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Nootropic Activity of Tuber Extract of *Dioscorea batatas* Using Lithium-Induced Head Twitches in Albino Wistar Rats.

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ABSTRACT

Nootropics referred as 'smart drugs' are mainly used in the treatment of memory and intelligence enhancement. The Objective of the study is to evaluate the nootropic effects of tuber extract of *Dioscorea batatas* using lithium-induced head twitches (LIH) in mice. Six groups of rats comprising of six animals and weighing between 150-200 grams were administered with distilled water, Lithium carbonate, Piracetam and different doses of alcoholic extracts of *Dioscorea batatas* intraperitoneally and the number of head twitches were counted for 60 minutes for each group. It was observed that piracetam and different doses of alcoholic tuber extracts of *D.batatas* diminished serotonergic function indicated by reduction in number of head twitches. It with the fact that blocking serotonergic transmission in the brain is a mechanism to enhance the retention of conditioned avoidance response. Thus, the present study suggests the role of serotonergic system in nootropic and neuroprotective effects of *D.batatas*.

Keywords: *Dioscorea batatas*, lithium induced head twitches, nootropic, serotonin.

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INTRODUCTION

For many years, improving memory has been part of the realm of imagination and fiction. Currently, our knowledge pertaining to the neural construct of intelligence and memory is in its infancy. Several neurotransmitter systems that have different anatomical locations are involved in various aspects of memo [1]. Serotonergic system has also been implicated in this. Evidences suggest that serotonergic transmission inhibits the working memory performances. It is also suggested that blocking serotonergic transmission in brain is a possible mechanism to enhance the working memory performances [2].

Dementia is described as a syndrome due to chronic or progressive disease of the brain, leading to disturbance of multiple functions of higher cortical centers including memory, orientation, comprehension, calculation, learning capacity, language and judgment without alerting consciousness.

Alzheimer's disease is an incurable, progressive brain disorder that causes dementia and abnormal phosphorylation of the intracellular tau-proteins, causing abnormalities of microtubule assembly and collapse of the cytoskeleton particularly affecting pyramidal cells of the cortex and sub cortex [3].

In the present study, a plant *Dioscorea batatas* popularly used in folklore medicine was selected as it is reported as mind power syrup in Ayurvedic formulations. Earlier the plant has been studies for its antioxidant, anti-inflammatory, angiotensin converting enzyme inhibitor, carbonic anhydrase and trypsin inhibitor activities [4].

MATERIALS AND METHODS

Selection of Animals:

Adult wistar rats of either sex weighing between 150-200 grams were selected. The rats were maintained under standard conditions of temperature (25°C±5°C), relative humidity (55±10%) and a 12/12 h light/dark cycle. The rats were fed with commercial rat pellet diet and water. After obtaining the permission from Institutional Animal Ethics Committee (IAEC) of Sree Balaji Medical College, Chennai (Tamil Nadu) with registration number 004/01/IAEC/2013, animal studies were performed as per rules and regulations and in accordance to guidelines of CPCSEA. All experiments were carried out during the light period between 09.00-15.00 hr.

Preparation of Extract

The tubers powder (**figure 1**) was extracted with 95% alcohol in a soxhlet apparatus at 60-80 C for 18 hours. The alcoholic extract was subjected to evaporation in a beaker on a water bath maintained at 50 C till a thick paste of extract remained in the beaker. The final extracted material weighed 10g. Concentrations of the extract were prepared by dissolving final product in distilled water. For the assessment of nootropic activity, three dose levels were chosen i.e, 50mg/kg, 100mg/kg and 200mg/kg respectively [5].

Parts of *Dioscorea batatas* plant

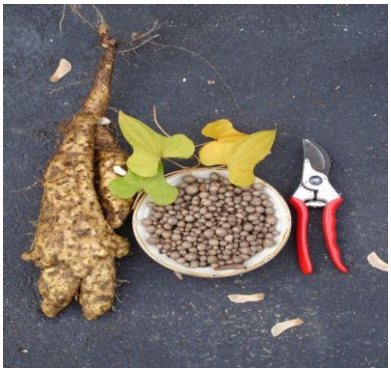

Figure 1: Parts of *Dioscorea batatas* plant including tubers, leaves and seeds.

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Drugs Used In the Study

Lithium carbonate (190mg/kg), piracetam (200mg/kg) and amitriptyline (20mg/kg) were of analytical grade and were procured from local commercial companies.

Behavioral Study- Lithium-Induced Head Twiches (LIH)

Six groups of rats each comprising of 6 animals and weighing between 150-200 grams were selected. Group 1 was given distilled water (10ml/kg.ip), group 2 treated with lithium carbonate (190 mg/kg,ip), group 3 with piracetam (200mg/kg,ip), groups 4,5,6 were treated with 50,100,200mg/kg, ip of alcoholic extracts of *Dioscorea batatas* respectively. 30 minutes later lithium carbonate was administered intraperitoneally (Figure 2) to all groups and the number of head twitches was counted for 60 minutes for each group of rats [6].

Intraperitoneal administration:

Figure 2: Drugs administered through intraperitoneal route.

RESULTS

Effect Of Extract On LIH Model

Lithium treated group had shown 18.5±1.04 head twitches in 60 minutes. Prior treatment with Piracetam decreased the number of head twitches to 3.6±0.81, alcoholic extract of *D.batatas* with 50, 100 and 200 mg/kg doses had showed a statistically significant reduction in the number of head twitches i.e., 16.0±1.26, 10.83±1.47 and 3.5±0.55 (Table 1) and (Graph 1).

