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RESEARCH ARTICLE

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## Histological observations of the cerebellum of wistar rats following the administration of ethanolic extract of *Cola nitida*

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### ABSTRACT

*Cola nitida* is one of the species of kola nut which possess stimulatory properties. It is used as a masticatory stimulant by Africans and has numerous uses in social, religious, ritual and ceremonial functions by the natives in the forest region of Africa. In this study, the effects of ethanolic extract of *Cola nitida* were evaluated on the cerebellum of wistar rats. Fifteen Wistar rats were used for this experiment. Group I was the control that received distilled water only while groups II and III received 100mg/kg and 150mg/kg respectively of ethanolic extract of *Cola nitida* for duration of fourteen (14) days. The Wistar rats were sacrificed using chloroform and the brain was dissected. The dissected brain was fixed in Bouin's fluid, processed and stained in Haematoxyline and Eosin. Histological observations showed neuro-degeneration in the cerebellum of the *Cola nitida* treatment groups when compared with the control group that showed normal histological features. Based on our observations, it is therefore concluded that ethonolic extract of *Cola nitida* had neurodegenerative effects on the cerebellum of Wistar rats which is more pronounced at high dose; hence, caution should be taken in its usage.

**Key words:** Cerebellum, histological observations, administration, *cola nitida*, Wistar rats, neuro-degeneration.

### INTRODUCTION

*Cola nitida* (Kola nut) is a shade bearer but develops a better spreading crown which yields more fruits in open places. Though, it is a lowland forest tree it has been found at altitudes over 300 m on deep rich soils under heavy and evenly distributed rainfall [1]. It is an evergreen tree of about 20metres in height, has long and ovoid leaves pointed at both ends and has a leathery texture. The trees have yellow flowers with purple spots and star shaped fruit. Inside the fruit, about a dozen round or square seeds can be found in a white seed shell. The first taste of *Cola nitida* is bitter, but it sweetens upon chewing [2].

There are over forty cola species, out of which *Cola nitida* and *Cola acuminata* are of major economic and social importance in Nigeria. It was affirmed that fresh and cured *Cola nitida* chewing is prominent as a masticant and stimulant [3]. It is one of the species of kola nut which possess stimulatory properties. It can be chewed and also prepared as beverages. It contains caffeine and traces of theobromine, these are alkaloids which stimulate the nervous system and the skeletal muscles to counteract fatigue, suppress thirst and hunger and it is believed to enhance intellectual activity [4, 5]. It is a caffeine containing nut which belongs to sterculiacea plant family. The chemical compositions of kola nut are caffeine, theobromine, theophylline, phlobaphens (kola red), epicatechin, tannic acid, sugar (cellulose) and water [4].

*Cola nitida* is used as a religious object and sacred offering during prayers, ancestor veneration and ceremonies such as weddings, traditional divinations. It is chewed in many West African cultures, individually or in a social setting to restore vitality and ease hunger pangs [6]. In Nigeria, it is generally acknowledged that the Yoruba's grow the kola nuts; the Hausas eat it while the Igbo's celebrates it. In eastern part of Nigeria, it is a common saying that "he who brings cola, brings life", it is a sign and gesture of friendship, hence *Cola nitida* cut across all and sundry in our society, however it is a plant of importance. It is used as a masticatory stimulant by Africans and has numerous uses in social, religious, ritual and ceremonial functions by the natives in the forest region of Africa. It is used during ceremonies related to marriage, child naming, installation of Chiefs, funeral and sacrifices made to the various gods of African mythology [7, 8, 9]. There is also increasing demand for its usage in pharmaceutical industries and for production of soft drinks, wines and candles [10, 1].

*Cola nitida* has been reportedly used in folk medicine as an aphrodisiac, an appetite suppressant, to treat migraine headache and indigestion [11]. It has also been applied directly to the skin to treat wounds and inflammation [12]. In some developed countries, however *Cola nitida* extract is used industrially for the manufacturing of many cola-type soft drink flavours [10], and as a main ingredient in the production of heat tolerant chocolate bars [13]. Its uses have inevitably created a high demand in excess of its production [14].

Cerebellum (Latin word for little brain) is a region of the brain that plays an important role in motor control and equilibrium. Cerebellum is located at the bottom of the brain with large mass of cerebral cortex above it and portion of the brainstem called Pons anterior to it (in front of it). Cerebellum is separated from the overlying cerebrum by a layer of leathery Dura mater; it is a part of the metencephalon and is divided into two hemispheres which contains narrow midline zone called the vermis [5].

