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The effect of aqueous extract of *Terminalia chebula* dried fruit pulp on haloperidol induced catalepsy in rats using cataleptic scoring

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ABSTRACT

This research evaluated Terminalia chebula extract's anticataleptic impact on haloperidol-induced catalepsy in Wister albino rats. There are several ways to induce and measure catalepsy in animals. Standard catalepsy tests include placing an animal in an unexpected position and timing how long it takes to rectify it. The researcher is interested in catalepsy because it mimics Parkinsonism, catatonic schizophrenia, and basal ganglia brain damage. Terminalia "The king of medicine" is dried apple pulp. In addition to the chemistry of Terminalia chebula Dried fruit pulp components, its biological activity and therapeutic use have advanced significantly in the past 50 years. Atypical antipsychotics may cause pyramidal symptoms. Dopaminergic blockers like neuroleptics cause catalepsy in animals. Cataleptic effect and neuroleptic efficacy are connected. Researchers think tannins may reverse 6-hydroxydopamine-induced toxicity. Tannic acid is a possible treatment drug for neurological illness patients. Antidepressants and haloperidol induced catalepsy in Wistar Albino Rats are related to oxidative stress and neurodegeneration.Wistar albino rats of either sex (weighing 250-300gm) and 1-2 months old were used in the investigation. Before the experiment, they were acclimated to the lab. Healthy wester albino rates of either sex were placed into four (6) groups with equal numbers of animals.The rats in each group received their specific medications 30 minutes before haloperidol 1 mg/kg i.p. Catalepsy was determined by timing how long a mouse could maintain both front limbs extended and resting on a 4.5 cm wooden bar (1.0 cm diameter). Catalepsy was considered to occur when both front paws left the bar or the animal moved its head. Terminalia chebula (100mg/kg, 200mg/kg) at 120 minutes provided practically identical impact (p>0.05) on cataleptic time as standard medication. Terminalia chebula 200mg/kg at 240 minutes and 400gm/kg at 120 and 240 minutes reduced cataleptic time (p0.01). In repeated dosage testing, each group's cataleptic condition after 30 minutes was similar to the negative control. All dosages of the test medication and conventional medicine reduced cataleptic scores from 60 minutes after haloperidol administration. L Dopa-carbidopa (30 mg/kg) and Terminalia chebula (200 mg/kg) at 240 minutes.T.chebula fruits might be utilized as antidepressants in Parkinson's disease using the cataleptic model and cataleptic bar score technique. These data are too preliminary to be utilized therapeutically; additional study is needed on safety, mechanism of action, and clinical trials.

Keyword:*Cataleptic score; Terminalia chebula; Dopa-carbidopa ;Haloperidol ; Neuroleptics*

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INTRODUCTION

Captive animals with catalepsy cannot alter positions. If positioned in an odd position, a regular animal will shift in seconds. Cataleptic animals stay in this position for hours (i.e., several minutes or longer)

[14]. The researcher is interested in catalepsy because it mirrors Parkinson's, catatonic schizophrenia, and basal ganglia injury [1-9]. Catalepsy is used to analyze neurochemical system behavior. There are several techniques to produce and assess animal catalepsy. Standard catalepsy tests include putting an animal in an unusual posture and monitoring how long it takes to move. It influences catalepsy severity [12]. Catalepsy detection is so effective that procedure changes seldom impede it. Small methodological modifications may impact the cataleptic effect, making lab-to-lab comparisons difficult or impossible. The "bar test" was created by Kuschinsky and Hornykiewicz (1972). Despite its simplicity and application in psychopharmacology, the "standard bar test" isn't standard [3].

Since antiquity, *Terminalia chebula*'s dried fruit pulp, termed Haritaki in Ayurveda, has been used to treat a variety of ailments. Terminalia Dried fruit pulp is Terminalia Combretaceae[4]. Terminalia Teak, mixed deciduous, and drier forests contain fruit pulp. 1500-2000 m tall. It likes clayey, shady soil. From the Ravi River to West Bengal, Assam, Central, and South India. *Terminalia chebula* is bioactive and therapeutic. Apple pulp is a "king of medicine"[5]. *Terminalia chebula* chemistry *Terminalia chebula*'s biological activity and medicinal usage have improved in 50 years. It's a natural remedy for many ailments. Terminalia Dried fruit pulp has antioxidant components [6]. The extract protects rat hepatocytes and liver against t-BHP-induced oxidative damage. HPLC identified hydroxybenzoic acid derivatives, hydroxycinnamic acid derivatives, flavonol aglycones, and other phenolic substances [7].

