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ANTI-ANXIETY AND NOOTROPIC ACTIVITY OF CARALLUMA FIMBRIATA EXTRACT IN ALBINO WISTAR RATS

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Abstract:

Objective: *The current investigation was planned to assess Anti-anxiety and Nootropic activity of aqueous and ethanol extracts of Caralluma fimbriata. in Albino wistar rats.*

Methods: Anti-anxiety of aqueous and ethanolic extracts of Caralluma fimbriata was appraised by adaptogenic activity in rats through the forceful swimming. Biochemical parameters such as 6-β-OH-cortisol, urinary vanilly mandelicacid (VMA), homovanillic acid (HVA), ascorbic acid and 5-hydroxy indole acetic acid (5HIAA) were estimated to analyze the anti-anxiety activity. Aqueous and ethanolic extracts of Caralluma fimbriata were administrated orally at dose of 200 and 400mg/kg body weight 1h before the induction of anxiety to prevent anxiety-induced urinary biochemical changes in a dose dependent manner. Behavioral procedures of anxiety and cognitive-enhancing were assessed in rats. A ethanolic extract of C. fimbriata with dose ranges of 100, 200, and 400 mg/kg was given once a daily for 7 days via oral route and the efficacy was matched by those elicited by lorazepam (1 mg/kg, p.o.), imipramine (10 mg/kg, p.o.) and Withania somnifera (100 mg/kg, p.o.) for antianxiety, and nootropic studies, respectively. Standard drugs were given 1 time, 30 min preceding the behavioral trials.

Results*: Nevertheless, in all groups which were treated with aqueous and ethanolic extracts of Caralluma fimbriata, there was no statistically difference between level of 6-β-OH-cortisol, urinary vanillymandelic acid (VMA), homovanillic acid (HVA), ascorbic acid and 5-hydroxyindoleacetic acid (5HIAA) as compared to normal animals. One-way analysis of variance followed by Newman–Keuls multiple comparison test was employed to analyze the results. $P < 0.05$ was considered statistically significant as compared to control. CF at 400 mg/kg also induced an antianxiety activity similar to imipramine, in the behavioral despair, learned helplessness test, and tail suspension among selected doses of the CF. Moreover, CF at 400 mg/kg produced a significant nootropic effect.*

Conclusion*: The study shows that among the different CF doses, CF at 400mg/kg possesses significant antianxiety and nootropic effects has therapeutic beneficial for the management of psychological ailments.*

Keywords*: adaptogenic activity, Caralluma fimbriata, biochemical parameters.*

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INTRODUCTION:

Anxiety, nootropic (cognitive-enhancing) and stress are the most predominant psychological diseases globally. The estimated range of their occurrence among adolescents across the globe is from 5% to 70%[1]. Implausibly, women are more affected by this unwellness rather than men.[2] Currently, antianxiety, antidepressants, and antistress drugs are the only choice of treatment for these maladies. Regardless of therapeutic benefits, these drugs also cause unusual adverse effects which ensue patient's noncompliance. The drugs derived from natural origin barely have side effects and moreover, are economically cheaper. Anxiety is described as an individualized response of an organism to external and internal challenges that can be governed with intricacies[3].Anxiety can be aroused by environment, social and pathological conditions arising during the life which induces changes in the immune, endocrine and nervous systems[4]. Hence, anxiety/stress has been assumed to be involved in the epiopathogenesis of a various ailments such as psychotic disorder (depression/anxiety), endocrine disorder (diabetes mellitus), male sexual dysfunction, cognitive dysfunction, peptic ulcer, ulcerative colitis, immune suppression and hypertension [5].

