Evaluation of Consumption of Mixed Diet of Garlic, Garden Egg and Groundnut on the Cytoarchitecture of the Spleen of Anaemic Wistar Rats

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Abstract: Twenty five induced anaemic wistar rats of both sexes weighing 160-200g were used in this study to evaluate the effectiveness of consumption of mixed diet of garlic, garden egg and groundnut on the cytoarchitecture of the spleen. The animals were divided into five groups labelled 1, 2, 3, 4 and 5. Group 1 served as the non-anaemic control and was fed with normal rat chow. Groups 2, 3, 4 and 5 the experimental, were induced with anaemia by oral administration of phenylhydrazine (PHZ) given at 50mg/kgBW. Group 2 served as anaemic control, fed with normal rat chow; Group 3 were fed with 20g (75%ww) of garlic, garden egg and groundnut in the ratio of 1:1:1 with normal rat chow; Group 4 fed with 10g of garden egg (50%ww) in the ratio 1:1 with normal rat chow and Group 5 fed with 10g of groundnut (50%ww) in the ratio 1:1 with normal rat chow. Animals were sacrificed at the end of fourteen days of dietary feeding using chloroform inhalation method. The spleen were dissected out and fixed in 10% formal saline. Cytoarchitecture of spleen were observed in groups 1, 3, 4 and 5 rats to be normal. Sections from group 2 anaemic control rats, showed distortion of splenic white pulp with degenerated splenic nodules and diffused red pulp. Thus, the results from this study showed that the mixed diet of garlic, garden egg and groundnut have a protective effect on the cytoarchitecture of the spleen of induced anaemic wistar rats.

Keywords: anaemia, garlic, garden egg, groundnut, phenylhydrazine, diet, spleen

1. Introduction

Worldwide, varieties of plants are consumed both for dietary and therapeutic purposes. Of such plants commonly consumed especially in Nigeria include garlic (Allium sativum), garden egg (Solanum melongena) and groundnut (Arachis hypogaeae). A broad range of therapeutic responses to garlic have been reported, including decreases in blood pressure, blood lipid and glucose concentrations, and the risk of atherosclerosis as well as antimicrobial, anticancer and hepatoprotective effects [1-3]. Garden egg has been shown to be beneficial to diabetic patients, used as a remedy for liver complaints [4], beneficial to patients suffering from glaucoma and convergence insufficiency [5] and diseases associated with hyperlipidemia such as arteriosclerosis. Garden egg also produces antipyretic (dose-dependent) and analgesic effect and reduces blood level of total and LDL cholesterol [6]. Groundnut commonly referred to peanuts is a widely consumed legume. Several studies have demonstrated its health benefits including cardio-protective benefits [7-8], reduced risk of stroke [9], anticancer [10-11], and reduced risks of Alzheimer and weight gain [12-14].

The spleen is comprised of two histologically and functionally distinct organs; one is a phagocytic organ, the red pulp, and the other is an immune organ, the white pulp [15]. Considering its central role in the sequestration and destruction of drug-damaged erythrocytes, the spleen is expected to be affected in response to hemolysis. Phenylhydrazine and its hydrochloride derivatives have been extensively used experimentally to study oxidative haemolysis. Previously, these compounds were used for the treatment of Polycythemia [16]. It has been documented that a healthy diet may improve or maintain optimal health [17]. Thus, this study was carried out to investigate the possible protective effect of consumption of mixed diet of garlic, garden egg and groundnut on the histology of the spleen of induced anaemic wistar rats.

2. Materials and Methods

2.1 Breeding of animals

Twenty five adult Wistar rats of both sexes weighing between 160-200g were used. They were obtained from the animal house of Department of Physiology, University of Calabar and kept in the animal house of the Department of Human Anatomy for a period of two weeks under standard conditions of temperature 27°C - 30°C, photo period of 12-hour natural light cycle and 12-hour dark to acclimatize. They were fed with pelleted chick mash manufactured by Agro Feed Mill Nigeria Ltd and drinking water given ad libitum. After the acclimatization period, they were randomly divided into five groups of five rats each; two controls and three experimental groups.

