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THE EFFECT OF DIETARY FIBRE ON TRANSIT TIME IN RATS

[1]Z. M. Ofuya*, [2]A. A. Georgewill and [3]G. O Agu
[1]DEPARTMENT OF HUMAN PHYSIOLOGY
[2]DEPARTMENT OF PHARMACOLOGY
[3]DEPARTMENT OF ANIMAL AND ENIVRONMENTAL BIOLOGY
UNIVERSITY OF PORT HARCOURT, PORT HARCOURT, NIGERIA

ABSTRACT

A study was carried out on the effect of dietary fibre of some high fibre containing Nigerian foods on transit time in rats. Rats were used as human model. Dietary fibre from coconut *(Cocus nucifera)*, Cowpea *(Vigna unguiculata)*, pumpkin leaf *(Telfaria occidentalis)* and 'Afang' *(Gnetum africanus)*, were extracted and fed to albino Wistar strain rats. The result showed pumpkin leaf fibre *(Telfaria occidentalis)* having the greatest transit time of 91 ± 1.4% followed by coconut fibre *(cocus nucifera)* with a transit time of 86 ± 5.6% and cowpea fibre *(Vigna unguiculata)*, 81 ± 3.5%. The transit time of 'Afang'*(Gnetum africanus)* was least (74 ± 5.6%).

Key Words: Dietary fibre, Transit time.

INTRODUCTION

The term dietary fibre was introduced to describe the remnants of plants cell wall materials which are not hydrolyzed by digestive enzymes in man (Trowell, 1974). The description covers a wide variety of plants derived from substances with different chemical composition and different physical properties. As a result of their physical properties, dietary fibre can alter physiological mechanisms and consequently, may be used in the treatment of some clinical conditions.

Dietary fibre is categorized into two types, insoluble dietary fibre and soluble dietary fibre. The insoluble dietary fibre consists of lignin, cellulose and hemicellulose. While the soluble dietary fibre consists of pectin, gum and mucilage. The insoluble dietary fibre has been known to decrease transit time in man and rats (Eastwood *et al* 1992 and Guthrie 1989). This type of fibre is claimed to alleviate conditions such as constipation, diverticular disease and possibly colonic cancer. The soluble dietary fibre has a different physiological function from the insoluble dietary fibre. It is implicated in the delay of gastric empting, lowering of serum cholesterol and in the slowing down of glucose absorption in man (Sam Brook and Rainbird, 1985, Gatenby 1990, Fairchild *et al* 1996, and Giacco *et al* 2002). The ability of dietary fibre to bind cholesterol in the human gut is suspected of being capable of reducing colonic cancer in man (Burkitt and Trowell 1985, Davis and Stewart 1987, Eastwood *et al* 1992, Cummings 1982 and Rosen *et al* 1988).

Some work has been carried out on the effect of fibre from wheat bran and pectin on feacal bulk and transit time in rats (Brown and Greenburgh 1994, Matters and Fortsotagny 1984). Information on the effect of fibres from Nigeria foods on transit time is scanty. This research was carried out in order to find out the effect of fibre from some high fibre Nigerian foods, on transit time in man. Rats were used as human model. It is hoped that such fibres can be extracted and used for the treatment of patients suffering from colonic diseases such as constipation and diverticular disease.

MATERIALS AND METHODS

EXTRACTION OF FIBRE

The fibres from the aforementioned foods were extracted using different methods. The methods are as follows:

COCONUT FIBRE

Coconut *(Cocos nucifera)* was bought from a local market in Port Harcourt and grated finely. The product was then boiled in water for three hours in order to remove as much oil as possible. The residue was afterwards sun dried after which it was boiled in a shaking water bath in 80% alcohol (ethanol) for six hours (1/10 /w/v).

COWPEA FIBRE

Cowpeas *(Vigna unguiculata walp)* was bought from a local market in Port Harcourt and soaked for thirty minutes. The testa was removed and dried. It was afterwards ground to less than 1mm particle size using a moulinex blender.

