Histomorphology of spleen of rats sub-acutely administered with *Averrhoa carambola* juice extract

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Abstract

Averrhoa carambola otherwise called Star fruit is a sweet juicy and succulent fruit that is cherished and consumed by many people. The juice extract is also used in folkloric medicine in treatment of certain ailments such as skin rashes, inflammatory conditions and diabetes. However, anecdotal evidence indicates that the fruit may be toxic to some vital organs in the body. This study therefore, was designed to investigate possible toxicity profile of *Averrhoa carambola* juice extract in the spleen of female albino rats. Twenty (20) rats were assigned to 4 groups (A –D) of 5 rats each. Rats in group A received distilled water at 10 ml/kg to serve as normal control while rats in groups B-D were administered the extract at 600, 300, 150 mg/kg body weight respectively *Per Os* for 28 days. On 29th day, the spleens were collected under mild ether anaesthesia for histopathology assessment. The spleen histomorphology of the rats treated with the juice extracts showed no lesions and were comparable with that of the normal control. In conclusion, the result of this study suggested that the juice extract of *Averrhoa carambola* has no effect on the spleen histo-architecture.

Keywords: *Averrhoa carambola*; Histopathology, Rats, Spleen

Introduction

Averrhoa carambola L also known in English language as star fruit, Chineeze gooseberry, belongs to the family Oxalidaceae (Carreira and Schatzmayr, 1982). The fruit which is star-shaped, contains sweet juicy liquid. *Averrhoa carambola* L is found preponderantly in Malaysia, Brazil, China and India (Ghani, 2003). Studies on the fruit, by some researchers, have indicated the presence of phytochemicals such as flavonoids, tannins, saponins and alkaloids, gallic acid, epicatechin, ascorbic acid and proanthocyanidins (Guanghou and Leong, 2004).

In folkloric medicine, the juice from the fruit is useful in management of fever and in stimulation of appetite. Brazillians use the juice for diuretic purposes while the chineese use it to promote digestion. Researched studies have reported analgesic properties, anti-inflammatory effects and hypoglycaemic potentials (Ahmed and Das, 2012; Sripanidkulchai *et al.*, 2002). *A.carambola* also exhibit anthelmintic, antioxidant, hypolipidemic, antimicrobial, hypotensive, anti-ulcer and anti-tumour activities (Shah *et al*., 2011; Shui and Leong, 2004).

Histopathology of various organs always reveals any pathological lesions of such test substance on the organs of interest. The spleen is the largest organ in the body saddled with the responsibility of blood filtration, storage, production and destruction (Steinger and Barth, 2000). It is also involved in adaptive immunity (Bronte and Pittet, 2013). People consume this fruit greatly, probably because of its sweetness or because of its nutritional and medicinal values. However, certain contents of the fruit juice such as oxalic acid and caramboxin have been noted to be highly toxic in uraemic patients precipitating encephalopathy (Garcia-Cairasco *et al*., 2013). We embark on this study to investigate the effects of juice extract of *A.carambola*, grown in our environment- Nsukka, Enugu state, southeast Nigeria, on the spleen histo-architecture and by extension its function.

Materials and methods

Plant material

Averrhoa carambola fruits were obtained from the University of Nigeria Nsukka teaching farm and authenticated by a botanist in the Department of Plant Science and Biotechnology.

Animals

Albino rats used for this study were obtained from the Department of Veterinary Physiology and Pharmacology animal house. They were acclimatized for two weeks before the commencement of the experiment. They were fed with standard rat feed and clean water *ad lib*.

