



RESEARCH PAPER

CNS STIMULANT AND ANTIDEPRESSANT ACTIVITY OF SEEDS OF *ABELMOSCHUS ESCULENTUS* IN RATS

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Received: May 27, 2015 / Revised: Jun 04, 2015 / Accepted: Jun 05, 2015

Depression is a common mental disorder, which affects the personal and social relations of a person. There are varieties of synthetic antidepressant and stimulant drugs available now a days, however, their effectiveness does not come up with the entire range of population suffering from this disorder. Moreover, the side effects and the drug interactions are major restrictions in their clinical applications. To avoid synthetic medications, herbal medicines are their reasonable substitute and hence widely used across the globe due to their wide applicability and therapeutic efficacy associated with least side effects, which in turn has initiated the scientific research regarding the antidepressant activity from plants. The present study was done with an objective to explore the CNS stimulant and antidepressant activity of *Abelmoschus esculentus* Linn. which is commonly used plant throughout the world. Extraction of defatted seeds was done using different solvents like chloroform, ethyl acetate, ethanol, water and decoction of roasted seeds. Among all the extracts, decoction and aqueous extracts showed maximum CNS stimulant and antidepressant activities.

Key words: CNS stimulant, Antidepressant, Herbal, *Abelmoschus esculentus* seeds, Extraction.

INTRODUCTION

Over past few decades, the affinity towards the herbal drugs has been grown by utilization of traditional medicinal plant to heal some critical diseases. It is turning out to be better medicine with respect to synthetic drugs that assure numerous side effects for prolong treatment (Gangopadhyay *et al* 2012). In recent years, focus on plants research has increased all over the world. A large body of evidence has been collected to show immense potential of medicinal plants (Jain *et al* 2011; Srividya *et al* 2012; Jain and Argal, 2013; Parsai *et al* 2014; Sadanand and Palanivelu, 2015) used in various traditional systems. According to World Health Report, about 450 million people suffer from a mental or behavioral disorder. This amounts to

12.3 % of the global burden of disease, and predicted to rise up to 15 % by 2020 (Gautam *et al* 2013).

Depression is a state of low mood and aversion to activity that can affect a person's thoughts, behavior, feelings and physical well being. According to WHO estimation, 121 million people worldwide suffer from clinical depression. The high prevalence of suicide in depressed patients (up to 15 %) coupled with complications arising from stress and its effects on the cardiovascular system have suggested that it will be the second leading cause of death by year 2020 (Arya and Verma, 2012). Central nervous system (CNS) stimulation is the primary action of a diverse group of pharmacological agents and an adverse effect associated with the

administration of an even larger group of drugs. CNS stimulation consists of a range of behaviors including mild elevation in alertness, increased nervousness and anxiety and convulsions. In general, any hyper excitability associated with drug administration results from an alteration in the fine balance normally maintained in the CNS between excitatory and inhibitory influences. Thus, the bases for CNS stimulation by the class of drugs reside in adjusting the integration of excitatory and inhibitory influences at the level of the individual neuron. Historically, general CNS stimulants were used preliminary as respiratory stimulants in the treatment of acute over dosage with CNS depressants. Tolerance and abuse potential are additional problems associated with the use of such psychomotor stimulants as amphetamine and many of its congeners (Jaya Preethi *et al* 2013). The present study was done with an objective to explore the CNS stimulant and antidepressant activity of *Abelmoschus esculentus* Linn., commonly used plant throughout the world.

MATERIALS AND METHODS

Collection and authentication of plant

The seeds of *Abelmoschus esculentus* (L.) were collected from Naya Farm House, Near Kadam Kandi, Jodhpur region. The authentication of plant was obtained from Botanical Survey of India (BSI), Jodhpur. Voucher specimens and herbarium sheet was kept in the institution for further references.

Preparation of extracts

The seeds of *Abelmoschus esculentus* (L.) were powdered and defatted with the help of petroleum ether. For this, the seeds were packed in the soxhlet apparatus and extracted with petroleum ether. Then, the defatted seeds were used for the extraction with other solvents. For this, the seeds were packed in the soxhlet apparatus and extracted with the solvents in order of decreasing polarity like chloroform, ethyl acetate, ethanol and then with water. The method used for the extraction of the powdered seeds was the differential extraction method. In this method always new defatted powdered drug was used for the extraction.

