

Effects of Aqueous Leaf Extract of *Paulinia Pinnata* on Swimming Endurance Time of Mice

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Abstract: The swimming test was used to investigate the effect of aqueous leaf extract of *Pauliniapinnata* on the swimming endurance in mice. Mice were categorized into controls and test groups and placed in plastic jar containing water maintained at 25±1°C. Each animal was allowed to swim until exhausted and the swimming time recorded. The results revealed that the extract (500mg/kg) and imipramine (50mg/kg) caused significant reduction ($P<0.05$) in swimming time compared to the control that was given normal saline. This effect is considered to be attributed to its CNS depression which diminishes ability for physical activity. Depressant activity of the extract was dose-dependent as swimming time decreased with increasing dose as revealed in the regression data. The results obtained with this extract therefore demonstrated that *Pauliniapinnata* leaf possess obvious depressant activity on the CNS of mice.

Key words: CNS depressant activity, Mice, *Pauliniapinnata*, Swimming time.

I. Introduction

In the search for new therapeutic products for the treatment of neurological disorders, medicinal plant research worldwide has progressed, constantly demonstrating the pharmacological effectiveness of different plant species in a variety of animal models [1].

Crude extracts of medicinal plants are usually a complex mixture of different constituents and *P. pinnata* is not an exception. The presence of cardiac glycosides, saponins, alkaloids and tannins have been demonstrated in *Pauliniapinnata* leaf [2]. These constituents are usually responsible for the different pharmacological actions of the extract. Saponins have been shown to have antidepressant activity as well as anti-inflammatory, antinociceptive and antipyretic activities [3] while alkaloids tend to have vasodilator and antipsychotic effects. Tannins also have diuretic, vasoconstrictive and antibacterial properties.

The swimming test in laboratory animals (e.g. mice) has been used widely to evaluate some pharmacological activities of various agents on the central nervous system (CNS) including CNS depressants, antidepressants, sedative hypnotics, psycho-stimulants, euphoric, nootropic, adaptogens etc [4]. The swimming test has also been used to assess antistress activity in mice and rats of phytomedicines including *Panax ginseng*, *Withaniasomnifera*, *Ocimum sanctum*, *Sedum rosea*, *Aralia elata* and *Tiliaagentea* [5]. *Pauliniapinnata* is a herbaceous climbing plant common in west Africa. The leaves, roots and seed are powdered together with ginger or ginger grains and applied to fractures to aid bone healing and healing of open wounds [6] and as nerve poison to cause paralysis [7]. Methanol leaf and root extracts of *Pauliniapinnata* are rich sources of phenolic compounds [8] while the methanol stem bark extract have been found to contain bioactive constituents which possess anti-convulsant activity [9] with a median lethal dose of 2346.42 mg/kg.

The leaf was extensively used with acclaimed success in the treatment of cutaneous Leishmaniasis in Idah and Keana in Kogi and Nassarawa states of Nigeria respectively. These assertions arose during an outbreak of cutaneous leishmaniasis in these communities (oral communication), in which epidemiological studies confirm the disease [10]. Interest is therefore generated in studying its pharmacological profiles to determine its safety, considering its extensive use by leishmanial patients in the affected communities as well as its other traditional usage. In this study, the neurological effect of the aqueous leaf extract of *Pauliniapinnata* was tested in mice.

II. Materials and methods

2.1. Animals

Young male albino mice 19-21 days old weighing 15-19g were obtained from the animal unit, Department of Pharmacology, University of Jos and maintained on standard diet and water ad libitum. Animals were handled in accordance with ethical standards.

2.2 Plant Material

The plant was first obtained in Keana, Nassarawa state of Nigeria and later from herbs sellers in terminus, Jos Plateau state. The leaves were harvested from the stuck, washed with water and dried under shade. The dried leaves were pulverised into powder using wooden mortar and pestle.

2.3 Extraction

Fifty gram of the powdered materials was subjected to exhaustive soxhlet extraction in 200ml of water at 70°C for 72hrs, the resultant solution was evaporated to dryness in a water bath maintained at 50 – 60°C. The extract obtained was stored in a refrigerator until required for use.

