Original Article

Advantage of *Corchorus olitorus* on Intestinal Transit Time over *Manihot esculenta* in Female Wistar Rats

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Abstract

Since fiber is widely known to decrease Intestinal Transit Time (ITT), we sought to understand the relative effect of fiber of *Corchorus olitorus* on ITT over that of *Manihot esculenta* in female wistar rats. 27 animals weighing 100-130g were randomly divided into three groups of 9 rats each. While group 1 was fed grower's mash (GM) (normal feed diet), groups 2 and 3 were fed crude fibers of *Manihot esculenta* (ME) and *Corchorus olitorus* (CO) respectively. Crude fibers were extracted from GM, CO and ME using standard procedures. ITT was determined by measuring the intestinal length covered by the feeds at 90, 120 and 150 minutes postprandial and was expressed in percentage of the total length of the small intestine. When compared with GM fed group, there was an increase in % intestinal length covered in CO and ME fed rats 90 minutes postprandial. At 90 minutes postprandial, there was no significant change in % intestinal length covered in CO fed rats when compared with rats given ME. At 120 minutes postprandial, ME and CO fed rats showed increased % intestinal length covered when compared with GM fed rats. CO fed rats showed a higher % intestinal length covered than ME fed rats. Furthermore, At 150 minutes postprandial, CO and ME fed rats exhibited higher % intestinal length covered than GM fed rats. However, CO consumption resulted in increased % intestinal length covered than ME. Hence, we conclude that ingestion of fibers of CO decreased ITT than that of ME.

Keywords: Crude fibers; *Corchorus olitorus*; *Manihot esculenta*; Postprandial; Intestinal transit time

Introduction

Dietary fiber (DF), one of the components of foods, consists of arabinoxylans, cellulose and plant components such as lignin, inulin, chitins, pectins, beta-glucans, and oligosaccharides. [1] It is present naturally in a variety of foodstuffs including grains and their by-products, oil seeds, fruits and vegetables and supplemented to others. [2]

Although, fibers are resistant to digestion and absorption in the digestive tract in human small intestine, [3] they undergo complete or partial fermentation in the large intestine resulting in decreased low density lipoprotein, low risk of atherosclerosis and reduction in gastrointestinal transit time. [4]

Gastrointestinal transit time is the interval between consumption of food and it's elimination as feces. It is a handy indicator of digestive health, and by extension, overall health status. For example, Simpson and Campbell [5] claimed that some soluble fibers may block intestinal mucosal adherence and translocation of potentially pathogenic bacteria resulting in modulation of intestinal inflammation. Also, a population of women with higher ingestion of fibers had lower interlukin-6 and tissue necrotic factor (TNF-α-R2). [6]

Furthermore, study has revealed that the physical nature and type of foods determine the rate of intestinal digestion, absorption and transit. [4] For instance, foods containing insoluble fibers were shown to demonstrate the tendency to increase bulk, soften stool and shorten transit time through intestinal tract. [4] Bond and Levitt, [7] showed that small bowel transit time of wheat bran was greater than that of lactulose.

Corchorus olitorus (popularly known as Ewedu in Yoruba Language) and *Manihot esculenta* (cassava) are major staple food in developing countries. Works have shown that these plant-borne foods play a beneficial role in gastrointestinal health. [8,9] However, it is unclear whether the crude fiber of *Corchorus olitorus* decreases intestinal transit time than that of *Manihot esculenta*. Therefore; the aim of the study is to investigate the relative effect of crude fiber of *Corchorus olitorus* on intestinal transit time over that of *Manihot esculenta* in female wistar rats.

Materials and Methods

Site of the experiment

This study was conducted in the animal house of the Department of Physiology LAUTECH, Ogbomoso, Nigeria.

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Animal care and management

Twenty seven adult female wistar rats weighing 100-130 g were used for the research work. They were divided into three groups consisting of nine animals each. These rats were kept in three different cages with a wire mesh covering. They were fed pelletized grower's mash ad libitum, provided water through drinking trough and kept under 12 hour light and 12 hour darkness at room temperature.

Ethical certification

The study was conducted in line with the guidelines of United State National Institute of Health (NIH) Guidelines for the use of laboratory rats.

Collection and extraction of fiber materials

The stem of *Corchorus olitorus* and root of *Manihot esculenta* were purchased at a local Market in Ogbomoso, Oyo State, Nigeria.

