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TO INVESTIGATE THE EFFECT OF GINGER (*ZINGIBER OFFICINALE ROSCOE*) ON PENDULAR INTESTINE MOTILITY OF RAT

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ABSTRACT: To investigate the effects of ginger-juice (*Zingiber Officinale Roscoe*) on rat's intestinependular motility. **Methods:** Albino rats were sacrificed to isolate intestine. Concentration of ginger is expressed in term of mg/ml of ginger rhizome. It is based on preparation of ginger-juice as detailed in material and methods section. 150 ml of filtrate used in the isolated experiment represented 500 gm of ginger rhizome. The diluted filtrate was used in the "in vitro" experiment. **Result:** G.J.F produced significant pendular motility in isolated rat intestine

INTRODUCTION: A Ginger is one of the most important and oldest spices, consisting of the prepared and sun-dried rhizomes of *Zingiber officinale* (Zingiberaceae). It is cultivated in many tropical countries. It is produced all over India from ancient times. It has a good commercial value and is claimed to have many medicinal uses. Because of differences in cultivation pattern, harvesting technique and climatic conditions its commercial value differs and so also the medicinal actions and uses. It is referred by different names in the languages of different regions and countries. It is widely consumed almost all over the world however in tropical countries or warm regions like Asia, it is more popular ¹.

Because of its typical taste and a pleasant odour it's widely used as flavoring agent in numerous food recipes, beverages, pickles, many popular soft drinks etc ².

From the ancient times it is included in many traditional medicinal systems for treatment of number of diseases. It is widely claimed as a stomachic, aromatic, carminative, aphrodisiacs, diaphoretic, antiemetic, allergic rhinitis and gastric stimulant and for treating migrane headache. It is also used an antispastic against intestinal colic. Ginger oil is used in mouthwashes and liquors ³.

Many varieties of ginger are found such as processed, coated or unscrapped, unbleached (natural) and bleached ginger. There are different types of active principles present in the ginger. Ginger oil is isolated by distillation of dried ginger. Many scientists have investigated the ginger oil and found about 50 constituents, mainly aroma, Starch, Volatile oil, Zingiberene, Gingerol, Oleoresin (Gingerin), Zingiberol, Zingerone, Shagaol etc. The

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acetone extract of ginger contains Zingerberone and ether extract contain Zingerone (Pungent principles).

In view of the available literature, we have tried to screen some actions of ginger-juice; as crude form of ginger. We presume that crude form contains majority of active principles, may be in very low concentrations. Keeping in mind some of its potential therapeutic applications we have carried out animal experiments to investigate the effects of ginger-juice on blood coagulation, gastrointestinal system, central nervous system, antioxidant status and lipid profile.

Antiemetic and Gastric Motility:

Sharma et al., (1998)⁵ have investigated the activity of acetone, 50% ethanolic and aqueous ginger extracts against emesis produced by cisplatin (100% emetic dose i.v) in healthy mongrel dogs. The finding suggests that ginger could be an effective and cheap adjunct to cancer chemotherapy.

Studied¹⁵ that the acetone and 50% ethanolic extracts at the dose of 25, 50, 100 and 200 mg/kg, p.o exhibited significant protection, while the aqueous extract was more ineffective at these doses. The acetone extract was more effective than the ethanolic extract. However, both were less effective when compared with the 5-HT₃ receptors antagonist, granisetron. Ginger extracts were not effective against apomorphine-induced emesis, ruling out mediation at the level of dopaminergic transmission. The finding suggests that ginger could be an effective and cheap anti-emetic adjunct to cancer therapy.

Studied¹³ the activity of dried acetone extract of ginger and its pungent constituent 6-gingerol against vomiting induced by cytotoxic drug in Suncus. The finding suggests that dried acetone extract and 6-gingerol inhibited the vomiting induced by cytotoxic drugs in the experimental animals, Suncus murinus.

Developed⁸ new assay method for screening the anti-emetic properties of compounds from *Zingiber officinale* in young chicks instead of frogs for screening anti-emetic compounds from natural

sources, compared with previous method using leopard and ranid frogs. The advantages of new method included parallel results as well as decreasing standard errors.

Langner et al., (1998)⁹ have investigated the efficacy of rhizomes of *Zingiber officinale* for the prevention of nausea, dizziness and vomiting as symptoms of motion sickness (Kinetosis) as well as for postoperative vomiting and vomiting during pregnancy.

Fudler et al., (1996)¹⁰ have shown that the ginger is safe for use as anti-emetic or anti-nausea remedy in pregnancy provided normal doses are consumed. It is permitted as an over-the-counter (OTC) medication in some countries for specific indications. There are no reports of adverse effects and toxicological evidence in Pharmacological literature.