2.4 Swimming endurance in mice

Five groups of 5 mice each aged 10-21days old and weighing between 15-19g were used. Mice in group 1 were given 0.2ml of normal saline intra-peritoneally (IP) as control. Mice in group 2 received 50mg/kg body weight of the antidepressant imipramine (Tofranil APO-India) dissolved in normal saline. Mice in groups 3-5 received 250, 500 and 1000mg/kg doses of the extract respectively prepared in normal saline. All administrations were done IP and injection volume did not exceed 0.35ml. After administration, the animals were allowed 1hr before start of the experiment during which they were observed for general behaviour and Hippocratic screening. The experiment essentially involved allowing the animals to swim separately (until exhausted) in plastic jar (38cm x 27cm x 15 cm) containing water maintained at 25±1°C. The endurance of each mouse was recorded as the time from the beginning of swimming to exhaustion, which was determined by observing loss of coordinated movements and eventual drowning. The mean swimming time for each group was calculated.

2.5 Statistical analysis

The data obtained was evaluated using the student t-test. All data represent mean values ± standard error of the mean (SEM). P values equals to or less than 0.05 were considered significant. The dose-dependent effect of the extract on swimming performance was tested by the application of linear regression procedure.

III. Results

During Hippocratic screening, all the animals that received imipramine and the extract exhibited various degrees of sedation and weakness as motor activity was depressed or due to direct effect on the musculo-skeletal system.

The aqueous extract of *Paulliniapinnata* demonstrated significant depression of locomotor activity in the mice. The mice forced to swim in the jar after a period adopted a characteristic immobile posture which was readily noticeable. Further loss of motor activity made the animals to drawn. These effects were dose-dependent, showing decrease locomotor activity characterised by decrease swimming time with increasing dose of the extract (Fig.1).

Table 1: Regression data of the effect of *Pauliniapinnata* extract on swimming endurance time in mice.

Group	Drug/Dose	Swimming time (min)	Regression data
		Mean±sem	
1	Normal saline 0.2ml	46.60±0.60	-
2	Imipramine 50mg/kg	38.40±1.63 <i>P</i> <0.05	$\hat{y} = 70.33 + 2.33X$ <i>r</i> =0.8675, <i>P</i> <0.05
3	Extract 250mg/kg	39.60±1.96 <i>P</i> <0.05	$\hat{y} = -109.52 + 3.2X$ <i>r</i> =0.2036, <i>P</i> >0.1
4	Extract 500mg/kg	38.20±0.37 <i>P</i> <0.05	$\hat{y} = 0.92 + 0.8X$ <i>r</i> = 0.5345, <i>P</i> >0.1
5	Extract 1000mg/kg	34.40±1.03 <i>P</i> <0.001	$\hat{y} = - 720.52 + 16.2X$ <i>r</i> = 0.8741, <i>P</i> <0.05

