



Anti- depressant and Anti- oxidant effect of *Solanum xanthocarpum* in high fat diet induced obese rodents

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Abstract: The Dispiritedness is a prevalent ailment that often goes unnoticed and neglected. Many adverse consequences, such as heart toxicities, impotence, obesity, as well as insomnia, are commonly imposed by drug users. Around past ten years, their has been an increase in research in how herbal remedies might treat psychological issues. It was looked into whether solanum xanthocarpum has any antidepressant properties. Using tail suspension test (TST) models and locomotor activity by actophotometer, the anti-depressive potential of Solanum xanthocarpum ethyl acetate extract was examined. Different concentrations of Solanum xanthocarpum, such as 200 mg/kg and 400 mg/kg, were administered. Imipramine served as the benchmark. In comparison to the normal, diseased control, and standard groups, our investigation revealed the use of EAESX at higher concentration significantly reduced immobile phase in tail suspension and improved movement in actophotometer.

Keywords: Depression, Solanum xanthocarpum, imipramine, tail suspension, actophotometer, locomotory activity.

INTRODUCTION

Dispiritedness is linked to a higher chance of being overweight and raise in weight, that are linked to a higher susceptibility to symptoms of depression. [Lupino F.S et al., 2010, Capuron L et al., 2017]. Compared against the overall all- inclusive inhibitants, obese people have a much greater prevalence of depression—nearly 30%—than those who are not obese. [Dawes A.J et.al 2016, Lasselin. J et al.,2014].

It is necessary to characterize adiposity as more than merely a problem with metabolism because there is a clear change in systemic inflammation, to the point where persistent low-grade inflammation is now recognized as a characteristic feature of adiposity. Owing their capacity to operate directly on several body parts, the inflammatory mediators may have a role in the genesis of numerous problems with metabolism linked to overweight. [Aguilar-Valles. A et al., 2015].

Multiple investigations have demonstrated a bidirectional relationship among Dispiritedness and being overweight, with having a history of one raising the likelihood of another. Moreover, there are compelling arguments to support the theory that such illnesses are linked in an endless cycle that amplifies one another's negative biological responses. [De Wit L et.al 2010, Milaneschi.Y et.al 2019, Baldofski. S et al 2019].

Obesity and Dispiritedness are conditions linked to the dysfunction of the stress system. Many studies have been conducted on the processes relating to both illnesses, and the results suggest that swelling oxidative stress, and hormonal imbalances are involved,

as well as changes in the hypothalamic-pituitary-adrenal (HPA) axis. Numerous research findings imply that Dispiritedness is associated with a persistent proinflammatory state. Results that corroborate this theory show that inflammatory cytokines are elevated during the depression phase and then decrease after depressive symptoms subside because antidepressant medications have an inhibitory influence on cytokine production. These cytokines are overexpressed in Dispiritedness that is not responding to treatment. [Jantarotnotai N et al 2017, Miller A.H et al., 2009, Berk M 2017]

often to as Yellow Berried Nightshade (Kaṇṭakāri), Solanum xanthocarpum (Solanaceae) is a thorny widespread brightly colored annual shrub that grows between two and three meters tall and woody at the base. It is distributed across the country [Quek Y.H et al., 2017] mostly in dry places as a weed on roadsides and waste lands. [Jung S.J et al., 2017]. The goal of the current study is to examine in lab animals the antidepressant and antioxidant properties of the complete herb C4H8O2 extract of S. xanthocarpum (EAESX)..

Materials and methods:

Anti-oxidant test

3.5.1 Hydrogen Peroxide Scavenging Capacity

Using a buffer composed of phosphates, that possesses a pH of 7.4, anhydrous H₂O₂ mixture was prepared. Extract was added into a H₂O₂ mixture (0.60 40.0 mM) with a concentration of 100.0 g/mL in distilled water. A control mixture with a buffer composed of phosphates with H₂O₂ had been employed to measure the H₂O₂ absorbance at 230 nano meter after 10 minutes period of

incubation [Khan M.S.Y et al.,2003, Chen Y et al., 1999]. Inhibition percentage is done using below formula

$$\% \text{ Scavenged } [\text{H}_2\text{O}_2] = [(\text{As} - \text{Ac})/\text{As}] \times 100$$

3.5.2 Nitric oxide radical activity

Nitric oxide radical generated by sodium nitroprusside was measured. In a nutshell, the reaction mixture (5.0 milliliter) was incubated at 25.0°C till 3 hours whether the plant extract is present or not at various concentrations. The resulting mixture contained $\text{Na}_2[\text{Fe}(\text{CN})_5\text{NO}]$ (5.0 milli Molar) in Po_4 -buffer saline.