Terminalia chebula dried fruit pulp lowered histamine in anaphylactic rats. *Terminalia chebula* dried fruit pulp reduced lipid peroxidation and DNA damage in mice. Neuroleptic-induced movement disorders and atypical antipsychotic shortages are worldwide mental health issues. Antipsychotics may produce pyramidal symptoms. Dopaminergic blockers induce catalepsy in animals. Cataleptic and neuroleptic effect are linked [8]. Experimental catalepsy evaluates extrapyramidal diseases and neurochemical system behavior. Haloperidol suppresses dopaminergic activity in the nigrostriatal pathway, producing catalepsy, dystonia, and pseudo-parkinsonism. Haloperidol-induced catalepsy is similarly affected by central cholinergic stimulation or antagonism [23, 24]. In light of past studies on *Terminalia chebula* dried fruit pulp's CNS and dopaminergic system effects on behavior, the current study investigated its anticataleptic potential.

MATERIAL AND METHODS

Selection of the plant:

Selection of the plants for screening may be guided by taxonomy, phytochemistry, ecology or ethnobotany. Based on the discussion with the traditional medical practitioners and the ethanopharmacological literatures the plant *Terminalia chebula* selected for the neuroprotective activity.

Collection and authentication of plant

The mature fruits of the plants, *Terminalia chebula* were collected from the saththyamanglam forest Erode Dt, Tamilnadu, in September 2020. The plant materials were identified and authenticated by the Dr. Chandrashekar R, Ayurvedic Physician and Researcher in the Department of Pharmacology at the A.J. Institute of Medical Sciences and Research Centre in Mangalore, Karnataka, India, A voucher specimen (TCMA-1) has been deposited in the Department of Pharmacology, Vinayaka Mission's KirupanandaVariyar Medical College,Salem for future reference. The fruits were shade dried at room temperature for 10 days and coarsely powdered and passed through sieve No. A.N.16-A/2020 DATED : 05/10/2020.

Extraction and Phytochemical analysis

The fruit pulp was then shade dried at room temperature for 10 days and coarsely powdered and stored in an air-tight container. About 500 g of coarsely powdered dried fruit pulp were taken and subjected to continuous hot percolation with different solvents of increasing order of polarity such as pet ether, chloroform, acetone, ethanol, and aqueous. The extracts were dried under the rotary evaporator and the percentage yield of the extracts were calculated. As it shown in table no 1. Then the extracts were tested for various phytochemical constituents like alkaloids, flavonoids, glycosides, phenols, saponins, sterols, tannins, proteins, and carbohydrates. Percentage yield and phytochemical screening. Conventional qualitative methods described by a number of authors were used to conduct a phytochemical analysis of the plant extracts' major phytoconstituents [11, 17-20]. Compounds such as glycosides, alkaloids, flavonoids, phenolic compounds, saponin, steroids, quinine, and tannin were looked for in the plant extracts [21]. Standardized chemical analyses are performed on both the aqueous extract and the powdered form of each plant sample [22].

a. ***Test for Alkaloids:*** Dragendroffs reagents
   Solution A: 0.6g of Bismuth sulphate dissolved in 20ml of water.

Solution B: 6g of Potassium iodide was dissolved in 50ml of water. Solution A and Solution B were mixed and allowed to strand for some time.The supernatant was decanted from potassium iodide and make up to 100ml.

b. ***Test for Flavonoids:***1ml of stock alcoholic solution with few drops of neutral FeCl3 and 5ml of extract with 1ml of alcohol subjected to the Ferric chloride test.
c. ***Test for Phenolic compounds:*** 1ml of extract with 5ml of alcohol and few drops of neutral FeCl3.
d. ***Test for Tannin:*** 1ml of extract with minimum amount of H20. Filtered and to the filtrate add few drops of FeCl3 solution.
e. ***Test for Saponins:*** 1ml of extract with 20ml of distilled water agitated vigorously for 15 minutes.
f. ***Test for Steroids:*** 1ml of extract with 1ml of methanolic extract of drug and 1ml of chloroform, 2 -3ml of acetic anhydride and 1 -2 drops of conc. H2SO4 were added.
g. ***Test for Quinine:*** 1ml of extract with few drops of alcoholic KOH was added.
h. ***Test for Glycosides:*** 1g powder with dissolved in 2 -3 ml of distilled water and 2 -3 drops of 1per cent solution of alcoholic -napthol added side of test tube.