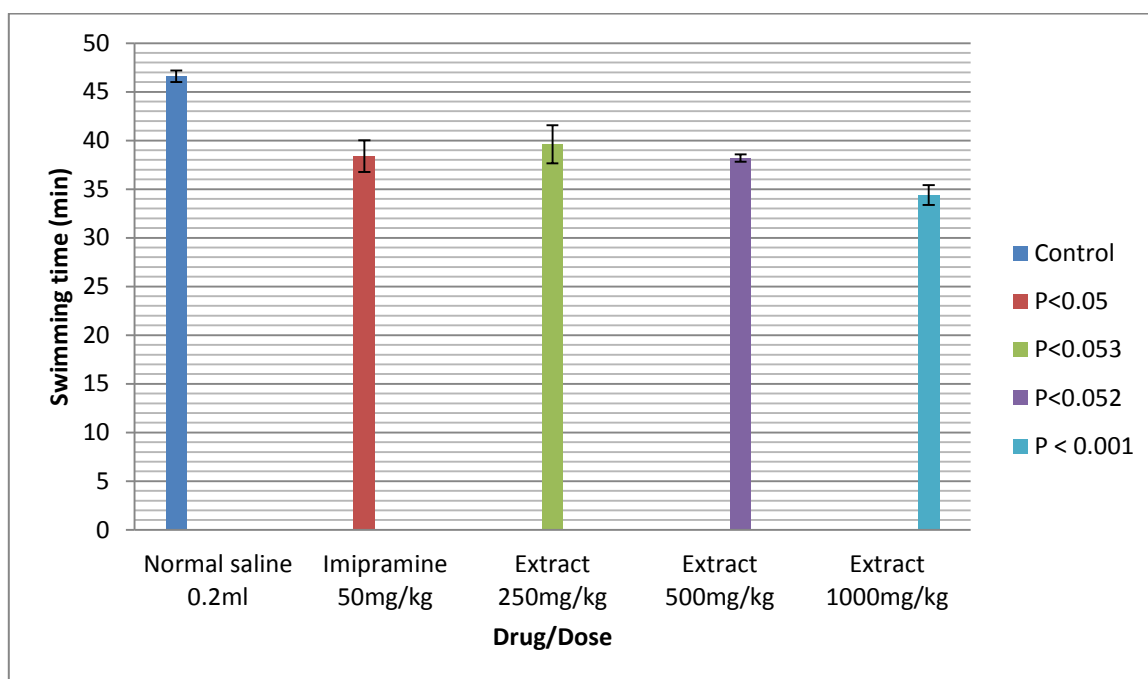


Figure 1: Effect of *Paulinia pinnata* aqueous leaf extract on swimming endurance time in mice

IV. Discussion

It is often necessary to test plants extract for its activity on biological systems to confirm its reputation in traditional usage or simply to complete its pharmacological profile. Locomotor activity in mice involves placing a number of mice in activity cage which enable movement of the animal across a light beam to be counted as locomotion count [11].

In this experiment, water was placed in the cage and mice had to swim to remain afloat. This type of test is used to evaluate a CNS depressant or stimulant activity profile. The times taken for the mice to drown in the treated groups are lower than the control. This result shows that the aqueous leaf extract of *Paulinia pinnata* reduced swimming time in mice. This effect was dose-dependent, being significant ($p < 0.05$) at 250mg/kg and 500mg/kg but highly significant ($p < 0.001$) at 1000mg/kg (Fig.1). The regression data shows that the depressant activity of *P. pinnata* extract is only significant ($p < 0.05$) at the highest tested dose of 1000mg/kg similar to the reduction obtained with the standard drug imipramine (TABLE 1). The reduced swimming time in the extract-treated mice may be attributed to CNS depression and or stress-related physical fatigue. Mice are not aquatic animals and so will easily develop fatigue trying to stay afloat when placed in water. Fatigue is defined as physical and/or mental weariness resulting in negative impacts on exercise intensity, work performance, family life, and social relationships [12]. Physical fatigue can be accompanied by deterioration in functional performance [13].

There are at least two mechanisms that can explain the occurrence of physical fatigue: oxidative stress and energy exhaustion [14]. Exhaustive or intensive exercise can lead to the accumulation of excess reactive free radicals that result in tissue damage. Exhaustion theory suggests that energy source depletion and excess metabolite accumulation can lead to fatigue [15].

The immobility seen in the mice and indeed other rodents has been demonstrated [16, 17] during swimming and this reflects behavioural despair as seen in human depression. It is possible that the decrease in swimming time observed in the treated mice is through CNS depression of motor cortex and or other higher structures in the CNS. Imipramine, a known tricyclic antidepressant prevents reuptake of nor-adrenaline and serotonin resulting in their increased availability in the synapse and therefore an increase in adrenergic and serotonergic neurotransmission [18].

This and the Hippocratic screening are generally in agreement with clinical findings that tricyclic antidepressant drugs cause sedation, dysphoria, confusion and motor incoordination in non-depressed patients during the first few days of treatment [19]. Advances made in neuroscience suggest that dysfunction of the GABAergic system in addition to monoamine deficit contributes to the pathophysiology of anxiety and depression [20].

The results obtained with this extract therefore demonstrated that *Paulinia pinnata* leaf possess obvious depressant activity on the CNS of mice. The observations are similar with other plants extract such as *Desmodium adsendens* which cause CNS depression in rodents indicated by decreased level of spontaneous

motor activity and lack of exploratory behaviour [21]. The bark and leaf aqueous extract of *Byrsonimacrassifolia*, *Gliricidiasepium* have been demonstrated to reduce spontaneous motor activity and exploratory conduct in mice [22].

V. Conclusion

Pauliniapinnata leaves has significant neurological and musculoskeletal depressant effects in rodents and so must be used systemically with caution in traditional medicine in conditions for which it is efficacious.

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