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Short communication

Gastric Acid Secretion and Experimental Ulceration in rats fed Soybean Diet Preparations

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ABSTRACT
Effects of different preparations of Soybean diet on histamine or carbachol-induced acid secretion and indomethacin –induced ulceration were studied in male albino Wister rats. The animals were divided into four dietary groups (groups I, II, III and IV) and fed normal rat diet, 75% soybean diet, 50% soybean diet and 25% soybean diet respectively. Rats in group I served as control. After six weeks of feeding, acid secretion studies using histamine (3mg/Kg) or carbachol (50µg/Kg) and ulcer studies were carried out. While histamine and carbachol produced 400% and 350% increases respectively in acid output in rats fed normal diet, the acid output in soybean diet fed rats were between 210% and 280%. Also, rats fed soybean diets had lower ulcer scores than rats fed normal diet. Indeed, the higher the concentration of soybean in the diet the lesser the ulcer scores. The results therefore seem to suggest that soybean has buffering effect on induced acid secretion and protect the stomach against ulcer formation.

Key words: *Soybean, acid secretion, ulcers, rats*

INTRODUCTION

Soybean (Glycin max L. Merrill) is a food crop found in many parts of the world. It is gradually becoming a common menu on many tables in different parts of Nigeria. It is an economical source of high quality protein (about 40%). Apart from this, it is also rich in highly nutritional edible oil (20%) which contains no cholesterol (IITA, 1990).

Previous studies have shown that high protein diet such as beans, milk and wheat have high buffering capacity on gastric acid (Elegbe and Bamgbose, 1976; Oluwole and Bolarinwa, 1986). Earlier, Kotroba and Code (1969) had also reported that gastric acidity is significantly reduced after ingestion of high protein food. Saint-Hilaire *et al*; (1960) however, reported that the presence of a high protein in a diet stimulates acid secretion. The relationships between dietary consumption and ulcerogenesis have been reported in experimental and clinical studies. Thus, high protein-low carbohydrate diets have been associated with low incidence of gastric and peptic ulcers (Elegbe and Bamgbose, 1976; Oluwole and Bolarinwa, 1986).

In spite of its ubiquitous use as food in various parts of the world, the effect of soybean on acid secretion and other gastro-intestinal activities have been scarcely reported. Apart from McArthur *et al* (1988) who reported that soybean protein meal stimulates less gastric acid than beef meal; there is little or no other information in the published literature on the effect of soybean diet on acid secretion and ulcer formation.

The present study was therefore designed to investigate the effect of different concentrations of soybean diets on gastric acid secretion and ulcer formation.

MATERIALS AND METHODS

The study was carried out on male albino Wistar rats (250-300gm).

Preparation of Soybean Diet: Soybean diet was prepared according to the method described by Bolarinwa and Evbuomwen (1990) to contain 25%, 50% and 75% soybean with the ingredients mixed with water in adequate proportion. The control rats were fed normal mouse cubes prepared by Ladokun Feeds Limited, Nigeria and are composed of protein (21%), fat (3.5%), fiber (6%), calcium (0.8%), and phosphorus (0.8%).

Experimental Procedure: The experiments were carried out on four groups of rats with 8 rats per group. Rats in group I were fed with normal mouse cubes for six weeks and served as the control. Rats in groups II, III and IV were fed on a diet containing 75%, 50% and 25% soybean respectively for six weeks. At the end of six weeks, acid secretion studies were carried out on each rat using the continuous perfusion technique of Ghosh and Schild (1958) using urethane anaesthesia (25% w/v), 0.6mg/100g.b.wt. After basal effluent collection, histamine (1mg/Kg) or carbachol (50µg/Kg) were given i.v, followed by 10min. effluent collection for the next 90min. post-injection. The acidity of each 10min. effluent collected was assayed by titration

Determination of Ulcer Scores: After the gastric acid secretion studies, the animal was administered i.p with indomethacin (Mark, Sharp and Donne, Ltd) (40mg/Kg) and 4h after, the stomach of the animal was open through the lesser curvature and examined macroscopically for the presence of ulceration. The ulcers were scored using the Alphin and Ward (1967) method. The scoring technique used for the induced ulceration was based on the following criteria: Normal stomach- 0; Punctuate hemorrhage or pin-point ulcer - 0.5; Two to more small hemorrhagic ulcers- 1.0 and Ulcers greater than 3mm in diameter - 3.0

Statistical Analysis: The mean ± S.E value of each of the parameters (acidity and ulcer scores) measured in groups II, III, and IV rats were compared with those of group I (control) rats for any significant difference using the Student's t-test for unpaired samples. P values of 0.05 (or less) were taken as statistically significant.