The *Manihot esculenta* tuber and *Corchorus olitorus* stem were peeled and washed respectively. They were soaked in warm water for five (5) days. On the fifth day, the fiber was removed and air dried for seven (7) days. On the seventh day, the fiber was blended into small particles according to the method of Nwoke et al. [10]

Fiber determination

Fiber determination of the selected fibers was carried out at Animal Production and Health Department, Federeal University of technology Akure (FUTA), Nigeria, using the standard method of AOAC. [11]

Percent Crude fibre (% CF):

$$\%CF = \frac{(W2 - W3) \times 100}{W1}$$

Where,

W1 = Weight of the sample (g),

W2 = Weight of crucible and residue after drying (g), and

W3 = Weight of crucible and residue after incineration (g).

Test meals preparation

10 g of the extracted fiber was mixed with 1gram of eosin dye to form pellets.

Experimental procedure

The experimental animals were weighed and randomly grouped into:

Group 1: Administered normal feed diet (Grower's mash).

Group 2: Administered test meal containing *Manihot esculenta* fiber

Group 3: Administered test meal containing *Corchorus olitorus* fiber.

The animals were fasted for 12 hours before the onset of the experiment after which they were then weighed and fed with the prepared test meal.

After feeding, the animals were returned into their cages and given water ad libitum. Three animals were then sacrificed per each group at 90 minutes, 120 minutes and 150 minutes by cervical dislocation. The animals were immediately dissected, their abdominal cavity was opened and the distance travelled by the test meal in the intestine was measured. [12] The length of the small intestine was measured from the pyloric sphincter to the appendix.

The transit time was then expressed as a percentage of the small intestinal tract travelled. The formula is as follow:

$$\%travelled = \frac{Small\ intestinal\ distance\ \ travelled\ \ by\ \ test\ meal}{Total\ length\ of\ the\ small\ intestine} \times \frac{100}{1}$$

Statistical analysis

Data are analyzed using SPSS using Analysis of Variance (ANOVA). Pairwise comparisons were done using Least Square Difference at P<0.05.

Results

The figure shows that *Corchorus olitorus* fiber is significantly more compared to fiber of Maniot esculenta and the growers mash [Figure 1].

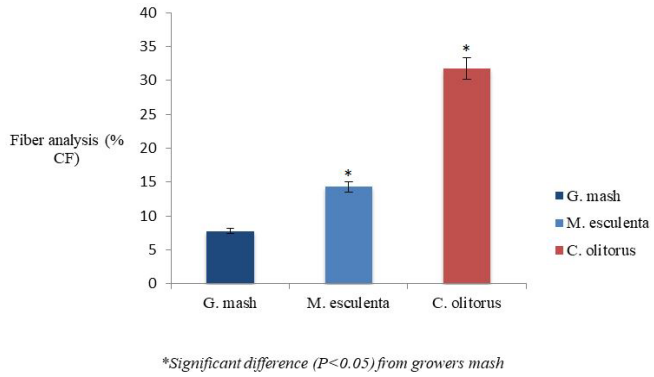

Figure 1: Fiber content of *M. esculenta* and *C. olitorus* compared with the grower's mash fiber.

At 90 minutes, there was a significant increase in the percentage travelled by *Manihot esculenta* and *Corchorus olitorus* compared to grower's mash used in control animals (p<0.05). There was no significant difference in the percentage travelled of *Manihot esculenta* when compared with that of *Corchorus olitorus* in the experimental rats in 90 minutes (p>0.05) [Figure 2].

At 120minutes, there was a significant increase in the percentage travelled of *Manihot esculenta* and *Corchorus olitorus* compared to grower's mash used in control animals (p<0.05). There was also significant increase in the percentage travelled of *Corchorus olitorus* when compared with that of *Manihot esculenta* in the experimental rats in 120 minutes (p<0.05) [Figure 3].

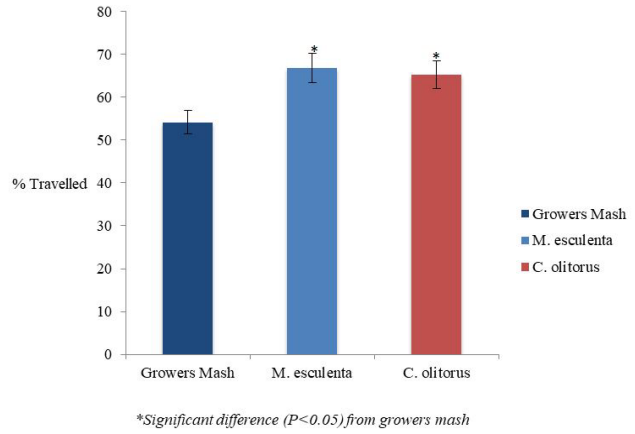

Figure 2: Percentage of fiber travelled in the GIT at 90 minutes.