***Correspondence Author: Z. M. OFUYA**

VEGETABLE FIBRE

Fresh vegetables ('Afang' *(Gnetum africanus)* and Pumpkin leaf *(Telfaria occidentalis)* were brought from a nearby local market and sliced. The sliced 'Afang' *(Gnetum africanus)* was soaked in water for two days, after which it was squashed, washed and sieved leaving the fibre behind. The fibre was then sun dried. Pumpkin leaf (*Telfaria occidentalis*) was similarly treated except for the fact that it was not soaked for two days. The fibre was afterward ground using a laboratory mortar.

PREPARATION OF TEST MEALS

0.5g of extracted fibre and 0.5g of activated charcoal were mixed with 5ml of water.

PROTOCOL

40 male albino Wister strain rats weighing 128-150g were obtained from the University of Port Harcourt animal breeding house. The rats were matched for weight and then grouped into 5 groups. They were housed in a well-ventilated room at 28^{0}C, 12 hours light/dark cycle, where they were kept for three days for adaptation and then fed the normal rat's diet. At the onset of the experiment, the rats were starved for 24 hours after which each rat was weighed and fed the prepared test meal.

After feeding, the animals were returned into their cages and given water *ad labium*. The rats were killed after 1 hour and after two hours. The rats were afterwards dissected. Their abdominal cavities were cut open and the intestine exposed. The total length of the intestine was measured and the distance traveled by the meal. Transit time was expressed as a percentage of the small intestinal tract traveled. The formula is as follows:

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

Table 1

	TRANSIT TIME (%)	
	AFTER I HR	AFTER 2 HRS
Control	50±2.89^a	72±2.8^a
Coconut fibre (*cocus nucifera)*	65.5±10.6^a	86.5±5.6^b
Pumpkin leaf *(Telfaria occidentalis)*	81.5±0.7^b	91±1.4^b
"Afang" fibre (*Gnetum africanus*)	56±1.4^a	74±5.6^a
Cowpea testa (*Vigna unguiculata*)	58±11.3^a	71±3.5^b

Values with common superscripts are not significantly different (PL0.05)

Values are mean ±SD n = 4

Length of the small intestine was measured from pyloric sphincter to the appendix.

RESULTS

After one hour, the transit time of Pumpkin leaf (*Telfaria occidentalis*) was found to be highest (81.5 ± 0.7%). The transit time of the other fibres namely Coconut fibre (*Cocus nucifera*), 'Afang' fibre (*Gnerum africanus*) and Cowpea testa (*Vigna unguiculata*) were not significantly different from those of the Control meal. The difference between the transit time of Pumpkin leaf (*Telfaria occidentalis*) and that of other fibres is significant (PL 0.05).

The result obtained after two hours is slightly different from that obtained after one hour. Pumpkin leaf fibre (*Telfaria occidentalis*) had the highest transit time (91±1.4^b). That of 'Afang' fibre (*Gnetum africanus*) was not significantly different from that of the Control meal, while that of Coconut (*Cocus nucifera*) and cowpea testa (*Vigna unguiculata*) were significantly different (PL 0.05) from that of the Control meal. They both caused an increase in transit time.

DISCUSSION

The result shows that the dietary fibres of Coconut (*Cocus nucifera*), Pumpkin leaf (*Telfaria occidentalis*) and Cowpea testa (*Vigna unguiculata*) are capable of promoting a faster transit time in rats. The ability of dietary fibre to promote a faster transit time in rat is due to its ability to absorb water causing a greater bulk. The bulk would distend the gut wall stimulating peristalsis. Also, the irritation of the gut wall by the dietary fibre would also stimulate peristalsis.

The reason for the inability of 'Afang' fibre (*Gnetum africanus*) to promote a faster transit time in rats is not really known. It could be due to its hard and coarse nature. The exact mechanism by which these fibres operate is also not known.

From the experimental procedure, there is a possibility that dietary fibre from vegetable can be extracted. They can also possibly be caked or pelleted. Such if properly processed, can be fed to patients suffering from colonic diseases, such as, constipation, and diverticular disease.

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