The evidences obtained from previous literatures revealed that main researches were undertaken on alternation of biochemical, neurochemical and molecular effect engendered by Anxiety/stress[6,7]. The neurotransmitter (epinephrine, norepinephrine, dopamine, and serotonin) and glucocorticoids (cortisol, corticosterone) has a crucial role during anxiety [3]. Herbal remedies have been investigated for treatment of anti-anxiety activity[8]by reason of having adaptogenic properties due to their active constituents[9].***Carallumafimbriata*** belongs to family Asclepiadaceae commonly called as a famine food, appetite suppressant and thirst quencher among tribal populations[10].This plant has been used traditionally as analgesic, anti-inflammatory and antihyperglycaemic[11].The Present research was taken up to predict potential anti-anxiety activity of aqueous and ethanol extracts of Caralluma fimbriata.

MATERIALS AND METHODS:

Plant material and preparation of extracts

The leaves of *Caralluma fimbriata* were collected from Andhra Pradesh, India and authenticated by Department of Botany, affiliated to Osmania University. Telangana, India, The fresh leaves of ***Caralluma fimbriata*** were washed with tap water and air dried for 1h. Then it was cut into small pieces, dried in room temperature for two weeks, grounded into powder with the help of hand mill and stored in room temperature. The leaves powder was macerated in the solvents including ethanol 95% (v/v) and water at room temperature, undergoing mechanical shaking for 4h followed by filtration. The extracts obtained were concentrated in a rotary evaporator at 40°C and the residue was extracted twice again analogously, thereby obtaining the crude solvent extracts.

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Chemicals

Homovanillic acid (CAS306-08-1), vanillymandelic acid (VMA), 6-β-OH-cortisol, 5-hydroxyindoleacetic acid (5HIAA) and ascorbic acid was purchased from Ganis Scientific & Surgicals Telangana, India. Acetonitrile and methanol HPLC grade were supplied from Qualigens, Fischer Scientific, mumbai. All other chemicals were analytical grade and obtained from local store of Ganis Scientific & Surgicals Telangana, India

Albino wistar rats (150-200gm) of either sex obtained from the NIN animal house, Hyderabad and were housed at room temperature in a well-ventilated animal house. The animals had natural day and night cycle with temperature between 25±3°C. The animals were maintained under standard conditions. The rats had free access to standard rat chow and water ***adlibitum*** for at least one week prior to use. The study protocol was approved by Institutional Animal Ethics Committee (IAEC), AUC Institute of Pharmaceutical Sciences, Hyderabad.

Evaluation of anti-anxiety activity

Calibration curve was obtained for determination of standard value of HVA, VMA, 6-β-OHcortisoland5-HIAAinurineby using HPLC method[12].Calibration curve for ascorbic acid was attained to estimate standard value of this biomarker by using spectrophotometer [13]. Rats of either sex weighing between 180–220gm were divided into five groups (I,II,III, IV&V) each containing six animals. The 24 h urine samples from each group were collected into two different beakers, one containing 5 ml of 10% oxalic acid for the spectrophotometric determination of ascorbic acid at 550 nm and the other containing 0.5ml of 6 N hydrochloric acid for the determination of anxiety metabolites. The experimental protocol was divided into four phases: In the first phase of the experiment, 24 h urine samples were collected in all the groups and subjected to analysis for all biomarkers to gain the normal value for 4 consecutive. In the second phase, after a recovery period of one week, the

animals were subjected to swimming anxiety individually. The 24h urine samples were collected in all the groups and subjected to analysis for finding changes in biomarkers value during stress for 4 consecutive days. In the third phase of the experiment, after a recovery period of one week, the experimental animals were treated as follows for 4 consecutive. Group 1 rats served as normal control and received 2ml/kg distilled water, group 2, 3 rats were administrated orally with aqueous extracts of *Caralluma fimbriata* at dose of 200mg/kg and 400 mg/kg respectively. Group 4, 5 rats received ethanol extracts *Caralluma fimbriata* orally at dose of 200mg/kg and 400 mg/kg respectively. In the final phase of the experiment, after a recovery period of one week, the administration of *Caralluma fimbriata* extract were done as mentioned in the third phase, one h prior to the daily induction of anxiety for 4 consecutive d while group I serving as control. The 24 h urine samples were collected in all the groups and subjected to analysis for all bio markers and the data were noted for 4 consecutive d to estimate the effect of the aqueous and Ethanol extracts of *Caralluma fimbriata* on the anxiety induced biochemical changes.

