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Evaluation of antidepressant Activity of methanolic Extract of *Musa x paradisiaca* Linn using animal models

GB Alaka Kar¹, Susanta Kumar Rout^{2*}, Debashisa Mishra¹

1. IMT Pharmacy College, Puri, New Nabakalabara Road, Sai Vihar, Gopalpur, Puri, Odisha

2. Patent Information Centre, Science & Technology Department, Secretariat, Odisha,

ABSTRACT

To investigate the antidepressant Activity of the methanolic extract of the leaves of *Musa x paradisiaca* Linn This study was undertaken to evaluate the possible antidepressant effect of *Musa x paradisiaca* Linn leaf extract (MPLE) on different extracts like chloroform, methanol and aqueous extracts using Tail Suspension Test (TST) & Forced Swim Test (FST). 48 albino rats of either sex weighing between 180-220gm were randomly selected and divided into 8 equal groups. Group-I (control) received normal saline (1ml/100gm), Group- IV , V, VI, VII, VIII and IX received CEMPL (Chloroform Extract *Musa x paradisiaca* Linn) , MEMPL (Methanol Extract *Musa x paradisiaca* Linn) and AEMPL (Aqueous Extract *Musa x paradisiaca* Linn) in doses of 200 and 400 mg/kg orally (P.O.) respectively. Group II & III (positive control) received Fluoxetine & Imipramine at doses of 20mg/kg & 15mg/kg P. O. respectively. Drug treatment was given for seven & fourteen successive day. 60 minutes after last dose of drug or standard the immobility period was recorded. The test compounds like crude methanolic extract at 200, 400 and 500 mg/kg produced significant antidepressant like effect. The efficacy of EALE at 200mg/kg was found to be comparable to that of Fluoxetine & Imipramine at doses of 20mg/kg & 15mg/kg.. The results revealed that the crude methanolic extract produces remarkable antidepressant activity by possessing the active compounds such as flavonoids, terpenes, alkaloids and saponins.

Keywords: *Musa x paradisiaca* Linn, Tail suspension test, Antidepressants, Immobility time.

*Corresponding Author Email: odishapic@gmail.com

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INTRODUCTION

Historically, plants have provided a source of inspiration for novel drug compounds, as plant derived medicines have made large contributions to human health and well being. Plants have been utilized as a wide source for discovering novel drug or compounds. Now a day's medicines obtained from different parts of the plant have made huge contributions towards human health and well being ¹. Traditional medicines obtained from plant materials are easily available in rural areas. Due to readily available traditional medicines in rural belt traditional medicines are cheaper than the modern medicines. Medical plants and plant products are the oldest and tried health-care products. Their importance is growing not only in developing countries but in many developed countries ². The herbal medicines from natural sources with least or no side effect having similar or better therapeutic activity are best. The herbal medicines have wide therapeutic actions and safety profile. Approximately 80% of the world inhabitants rely on traditional medicine for their primary health care and play an important role in the health care system of the remaining 20% of the population. The World Health Organization (WHO) is encouraging, promoting and facilitating the effective use of herbal medicine in developing countries for health programs ³. Different biological activities like anti microbial, anti oxidant, sedative and anxiolytic effects of the plant extracts may be due to presence of the active compounds. Consequently, due to some other biological activities on the same time make excellent leads for new drug development ⁴.

Musa x paradisiaca L., Musaceae, popularly known as 'banana', is a perennial tree-like herb cultivated in many tropical and subtropical regions around the world. Banana, eaten as a fruit or a vegetable, is one of the most important crops in several countries due to its enriched food and versatile medicinal value. Various parts of the *Musa* plants have been used orally or topically as remedies in folk medicine and some studies have demonstrated this medicinal potential. The fruits, peel, leaves, roots and pseudostem of *Musa* plants have shown antiulcerogenic, antioxidant and antimicrobial activity, among others activities. In addition, studies have shown that some species of *Musa* possess antidiabetic activity ^{5, 6}. The presence of bioactive compounds like apigenin glycosides, myricetin glycoside, myricetin-3- O-rutinoside, naringenin glycosides, kaempferol-3-O-rutinoside, dopamine, N-acetyl serotonin, and rutin, has been reported in different species of *Musa* ^{7, 8, 9}. However, as far as the activity is concerned, there are no reports regarding the pharmacological properties of their leaves on anti depressant activity. Thus, the aim of the present study was to investigate the antidepressant effect of crude extract of chloroform, methanol and aqueous extract of leaves of *Musa x paradisiaca* on laboratory animals.

MATERIALS AND METHOD

Plant Material

Musa x paradisiaca Linn leaves were collected from Puri district of Odisha, India. The leaves were authenticated in the Department of Botany, Utkal University, Odisha. The plants were collected in bulk and washed with running tap water to remove, adhering soil and dirt particles and then shade dried. A voucher specimen was deposited at the IMT Pharmacy College, Puri, Odisha. The dried plant materials were coarsely powered and stored in airtight, non-toxic polyethylene bags until used.

Preparation of extract and fractions

The powdered leaves of *Musa x paradisiaca* Linn was extracted with petroleum ether (60 – 80 °C) for 72h to de-fat it and then the residue plant materials were macerated using different solvents like Chloroform, methanol and water as solvent with constant stirring. The solvent incorporating the extractives were filtered and the marc pressed to squeeze out residual extractives. This process was repeated thrice to achieve complete extraction. The extracts obtained during the three cycles were combined and reduced to 1/8th of its original volume in a rotary evaporator at 45 °C and then lyophilized in a freeze dryer to obtain the yield. The extract was again dissolved in distilled water and then successively extracted by the following solvents with increasing polarities; chloroform, ethyl acetate and methanol. The so obtained different fractions were concentrated dried and preserved for further study. Phytochemical screening give positive tests for alkaloids, glycosides, saponins, Flavonoids, carbohydrates, tannins, phenolic compounds, protein, and fats. All the extracts of plant leaves were prepared 10% w/v in normal saline consisting of 0.1% propylene glycol.