The physicochemical properties of powdered *Terminalia chebula* seeds from dried fruit pulp. The total ash, water soluble ash, acid insoluble ash, pH, volatile oil content, moisture content, fixed oil present, and specific gravity were all measured. Wistar albino rats of either sex (weighing 250-300gm) and 1-2 months of age were employed in the study, which were bred in the Central animal house facility of the government erode medical college. They were acclimatized to the institute's laboratory conditions prior to the experiment. They were kept in polypropylene cages at a temperature of 252 degrees Fahrenheit, with a photoperiod of 12 hours natural light and 12 hours darkness, humidity of 50 to 55 percent, and free access to food and water. All of the experimental procedures were completed between 10:00 and 16:00 hours, and each animal was utilised just once. The Institutional Animal Ethics Committee granted ethical clearance 588/GO/Re/S/02/CPCSEA to the experimental protocol. Date of Registration: 05/04/2002) dated 22nd September 2020 (Ref No Ph. D 001/1AEC/GEMCH/Dated 2020, study was conducted in accordance with CPCSEA guidelines)

Experimental animals

The study employed 1-month-old, 200-300-gram Wistar albino rats of either sex. These rats came from the Government Erode Medical College's animal house. They were acclimated to the lab's conditions before the experiment. They were kept in polypropylene cages at 252°F. 12 hours of light were followed by 12 hours of darkness. 50 to 55% humidity, unlimited food and water. Each animal was only utilized once throughout the experiment, which was completed between 10:00 and 16:00. The Institutional Animal Ethics Committee approved experiment 588/GO/Re/S/02/CPCSEA. dated 22nd September 2020 (Ref No Ph. D 001/1AEC/GEMCH/Dated 2020, CPCSEA-compliant study) date of registration: 05/04/2002;

Experimental design:

For all the tests except otherwise, healthy wistar albino rats of either sex were divided into four (6) groups, having equal number of animals, as under: Group-I: control group. It was administered Control (1% Gum acacia)i.p. Group-II: Standard control group. It was administered L Dopa-carbidopa (30 mg/kg) + Haloperidol (1 mg/kg, i.p.) , Group-III: Negative control group. It was administered Haloperidol 1mg/kg, i.p. Group IV :Test group. It was treated with *Terminalia chebula* extract 100mg/kg p.o. Group-V: Test group. It was treated with *Terminalia chebula*extract 200mg/kg p.o., ,Group VI: It was treated with *Terminalia chebula* extract 400mg/kg p.o. [11].

Acute oral toxicity study

The fixed-dose acute toxicity test followed OECD guideline 420. The method provides information on hazardous properties and ranks and classifies substances according to the GHS for acutely toxic chemicals. OECD guidelines recommend testing one sex (usually females). Six 8-10-week-old Wistar rats were acclimatized for 7 days. In a 300 mg/kg dose study on one rat, no toxicity symptoms were found, so the dose was increased to 2,000 mg/kg. Further tests at 2,000 mg/kg showed no toxicity. In the main test, 4 rats received 2,000 mg/kg. Each animal was observed for 24 h and 14 days for toxicity symptoms. The compound will then be ranked and classified using the GHS for acutely toxic chemicals.

Bar test :After 20 seconds of holding the prescribed position, the animal was pronounced cataleptic and awarded one point. One point was added for every additional 20 seconds that the cataleptic position was maintained. The animals were observed twice, at 30-minute intervals, and the longer period of inactivity was taken into account. *Terminalia chebula* and scopolamine were given only once, 30 minutes before haloperidol, in the acute trial. These medications were given once daily, 30 minutes before haloperidol, for seven days during a chronic trial. On day one and day seven of therapy, catalepsy was evaluated 30 minutes after haloperidol delivery.

RESULTS AND DISCUSSION

Phytochemical studies table 1 shows the sequential extractive values for whole aqueous solution, acid insoluble solution, and aqueous soluble. The hydro-alcoholic solvent had the highest extractive value (28.210.62), followed by aqueous (21.310.32), and alcoholic solvents (5.710.52). The moisture content was 9.30 percent in the dry oven and 10% in the Toluene distillation process, respectively. The volatile concentration was discovered to be less than 1%, and fixed oil was found to be present. The pH of a 1 percent and a 10% aqueous solution was tested at 300C and found to be 6.7 and 6.3, respectively. Table 1 displays the results.

Table 1: Phytochemical analysis in *Terminalia chebula* Retz with different solvents

S. No	Extract	Phytochemicals							
		A	F	S	S	Q	PC	T	G
1.	Acetone	+	+	-	-	-	+	+	-
2.	Ethyl acetate	+	+	-	-	-	+	+	-
3.	Hexane	+	+	-	-	-	+	+	-
4.	Ethanol	+	+	-	-	-	+	+	+
5.	petroleum ether	+	+	-	-	-	+	+	+
6.	Chloroform	+	+	-	-	-	+	+	+
7.	Diethyl ether	-	+	-	-	+	+	+	+
8.	n-propyl alcohol	+	+	-	-	-	+	+	+
9.	n-butanol	+	+	-	-	-	+	+	+
10.	Methanol	+	+	-	-	+	+	+	+
11.	Water	+	+	-	-	-	+	+	+

A -Alkaloid, PC - Phenolic compound, F - Flavonoid, T - Tannin S - Steroid, G -Glycoside S -Saponin, CA - Carboxylic acid and
Q -Quinine. (indicates absence of compounds)