Aqueous and ethanolic extracts of *Caralluma fimbriata* significantly ($P<0.05$) diminished urinary levels of VMA, in group II-V. Significant reduction ($P<0.05$) in 5-HIAA, 6-β-OH cortisol and HVA was found in group III, IV And V. Significant increase ($P<0.05$) in urinary ascorbic acid levels was perceived in group III, IV and V compared to their respective anxiety condition.

CF dose was selected on the basis of randomization and was administered in distilled water to Groups (II, III, and IV) at 100, 200 and 400mg/kg orally, once in a day for 7days. The control group (Group I) received an equal volume of distilled water. Standard drugs were also employed to Group V accordingly in each set of protocol and were dispensed orally to animals 1h before the experiments. On day7, animals were subjected to behavioral studies.

Nootropic Activity

Elevated plus maze -

The apparatus for elevated plus-maze test contained 2 open arms (50cm×10cm×40cm) and 2 closed arms (50 cm × 10 cm × 40 cm), for rats facing each other with an open roof that extends from a common central platform (10 cm × 10 cm).The maze was kept in a dimly lit room and elevated at a height of 50cm above the ground level. The rats were positioned in the center of the maze independently, facing one of the closed arms. Thereafter, a number of entries and time spent on the open and closed arms were documented throughout the 5 min observation period. An arm entry was defined when four paws of the rats were inside the arm. A neutral "blind" observer made observation. [14]

Open field test-

The open field test apparatus was built of plywood (60cm×60cm×60cm) and was painted black. White marks of 6mm wide divide the floor in to sixteen squares (15cm×15cm). The open field was lit with 16W bulb focusing on to the arena from a height of 100 cm excluding the open field; the whole room was kept dark throughout the experiment. Animals were positioned individually at the center of the test apparatus for 5min, and the following behavioral aspects were observed [15].

- Ambulation: Assessed in terms of the number of squares traversed by the rat
- Rearings: Measured in terms of the number of times the rat

raised on its rear limbs

- Self-grooming: Measured in terms of the number of times The rat cleaned facial region and licked different body parts
- Activity in center: Measured in terms of the number of Central squares traversed by the rat.
- Fecal dropping: Measured in terms of the number of fecal Droppings excreted during the observation.

Social interaction test-

The rodents were individually accommodated for 5 days prior investigation. The test device consists of a wooden box (60cm×60cm×35cm) located in a faintly illuminated room.On the 6thday, the rodents were individually positioned in the wooden box and offered two 7.5min familiarization sessions at 2 h time period. On the 7thday, based on sex and weight, rodents were paired and retained in the apparatus for 7.5min. The total time devoted by the rodent pair in "social interaction," included sniffing, biting, grooming, boxing, kicking, and crawling under or over the partner, was documented during 7.5min time, by a neutral blind observer.[16]

Anti-anxiety activity

Behavioral despair test-

Each animal was restrained in a cylinder (45cm×20cm) filled with water at a height of 38 cm (25°C ± 2°C) so that it could not contact with the bottom of the cylinder with its rear paws or mount over the edge of the cylinder. Dual swim sessions were performed, an early 15 min pretest followed by a 5 min test after 24h of drug administration. During the test session, the immobility period characterized by absolute cessation of swimming and performing necessary movement's essential to place its head

beyond the aquatic level was observed. [17]

Tail suspension test

Each rat in the group was hanged by the tail (50 cm above the floor) with an adhesive tape to a cord in an upside down position so that its nostrils touch the water surface in a vessel. After the early escape-oriented actions, the rat rapidly turns out to be immobile, and the immobility period (the absence of initiating movements and includes passive swaying) was recorded during 5 min observation period.[18]

