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308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

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The Combined Effects of Excessive Consumption of Ginger, Clove, Red Pepper and Black Pepper on the Histology of the Liver

A.O. Nwaopara[1], M.A.C. Odike[2], U. Inegbenebor[3] and M.I. Adoye[3]
[1]Departments of Anatomy, [2]Departments of Pathology, [3]Departments of Physiology,
Ambrose Alli University, Ekpoma, Edo State, Nigeria

Abstract: Yaji, otherwise 'suya sauce', used in serving the meat delicacy called 'Suya', is a complex mixture of spices and additives whose active ingredients on individual basis, are known to have side effects if consumed in excess. The growing concern is that the excessive consumption of Yaji signifies an excessive consumption of a combination of these constituents amongst which are ginger, cloves, red pepper and black pepper; which are mixed without a standardized format. This study was therefore designed to correlate the individual with the combined effects of the excessive consumption of these spices on the histology of the liver of adult rabbits. Involved in this study were 12 rabbits that were divided into six groups of two (2) each (A, B, C, D, E and F). Those in groups B, C, D, E and F, constituted the test groups whereas group A served as the control. For 21 days, test group B were fed with a combination of Ginger (3g), Clove (3g), red Pepper (3g) and Black Pepper (3g) per day while test groups C, D, E and F were fed with ginger (3g), Clove (3g), Red pepper (3g) and Black Pepper (3g) per day respectively. The histological observations show that the excessive consumption of these spices can cause necrosis of liver hepatocytes and therefore acute hepatitis.

Key words: Yaji, spices, liver, hepatocytes, necrosis

Introduction

For decades, it has been known that insufficient nutrients to maintain healthy bodily functions is associated with malnutrition, which may result from faulty nutrition, poor diet, or excessive consumption of particular foods (Bender, 1975).

Some diseases and ailments have been associated with faulty nutrition like cardiovascular diseases (JAMA, 1984; 1997; Hunninghake *et al*., 1994), atherosclerotic vascular diseases (Graham *et al*., 1997), obesity (Krauss *et al*., 1996) and cancer (Hunninghake *et al*., 1994).

Indeed, international bodies like the WHO and UNICEF, supports that every public policy decisions on nutrition in health and other sectors require knowledge of the extent to which people consume sufficient food of adequate quality (Mason, 1984).

In Nigeria however, there is the growing concern about the excessive consumption of a meat sauce called 'Yaji' which is used to serve the meat delicacy called 'Suya'. Yaji is a complex mixture of spices and additives; its constituents are ginger, cloves, red pepper, black pepper, salt, maggi cubes and groundnut powder; and their active ingredients on individual basis, are known to be harmful if consumed in excess (Nwaopara *et al*., 2004).

Of interest in this study, are the four spicy constituents of yaji, that is, ginger, clove, red pepper and black pepper as the excessive consumption of Yaji signifies an excessive consumption of a combination of these spices. The active principle in ginger is gingerol (Witchtl, 2004); in cloves are eugenol, which has made it the subject of numerous health study (Krishnaswamy and Raghuramulu, 1998), beta-caryophyllene used as an anesthetic (Ghelardini *et al*., 2001) and a variety of flavonoids that includes kaempferol and rhamnetin (Friedman *et al*., 2002; Krishnaswamy and Raghuramulu, 1998); in red pepper are capsaicin (Collier *et al*., 1965), carotenoids; e.g. capsanthin, capsorubin, carotene (Govindarjan, 1968; Saber, 1982) and steroidal saponins known as capsicidins found in the seed and root (Saber, 1982); and in black pepper are piperine, essential oils like terpenes (pinene, sabinene, limonene, caryophillene and linalool) that contributes to its aroma (McGee, 2004) and alkaloids that includes the pungent tasting chavicine and piperidine (Bentley and Henry, 1880).

Considering the active ingredients of these spices, this study is therefore designed to correlate the individual, with the combined effects of the excessive consumption of ginger, cloves, red pepper and black pepper, on the histology of the liver in adult rabbits.

