Effect of Chronic Consumption of Nutmeg on the Stomach of Adult Wistar Rats

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Received: April 26, 2010 Revised: May 31, 2010 Accepted: July 22, 2010

Nutmeg is commonly used as a spice in various dishes; it is a component of teas and soft drinks, and can also be mixed in milk and alcohol. In this study, we investigated the effect of chronic consumption of nutmeg on the stomach of adult Wistar rats. Rats of both sexes (n=24), with an average weight of 200g, were randomly assigned into two treatment groups (A and B, n=8 for each group) and one control group (C, n=8). The rats in the treatment groups received 1 g of nutmeg in group A and 2 g of nutmeg in group B. The nutmeg was thoroughly mixed with feed and given daily for 32 days. Group C received an equal amount of feed daily without nutmeg for 32 days. The rats had free access to water. On day 33 of the experiment, the rats were sacrificed by cervical dislocation. The stomachs were carefully dissected out and immediately fixed in 10% formal saline for histological study. Hematoxylin and eosin staining showed that rats in groups A and B showed varying degrees of distortion in the epithelial cells of the stomach. Obvious signs of proliferation, hyperplasia, and atrophic changes in the treated stomach sections were more marked in group B than in the other groups. These findings indicate that nutmeg may have some deleterious effects on the microanatomy of the stomach of adult Wistar rats.

Key Words: histology; nutmeg; stomach; Wistar rats

Introduction

The nutmeg plant, Myristica fragrans Houtt, is a member of the small primitive family called Myristicaceae, taxonomically placed between Annonaceae and Lauraceae.1 Myristicaceae is considered a member of Magnoliales or its taxonomical equivalents.2,3 Nutmeg has been known for its psychoactive properties of producing anxiety/fear and hallucinations from as early as the 16th century.4-6 Nutmeg is widely accepted as a flavoring agent, and is used in higher doses for its aphrodisiac and psychoactive properties, as has been demonstrated in rodents.7,8 Nutmeg and its oleoresin are used in the preparation of meat products, soaps, sauces, baked foods, confectioneries, puddings, meat and vegetable seasonings, milk dishes and punches. Powdered nutmeg is rarely administered alone, but instead is an aromatic adjunct in numerous medicines. Medicinally, nutmeg is known for its stimulative and carminative properties.9,10 Nutmeg can act as an abortifacient. Although this use has been largely discounted, it remains a persistent cause of nutmeg intoxication in women.11

The stomach is the most dilated portion of the gastrointestinal tract, located in the epigastrium and the left hypochondrium regions of the abdomen.
It is lined by simple columnar epithelial cells and degrades and digests food materials. The stomach also helps to prevent gastric ulcerations due to the presence of numerous mucous secreting glands.

Nutmeg acts on the central nervous system, and thus it is important to determine its effect on the stomach because the amount used by food vendors in Nigeria varies greatly. The adverse cytotoxic and apoptotic effects of myristicin may be due to a direct effect of nutmeg on the stomach. The purpose of this study was to investigate the effect of chronic consumption of nutmeg on the stomach of adult Wistar rats using histological techniques.

Materials and Methods

Animals

Twenty-four adult Wistar rats of both sexes with an average weight of 200 g were randomly assigned into three groups: A, B and C (n=8 in each group). Groups A and B were treatment groups while group C acted as the control. The rats were obtained and maintained in the Animal Holding of the Department of Anatomy, School of Basic Medical Sciences, University of Benin, Edo State, Nigeria. The animals were fed with grower’s mash obtained from Edo Feeds and Flour Mill Limited (Ewu, Edo State, Nigeria) and given free access to water. The nutmeg seeds were obtained from Oba Market, Benin City, Edo State. They were dried and ground into powder at the Department of Pharmacognosy, Faculty of Pharmacy, University of Benin, Benin City.

Nutmeg administration

Rats in group A were administered 1 g of nutmeg daily while those in group B received 2 g daily. The nutmeg was thoroughly mixed with the grower’s mash and given daily for 32 days. Group C received an equal amount of feed without nutmeg for 32 days. The rats were sacrificed by cervical dislocation on day 33 of the experiment and their abdomens were quickly opened to expose the abdominal viscera. The stomachs were dissected out and their corpus parts were fixed in 10% formal saline for routine histological techniques. The reagents and chemicals used in this experiment were obtained from May & Baker Laboratory Chemicals Ltd. (Dagenham, England).

