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EVALUATION OF ANTI-DEPRESSANT ACTIVITY OF BOUGAINVILLEA SPECTABILIS IN WISTAR ALBINO RATS

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Abstract:

Depression disorder has significant potential morbidity and mortality, contributing to suicide, incidence and adverse outcomes of medical illness, disruption in interpersonal relationships, substance abuse, and lost work time. The present study was designed to study the anti-depressant activity of the leaves extract of Bougainvillea spectabilis using forced swim test and tail suspension test on Swiss albino Rats. The anti-depressant activity of the leaves of Bougainvillea spectabilis was assessed using Chronic Unpredictable Mild-Stress (CUMS) induced depression in Rats. The animals were treated with the methanolic extract of leaves of Bougainvillea spectabilis orally at two doses of 100; 200mg/kg body weight for eight days after CUMS induced depression in Rats. The results demonstrate that ethanolic extract of Bougainvillea spectabilis has got anti-depressant potential. The study showed that the extract of Bougainvillea spectabilis had significant antidepressant activity. The Microsoft excel was used to calculate the mean ± SEM and one way ANOVA followed by turkey multiple comparison test were used to analyzed the results. The extract presented significant antidepressant activity in Rats ($p<0.05$). This study was conducted to explore the antidepressant activity of leaves extracts of plant Bougainvillea spectabilis in CUMS induced Rats.

Keywords: *Bougainvillea spectabilis*, Antidepressant activity and forced swim test.

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INTRODUCTION:

Medicinal plants are various plants thought by some to have medicinal properties, but few plants or their phytochemical constituents have been proven by rigorous science or approved by regulatory agencies such as the United States Food and Drug Administration or European Food Safety Authority to have medicinal effects. World Health Organization (WHO) has provided a definition of medicinal plants, that is "A medicinal plant is any plant which, in one or more of its organs, contains substances that can be used for therapeutic purposes or which are precursors for synthesis of useful drugs. [1]

World Health Organization (WHO) reported that 80% of the world's population depends on medicinal plants for their primary health care. In the Plant Kingdom, Medicinal plants form the largest single grouping of plants. It is estimated that 30,000 species worldwide fall in this group, of which around 33% are trees [2] Plants are known to be the source of many chemical compounds. Medicinal plants were used by people of ancient cultures without knowledge of their active ingredients. The common practice of taking crude extract orally is laden with hazards as the extracts may contain some toxic constituents. There is an ever increasing need to limit toxic clinical drugs.In modern times, the active ingredients and curative actions of medicinal plants were first investigated through the use of European Scientific methods [3]. The most important ingredients present in plant communities turn out to be alkaloids, terpenoids, steriods, phenols glycosides and tannins [3].

The information obtained from extracts of medicinal plants makes pharmacological studies possible. The mode of action of plants producing therapeutic effects can also be better investigated if the active ingredients are characterized. Infectious diseases are the leading cause of death worldwide. The clinical efficiency of many existing antibiotics is being threatened by the emergence of multidrug resistant pathogens. Bacterial pathogens have evolved numerous defense mechanisms against antimicrobial agents and resistance to old and newly produced drug is on the rise. The increasing failure of chemotherapeutics and antibiotic resistance exhibited by pathogenic microbial infectious agents has led to the screening of several medicinal plants for their potential antimicrobial activity [4].

There are several reports in the literature regarding the antimicrobial activity of crude extracts prepared from plants [5]. Plants produce a diverse range of bioactive molecules making them a rich source of different types of medicines. Higher plants as sources of medicinal compounds have continued to play a dominant role in the maintenance of human health care since ancient times. Over 50% of all modern clinical drugs are of natural product origin and natural products play a vital role in modern drug development in the pharmaceutical industry [6].

History of plants in medicine [7]:

The earliest known medical document is a 4000-year-old Sumerian clay tablet that recorded plant remedies for various illnesses. The ancient Egyptian Ebers papyrus from 3500 year ago lists hundreds of remedies. The Pun-tsao contains thousands of herbal cures attributed to Shennung, China's legendary emperor who lived 4500 years ago. In India, herbal medicine dates back several thousand years to the Rig-Veda, the collection of Hindu sacred verses. The Badianus Manuscript is an illustrated document that reports the traditional medical knowledge of the Aztecs. Western medicine can be traced back to the Greek physician Hippocrates, who believed that disease had natural causes and used various herbal remedies in his treatments. Early Roman writings also influenced the development of western medicine, especially the works of Dioscorides, who compiled information on more than 600 species of plants with medicinal value in De Materia Medica. Many of the herbal remedies used by the Greeks and Romans were effective treatments that have become incorporated into modern medicine (e.g., willow bark tea, the precursor to aspirin). Dioscorides' work remained the standard medical reference in most of Europe for the next 1500 years.