Materials and Methods

Experimental animals: Twelve (12) adult rabbits bought from the animal house of the College of Medicine, Ambrose Alli University, Ekpoma, Edo, Nigeria and moved to the experimental laboratory of Anthonio Research Center, Ekpoma, Edo, Nigeria where used for this study after being were allowed to acclimatize for 3

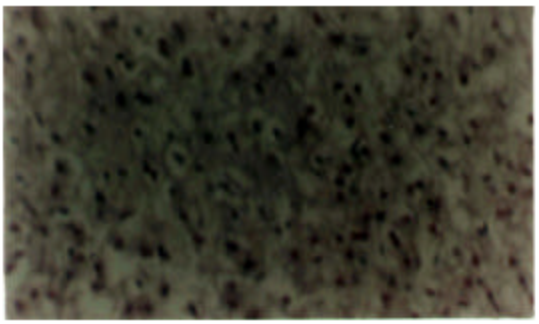

Plate B (Liver)×160: *Presence of some lymphoid follicular aggregation in portal tracts, severe and diffuse ballooning degeneration with moderate patchy necrosis of hepatocytes

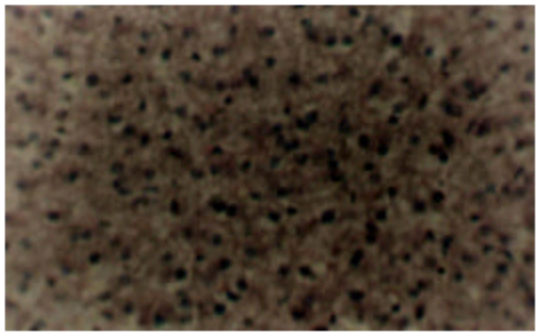

Plate C (Liver)×160: *Mild-moderate ballooning degeneration with moderate patchy necrosis

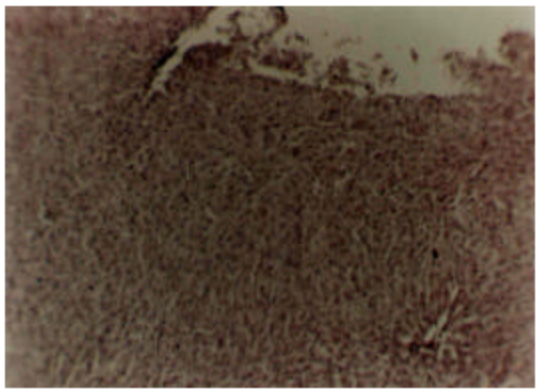

Plate D (Liver)×40: *Essentially normal pictures

weeks. Feed was from Bendel Feeds and Flour Mills (BFFM), Ewu, Edo, Nigeria with a daily supplementation of lemon grass procured from the immediate environment. Water was given ad libitum. The experimental animals were divided into six groups of two (2) rabbits each (A-F). Those in groups B, C, D, E and F, constituted the test groups whereas group A served as the control.

The spices: For this experiment, the spices ginger, clove, red pepper and black pepper were used. They were procured from Aduwawa Market Benin City, Edo Nigeria where the local meat sauce-Yaji-containing these spices and other ingredients are produced. A hand-grinding machine was used to grind them into powdered form and then measured as appropriate.

Experimental procedure: The rabbits were weighed just before the administration of the spices and just before they were sacrificed. The administration of the spices was performed via mixing with feed as follows:

(i) Group A (Control) received only normal feed with lemon grass supplementation daily for 21 days.
(ii) Group B received a mixture 3g of Clove, 3g of Ginger, 3g of Red pepper and 3g of Black pepper in feed with lemon grass supplementation daily for 21 days.
(iii) Group C received a mixture 3g of Clove in feed with lemon grass supplementation daily for 21 days.
(iv) Group D received a mixture 3g of Ginger, in feed with lemon grass supplementation daily for 21 days.
(v) Group E received a mixture 3g of Red pepper in feed with lemon grass supplementation daily for 21 days.
(vi) Group F received a mixture 3g of Black pepper in feed with lemon grass supplementation daily for 21 days.

At the end of the 21st day, the animals were sacrificed and the organ-liver-was obtained and immediately fixed in formaldehyde solution.

Tissue processing: Tissue sections of the organs were produced via normal histo-chemical methods of fixation, dehydration, impregnation, embedding, sectioning and staining (with haematoxylin and eosin).

Results

Weight gain was observed in groups A (control), C (ginger), D (clove) and E (red pepper) while there was weight loss in group B. The weight for the animals in group F (black pepper) remained the same.
The histological changes of the liver as observed under the microscope for test groups (B, C, E, D and F) and represented by micrographs labelled Plates B-F, is given below as follows:

Plate B (Liver×160): Presence of some lymphoid follicular aggregation in portal tracts, severe and diffuse ballooning degeneration with moderate patchy necrosis of hepatocytes.

Plate C: (Liver×160): Mild-moderate ballooning degeneration with moderate patchy necrosis.

