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Stomach Histopathologic and Ulcerogenic Potentials of Tea Beverage

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ABSTRACT
Sixty four (64) albino rats were studied for possible histopathologic and ulcerogenic potentials of Lipton tea for the period of twenty eight days (28). The ulceration of the lumen of the stomach counted as ulcer points increased considerably within the 28 days duration, particularly 7-21 days.
There were marked histologic changes as evidenced in the degeneration of gastric glands and cells due to loss of mucus such which were not found in the controls. Also the gastric pits were grossly dilated in 75% of the animals fed with Lipton tea while 15% had mild or no dilations of the gastric pits. Some of the dilated pits were filled with mucus absent in controls without Lipton tea.
The oxyntic or parietal cells showed pale cytoplasm in contrast to eosinophilic staining affinity in controls. Particularly prominent was the decreases in the number of parietal cells, however such cells still maintained normal large rounded morphology with round nuclei having nucleoli as in controls.
Few mucus cells were observed in the clustered of mucus gland or mucuous neck cells as against many of such cells in controls. However the morphology and basal location of the cells nuclei and basophilic staining affinity were as in controls.
It is concluded that Lipton tea has the tendency of inducing gastric ulcer, achlorhydria and pernicious anaemia.
Keywords: Lipton tea, Gastric, histopathology, ulcerogenic potentials,

Introduction

The stomach is a muscular sac structurally shaped as J. Its position is varied with height, it is vertical in tall people and horizontal in those who are short. There are four regions in the stomach; the cardia which is the orifice of the eosaphagus, the fundus which is dome shaped and the body both which are responsible for food storage due to their arrangement and contractions, Saladin, 2004, Oyebola, 2002. There is the antrum which forms the caudal region of the stomach. It is through the antral contraction that the chyme is thoroughly mixed, the contraction is also responsible for gastric emptying, Guyton and Hall 2006. The pylorus region of the stomach function in regulating the amount of entering the duodenum such that food entering is orderly. The motor function is controlled by the enteric nervous system via the parasympathetic and sympathetic nerves impacted by the myenteric and submucosal plexuses. The enteric system also control the secretory functions initiated by the presence of food, smell or sight which mainly involve the motility and the inducement of the peristalsis wave heightened particularly at the spike potentials. The secretory function is also related to the release of gastrin from the antrum and the initiation of contraction and the subsequent secretion via – binding of this hormone to the receptors on the parietal cells in the gastric glands particularly in the release of Hcl. The major metabolism in the stomach is that of protein with the actions of Hcl on pepsinogen and that of pepsin on the protein for amino acid formation. Part of the fat metabolism also occur in the stomach by the action of lingual lipase, but the stomach inhibits the activity of alpha-amylase or starch metabolism through Hcl inactivation properties, Oyebola 2002. The mucus from the mucus gland, pepsinogen from chief cells, enzymes and acid presence in the stomach apart from aiding in digestion also protect the stomach based on the concentration released at each stimulation particularly the Hcl release which at higher concentration would injure the stomach leading to ulceration; gastric ulcer. Such could also result from high concentration of bile from the duodenum due to increase presence of fat and stimulation by cholecystokinin (CCK). Other injuries to the stomach could be due to gastritis caused by bacterial infection, toxins, chemicals, intubations during gastric aspiration in peptic ulcer patients, during operation as in gastrectomy. Drugs such as aspirin and ibuprofen could also caused injury to the stomach (Aguwa 2002). The food that is eaten could also injure the stomach particularly those with high acidic contents. Certain chemicals in food could also damage the stomach and it is this area that the study was initiated. Some herb form part of the food eaten and also as drugs and of interest is the Lipton tea the most globally consumed tea beverage founded by sir Thomas Lipton in 1850 as he was bent to make this beverage available to all which was exclusively for the rich. Tea is mostly consumed as break fast either with

milk, sugar, bread, biscuit etc or without. A cup of tea is said to contain 10-50mg of caffeine associated with wakefulness or alert energy, gastric secretion, Peter, et al, 2001. Apart from caffeine, there is tannin, catchins, flavonoid, antioxidant in tea associated with body protection eg. against cancer etc and enhancement of metabolism Hitrata, 2004, Huxley, 2003. There is no proper documentation of the actual effects of Lipton tea as regards the direct effect(s) on the stomach. It was therefore necessary to study the likely ulcerogenic and histopathologic potentials of this beverage in view of the increase prevalence of peptic ulcer which some causes are still ideopathetic medically. The study is to advice on the gastroenterologic health implication of daily intake of tea.