***Acute toxicity study*:**

The test was conducted using a normal bar test. Catalepsy was induced with haloperidol (1.0 mg/kg i.p.) and measured at 30 minute intervals till 120 minutes and 240 minutes. The drug haloperidol (1 mg/kg i.p.) was chosen since it elicited a moderate level of catalepsy, allowing for the identification of either attenuation or potentiation of the phenomena. The results of the acute trial showed that all dosages of the test medication provided cataleptic scores similar to the negative control at 30 minutes. The standard drug (L Dopa+carbidopa (30 mg/kg) and all other groups, however, demonstrated significantly (p0.01) shorter cataleptic times than the negative control group from 60 minutes onwards following haloperidol administration. When the mean cataleptic time of different groups at different time intervals was compared to the negative control at 30 minutes, *Terminalia chebula*, 200mg/kg, and 400mg/kg at 120 minutes were shown to be nearly identical to the negative control ($p>0.05$). Similarly, at 240 minutes, *Terminalia chebula*in doses of 100gm/kg and 400gm/kg resulted in a significantly (p0.001) lower score than the negative control.

The mean cataleptic score of various groups when compared with respect to standard control (L Dopa+carbidopa (30 mg/kg) at 30 minutes it was observed that *Terminalia chebula*(100mg/kg, 200mg/kg) at 120 minutes produced almost similar effect ($p>0.05$) on cataleptic time as that of standard drug. However, *Terminalia chebula*200mg/kg) at 240 minutes and *Terminalia chebula*(400gm/kg) at 120 minutes and 240 minutes showed significant ($p<0.01$) reduction in cataleptic time.

The test drug was actually more protective against the haloperidol induced catalepsy than the standard drug (L Dopa+carbidopa (30 mg/kg). The mean cataleptic time of different groups at various time intervals when compared with respect to negative control at 240 minutes, showed statistically significant ($p<0.01$) reduction in the cataleptic score.

The mean cataleptic time of *Terminalia chebula*(100mg/kg) at 30 minutes when compared with mean cataleptic time of other groups, also showed that *Terminalia chebula*(200gm/kg and 400gm/kg) at 240 minutes reduced cataleptic time significantly($p<0.01$).The results are summarized table 2,fig 1.

Table 2. EFFECT OF ACUTE TOXIC DOSE ADMINISTRATION OF *TERMINALIA CHEBULA* FRUIT PULP (AETCFP)ON HALOPERIDOL –INDUCED CATALEPSY

	Groups	**Time**					
	Drug/Dose	0 Minutes	30 Minutes	60 Minutes	90 Minutes	120 Minutes	240 Minutes
	Control (1% Gum acacia)	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
	L Dopa-carbidopa (30 mg/kg) + Haloperidol (1 mg/kg, i.p.)	0.00±0.00	3.00±0.89[a]	2.17±1.17[a]	1.67±0.82[a]	1.67±0.52[a]	1.50±0.84[a]
	Haloperidol (1 mg/kg, i.p.)	0.00±0.00	1.17±0.41[b]	2.17±1.17[a]	0.83±0.41[a]	0.50±0.55[b]	0.33±0.52[b]
	AETCFP (100 mg/kg)	0.00±0.00	1.67±0.52[b]	0.67±0.52[b]	1.50±0.55[a]	1.83±0.75[a]	2.17±1.17[a]
	AETCFP (200 mg/kg)	0.00±0.00	1.67±0.82[b]	1.50±0.55[a]	1.83±0.75[a]	1.33±0.52[a]	1.67±0.82[a]
	AETCFP (400 mg/kg)	0.00±0.00	2.17±0.75[b]	2.17±1.60[a]	1.50±0.55[a]	1.50±0.55[a]	2.00±1.10[a]
	2 Way ANOVA	**F Value**	**P-Value**				
	Groups	30.417	0.000				
	Days	26.129	0.000				
	Groups * Days	3.677	0.000				

Data are represented as mean ± SEM (n = 6); a- highly significant, b-less significant, c- not significant. The mean values having different superscripts are statistically significant (P<0.05).n=6 in each group, Test use: Intra Group Comparison: by Repeated ANOVA with Tukey-Kramer multiple comparison test as post-test. Intergroup comparison: by Non- Repeated ANOVA with Tukey-Kramer multiple comparisons test as post-test. A p< 0.001,a*-p<0.05w.r.t control group at 3o minutes. b-p<0.001, b*-p<0.05w.r.t standard control group at 30 minutes. c-p<0.001, c*-p<0.05w.r.t control at 240 minutes. d-p<0.001, d*-p<0.05w.r.t *Terminalia chebula* (lower dose) at 30 minutes.