Histological study

The tissues were dehydrated in an ascending grade of alcohol (ethanol), cleared in xylene, and embedded in paraffin wax. Serial sections of 7 μm thick were obtained using a rotatory microtome. The deparaffused sections were stained routinely with hematoxylin and eosin (H&E). Photomicrographs of the desired results were obtained using a research photographic microscope (CHC-212-W; Olympus Optical Co. Ltd., Tokyo, Japan).

Results

The results obtained in our study were limited to general histological features using H&E staining. The corpus part of the stomach of the control animals showed normal histological features consisting of mucosa lined with simple columnar epithelial cells, lamina propria, some highly packed glandular secretory cells, and the muscularis mucosa of the stomach (Figures 1A and 2A).

Sections of the stomach treated with nutmeg revealed variable degrees of distortion in the epithelial cells. There was considerable proliferation, hyperplasia, and atrophic changes in the stomach from the treated groups, particularly in group B (Figures 1B, 1C, 2B and 2C).

Discussion

The results of H&E staining demonstrated various degrees of changes in the epithelial cells of the stomach after treatment with nutmeg. Stomach sections from the group given the highest dose of nutmeg (group B) had obvious proliferation, hyperplasia, and atrophic changes (Figures 1B, 1C, 2B and 2C).

The cellular hyperplasia observed in this study may have been the result of nutmeg-induced cellular proliferation. We found that the high dose and prolonged intake of nutmeg led to changes seen in the glandular epithelium of the treated stomachs. The mechanism by which nutmeg induces cellular degeneration requires elucidation. We also observed degenerative and atrophic changes in the treated stomachs. Degenerative changes have been reported to result in cell death, which is of two types, namely apoptotic and necrotic cell death. These two types differ both morphologically and biochemically. Pathological or accidental cell death is regarded as necrotic and can result from extrinsic insults to the cell such as osmotic, thermal, toxic and traumatic effects. In our study, nutmeg could have been toxic to the cells of the stomach. The process of cellular necrosis involves disruption and distortion of the membrane’s structural and functional integrity, which were observed in our study.

In cellular necrosis, the rate of progression depends on the severity of the environmental insults. The greater the severity of insult is, the more rapid the progression of neuronal injury.

This principle
Figure 1  (A) Section of the stomach of control group rat [hematoxylin and eosin (H&E) 100×]. (B) Section of the stomach of rat treated with 1 g of nutmeg (H&E, 100×). (C) Section of the stomach of rat treated with 2 g of nutmeg (H&E, 100×).

Figure 2  (A) Section of the stomach of control group rat [hematoxylin and eosin (H&E) 100×]. (B) Section of the stomach of rat treated with 1 g of nutmeg. The arrow shows signs of proliferation and hyperplasia (H&E, 400×). (C) Section of the stomach of rat treated with 2 g of nutmeg. The arrow shows signs of atrophic changes (H&E, 400×).
holds true for toxicological insults to the brain and other organs.\textsuperscript{18} Our results showed that a high dose and prolonged intake of nutmeg resulted in increased toxic effects on the stomach. Our findings are consistent with a study by Eweka et al\textsuperscript{19} who reported that monosodium glutamate used as a food additive causes cellular hypertrophy, vacuolations, and distortions in the epithelium of the stomach.

In 2007, Kendabie and Adjene\textsuperscript{20} reported that red pepper administration to adult Wistar rats results in cellular hypertrophy blood vessel congestion, degenerative changes, and disruption and distortion of the cytoarchitecture of the stomach. Our own results are consistent with those of Kendabie and Adjene.\textsuperscript{20} The current results suggest that a high dose and prolonged administration of nutmeg resulted in hyperplasia and atrophic changes in the glandular epithelial cells of the stomach. The actual mechanism by which nutmeg induced cellular hyperplasia and atrophic changes observed in this study needs further investigation.

The varying degree of distortion in the lining and glandular epithelial cells of the stomach observed in our study may be a sign of ulcerative changes that could result from a high dose and long term consumption of nutmeg in the wall of the stomach. There were also obvious signs of proliferation, hyperplasia and atrophic changes in treated sections of the stomach with the high dose of nutmeg. These are medical signs associated with neoplastic changes. Therefore, it is possible that a high dose and chronic consumption of nutmeg may result in ulcerative and neoplastic changes in the stomach.

Conclusion

In conclusion, this study revealed that a high dose and chronic administration of nutmeg to adult Wistar rats caused varying degrees of distortion in the lining and glandular epithelial cells of the stomach. Consistent with neoplastic changes, proliferation, hyperplasia and atrophic changes were also observed in the stomach with a high dose of nutmeg.

Therefore, it is likely that function of the stomach may be adversely affected by high dose nutmeg. Thus we recommend that further studies be carried out to corroborate these findings.

References