Materials and Methods

A total of sixty four (64) albino male and female rats weighting averagely between 90g – 150g were used for the study. The animals were maintained in a well ventilated animals house, university of Jos. The animals were allotted randomly into four groups with eight (8) animals in each group including control. The groupings corresponded with the daily weekly feeding of Lipton tea and observation days, 7, 14, 21, 28. This model was arrived at based on the questionnaire given to members of the public with greater number indicating the consumption of Lipton tea daily for a month. But the tea feeding was done on weekly basis to observe the, weekly effects for 28days and not for 30days for 7 days intervals, pattern model. The WHO 1982 model of parasite clearance and antimalarials efficacy was also adopted in this method but in this case for the observation of the weekly effects of Lipton tea and not malaria parasites and antimalarials. Also follow up in therapy regimen are often done for patients including peptic ulcer patients weekly or on monthly basis and such also form part of the logistics for the study.

Dosage of Lipton tea: A sachet of Lipton tea was arrived at as the dosage based on information of such daily intake per cup of tea which measures between 100-250ml from the questionnaires to members of the public.

Preparation of Lipton tea: A sachet of Lipton tea weighing 2.03g was dissolved in 100ml of hot water per cup of tea and brewed ie kept in the hot water for 5 mins for tea contents to be obtained. The final weight of the tea per volume was obtained by weighing the dried shaft of tea leaves and subtracted such from the sachet weight of Lipton tea.

Administration of Lipton tea: After brewing for 5 mins it was left for 10-20 mins for heat reduction i.e. cold and was administered per weight of animal based on the average weight of man, 70 mg mg/kg which translates into 0.03ml averagely as the dosage per the weight of the animal and caffeine concentration. Variations were obtained as the weight of the animal increase. The tea was then administered orally using 10ml canula by-passing, the esophagus and delivered into the stomach, Bertram 2004 and Robert et al, 1979. The feeding was done daily for 7 days, 14, 21 and 28 days.

Gross Study: The weekly gross and histopathologic changes were observed for 28days in the stomach of all the animals. The ulcerations were noted.

Gross ulcer counts: This was done according to the methods of Barry et al 1988 and weekly for 28 days. The score guides follow 5 -0 pattern which 5 indicates multiple ulcers along the entire length of the gastric fold 4, which is lesions approximately 80% of the fold same with 3, 2, ulcers spots. 1 means 1 ulcers spot while 0 has no ulcer spot.

Histology (Stomach Processing and Preparation)

The methods of Druby and Wallington 1967 were used for the histologic assessment of the stomach. The stomach were isolated and fixed in 10% formalin for further processing. They are were cleared from fixative (formalin) by dissolving in grades of ascending alcohol; 50%, 70%, 95% and 100% for two hours. Clearing of the alcohol was done by fixing the stomach in pure xylene to make the organ transparent. The cleared stomach were further impregnated in molten paraffin wax and maintained at the temperature between 54^0C – 60^0C to avoid burning of the tissue in the oven. The impregnation enhanced the removal of the paraffin wax. The stomach were further embedded in fresh molten paraffin wax and allowed to solidify to obtain a solid block containing mould with some molten paraffin wax. The paraffin blocks from the mould were trimmed with bench knife to remove excess paraffin wax. The trimmed wax with stomach were mounted on a wooden block by slightly melting it with a hot spatula and labeled. The blocks were later fixed in a microtome and trimmed to expose the tissues in the stomach. The block of tissue were then cut in their sections of 3 cm in thickness and spread on slide with the aid of paraffin ribbons. The best sections were floated on a glass side smeared with Mayer's glycerol albumin which help to adhere the sections of the cut organ on the slides. The slides were then firmly placed in a wooden tray in an inclined position and dried at 60^0C for 24hrs in incubator for the purpose of dewaxing and sectioning.

The slides were washed under running tap water for 10mins and stained with haematoxylin stain for 15 mins; an agitated in 10% acidic alcohol for 1 mins. for proper differentiation of the section after excess haematoxylin was

removed by washing with water for 2 mins. The slides were counter stained with eosin for 5 mins and rinsed with water for 1 min. The slides were then transferred into graded alcohol 95% ethanol once for 2 min, 100% ethanol twice for 5 mins. The slides were again rendered transparent by fixing it in xylene to rid of alcohol for 2 mins. The slides were blotted with filter paper and covered with cover slip using DPX mounting and left to dry and viewed under the light microscope at 40 and 160 magnification for any microanatomica changes in comparison with control.
Photomicrographs were taken for clarity