The beginning of the Renaissance saw a revival of herbalism, the identification of medicinally useful plants. This coupled with the invention of the printing press in 1450 ushered in the Age of Herbals. Many of the herbals were richly illustrated; all of them focused on the medicinal uses of plants, but also included much misinformation and superstition. The Doctrine of Signatures, for example, held that the medicinal use of plants could be ascertained by recognizing features of the plant that corresponded to human anatomy. For example, the red juice of bloodworm suggests that it should be used for blood disorders; the lobed appearance of liverworts suggests that it should be used to treat liver complaints; the "humanoid" form of mandrake root suggests that is should be used to promote male virility and ensure conception.

Many of the remedies employed by the herbalists provided effective treatments. Studies of foxglove for the treatment of dropsy (congestive heart failure) set

the standard for pharmaceutical chemistry. In the 19th century, scientists began purifying the active extracts from medicinal plants (e.g. the isolation of morphine from the opium poppy). Advances in the field of pharmacology led to the formulation of the first purely synthetic drugs based on natural products in the middle of the 19th century. In 1839, for example, salicylic acid was identified as the active ingredient in a number of plants known for their pain-relieving qualities; salicylic acid was synthesized in 1853, eventually leading to the development of aspirin. It is estimated that 25% of prescriptions written in the U.S. contain plant derived ingredients (close to 50% if fungal products are included); an even greater percentage are based on semisynthetic or wholly synthetic ingredients originally isolated from plants.

While Western medicine strayed away from herbalism, 75% to 90% of the rural population of the rest world still relies on herbal medicine as their only health care. In many village marketplaces, medicinal herbs are sold alongside vegetables and other Wares. The People's Republic of China is the leading country for incorporating traditional herbal medicine into a modern health care system; the result is a blend of herbal medicine, acupuncture, and Western medicine. Plantations exist in China for the cultivation of medicinal plants, and thousands of species are thus available for the Chinese herbalist; prescriptions are filled with measured amounts of specific herbs rather than with pills or ointments. In India, traditional systems have remained quite separate from Western medicine. In addition to Ayurvedic medicine, which has a Hindu origin, Unani medicine, with its Muslim and Greek roots, is another widely practiced herbal tradition in India. The renewed interest in medicinal plants has focused on herbal cures among indigenous populations around the world, especially those in the tropical rain forests. It is hoped that these investigations will add new medicinal plants to the world's pharmacopoeia before they are lost forever. In addition to the destruction of the forests, the erosion of tribal cultures is also a threat to herbal practices.

Traditional medicine [8]:

Traditional medicine is the synthesis of therapeutic experience of generations of practicing physicians of indigenous systems of medicine. Traditional preparation comprises medicinal plants, minerals and organic matters etc. Herbal drug constitutes only those traditional medicines that primarily use medicinal plant preparations for therapy. The ancient record is evidencing their use by Indian, Chinese, Egyptian, Greek, Roman and Syrian dates back to about 5000 years.

About 500 plants with medicinal use are mentioned in ancient texts and around 800 plants have been used in indigenous systems of medicine. Indian subcontinent is a vast repository of medicinal plants that are used in traditional medical treatments[8], which also forms a rich source of knowledge. The various indigenous systems such as Siddha, Ayurveda, Unani and Allopathy use several plant species to treat different ailments [9]. In India around 20,000 medicinal plant species have been recorded recently, but more than 500 traditional communities use about 800 plant species for curing different diseases[10]. Currently 80 % of the world population depends on plant-derived medicine for the first line of primary health care for human alleviation because it has no side effects. Plants are important sources of medicines and presently about 25% of pharmaceutical prescriptions in the United States contain at least one plant-derived ingredient. In the last century, roughly 121 pharmaceutical products were formulated based on the traditional knowledge obtained from various sources.

The use of traditional medicine has increased in developed countries also, mainly due to the failure of modern medicine to provide effective treatment for chronic diseases and emergence of multi-drug resistant bacteria and parasites. The adverse effects of chemical drugs, questioning of the approaches and assumptions of allopathic medicine, their increasing costs and greater public access to information on traditional medicine has also led to an increase in interest in alternative treatments (WHO 2002). Plant extracts have become a source of hope as a wide group of medicinal plant preparations are available that have been used over the centuries almost exclusively on the basis of empirical evidence. Hence, it has become necessary to revisit the importance of these herbal medicines.

