-genital grooming and 2 for genital grooming)

Orientation towards environment – (1 for climbing and 2 for exploration)

The orientation behavior of male rats was scored using the above method of scoring:

E. Effect on body and organ weight

24 h after the extract dosing the body weight of animals was determined. The animals were then sacrificed and organs like testis, seminal vesicles, and prostate glands were carefully removed and their weight were recorded [14].

F. Hormonal Assay

The same set of animals used for sexual behavior parameters were also used for the testosterone assay.

They were sacrificed under light ether anesthesia, 24 h after the extract dosing and the blood was collected from the heart and serum was separated and analyzed for cholesterol by Cod Pap method [15] and Testosterone level by electro-Chemiluminescence immunoassay (ECLIA) method using Eclesys Testosterone reagent kit (Roche Diagnostic GmbH, indiana polis, IN, USA).

G. Statastical analysis

The data are expressed as mean±SE. Statistical analysis was done by using paired and unpaired Student's t-test and one way analysis of variance (ANOVA) [16].

IV. RESULTS

Phytochemical screening of the aqueous, chlololform and alcohol extract of *Gloriosa superba* tuber showed the presence of alkaloids, steroid and saponins, while anthraquinone glycosides, tannins, and phenolic compound were found to be absent.

The result of the acute toxicity test shows no lethal or any treatment related effects of the extract of *Gloriosa superba* tuber in all treatment groups of animals. Clinical toxicity symptoms such as respiratory distress, salivation, weight loss and change in appearance of hair as well as maternal mortality were not observed. Similarly no changes in the behavioural and neurological profiles were observed in treated groups of the rats up to highest dose of 5000 mg/kg body weight. Hence one- tenth of this dose was used for further testing.

Administration of *Gloriosa superba* tuber extract (aqueous, chloroform and alcohol) for 15 days to male rats influenced the behaviour of the treated animals in a dose-dependent manner. Increase in the Mount frequency (MF) and Intromission frequency (IF) were observed in all three extract treated groups (aqueous, chloroform and alcohol) in a dose dependant manner that was statistically significant (P<0.001) when compared with control. However the mount latency (ML), Intromission latency (IL) and ejaculatory latency decreased significantly with the increased doses of the extract. A significant increase in intromission frequency in Sildenafil citrate treated group as compared to control was noted (Table 1).

Table 1: Effect of aqueous, chloroform and alcohol extract of *Gloriosa superba* tuber on sexual behavior of rats on 15th day (n = 6).

Treatment groups	Drug dose (mg/kg body wt.)	Mount latency (time in min.)	Mount frequency (No. no.)	Intromission latency (time in min.)	Intromission frequency (No.)	Ejaculatory latency (time in min.)
Control (Group I)	vehicle	3.34±0.01	3.33±0.20	25.06±0.18	1±0	29.58±0.13
Aqueous extract (Group II-IV)	100	2.5±0.22***	5.5±1.36	17.96±0.14***	1.33±0.19***	29.57±0.41ns
	250	0.05±0.10***	10±1.36***	11.72±0.14***	2.66±0.20***	28.04±0.13***
	500	0.04±0.02***	20.66±1.38***	9.13±0.08***	3.5±0.22***	25.82±0.26***
Chloroform extract (Group V-VII)	100	0.86±0.09***	3.83±1.35ns	16.73±0.23***	1.16±0.16**	29.57±0.13***
	250	0.52±0.025***	9±1.36***	10.90±0.18***	2.33±0.20***	28.18±0.19***
	500	0.07±0.021***	18.66±1.38***	8.46±0.06***	3.16±0.16***	27.05±0.51***
Alcohol extract (Group VIII-X)	100	0.57± 0.25***	3±1.34ns	18.13±0.15***	1.22±0.14**	29.58±0.13***
	250	0.38±0.07***	7.5±1.37**	12.06±0.07***	2.16±0.52***	28.48±0.13
	500	0.20+0.14***	15.83±1.35***	9.8±0.72***	2.5±0.69***	27.70±0.13***
Sildenafil Citrate (Group XI)	5	0.05±0.02***	10.33±0.20***	11±0.01***	4.66±0.80***	26±0.13***

P values: *<0.1, **<0.01, ***<0.001, when compared with control, ns=non significant. Values are mean±S.E.