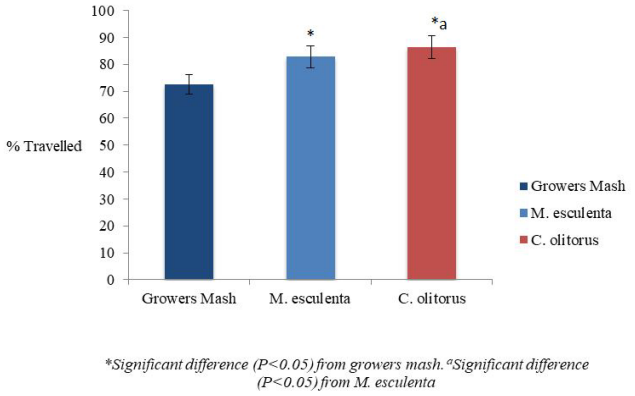

Figure 3: Percentage of fiber travelled in the GIT at 120 minutes.

At 150 minutes, there was a significant increase in the percentage travelled of *Corchorus olitorus* compared to grower's mash used in control animals ($p<0.05$). There was also a significant increase in the percentage travelled of *Manihot esculenta* compared to grower's mash used in control animals ($p>0.05$). When compared with fiber of *Manihot esculenta*, there was a significant increase in the percentage travelled of *Corchorus olitorus* in the experimental rats ($p<0.05$) [Figure 4].

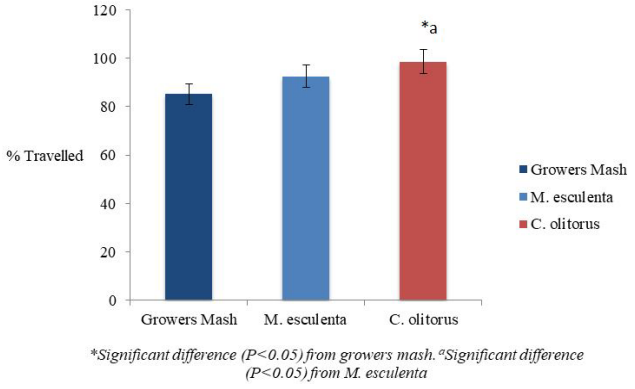

Figure 4: Percentage of fiber travelled in the GIT at 150 minutes.

Discussion

Studies have documented the advantages of consuming dietary fiber. These include production of healthful compounds through fermentation process, increase in bulk, softening of stool and shortening of transit time through the intestinal tract. [4,13,14] This research work investigated the relative effect of crude fiber of *Manihot esculenta* over *Corchorus olitorius* on intestinal transit time using female wistar rats as a model.

Analysis of crude fiber content of *Manihot esculenta* and that of *Corchorus olitorius* (Figure 1) showed that the latter contained more fiber than *Manihot esculenta* and grower mash respectively and that *Manihot esculenta* contained more fiber than grower mash. Therefore, the significant increases in % intestinal length covered in rats that ingested *Manihot esculenta* fibers when compared with those that consumed fiber of grower mash postprandial was due to the high fiber content in *Manihot esculenta*. Apart from the fact that crude fiber (Weende Cellulose) is a part of insoluble fiber, [15] foods containing high insoluble fiber are known to exhibit short intestinal transit time with high fecal volume and suppressed fat absorption. [4,14,16] In this study, we also observed that there was a significant increase in % intestinal length covered in *Manihot esculenta* fed rats when compared with grower mash fed rats 150 minutes postprandial.

Consumption of *Corchorus olitorius* 90, 120 and 150 minutes postprandial increased % intestinal length covered when compared with grower mash fed group. This was also due to the high crude fiber content of *Corchorus olitorius*. The short transit time associated with high fiber containing foods has been linked to low risk of colorectal cancer and diverticulosis, increased growth of colonocytes and protection of gastrointestinal mucosa. [8]

Conclusion

Although, at 90 minutes postprandial, there was no significant change in % intestinal length covered when compared with rats given *Manihot esculenta*, intake of *Corchorus olitorius* caused an increase in % intestinal length covered 120 and 150 minutes postprandial when compared with group fed *Manihot esculenta*. This indicates that crude fiber of *Corchorus olitorus* exhibits a shorter intestinal transit time than that of *Manihot esculenta*. This result suggests that consumption of crude fiber of *Corchorus olitorus* (Ewedu) may improve gastrointestinal health by lowering the risk of constipation and fecal impaction than that of *Manihot esculenta* (Cassava).

In conclusion, the findings of this study show that intake of *Corchorus olitorus* decreased intestinal transit time than *Manihot esculenta*.

Conflict of Interest

All authors disclose that there was no conflict of interest.

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