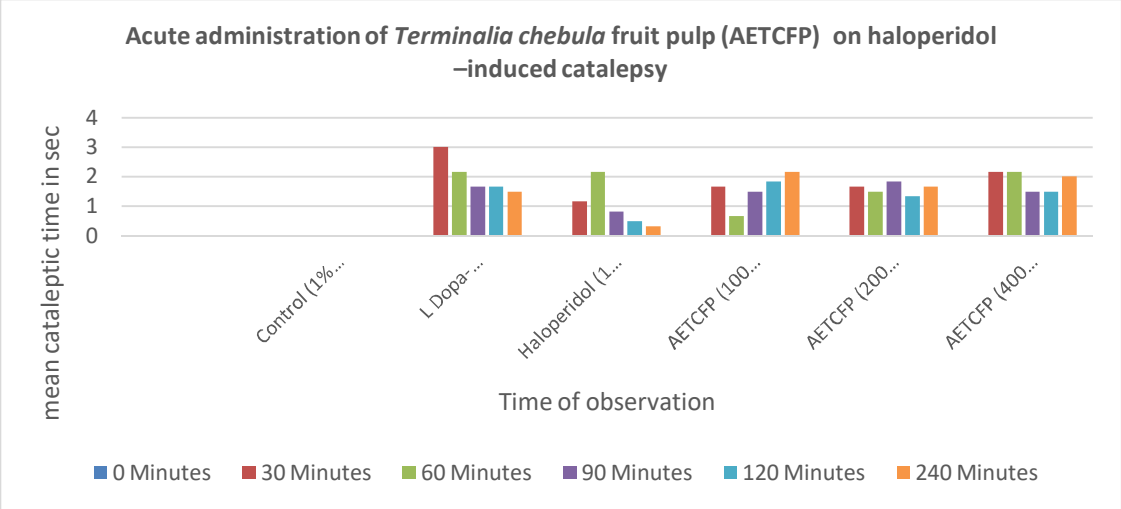

FIG.1 Acute toxic dose administration of *Terminalia chebula* fruit pulp (AETCFP) on haloperidol – induced catalepsy

Chronic toxicity study

In the repeated dose research, the cataleptic state of each group at 30 minutes was almost same when compared to the negative control. All doses of the test drug and standard medicine resulted in considerably lower cataleptic scores than the negative control group from 60 minutes after haloperidol administration. In a dose and time dependent manner, L Dopa-carbidopa (30 mg/kg) at 240 minutes and *Terminalia chebula*(200 mg/kg) at 240 minutes demonstrated statistically significant (p0.01) reductions in the cataleptic time compared to the negative control at 30 minutes. When the mean cataleptic time of different groups at different time intervals was statistically compared with the standard drug (L Dopa-carbidopa 30gm/kg) at 30 minutes, it was discovered that *Terminalia chebula*400mg/kg at 120 minutes and 240 minutes showed statistically significant (p0.01) reductions in cataleptic time when compared to the standard drug. When the mean cataleptic time of different groups at various time intervals was compared to the negative control at 240 minutes, practically all groups showed a statistically significant (p0.01) reduction in cataleptic time.When the mean cataleptic time of the various groups was compared to *Terminalia chebula*(100mg/kg) at 30 minutes, it was discovered that *Terminalia chebula*(200mg/kg) at 120 minutes was nearly similarly efficacious (p>0.05). At 240 minutes, *Terminalia chebula*(400gm/kg) had a statistically significant (p0.01) shorter cataleptic period than *Terminalia chebula*(100mg/kg) at 30 minutes. As a result of the aforesaid findings, *Terminalia chebula*appears to have a dose and time dependent protective effect against haloperidol-induced catalepsy.

Table 3 . EFFECT OF CHRONIC TOXIC MULTIPLE DOSAGE ADMINISTRATION OF *TERMINALIA CHEBULA*ON HALOPERIDOL –INDUCED CATALEPSY

	Groups	**Time**					
	Drug/Dose	0 Minutes	30 Minutes	60 Minutes	90 Minutes	120 Minutes	240 Minutes
	Control (1% Gum acacia)	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
	L Dopa-carbidopa (30 mg/kg) + Haloperidol (1 mg/kg, i.p.)	0.00±0.00	1.16±0.16[a]	2.16±0.47[a]	1.66±0.33[a]	1.66±0.21[a]	1.5±0.34[a]
	Haloperidol (1 mg/kg, i.p.)	0.00±0.00	3±0.36[b]	0.66±0.21[a]	0.83±0.16[a]	0.5±0.22[b]	0.33±0.21[b]
	AETCFP (100 mg/kg)	0.00±0.00	1.86±0.21[b]	1.5±0.22[b]	1.83±0.16[a]	1.83±0.30[a]	2.16±0.47[a]
	AETCFP (200 mg/kg)	0.00±0.00	1.66±0.33[b]	2,16±0.65[a]	1.83±0.30[a]	1.33±0.30[a]	1.66±0.33[a]
	AETCFP (400 mg/kg)	0.00±0.00	2.26±0.30[b]	1.83±0.40[a]	1.5±0.22[a]	1.5±0.22[a]	2±0.44[a]
	2 Way ANOVA	**F Value**	**P-Value**				
	Groups	30.317	0.000				
	Days	27.029	0.000				
	Groups * Days	3.577	0.000				

