

## Effect of honey consumption on intestinal motility in male albino rats

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**Summary:** This study investigated the effects of honey on intestinal motility and transit using twenty (20) male albino rats of Wistar strain weighing 210-220g. The rats were randomly grouped into control and honey-fed (test) groups of ten (10) rats each. The control group was fed on normal rat chow (Pfizer Company, Nigeria) and water while the test group was fed on rat feed, water and honey (1 ml of honey to every 10 ml initial drinking water daily) for twenty two (22) weeks after which the rats were starved over night before the experiment and sacrificed by stunning. Laparotomy was immediately performed, proximal and distal portions of the intestine identified, cut and put in aerated tyrode solution. Cut sections of the ileum (2-3cm) were mounted on organ bath instrument for motility experiment with varying concentrations of acetylcholine and carbachol. Contractions were recorded as well as the intestinal transit in each group and lengths of intestine with total mean values calculated. Results obtained showed that honey significantly decreased ( $p < 0.01$ ) intestinal transit in the test group ( $21.15 \pm 0.75$ ) compared with the control group ( $35.96 \pm 1.15$ ); decreased intestinal motility in the test group compared with the control and caused significant percentage reduction of intestinal motility with varied concentrations of acetylcholine and carbachol in the test group (Ach- $75.00 \pm 0.75\%$ ; Carbachol- $79.00 \pm 0.28\%$ ) compared with the control group (Ach- $62.00 \pm 0.39\%$ ; Carbachol- $51.00 \pm 0.39\%$ ). In conclusion, unprocessed Nigerian honey decreased intestinal transit, caused intestinal smooth muscle inhibition and motility and reduced sensitivity of gastrointestinal tract to cholinergic agents.

**Keywords:** Honey, Intestinal motility, Intestinal transit, Diarrhoea treatment.

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### INTRODUCTION

Natural honey is elaborated by honey-bees as blossom honey by secreting nectars of flowers, and by honeydew honey (forest honey) by secreting the exudates of plant sucking insects (Ajibola et al, 2007). It is a sweet, flavourful liquid food of high nutritional value (White and Doner, 1980; Bogdanov, 2008), with immense health benefits (Ajibola et al, 2007; Bogdanov, 2008).

The constituents of honey include sugars (sucrose, fructose, glucose, erlose, melezitose), amino acids, proteins, acids, minerals (sodium, calcium, potassium, magnesium, phosphorus, selenium, copper, iron, chromium), vitamins (thiamine, riboflavin, niacin, panthothenic acid, pyridoxine, folic acid, ascorbic acid, phylochinon) (White and Doner, 1980; Bogdanov, 2008), enzymes (invertase, glucose oxidase, amylase, catalase, acid phosphatase) (White, 1975 & 1978). The precise composition of honey may vary according to the plant species on which the

bee forages, but the main constituents are the same in all honeys (Jeffrey and Echazarreta, 1996).

The acceptance and use of honey cuts across all ages and barriers of culture, religion, race and ethnicity. Its many and varied properties include: growth stimulating (Molan, 2001; Ajibola et al, 2007; Chepulis et al, 2008); antioxidant (Frankel et al, 1998; Kreider et al, 2002; Al-Waili, 2003; Schramm et al, 2003; Alvarez-Suarez et al, 2010); prebiotic (Busserolles et al, 2002; Sanz et al, 2005); mild laxative (Ladas et al, 1995; Ladas and Raptis, 1999); promotes oral health and wellness (Molan, 2001; English et al, 2004); haematopoietic (Ajibola et al, 2007; Chepulis et al, 2007); cardio-protective (Gheldof and Engeseth, 2002; Al-Waili, 2004; Earnest et al, 2004; Yaghoobi et al, 2008; ); effective in wound healing and management (Bergman et al, 1983; Efem 1988; Molan, 1996 & 1999); sporting enhancer (Kreider et al, 2002; Earnest et al, 2004); effective in acute and chronic gastric lesions in animals (Mobarok and

Swayeh,2003); antimicrobial activity (Alvarez-Suarez et al, 2010); improves memory and growth in children (Chepulis et al, 2009). Alagwu et al(2011) have also documented its gastroprotective activity.

There is paucity of report on the claims by Folk medicine that honey is effective in the treatment of diarrhea infection. has claimed that honey is used to treat diarrhoea .World Health Organization (WHO , 2005) defined diarrhea as passage of watery or loose stools usually three times in a 24 hour period. This according to World Health Organization is one of the killer diseases in childhood. Diarrheal infection is associated with increased parasympathetic nerve activity, its transmitter being acetylcholine (Schild, 1980). This results in increase peristalsis of gastrointestinal tract, leading to frequent and rapid evacuation of watery stools, loss of water and electrolytes (WHO, 2005).

This study therefore investigated the effects of this widely consumed product on varied concentrations of acetylcholine and carbachol (both being cholinergic agents) on intestinal motility and transit to possibly resolve the claim by Folk on the use of honey to treat diarrhea infection.

