

## Phoenix dactylifera conferred neuroprotection against lead acetate induced neuronal damage on the occipital cortex of Wistar rats

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**Objective:** To investigate the neuroprotective effect of aqueous extract of *Phoenix dactylifera* on the microarchitecture of the occipital cortex of wistar rats against lead acetate induced neuronal degeneration.

**Methodology:** Fifteen F1 adult male wistar rats with an average weight of 220g were randomly assigned into groups A, B and C, each with five animals. Aqueous extract of *Phoenix dactylifera* was prepared and the stock solution was mixed with phosphate buffered saline which served as the vehicle of oral administration. Animals in group A received 350g/kg/BDW per day of *Phoenix dactylifera* extract for 8 days, animals in group B received only 800mg/kg/BDW of lead acetate daily for three 3 days. Group C received 800mg/kg/BDW of lead acetate, then 350mg/kg/BDW aqueous extract of *Phoenix dactylifera*

simultaneously for 8 days. After sacrifice, the brains of the animal subjects were removed; the occipital cortices were then excised carefully and processed for histological examination.

**Results:** Oral administration of 800mg/kg/BDW of lead acetate induced neuronal degeneration. However, neuronal and cellular degeneration were prevented by the simultaneous-counter administration of 350mg/kg/BDW of aqueous extract of *Phoenix dactylifera*.

**Conclusion:** Aqueous extract of *Phoenix dactylifera* conferred neuroprotective measures against lead acetate induced degeneration. This should be screened further for possible use against neurodegenerative diseases in humans. (Rawal Med J 2014;39:78-80).

**Key Words:** *Phoenix dactylifera*, lead acetate, occipital cortex, neuroprotection.

## INTRODUCTION

The sky and its associated blue colour are discernable to the human eye only through the function of a specialized area of the cerebral cortex, the occipital cortex. Located at the back of the brain, the occipital area is responsible for visual perception.<sup>1</sup> *Phoenix dactylifera* (Date Palm) is a palm in the genus *Phoenix*, cultivated for its edible sweet fruit. It is one of the oldest fruit trees in the world as it is mentioned even in the holy books (Qur'an and Bible) and found abundantly in the Arab world.<sup>2</sup> The date fruit is taken as food across regions of the world and vinegar made from dates is a traditional product of the Middle East.<sup>3,4</sup> Dates consists of protein, fiber, and trace elements including boron, cobalt, copper, fluorine, magnesium, manganese, selenium, and zinc.<sup>5</sup> The glycemic index for three different varieties of dates are 35.5 (khalas), 49.7 (barhi) and 30.5 (boma'an).<sup>6</sup> It is well known that chronic exposure to lead (Pb(+2)) alters a variety of behavioral tasks in rats

and mice.<sup>7</sup> As one of the ubiquitously polluted heavy metals in ecosystem and modern industry, lead may enter human body via many routes including airway, water and food.<sup>8</sup> Lead(II) acetate ( $\text{Pb}(\text{CH}_3\text{COO})_2$ ), also known as lead acetate, lead diacetate, plumbous acetate, sugar of lead, lead sugar, salt of Saturn, and Goulard' powder, is a white crystalline chemical compound with a sweetish taste and it is toxic.<sup>8</sup> Lead acetate exposure causes chronic central and peripheral nerve damages in humans at all ages, with more concerns for the pediatric population. Neurological consequences of Pb poison in children are reported to include reduction in IQ and learning/memory capability, hearing and language impairments and certain neuropsychological abnormalities.<sup>9</sup> Lesions in the occipital lobe may be caused by infarction, inflammation, trauma and neoplasia<sup>10</sup> with infarction being the most common etiology.<sup>11</sup>

A lot of research has been carried out on *Phoenix dactylifera* to investigate its medicinal properties,

each concentrating on different areas of studies. However, there are scanty reports on the possible neuroprotective properties of the plant as most other studies have concentrated on its direct effects on animal tissues of their interest. This study was intended to ascertain histologically, the neuro protective effects of phoenix dactylifera from lead acetate induced neuronal damage on the occipital cortex of rats.

## METHODOLOGY

Fruits of phoenix dactylifera were procured from a local market in Ilorin, Kwara State, Nigeria and authenticated at the Department of Botany, University of Ilorin, Nigeria. The fruit was pulverized into fine powder with an electric blender. Fifty grams of the powder was then placed in 500mls of distilled water for 48 hours at room temperature. After 48 hours, the mixture was filtered twice using a filter paper and the filtrate was left to evaporate at room temperature until it was totally dry. The stock solution was thereof prepared, such that 10 grams of the kola extract was dissolved in 100mls of phosphate buffered saline, which served as the vehicle of oral administration.

Ethical approval for the experiment was obtained from the College of Health Sciences Ethical Committee at the University of Ilorin. Fifteen first filial male wistar rats with an average weight of 220g were raised to adulthood from an initial three female and two male parent rats in the animal holdings (Anatomy) of the University. The animals were fed with standard pellet diet and clean water ad libitum, and routinely housed in controlled conditions with temperature of 25–26°C, relative humidity of 60–80% and 12 hours light/dark cycle. Appropriate care and hygienic conditions were maintained.

The fifteen rats were then randomly assigned into three groups, with each group comprising of five rats each as thus;

Group A – received only 350mg/kg body weight of phoenix dactylifera daily for eight days.