Learned helplessness test

Rats were exposed to a shock of 0.7 mA for 10 s every minute for 1h. The gadget was a box with dimensions of 30cm×45cm×30cm having grid floor. At an altitude of 20 cm above the base, a platform (7.5 cm × 7.5 cm) was introduced from one side wall to permit a jump-up escape reaction.The platform was not provided for the whole period of training. After the proper treatment, the rats were allowed for acquisition of a jump-up response. At the beginning of a trial, the platform was provided in the box, and a current of 0.7mA was introduced. The shock was ceased in 10s if the rat couldn't escape on to the platform within the specified period. If an escape retort ensued, the rat was permitted to stand on the platform for the length of 10s, and then reverted to the base.[19]

Statistical analysis

The data were displayed as mean ± S.E.M. Statistical analysis was done by using student's paired t-test, where the difference was considered significant if $p < 0.05$.

RESULTS AND DISCUSSION:

Anxiety is linked to many diseases such as heart disease, stroke, cancer, gastrointestinal problems, necrosis, etc[3]. In view of the increasing investigation towards plants have non- specific resistance (adaptogens) activity towards anxiety, current research was considered to estimate the effect of aqueous and ethanol extracts of Carallumafimbriata on non- invasive bio markers. Locus coeruleus in the centre and sympathetic nerves in the periphery release noradrenaline as the mediator [20].

Raphe nuclei in the centre and enterochromaffin cells in the periphery secrete serotonin as the mediator. While neurons of mesolimbic system, nigrostriatal system and tubero infundibular system in the centre and the renal system in the periphery secrete dopamine as the mediator. These amines are metabolized by MAO and COMT to various metabolites for instance; HVA is a metabolite of dopamine, VMA is a metabolite of NA,5-HIAAis a metabolite of serotonin, 6-β-OH cortisol is ametabolite of cortisol and ascorbic acid is a metabolite of glucose that all of the m were appraised as non- invasive bio markers to divulge the increase in peripheral sympathetic activity during anxiety to evaluate the anti-anxiety activity of aqueous and ethanol extracts of Carallumafimbriata[13].The standard value of HVA, VMA, 6-β-OH cortisol, 5-HIAA and ascorbic acid were obtained by calibration and exhibited respectively in Table1-5. Figures1-5 displayed the effect of aqueous and ethanol extracts of Carallumafimbriata on urinary levels of HVA, VMA, 6-β-OHcortisol, 5-HIAAand ascorbic acid biomarkers respectively in normal and anxiety condition. There was variation in each bio markers from group to group in normal state. The amount of VMA was found to below in group I (0.353µg ± 0.019) and high in group V (0.429µg± 0.014). The amount of 5-HIAA was perceived to be low in group II (0.375µg ± 0.014) and high in group V (0.518µg± 0.015). The amount of 6-β-OH cortisol was observed to be low in group V (0.435µg± 0.016) and high in group I(0.518µg ± 0.013). The amount of HVA was noted to be low in group I (0.109µg ±0.005) and high in group III (0.159µg± 0.014). The amount of ascorbic acid was found to low in group IV (44.46µg±1.53) and high in group I (54.01µg±4.49).The data revealed the significant increase ($P< 0.05$) in urinary level of HVA, VMA, 6-β-OHcortisol, 5-HIAA and significant reduction ($P<0.05$) in urinary level of ascorbic acid in anxiety condition. The changes in levels of the urinary metabolites in animals treated with aqueous and ethanol extracts of Carallumafimbriata as compared to normal basal levels were found to be non-significant.

Results

Effect of the *Caralluma fimbriata* Extract on Elevated Plus Maze

CF (200 and 400 mg/kg) treated rats exhibited a significant increase in entries made ($P = 0.0021$, $P < 0.001$) and time spent in open arms ($P=0.0063$,$P<0.001$) except at 100mg/kg ($P>0.05$).CF-treated rats exhibited a significant decrease in entries made ($P<0.001$,$P<0.001$) and time spent ($P=0.0218$,$P<0.001$) in enclosed arms at 200 and 400mg/kg, respectively. Lorazepam ($P < 0.001$) also produced significant anxiolysis and its effect was qualitatively comparable to that of CF. The results were summarized in Table-I.