MATERIALS AND METHODS:

The designing of methodology involves a series of steps taken in a systematic way in order to achieve the set goal(s) under the prescribed guidelines and recommendations. It includes in it all the steps from field trip to the observation including selection and collection of the medicinal plant, selection of dose value, standardization of protocol, usage of instruments, preparation of reagents, selection of specific solvents for extraction, formation of protocols and final execution of the standardized protocol. All this requires good build of mind and a good and soft technical hand to handle the materials and procedure in a true scientific manner.

Drugs and Chemicals

Drugs and Chemicals used in this study were of analytical grade and of highest purity procured from standard commercial sources in India.

Table No: 7.1 Drugs and Chemicals

S.No	***Materials***	***Company Name***
1.	Diazepam	Nicholos Piramal Ltd

Instruments

Following instruments were required for the study:

Table No:List of Instruments used for study

Name of the instrument	***Source***
Centrifuge	Dolphin
Digital weighing balance	Horizon
Glucometer	Horizon
Heating mantle	ASGI®
Refrigerator	Videocon
Actophotometer	Dolphin
Elevated Plus maze apparatus	Dolphin
Glass cylinder	ASGI®
Adhesive tape	YVR medivision Pvt Ltd
Thread	YVR medivision Pvt Ltd
Stop watch	ASGI®
Syringes	YVR medivision Pvt Ltd
Needles	YVR medivision Pvt Ltd
Soxhlet extractor	ASGI®
Condenser	ASGI®
Burette stand	Dolphin
Round bottom flask	ASGI®, Amar
Mixer	Videocon
Oven	ASGI®
Water bath	ASGI®
Stirrer/glass rod	ASGI®
Watch glass	ASGI®
Whatmann filter paper	Manipore microproducts, Ghaizabad.
Butter paper	ASGI®
Spatula	ASGI®
Rubber pipes	ASGI®

Experimental animals:

Wistar rats (150-200 g) and Swiss albino Rats (18-22g) of either sex selected for the study. Animals were housed in appropriate cages in uniform hygienic conditions and fed with standard pellet diet (Amrul Laboratory Animal Diet) and water ad libitum. All the animals were maintained under standard conditions, that is room temperature 26 ± 1°C, relative humidity 45 - 55% and12:12 h light – dark cycle. Animal studies had approval of IAEC.

Plant Material Collection:

The fresh leaves of *Bougainvillea spectabilis* was collected from local market. The plant material was cleaned, reduced to small fragments, air dried under shade at room temperature and coarsely powdered in a mixer. The powdered material was stored or taken up for extraction process.

Preparation of plant extracts:

Preparation of Ethanolic Extract:

Fresh leaves of *Bougainvillea spectabilis* leaf were collected and washed under tap water. The leaves extract used was prepared by taking 20gms of finely cut leaves into 250ml beaker containing 200ml of Ethanol. The contents were mixed well and then the mixture was boiled up to 50-60^{0}C for 4-5hrs. Further the extract was filtered with whatmann filter paper. The filtrate was boiled until the concentrated residue is formed. The concentrated product was sealed in sample covers and stored under room temperature and used for further experiment to check the activities.

Preliminary phytochemical analysis of the extracts:
The extracts so obtained were subjected to preliminary phytochemical screening. Phytochemical studies were performed to identify the presence of various Phytoconstituents as follows:

Alkaloids:
Extracts were dissolved individually in dilute Hydrochloric acid and filtered.
a. Mayer's Test: Filtrates were treated with Mayer's reagent (Potassium Mercuric Iodide). Formation of a yellow coloured precipitate indicates the presence of alkaloids.
b. Wagner's Test: Filtrates were treated with Wagner's reagent (Iodine in Potassium Iodide). Formation of brown/reddish precipitate indicates the presence of alkaloids.
c. Dragendroff's Test: Filtrates were treated with Dragendroff's reagent (solution of Potassium Bismuth Iodide). Formation of red precipitate indicates the presence of alkaloids.
d. Hager's Test: Filtrates were treated with Hager's reagent (saturated picric acid solution). Presence of alkaloids confirmed by the formation of yellow coloured precipitate.

Triterpenoids:
a. Salkowski's Test: The extracts were treated with chloroform and filtered separately. The filtrate was treated with few drops of concentrated sulphuric acid, shaken and allowed to stand. If the lower layer turns red, sterols are present. If the lower layer turns golden yellow triterpenes are present.

Saponins:
a. Froth Test: The extracts were diluted with distilled water to 20 ml and shaken in a graduated cylinder for 15 mins. The formation of 1 cm layer of foam indicates the presence of saponins.
b. Liberman Burchard Test: The extracts were treated with chloroform and filtered. The filtrates were treated with few drops of acetic anhydride boiled and cooled. Concentrated sulphuric acid was added through the sides of test tube. The formation of brown ring at the junction indicated the presence of steroidal saponins.