At 30-minute intervals, the NO_2 ion was measured by combining one millilitre of the solution-incubated mixture with the corresponding amount of Griess reagent. The NO radical thus produced interact with O_2 to form it. When NO_2 ions were diazotized with $\text{C}_6\text{H}_8\text{N}_2\text{O}_2\text{S}$ then coupled with $\text{C}_{12}\text{H}_{16}\text{Cl}_2\text{N}_2$, a

purple azo dye was produced. At 546 nm, this dye's absorbance was gauged [Marcocci L et al., 1994].

$$\% \text{ Scavenging activity} = [(\text{As} - \text{Ac})/\text{As}] \times 100$$

Tail suspension method:

Albino rats of 180-210 grams were taken they are placed in cages for 12hours dark and 12 hours light cycle. Obesity is induced to animals. Vehicle to control and test to the test group animals are given half an hour before experiment. Adhesive tape, positioned about 1cm from the tip of the tail, suspends test mice from the edge of a shelf situated 58cm above a surface. Five minutes are the cutoff time for recording the length of immobility. When an animal hangs passively and fully still for at least 1 minute, it is called immobile [Steru L et al.,1985].

Table 1: Treatment schedule for Tail suspension method

S. No	Groups	Treatment	No. of animals
1.	Normal	H_2O /saline	6
2.	Disease control	H_2O /saline	6
3.	EAESX (T1)	HFHCC diet + EAESX 200mg/kg	6
4.	EAESX (T2)	HFHCC diet + EAESX 400mg/kg	6
5.	Standard control	HFHCC diet + imipramine (20 mg/kg <i>i.p</i>)	6

Evaluation: Immobility time is recorded for 5min, compared with standard group to evaluate anti- depression activity.

CNS Depression And behavioural Activity by Actophotometer

A total of five groups of six albino mice of either gender, weighing 18 to 25 g all of them are created. Utilizing an actophotometer, which is made up of a display that represent light beam interruptions and an illumination source, we were able to assess the mice motor function. The baseline movement count for every mice was taken note of after it was set in the equipment for five minutes. For each group, the average baseline motor count has to be determined. Mice in the untreated group and treated groups received extract at varied concentrations, and mobility scores were determined after an hour. Estimate the final result averages and contrast the averages for the test and control groups. A higher test group result denotes the investigated extract's antidepressant efficacy [Sanmukhani J et al 2011].

Table 2: Treatment schedule for locomotory activity by actophotometer

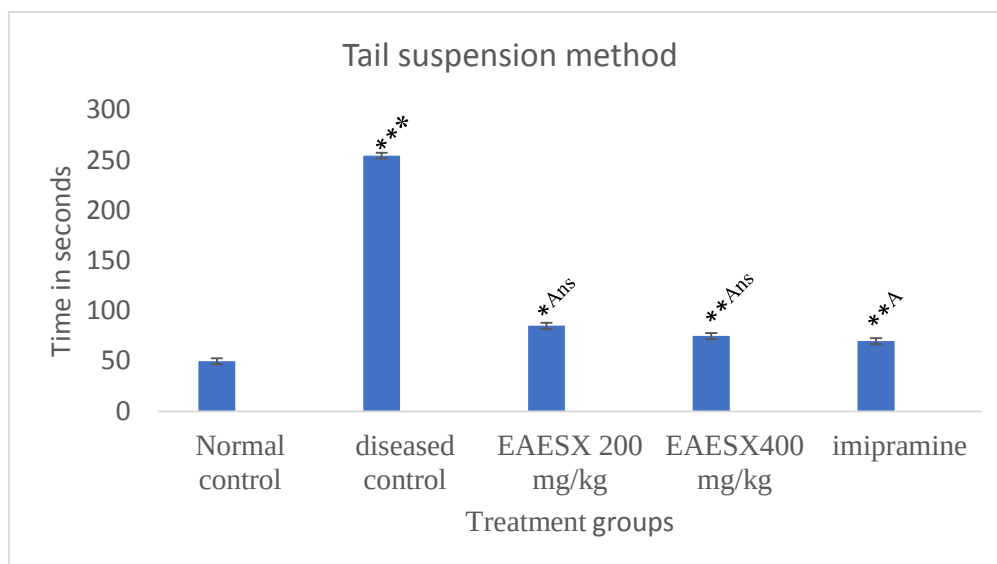
S. No	Groups	Treatment	No. of animals
1.	Normal	H_2O /saline	6
2.	Disease control	H_2O /saline	6
3.	EAESX (T1)	HFHCC diet + EAESX 200mg/kg	6
4.	EAESX (T2)	HFHCC diet + EAESX 400mg/kg	6
5.	Standard control	HFHCC diet +imipramine (20 mg/kg <i>i.p</i>)	6