Group B – received only 800mg/kg body weight of lead acetate daily for three days.

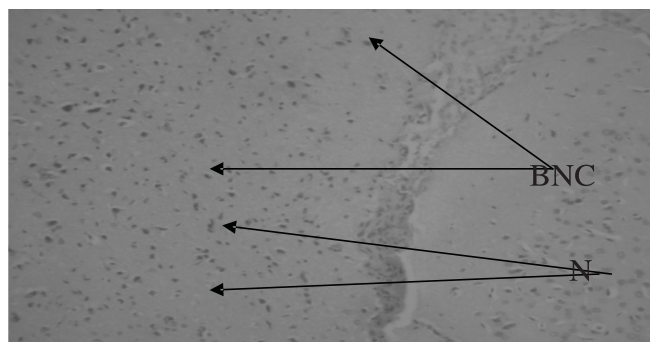
Group C – received 800mg/kg body weight of lead acetate, then 350mg/kg body weight aqueous extract of phoenix dactylifera simultaneously for 8 days.

Animals were sacrificed by cervical dislocation; the head was immediately separated from the trunk. The brain of each animal was carefully removed and placed into formol calcium fixative after which the occipital cortices were carefully excised. They were subjected to further processing for histological assessment. Sections were then obtained at 5µm and stained with Haematoxylin and Eosin.<sup>12</sup>

## RESULTS

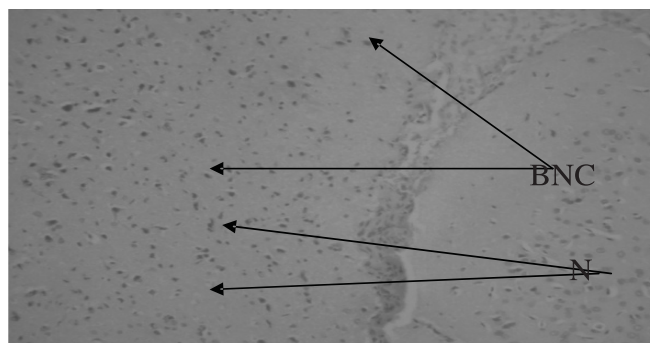
Cellular hypertrophy and the appearances of perineural spaces around the neurons were observed in group B rats that were treated with 800mg/kg body weight of lead acetate (Fig 1).

**Plate 1: Photomicrograph showing a section from the occipital Lobe in Group A. (H&E X100). A compact general cytoarchitecture is observable. Dense population of Nuclei (N) all over the neurons are clearly demonstrated. BNC=Binucleate cells.**



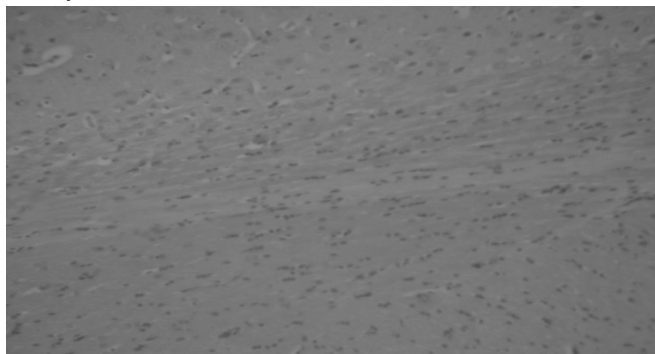
When compared with the group A, treated with just 350mg/kg body weight of phoenix dactylifera daily, a compact general cytoarchitecture is observed (Fig 2).

**Fig 2. Photomicrograph showing a section from the occipital Lobe in Group A. (H&E X100). A compact general cytoarchitecture is observable. Dense population of Nuclei (N) all over the neurons are clearly demonstrated. BNC=Binucleate cells.**



Group 3 that were treated with the aqueous extract of phoenix dactylifera and lead acetate simultaneously did not exhibit any of the cellular disruption associated with group B (Fig 3).

**Fig 3. Photomicrograph showing a section from the Occipital Lobe in Group C (H&E X 100). The Nuclei (N) and BNC=Bi-nucleate Cells here are prominent. Cellular Hypertrophy (CH) and Perineural Spaces (PNS) are totally absent.**



It is clear that the administered 800mg/kg of lead acetate induced neuronal damage in the occipital lobe of the rat subjects.

## DISCUSSION

The occipital lobe, like the rest of the nervous tissues, is made up of neurons and neuroglia as well as other connective tissue.<sup>13</sup> Two of the major histological manifestations of necrosis in neuronal tissues are cellular hypertrophy and the appearances of perineural spaces around the neurons. Occipital lobe lesion as a result of lead exposure was reported by Simpson in 1990. In his findings, he reported that such lesions tend to give isolated visual symptoms which are different from symptoms as a result of lesion from other parts of the intra-cranial visual pathway.

Our findings strongly suggest that 350mg/kg body weight of *phoenix dactylifera* protected the neuronal cells of the occipital lobe from lead damage. This finding further buttresses reports from earlier researches on the rich medicinal benefits of phoenix dactylifera. It is recommended that more detailed research be carried out especially in the area of molecular biology, to ascertain the precise mechanisms by which Date Palm (Phoenix

dactylifera) confers its neuroprotective properties.

## CONCLUSION

It can be inferred that the aqueous extract of *phoenix dactylifera* had a neuroprotective role in degeneration of neuronal cells.

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