THE EFFECTS OF *CAPSICUM ANNUUM* AND *CAPSICUM FRUTESCENS*-INDUCED GASTRIC ACID SECRETION IN THE RAT IS BY H_2 RECEPTOR STIMULATION.

[1]SAMBO N., [2]ODEH S. O., [3]IBU J.O. and [1]ONYIKWOLA O.

[1]Department of Human Physiology, College of Medical Sciences, University of Maiduguri, Maiduguri, Nigeria.
[2]Department of Human Physiology, Faculty of Medical Sciences, University of Jos, Jos Nigeria.
[3]Department of Human Physiology, College of Medicine, University of Calabar, Calabar, Nigeria.

Address for Correspondence: Dr. Nuhu Sambo
Department of Human Physiology, College of Medical Sciences,
University of Maiduguri, Maiduguri,
Borno State, Nigeria.
E-mail: nuhusambo@yahoo.com

ABSTRACT;

Background: Peppers, containing *Capsicum annuum* and *Capsicum frutescens* are frequently consumed as spice in food. It is also known that the capsaicin content of peppers is a cause of hyper acidity.

Aims: This study was undertaken to assess the mechanism of action of the extracts of *Capsicum annuum* and *Capsicum frutescens* on gastric acid secretion.

Method: Aqueous extracts of *Capsicum annuum* and *Capsicum frutescens* prepared by simple maceration were administered to urethane anaesthetized rats, and gastric acid secretion assessed using the continuous perfusion method. The effects of ranitidine on *Capsicum annuum* and *Capsicum frutescens*-induced gastric acid secretion in albino rats of both sexes were also investigated.

Results: Aqueous extracts of *Capsicum annuum* or *Capsicum frutescens* induced gastric acid secretion dose-dependently. Maximum acid output induced by either crude extract was significantly ($p 0<0001$) reduced by ranitidine (67.57% and 52.45% respectively).

Conclusion: It is suggested that the effects of *Capsicum annuum* and *Capsicum frutescens* on gastric acid secretion being inhibited by a H_2- antagonist, ranitidine, might in part be due to H_2-receptor stimulation.

Key words: *Capsicum annuum, Capsicum frutescens,* gastric acid, secretion, ranitidine.
Running title: *Capsicum* and gastric acid secretion.

INTRODUCTION:

Peppers (Capsicum spp) are popular and consumed in large quantities in the cuisines of both the developing and developed countries due to thier unique aroma, flavour and pungency[1-4]. The pungency is due to the active principle capsaicin which is excitotoxic (Enyikwola 1994). Acutely, it stimulates, and on the long term, impairs the functions of sensory neurons (Holzer and Pabst, 1999).

Food intake is the major stimulus of gastric acid secretion which is in phases, cephalic and gastric, and regulated by neural, hormonal and paracrine mechanisms. The cephalic phase is augmented predominantly by acetylcholine while histamine is of major importance during the gastric Phase[2,3].

Imbalance between mucosal protective mechanisms and aggressive factors, such as acid, is attributed to the development and/or exacerbation of hyperacidity disorders[3-5] and thus the dictum 'no acid....no ulcer'. This study was designed to assess the mechanism of the effect of pepper

on gastric acid secretion in rats, in addition to earlier works, which established their effects on secretion of gastric- acid.

MATERIALS AND METHODS

Preparation crude extract:

Fresh *Capsicum annuum* and *Capsicum frutescens* were obtained from the Jos Main Market (Jos, Plateau State, Nigeria). They were chopped into pieces and blended in a domestic electric blender separately, and aqueous crude extract of different concentrations in freshly prepared normal (0.9%) saline made in a similar method to that employed by Ibu *et al* (1988).

The extract of each *Capsicum* species was prepared fresh and filtered each time before use.

Animal.

Adult albino rats of both sexes weighing 200-250g were obtained from National Veterinary Research Institute, Vom, Plateau State, Nigeria. All the animals were housed in a cross- ventilated room and fed on a standard mash (Feedex Nig., Kaduna, Nigeria).

