ACTA SCIENTIFIC MEDICAL SCIENCES

Volume 3 Issue 4 April 2019

Research Article

Antiulcerogenic and Contractile Motility Potentials of Cabbage (*Brassica Oleracea*) With Metoclopramide

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Received: February 26, 2019

Abstract

Cabbage is highly consumed today mainly in salad meals and without pre knowledge of the medicinal benefits particularly that of the involvement in the gastrointestinal system eg the motility and the related disorders and gastric acid secretion which leads to gastric ulcer at high level. Presently very few antiulcergenic drugs are available and some are not potent. This prompted the comparative study with metoclopramide to assess the likely motor potentials of this plant. Therapeutic efficacy and antiulcerogenic potentials of cabbage (*Brassica oleracea*) were studied in twenty four (24) male and female albino rats on their ileum motility and gastric secretion for the period of 14 days. The basal height of contraction was significantly higher ($p < 0.05$) in *Brassica oleracea* and metoclopramide treated group than the *Brassica oleracea* treated only and metoclopramide group only. There was no significant difference ($p > 0.05$) between the extract of cola nut and control in gastric secretion. But the atropine administration showed decrease in motility (basal height) than the extract significantly ($p < 0.05$). The stimulating effect of cabbage on the motility of ileum indicates its usefulness in gastrointestinal disorders including gastric emptying. The reduction in gastric secretion with this extract shows its antiulcerogenic potentials, which its consumption is encouraged.

Keywords: Cabbage; Metoclopramide; Ileum Motilfity; Acid Secretion

Introduction

Cabbage also known as *Brassica oleracea* is a widely grown vegetable crop. It belongs to the family of Cruciferae. This crop shows variation in size, shape and colour of the leaves but mostly have large green leaves [1]. The basic contents are carbohydrate, protein, vitamin B_5, B_6, Zinc, potassium, phosphorus, magnesium, calcium, folate, dietary fiber [2], sugars and low calorie energy [3]. Cabbage is used as medical remedy due to its antioxidative properties [4,5]. It lowers risk of atheroslerosis and cancer [6]. It has anti-inflammatory and bactericidal properties [7] coupled with its use in pepticulcer and tumour healing and as heart protective therapy [8], htt://www.health.com/cabbage. It is also eaten to reduce weight [7]. It is said to improve the bioavailability of non-heme iron [9]. It reduces risk of cancer due to its glucosinolates content [10]. It is highly consumed worldwide because of it use for the preparation of salad [11]. Historically, the *Brassica oleracea* plant is native to the Mediterranean region of Europe. The people in the Mediterranean began the growing of the first ancient cabbage plant as leafy vegetable. Since then the leaves became the mostly consumed part of this plant, it was then selectively propagated for its large scale production through its seed. By the 5th century BC much preference of this plant was in place called then as kale which botanically is known as *Brassica oleracea* with the variety called acephala which means cabbage of the vegetable garden without a head. Then the cluster of leaves became so large and dominated the whole plant and then the cabbage head [12]. Its morphology is that of a dicotydonous crop that has fibrous and finely branched roots [11]. It is distinguished by a short stem upon which is unfolded [3]. It is about 12-36 inches in width and 12-24 inches in height (Emebu 2011). The plant is widely distributed in Britain, Atlantic coast of Spain, France [13] and in Africa and all over the world [14]. It is grown mostly in the middle belt in Nigeria particularly in Jos due to the cold climatic condition of the area.

The phytochemical constituents of cabbage includes; 4-Me-glucobrassicin, Dithiolthiones, flavonoids, glucoiberin, gluconapin,

glucoraphanin, glutamine, indole-3-carbinol isothiacyanates, oxazolinethione, phenolic compounds, Sinigrin and thiocyanate [15]. Its potentials in reducing the risk of cancer is related to its phytochemical contents of glucosinates. Cabbage eating aids in digestion and its potential in the breakdown of toxins in the liver to detoxifying properties is helpful in the treatment of arthritis [16]. It acts against scurvy with its vitamin C content. The cabbage juice is said to heal ulcers particularly the stomach and intestinal ulcer, the activities of such is due to its content of glutamine and S-methylmethionine [17]. The interest in this study is on the antiulcerogenic potentials of cabbage and its motility properties compared with metoclopramide.