Preparation of plant material

The *Averrhoa carambola* fruit extract was obtained by aseptically expressing out the juice from the fruit using juice extractor machine and the concentration of the juice determined using a lyophilizer. The crucible was weighed and recorded. Thereafter 1ml of the extract was placed into the crucible, and then weighed. This was freezed and then lyophilized until the water content of the juice was completely sublimed. The crucible and the dried extract were weighed again and the concentration of the juice extract calculated as follows:

Weight of crucible alone $=A_1$
Weight of crucible + liquid extract $=A_2$
Weight of crucible + dried extract $=A_3$
Weight of dried extract alone = A_3-A_1
Concentration of the fruit juice = weight of the dried extract (in mg)per ml= A_3-A_1/ml

Experimental design

Twenty (20) female albino rats were assigned into 4 groups (A-D) consisting of 5 rats per group. Rats in group A received distilled water (10 mg/ml) to serve as normal control while rats in group B – D were administered 600, 300 and 150 mg/kg of the juice extract of *Averrhoa carambola* respectively. All treatments were *Per Os* using gastric gavage for 28 days. The rats were humanely euthanized using ether. Thereafter the spleens were collected, weighed and preserved for histopathology studies.

Histopathology

The histological examination of the tissues of Wistar albino rats was done using the method of Drury *et al.*,(1967)

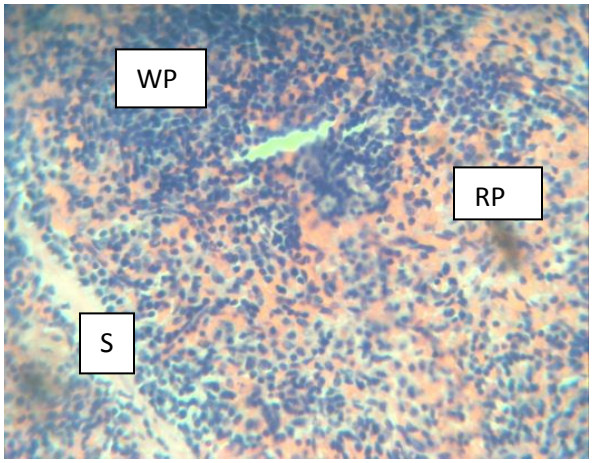
Results and Discussion

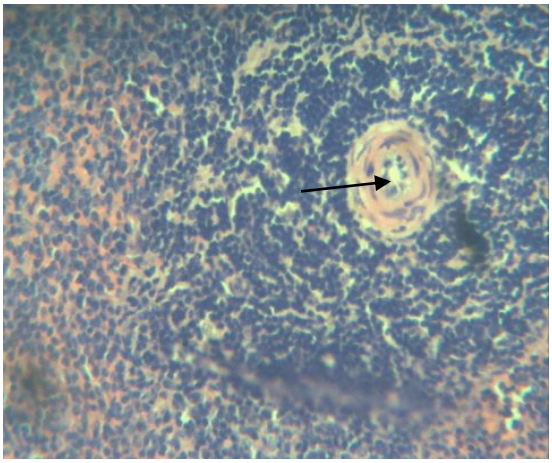
Concentration of the juice extract

The concentration was calculated to be 70 mg/ml

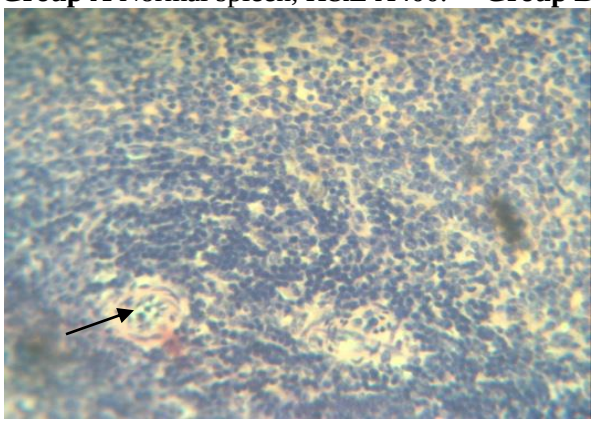
Effect of sub-acute administration of *Carambola averrhoa* juice extract on the spleen