Determination of gastric acid secretion:

Two groups of eight rats each were fasted overnight but with liberal access to water. The rats were anaesthetized with 25% (w/v) ethyl carbamate (urethane) 0.6ml per 100g body weight intraperitoneally. Gastric-acid secretion was then determined by the continuous perfusion technique of Ghosh and Schild (1958) as modified by Ibu *et al.* (1988). Ten-minute effluent samples were collected and titrated with 0.1 N NaOH and phenolphthalein end points (pH 7.0). After reaching a steady state secretion, the mean of six basal readings for each rat were recorded as the basal acid output before Capsicum-induced secretion began.

Drugs.

Aqueous crude extracts were given orally (4mg/ml). Ranitidine (Glaxo Welcome) (0.5mg/ml) was given intravenously. Sodium chloride was obtained from May and Baker Laboratory Chemicals Nig. Ltd., and urethane (ethyl carbamate) from BDH Chemicals Ltd., Poole, England as anaesthetic agent.

Data analysis:

Basal acid output was recorded as a mean of six effluent samples obtained from animals by oral administration normal (0.9%) saline. The change in *Capsicum*-induced gastric acid secretion was calculated as a percentage increase above basal acid output and the percentage inhibition as a reduction in maximum acid output induced by *Capsicum* after intravenous administration of ranitidine. The paired t-test was used to compute for test of significance at 95% confidence interval.

RESULTS

The mean basal acid output for the rats was 1.5 ± 0.1 mM/L/hr. On perfusing the stomachs of the rats with either the crude extract of *Capsicum annuum* or *Capsicum frutescens*, the induced maximum acid output was 91.9% above basal acid output for *Capsicum annuum* (Table 1) and 89.5% for *Capsicum frutescens* (Table 2); and both were significantly raised ($p < 0.001$).

Ranitidine (0.5mg/ml) administered intravenously inhibited the maximum acid output by 67.6% for *Capsicum annuum*-induced secretion (Table 1) and by 52.5% for *Capsicum frutescens*-induced secretion (Table 2).

Table 1. The effect of ranitidine on *Capsicum annuum* induced gastric acid secretion in rats.

Basal acid output (mM/hr)	maximum acid output (mM/hr)	effect of ranitidine (mM/hr)	%increase	%inhibition
1.5 ± 0.104	18.5± 0.280	6.0 ±0.151	91.89	67.57

P< 0.001; significance relative to basal level; values ±SEM; n= 8

Table 2. The effect of ranitidine on *Capsicum frutescens* induced gastric acid secretion in rats.

Basal acid output (mM/hr)	maximum acid output (mM/hr)	effect of ranitidine (mM/hr)	%increase	%inhibition
1.5 ± 0.104	14.3± 0.158	6.8 ±0.068	89.51	52.45

P< 0.001; significance relative to basal level; values ±SEM; n= 8

DISCUSSION

Oral administration of the crude extracts of both *Capsicum annuum* and *Capsicum frutescens* significantly ($p < 0.001$) stimulated gastric- acid secretion, thereby corroborating the report of Enyikwola[5-6] that saline extract of guinea pepper stimulated gastric- acid secretion. Stimulation of the parietal cell H_2-receptor causes acid secretion. Ranitidine, an H_2-receptor blocker[2,6], inhibit the *Capsicum*-induced gastric acid secretion.

Thus, the effect of the *Capsicum* extracts could be by direct stimulation of the parietal cell H_2-receptor or indirectly by causing the enterochromaffin-like (ECL) cells to release histamine which is responsible for stimulating the parietal cell H_2-receptors[4,5,9].

Capsicum annuum-induced gastric acid secretion was more than that caused by *Capsicum frutescens*. This could be due to the relative difference in their capsaicin content[10,11]. Capsaicin, the pungent principle is excitotoxic. Acutely, it stimulates the neurons innervating the gut and may cause the release of acetylcholine which is able to release histamine from the ECL cells[13,15]. It was argued that capsaicin itself does not damage the gut mucosa, but on long term, causes the non-function of sensory neurons producing a chemical 'knockout' of neurons that participate in the maintenance of gastric mucosal integrity[15,16]. It was also observed that ablation of the sensory neurons by capsaicin impairs HCO_3 secretory response to acid and results in acid disorders if acid hyper-secretion is present[20]. From this it can therefore, be inferred that pepper is a factor in disturbing the gastro-duodenal protective mechanism by increasing acid secretion and causing the non-function of sensory neurons. Further more, the mechanism of capsaicin - induced gastric-acid secretion follows the pattern of H_2-receptor stimulation. This is evident by the significant level of inhibition exhibited by ranitidine on this plant extracts.