Flavonoids:
a. Alkaline reagent Test: The extracts were treated with few drops of sodium hydroxide separately. Formation of intense yellow colour lesson addition of few drops of dilute acid indicates the presence of flavonoids.
b. Lead acetate Test: The extracts were treated with few drops of lead acetate solution. Formation of yellow precipitate indicates the presence of flavonoids.

Phenolic and Tannins:
a. Ferric chloride Test: The extract was treated with few drops of neutral ferric chloride solution. The formation of bluish black colour indicates the presence of phenolics nucleus.
b. Gelatin Test: To the extract, 1%gelatin solution containing sodium chloride was added. The formation of white precipitate indicates the presence of tannins.
c. Vanillin hydrochloride Test: the extracts were treated with few drops of vanillin hydrochloride reagent. The conformation of pinkish red colour indicates the presence of tannins.

Selection of dose for animal study:
The dose considered for the experiment on rats was obtained from conversion of human dose of *Bougainvillea spectabilis* (3-5 g/kg). The conversion factor of human dose (per 200 g body weight) is 0.018 for rats and 0.002 for Rats (Ghosh 1984). Hence the calculated dose for the rats (considering human dose3 and 5 g/kg) is 200 mg/kg and for Rats is 20 mg/kg. Acute toxicity was done at dose of 2000mg/kg body weight.

Pharmacological evaluation:
Preparation of extracts:
Ethanolic extracts of *Bougainvillea spectabilis* suspended in water in presence of 3%v/v Tween-80 solution.
All the drugs were administered orally for experimental purpose. Each time preparations of the extracts were prepared when required. The drugs were administered at a constant volume of 10ml/kg for each animal.

ACUTE ORAL TOXICITY:
The acute oral toxicity of Ethanolic extracts of *Bougainvillea spectabilis b* was determined by using rats and Rats which were maintained under standard conditions. The animals were fasted 12 hour prior to the experiment, up and down procedure OECD

guideline no. 425 were adopted for toxicity studies. Animals were administered with single dose of individual extract up to 2000mg/kg and observed for its mortality during 2days and 7days study period (short term) toxicity and observed up to 7days for their mortality, behavioral and neurological profiles.

Screening for antidepressant activity:
Animals the experimental Swiss albino Rats (28-30 days) of either sex weighing between 25-50 g was used in present study. The animals were housed in a propylene cage under standard conditions (25 ± 2 °C, 55 ± 5 % relative humidity, and 12 h light and dark cycles). The animals were allowed free access to tap water and standard laboratory Rats food through oral and acclimatized to laboratory conditions for 5 days before starting the behavioral studies. All the parameters was closely observed during the same time of the day i.e., between 10 a.m. and 4 p.m. The care and handling of Rats accordance with the internationally accepted standard guidelines for use of animals.

Plant material and extraction:
The leaves of *Bougainvillea spectabilis* plant were collected from Hyderabad local market. The plant was shade dried under normal room temperature. The leaves of *Bougainvillea spectabilis* were collected washed and air dried for a week at 35-40ºC and pulverized in a grinder. The preparation of Ethanolic extract of *Bougainvillea spectabilis* was done using continuous hot percolation (Soxhlet) extraction procedure and the procedure was conducted for about 8-10 cycles. After the extraction procedure the menstruum was collected and solvent was evaporated so as to obtain dried extract.

Experimental Design:

Table 1: The Rats **were randomly divided into 5 groups (n=6 Rats per group)**

Group	Drug	Dose
Normal Control	Saline 0.9%	10 mL/kg
Negative Control	CUMS Induced depression	Food and water Deprivation
Test-1	*Bougainvillea spectabilis*	100 mg/kg P.O
Test-2	*Bougainvillea spectabilis*	200 mg/kg P.O
Standard drug	Imipramine Hydrochloride	10 mg/kg

Induction of Disease:
For inducing depression in Rats, Chronic Unpredictable Mild-Stress procedure was followed.[9] The all groups of animals except normal control were deprive food, water for 24 hours, and the alignment of propylene case was adjusted at 45º angle at same time frame after 24 hours of stress induced the animals were allowed for forced swim at 2-4 °C.
The above stress method was randomly applied each day for 6 weeks consecutively ensuring no same stress method was continuously applied. This did not allow Rats to anticipate next type of stress method. The sucrose preference test was carried out on day 1 and day 42 of the CUMS procedure so as to confirm the depression in the Rats.

Anti-depressant activity
Healthy Rats weighing 25-50g (3- 4 weeks of age) were divided into five groups, each consisting of six animals. Group 1 received only saline and not depression induced while all other groups were depression induced following the CUMS procedure. Group 2 received CUMS induced depression, Group 3 and 4 were treated with the seeds extract at the dose of 100 and 200 mg/kg body weight. The group 5 was treated with the standard drug (Imipramine hydrochloride) at the dose of 10 mg/kg body weight. All extracts and the standard drug were administered orally.

