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Comparative Effects of the Aqueous Leaf Extract of *Ocimum basilicum* and Loperamide on Intestinal Transit in Rats

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With 2 figures and 17 references

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ABSTRACT

The effect of 10% aqueous leaf extract of *Ocimum basilicum* on intestinal transit in rats was determined and compared with that of loperamide (Imodium®), a known inhibitor of intestinal motility. Three doses of the leaf extract and loperamide were administered orally to the experimental rats, and the animals in the control group received 0.5 ml normal saline. Intestinal transit was measured in all the animals by the charcoal meal test and was expressed as the percentage of the distance traveled relative to the entire length of the intestine from the pyloric junction to the anal orifice. The mean transit point of dye in control rats was 66.68 ± 3.20%. The leaf extract of *O. bacilicum* caused a dose-dependent increase in the transit point. The mean transit points of the dye were 73.32 ± 3.77%, 74.84 ± 3.92% and 78.30 ± 4.30% at 0.5 ml/100 g body weight, 0.75 ml/100 g body weight and 1.0 ml/100 g body weight, respectively. Loperamide on the other hand, caused a dose-dependent decrease in the transit point indicating reduced intestinal motility. For this drug, the mean transit points were 57.68 ± 2.50% at 0.10 mg/100 g body weight, 56.36 ± 4.78% at 0.20 mg/100 g body weight, and 50.95 ± 2.46% at 0.5 mg/100 g body weight. Loperamide and the leaf extract had opposing actions on the intestinal smooth muscle; while loperamide showed a constipating effect, *O. basilicum* aqueous leaf extract enhanced intestinal motility.

Key words: Intestinal transit, loperamide, aqueous leaf extract, *Ocimum basilicum*
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Introduction

The consumption of a variety of local herbs and vegetables by man is believed to alleviate pain, fight disease, as well as contribute significantly to his nutrition and improvement of his health. In terms of prevention, and or cure of disease, plants have long served as useful and rational sources of therapeutic agents [Roberts and Tyler, 1999].

Ocimum basilicum (the common basil), is a member of the Labiatae family. The plant as well as oils from it, have received lots of attention for their potential medicinal properties. Hence, parts of the plant have been used in the treatment of many ailments, including acne, alcoholism, childbirth recovery, cholera, colds, constipation,

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dysentery, convulsion, respiratory problems such as catarrh, sinusitis and cough, and urinary tract infects, e.g., gonorrhea and syphilis [Meyer, 1984; Vogel, 1994; Iwu, 1993; Buchanan, 1995]. The plant has also been used in cosmetics, liquors, medicines, and perfumes. In addition to these medical uses, the plant is commonly used in cooking and flavouring sauces and soups in Nigeria.

Loperamide (Imodium®), is a synthetic opioid which has been shown to produce inhibition of gastrointestinal transit, an action that is blocked by maloxone, an opioid antagonist [Patil and Taher Ali, 1995; Schultz *et al.*, 1999]. Consequently, loperamide is used in the treatment of diarrhoea in both humans and animals [Heel *et al.*, 1978; Romanski and Slawuta, 2004].

Although there are reports of the uses of *O. basilicum* in the treatment of gastrointestinal ailments, reports of its effects on gastrointestinal smooth muscles are scarce. The present study was, therefore, carried out to establish the effects of different doses of the aqueous leaf extract of *Ocimum basilicum* on intestinal transit in rats. The action of was compared to that of loperamide, a known inhibitor of intestinal motility.

Materials and Methods

Animals

Seventy albino rats of both sexes, weighing between 100 - 130 g were used for this study. The animals were randomly selected and kept in 7 groups (I - VII) of 10 rats each. Each group was kept in a separate cage which was cleaned daily, and food and water changed on daily basis throughout the experimental period. All animals were fed with a commonly formulated rat feed.

Preparation of the aqueous extract of Ocimum basilicum

The leaves of *Ocimum basilicum* were collected from a backyard garden at the Institute of Social and Economic Research (NISER), Ibadan, Nigeria, and authenticated at the Department of Botany, University of Ibadan, Ibadan. The leaves were oven-dried at 80°C, pulverized and then sieved. A 25 g weight of the powdered leaf was soaked in distilled water and the mixture made up to 250 ml. The mixture was continuously stirred for 1 h using a magnetic stirrer after which it was filtered and the residue discarded. The resultant extract was stored in capped bottles and kept at −4°C before use. Just before use, the frozen extract was kept for 2 h in a water bath maintained at 27°C.

