IJPSR (2022), Volume 13, Issue 4 **(Research Article)**

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 23 June 2021; received in revised form, 17 August 2021; accepted, 23 August 2021; published 01 April 2022

ANTIOXIDANT AND ANTIDEPRESSANT ACTIVITIES OF ETHANOLIC LEAF EXTRACT OF *MANILKARA ZAPOTA*

G. V. N. Kiranmayi [*1] and M. Sai Sureshma [2]

Department of Pharmacology [1], Faculty of Pharmacy, Dr. M. G. R. Educational and Research Institute, Deemed to be University, Chennai - 600095, Tamil Nadu, India.
Department of Pharmacology [2] , Aditya College of Pharmacy, Surampalem, E. Godavari - 533437, Andhra Pradesh, India.

Keywords:

Manilkara zapota, Antioxidant, Ascorbic acid, Antidepressant, Forced swim test, Free radicals, Phytochemical screening, Scavengers, Tail suspension test

Correspondence to Author:
Dr. G. V. N. Kiranmayi

Associate Professor, Department of Pharmacology, Faculty of Pharmacy, Dr. M. G. R. Educational and Research Institute, Deemed to be University, Chennai - 95, Tamil Nadu, India.

E-mail: kiranmayi54@yahoo.com

ABSTRACT: Aim: The present investigation deals with the preliminary phytochemical screening, in vitro antioxidant, and *in vivo* antidepressant activity of ethanolic leaf extract of *Manilkara zapota*. **Materials and Methods:** *In-vitro* antioxidant activity was evaluated using AS free radical scavenging parameters using Hydroxyl radical scavenging assay, phosphor molybdenum antioxidant assay and NO scavenging activity, and H_2O_2 scavenging assay. The forced swim test, tail suspension test and locomotor activity using a digital Photoactometer were used to investigate the extract's antidepressant activity further. AA, fluoxetine (10 mg/kg) and imipramine (4 mg/kg, p.o) were used as reference drugs for comparison. **Results and Discussions:** The presence of these bioactive constituents is linked to the plant's antioxidant and antidepressant activity. The IC_{50} values of Hydrogen peroxide and Hydroxyl radical scavenging were found to be 24.5 and 81.28 ug/ml for extract and 7.94 and 40.7 ug/ml for AA. In our study, the extract showed a significant ($P< 0.01$) reduction in immobility in the tail suspension and forced swim models of depression, comparable to imipramine. **Conclusion:** psychostimulant effect comparable to standard fluoxetine in locomotor activity testing. The results showed that ethanolic leaf extract of *M. zapota* has comparable *in-vitro* antioxidant activity against phosphor molybdenum antioxidant assay, NO scavenging activity, H_2O_2 scavenging and hydroxyl radical scavenging to standard AA.

INTRODUCTION: During the past decade, giant attention has been centered on the involvement of reactive oxygen species in numerous illnesses. The technology of unfastened radicals causes cumulative damage to DNA, proteins and lipids brought about oxidative strain. This oxidative strain has been suggested to cause growing older and numerous human illnesses, including most cancers, hepatic disorders and diabetes. DNA harm mediated by way of unfastened radicals might also result in mutation or chromosomal aberrations main to carcinogenesis [1].

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.13(4).1581-90

This article can be accessed online on www.ijpsr.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.13(4).1581-90

The usage of the medicinal herb within the remedy and prevention of diseases is attracting attention through scientists globally [7, 8]. Active oxygen species and loose radicals play an position in the initiation and evolution of severe sicknesses. The use of compounds with antioxidant activity is expected to be useful for the remedy of these

diseases. Therefore, there has been a developing interest in locating novel antioxidants to fulfill the requirements of pharmaceutical industries [2]. Scanty paintings have pronounced an antimicrobial hobby of the complete plant. *Manilkara zapota* has been used to remedy ulcers, despair the inflammation of most cancers, lithiasis, hepatotoxicity, and diabetes [3, 6]. Therefore, the examination is aimed to illustrate and decide the antioxidant and antidepressant effects of *M. zapota* leaves on numerous free radical scavengers. According to the sector fitness corporation document, mood disorders are the second main purpose global of incapacity-adjusted existence years and the main motive of years lived with incapacity in all ages. Every drug used to deal with this sickness has a success charge of about 60%.

Similarly, most treatments require several weeks of remedy before the development of symptoms and symptoms is found, and there are various aspect effects due to antidepressants [9, 11]. Thus, the excessive occurrence of depression and the fact that many individuals no longer reply properly to any currently marketed antidepressants or remedies support the want for new therapeutics to treat melancholy. Severe antidepressant compounds are actually available, probably appearing through different mechanisms along with serotonergic, noradrenergic, and/or dopaminergic systems [3]. Medical plant treatments can be powerful options within the treatment of despair and have improved drastically in the past decade [4]. Therefore, the present work aimed to evaluate the antioxidant and antidepressant-like effect of the ethanolic leaf extract of *M. zapota*.

MATERIALS AND METHODS:

Collection of Plant Material: Collection of *M. zapota* leaves was done from the Peddapuram area of the East Godavari district of Andhra Pradesh. The plant authentication was done by Dr. T. Raghuram, Taxonomist, Maharani College, Peddapuram, and the voucher specimen number given is 12216.

