International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Hepatoprotective Effects of Carotenoid on the Liver Cells of Adult Wistar Rats

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Received: 23/11//2013 *Revised: 18/12/2013* *Accepted: 23/12/2013*

ABSTRACT

This work focuses primarily on the hepatoprotective effects of carotenoid on the liver cells of wistar rats, following low and high consumption. Twenty wistar rats weighting between 150 – 210kg were used. The animals were divided into four groups of five animals each. The groups were designated as A,B,C & D. Group A served as the control and received 0.35ml of distilled water; the experimental groups B,C & D received 0.4ml, 0.5ml and 0.6ml of carotenoid respectively for a period of twenty one days. The drugs were administered orally using intubation method between the hours of 12 - 3pm daily. Twenty hours after the last administration, the animals were weighed, anaesthetized under the influence of chloroform vapour and dissected. Liver tissues were removed, weighed and trimmed down to a size of 3mm x 3mm and fixed in zenkers fluid for histological studies. The final body weight of the experimental groups increased significantly ($P<0.001$) relative to the control. The histological result showed that there were no hepathological lesions in the experimental groups compared with the control.

The present study indicated that consumption of carotenoid at low and high dosage may not put the liver at risks of adverse histopathological conditions.

Keywords: Hepatoprotective, Carotenoid. Liver weight, Body weight, Wistar rats.

INTRODUCTION

Carotenoids are pigmented molecules usually yellow, orange and red that interacts with chlorophylls to absorb light energy needed in photosynthesis. There are two major types, the hydrocarbon class or carotenes and the oxygenated class or xanthophylls. [1]

Carotenoids have important functions in photosynthesis, nutrition, and protection against photooxidative damage. [2] They are produced by all photosynthetic organisms, plants, algae and bacteria as well as many species of nonphotosynthetic eubacteria. Cyanobacteria are a group of eubacteria that can be traced back 3.5 bllion years based on the fossil and molecular evidence. [3,4] Carotenoids have two main functions, they serve as light harvesting pigments in photosynthesis and protect

against photooxidative damage. [5] Carotenoids are used as antioxidants which help to protect against free radicals that attack molecules of cells. They are fat soluble compounds formally called lipochromes. Their significant is attributed to their well documented antioxidant properties. Their antioxidant effect enables these compounds to play crucial role in protecting organisms against damage during photosynthesis. [6] Carotenoid cannot be manufactured by species in the animal kingdom, so animals obtain carotenoids in their diet. People consuming diet rich in carotenoid from natural foods such as fruits and vegetables are healthier and have lower mortality from a number of chronic illnesses. [7] The liver plays a central role in the metabolism of many drugs and induced hepatic injury is now one of the commonest forms of iatrogenic disease. Indeed, in any patient presenting with obscure liver disease, the possibility of a drug induced lesion should always be considered. Many of the pathological features such as hepatocellular injury, necrosis and hepatitis both acute and chronic can by various mechanisms be reproduced by drugs. [8] In the absence of reliable liver protection in modern medicine, a number of medicinal preparations are recommended for the treatment of liver disorders. [9] This scenario provides a severe necessity to carry out research on this research. Hence, this study aims at investigating the hepatoprotective effects of carotenoid on the liver cells of adult wistar rats.

MATERIALS AND METHODS

Breeding of Animals

Twenty wistar rats were purchased from animal house of Anatomy Department, University of Calabar, Cross River State, Nigeria. They were bred in the animal house of University of Uyo Akwa Ibom State. They were allowed for a period of seven days for acclimatization under normal temperature (27^oC - 30^oC), and fed ad libitum with water and guinea feed pallets from Agro feed Mill Nigeria Ltd.

Drug Preparation

Commercial carotenoid was obtained from Golden Neo-Life Diamite (GNLD) Int. Spartan by pharmaceutical contractors Isando Road, Isando, South Africa and purchased from No.6 Itu Road Uyo retail outlet, Akwa Ibom State, Nigeria. One capsule of carotenoid containing 900mg was dissolved in 10mls of distilled water and administered to the animals.