Preparation of dye

The dye was prepared by dissolving 10 g of activated charcoal in distilled water in a glass beaker. This was made up to 100 ml. Ninety-five milliliters of this 10% aqueous suspension of charcoal was then mixed with 5 ml of Giemsa stain to make a 100 ml dye.

Experimental procedure

Twenty-four hours before the experiments, food was withdrawn from the animals in the group to be used, but water was allowed until the morning of the experiment. The rats in each of the 7 groups were weighed to determine the dose of the extract and loperamide to be administered. To each animal in group 1 (control), 0.5 ml of normal saline was administered orally using an oral cannula. After a period of 30 min., 0.5 ml of the dye was also given orally. Each animal in group II received 0.5 ml/100 g of the leaf extract of *O. basilicum* administered by the same oral route. This was followed 30 min later by similar oral administration of 0.5 ml of the dye. Animals in groups III and IV received 0.75 and 1.00 ml/100 g of the leaf extract respectively, plus 0.5 ml of the dye. Each animal in group V received 0.1 mg/100 g body weight of loperamide while those in groups VI and VII were orally administered with 0.2 and 0.5 mg/100 g body weight of loperamide, respectively. Animals in groups V to VII also received 0.5 ml of the dye 30 min after the administration of loperamide. One hour following administration of the dye, all the animals in each group were sacrificed using chloroform anaesthesia.

For all the groups, the peritoneum of each rat was opened and the whole length of the intestine from the pyloric junction to the anal orifice was stretched out and measured using a piece of cotton thread and a tape rule. The point reached by the dye was also measured from the pyloric junction and recorded for each rat.

Statistical analysis

The distance traversed by the dye from the pyloric junction was calculated as percentages of the entire length of the intestines. This was regarded as the percentage transit of the dye for each dose of the extract or loperamide. The means and standard deviations of the means (SEM) of these percentages were calculated for each group. The levels of significance between the transit points of each dose were determined by Students' *t*-test and a p-value of 0.05 was regarded as significant. Data from the control groups were regarded as zero administration of the extract or loperamide. All data were analyzed using the Microsoft Excel software (Microsoft Corporation, Washington DC, USA) to create graphic representations as shown in Figs. 1 and 2.

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Results

The transit points of the dye in group I (control) rats which received 0.5 ml of normal saline was 66.69 ± 3.20% (Fig. 1). The crude leaf extract of *O. basilicum* caused dose-dependent increases in transit points. This was indicative of accelerated movement of intestinal contents. The mean transit points of the dye were 73.32 ± 3.77%, 74.84 ± 3.92% and 78.30 ± 4.30% for 0.5, 0.75 and 1.00 ml/100 g body weight of the extract, respectively. In relation to the control group, these changes were significant ($p<0.05$).

Loperamide caused a dose-dependent reduction in the transit point (Fig. 2). At 0.1 mg/100 g body weight, there was a significant decrease in the transit point from 66.69 ± 3.20% (control) to 57.68 ± 2.50% ($p<0.05$). At 0.2 mg/100 g body weight, the transit point reached by the dye dropped to 56.30 ± 4.78%. At 0.5 mg/100 g body weight, the transit point dropped significantly to 50.95 ± 2.46% when compared to the control value ($p<0.05$).

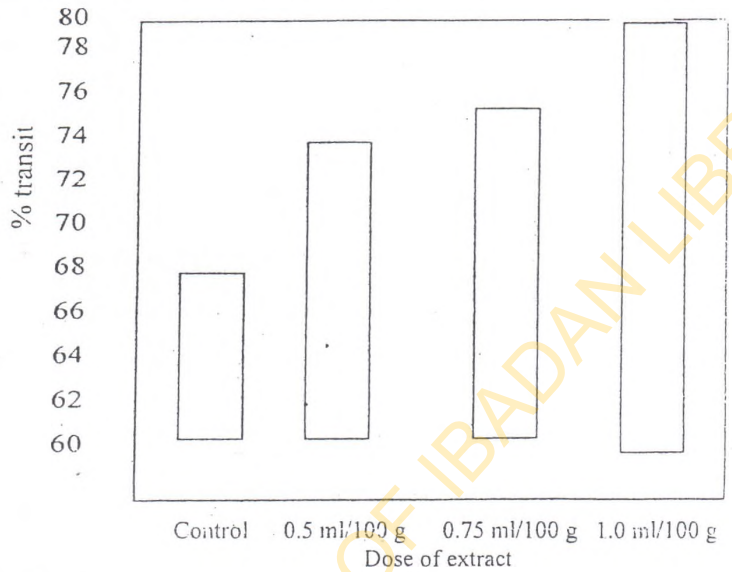

Fig. 1. Effects of varying doses of 10% aqueous leaf extract of *Ocimum basilicum* on intestinal transit in rats (n = 10 for each treatment dose)