There was significant increase in orientation behavior parameters in extract treated group and Sildenafil citrate treated group, In particular there was increase in mean orientation scored towards female as indicated by increase in parameters such as in licking and anogenital sniffing and mean orientation score towards self indicated by increase in parameters such as nongenital grooming and genital grooming. Attraction towards environment was more evident in plant extract treated group of male rats when compared to the control group, but was less as compare to orientation score towards female and towards self. Among the three extract, (aqueous, chloroform and alcohol) treated group the aqueous extract (500 mg/kg b.w.) showed a highly significant effect on orientation behavior as compared to control (P<0.001). It was observed thatanimals in the aqueous extract treated group were twice as sexually active than control rats (Table 2).

Table 2: Effect of aqueous, chloroform and alcohol extracts of *Gloriosa superba* on orientation activities in male rats (n = 6).

Treatment groups	Doses (mg/kg body wt.)	Mean orientation score towards female (licking & anogenital sniffing)	Mean orientation score towards environment (climbing & exploration)	Mean orientation score towards self (nongenital grooming & genital grooming)
Control (Group I)	Vehicle	6.16±0.16	6.16±0.23	7.16±0.23
Aqueous extract (Group II-IV)	100	7.33±0.20***	6.16±0.16ns	8.5±0.22**
	250	9.16±0.30***	7.33±0.20***	10.66±0.20***
	500	13.16±0.30***	10.5±0.22***	13.5±0.22***
Chloroform extract (Group V-VII)	100	6.33±0.20ns	4.33±0.20ns	7.5±0.22*
	250	7.33±0.20***	5.33±0.20***	9.16±0.16***
	500	11.16±0.16***	8.66±0.20***	12.16±0.16***
Alcohol extract (Group VIII-X)	100	5.33±0.20***	3.16±0.26ns	7.16±0.16ns
	250	6.5±0.22ns	3.66±0.20ns	8.33±0.20***
	500	8.33±0.25***	7.5±0.22***	11±0.25***
Sildenafil Citrate (Group XI)	5	8.5±0.27***	8.66±0.21***	7.66±0.62ns

P values: * <0.1, **<.0.01, ***<0.001, when compared with control, ns= non significant.
Values are mean ± S.E.

The three extracts (aqueous, chloroform and alcohol) of *Gloriosa superba* at the dose of 500 mg/kg b.w. resulted in an increase in body and organ weight in treated animals in a dose dependant manner. There was significant increase in weight of testis (P<0.01), seminal vesicle and prostate gland (P<0.01), in aqueous, chloroform and alcohol extract treated group as compared to control. In Sildenafil citrate treated group of male rats also a similar increase in weight of testis, seminal vesicle and prostate gland were observed (Table 3).

Table 3: Effect of *Gloriosa superba* extract on body/organ weights of albino rats (n = 6).

Treatment groups	Doses (mg/kg body wt.)	Body weight Initial body wt. (g) (0 days)	Final body wt. (g) (15th days)	Increase in body weight (g)	Weight of testis (15th day) (mg/100g)	Weight of seminal vesicle (15th day) (mg/100g)	Weight of prostate (15th day) (mg/100g)
Control (Group I)	Vehicle	189.16±3.28	191.83±5***	2.67	0.69±0.01	0.067±0.02	0.09±0.02
Aqueous extract (Group II-IV)	100	198.83±35.03	201.66±3.62***	2.83	0.74±0.01***	0.08±0.02ns	0.14±0.001 ***
	250	190.16±3.74	195.33±3.71***	5.17	1.23±0.01***	0.18±0.02 ***	0.60±0.001 ***
	500	196±3.41	209.83±5.75***	13.83	1.37±0.03***	0.24±0.04 ***	1.13±0.005 ***
Chloroform extract (Group V-VII)	100	112.83±3.61	118.33±3.62***	5.5	1.07±0.08***	0.09±0.04 ns	0.18±0.11 ns
	250	138.33±8.83	146.66±9.18***	8.33	1.23±0.16**	0.16±0.05 ns	0.37±0.13*
	500	185±11.41	198.66±7.75ns	13.66	1.32±0.08***	0.24±0.11 ns	0.59±0.13 **
Alcohol extract (Group VIII-X)	100	197.5±2.55	202.83±4.14*	5.33	0.71±0.04ns	0.08±0.03 ns	0.1±0.1 ns
	250	206±4.91	211.83±4.97***	5.83	1.08±0.04***	0.15±0.03 *	0.52±0.13 **
	500	191±5.46	204.5±12.72ns	13.5	1.3±0.05***	0.26±0.03 ***	1.08±0.13 ***
Sildenafil Citrate (Group XI)	5	196.66±3.36	198.66±5.67***	2	1.27±0.01***	0.20±0.02***	0.66±0.009 ***

P values: * <0.1, **<.0.01, ***<0.001, when compared with control, ns= non significant. Values are mean ± S.E.