Motility in the gastrointestinal system is the contractile movement that enables a lot of activities in it e.g increase in the process of digestion and absorption and nutrients and expulsion of unwanted materials [18]. The myogenic electrical activity of the smooth muscle provides the basis for such intestinal movement. However, such movements are regulated by neural and hormonal mechanisms [19]. The contractile activity of the smooth muscle is rhythmical and determined by the frequency of the slow waves. Disorders of such motility may occur which may be abnormal intestinal contractions, spasm, constipation, cramps and intestinal paralysis. In such diseases, the gut has lost its ability to coordinate muscular activity, such could lead to intestinal obstruction, bloating, pain, vomiting, nausea which may be due to visceral myopathy [20] or nerve visceral neuro pathy. Metoclopramide is used mainly for the treatment of stomach and esophagus disorders. It helps in gastric emptying particularly in gastroesophageal reflux disease [21] and gastroenteritis. The drug enhances peristaltic contractions of esophagus body, increase the muscle tone of the lower esophageal sphincter and stimulates gastric motor activity [22]. And so it is used in gastric motor failure and reflux esophagitis secondary to lower esophageal sphincter incompetence. In this study, the motility potentials of cabbage is compared with this drug; metoclopramide in the ileum of the rats. The ileum is next to rectum, it is therefore a sensitive part of the small intestine in the functions of absorption and emptying into the colon through ileocaecal valve, (Oyebola 2002). The most frequent motility in the small intestine is segmentation and the higher rates of this segmentation occurs in the duodenum and ileum, hence the relevance of the motility studies in ileum.

Most studies of motility have been done with guinea pigs but our study is encouraging the use of highly available and affordable resources; the rats in our environment to assess comparative research which is quite rewarding.

Materials and Methods

- **Plant Material:** The plant material used for the study was *Brassica oleracea* also known as Cabbage
- **Plant Collection and Extraction:** Fresh Bunches of two (2) cabbages were bought from the market and were identified in the herbarium of the Department of Pharmacognosy, Faculty of Pharmacy, University of Uyo. The balls were cut into pieces and dried at 45^0C in oven to rid of the moisture which was very high at the time of obtaining it as the sun drying would have taken along time. The dried cabbage was then pulverized and weighed, and the weight was 500g. It was macerated and subjected to ethanolic extraction in extraction jar at 50%. It was allowed to stand for 72 hrs and the mixture was stirred every 24hrs and later filtered. The residue was discarded and the filtrate was concentrated to dryness using evaporator and the weight of the concentrate was 91.0g. Methods of Trease and Evans, 1996 was used. The prepared extract was stored in glass bottle in a refrigerator at -4oc for use when needed for the studies.

Acute toxicity test

Fifteen (15) albino mice weighing 18-20g were used. The animals were grouped into 5 with 3 mice in each group. The animals were administered intraperitoneally with the extract at the dosage between 1000-5000g using needle and syringe. The animals were observed for toxicity signs, but none of the animals died, it was 0% mortality. And so there was no LD50 established, indicating that cabbage consumption is very safe.

Animal stock

Twenty four (24) albino wistar rats weighing between 110-200g and fifteen (15) albino mice weighing between 18-20g were used for the studies

Administration of extract into albino rats

A total of 24 male and female rats were used and divided into four groups with 6 rats in each group. Group 1 was administered 1500mg/kg of extract of cabbage. Group 2 was given 0.2mg/kg of metoclopramide. Group 3 was given 1500mg/kg and 0.29mg/kg of metoclopramide. Group 4, was given 10ml of distilled water. The administration was done orally using canula by- passing the esophagus and delivered into the stomach [23]. The effects of the extract and drug were observed for 14 days and were sacrificed for the removal of the stomach and ileum for the gastric secretion and motility studies.

Isolation of the ileum and motility study

The abdomen of the sacrificed rats were shaven along the linea alba to expose the intestine and the ileum was isolated and

cut into 3cm long and placed in a dish of Tyrode solution and was continuously aerated by the use of aerator to keep such alive with oxygen. Thread was attached to both ends of the ileum with a suture needle. It was then mounted in the tissue bath of 50 ml capacity and allowed to equilibrate for 45min. One end of the ileum was tied to the hook of the tissue bath and the other end to the writing lever of kymograph. The kymograph was set to rotate at the revolution of 0.01 rev/second with the administration of atropine of 0.2 mg to ameliorate contractile effect. The height of each contraction was recorded via the kymogaphic tracing. The modified method of Udombon [24] was used.

GASTRIC SECRETION: The method of Silverton and Barker [25] was used. The stomach of the sacrificed rats was isolated and cut opened and the content obtained. It was washed or rinsed with 5ml distilled water and the filtrate obtained. It was titrated against 0.01M of NoaH using 2 drops of phenol indicator and the volume of the acid was recorded based on this calculation.

$$\frac{\text{X. kmmol Noah}}{\text{Y}}$$

Where: X = Final titre

Y = Original volume of content

K = Concentration of the NaoH

Data analysis

The student t test was used for the statistical analysis of the data.