Effect of the *Caralluma fimbriata* Extract on Open Field Test

Rats treated with doses (100,200 and 400mg/kg) of CF showed a significant increase in open field ambulation ($P=0.0221$, $P<0.001$,and$P<0.001$), rearing ($P>0.05$,$P<0.001$, and $P<0.001$), activity in center ($P>0.05$, $P>0.05$, and $P=0.0041$), and self-grooming (P

< 0.001, P < 0.001, and P < 0.001) when compared to vehicle-treated rats and produced comparable activity with lorazepam; indicating anxiolytic activity of CF. Simultaneously, a significant decrease in fecal droppings was observed at all doses of CF, except at 200 mg/kg (P > 0.05). Lorazepam (P < 0.001) also induced significant anxiolytic activity and its effect was also found to be qualitatively comparable to that of CF. The results were summarized in Table-II.

Effect of the *Caralluma fimbriata* Extract on Social Interaction Test

Rats treated with CF spent significantly more time in social interaction as compared to control rats in a dose-dependent wise (P<0.001). Similarly, lorazepam-treated group exhibited a significant increase in social interaction (P<0.001) in rats and its effect was comparable to CF at all doses. The results were shown in Table-III.

Effect of the *Caralluma fimbriata* Extract on Behavioral Despair Test

CF at 100mg (P=0.013), 200mg (P<0.001), and 400mg/kg (P<0.001) treated rats caused a significant dose-dependent decrease in immobility time. Imipramine also showed similar activity and effects were qualitatively comparable to that of CF (P<0.001). The results were summarized in Table-IV.

Effect of the *Caralluma fimbriata* Extract on Tail Suspension Test in Rats

CF at 100(P=0.017), 200(P<0.001) and 400mg/kg (P<0.001) treated rats significantly reduced the immobility time dose- dependently, and CF at 400 mg/kg (P > 0.05) produced the equivalent effect as that of imipramine, a well-established antidepressant drug, which showed a significant reduction in immobility time. The results were summarized in Table-IV.

Effect of the *Caralluma fimbriata* Extract on Learned Helplessness Test

The escape failure significantly decreased in rats treated with the dose of CF 400mg/kg (P<0.001).In addition, the number of avoidance response also significantly increased, respectively, with the same dose of CF (P < 0.001). Imipramine (P <0.001) also showed significant reduction of learned helplessness and its effect was qualitatively comparable to that of TC at 400 mg/kg. The results were summarized in Table-IV.

Table1: Standard values of homovanillic acid (HVA)

Concentration(ng/ml)	Peak Area Ratio		
	Trial-I	Trial-II	Average
25	0.041	0.043	0.042
50	0.090	0.089	0.089
100	0.183	0.179	0.181
250	0.470	0.471	0.470
500	0.922	0.928	0.925
1000	2.012	2.003	2.009
2500	5.050	5.285	5.168
5000	10.274	10.207	10.241

Table2: Standard values of vanillylmandelic acid (VMA)

Concentration(ng/ml)	Peak Area Ratio		
	Trial-I	Trial-II	Average
25	0.056	0.060	0.058
50	0.088	0.102	0.095
100	0.188	0.208	0.198
250	0.546	0.522	0.534
500	1.007	1.142	1.074
1000	2.428	2.646	2.537
2500	6.100	6.349	6.224
5000	12.743	12.881	12.812

Table3: Standard values of 6-β-hydroxycortisol (6-β-OHcortisol)

Concentration(ng/ml)	Peak Area Ratio		
	Trial-I	Trial-II	Average
100	0.826	0.828	0.827
250	2.809	2.110	2.459
500	4.196	4.020	4.108
1000	8.244	9.013	8.628
2500	19.860	19.320	19.590
5000	39.350	40.320	39.835

Table4: Standard values of 5-hydroxyindole acetic acid (5-HIAA)