Dose dependent increase in serum testosterone concentration of aqueous, chloroform and alcohol extract treated group of male rats (P<0.01) on 15th day of study was noted. There was significant increase in serum testosterone concentration in aqueous extract treated group (500 mg/kg) as compared to control. Approximately two fold increase was noted in aqueous, chloroform and alcohol extract treated group (500 mg/kg) as compared to control. Increase in serum testosterone concentration in Sildenafil citrate treated group of male rats as compare to control was also noted. An increase in cholesterol level in the three extract treated group (aqueous, chloroform and alcohol) as compared to control was noted (P<0.01) (Table 4).

Table 4: Effect of aqueous, chloroform and alcohol extracts of *Gloriosa superba* ontestosterone hormone in male rats (n = 6).

Treatment groups	Doses (mg/kg body wt.)	Cholesterol (mg %)	Testosterone (µg/dl)
Control (Group) I	vehicle	64.66±0.16	141.83±5.79
Aqueous extract (Group II-IV)	100	68.66±0.60***	149.53±8.22ns
	250	77.16±0.84***	190.5.59±0.86***
	500	79.5±1.35***	285.08±6.25***
Chloroform extract (Group V-VII)	100	66.5±0.55***	146.6±5.58ns
	250	69.33±5.54***	180.38±5.59***
	500	75.16±3.03***	263.08±5.58***
Alcohol extract (Group VIII-X)	100	65.16±0.31ns	144.53±0.97ns
	250	69±0.44***	170.53±5.58***
	500	72±0.44***	245.06±1.37***
Sildenafil Citrate (Group XI)	5	72.83 ± 0.64***	223.82±8.06***

P values: * <0.1, **<.0.01, ***<0.001, when compared with control, ns = non significant. Values are mean ± S.E.

V. DISCUSSION

The aqueous extract of *Gloriosa superba* stem and leaves has been in use by the tribals of Melghat region as a means of treating sexual inadequacy and stimulating sexual vigor even without recourse to the scientific validity of the claim. Hence this study was carried out to validate scientifically this tribal claim.

Phytochemical screening during the aphrodisiac study of the *Fodegia agrestis* stem was reported to show the presence of major metabolites of alkaloids and saponins, while anthraquinones and flavonoids were weakly present [17]. Similar results were obtained during the present phytochemical study on *Gloriosa superba* which shows the presence of alkaloids, steroids and saponins. Alkaloids increase the dilation of blood vessels in the sexual organs [18]. In *Panax quinquefolium* (Ginseng) saponin has been shown to enhance libido and copulatory performance by acting directly on the central nervous system and gonadal tissues [19] and evidence suggests that it can facilitate penile erection by directly inducing the vasodilatation and relaxation of the penile corpus cavernosum via an NO-dependent mechanism [20], Phytochemical investigation on petroleum ether extract of *Pedalium murex* was found to contain higher concentrations of steroids and sterols, and moderate concentrations of flavanoids, phenols, glycosides, alkaloids, proteins, terpenes, carbohydrates, and gums and mucilage. It has been reported that steroidal constituents found in the plant possess fertility potentiating properties [21]. In the present study, alkaloids and saponins which were found to be present in *G. superba* stem and leaves extract may be responsible for its aphrodisiac activity.

Petroleum ether extract of *Pedalium murex* produced no toxic symptoms or mortality up to a dose level of 2000 mg/kg body weight orally in rats, and hence the drug was considered safe for further pharmacological screening [21]. The present study on *Gloriosa superba* shows that the plant extract upto the dose of 500 mg/kg b.w. was found to be very safe and nontoxic hence it was used for the present aphrodisiac study. Petroleum ether extract of *Pedalium murex* produced no toxic symptoms or mortality up to a dose level of 2000 mg/kg body weight orally in rats, and hence the drug was considered safe for further pharmacological screening [21].