Results

The results showed average increase in the ulceration as the feeding of Lipton tea increases by day, though some animals did not show significant increase in the ulceration for the 28 days.
The sections showed mainly rounded oxyntic cells with prominent oval to round nucleoli plate I, this observation was same with control without Lipton tea. However, the cytoplasm was paler in stomach cell of rats with Lipton tea whereas those of control were eosinophilic and the number of oxyntic cells were fewer in the rats with Lipton tea than control. The mucosa of the stomach of normal rats showed prominent gastric glands containing mixed population of cells including mucus secreting cells. The peptic or chief cells clustered at the base of the gland and displayed condensed basally located nuclei with basophilic granular cytoplasm, these features were not observed in the normal rats. Also localized degeneration of the gastric glands and cells were observed in animals fed with Lipton tea due to loss of mucus, whereas such were not found in the normal rats. The gastric pits of the animals fed with Lipton tea were grossly dilated as against controls, plate II. The parietal cells were distributed along the length of the glands mainly at the intermediate region with cells having centrally located nucleus in normal rats, whereas in rats fed with Lipton tea a few parietal cells were found along the length of the glands.

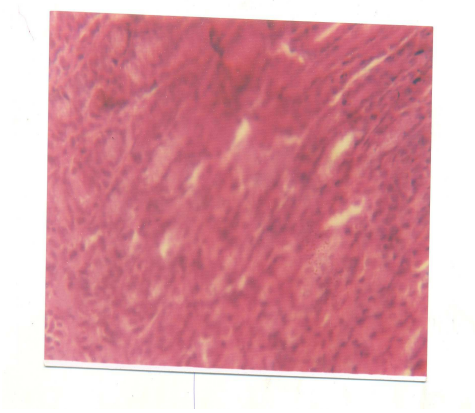

Plate 1: Stomach with lipton Tea x 40.jpg

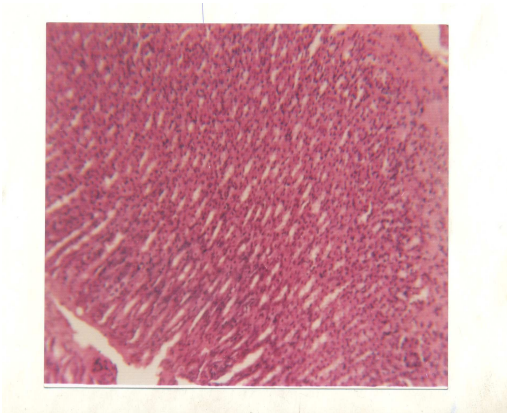

Plate 2: Stomach with lipton tea x 160.jpg

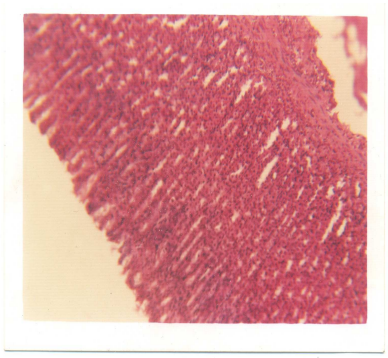

Plate 3: Stomach without lipton tea x 160.jpg

Discussion

The study has shown marked increase in the ulceration of the gross stomach specimen on the weekly basis for 28 days though not all the animals had weekly increase ulceration but greater percentage had ulceration. The implications are that drinking Lipton tea weekly could induce ulceration of the gastrointestinal system of human though, the gastric stomach was the focus in this present study. It also implies that harmful effects exist in consuming Lipton tea daily. The harmful effects may be associated with the presence of caffeine in tea which a cup of tea of 100 – 250ml of water contains 10-50mg caffeine. Caffeine is a stimulant, it has been showed to be associated with wakefulness, vigor, energy, Peter et al 2001. Tea has been found to be a potent stimulant of gastric acid, the acid secretion which is mainly the hydrochloric acid, causes the ulceration of the stomach lumen, Oyebola 2002, Guyton and Hall 2006 i.e when secreted in excess, though gastric acid is essential in the metabolism of protein by its action on pepsinogen in pepsin. However, increase in gastric Hcl concentration may not necessarily leads to stomach ulcer. But Hcl also maintains optimum enzymatic activity in the gastrointestinal system. The acid may be the reason for the ulceration of the stomach of the animals in our study. The lumen of a few animals had haemorhage indicating high traumatic impact of the tea which also showed that perhaps the haemostatic integrity had been severed especially the clotting pathways and the platelet status.