Experimental Protocols

The twenty animals were weighed and allocated into four groups of five animals each. Group A served as the control and received 0.35ml of distilled water, the experimental groups B,C &D received 0.4ml, 0.5ml and 0.6ml of cartonoid respectively for twenty one days. On the 22^{nd} day, the animals were weighed and there weights recorded. Twenty four hours after the last administration, the animals were anaesthetized under the influence of chloroform vapour and dissected. Liver tissues were removed and weighed. The tissues were trimmed down to a size of 3mm x 3mm thick and fixed in zenkers fluid for four hours for histological studies.

Tissue Processing

For easy study of sections under microscope, the tissues passed through several processes of fixation, dehydration, clearing, infiltration, embedding, sectioning and staining. Fixation was carried out in zenkers fluid. The tissues remained in the fluid for four hours. After fixation, the tissues were washed overnight under a stream tap water. Dehydration of the fixed tissues was carried out in different percentages of alcohol, 50%, 70% and 90% absolute. After dehydration, tissues were cleared in zylene for two hours after which infiltration was done in molten paraffin wax

at a temperature of 60°C for two hours each in two changes and then sectioned. Haematoxylene and eosine method was used.

RESULT

❖ *Morphometric Analysis of Body Weight*

Table 1: Comparison of mean initial and final body and weight change in all the groups (A,B,C &D).

	GP.A	GP.B	GP.C	GP.D	F-RATIO	PROB. OF SIG
INITIAL BODY WT.	190.10±3.60	192.80±4.60	195.60±6.60	198.40±7.20	64.230	<0.001
FINAL BODY WT.	200.40±5.50	209.30±2.70	212.30±4.20	215.20±2.50	40.240	<0.001
WT. CHANGE	10.10±2.20	17.10±4.60	17.70±6.20	17.60±6.50	7.280	<0.001

The final body weight for the experimental groups B,C & D increased significantly (P<0.001) relative to the control (A).

❖ *Morphometric Analysis of Liver Weight*

Table2: Comparison of mean relative liver weight of all the groups (A,B,C &D).
(Mean ± SEM given for each measurement)

	GP.A	GP.B	GP.C	GP.D	F-RATIO	PROB.OF SIG
LIVER WT.	5.10±0.240	5.25±0.260	5.31±0.320	5.42±0.600	54.60	<0.001

The relative liver weights for the experimental groups increased significantly (P<0.001) with the control.

❖ *Histopathological Findings*

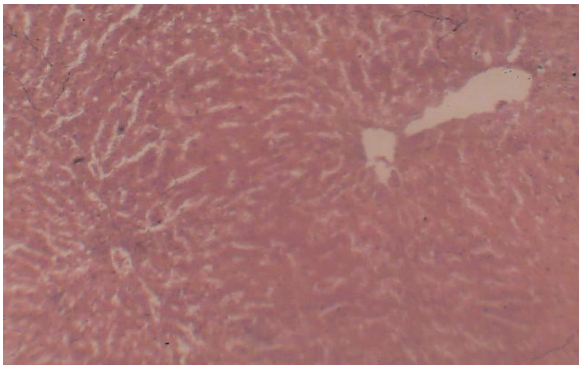

Fig. 1: MICROGRAPH 1(Group A control).

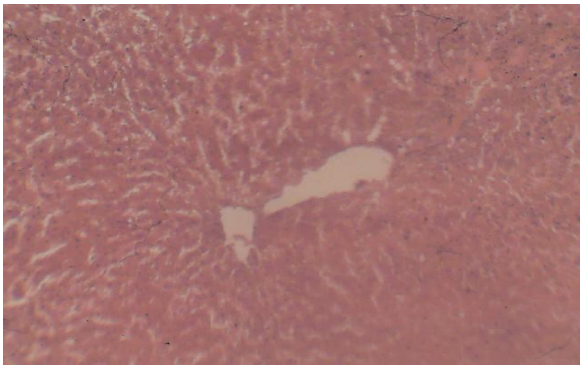

Fig. 2: MICROGRAPH 2 (Treated with 0.4ml of Carotenoid).