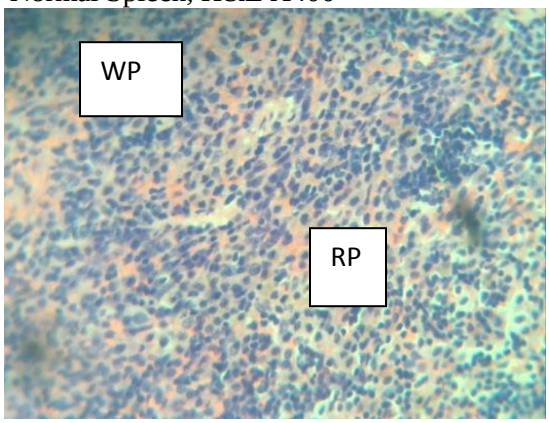
The photomicrographs of the spleen sections indicate that the spleen of all the juice extract-treated groups presented normal histo-architecture comparable to that of the group A rats (normal control)





Group A Normal spleen, H&E X400. **Group B** Normal Spleen, H&E X400





Group C Normal spleen, H&E X400 **Group D** Normal spleen, H&E X400

Legends:
Group A: Showing splenic sinus (S), white pulp (WP) and red pulp (RP)
Group B: Showing splenic artery (black arrow)
Group C: Showing splenic artery(black arrow)
Group D: Showing white pulp (WP) and red pulp (RP)

This study investigated the effects of sub-acute administration of *A. carambola* juice extract on the spleen histo-architectures of female Albino rats.

The results of the study indicates that the histomorphometry of all the rats that received the juice extract did not vary from that of the normal control rats that received distilled water. This is an indication that the juice extract may not have affected the structure and probably the function of the spleen. Mammalian spleen is a very important organ of reticuloendothelial system. The presence of both the red and white pulp in the spleen equips the organ with both the functions of erythrophagocytosis and immunologic functions (Steinger and, Barth, 2000).

The red pulp splenic macrophages ingest the effete red blood cells in a process called erythrophagocytosis. In this way, senescent red blood cells are removed from the system (Groom *et al*., 1991). The red blood cells are digested in the macrophages and heme is released following proteolytic degradation of haemoglobin. The released heme is further degraded to yield biliverdin, carbon monoxide and ferrous iron which can either be released or stored (Maines, 1997). This process is also important in iron recycling.

On the other hand, the white pulp is the lymphoid region of the spleen which houses the T and B cells compartments. The white pulp has the responsibility of capturing and destroying of pathogens and in induction of adaptive immune responses (Bronte and Pittet, 2013).

Atrophy (reduction in the size of spleen) can affect the white pulp and/or red pulp compartments of the spleen. Lymphocyte atrophy of the white pulp is characterized by a loss of lymphocytes in the T-cell areas (periarteriolar lymphatic sheaths [PALS]) and/or B-cell areas (follicles, germinal centers, marginal zones). Depending on severity, this can result in a decrease in overall PALS cellularity/area or follicle number/size.Red pulp atrophy is characterized by a decrease in the relative amount of red pulp components, including hematopoietic cells. Atrophy can occur as a direct treatment-related effect or can be an indirect effect secondary to weight loss or reduced body weight gain (Ward *et al.*, 1999)

On the other side of the coin, splenomegally (enlargement of spleen) may be caused by neoplasia and some conditions that may lead to overload in splenic functions such as increased haemolysis as may be occasioned by toxin or haemoparasites-induced haemolysis. Other conditions include inflammatory disorders, viral or bacterial infections (Pozo *et al*., 2009).

In our study, we recorded neither splenic atrophy nor splenomegally, indicating that the juice extract may not have interfered with the splenic functions or cause any form of toxicity to the spleen.

Conclusion

Sub-acute administration of *A. carambola* juice extract to female albino rats did not precipitate any deleterious effects on the histoarchitecture of the spleen.

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