Cerebellum contains more neurons than the rest of the brain because of the presence of large number of tiny granule cells in it. Cerebellum takes up ten percent (10%) of the total brain volume and receives about 200 million input fibers [16]. The bulk of the structure of the cerebellum is made up of a very tightly folded layer of gray matter (cerebellar cortex), underneath, the gray matter of the cortex lies the white matter which are composed of largely myelinated nerve fibers running to and from the cortex [17]. The Purpose of this study was to evaluate the effects of ethanolic extract of *Cola nitida* on the cerebellum of wistar rats.

## MATERIALS AND METHODS

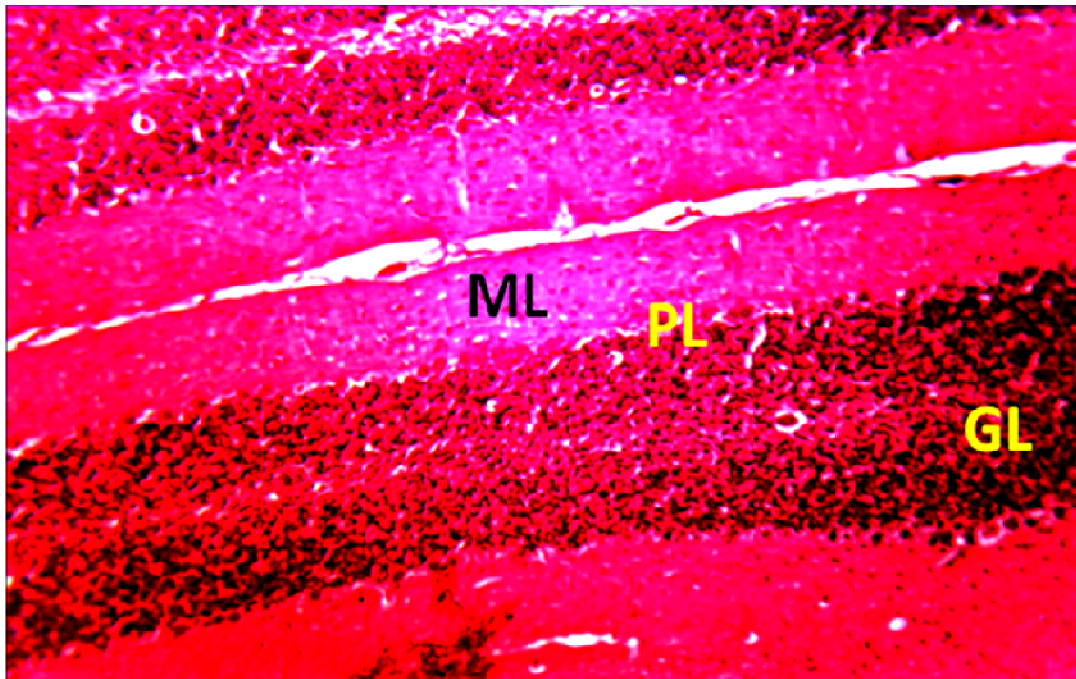
**Materials:** *Cola nitida*, Distilled water, Ethanol, Cages, Pelletized Feeds, Butterfly needles, Syringes, Wistar rats, Weighing balance, Beakers, Dissecting kit, Dissecting tray, Bouin's fluid, Chloroform, Cotton wool.

**Extraction of Plant Materials:** The fresh seeds of *Cola nitida* were cut into pieces and dried; the dried seeds were grounded into powder which weighs 327grams. The powdered form of *Cola nitida* was turned into the separating funnel where 70% ethanol was added (Percolation method) for 24hours to get the filtrate of the ethanolic extract of cola nitida. The filtrate or extract was evaporated to dryness at a temperature of 40-45 degree Celsius. A yield of 14.75grams was obtained and kept in a dessicator prior to use.