The present study confirmed that the extract (aqueous, chloroform and alcohol) of *Gloriosa superba* stem and leaves possesses sexual enhancing effects on male rats as evidenced by the increased mount (MF) and intromission (IF) frequencies and a highly significant decrease in mount (ML) and intromission latencies (IL), when compared with the control. The aqueous extract of the *Gloriosa superba* (500 mg/kg b.w.) tuber has a pronounced effect on sexual behaviour by shortening mount latency (ML) and ejaculation latency (EL). Similarly in Sildenafil citrate treated group increased mount frequencies (MF) and intromission frequencies (IF) while decrease in mount (ML) and intromission latencies (IL) was noted, when compared with the control. Decrease in ML and EL are considered to be the indicators of an increase in sexual motivation in *Kaempferia parviflora* [22].

Aqueous extract of *Arctium lappa* L. roots significantly increased MF and IF and also caused significant reductions in ML and IL, compared with control group of rat. Increased MF and IF are considered to be indices of libido (sexual desire) and potency, while decreased ML and IL are also indicators of sexual arousal. The significant increases in MF and IF and the decreases in ML and IL indicate that libido and potency were enhanced by *Arctium lappa* L. root extract [23-26]. Above evidences prove that *Gloriosa superba* possesses an aphrodisiac action.

An increase in self exploratory behavior is reported in *Pederia foetidus* during its aphrodisiac study indicative of an enhancement of the overall sexual stimulus in the body, which is considered to be very important for the treatment of sexual debility [27]. Similar results were obtained in the present study on *Gloriosa superba* tuber which shows enhanced orientation behaviour. Aqueous extract of *Gloriosa superba* (500 mg/kg b.w.) shows highly significant increase in orientation behaviour (orientation towards self and orientation towards females) as compared to control. But there was a reduction in orientation towards an environment in the extract treated group. Chloroform, methanol, Water and Butanol fractions of *Eurycoma longifolia* Jack modified the orientation activities of the middle-aged male rats, after dosing them with 200, 400 and 800 mg/kg body weight twice daily for 10 days prior to the test . The treated male rats significantly displayed licking and anogenital sniffing towards the receptive females, and it further intensified self orientation as indicated by the increased grooming of the genitals compared to the controls ($P<0.05$) [28]. Ethanolic extract of *Ocimum gratissimum* increase the orientation behavior in mice [29]. Similar intensification in orientation behaviour of rat was observed in the present study on *Gloriosa superba* suggesting its aphrodisiac role.

The result of the present study shows that administration of aqueous extract of *Gloriosa superba* tuber increases the weight of the organs likes testes, seminal vesicle and prostrate significantly in treated animals. The final body weight of rats of all extract treated groups increased markedly when compared with their initial body weights. Similarly increase in total body weights of rat after administration of *Pedalium murex* was reported [21]. *Tribulas terristus* test drug has been proved to demonstrate an anabolic effect as evidenced by body weight gain and weight gain of reproductive organs [30]. The study on *Piper guineense* shows a significant increase in the body weight of treated rats, which was reported to be due to the androgenic properties of this plant since androgens possess anabolic activity [26]. These findings support the androgenic nature of the *Gloriosa superba* tuber.

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 as reported in *Tribulus terrestris* [31]. The findings of present study on *Gloriosa superba* (aqueous, chloroform and alcohol) extract at various doses show that there was increase in serum cholesterol and testosterone concentration in treated rats ($P<0.001$) as compared to control. Sildenafil citrate treated group of male rat also show enhanced level of serum cholesterol and testosterone as compared to control. Similar results were observed after administration of aqueous root extract of *Arctium lappa* which increased testosterone, indicating the involvement of the stimulation of hypothalamic-pituitary-gonadal axis [32]. Where as the study on vagikaran rasayana herb stated that the increase in testosterone might have been caused by the enhancement in the GnRH-LH signalling [33]. Testosterone is the main male gonadal hormone produced by the interstitial Leydig cells of the testis. In the testes, Luteinizing hormone (LH), a gonadotrophin stimulates synthesis and secretion of testosterone [34]. Administration of extract of *Arctium lappa* increased testosterone level and it was stated that some phytoconstituent present in the extract may possibly mimic the function of LH to stimulate interstitial cells. In the complex mechanism that regulates copulatory behaviour, an increase in testosterone level due to *Panax quinquefolium extract* has been associated with a moderate but significant increase in sexual desire and libido [35-37]. The increase in level of testosterone in *Gloriosa superba* extract treated rats may also be associated with the increase in sexual desire and libido of rats.

In conclusion, the study validates the effectiveness of herb in improving the functionality of sexual organ as well as substantiates the hype that this plant has aphrodisiac activity and may be helpful in improving the sexual behavior and performance.

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