Data are represented as mean ± SEM (n = 6); a- highly significant, b-less significant, c- not significant. The mean values having different superscripts are statistically significant (P<0.05).n=6 in each group, Test use: Intra Group Comparison: by Repeated ANOVA with Tukey-Kramer multiple comparison test as post-test. Inter group comparison: by Non- Repeated ANOVA with Tukey-Kramer multiple comparisons test as post-test. A p< 0.001,a*-p<0.05w.r.t control group at 3o minutes. b-p<0.001, b*-p<0.05w.r.t standard control group at 30 minutes. c-p<0.001, c*-p<0.05w.r.t control at 240 minutes. d-p<0.001, d*-p<0.05w.r.t *Terminalia chebula* (lower dose) at 30 minutes.

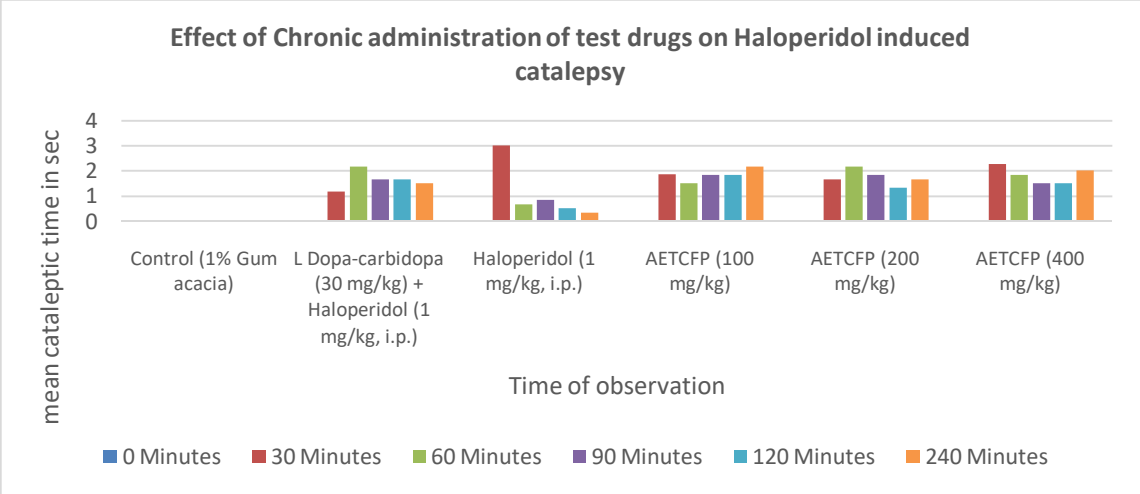

FIG.2 . Effect of Chronic administration of test drugs on Haloperidol induced catalepsy

DISCUSSION

Studies in people and animals show that neuroleptics inhibit striatal dopamine D2 receptors. This may trigger neuroleptic-induced extrapyramidal side effects. Catalepsy is used to test antipsychotics' extrapyramidal effects. Other neurochemical explanations for catalepsy include striatonigral, GABAergic, cholinergic, glutamate, and serotonergic. Preclinical and clinical studies have linked haloperidol-induced toxicity to reactive oxygen species and other neurotransmitters. Scopolamine, an anticholinergic medication that enters the brain in vivo, was administered intraperitoneally to rule out peripheral catalepsy. Haloperidol-induced catalepsy was attenuated by scopolamine, showing that catalepsy reflects CNS impact. *Terminalia chebula* dried fruit pulp was as effective as scopolamine in preventing drug-induced catalepsy. Terminalia chebula's dried fruit pulp contains phytochemicals. Gallic acid, chebulic acid, punicalagin, chebulanin, corilagin, neochebulanic acid, ellegic acid, chebulagic acid, chebulinic acid, 1,2,3,4,6-penta-Ogalloyl-D-glucose, 1,6,-di-O-galloyl-D-glucose, casuarinin, 3,4,6-tri- *Terminalia chebula*dried fruit pulp extracts include dopaminergic and D2 receptor agonists, according to the study [25, 26].