Extract Preparation: *M. zapota* leaves were shade dried at room temperature for 4-5 days. The dried leaves were then powdered in a mixture and weighed. 100 g powder was taken from the obtained fine powder, and it is macerated in 200 ml of ethanol for 3 days. The hot percolation process is carried out for about 3 h. later on, the filtration was done and distillation is performed to get the concentrated product.

Instruments and Chemicals:

- Acacia (1%), ascorbic acid (AA), ethanol (90%), fluoxetine, imipramine, and normal saline were used AS drugs.
- **Experimental** The following instruments were used: a digital photoactometer, a pH meter, and an ultraviolet spectrophotometer.

Animals: Albino rats (75-100 g) of either sex were used throughout the study. The animals were kept in standard laboratory conditions, including humidity, temperature, and light. The animals were fed a standard laboratory diet and were given a clean water.

***In-vitro* Antioxidant Activity**

Phosphomolybdenum Antioxidant Assay: The concentrates of *M. zapota* was assessed by the phosphor molybdenum strategy for cancer prevention agent action SAS indicated by procedure [13]. The test depends on the decrease of Mo (VI)- Mo (V) by the concentrate and the resulting development of a green phosphate/Mo (V) complex at corrosive pH. Concentrates of 0.3 ml (0.05, 0.1, 0.3 and 0.5 mg/ml) were joined with 3 ml of the blend (0.6 M sulfuric corrosive, 28 mM sodium phosphate and 4 mM ammonium molybdate **Table 4**. The cylinders containing the response arrangement were brooded at 95 °C for 90 min. The absorbance of the arrangement was estimated at 695 nm against clear utilizing spectrophotometer **Fig. 6.**

Nitric Oxide Antioxidant Assay: Nitric oxide was created from sodium nitroprusside and estimated by the Greiss response, as depicted already. Sodium nitroprusside in the fluid arrangement at physiological pH unexpectedly creates nitric oxide, which cooperates with oxygen to deliver nitrite particles that the utilization of Greiss reagent can assess. Foragers of nitric oxide rival oxygen, prompting diminished creation of nitric oxide [14]. Sodium nitroprusside (5 mM) in phosphate-supported saline was blended in with various convergences of the concentrates (0.05, 0.1, 0.3,

and 0.5 mg/ml) disintegrated in the reasonable dissolvable frameworks and brooded at 25 °C for 150 min. The examples were added with Greiss reagent (1% sulfanilamide, 2% H_3PO_4, and 0.1% naphthyl ethylenediamine dihydrochloride **Table 3**. The chromophore absorbance blended during the nitrite diazotization with sulfanilamide and resulting response with naphthyl ethylenediamine was perused at 546 nm, and the absorbance of standard arrangements of SA was done in comparable. Every one of the tests was acted in three-fold. AS a kind of perspective compound, AA was utilized. The rate decline in absorbance was determined **Fig. 5.**

Nitric oxide scavenged (%) = [(Ao - A1)/ Ao] × 100

Where Ao is the absorbance of the control reaction (containing all reagents except the sample extract), and A1 is the absorbance of the sample extract. AA was used as a positive control.

Scavenging of Hydrogen Peroxide: Hydrogen peroxide to search the capacity of the concentrates was determined [15]. Hydrogen peroxide (40 mM) arrangement was set up in a phosphate cushion (pH 7.4). The centralization of hydrogen peroxide was controlled by ingestion at 230 nm utilizing a spectrophotometer. Concentrates (0.05, 0.1, 0.3, and 0.5 mg/ml) in refined water were added to a hydrogen peroxide arrangement (0.6 ml and 40 mM) **Fig. 4.** The absorbance of hydrogen peroxide at 230 nm was resolved after 10 min against a clear arrangement containing phosphate cradle without hydrogen peroxide. The hydrogen peroxide rummaging rate by the concentrates and standard builds was determined as follows in **Table 2.**

% Scavenged [H_2O_2] = [(A_o - A_1)/ A_o] × 100

Where Ao is the absorbance of the control reaction (containing all reagents except the sample extract), and A1 is the absorbance of the sample extract. AA was used as a positive control.

Hydroxyl Radical Scavenging Assay: The searching capacity of the five examples extricates on hydroxyl revolutionaries was resolved by the strategy for certain changes. Momentarily, singular example extricates (1 mL) at various fixations (50, 100, 300 and 500 µg/ml) were added to the reagent containing 1 mL 1.5 mM $FeSO_4$, 0.3 mL 20 mM sodium salicylate and 0.7 mL 6 mM H_2O_2. Later on, the example was brooded at a temperature of 37 °C for 1 h, and absorbance of the response combination was perused at 562 nm **Fig. 4.**

Scavenging ability on hydroxyl radicals (%) = [(A_o-A_1)/A_o] × 100

Where, Ao indicates the control reaction (containing all reagents except the sample extract) absorbance and A1 is the sample extract absorbance. Ascorbic acid was used as positive controls **Table 2.**

Antidepressant Activity:

Experimental Design for Antidepressant Activity: Five groups of rats (n = 3) were formed. The animals were given drugs/vehicles 60 min before the study.

Group I: AS a negative control, saline (2 mL/kg) was administered orally.

Group II: Oral administration of *M. zapota* ethanolic leaf extract at a dose of 150 mg/kg.

Group III: Oral administration of *M. zapota* ethanolic leaf extract at a dose of 300 mg/kg.