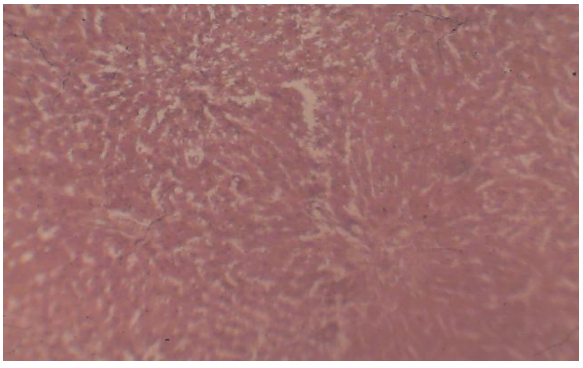

Fig. 3: MICROGRAPH 3 (Treated with 0.5ml of Carotenoid). Hepatocellular cytoarchitecture normal, portal tract centrally placed.

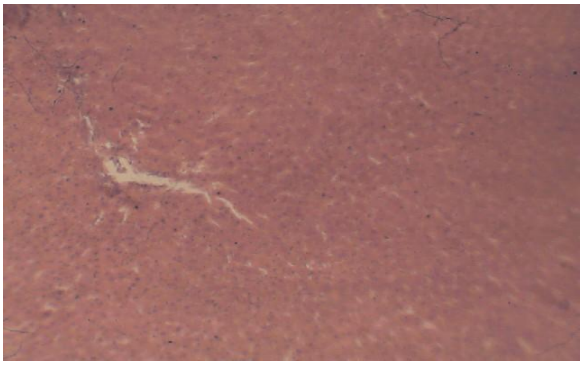

Fig. 4: MICROGRAPH 4 (Treated with 0.6ml of Carotenoid).

The micrograph (Fig. 1) of liver showing portal tract and surrounding hepatocytes arranged in plates, converging towards it. Hepatic plates are separated by spaces called sinusoids. Normal histology.

The portal triad is placed centrally in this photomicrograph (Fig. 2). It is composed of the branches of the portal vein, hepatic artery and bile duct.

The Micrograph (Fig. 4) shows non-disruption delivery architecture. The central vein and sinusoid are well distended and hepatic plates are differentiated. It indicates essentially normal histology.

DISCUSSION

Carotenoids as antioxidants, serve to protect cells from the danger of free radicals that may be produced by the body during metabolism or by cigarette smoke, sunlight, radiation, pollutants or even stress. [10]

Carotenoid acts as a sunblock in the retina of our eyes. Just as the protect a plants photosynthetic structures, the carotenoids in our eyes filter out harmful, damaging blue light and help protect our sight. Along with this benefit, carotenoids also function to protect other parts of our bodies as well. [10]

In the present study, the mean initial and final body weight for the experimental groups treated with carotenoid in low and high doses increased significantly with the control. Carotenoid in this instance functions, primarily as a dietary supplement enhancing growth. The comparison of mean relative weight of the control animals with the experimental groups showed no significant increase or decrease (<0.001).

The histopathological result indicated that there was no histopathological lesion in the liver cells of the experimental groups compared with the control. Antioxidant properties of carotenoid could have been responsible for the protective effects of it on the liver architecture of the animals.

CONCLUSION

The administration of carotenoid in low and high doses did not induce any histopathological lesion in the liver tissues of the rats. The findings of this study suggest that carotenoid administered to individuals exposed to poisons could provide some protection against the toxic effects of poisons on the liver.

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How to cite this article: Ezejindu D N, Ihentuge C J, Ezejindu C N. Hepatoprotective effects of carotenoid on the liver cells of adult wistar rats. Int J Health Sci Res. 2014;4(1):69-73.

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