2.2 Preparation of the diet

Garlic, garden egg and groundnut were bought from Watt Market in Calabar, Cross River State, Nigeria and were identified by the botanist in the botanical garden of the University of Calabar. The plants were washed with water to remove impurities and samples certified as spoiled or attacked by infections were removed. Garlic was defoliated then minced while the garden egg was chopped. The garlic, garden egg and groundnuts were dried in carbolite moisture extraction drying oven (Grant Instruments, Cambridge England) at 50°C. The groundnut was dried for an hour while the garden egg was dried for three hours. The now dried samples were blended into coarse powdered form and kept in glass containers with plastic cover to keep them airtight.
2.3 Induction of anaemia

Anaemia was induced by oral administration of phenylhydrazine (PHZ) given at 50mg/kgBW for the first two days and then at an interval of three days as maintenance dose. Anaemia was confirmed by test of haemoglobin (Hb) level using haemoglobemeter (Hemocue Hb 201+, Ängelholm, Sweden) using blood samples collected by nipping of rat’s tail. Phenylhydrazine is a known haemolysing drug [19].

2.4 Experimental protocol

The rats were divided into five groups of five rats each and placed on a two week feeding regimen as follows:

- **Group 1** - Negative control, non-anaemic and fed with normal rat chow;
- **Group 2** - Positive control, anaemic rats and fed with normal rat chow;
- **Group 3** – Anaemic rats, fed with 20g (75%ww) of garlic, garden egg and groundnut in the ratio of 1:1:1 with rat chow;
- **Group 4** – Anaemic rats, fed with 10g of garden egg (50%ww) in the ratio 1:1 with rat chow
- **Group 5** – Anaemic rats, fed with 10g of groundnut (50%ww) in the ratio 1:1 with rat chow.

2.5 Termination of the experiment

The rats were sacrificed at the end of fourteen days of dietary feeding using chloroform inhalation method. The spleen were dissected out and fixed in 10% formal saline for 48 hours, processed and sections stained using Hematoxylin and Eosin staining method.

3. Results

Splenic tissue obtained from animals in normal control group shows normal histology of the spleen. Splenic white pulp show well defined splenic nodules. The red pulp was also prominent. Sections from rats in anaemic control group shows splenic white pulp with degenerated splenic nodules and diffused red pulp. Test Groups 3, 4 and 5 showed normal cyto architecture of the spleen as seen in the normal control group.

4. Discussion

Considering its central role in the sequestration and destruction of drug-damaged erythrocytes, the spleen is expected to be affected in response to haemolysis [18]. Phenylhydrazine is a known haemolysing drug [19].
histological features of the spleen administered with phenylhydrazine alone (positive control) showed distorted white pulp and red pulp. Altered splenic cytoarchitecture after administration of phenylhydrazine was also observed in studies carried out by [20] and [21].

Experimental animal studies have demonstrated that the splenic arterial system is necessary for optimal control of infection [22], thus splenic filtering function is important in maintaining normal body morphology and functioning. In this study, it was observed that consumption of combined diet of garlic, garden egg and groundnut, diet of garden egg or groundnut could restore back or preserved splenic cytoarchitecture. This could be attributed to the antioxidant properties present in garlic, garden egg and groundnut. Research evidences points to the fact that antioxidants such as polyphenols, flavonoids, DADs and vitamins A, C and E have the capacity to perfectly regulate the production of reactive oxygen species and foods of high antioxidant activity have been encouraged for consumption.

5. Conclusion

Based on the current research it be said that phenylhydrazine induces splenic cytoarchitectural distortion which was reversible after consumption of garlic, garden egg and groundnut. This further supports the nutritional and therapeutic health benefits of usage of these plants.

References


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