Phytochemistry revealed neuroactive compounds. Because of its excellent yield and phytochemical profile, *Terminalia chebula* fruit pulp aqueous extract was chosen. T.chebula The plant contains tannins,

glycosides, alkaloids, flavonoids, phenolic compounds, saponins, and carboxylic acid. Various solvents extract fruit phytochemicals to variable degrees. Both institutions reached the same conclusion. Fruit alkaloids react with Dragendroff's reagents to form a reddish brown precipitate. Blue precipitate formed from fruit extract and ferric chloride. Evidence suggests T contains tannins. Retz. Glycosides turn naphthol and sulpuric acid brick red. Chloroform, acetic anhydride, and sulphuric acid may detect steroid use. Saponin with mercuric chloride formed a white precipitate. Flavonoids are needed because ferric chloride and water become reddish-black in their presence. Quinine became blue in NaOH solution. Neutral and phenolic-charged chemicals interacted. According to our research, *Terminalia chebula* showed antidepressant and anxiolytic-like actions. Terminalia-genus plants made this finding feasible. Chlorpromazine, haloperidol, and reserpine create a cataleptic condition in rats, which is used to study extrapyramidal side effects. Neuroleptic-induced catalepsy is connected to striatal D1 and D2 receptor inhibition. Despite this evidence, acetylcholine, serotonin, angiotensin, adenosine, and opioids are involved. Many preclinical and clinical studies have revealed that reactive oxygen species contribute to haloperidol toxicity and catalepsy. Drugs that worsen or relieve extra pyramidal symptoms in mice may have the opposite effect in humans [20, 22, 10-15].

Terminalia chebula aqueous extract was as efficacious as scopolamine in decreasing haloperidol-induced catalepsy. Anticataleptic effectiveness of *Terminalia chebula*increases with repeated (chronic) therapy. *Terminalia chebula* protected against Haloperidol-induced catalepsy, supporting our prior investigations on its anticataleptic activity. *Terminalia chebula*, known as haritaki in Ayurveda, component reports. Dried fruits include glucose, sorbitol, saponins, anthrones, and anthranols. 20% of the dried fruit contains lipids, b-sitosterol, saponins, gallic acid, ellagic acid, and its derivatives, glycosides, and carbs. In *Terminalia chebula* fruits, hydrolyzable tannins (10%-12%) including emblicanins A and B, punigluconin, pedunculagin, and putranjivain A are more effective antioxidants than alpha-tocopherol. Terminalia chebula's tannoid principles exhibit substantial antioxidant effects in rats' frontal brain and striatum, and EO reduces haloperidol-induced catalepsy in mice. *Terminalia chebula* reduces cold-induced LPO and corticosterone.

In view of the present study and earlier antioxidant reports on Terminalia chebula, human studies are required to evaluate its effectiveness against antipsychotic drugs' extrapyramidal adverse effects. Unknown which preparation components provide this test chemical's anticataleptic effect. *Terminalia chebula* possesses anticataleptic qualities due to its antioxidants and free radical scavengers. Understanding the observed impacts' chemical pathways will need further investigation.

CONCLUSION

The antidepressant effects of *T.chebula* aqueous extract in the treatment of parkinsonism were confirmed in a variety of rat behavioral models. Treatment with extract at either 100 or 200 mg/kg, p.o., for fifteen consecutive days significantly increased immobility time as measured by the cataleptic scoring model. The increased monoamine neurotransmitters may be the result of the large dosage (200 mg/kg, p.o.) inhibiting the metabolic enzyme MAO-A. These results suggest that the fruits of *T.chebula,* analyzed using the cataleptic model and cataleptic bar score approach, might be utilized as an alternative therapy for a variety of illnesses affecting the central nervous system, such as antidepressants in Parkinson's disease. The goal of this research was to determine whether or not *Terminalia chebula* extract had any impact on haloperidol-induced catalepsy in Wister albino rats. However, additional study into the safety profile, specific mechanism of action, and start of clinical trials is needed before these results may be employed in a therapeutic setting.

REFERENCES

1. Luciani, K. R., Frie, J. A., & Khokhar, J. Y. (2020). An Open Source Automated Bar Test for Measuring Catalepsy in Rats. eNeuro, 7(3), ENEURO.0488-19.2020.
2. Vogel, H.G., Vogel, W.H., Schölkens, B.A., Sandow, J., Müller, G., Vogel, W.F. (2002). Drug effects on learning and memory1 . In: Vogel, H.G., Vogel, W.H., Schölkens, B.A., Sandow, J., Müller, G., Vogel, W.F. (eds) Drug Discovery and Evaluation. Springer, Berlin, Heidelberg.
3. Sanberg, P.R., Martinez, R., Shytle, R.D., Cahill, D.W. (1996). The Catalepsy Test. In: Sanberg, P.R., Ossenkopp, KP., Kavaliers, M. (eds) Motor Activity and Movement Disorders. Contemporary Neuroscience. Humana Press, Totowa, NJ.
4. Bag, A., Bhattacharyya, S. K., & Chattopadhyay, R. R. (2013). The development of *Terminalia chebula* Retz. (Combretaceae) in clinical research. Asian Pacific journal of tropical biomedicine, 3(3), 244–252.
5. R. Arbind Kumar Choudhary, E. Manivannan, (2021). Phytochemical analysis of Ethanolic extract of fruits of *Terminalia chebula* and its medicinal use in human.PhOL ,• vol.2 • 43-54.
6. Aparna Upadhyay, Pooja Agrahari and D.K. Singh, (2014). A Review on the Pharmacological Aspects of *Terminalia chebula*. International Journal of Pharmacology, 10: 289-298.