Sucrose Preference Test
This test was performed to evaluate the anhedonia, the core symptom of depression. In this, the Rats were allowed to drink sugar water 72 hour before the test. Two water bottles were kept simultaneously in each cage; one bottle filled with 1% sucrose solution whiles other with pure water. The bottle position was switched every 12 hr. After that, the test was conducted at 5:00 pm on days 1 and day 42 of the study. The Rats were housed in individual cages and freed to access either of the two bottles containing 1% sucrose solution or water.[12] The volume of consumed sucrose solution and water was recorded and the sucrose preference ratio (SPR) was calculated according to the following equation;

$$SPR = \frac{\text{Sucrose intake (ml)}}{[\text{Sucrose intake (ml)} + \text{water intake (ml)}]} X100\%$$

Forced Swimming Test:
It is the most used behavioral model for screening anti-depressant activity in the rodents. In this, Rats were forced to swim in the open glass chamber (25×15×25cm) containing fresh water to a height of 15 cm and maintained at 26±1ºC. Here the animal cannot get support either from walls or bottom of the chamber. Water is changed after each mouse is subjected to FST. The duration of immobility of Rats was recorded during the last 4 minutes of the total 6 minutes testing period because the animals show vigorous movement during initial 2 minutes of the test. The Rats were considered immobile when they were ceased struggling and remained floating motionless in water, making only the movement to keep their head above water.

Tail Suspension Test:
Tail suspension test is also performed for screening the antidepressant like activity in Rats. Firstly prior to the laboratory test, animals were brought in the lab to adapt the lab condition for 1-2 hr. In this test each individual animal were suspended to the edge of table, 50cm above the floor by the adhesive tape placed approximately 1cm from tip of the tail. The total period of immobility was recorded for each mouse manually for 6 min. If the animals were completely passive and motionless then they were considered as immobile. For this test dim light room was preferred.
The results from the experiment are expressed as mean ± SEM. The statistical analysis was performed by using one-way analysis of ANOVA followed by Tukey's Multiple Comparison test using graph and pad version 5.01. The values of P <0.05 was considered as statistically significant.

RESULTS:

Phytochemical screening of *Bougainvillea spectabilis:*
The present investigation concluded that the isolated compounds from the plant *Bougainvillea spectabilis* shows the various Pharmacological effects was determined due to the presence of different phytochemical compounds. Further study is needed for the isolation of the constituents present in the plant and its individual pharmacological activity should need to consider and ultimately it should be implemented for the benefit to human beings.

Table 1: Phytochemical screening of *Bougainvillea spectabilis*

S.No.	Phytoconstituents	Ethanolic
1.	Alkaloids	-
2.	Flavonoids	+
3.	Steroids	-
4.	Tannins	+
5.	Anthraquinones	-
6.	Terpenoids	+
7.	Cardiac glycoside	+
8	Saponins	-

ANTIDEPRESSANT ACTIVITY OF *BOUGAINVILLEA SPECTABILIS*
After 42 days of the treatment of varying concentration 100 and 200 mg/kg of *Bougainvillea spectabilis* extract showed that the high dose was effectively reduced the depressant activity 44.17 ±2.41 as compared with standard drug 43.15 ±14, represented in table 2.

Table : Percentage Sucrose Preference of Rats during Sucrose Preference Test

S.No	Groups	Dose	Sucrose Preference (%)	
			At Day 1 of CUMS	At Day 42 of CUMS
1	Control	10ml/kg BW	70.12 ± 1.36	62.14 ±1.24
2	Negative Control	10ml/kg BW	62.62 ±1.41	43.69 ±2.09
3	Plant Extract Bougainvillea spectabilis treated (low dose-)	100mg/kg BW	67.98 ±2.15	47.41 ±1.89
4	Plant Extract Bougainvillea spectabilis treated (High dose)	200mg/kg BW	65.92 ±1.98	44.17 ±2.41
5	Standard Drug treated (Imipramine)	10mg/kg BW	64.02 ±2.05	43.15 ±14