RESULTS AND DISCUSSION

Effects of Soybean Diet Preparations on Acid secretion: The effects of histamine and carbachol on acid secretions in rats that were fed with normal diet and soybean diet are shown in Fig.1 and Fig. 2. Feeding the rats with different concentrations of soybean diet significantly increased the basal acid output. Although, histamine and carbachol also significantly increased acid secretion in both normal diet group and soybean diet groups, the percentage increases in the latter groups were far less than in the former group. While histamine and carbachol produced 400% and 350% increases respectively in acid output in normal fed animals, the increases in acid output in soybean fed rats were between 210% and 280%. In other words, feeding the rats with different concentrations of soybean diet produced lower values for the acid outputs that are produced maximally in response to histamine and carbachol when compared with the control rats.

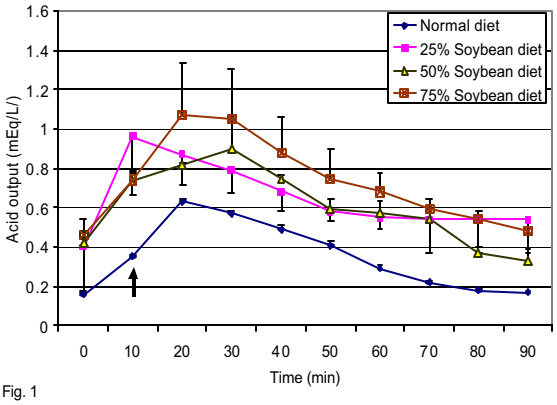


Fig. 1
Effect of Histamine (1mg/kg) on gastric acid secretion in rats fed normal and soybean diets (Heavy arrow indicates poit of administration of drug)

The increase in basal acid output as a result of feeding the rats with soybean diet in this study is similar to the observation of Macarthur et al; (1988). The latter reported that the increase in the basal acid secretion following soybean diet ingestion is due to a slight but significant increase in serum gastrin concentration. Also, The lower values observed for the peak acid output of rats fed soybean diet compared with the control rats and in response to histamine and carbachol in the present study is also consistent with previous reports on acid secretion and ingestion of different amount of proteins. Thus, Saint-Hillarie *et al* (1960) observed that the acidity of gastric content is reduced after ingestion of high protein diet. This observation is supported by Williams et al (1976) who reported that proteins have buffering effect on gastric acidity. Soybean has a very high protein content which may be as high as 42% in some cases (Waldroup *et al*, 1984).

Effects of soybean diet preparation on ulcer formation

The effects of indomethacin on ulcer formation in normal fed rats and soybean fed rats are shown in figure 3. The Figure shows that as the concentrations of soybean increases in the diet, the number of ulcer scores decreases. That is, while the normal fed rats had the highest ulcer score, rats fed 75% soybean diet had the least ulcer score.

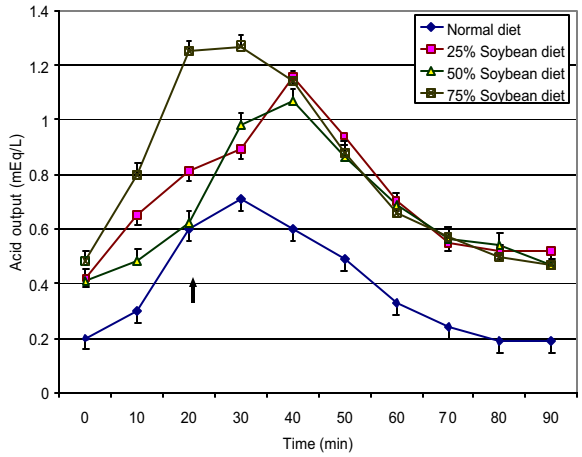


Fig. 2. Effect of Carbachol (50ug/kg) on gastric acid secretion in rats

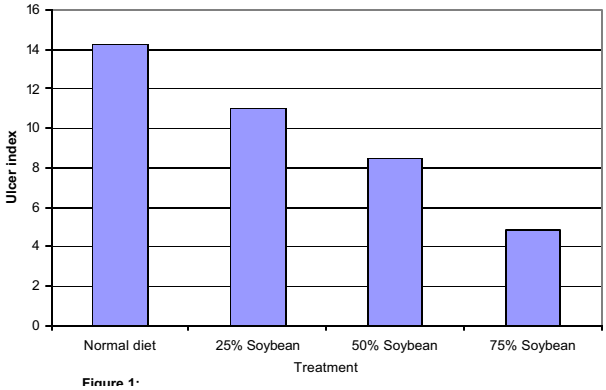


Figure 3
Index of Ulceration (Mean ± SEM) in rats fed normal diet (control) and different concentrations (75%, 50% and 255%) of Soy bean diet preparations

These observations are consistent with the report of Malhotra (1964) that protein has a protective effect on the gastric mucosa. Since soybean is rich in protein, it will therefore not be inconsistent to suggest that the protein in the soybean confers on the gastric mucosa some protective effect. Previous report by Wissmer and Adami (1965) on chicks, guinea pigs and rats; and, using different methods of producing ulcers have also shown that pre-feeding the animals with certain foodstuff such as egg yolk, milk, lettuce and cabbage protect the stomach of the animals against ulceration.

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