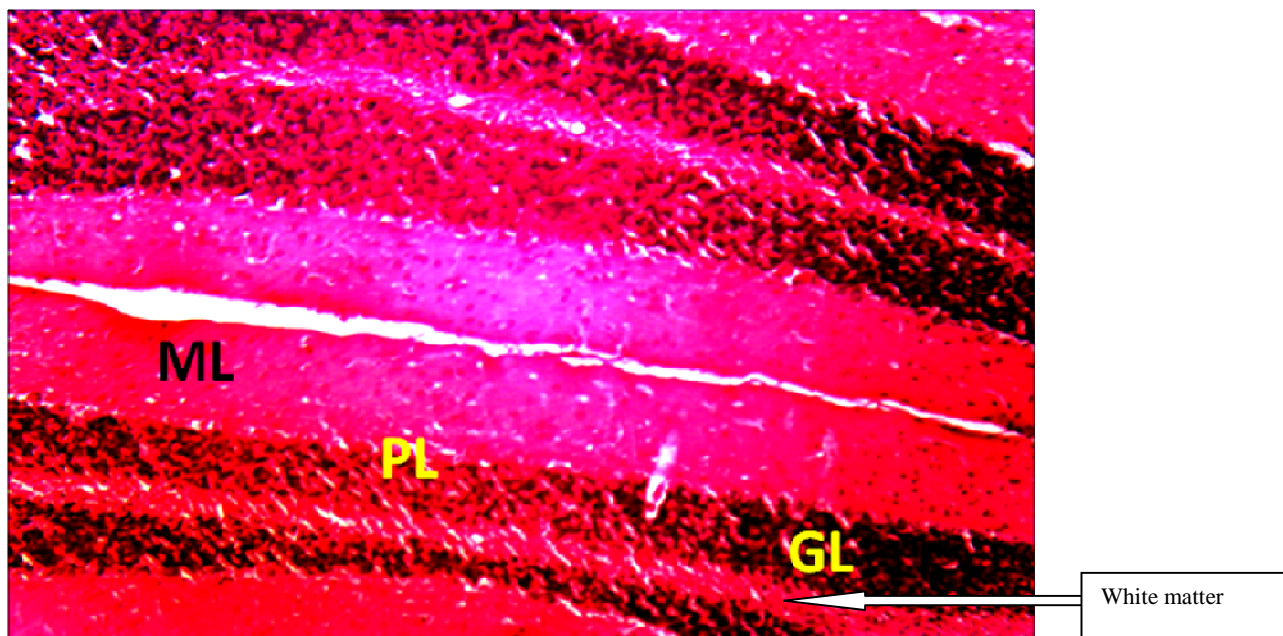
**Experimental Procedure:** Fifteen Wistar rats, obtained from the animal house of the Faculty of Pharmaceutical Sciences, Ahmadu Bello University, Zaria were used for this study. The Wistar rats were divided into three (3) groups of five (5) Wistar rats per group. The average weight was between 140 and 225grams. The Wistar rats were kept in the animal house of the Department of Human Anatomy, Ahmadu Bello University, Zaria for two (2) weeks before administration of *Cola nitida*; this is in order to allow the animals acclimatize to the environment.

Group I was the control that received distilled water while groups II and III received 100mg/kg and 150mg/kg extract of *Cola nitida* respectively for duration of two weeks.