**MATERIALS AND METHODS**

Twenty (20) male albino wistar rats (210-220g) were used in the study. They were randomly grouped into control and honey-fed (test) groups of ten rats each. The natural honey used was bought from a seller at Amaba Village in Isiukwuato Local Government Area of Abia State Nigeria. The control group was fed with rat feed (Pfizer Company Nigeria) and water while the test group was fed with rat feed (Pfizer Company, Nigeria), water and natural honey (1ml of honey to 10ml of initial drinking water) daily for twenty two (22) weeks. At the end of the 22 weeks, the rats were starved overnight prior to the experiment and sacrificed by stunning. Laparotomy was quickly performed and the intestine exposed. The proximal and distal ends were identified, cut and placed on aerated tyroid solution. The ileum was cut into sections (2-3cm long) and mounted on an organ bath instrument for motility experiments. The tissue was allowed to equilibrate for ten minutes and bathing solution replaced with freshly prepared one at fifteen minutes intervals to avoid accumulation of metabolites. The tissue was then challenged with graded doses of acetylcholine (Ach) and carbachol

and contractions recorded. Also used was atropine at submaximum doses of acetylcholine and carbachol, responses and percentage reductions were noted Also carried out was intestinal transit using methods of Uwagboe and Orimililewe (1999). In this method, the rats in their different groups studied were deprived of food but water was allowed for 24 hours before the transit experiment. 50g chow (Pfizer Company Nigeria) was ground to powder, sieved and mixed with 200ml of water. The mixture was allowed to stand for 30 minutes after which it settled into three layers-the topmost, middle and bottom layers. The topmost and bottom layers were discarded in preference to the middle layer for its homogeneity. Leishman’s stain charcoal (0.15g) was prepared in 100ml phosphate buffer. 20ml of Leishman-Charchol mixture was then mixed with the middle layer. All the rats were fed orally with 3ml of Leishman’s stain-charcoal food mixture using 8cm long metallic intubing syringe. The experiment was timed for 90 minutes to allow room for the food to move from the small intestine completely. At the end of the 90 minutes, the rats were sacrificed by decapitation and the abdomen cut open immediately. The location of the Leishman’s stained food mixture in the intestine was measured using a meter rule.

The intestinal transit was calculated as:  

$$\frac{\text{Length travelled by the black marker}}{\text{total length of small intestine}} \times \frac{100}{1}$$

**Statistical Analysis**

The results were subjected to statistical analysis using student – t test and P values less than 0.05 were considered significant.

**RESULTS**

Results showed statistically significant decrease responses and percentage responses with carbachol in the test rats compared with control (Table 1). Results also showed statistically significant increase responses and percentage responses with acetylcholine in the test rats compared with control (Table2).

Figure 1 showed decrease response to Ach in the test group compared with the control however, the response increased with carbachol in the test group compared with the control (p<0.01). There are statistically significant reduction in responses to Ach and carbachol in the test groups compared with

Table 1: Effects of varied doses of carbachol on intestinal motility of rats.

S/No	Carbachol	Control		Test	
	Dose(ng)	Response(cm)	%Maximum response	Response(cm)	% Maximum response
1	1.25	2.52±0.08	34.68±0.08	2.92±0.25*	44.77±0.01*
2	2.50	4.62±0.08	63.82±0.08	3.42±0.07*	52.25±0.01*
3	5.00	5.24±0.11	72.28±0.08	3.68±0.08*	55.21±0.01*
4	10.00	6.92±0.08	95.74±0.04	6.52±0.09*	89.54±0.04*
5	20.00	7.18±0.08	99.50±0.04	6.67±0.41*	99.50±0.40

\*Statistically significant decrease (P<0.05).

Table 2: Effects of varied doses of acetylcholine on intestinal motility of rats.

S/No	Acetylcholine	Control		Test	
	Dose(ng)	Response(cm)	% Maximum response	Response(cm)	% Maximum response
1	1.25	1.28±0.09	18.60±0.22	4.04±0.19	58.56±0.01
2	2.50	3.20±0.07	42.60±0.10	4.46±0.08	64.28±0.01
3	5.00	4.20±0.07	60.20±0.29	5.92±0.08	85.70±0.01
4	10.00	6.80±0.12	97.10±0.12	6.48±0.19	92.86±0.01
5	20.00	7.00±0.10	100.00±0.51	7.10±0.10	99.20±0.67

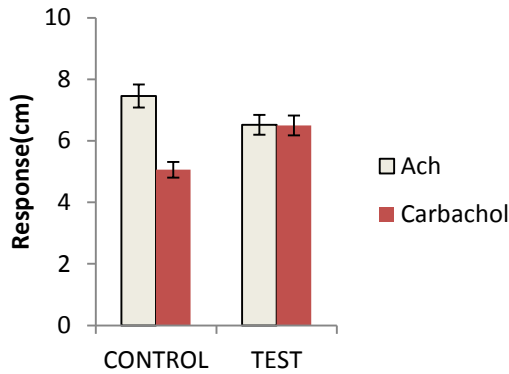


Figure 1: Responses to submaximum doses of acetylcholine and carbachol on sections of the ileum of the control and test groups.