Experimental animals

The approval of experimental protocol was taken from IAEC before starting the study (1258/ac/09/CPCSEA). Wistar rats of either sex (150-200 g) were used for the study. Total

48 animals were used in the study. Animals were housed under standard conditions of temperature (25 °C), 12 h light/dark cycle and fed with standard pellet diet and water *ad-libitum*. Animals were acclimatized to laboratory condition for 2 h before conducting experiments.

Investigation of CNS stimulant activity by actophotometer

Wistar Rats (150-200 g) of either sex were divided into six groups (n=6):

Group I - (Std. group) animals received Standard CNS stimulating drug caffeine in a single dose (30 mg/kg; *p.o.*) dissolved in 1% acacia solution (Doke *et al* 2011); Group II - (Test I group) animals received chloroform extract in a single dose (400 mg/kg/10 ml; *p.o.*) dissolved in 1% acacia solution; Group III - (Test II group) animals received ethyl acetate extract in a single dose (400 mg/kg/10 ml; *p.o.*) dissolved in 1% acacia solution; Group IV - (Test III group) animals received alcoholic extract in a single dose (400 mg/kg/10 ml; *p.o.*) dissolved in 1% acacia solution; Group V - (Test IV group) animals received aqueous extract in a single dose (400 mg/kg/10 ml; *p.o.*) dissolved in 1% acacia solution; Group VI - (Test V group) animals received decoction of roasted seeds in a single dose (400 mg/kg/10 ml; *p.o.*) dissolved in 1% acacia solution (Sabitha *et al* 2011).

In this method, animals were placed in the actophotometer and allowed to move for a given period of time. When the beam of light falling on the photocell was cut by the moving animal, the count was recorded on the display. The locomotor activity of each animal was measured and results of test drug were compared with self control and standard.

Antidepressant activity by tetrabenazine induced catatonia (catalepsy) in rats

The Wistar rats (150-200 g) of either sex were divided into seven groups: Group I - (Control group) animals received saline solution (0.9% w/v) in a single dose (5 ml/kg; *p.o.*) and TBZ (40 mg/kg; *p.o.*); Group II - (Standard group) animals received standard antidepressant drug in a single dose (Imipramine 10 mg/kg; *p.o.*) and TBZ (40 mg/kg; *p.o.*); Group III - animals received chloroform extract in a single dose (400 mg/kg/10 ml; *p.o.*) dissolved in 1% acacia solution and TBZ (40 mg/kg; *p.o.*); Group IV - animals received ethyl acetate extract in a single dose (400 mg/kg/10 ml; *p.o.*) dissolved in 1% acacia solution and TBZ (40 mg/kg; *p.o.*);

Group V - animals received alcoholic extract in a single dose (400 mg/kg/10 ml; *p.o.*) dissolved in 1% acacia solution and TBZ (40 mg/kg; *p.o.*); Group VI - animals received aqueous extract in a single dose (400 mg/kg/10 ml; *p.o.*) and TBZ (40 mg/kg; *p.o.*); Group VII - animals received decoction of roasted seeds in a single dose (400mg/kg/10ml; *p.o.*) and TBZ (40 mg/kg; *p.o.*). In this method, the animals were treated with the test, standard and normal saline. After one hour of treatment, tetrabenazine (TBZ) in a dose of 40 mg/kg; *p.o.* was given to each rat. Then, the animals were placed in individual cages. Each animal was grasped gently around hindlegs and placed carefully on the stair having 2 steps of 3 cm by facing its head downwards. Tetrabenazine induced the catalepsy and the animals were remained in the catatonic condition. The time was recorded when animal removes its paw and scoring was given as:

Catalepsy more than 60 s = 5, Catalepsy between 30 and 60 s = 4, Catalepsy between 10 and 30 s = 3, Catalepsy between 5 and 10 s = 1, Catalepsy less than 5 s = 0.

The ptosis was also induced in the rats which was characterized by closing of eyes. The degree of ptosis is scored: eyes closed = 4, eyes ¾ closed = 3, eyes ½ closed = 2, eyes ¼ closed = 1, eyes open = 0. The results of test drug were compared with that of control and standard (Chowdhury and Juvekar, 2014).