Iwasaki et al., (1998)¹¹ have investigated effect of Banxia Houpo Tang (BHT) a traditional Chinese medicine on swallowing reflex among the elderly patient with aspiration pneumonia. *Zingiber officinale* is the main component of this preparation. The swallowing reflex was measured by a bolus injection of 1 ml of distilled water into the pharynx through a nasal catheter. The reflex was evaluated by the latency time of response, which was from the injection to the onset of swallowing. They suggested that BHT improves the impaired swallowing reflex and may help to prevent aspiration pneumonia in the elderly.

Sharma et al., (1993)⁴ had studied the "Shalpamyad Churna" an Ayurvedic preparation. Its main component is *Z. officinale*. It was administered in powder form (3 gm 3 times a day for 1 month) to 15 patients. Reduction of irritable bowel syndrome (IBS) symptoms was observed in most cases. Comparison was made with placebo group.

Acetone extract of *Zingiber officinale* enhancing the gastro-intestinal motility. The effects of this extract were similar to or slightly weaker than those of equal doses of domperidone or metoclopramide (Yamahara et al., 1990)¹³.

MATERIAL AND METHODS: A keeping in view the aims and objectives, experiments were planned to study the effects of ginger juice filtrate on rat intestine and peristalsis.

Preparation of ginger-juice:

The commercially available ginger was obtained from the local market. It was confirmed from the botanist that it was *Zingiber officinale*. The rhizome of ginger after cleaning and scrapping the superficial skin was cut into small pieces. With the help of mixer-grinder the pieces were made in to paste. The paste was taken on a white clean cloth and the liquid was squeezed out. The juice so obtained was used in the experiments. The stock of juice was kept in a refrigerator for maximum period of 15 days and the required quantity was used for the experiments after removing particulate matter from it.

500 gm ginger rhizome yielded about 250ml juice. 250 ml juice was filtered which yielded about 120 – 150 ml filtrate.

The liquid portion which was obtained in the course of filtration looked like yellowish hazy opalescent liquid. It was administered orally in acute or chronic experiments. The doses were either 2 ml to 4 ml per rat. This liquid portion was passed through the fine filter paper and golden coloured translucent liquid was obtained. This was used for isolated intestine experiments.

Gastrointestinal activity:

Intestinal motility (*In vitro* study):

Rat intestinal activity was studied in vitro experiments in the term of

A. Pendular motility:

Albino Wistar rats of either sex, weighing 150 to 280 gm, fasted overnight were sacrificed by a sharp blow on the head. The abdominal cavity was quickly opened and intestinal loops of 5-6 cm (jejunum) was taken out caring to avoid damaging the gut muscles and placed in Tyrode solution (composition g/l: Glucose-1gm, NaCl-8 gm, KCl-0.2 gm, CaCl₂-0.2 gm, MgSO₄·7H₂O-0.26gm, Na₂HPO₄-0.05 gm, NaHCO₃-1 gm at 32 degree Celsius and gassed with oxygen. For each piece the mesentery was removed and the tissue was cleaned.

The intestine was washed carefully through the pipette in order to expel the contents.

About 4-5 cm length of intestine was mounted in a 40ml organ bath. The tissue was equilibrated for 30 minutes under resting tension 500 mg. Responses were recorded isometrically with a force displacement transducer of Physiograph which recorded the contraction (pendular movement) of the longitudinal muscles.

After initial stabilization, the responses of various doses of acetylcholine and various doses of fine filtrate of ginger-juice were recorded. Muscarinic blocking action of atropine and ginger-juice with atropine was also studied.

RESULT:

Intestinal motility (*In Vitro* study):

A. Pendular motility:

In experimental set up in our laboratory illustrated graph of Ginger-juice filtrate (G.J.F) in graded doses (2.5 to 160 mg/ml calculated in term of raw ginger) also caused dose related contraction of ileum. Maximal contraction obtained was on 160mg/ml concentration.

Atropine of 1.6 µg/ml blocked the contraction of ileum induced by G.J.F. Contraction produced by smaller doses of G.J.F (2.5 to 20 mg/ml) were completely blocked by atropine at concentration of 1.6 µg/ml. Addition of higher doses of G.J.F (40 and 80 mg/ml) could overcome the blocked produced by atropine.

The experiments conducted were of qualitative type and detailed quantitative study was not undertaken.

Fig. 1 presents an illustration based on findings of one of the three experiments conducted.

Concentration of ginger is expressed in term of mg/ml of ginger rhizome.