Group IV: Imipramine standard drug (4 mg/kg orally) is given.

Forced Swim Test (FST): Rats of either sex had to swim in a holder (breadth 10 cm and height 25 cm) containing 19 cm of water at 25 ± 1 °C. 60 min before the examination, all animals had to swim for 6 min, and the immobility duration was noticed and estimated during the last 4 min time interval test. Stationary methods when the creature stopped battling and stayed in the water gliding unmoving, making just those developments to keep its head above water **Fig. 1.** A decrease in the term of idleness is characteristic of an upper-like effect [16] **Table 5.**

Tail Suspension Test (TST): The tail suspension strategy utilized in this examination was like those portrayed by Steru *et al.* [17] **Fig. 2.** Treatment was given 60 min before the investigation, as depicted by the examination plan.

Mice were suspended on the edge of the table, 50 cm over the floor, with the assistance of sticky tape, put around 1 cm from the tip of the tail.

The absolute term of stability prompted by tail suspension was recorded during a 6 min of the 10 min time frame.

The creature was viewed AS stationary when it didn't show any development of the body, hanged inactively, and still **Table 5.**

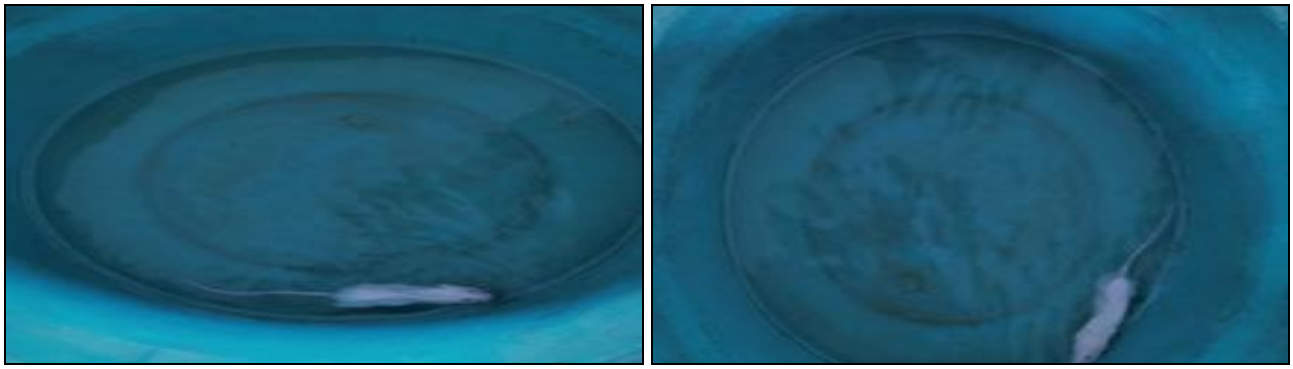


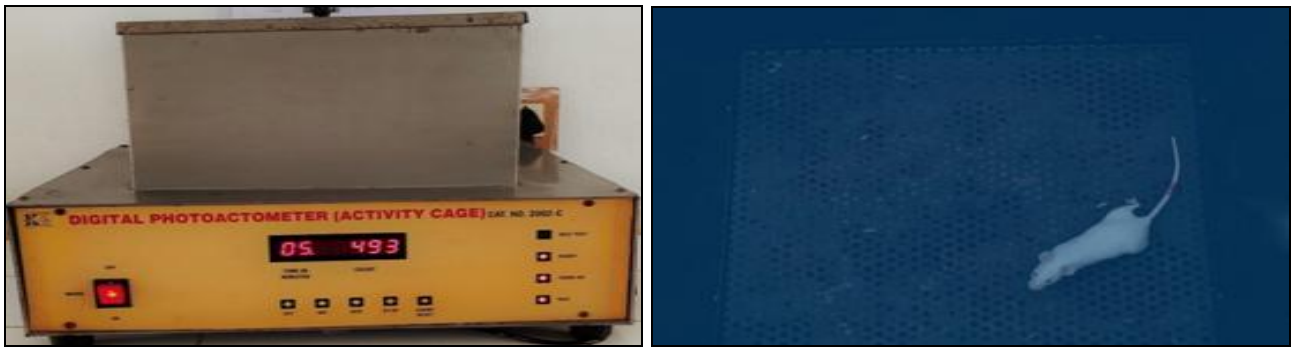
FIG. 1: FORCED SWIM TEST (FST)

FIG. 2: TAIL SUSPENSION TEST

Locomotor activity using Photo Actometer test:

Actophotometer test: The locomotor activity can be easily studied with the help of actophoto meter; the rats were grouped and treated with the drugs. Turn on the gear (check and ensure that every one of the photocells is working for an exact account) and set each rodent exclusively in action confine for 10 min. Note the basal movement score of the multitude of creatures. Inject the drug diazepam (Dose: 5 mg/kg, i.p; make a stock solution containing 0.5 mg/ml of the drug and inject 1 ml /100 g body weight of mouse) and after 30 min re-test each mouse for activity scores for 10 min **Fig. 3.**

Take note of the difference in activity before and after the addition of chlorpromazine. Determine the percentage decrease in motor activity **Table 6.**



PHOTOACTOMETER **RAT-IN PHOTOACTOMETER**

FIG. 3: LOCOMOTOR ACTIVITY USING PHOTOACTOMETER TEST

Statistical Analysis: A one-way analysis of variance was used, followed by Dunnett's multiple tests, for statistical analysis. For each group of six rats, the results are expressed as the mean, standard deviation. Differences between groups were deemed statistically significant at the P 0.001 level.