RESULTS AND DISCUSSION

CNS stimulant activity

The results showed that locomotor activities of the rats were increased with the different treatments that indicate the increase in CNS stimulant activity (Table 1). Among all, decoction followed by aqueous, alcohol and ethyl acetate have effective CNS stimulant activity and decoction showed maximum CNS stimulant activity (Figure 1).

Table 1. Effect of different treatments on CNS stimulating activity

S. No.	Groups	Increase in CNS stimulating activity (%)
1.	Standard (caffeine)	112.54 ± 11.03***
2.	Decoction	115.56 ± 9.49***
3.	Aqueous	107.33 ± 7.78***
4.	Alcohol	90.45 ± 2.43***
5.	Ethyl Acetate	55.05 ± 2.70***
6.	Chloroform	20.44 ± 2.34**

Values are given as mean ± SEM, (n=6/group); ****p* <0.001; ** *p* <0.01 when compared with self control, using student *t*-test.

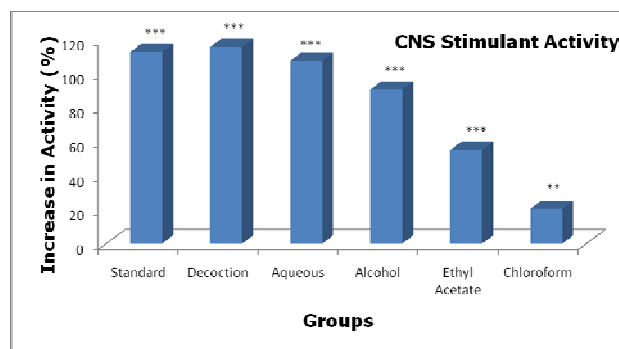


Fig. 1. Effects of various extracts of *Abelmoschus esculentus* seeds on CNS stimulating activity

Antidepressant activity

The results of antidepressant activity showed that catalepsy and ptosis score of the rats were decreased with the different treatments that indicate the increase in antidepressant activity (Table 2, 3). Among all decoction followed by aqueous, alcohol and ethyl acetate have effective antidepressant activity and decoction showed maximum antidepressant activity (Figure 2, 3).

Table 2. Effects of treatments on catalepsy

S. No.	Groups	Catalepsy score
1.	Control	5.0 ± 0
2.	Standard (Imipramine)	1.66 ± 0.25***
3.	Decoction	1.16 ± 0.16 ***
4.	Aqueous	1.83 ± 0.22***
5.	Alcohol	2.0 ± 0.18***
6.	Ethyl Acetate	3.16 ± 0.16*
7.	Chloroform	3.83 ± 0.12

Values are given as mean ± SEM, (n=6/group); ****p* <0.001; ** *p* <0.01 when compared with self control, using student *t*-test.

Table 3. Effects of different treatments on ptosis

S. No.	Groups	Ptosis score
1.	Control	3.83 ± 0.06
2.	Standard	0.66 ± 0.08***
3.	Decoction	0.5 ± 0.09 ***
4.	Aqueous	0.83 ± 0.12***
5.	Alcohol	1.0 ± 0.14***
6.	Ethyl Acetate	2.0 ± 0.10***
7.	Chloroform	2.5 ± 0.09**

Values are given as mean ± SEM, (n=6/group); ****p* <0.001; ** *p* <0.01 when compared with self control, using student *t*-test

CONCLUSION

It is concluded that decoction followed by aqueous, alcohol, ethyl acetate seeds extracts of *Abelmoschus esculentus* have CNS stimulant and antidepressant activities. The animals of the decoction group showed the maximum effects on CNS stimulant and antidepressant activities.