Evaluation of antidepressant activity

About 54 albino rats of either sex weighing between 180 -220 gms. procured from disease free animal house of SOA University, BBSR, Odisha were used for the present study. Animals had free access to food and water and maintained under standard laboratory conditions with a natural light and dark cycle. The animals were acclimatized for at least five days before behavioural experiments. Experiments were carried out between 9.00 and 15.00 hrs. Experimental protocol was approved by the institutional animals' ethics committee before the start of the study.

Drugs & Chemicals

CEMPL, MEMPL and AEMPL, Fluoxetine Hydrochloride (Ranbaxy Lab.), Imipramine Hydrochloride (Sigma Aldrich). Normal Saline, Polyethylene Glycol (PEG).

Study Design

The animals were selected randomly for each experiment and divided into 6 equal groups. Drugs (PEG, CEMPL, MEMPL, AEMPL, Fluoxetine and Imipramine) administered orally (P.O.) for 7 & 14 successive days. Sixty minutes after last dose, immobility period was recorded in two different animal models of depression.

Forced Swim Test (FST):

FST or behaviour despair was proposed as a model to test for antidepressant activity by Porsolt *et al.* Depression was produced by forcing the animal to swim individually in a glass jar containing fresh water of 15cm height and maintained at 25°C. This constituted pretest session. Twenty-four hours later each animal was again forced to swim. After an initial 2 min period of vigorous activity, each animal assumed a typical immobile posture. The total duration of immobility was recorded in next 4 min of a total 6 min test. The change in the immobility period was calculated after administering drugs to the groups¹⁰.

Tail Suspension Test (TST):

The total duration of immobility induced by tail suspension was measured according to the method described by Steru *et al* [11]. Depression was produced by suspending the animal from the edge of a table 50 cm above the floor by an adhesive tape placed approx. 1cm. from the tip of the tail. Immobility time was recorded during a 6 min. period. Changes in the immobility duration were studied after administering drugs in separate groups of animals. The antidepressant activity was expressed as reduction in the immobility duration between the control, standard and animals treated with test drug¹¹.

Acute Toxicity Study:

Acute toxicity study was done according to OECD (Organization for Economic Co-operation and Development) Guideline, fixed dose method; with starting dose of 2000mg/kg body weight was adopted. Starting dose of 200 to 4000 mg/kg (per oral) of each was given to 5 animals (albino rats), animals were kept for observation of behavioural change and death up to 72h.

Statistical Analysis:

All the results are expressed as Mean \pm SEM. All the groups were analysed using student's 't' test.

RESULTS AND DISCUSSION

The observation of acute toxicity study indicated that there was no death in 4000mg/kg dose after 72hr. CEMPL at the dose of 200 mg/kg had no beneficial effect on immobility period of rats in both the models of depression i.e. FST & TST. The extracts like MEMPL and AEMPL decrease in immobility period in both the models was observed starting from 200 and 400 mg/kg (Table-1 and 2). At the dose of 400 mg/kg both MEMPL and AEMPL, showed highly significant antidepressant effect which is comparable to that of Imipramine and Fluoxetine at the dose of 15 & 20 mg/kg respectively.

Depression is a mood disorder which is the most common illness, which affects the mood, lack of interest in surroundings, decreased energy level, lack of confidence, poor concentration, disturbed sleep and the arousal of negative thoughts. It is mainly associated with anxiety. Ayurveda provides lot of medicinal plants to counteract these side effects. The different parts of the plant such as fruit and leaves of *Musa x paradisiaca* Linn has been used for thousands of years for its medicinal properties⁴. Phytomedicines can be used for the treatment of diseases as is done in case of Unani and Ayurvedica system of medicines, a natural blue print for the development of new drugs⁴. In the present study, preliminary phytochemical studies of the chloroform, methanol and aqueous extract of *Musa x paradisiaca* showed the presence of flavonoids, saponins, tannins and steroids.

CONCLUSION

Drugs from plants have a long history in both traditional and modern societies as herbal remedies or crude drugs and as purified compounds. The present study revealed that the MEMPL and AEMPL extracts at doses 200 and 400 mg/ kg produced significant antidepressant effect in the different animal models like FST & TST. The present study thus proves that the higher dose of both methanol and aqueous extract of *Musa x paradisiaca* Linn possess significant antidepressant activity due to its reduction in the immobility period in FST. These models of depression are widely used to screen new antidepressant drugs. The tests are quite sensitive and relatively specific to all major classes of antidepressant drugs including TCAs, SSRIs, MAOI, Atypical antidepressants¹². The forced swimming test is the most widely used tool for assessing antidepressant activity pre-clinically. The widespread use of this simple model is mainly due to its ability to detect a broad spectrum of antidepressant agents. It has been argued that TST (Tail Suspension Test) is less stressful than FST (Forced swim test) and has greater pharmacological sensitivity. The results obtained from TST are in concordance with the validated FST by Porsolt *et al.* Environmental factors and hereditary factors play a major role in producing deficient

monoaminergic transmission in central nervous system thereby producing symptoms of depression^{13,14}. The Phyto chemicals present in the plant extracts may be facilitating monoaminergic transmission there by producing antidepressant effects. It has been reported that flavonoids may be responsible for antidepressant activity in experimental animal models.

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