Phytochemical Analysis Table 1: The qualitative determination of major phytoconstituents, such as alkaloids, carbohydrates, glycosides, phenolic compounds, saponins, steroids, tannins and flavonoids, was performed on powdered leaf [12]. Antidepressant Activity Using TST, FST and Spontaneous Locomotor Activity **Tables 5** and **6.**

RESULTS:

Phytochemical Analysis:

TABLE 1: RESULTS OF PHYTOCHEMICAL ANALYSIS OF ETHANOLIC LEAF EXTRACT OF *MANILKARA ZAPOTA*

Compounds	Chemical Tests	Ethanolic Extract
Alkaloids	Dragendroff's test	+ve
	Mayer's test	+ve
	Hager's test	+ve
Glycosides	General test	+ve
	Legal's test	+ve
	Modified Borntrager's test	+ve
Flavonoids	Lead acetate test	+ve
	Zinc hydrochloride test	+ve
	NaoH test	+ve
Saponins	Froth formation test	+ve
Triterpenoids	Salkowski test	+ve
	Liebermann-Buchard's test	+ve
Tannins	Ferric chloride test	+ve
Carbohydrates	Molisch's test	+ve
	Benedict's test	+ve
	Fehling's test	+ve
Proteins	Xanthoproteic test	-ve
	Millon's test	-ve
	Biuret test	-ve

+ = Presence-ve = Absence

In-vitro Anti-Oxidant Activity:

TABLE 2: EFFECT OF ETHANOLIC LEAF EXTRACTS OF *MANILKARA ZAPOTA* ON HYDROGEN PEROXIDE METHOD (H_2O_2) AND HYDROXYL RADICAL SCAVENGING METHOD

Tested Material	Concentration (µg/ml)	(H_2O_2) method		Hydroxyl method	
		%Inhibition	IC^{50} (µg/ml)	%Inhibition	IC50 (µg/ml)
Manilkara	50	52.71 ±0 .35	24.5	43.84 ± 0.25	81.28
Zapota	100	63.73 ± 0.18		52.48 ± 0.29	
Ethanolic Leaf	300	70.45 ± 0.13		65.04 ± 0.15	
Extract	500	78.29 ± 0.16		70.77 ± 0.25	
Ascorbic Acid	50	58.45 ± 0.23	7.94	51.22 ± 0.32	40.7
	100	70.07 ± 0.22		60.08 ± 0.36	
	300	71.76 ± 0.32		65.15 ± 0.19	
	500	74.84 ± 0.13		75.19 ± 0.18	

Values are indicated in terms of Mean ± SEM; n=3 in each concentration

TABLE 3: EFFECT OF ETHANOLIC *MANILKARA ZAPOTA* LEAF EXTRACT USING NITRIC OXIDE METHOD

Tested Material	Concentration (µg/ml)	Nitric oxide method	
		%Inhibition	IC^{50} (µg/ml)
Manilkara zapota	50	43.56 ± 0.002	71.44
Ethanolic leaf extract	100	56.45 ± 0.001	
	300	70.49 ± 0.005	
	500	79.75 ± 0.003	
Ascorbic Acid	50	55.36 ± 0.22	33.11
	100	60.32 ± 0.27	
	300	70.85 ± 0.13	
	500	80.32 ± 0.12	

Values are indicated in terms of Mean ± SEM; n=3 in each concentration

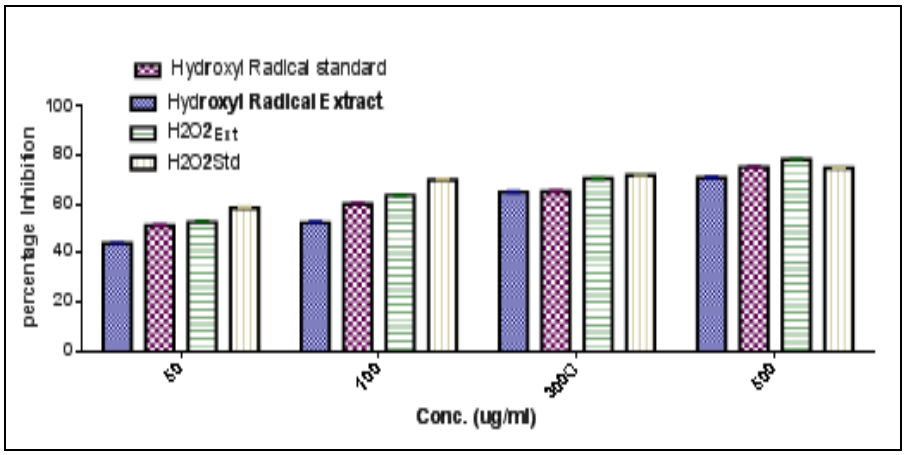


FIG. 4: EFFECT OF ETHANOLIC LEAF EXTRACT OF *MANILKARA ZAPOTA* ON HYDROGEN PEROXIDE METHOD (H_2O_2) AND HYDROXYL RADICAL SCAVENGING METHOD