7. Chen, Xiuping& Sun, Fangyun& Ma, Lifeng& Wang, Jinhua & Qin, Hailin& Du, Guan-Hua. (2011). In vitro evaluation on the antioxidant capacity of triethylchebulate, an aglycone from *Terminalia chebula* Retz fruit. Indian journal of pharmacology. 43. 320-3.
8. Sudhanshu Kumar Meher, Purnendu Panda, Banmali Das, G. C. Bhuyan, Dr. K. K. Rath. Pharmacological Profile of *Terminalia chebula* Retz. and Willd. (Haritaki) in Ayurveda with Evidences. Res. J. Pharmacology and Pharmacodynamics.2018; 10(3):115-124
9. Ananth, J., Burgoyne, K. S., Gadasalli, R., & Aquino, S. (2001). How do the atypical antipsychotics work?. Journal of psychiatry &neuroscience : JPN, 26(5), 385–394.
10. Shireen E. Experimental treatment of antipsychotic-induced movement disorders. Journal of Experimental Pharmacology. 2016 ;8:1-10.
11. Ananth, J., Burgoyne, K. S., Gadasalli, R., & Aquino, S. (2001). How do the atypical antipsychotics work?. Journal of psychiatry &neuroscience: JPN, 26(5), 385–394.
12. Luciani, Karling R et al. "An Open Source Automated Bar Test for Measuring Catalepsy in Rats." eNeuro vol. 7,3 ENEURO.0488-19.2020. 19 Jun. 2020,
13. Dar PA, Sofi G and Jafri MA: Evaluating the Effect of Extract of HalelaSiyah (*Terminalia Chebula* Retz) on chemically induced Catalepsy in Mice. Int J Pharm Res Sci. 3(8); 2873-2879.
14. Lee, Su-Kyoung& Lee, H.s. (2006). Growth inhibitory activity of active component of *Terminalia chebula* fruits against intestinal bacteria. Journal of food protection. 69. 2205-9
15. Cryan JF, Mombereau C, Vassout A. The tail suspension test as a model for assessing antidepressant activity: review of pharmacological and genetic studies in mice. NeurosciBiobehav Rev. 2005;29(4-5):571-625.
16. Steru L, Chermat R, Thierry B, Simon P. The tail suspension test: a new method for screening antidepressants in mice. Psychopharmacol (Berl). 1985;85(3):367-70.
17. Samarakoon SM, Chandola HM, Shukla VJ. (2011). Evaluation of antioxidant potential of AmalakayasRasayana:A polyherbal Ayurvedic formulation. Int J Ayurveda Res. 2(1):23-8. 13
18. Joshi H, Parle M.(2006). Brahmi rasayana Improves Learning and Memory in Mice. Evidence-Based Complementary and Alternative Medicine. 3(1):79-85.
19. Mohan L, Rao USC, Gopalakrishna HN, Nair V. (2011). Evaluation of the Anxiolytic Activity of NR-ANX-C (a Polyherbal Formulation) in Ethanol Withdrawal-Induced Anxiety Behavior in Rats. Evid Based Complement Alternat Med. ;2011:327160.
20. Kim YR, Park BK, Kim YH, Shim I, Kang IC, Lee MY.(2018). Antidepressant Effect of Fraxinus rhynchophylla Hance Extract in a Mouse Model of Chronic Stress-Induced Depression. BioMed Res Int. 2018:8249563.
21. Ramesh M, Dokurugu YM, Thompson MD, Soliman ME. (2017). Therapeutic, molecular and computational aspects of novel monoamine oxidase (MAO) inhibitors. Comb Chem High Throughput Screen. 20(6):492-509.
22. Vonshak A, Barazani O, Sathiyomoorthy P, Shalev R, Vardy D, Golan-Goldhirsh A. (2003). Screening of South-Indian medicinal plants for antifungal activity. Phyther Res. 17:1123e1125.
23. Peterson CT, Denniston K, Chopra D. (2017). Therapeutic uses of triphala in Ayurvedic medicine. J Altern Complement Med. 23(8):607-14.
24. Gupta P. (2012). Biological and pharmacological properties of *Terminalia chebula* Retz. (haritaki)- an overview. Int J Pharm Pharm Sci. 2:2.e10.
25. Arbind K, Manivannan E, Chandrasekar R. (2019). Ethnopharmacological review of *Terminalia chebula*. BioequivBioavailab Int J. 3:1.e8.
26. Chattopadhyay RR, Bhattacharyya SK. (2007). Plant review – *Terminalia chebula*: an update. Pharm Rev. 1:151. e156.

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