Results

Comparative effects of *Brassica oleracea* and metoclopramide on intestinal motility were as follows; the mean basal height of contraction were 4.9 ± 0.04 7.3 ± 0.07 7.6 ± 0.09 for *brassica oleracea* and metoclopramide respectively and 8.8 ± 0.6 for control. The basal height of contraction was significantly ($p < 0.05$) higher in extract plus metoclopramide compared to the other groups treated with metolopramide only and extract only. The effects of ethanolic extract of *Brassica oleracea* and metoclopramide on gastric secretion were as follows; 1.88 ± 0.06, 1.98 ± 0.17, 1.58 ± 0.07, 1.90 ± 0.04, for extract, metoclopramide, metoclopramide and extract and control respectively. But there was no significant ($P > 0.05$) increase in gastric secretion in all the groups after 14 days of administration.

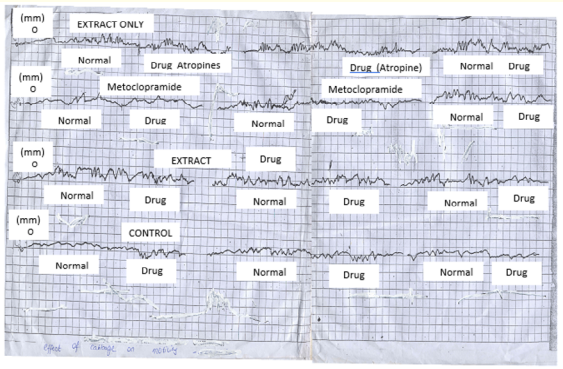

Figure 1: Effect of Cabbage on ileum motility.

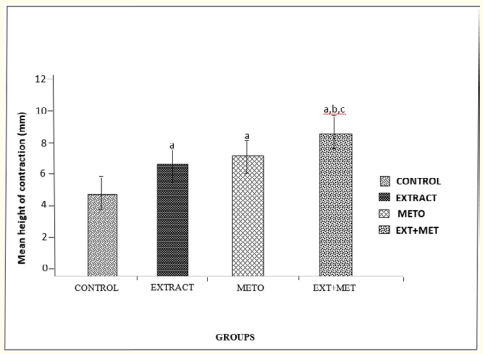

Figure 2: Mean basal height of contraction in different experimental groups.
Values are mean + SEM, n = 6, a = $p<0.05$ vs control;
b = $p<0.05$ vs extract, c = $p<0.05$ vs metoclopramide

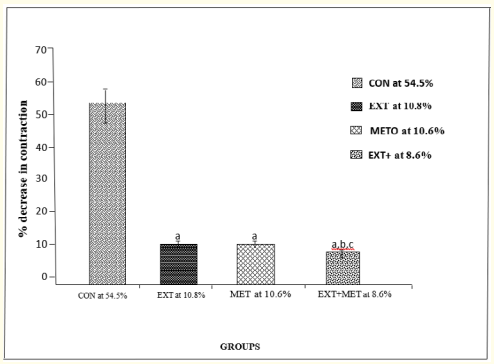

Figure 3: Percentage decrease in contraction of rats ileum in response to Atropine in the different experimental groups.
Values are mean + SEM, n = 6, a = $p<0.05$ vs control;
b = $p<0.05$ vs extract, c = $p<0.05$ vs metoclopramide

Discussion and Conclusion

The study has demonstrated the relevance of *Brassica oleracea* on the intestinal motility as a potent anti-inhibitor as compared with metoclopramide. There is the prevalence of disorders of intestinal motility particularly associated with gastric secretion and this often complicate the pathogenesis of gastrointestinal diseases [26]. Competitiveness observed in the study between *Brassica oleracea* and metoclopramide when administered is shown in the significant increase in the basal height of ileum contraction. And when administered mixed with metoclopramide the contraction was at the highest indicating the enhancing potentials of this herbal plant. *Brassica oleracea* (cabbage) is known to contain sulforaphane, indole-3- carbinol, glucaric acid and other isothiocyanates which are potent stimulators which are likely to be the source of muscle stimulating potentials of this herbal plant apart from it atherosderosis and cancer, reducing effects [27]. The pathways induction motility in *Brassica oleracea* seems to follow that of metoclopramide which involves augmentation of peripheral cholinergic responses and antagonism of daponine receptors in the gut, [28-35]. It could also be by the activation of intramural cholinergic neurons responsible for controlling intestinal motility either by direct stimulation or by removal of inhibiting circuits or pathways [18]. The gastric secretion studies showed no increase in secretion but the secretion decreased at the administration of the cabbage extract and metoclopramide. This means both are antagonists against agent of secretion and could be used as antiulcerogenic therapy particularly the cabbage which is said to heal ulcer. But mostly it is associated with the reduction of pains and symptoms free within a month of the consumption of cooked leaves of cabbage [8]. The antiulcer components of cabbage is said to be glutamine and 5-methyl-methionine. And cabbage is found to improve the functioning of gastrointestinal tract Portincasa 2017.

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Volume 3 Issue 4 April 2019