However, such bleeding may have been resulted from increase ulceration areas in the mucosa and stretching with contractions. The histology of the cells of the stomach has shown derangement; the cytoplasm of the gastric cells mainly the parietal cells were paler in morphologic appearance as against the normal eosinophilic staining affinity. Changes in the affinity of the cytoplasm also indicates the structural abnormality of the stomach in Lipton tea drinking. The reduction in the number of parietal cells in Lipton tea drinking implies achlorhydria which means reduction in gastric secretion which would affect protein digestion, and such will affect growth. Also the parietal cells secret intrinsic factor which is a biological carrier for vitamin B. Vitamin B deficiency through absence of intrinsic factor would lead to pernicious anaemia. The gross and histologic evidences have added diagnostic and prognostic approaches and model, in gastric ulcer. Mainly, two significant physiologic abnormalities have been established; the histologic derangement and the ulcerogenic potentials of Lipton tea. However, Lipton tea has also been associated with certain physiologic benefits; high performance, loss of weight for beauty due to the presence of catchins, Davies et al 2003, Maron et al 2005, Dullo 1999, body protection, as anti-allergic, anti-inflammatory and anti-bactericidal; Alex 1999, Mabe, 1999, Yang, 1998, Toyoda, 1997 and Nakayama 1990. The flavonoid antioxidants is found to be associated with the reduction of the risk of heart disease via the reduction of cholesterol level, prevention against cancer and neurodegenerative disease; Hirata, 2004, Huxley, 2003. But tea has also been found to affect the absorption of protein and fats and vitamin B which may be associated with the effects on the gastric glands and the parietal cells as related with the synthesis of intrinsic factor. Others are neural tube defects in babies, reduction of estrogen, fluorosis due to presence of fluoride in tea, with decoloration of teeth and decay, kidney stones due to presence of oxalic acid, increase heart rate, and blood pressure due to caffeine in tea.

Many of the side effects of tea drinking seem to be individualistic as also observed in the study, while some rats had ulceration, some did not. However, there is need to consume Lipton tea with moderation to avoid incurring likely gastric ulcer, achlorhydria and pernicious anaemia alongside other listed negative effects of tea drinking. This paper does not discourage the drinking of Lipton tea but the adoption of caution in its consumption.

REFERENCES

Aguwa C. N. (2002) In amazing drug called aspirin and its therapeutic uses. 1st edition.

Davies MJ et al. Black tea Consumption reduces total and LDL cholesterol in mildly hyper-cholesterolaemic adults. J. Nutr. 2003, 133; 3298S-3302S.

Druby, R. A. B. & Wallington (1967). In Histological Technique 4th edition, Oxford University Press New York.

Dulloo, AG, Duret C, Rohrer D, Girardier L, Mensi N, Fathi M, Chantre P, Vandermander J. "Efficacy of a green tea extract rich catechin polyphenols and caffeine in increasing 24-h energy expenditure and fat oxidation in humans" Am J clin. Nutr 199 Dec, 70 (6): 1040-5.

Guyton, AC., Hall, J. E. (2006): In textbook of Medical Physiology, 11th edition, Elsevier, Saunders, Philadelphia, Pennsylvania, India.

Hirata K et al. Black tea increases coronary flow velocity reserve in healthy male subjects. AM J Cardiol. 2004, 93; 1384 – 1388.

Huxley RR et al. The relationship between dietary flavonol intake and coronary heart disease mortality, a meta-analysis of prospective cohort studies. Eur J. Clin. Nutr 2003; 57, 904 – 8.

Maron DJ et al. cholesterol lowering effect of a theaflavin enriched green tea extract; a randomized controlled trial. Arch intern. Med. 2003; 1448 – 1453.

Mabe, K., Yamada, M., Oguni, I., and Takahashi T. (1999) in vitro and in vivo activities of tea catechines against Helicobacter pylori, Antimicrob. Agents Chemother. 43, 1788 – 1791 (animals).

Nakayama M, Toda M. Okubo S, Shimamaura T, inhibition of influenza virus by tea. Lett. App. Microbial. 1990, 11:38-40.

Oyebola D. O. (2002): In essential physiology. Ibadan Press

Peters U et al. Does tea affect heart cardiovascular disease? A meta analysis, Am J. Clin. Epidemiol, 2001 154; 495 – 503.

Saladin (2004) In anatomy Physiology 3rd edition, New York, San Francisco, London.

Toyoda M, Tanaka K, Hoshino K, Akiyama H, Tanimura A, Saito Y. Profiles of Potentially antiallergic flavonoids in 7 kinds of health tea and green tea infusions. J. Agric. Food chem.. 1997; 45:2561 – 4.

Yang F, de Villers WJ, Mcclain CJ, Varilex GW. Green tea polyphenols block endotoxin – induced tumor necrosis factor – production and lethality in murine model. J. Nutr. 1998; 128:2334 – 40.

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