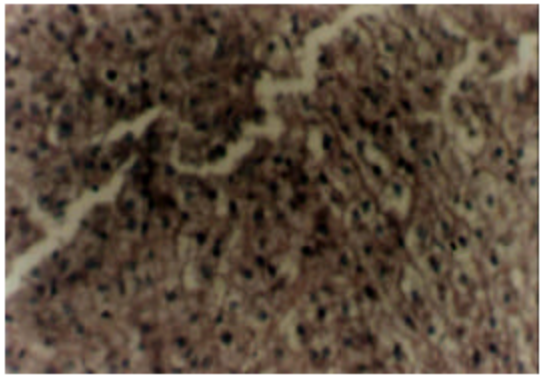

Plate E (Liver)×160: Mild ballooning degeneration of hepatocytes

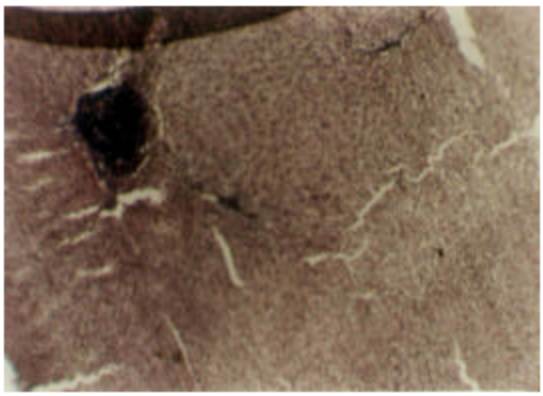

Plate F (Liver)×40: Moderate cloudy degeneration with mild-moderate patchy necrosis of hepatocytes

Plate D (Liver×40): Essentially normal pictures.

Plate E (Liver×160): Mild ballooning degeneration of hepatocytes.

Plate F (Liver×40): Moderate cloudy degeneration with mild-moderate patchy necrosis of hepatocytes.
The Main injuries observed were in the liver of group B, C and F where acute hepatitis were recorded.

Discussion

From the result of this study, the excessive consumption of ginger, red pepper and black pepper, induced patchy necrosis of liver hepatocytes (Plates C, E and F); an indication that they were also responsible for the changes observed in group B (Plate B) fed with a combination of all the spices as clove had no effect on the liver hepatocytes (plate D). Although, obviously different in duration, this is in line with the findings by Velisek *et al.* (2005) that "no histological changes were demonstrated in tissues like liver and spleen following 24 hours administration of 30mg 1^{-1} dose of clove oil."
The presence of some lymphoid follicular aggregation in portal tracts, ballooning degeneration of hepatocytes and patchy necrosis of hepatocytes as induced by the spices and as seen in plate B, C, E and F are symptoms of acute hepatitis (Kumar *et al.*, 2004).
The broad groups of drugs and other substances that are capable of inducing such a liver damage includes: ethanol, steroids, psychotropic agents, analgesic, anti-inflammatory agents, anti-convulsants, anti metabolites and immunosuppressive drugs, antibiotics, anesthetic agents, drugs used in the treatment of diabetes mellitus, endocrine disorders and cardiovascular disorders, industrial agents and toxins (Giarelli *et al.*, 1987).
Incidentally, the spices under study have been found to have steroidal contents as found in red pepper and black pepper (Saber, 1982); analgesic properties as found in ginger (Metz and Cupp, 2000), clove (Ghelardini *et al.*, 2001) and red pepper (Coleridge *et al.*, 1977); as anti-inflammatory agent as found in clove (Krishnaswamy and Raghuramulu,1998; Fortin, 1996); as an antibiotic as found in red pepper (Saber, 1982); with antitumorigenic effects as found in ginger (McCann, 2003); with hypoglycaemic effect as found in ginger (Mascolo *et al.*, 1989); in the treatment of cardiovascular disorders as in the case of ginger used to improve blood circulation (Chevalier, 2000; Ody, 2000) while its roots, when used in large doses, have positive inotropic effects on the cardiovascular system (Skidmore-Roth, 2003); for prevention of toxicity from environmental pollutants like carbon tetrachloride, digestive tracts cancer and joint inflammation as in the case of eugenol of cloves (Ensminger and Esminger, 1986; Krishnaswamy and Raghuramulu, 1998).
These scientific evidences show that the spices under study possesses some chemical and pharmacological properties similar to the classes of drugs that are capable of inducing liver damage and thus, explains their capability to effect the histological changes observed. Therefore, based on the findings of this study, the excessive consumption of ginger, red pepper and black pepper, most especially in their combined state in Yaji (suya sauce), is capable of inducing liver damage and so should be avoided.

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