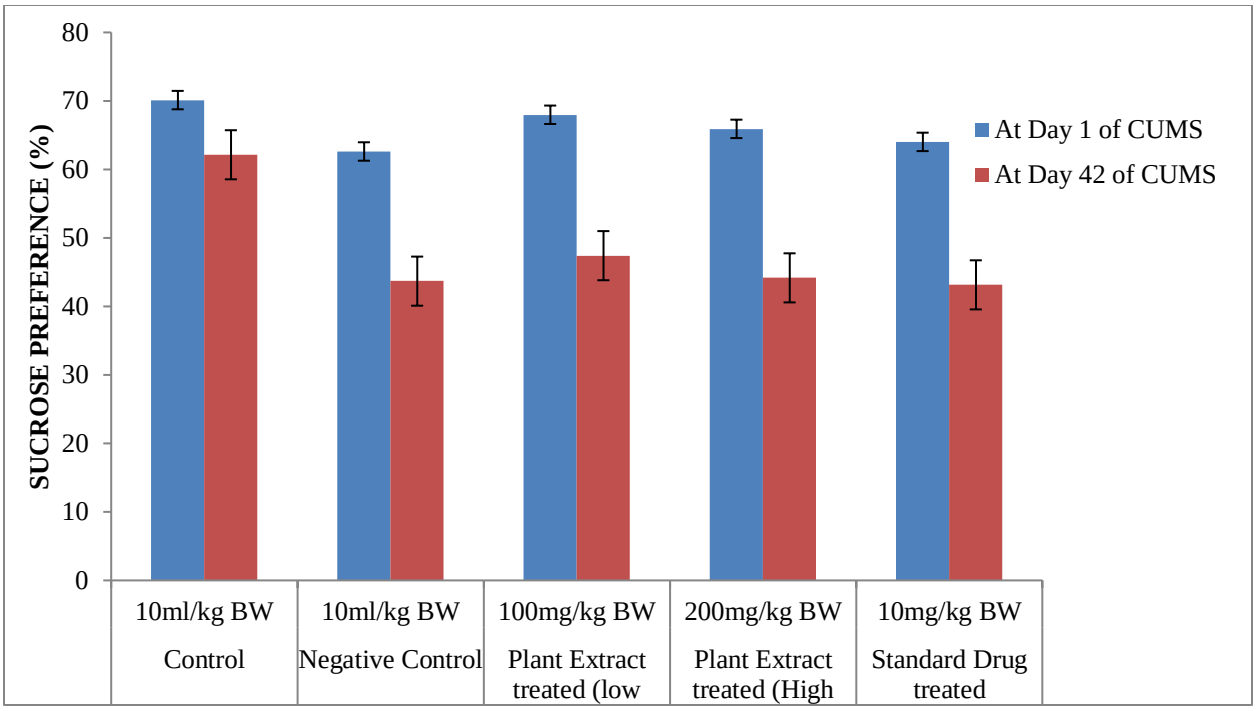

Figure : Percentage Sucrose Preference of Rats during Sucrose Preference Test

The forced swim test was carried out and the immobility time was determined of selected groups. After 8 days of continuous treatment and observation the result showed that 200 mg/kg of *Bougainvillea spectabilis* as compared with standard which was 35.19±1.21 and 34.05±1.57 showed significant result $p< 0.05$.

Table : Effect of *Bougainvillea spectabilis* extracts on the immobility time of Rats during FST.

S.No	Groups	Dose	Immobility time (sec)	
			At Day 1 of Treatment	At Day 8 of Treatment
1	Control (Saline 0.9%)	10ml/kg BW	25.10±1.05	23.05±1.25
2	Negative Control (Food and water)	10ml/kg BW	90.26±2.14	86.21±1.36
3	Plant Extract Bougainvillea spectabilis treated (low dose-)	100mg/kg BW	50.14±1.62	46.09±0.41
4	Plant Extract Bougainvillea spectabilis treated (High dose)	200mg/kg BW	40.24±2.14	35.19±1.21
5	Standard Drug treated (Imipramine)	10mg/kg BW	38.31±1.11	34.05±1.57