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REFERENCES

1. Berardi, R.R and Dunn-Kucharski, V.A. Peptic ulcer disease: An update. *Am. J. Pharmacol* (1993). 33: 26-34.
2. Britain, R.T, Daly, M.T. Martin, L.E, Stables, R. and Sutherand, M. Animal pharmacology of ranitidine; In. The Clinical Use of Ranitidine. A Glaxo International Symposium, Barbican, London. (1981). Pp32.
3. Dixit C and Dikshit M. A flowcytometric method for evaluation of isolated rat gastric mucosal cells. *J. Pharmacol. Toxicol. Methods.* (2001). 45: 47 53.
4. Enyikwola, O. Effects of Guinea pepper (*Aframomm melegueta*) on gastric acid secretion in albino rats. *Int. J. Pharmacog* (1994). 32: 37-43.
5. Enyikwola, O., Sathiamoorthy, S.S. and Sathiamoorthy, A. Effect of pepper (*Capsicum frutescens*) on gastric mucosal mast cell population and histamine concentration in albino rats. *Discov. Innov* (1990).2: 60 - 62.
6. Fedotin, M.S. *Helicobacter pylori* and peptic ulcer disease. Re-examining the therapeutic approach. *Postgrad. Med.* (1993). 94:38- 40, 43-45.
7. Ghosh, M.N. and Schild, H.O. Continuous recording of gastric acid secretion in the rat. *Brit. J.*

Pharmacol. (1958).13: 54-61.

8. Godvindarajan, V.S. Rajalakshmi, D. and Chand, N. *Capsicum* production, technology, chemistry and quality. Part IV. In: Sensory Analysis and Consumer Acceptance. Central Food Technological Research, CRC. *Crit, Rev. Food Sci. Nutr.* (1987).25: 185-282.
9. Grantz, I.M. Schaeffer, J. DelValle, C. Logsdon, V. Campbell, M.Uhdler, M. and Yamada, T. Molecular cloning of a gene encoding the histamine, H_2-receptor. *Proc. Natl. Acad. Sci. USA* (1991). 488: 429-433.
10. Holzer P. Natural emergency systems in the stomach.*Gastroenterol.* (1998). 114:823-839.
11. Holzer P. and Pabst, M.A. Visceral afferent neurons: Role in gastric mucosal protection. *News Physiol. Sci.* (1999).14: 201-206.
12. Ibu, J.O. Nwokediuko, S.C. and Opara, E. The Effects of selective and non-selective anticholinergic drugs on cola-induced gastric acid secretion. *Nig. J. Physiol. Sci.* (1988). 4: 38-41.
13. Irozuru, M.N. and Ibu J.O. Effect of *Capsicum annuum, Capsicum frutescens* and *Tamarindus indica* (African peppers) on gastric acid secretion. *Proc. West Afr. Soc. Gastroenterol.* (1992).1: 14.
14. Partipilo, M. L. Woster, P.S. The role of *Helicobacter pylori* in peptic ulcer disease. *Pharmacotherapy* (1993).13: 330-339.
15. Prinz, C. Kajimura, M. Scott, D., Mercier, F., Hellander H and Sach, G. Histamine secretion from rat enterochromaffin- like cells. *Gastroenterol.* (1993). 105: 449-461.
16 aji Y, Udoh U S, and Ojo O O. Gastric ulceration activities of Piper guineese extract in rats. *Nig. J. Physiol. Sci.* (2003).18: 27 30.
1. Sachs, G. and Prinz, C. Gastric enterochromaffin-like and the regulation of acid secretion. *News Physiol. Sci.* (1996).11:57-62.
18. Schusdziarra, V. Physiologic regulation of gastric acid Secretion. *Z-Gastroenterol.* (1993). 31: 210-215.
19. Shamburek, R.D. and |Schubert, M.L. Pharmacology of gastric acid inhibition. *Baillieres Clin. Gastroenterol.* (1993).7:23-54.
20. Yusuf S. A, Nok A. J, Ameh D. A, Adelaiye A. B and Mohammed A. Quantitative changes in gastric mucus glycoprotein: effects of vagal nerve stimulation and cholinergic agonist (carbachol) in Rats. Proc. Physiol. Soc. Nig. Conf. In: *Nig. J. Physiol. (2003). 18:94.*