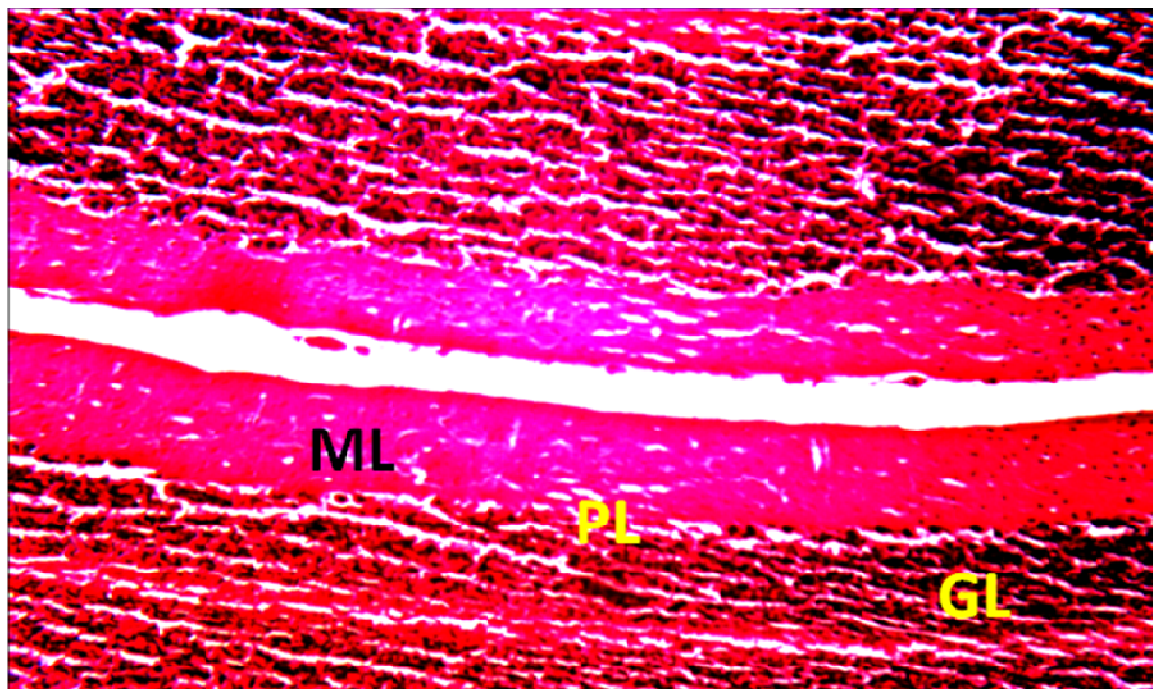
## RESULTS AND DISCUSSION



**Plate 1:** Photomicrograph of normal histological architecture of the cerebellum of the control with normal Molecular layer (ML), Granular layer (GL) and the Purkinje layer (PL).H&E X100.



**Plate 2:** Photomicrograph of group II treated with 100mg/kg showing partial loss of Molecular and purkinje cells of the cerebellum. H&E. X100.



**Plate 3: Photomicrograph of group III treated with 150mg/kg showing the neurodegeneration of cells in the Molecular layers (ML), Purkinje layer (PL) and the Granular layer (GL) of the cerebellum. H&E. X100.**

The cerebellum (Latin for "little brain") is a region of the brain that plays an important role in motor control. It may also be involved in some cognitive functions such as attention and language, and in regulating fear and pleasure responses [15], but its movement-related functions are the most solidly established. The cerebellum does not initiate movement but it contributes to coordination, precision, and accurate timing. It receives input from sensory systems of the spinal cord and from other parts of the brain, and integrates these inputs to fine tune motor activity.

In our study, the Cerebellum of Wistar rats in group I that received distilled water only showed normal histological features of the molecular, purkinje and granular layers (Plate I). The Cerebellum of Wistar rats in group II showed partial loss of Molecular and purkinje cells (Plate II) while that of group III revealed distinct neurodegeneration (Damage) of the cell layers (Plate III). The Cerebellar damage observed in the *Cola nitida* treated groups could produce disorders in fine movement, equilibrium and posture which could be in line with the general believe that cerebellar damage does not cause paralysis, but instead produces disorders in fine movement, equilibrium, posture, and motor learning [18]. Our findings was partially in concord with the report that stated that high doses of *Cola nitida* consumption can leads to cerebellar neuro-degeneration including nervousness, heart irregularities, headaches, and sleeplessness [12].

But our findings was in contrast with another report that stated that small doses of *Cola nitida* increases mental activity, reduce the need for sleep and also dispel hunger and thirst [1]. It is for this reason that *Cola nitida* chewing has become very popular among students, drivers and many other consumers who need to remain active for unusually long period. Although, it was reported that *Cola nitida* are commonly used to counteract hunger and thirst, in some cases it is used to control vomiting in pregnant women, also, it is used as a principal stimulant to keep awake and withstand fatigue by students, drivers and other menial workers [19, 20].

Despite several advantages offered by *Cola nitida*, there is certain health risks associated with excessive consumption of *Cola nitida*. Some of these side effects of *Cola nitida* are: Headache, Shaking and jittery hands and legs, increased heart rate, Nausea, Heart burn (Due to the presence of gastric acid), Vomiting, osteoporosis and gastric irritation [11]. Sleep disorder, excitability, nervous restlessness and gastric irritation may occur [9].

Our histological sections showed that neurodegeneration of the cerebellum of Wistar rats was observed in the *Cola nitida* treated groups (Plates II and III) when compared with the control (Plate I).

### CONCLUSION

Based on our observations, we conclude that the ethanolic extract of *Cola nitida* had neurodegenerative effects on the cerebellum of Wistar rats which was more pronounced at high dose but there was increased physical activity, as well as, alertness in the *cola nitida* treated groups when compared with the control.

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