In-vivo models for depression:

Tail suspension method

Table 3: EAESX effect on tail suspension test

S.no	Groups	Duration of immobility
1	Normal	49.83333±1.63441
2	Diseased control	254.6667±1.714859***
3.	EAESX (200mg/kg)	71.66±1.2* ^{Ans}
4	EAESX (400mg/kg)	75±2.108185** ^{A ns}
5	Standard	70±1.358103** ^A



Graph 1: Graphical representation of immobility time

Values expressed as mean $\pm$ SEM (n=6). The results were analyzed using one-way ANOVA and then Dunnett's multiple comparison test against normal Control *=0.05, **=0.01, ***=0.001, against diseased control A= 0.001 against standard ns = non -significant.

Increase in body weight of mice

Table 4: increase in body weights of mice during and after HFHCC diet

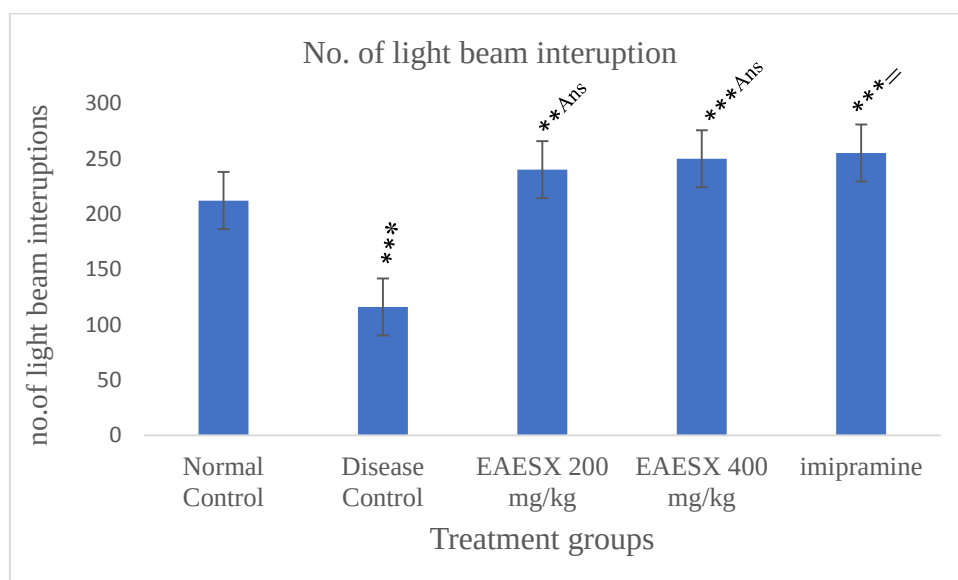
Groups	Body weight of mice at regular time intervals			
	0 th Day	7 th Day	14 th Day	21 th Day
Normal	26.833 $\pm$ 0.48	26.16 $\pm$ 0.38	27.83 $\pm$ 0.38	28.83 $\pm$ 0.19
Diseased control	26.66 $\pm$ 0.51	31.66 $\pm$ 0.56	35.16 $\pm$ 0.45	38 $\pm$ 0.36
EAESX 200 mg/kg	25.5 $\pm$ 0.27	30.83 $\pm$ 0.45	34.66 $\pm$ 0.38	39.12 $\pm$ 0.28
EAESX 400 mg/kg	26.33 $\pm$ 0.38	32.83 $\pm$ 0.476	36.83 $\pm$ 0.38	39.66 $\pm$ 0.310
Imipramine	25.833 $\pm$ 0.57	30.33 $\pm$ 0.51	35 $\pm$ 0.39	39.33 $\pm$ 0.32