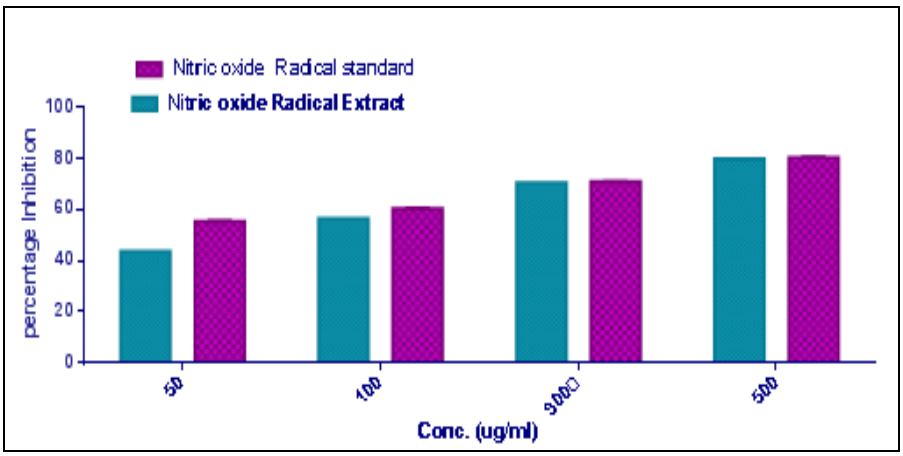


FIG. 5: EFFECT OF ETHANOLIC *MANILKARA ZAPOTA* LEAF EXTRACT USING NITRIC OXIDE METHOD

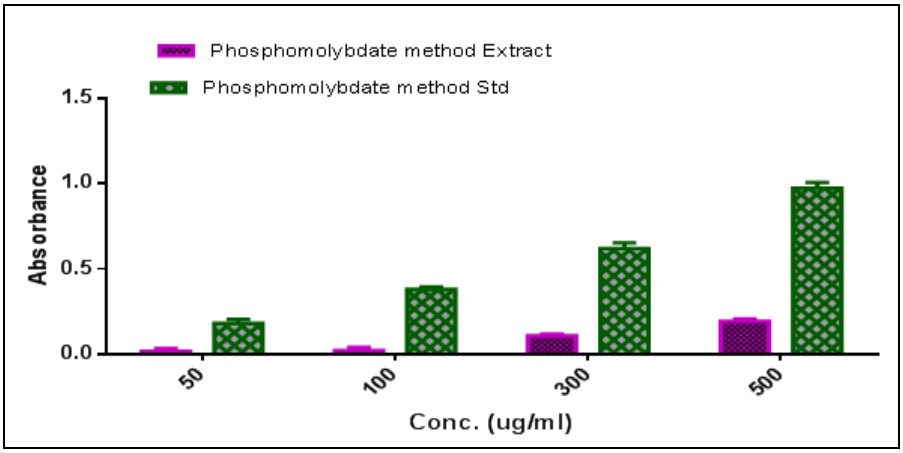


FIG. 6: EFFECT OF ETHANOLIC *MANILKARA ZAPOTA* LEAF EXTRACT USING PHOSPHOMOLYBDEUM METHOD

The stimulant impact of *Manilkara zapota* (150, 300 mg/kg), imipramine was concentrated by noticing the progressions in the length of idleness in the two models, the Forced swim test (FST) and Tail suspension test (TST). In Tail suspension test, *Manilkara zapota* (150 and 300 mg/kg), p.o. created critical decrease in fixed status time of 116.14 ± 3.45 & 80.16 ± 1.25 individually when contrasted and that of control bunch creatures accepting just vehicle of stationary period 175.38 ± 2.36. The standard medication imipramine shows a fixed status period of 78.90 ± 1.12. The outcomes are genuinely critical when contrasted and control with $p < 0.001$. In Forced swim test, *Manilkara zapota* (150 and 300 mg/kg), p.o. created a huge decrease in fixed status time of 97.20 ± 1.42 &

66.62 ± 1.23 individually when contrasted and that of control bunch creatures getting just vehicle of stationary period 143.55 ± 1.25.

The standard medication imipramine displays a fixed status period of 62.21 ± 2.05. The outcomes are genuinely huge when contrasted and control with p< 0.001.

The concentrate (300 mg/kg) was discovered to be successful and display the movement like that of ordinary medication imipramine and results are arranged in **Table 5.**

TABLE 4: EFFECT OF ETHANOLIC *MANILKARA ZAPOTA* LEAF EXTRACT USING PHOSPHOR MOLYBDEUM METHOD

Tested Material	Concentration (µg/ml)	Phospho Molybdenum Method
Manilkara zapota Ethanolic leaf extract	50	0.017 ± 0.016
	100	0.023 ± 0.018
	300	0.108 ± 0.011
	500	0.194 ± 0.013
Ascorbic Acid	50	0.181 ± 0.023
	100	0.381 ± 0.015
	300	0.621 ± 0.032
	500	0.973 ± 0.034

Values are indicated in terms of Mean ± SEM; n=3 in each concentration

TABLE 5: EFFECT OF ETHANOLIC LEAF EXTRACT OF *MANILKARA ZAPOTA* ON DURATION OF IMMOBILITY TIME INTHE TAIL SUSPENSION TEST (TST) AND FORCEDSWIMTEST (FST)

Treatment	Tail Suspension Test (Tst) Duration of Immobility (In sec)	Forced Swim Test (Fst) Duration of Immobility (In sec)
Vehicle (Water)	175.38 ± 2.36	143.55 ± 1.25
Manilkara Zapota (150 mg/kg, P.O.)	116.14 ± 3.45	97.20 ± 1.42
Manilkara Zapota (300 mg/kg, P.O.)	80.16 ± 1.25	66.62 ± 1.23
Imipramine (15 mg/kg, P.O.)	78.90 ± 1.12	62.21 ± 2.05

Test solutions were administered orally 60 minutes prior to the test. Values represented Mean ± SEM, (n=3), **p<0.01, **p<0.001 vs control.