Concentration(ng/ml)	Peak Area Ratio		
	Trial-I	Trial-II	Average
25	0.026	0.036	0.031
50	0.077	0.079	0.078
100	0.157	0.157	0.157
250	0.333	0.337	0.335
500	0.672	0.677	0.674
1000	1.345	1.354	1.349
2500	3.574	3.481	3.528
5000	6.955	7.024	6.989

Table5: Standard values of ascorbic acid

Concentration(ng/ml)	Peak Area Ratio		
	Trial-I	Trial-II	Average
5	0.029	0.028	0.028
10	0.074	0.077	0.075
20	0.148	0.158	0.153
30	0.251	0.243	0.247
40	0.321	0.332	0.326
50	0.407	0.409	0.408

The results obtained from present research exhibited that HVA, VMA, 5-HIAA, 6-β-OH cortisol and ascorbic acid were expelled in urine daily at certain levels (basal values).The anxiety modified the neuro transmitter levels and ascended level of HVA, VMA,5-HIAA, 6-β-OH cortisol and reduced ascorbic acid excretion. Administration of aqueous and ethanol extracts of *Caralluma fimbriata* to normal animals did not modify HVA,VMA,5-HIAA,6-β-OH cortisol and ascorbic acid in comparison with basal values but preliminary administration of aqueous and ethanol extracts of *Caralluma fimbriata* to anxiety induced rats revealed the decrease in urinary HVA,VMA, 5-HIAA,6-β-OH cortisol and increased the ascorbic acid levels in dose dependent manner.

The previous phytochemical analysis of *Caralluma fimbriata* displayed the presence of pre gnene glycosides, flavonoids and saponins which could be assumed to be responsible for anti-anxiety activity[14]. Literature survey evinced that these bioactive compounds can attach to the GABAA-BZDS complex, eventually, increase GABA level and reduces dopamine and decline plasma corticosterone level that cause to diminish level of VMA as it is a metabolite of norepinephrine which is synthesized by dopamine and 6-β- OH cortisol respectively[21].

phytoconstituents manifested D2 receptor blockers activities which cause to reduce serotonin level that leads to diminish level of HVA [22].They also can avert tryptophan hydroxylase enzyme which is responsible for biosynthesis of 5-HT (serotonin). Therefore it can reduce level of 5-HIAA eventually as metabolite of serotonin[23].Ascorbic acid acts a co-factor in the

biosynthesis of NE from DA that it causes to decrease concentration of ascorbic acid in urine. Consequently, the effects of these bio active phytoconstituent on reduction of synthesis of dopamine can impact on the increase of urinary level of ascorbic acid.

Table-I : Effect of the Caralluma fimbriata extract on elevated plus-maze test in rats

Treatment	Time spent on (s)		Entries n	
	Enclosed arms	Open arms	Enclosed arms	Open arms
Control	224.36±3.26	47.72±1.93	2.66±0.04	2.23±0.37
CF(100mg/kg)	221.19±4.82	43.23±1.01	2.82±0.04*	2.62±0.12
CF(200mg/kg)	206.91±4.03*	62.97±2.43*,$	2.48±0.03*,$	3.47±0.21*,$
CF(400mg/kg)	197.66±3.69*,$	82.26±3.24*,$,#	1.91±0.03*,$,#	4.67±0.16 *,$,#
Lorazepam(1mg/kg)	179.45±2.43*,$,#,¥	98.02±2.97*,$,#,¥	1.96±0.02*,$,#	5.16±0.25*,$,#

Values are expressed as mean±SEM (n=6).*P<0.05 significant as compared to vehicle, $$P$<0.05 significant as compared to CF (100mg/kg), #P<0.05 significant as compared to CF (200 mg/kg), ¥P<0.05 significant as compared to CF (400 mg/kg), statistical test employed is one-way ANOVA followed by Tukey's multiple comparisons test. CF: Caralluma fimbriata, SEM: Standard error of mean, ANOVA: Analysis of variance