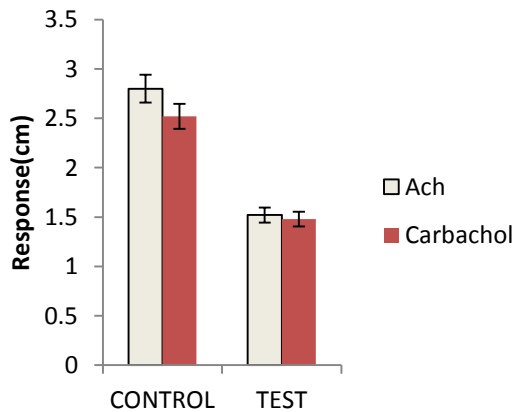


Figure 2: Responses to submaximum doses of Ach and carbachol following administration of atropine on sections of rat ileum of the control and test groups.

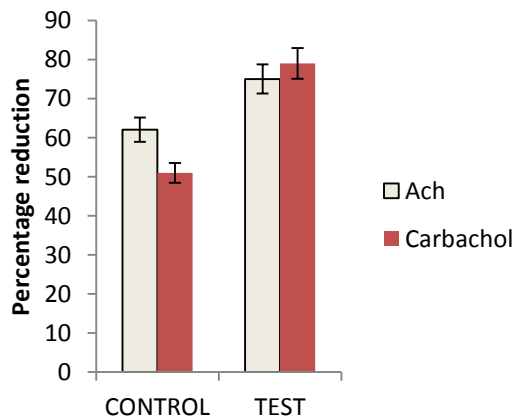


Figure 3: Percentage reduction to submaximum doses of Ach and carbachol following administration of atropine on sections of rat ileum of the control and test groups.

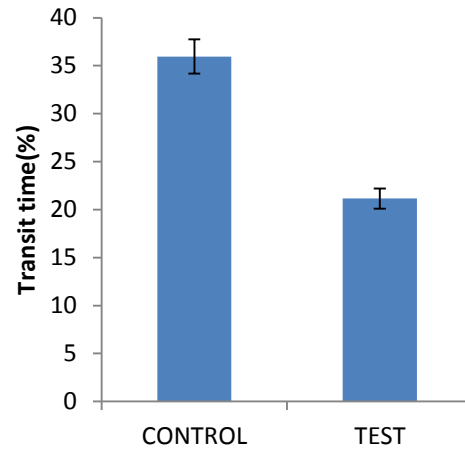


Figure 4: The effects of honey on intestinal transit in rats.

control after atropine administration on rat ileum ( $p < 0.01$ ) (Figure 2). The percentage reductions in the test group is statistically significant compared with the control ( $p < 0.01$ ) (Figure 3). There is statistically significant decrease in intestinal transit in the test group compared with the control ( $p < 0.01$ ) (Figure 4).

**DISCUSSION**

Honey as a remedy in the management of diarrheal disease, has been orchestrated by Folk medicine and as an alternative medicine, it has suffered much neglect due to lack of systematic scientific studies.

This study investigated the effect of honey intake on intestinal motility and transit using albino Wistar rats as model.

The results obtained showed that honey statistically decreased intestinal motility and transit in the honey-fed rats compared with the control rats ( $p < 0.01$ ), caused significant inhibition of the intestinal smooth muscles of the test group compared with the control group ( $p < 0.01$ ). It also caused significant decrease in response and percentage reduction of acetylcholine and carbachol actions on the gastrointestinal tract of honey-fed rats compared with control rats ( $p < 0.01$ ). However, response to carbachol action was increased in the test rats compared with the control ( $p < 0.05$ ).

The mechanism whereby honey caused these effects on the rat ileum is not quite understood. However, honey has been reported to cause relaxation of hepatic duct and decreased bile flow in albino rats (Alagwu et al, 2009; Osim et al, 2009). It is possible therefore that the same mechanism that operated on hepatic ducts may have also operated on the intestine

to cause decrease intestinal motility and transit as both are made up of smooth muscles. It is also possible that honey may have interfered with the acetylcholine and carbachol(cholinergic agents) to cause this action or may have interfered with the smooth muscle membrane by altering the membrane potential through ionic charges and other processes, yet unknown, to make the membrane less sensitive and less reactive to the actions of the cholinergic agents. These changes may have caused decrease peristalsis, thus giving rise to inhibition of the intestine and transit observed in this study. It is therefore concluded that honey has inhibitory effects on the intestine of albino rats, decreased intestinal motility and transit and reduced sensitivity of gastrointestinal tract to cholinergic agents.

If these findings are applicable to man, honey may be beneficial in the treatment of diarrhea disease and may therefore validate the claims by Folk medicine on the effectiveness of honey as good remedy in the management of diarrhea infection. However, further studies are necessary to establish this effect on the gastrointestinal tract of higher animals including man.

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