TABLE 6: EFFECT OF ETHANOLIC LEAF EXTRACT OF *MANILKARA ZAPOTA* ON LOCOMOTOR ACTIVITY BY ACTOPHOTO METER

Treatment	Mean Activity Score Before Treatment (10 min)	Mean Activity M score After Treatment (10 min)	Reduced Locomotor Activity (%)
Control	334.0±0.035	316.6 ± 0.126	5.38%
Manilkara zapota (150 mg/kg, p.o)	261.2 ± 0.155	170.4 ± 0.465	34.76%
Manilkara zapota (300mg/kg, p.o)	298.8± 0.226	140.0 ± 0.830	53.14%
Diazepam (3 mg/kg, p.o)	327.21 ± 0.428	86.21 ± 0.896	73.65%

Test solutions were administered orally 60 mins prior to the test and standard 30 prior to the test. Values represented as Mean ± SEM, (n=3), ***p<0.001 vs control.

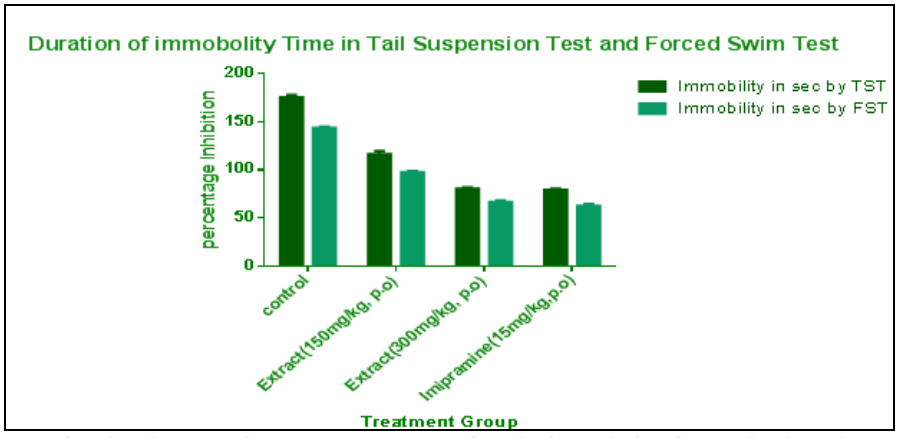


FIG. 7: DURATION OF IMMOBILITY TIME IN TAIL SUSPENSION AND FORCED SWIM TEST

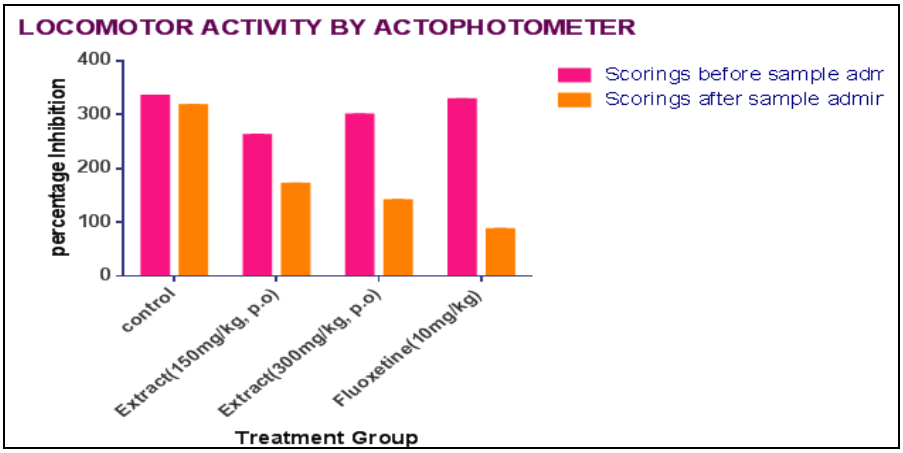


FIG. 8: ETHANOLIC LEAF EXTRACT OF *MANILKARA ZAPOTA* ON LOCOMOTOR ACTIVITY BY ACTOPHOTOMETER

Manilkara zapota (300 mg/kg, p.o, only) exhibited a sight reduction in locomotor activity (53.14%) compared to animals receiving vehicles. The Fluoxetine (10 mg/kg) treated group exhibited a statistically significant decrease in locomotor activity (73.65%) when compared with the control. The results of the extract are not statistically significant when compared with the control. These are statistically significant, with a *p-value* <0.001. Results are tabulated in **Table 6.**