Table 1: Nootropic effect of tuber extract of *D.batatas* on Lithium-induced (serotonin medicated) head twitches in rats (Values are mean±SD from 6 animals I each group)

Group No.	Treatment	Dose (per kg)	No. of head twitches for 60 min session
I	Normal Control	10 mg,ip	0
II	Lithium Control	190 mg,ip	18.5±1.04
III	Piracetam	200 mg,ip	3.6±0.81**
IV	*D.batatas*	50 mg,ip	16.0±1.26*
V	*D.batatas*	100 mg,ip	10.83±1.47**
VI	*D.batatas*	200 mg, ip	3.5±0.55**

Significance at $P<0.05^{*}$ and $<0.01^{**}$ vs Lithium control

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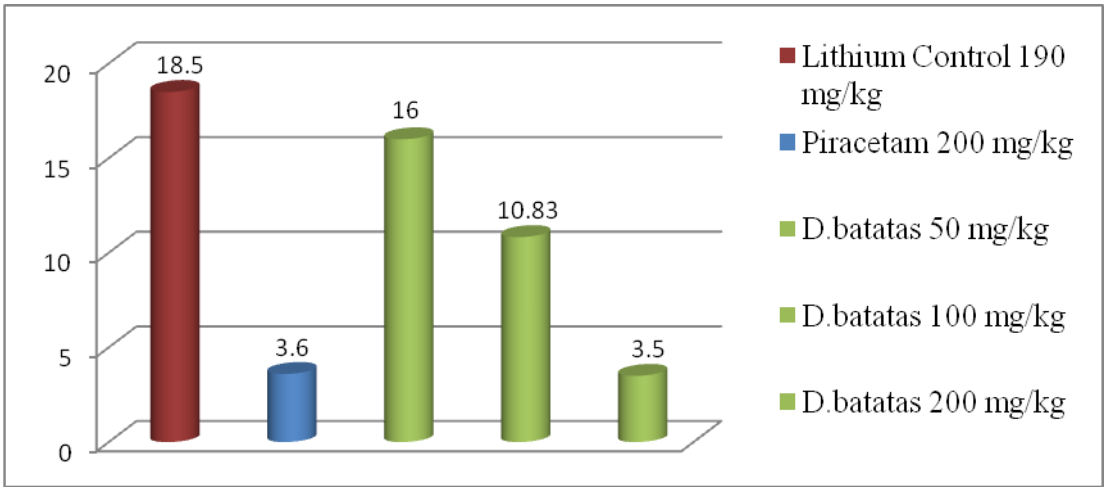
Graph 1: Number of head twitches for 60 minutes session



Statistical Analysis

The data were subjected to statistical analysis by Paired *'t'* test using IBM SPSS Statistics 20 and *P* value < 0.05 *and* < 0.01 were considered as significant.

DISCUSSION

Nootropics also referred as smart drugs. These are mainly used in the treatment of memory and intelligence enhancement. Memory is the ability of an individual to record sensory stimuli, events, information, etc. to retain them at over a short or long period of time to recall at latter when it needed [7]. Poor memory, lower retention and slow recall are common problems in today's stress full and competitive world. Age, stress, emotion may lead to memory loss [8]

Nootropic agents are used to correct observed cognitive defects. Nootropics are thought to work by altering the availability of the brain's supply of neurochemicals (neurotransmitters, enzymes, & hormones), by improving brain's oxygen supply, or stimulating nerve growth. The nootropic drugs belong to the class of psychotropic agents with selective facilitator effect on intellectual performance, learning memory.

Despite the extensive experimental and clinical studies, the neurochemical basis for learning and memory remains controversial but a predominant role of cholinergic mechanism has long been emphasized in learning and memory process [9]. Though a large number of other receptor systems too are now reported to be involved in the behavioral expression of dementia in animals and human beings, the role of these neurotransmitter systems cannot be ignored.

The present study revealed that extracts of tubers of *D.batatas* contained flavonoids which might be exhibited nootropic activity in view of its facilitatory effect on retention (memory) of acquired learning in rats as these are reported with nootropic activity. Head twitches induced by lithium chloride in rats constitute a useful model for quantifying the 5-HT(serotonin) activity in the brain and for the screening of potential antagonists at 5-HT receptors [2].

It has been indicated that an increase in serotonergic transmission in the median raphe of mid-brain will interfere with learning acquisition and memory consolidation [10]. In the present study with LIH model, it was observed that piracetam (200mg/kg) and different doses of alcoholic tuber extracts of *D.batatas* (50,100,200mg/kg) diminished serotonergic function indicated by reduction in number of head twitches.

The result of lithium-induced head twitches is in agreement with the fact that blocking serotonergic transmission in the brain is a mechanism to enhance the retention of conditioned avoidance response [11]. Thus, the results in the present study suggest the role of serotonergic system in nootropic and neuroprotective effects of tuber extracts of *D.batatas*.

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CONCLUSION

The present study was aimed to evaluate nootropic activity with Alcoholic Tuber Extract of *Dioscorea batatas* in Lithium-induced Head twitches in rats. The Alcoholic Tuber Extract of *Dioscorea batatas* showed significant nootropic activity possibly by an improvement with transmission of serotonergic transmission in the median raphe of mid-brain Hence, *Dioscorea batatas* may be served as a potential resource for natural therapeutic agent against memory related disorders such as Alzheimer's disease.

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