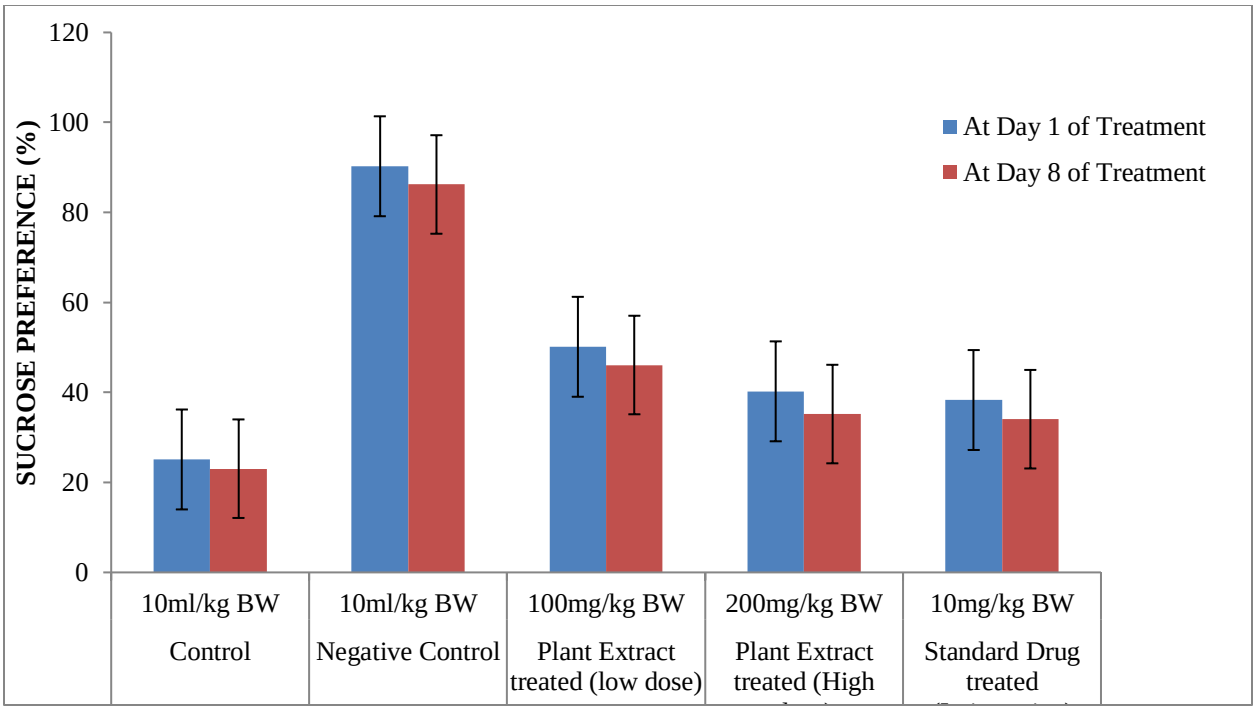

Figure : Effect of *Bougainvillea spectabilis* extracts on the immobility time of Rats during FST

The tail suspension test was performed. All the groups animal were treated individually. The negative control groups which are induced with CUMS showed the maximum immobility time as compared to the normal control group which was indicated the depressive effect. The standard drug (Imipramine) decreased the immobility time compared with negative control group, showed antidepressant activity.

Table : Effect of *Bougainvillea spectabilis* extracts on the immobility time of Rats during TST

S.No	Groups	Dose	Immobility time (sec)	
			At Day 1 of Treatment	At Day 8 of Treatment
1	Control (Saline 0.9%)	10ml/kg BW	27.12±2.12	24.12±2.10
2	Negative Control (Food and water)	10ml/kg BW	92.10±1.31	87.34±0.15
3	Plant Extract Bougainvillea spectabilis treated (low dose-)	100mg/kg BW	51.24±0.13	47.12±0.51
4	Plant Extract Bougainvillea spectabilis treated (High dose)	200mg/kg BW	42.15±1.20	36.10±2.30
5	Standard Drug treated (Imipramine)	10mg/kg BW	39.02±2.10	35.10±2.10