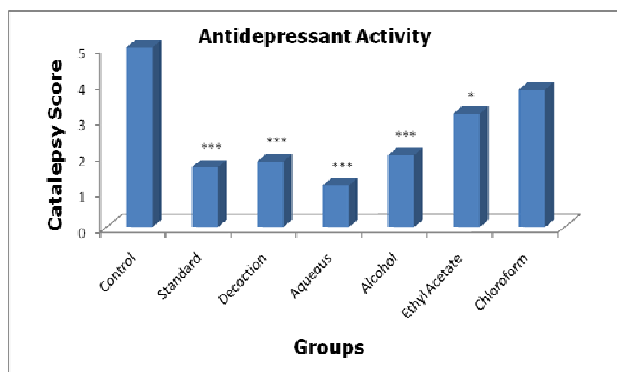


Fig. 2. Effects of various extracts of *Abelmoschus esculentus* seeds on catalepsy score

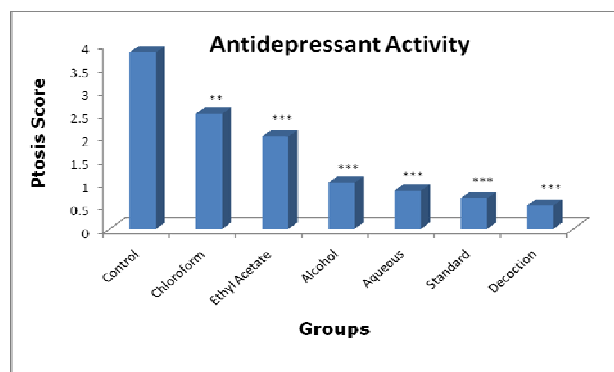


Fig. 3. Effects of various extracts of *Abelmoschus esculentus* seeds on ptosis score

REFERENCES

- Arya A, Verma P. A review on pathophysiology, classification and long term course of depression. *Int. Res. J. Pharm.* 2012;3(3):90-6.
- Chowdhury AA, Juvekar AR. Antidepressant and nootropic activity of aqueous extract of *Indigofera tinctoria* in mice. *Int. J. Pharm. Pharmaceut. Sci.* 2014;6(8):131-5.
- Doke PP, Tare HL, Sherikar AK, Shende VS, Deore SR, Dama GY. Central nervous system stimulant effect of the oils obtained from seeds of *Cucurbita maxima*. *J. Pharm. Biol.* 2011;1(1):30-6.
- Gangopadhyay A, Malakar J, Ghosh A, Deb J, Dey S, Datta S, Datta PK. The central nervous system activity of *Barleria prionitis* Linn. on the locomotor activity of swiss albino mice using actophotometer. *Int. J. Pharm. Biol. Sci. Arch.* 2012;3(2):403-5.
- Gautam RK, Dixit PK, Mittal S. Herbal sources of antidepressant potential: A review. *Int. J. Pharm. Sci. Rev. Res.* 2013;18(1):86-91.
- Jain RA, Agarwal RC, Pandey A, Jain R. Evaluation of *Argemone mexicana* fruits extract using micronucleus assay in mouse bone marrow cells. *Bull. Pharm. Res.* 2011;1(2):22-4.
- Jain S, Argal A. Effect of a polyherbal formulation on glycolic acid-induced urolithiasis in rats. *Bull. Pharm. Res.* 2013;3(1):40-3.
- Jaya Preethi P, Padmini K, Srikanth J, Lohita M, Swetha K. Screening models for CNS stimulant drugs: A review. *Asian J. Pharm. Res.* 2013;3(3):151-5.
- Parsai A, Eidi M, Sadeghipour A. Hepatoprotective effect of SAGE (*Salvia officinalis* L.) leaves hydro-methanolic extract against *aspergillus parasiticus* aflatoxin-induced liver damage in male rats. *Bull. Pharm. Res.* 2014;4(3):129-32.
- Sabitha V, Ramachandran S, Naveen KR, Panneerselvam K. Antidiabetic and antihyperlipidemic potential of *Abelmoschus esculentus* (L.) in streptozotocin-induced diabetic rats. *J. Pharm. Bioallied Sci.* 2011;3(3):397-402.
- Sadanand VK, Palanivelu M. Investigation of the pharmacological activity of ethanolic extract of *Abrus precatorius* seeds. *Bull. Pharm. Res.* 2015;5(1):28-30.
- Srividya AR, Dhanabal SP, Yadav AK, Sathish Kumar MN, Vishnuvarthan VJ. Phytopreventive antihyperlipidemic activity of *Curcuma zedoaria*. *Bull. Pharm. Res.* 2012;2(1):22-5.