Table-II: Effect of the Caralluma fimbriata extract on open field test in rats

Treatment	Ambulation	Rearings	Self-groomings	Activity in center	Fecal droppings
Control(vehicle)	32.07±1.03	8.75±1.97	3.70±0.09	0.41±0.03	3.68±0.12
CF(100mg/kg)	39.45±1.22*	17.08±2.25	4.84±0.05*	1.47±0.07	4.17±0.15*
CF(200mg/kg)	6.67±1.54*,$	21.62±2.82*	5.28±0.15*,$	2.01±0.04	3.79±0.06
CF(400mg/kg)	2.23±1.81*,$	26.47±1.46*,$,#	.08±0.13*,$,#	3.52±0.97*	1.88±0.08*,$,#
Lorazepam(1mg/kg)	56.61±1.63*,$,#,¥	31.81±2.31*,$,#	7.12±0.15*,$,#,¥	4.02±0.89*,$	1.34±0.02*,$,#,¥

Values are expressed as mean±SEM (n=6).*P<0.05 significant as compared to vehicle, $$P$<0.05 significant as compared to CF (100mg/kg),#P<0.05 significant as compared to CF (200 mg/kg), ¥P<0.05 significant as compared to CF (400 mg/kg), statistical test employed is one-way ANOVA followed by Tukey's multiple comparisons test. CF: Caralluma fimbriata, SEM: Standard error of mean, ANOVA: Analysis of variance

Table-III: Effect of the Caralluma fimbriata extract on social interaction test in rats

Treatment Social interacti on time(s)	
Control (vehicle)	63.33±1.38
CF (100mg/kg)	91.83±1.42*
CF (200mg/kg)	107.16±1.92*,$
CF (400mg/kg)	151.83±1.01*,$,#
Lorazepam(1mg/kg)	163.5±1.43

*,$,#,¥

Values are expressed as mean±SEM (n=6).*P<0.05 significant as compared to vehicle, $$P$<0.05 significant as compared to CF (100 mg/kg); #P<0.05 significant as compared to CF (200 mg/kg), ¥P<0.05 significant as compared to CF (400 mg/kg), statistical test employed is one-way ANOVA followed by Tukey's multiple comparisons test. CF : Caralluma fimbriata, SEM: Standard error of mean, ANOVA: Analysis of variance.

Table-IV: Effect of the Caralluma fimbriata extract on behavioral despair test, tail suspension test, and learned helplessness test in rats

Groups test	Immobility time(s)		Learned helplessness	
	Behavioral despair test	Tail suspension test	Escape failure	Avoidance response
Control(vehicle)	106.50±1.92	133.83±4.95	21.33±1.08	8.46±1.08
CF(100mg/kg)	94.83±2.16*	114±5.36*	18.94±0.56	10.40±0.56
CF(200mg/kg)	84.33±2.63*	102±1.15*	18.26±0.70	12.13±0.70
CF(400mg/kg)	64.50±2.59*,$,#	83.16±4.13*,$	11.43±0.33*,$,#	17.16±0.55*,$,#
Imipramine (10mg/kg)	48.16±2.30*,$,#,¥	80.83±4.60*,$,#	10.76±0.88*,$,#	18.36±1.16*,$,#

Values are expressed as mean±SEM (n=6).*P<0.05 significant as compared to vehicle,$$P$<0.05 significant as compared to CF (100mg/kg);#P<0.05 significant as compared to CF (200 mg/kg), ¥P<0.05 significant as compared to CF (400 mg/kg), statistical test employed is one-way ANOVA followed by Tukey's multiple comparisons test. CF: *Caralluma fimbriata*, SEM: Standard error of mean, ANOVA: Analysis of variance

CONCLUSION:

The current appraisal exhibited that aqueous and ethanol extracts of *Caralluma fimbriata* have anti-anxiety potential due to impede the anxiety induced increase of adrenergic, serotonergic, cortisol and dopaminergic mechanism. Future evaluations can assess on the levels of neurotransmitters in different regions of brain, as there is limited data that examines the correlation of CNS and urinary neurotransmitters in animals.

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