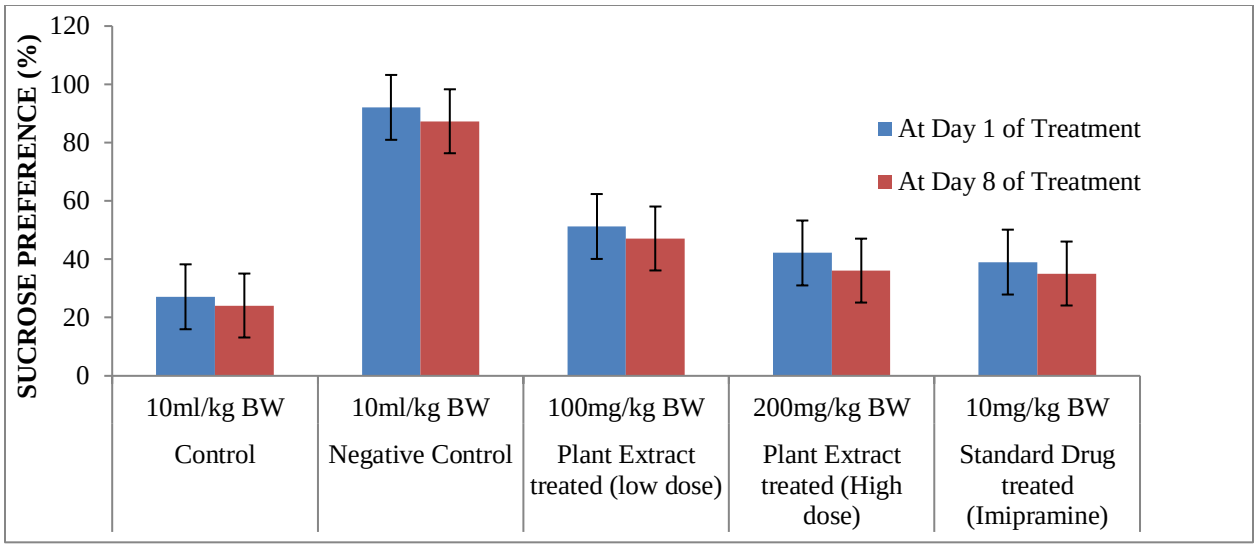

Figure : Effect of *Bougainvillea spectabilis* extracts on the immobility time of Rats during TST

DISCUSSION:

The Phytoconstituents are known to play an important role in bioactivity of medicinal plants. In qualitative phytochemical analysis reveals the presence of alkaloids, flavonoids, tannins, terpenoids and saponins have associated with various degree of anti-microbial, anti-bacterial, anti-fungal, anti-oxidant and anti-termites. Therefore, the anti-diabetic, hypoglycemic, anti-depressant, anti-anxiety, skeletal muscle relaxant property, locomotor activity, anti-inflammatory, analgesic and diuretic activities were observed in this study may be due to the presence of chemical constituents in Ethanolic extracts of *Bougainvillea spectabilis*.

The incidence of depression in the community is very high and is associated with lots of morbidity. So, it is necessary to address these problems and find effective remedies. Despite the availability of several drugs for the treatment of depression in the market, all are associated with some limitations and hence there is an urgent need of the alternative medications for this disorder. Although the *Bougainvillea spectabilis* is widely used for treating nervous disorders, there is an absence of scientific reports about the evaluation of its pharmacological effects. In this work, it was demonstrated that the different doses of the methanolic extract of *Bougainvillea spectabilis* when administered to the Rats, it was able to induce antidepressant effects.

In this study we employed a chronic stressor model CUMS to test the antidepressant effect of the seeds extract of *Bougainvillea spectabilis*. In this regard, the animal model of CUMS- induced depression has been developed to stimulate the pathogenesis of depression in humans. The validation of the CUMS procedure has been demonstrated in previously published reports.

In an attempt to mimic the excessive human day to-day stress, several animal models have been developed. The tail suspension test and forced swimming test is the most common predictive test for screening of antidepressant-like activity of drugs. In both cases, animals are kept in unescapable situation and the antidepressant activity is expressed by the decrease in the immobility time as compared with the control groups. In our study, we provided convincing evidence that the *Bougainvillea spectabilis* extract administered by oral route produces a specific antidepressant effects in FST and TST after one week of the treatment.

The Imipramine ameliorated depression-like behavior in animal decreased anhedonia, anorexia, weight loss, reduced social, locomotor and exploratory behavior. This was also noticeable in our study investigated for the confirmation of the depression in the animals following the CUMS procedure and tested for the sucrose consumption and found that the sucrose consumption significantly differs among the groups prior to the stress induction and post induction. Likewise, sucrose consumption was measured twice during our experiment.

There was significant difference ($p< 0.001$) in the sugar consumption in the groups prior to stress induction and post CUMS induced Rats.

In the previous study conducted in the different plants, after one week treatment, the plants extracts as well as standard drug induced significant decrease in the

immobility time during forced swimming test and tail suspension test when compared with the negative control group and the immobility time reduced as the treatment is prolonged. In our study found significant decrease ($p< 0.001$) in the immobility time as compared to the negative control group in both FST and TST. Further, the significant differences between the extract treated group and standard drug treated group as compared to the negative control group indicates the antidepressant activity of the extract.

CONCLUSION:

In the present study plant parts of *Bougainvillea spectabilis* have been be evaluated for antidepressant activity. As literature shows that traditionally this plant is being use in the treatment of depression. The plants materials *Bougainvillea spectabilis* used for the present studies were commercially procured from local market. Albino Rats were used for the antidepressant activity.

The results obtained in this study indicate that the ethanol fractions of the leaves of *Bougainvillea spectabilis* have significant CNS Depressant activities in animal model systems. The medicinal values of the plant leaves may be related to their constituent phytochemical. So, further detailed investigations are needed to isolate and identify the active compounds present in the plant extract and its various fractions and their efficacy need to be done. It will help in the development of novel and safe drugs for the treatment of different types of CNS disorders.

The result of the study showed that the selected plant possesses significant antidepressant activity. The leaves extract presented significant antidepressant activity in Rats, from the above study it can be concluded that the crude methanol extract of *Bougainvillea spectabilis* possesses significant antidepressant activity and appears to be attractive material for the further study and possible drug development.

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