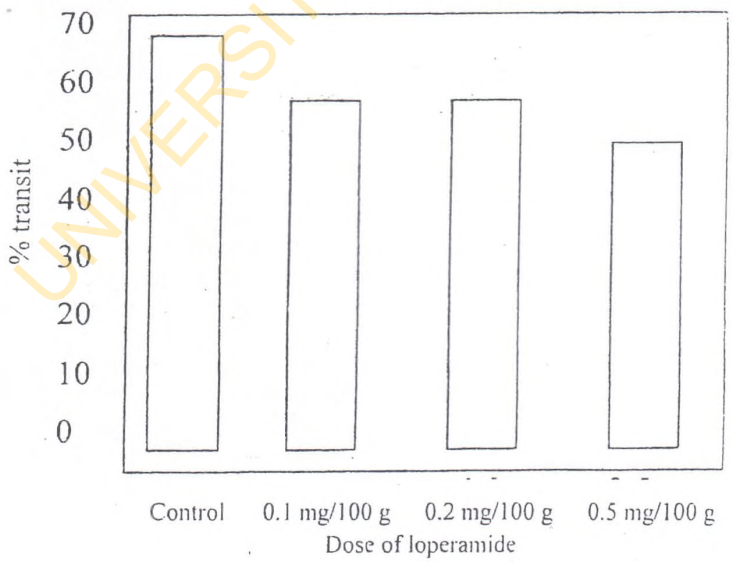

Fig. 2. Effects of varying doses of loperamide on intestinal transit in rats (n = 10 for each treatment dose)

Discussion

Loperamide decreased the percentage transit points of the dye indicating an increased transit time and reduced motility. This results of this study are in agreement with the findings of Patil and Taher Ali [1995] of an inhibition of gastrointestinal transit in normoglycemic rats and the report of Romanski and Slawuta [2004] of inhibition of

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intestinal motility by loperamide. The mechanism by which loperamide causes its action has been fairly understood. Loperamide is a synthetic opioid and acts via μ- and δ-opioid receptors to inhibit gastric and intestinal motility [Romanski and Slawuta, 2004]. Loperamide is also known to inhibit intestinal secretion, and increase water and electrolyte absorption from the gut lumen [Manara and Bianchetti, 1985; Coupar, 1987; Kroma, 1988]. Its action on kappa (K)-opioid receptors results in the inhibition of some inflammatory autacoids and this action attenuates the inflammation and sensation of visceral pain [Romanski and Slawuta, 2004]. Naloxone, an opioid antagonist has been shown to completely block the inhibitory effect of loperamide on intestinal transit [Patil and Taher Ali, 1995]. The action of loperamide on multiple opioid receptors has made it potentially useful in the treatment and prevention of diarrhoea, as well as the treatment and prevention of disorders accompanying enhanced motor activity [Romanski and Slawuta, 2004], and prolonging the availability of drugs in the intestinal lumen.

The aqueous leaf extract of *O. basilicum* caused an increase in the mean transit point indicating increased intestinal motility, and decreased transit time. This result contradicts observations obtained from the leaf extract of *O. gratissimum*, a related plant. *O. gratissimum* has been shown to cause a decrease in percentage transit point indicating a decrease in intestinal motility [Owulade *et al.*, 2004]. A direct action of basil on the gastrointestinal smooth muscle is not known for certain although there are reports that the herb could be used in intestinal dysfunctions as in diarrhoea and constipation [Vogel, 1994; Buchanan, 1995]. The use of the herb in the treatment of constipation is consistent with the results obtained in this study, that is, an increase in intestinal transit point or a decrease in transit time. Its use in the treatment of diarrhoea may not be associated with a direct action on intestinal smooth muscle as in the case of loperamide. The dried leaves of *O. basilicum* contain 0.20% essential oil. The major compounds in the oil are linalool and methylchavicol [Beckstrom-Sternberg *et al.*, 1994]. Some components of the essential oil have been shown to exhibit antimicrobial actions [McCorkie *et al.*, 1996].

Recent concept on intestinal movement suggests that the leaf of *O. basilicum* may be acting either by reducing the general muscle tone of the intestinal smooth muscle or by reducing the persistent contraction of the muscle. Smooth muscle relaxation would be consistent with reduced tone and more rapid rate of movement of intestinal content [Weisbrodt, 1981; Schemann and Ehrlein, 1986].

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