It is based on preparation of ginger-juice as detailed in material and methods section. 150 ml of filtrate used in the isolated experiment represented 500 gm of ginger rhizome. The diluted filtrate was used in the experiment.

Fig.1 Graded Doses Response of Ginger Juice Filtrate (G.J.F.)

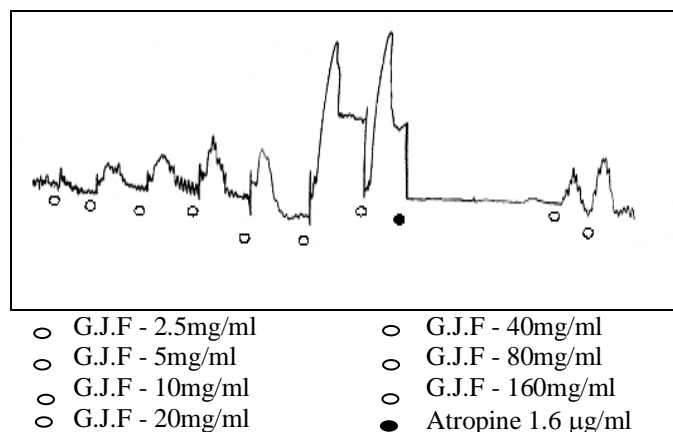


FIG.1: EFFECT OF GRADED DOSES OF GINGER JUICE FILTRATE (G.J.F- 2.5 to 160 mg/ml) IN RAT INTESTINE (*In vitro*) AND RESPONSES ARE BLOCKED BY ATROPINE (1.6 µg/ml) AND OVERCOME BY HIGHER DOSES OF G.J.F (40 AND 80 mg/ml).

DISCUSSION: Our data and that of Goso¹² suggest that ginger does contain certain active principles, which are orally bio-available from crude preparation.

The tonic contractions induced by the ginger-juice filtrate (G.J.F) were inhibited by atropine. This is suggestive of some muscarinic principle. However detailed quantitative study was not under taken. Possibility of involvement of other contractile substances could not be ruled out in the present experimental set up.

Experiments to exhibit peristaltic movement in rat intestine were successfully mounted. Raising intraluminal pressure or addition of acetylcholine or metoclopramide-induced the peristalsis, indicating the validity of the experimental set up. However these experiments exhibited qualitative response, quantitative analysis was difficult to carry out. On these experiments ginger-juice filtrate showed peristalsis, this was inhibited in presence of atropine.

Induction of peristalsis by ginger may be considered as stimulation of Auerbach's plexus. This kind of prokinetic activity was also reported by various authors (Yamahara et al., 1990; Langer et al., 1998; Sharma et al., 1998)^{10, 9, 5}. Both kinds of experiments on rat intestine are supportive to each other, highlighting muscarinic effect of

ginger-juice. Antiemetic use of *Zingiber officinale* as suggested by Akita et al., (1998)⁸ can be supported by above observation.

Yamahara et al., (1990)¹³ have reported that acetone extract of *Z. officinale* enhanced the gastrointestinal motility, similar to or slightly weaker than those of equal doses of domperidone or metoclopramide.

Sharma et al., (1998)⁵ also have reported that acetone and 50% ethanolic extract significantly reversed cisplatin induced delay in gastric emptying. The reversal produced by the acetone extract of *Zingiber officinale* was similar to that caused by the 5-HT₃ receptor antagonist ondansetron. They carried positive impression that ginger-juice produced better reversal than ondansetron.

Langer et al., (1998)⁹ reported usefulness of ginger-juice to prevent the symptoms of motion sickness. Prokinetic effect exhibited in the present study may explain possible effectiveness in motion sickness.

Observations on amphetamine-induced locomotor activity may give some clue about effects of ginger-juice treatment on central dopaminergic action. Amphetamine in the dose (1mg/kg i.p) administered to the rats exhibited enhanced locomotor activity this may be considered by virtue of stimulation of central dopamine receptors (Shigenabu et al., 1994)¹⁴.

This indicates that there is neither prodopaminergic nor antidopaminergic effect on part of ginger. This point is important from the angle that ginger has been shown to have antiemetic effect (Sharma et al., 1996)¹⁵. Many antiemetic compounds produce their antiemetic activity by virtue of central antidopaminergic effect; usually at CTZ (Chemoreceptor trigger zone) of Borison and Wang, (1953)¹⁶. It is clear from the present observations that there appears no contribution of central antidopaminergic mechanism for its reported antiemetic effect. Further, lack of antidopaminergic effect may also possibly rule out the possibility of acute dystonia as is the case with anti-dopaminergic antiemetics.

CONCLUSION: Pendular Intestine stimulant activity was exhibited in isolated rat intestine.

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