CNS behavioral study by locomotory activity

Table 5: EAESX effect on locomotory behaviour

Sl.no	Groups	Locomotory activity
1	Normal	212.3 $\pm$ 2.23
2	Diseased control	116 $\pm$ 1.28***
3	EAESX (200mg/kg)	240.16 $\pm$ 2.00***A ns
4	EAESX (400mg/kg)	255.33 $\pm$ 2.46***A ns
5	Standard	250 $\pm$ 3.2****A

The estimates are given as mean SEM (n=6). Dunnett's multiple comparison and one-way ANOVA were used to examine the results against Control **=0.01, ***=0.001, against diseased control A=0.001, against standard, ns = non- significant.

**Graph 2:** Graphical representation of number light beam interruption**Table 6:** Anti-oxidant activity of solanum xanthocarpum by employing H₂O₂ radical scavenging activity

Sl.no	Compound	Concentration	%inhibition	IC ₅₀
1	EAESX	10.0	23.6±0.13	27.47
		20.0	39.2±0.23	
		30.0	54.7±0.26	
		40.0	70.4±0.60	
		50.0	80.2±0.24	
2	Ascorbic acid	10.0	26.9±0.90	25.44
		20.0	43.9±0.50	
		30.0	62.8±0.80	
		40.0	68.8±0.95	
		50.0	74.9±0.28	

Table 7: Anti-oxidant activity of solanum xanthocarpum by employing nitric oxide scavenging activity

Sl.no	Compound	Concentration	% inhibition	IC ₅₀
1	EAESX	10.0	18.7±0.11	24.28
		20.0	43.4±0.55	
		30.0	72.1±0.72	
		40.0	78.0±0.51	
		50.0	85.6±0.49	
2	QUERCETIN	10.0	20±0.7	27.140
		20.0	37.1±1.15	
		30.0	55.5±0.56	
		40.0	78.2±0.51	
		50.0	87.7±0.49	

Discussion

In the population, depression is quite common and is linked to a high rate of morbidity. Therefore, it is critical to address these issues and identify workable solutions. despite the fact that there's a number of treatments accessible, they are all accompanied by certain restrictions, and other options are desperately needed for such illnesses. Herbal medicine might serve as an effective substitute for treating dispiritedness, and in the last ten years, study on the subject has advanced dramatically [Hasrat J.A et al 1997, Pieters L et al., 1997]. Studies are being done on EAESX fruits in this respect. Upon comparison with the control, EAESX at concentrations of 200 mg and 400 mg/kg was found to significantly reduce immobilization time in a dose-dependent manner in both TST and locomotory activity. As anticipated, the rats given imipramine (20 mg/kg) also demonstrated a notable reduction in the length of time they were immobile in lo. Investigators have already suggested that when an animal is given medication that raises serotonin, norepinephrine, and dopamine levels in the nerve terminals, there is a rise in both the neuro transmitters as well as decrease in immobilization. [Reneric J.P et al.,1998]. One possible explanation for a rise in each of the 3 neurotransmitters is a reduction in brain monoamine oxidase activity. More and more research suggests that mood disorders may be caused by a variety of different pathological processes in addition to the reduction of catecholamine and serotonin neurotransmitters. Investigators hypothesize that depression could prevent hippocampal development. [Sapolsky R.M 2000]. The discovery that antidepressants can increase regeneration of neurons lends credence to this theory. [Rajkowska. G et.al 1999]. Nevertheless, the exact processes by which the EAESX fruits generated an antidepressant-like effect remain unclear. Evaluation has also been done on the antioxidant qualities. Since it is yet unclear which elements caused these effects, more research will be required to assess the involvement of active chemical ingredients for the observed antidepressant action.

Conclusion

The current research offers preliminary proof that EAESX significantly reduced depression in locomotory activity and TSM models of depression. To determine the precise mechanism of action of the phytoconstituents included in the extract, more research is necessary.

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