DISCUSSION: The results obtained from this study clearly indicate that the Ethanolic Leaf Extract of *Manilkara zapota* possesses Antioxidant activity and Antidepressant activity. The Antioxidant activity was performed by Hydroxyl radical scavenging activity, hydrogen peroxide scavenging activity, Nitric oxide method, and Phopho molybdenum antioxidant assay. The results of antioxidant activity were expressed in terms of IC^{50} values using different antioxidant methods. The calculated IC^{50} values for Ethanolic leaf extract of *Manilkara zapota* and reference standard used as Ascorbic acid. The calculated IC^{50} values using Nitric oxide, Hydroxyl radical method, and Hydrogen peroxide method for *Manilkara zapota* are 71.44 µg/ml, 81.28 µg/ml, and 24.5 µg/ml, and for Ascorbic acid, it is 33.11 µg/ml, 40.7 µg/ml, and 7.94 µg/ml. The results are indicated in **Tables 2** and 3. In the Phopho molybdenum antioxidant assay, absorbance increases with concentration. From the outcomes acquired, it very well might be proposed that *Manilkara zapota* Leaf separation lessens the revolutionaries to the comparing hydrazine when it responds with the hydrogen giver in the cell reinforcement standards. Free revolutionary rummaging movement of the *Manilkara zapota* is focus subordinate, SAS the convergence of the test compound expands, the extremist searching action increments and lower IC^{50} esteem reflect the better defensive activity. H_2O_2 is exceptionally significant AS A result of its capacity to enter natural films. H_2O_2 itself isn't responsive; however, it can now and then be poisonous to cells since it might bring about hydroxyl extremist in the cells [18]. **Table 2** shows that ethanolic leaf concentrate of *M. zapota* had solid hydrogen peroxide movement and hydroxyl extremist rummaging action like that of AA.

Nitric oxide produced from sodium nitroprusside in the fluid arrangement at physiological pH precipitously creates nitric oxide [19, 20]. Nitric oxide scroungers contend with oxygen, bringing about diminished nitric oxide creation. Ethanolic leaf concentrate of *M. zapota* had more nitric oxide extremist searching movement than AA equivalently, as introduced in **Table 3.** The absolute cancer prevention agent limit of ethanolic leaf concentrate of *M. zapota* was dictated by phosphomolybdenum examination, AS demonstrated in **Table 3.** The antioxidant capacity of the ethanolic extract was determined using the phosphomolybdenum method, which is based on the reduction of molybdenum by the sample analyte and subsequent formation of green compounds containing phosphate/Mo (V) with a maximum absorption wavelength of 695 nm. The antioxidant capacity of extracts was discovered to increase with concentration. Depression is a significant mental issue that influences people's

personal satisfaction and social relations straightforwardly. Enthusiastic manifestations like misery, detachment portray depression, loss of fearlessness, blame, hesitation and inspiration, just AS organic indications like psychomotor hindrance, libido loss, sleep disturbances and appetite loss. When the symptoms are very severe, major depression is considered. Prescriptions like tricyclic antidepressants, particular serotonin reuptake inhibitors (SSRIs), specific reversible inhibitors of monoamine oxidase A and explicit serotonin-noradrenaline reuptake inhibitors (SNRIs) are clinically utilized for drug therapy [21].

However, these meds can cause heart poisonous-ness, hypopiesia, sexual brokenness, body weight gain, and rest problems [22, 25]. Formalized reword There will be a decrease in noradrenaline and serotonin reuptake, bringing about expanded accessibility in the neurotransmitter and, accordingly, an increment in adrenergic and serotonergic neurotransmission by imipramine [26].

We utilized two creature models in this investigation: FST and TST; the two standards are broadly acknowledged social models for surveying the adequacy of pharmacological antidepressants. Trademark conduct scored in these tests is named stability, reflecting social sadness as found in human depression [17]. Also, it is notable that numerous energizer drugs can lessen the idleness time in rodents [16]. Ethanolic leaf concentrate of *M. zapota* created a checked decrease in idleness time at dosages of 150 and 300 mg/kg in the rodent FST and TST, with a profile equivalent to that noticed for the traditional stimulant medication ESC and imipramine. FST has not customarily been seen as a reliably delicate model for identifying SSRI action, though these antidepressants are, for the most part, revealed as dynamic in the TST [27].

CONCLUSION: *M. zapota* ethanolic leaf extract exhibits dose-dependent antioxidant activity. This study discovered that an ethanolic leaf extract of *M. zapota* has antidepressant properties.

Because the effect of the extract was similar to that of imipramine, this effect may be due to inhibition of norepinephrine uptake, which leads to increased availability of norepinephrine in synapses. Further research is underway.

ACKNOWLEDGMENT: Nil

CONFLICTS OF INTEREST: Nil

REFERENCES:

1. Athar M: Oxidative stress and experimental carcinogenesis 2002.
2. Collins CA, Fry FH, Holme AL, Yiakouvaki A, Al-Qenaei A, Pourzand C and Jacob C: Towards multifunctional antioxidants: synthesis, electrochemistry, in vitro and cell culture evaluation of compounds with ligand/catalytic properties. Organic & Biomolecular Chemistry 2005; 3(8): 1541-46.
3. Bopana N and Saxena S: Asparagus racemosus - Ethnopharmacological evaluation and conservation needs. Journal of Ethnopharmacology 2007; 110(1): 1-15.
4. Sairam K, Priyambada S, Aryya NC and Goel RK: Gastroduodenal ulcer protective activity of Asparagus racemosus, An experimental, biochemical and histological study. J Ethnopharmacol 2003; 86: 1-10.
5. Singh GK, Garabadu D, Muruganandam AV, Joshi VK and Krishnamurthy S: Antidepressant activity of asparagus racemosus in rodent models. Pharmacology Biochemistry and Behavior 2009; 91(3): 283-90.
6. Liu W, Huang XF, Qi Q, Dai QS, Yang L, Nie FF and Guo QL: Asparanin A induces G2/M cell cycle arrest and apoptosis in human hepatocellular carcinoma Hep G2 cells. Biochemical and Biophysical Research Communications 2009; 381(4): 700-05.
7. Visavadiya NP, Soni B and Madamwar D: Suppression of reactive oxygen species and nitric oxide by Asparagus racemosus root extract using *in-vitro* studies. Cellular and Molecular Biology 2009; 55(4): 1083-95.
8. Wiboonpun N, Phuwapraisirisan P and Tip-pyang S: Identification of antioxidant compound from Asparagus racemosus. Phytotherapy Research an International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives 2004; 18(9): 771-73.
9. Wong ML and Licinio J: Research and treatment approaches to depression. Nature Reviews Neuroscience 2001; 2(5): 343-51.
10. Elhwuegi AS: Central monoamines and their role in major depression. Progress in Neuro-Psychopharmacology and Biological Psychiatry 2004; 28(3): 435-51.
11. Zhang ZJ: Therapeutic effects of herbal extracts and constituents in animal models of psychiatric disorders. Life Sciences 2004; 75(14): 1659-99.
12. Harborne AJ: Phytochemical methods a guide to modern techniques of plant analysis. Springer Science & Business Media 1998.
13. Prieto P, Pineda M and Aguilar M: Spectrophotometric quantitation of antioxidant capacity through the formation of a phosphomolybdenum complex: specific application to the determination of vitamin E. Analytical Biochemistry 1999; 269(2): 337-41.
14. Marcocci L, Maguire JJ, Droylefaix MT and Packer L: The nitric oxide-scavenging properties of *Ginkgo biloba* extract EGb 761. Biochemical and Biophysical Research Communications 1994; 201(2): 748-55.
15. Nabavi SM, Ebrahimzadeh MA, Nabavi SF, Hamidinia, A and Bekhradnia AR: Determination of antioxidant activity, phenol and flavonoids content of Parrotia persica Mey. Pharmacologyonline 2008; 2(9): 560-67.
16. Porsolt RD, Bertin A and Jalfre MJAIP: Behavioral despair in mice: a primary screening test for

antidepressants. Archives Internationales de Pharmacodynamieet de Therapie 1977; 229(2): 327-36.
17. Steru L, Chermat R, Thierry B and Simon P: The tail suspension test: a new method for screening antidepressants in mice. Psychophar 1977; 85(3): 367-70.
18. Halliwell B, Gutteridge JM and Aruoma OI: The deoxyribose method: a simple "test-tube" assay for determination of rate constants for reactions of hydroxyl radicals. Analytical Biochemistry 1987; 165(1): 215-19.
19. Nagmoti DM, Khatri DK, Juvekar PR and Juvekar AR: Antioxidant activity free radical-scavenging potential of Pithecellobium dulce Benth seed extracts. Free Radicals and Antioxidants 2012; 2(2): 37-43.
20. Marcocci L, Packer L, Droy-Lefaix MT, Sekaki A and Gardès-Albert M: Antioxidant action of Ginkgo biloba extract EGb 761, Meth in Enzym 1994; 234(46): 462-75.
21. Fava M, Freeman MP, Flynn M, Judge H, Hoeppner BB, Cusin C and Papakostas GI: Double-blind, placebo-controlled, dose-ranging trial of intravenous ketamine as adjunctive therapy in treatment-resistant depression (TRD). Molecular Psychiatry 2020; 25(7): 1592-03.
22. Antai-Otong D: Antidepressant-induced insomnia: treatment options. Perspe in Psychia Care 2004; 40(1): 29.
23. Baldwin D, Bridgman K and Buis C: Resolution of sexual dysfunction during double-blind treatment of major depression with reboxetine or paroxetine. Journal of Psychopharmacology 2006; 20(1): 91-96.
24. Khurana RN and Baudendistel TE: Hypertensive crisis associated with venlafaxine. The American Journal of Medicine 2003; 115(8): 676-77.
25. Park IY, Kim EJ, Park H, Fields K, Dunker AK and Kang C: Interaction between cardiac calsequestrin and drugs with known cardiotoxicity. Molecular Pharmacology 2005; 67(1): 97-104.
26. Cryan JF, Mombereau C and Vassout A: The tail suspension test as a model for assessing antidepressant activity: review of pharmacological and genetic studies in mice. Neuroscience & BioReviews 2005; 29(4-5): 571-25.
27. Tatsumi M, Groshan K, Blakely RD and Richelson E: Pharmacological profile of antidepressants and related compounds at human monoamine transporters. European Journal of Pharmacology 1997; 340(2-3): 249-58.

How to cite this article:
Kiranmayi GVN and Sureshma MS: Antioxidant and antidepressant activities of ethanolic leaf extract of *Manilkara zapota*. Int J Pharm Sci & Res 2022; 13(4): 1581-90. doi: 10.13040/IJPSR.0975-8232.13(4).1581-90.