Niger. J. Physiol. Sci. 28(December 2013) 173–177
www.njps.com.ng

Niger. J. Physiol. Sci.

Effect of honey consumption on intestinal motility in male albino rats

***Alagwu E.A.[1], Egwurugwu J.N.[1], Nneli R.O.[2], Oguike F.[3] and Osim E.E.[4]**

[1]Department of Physiology, College of Medicine and Health Sciences, Imo State University, Owerri, Nigeria. [2]Department of Physiology, College of Medicine and Health Sciences , Abia State University, Uturu, Nigeria. [3]Department of Physiology, Faculty of Basic Medical Sciences, Anambra State University, Uli, Nigeria. [4]Department of Physiology, Faculty of Basic Medical Sciences, University of Calabar, Calabar, Nigeria.

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. Laparatomy 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±0.75) compared with the control group (35.96±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±0.75%; Carbachol-79.00±0.28%) compared with the control group (Ach-62.00±0.39%; Carbachol-51.00±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.

**Address for correspondence:* chinayo58@yahoo.ca

Manuscript Accepted: June, 2013

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, phyllochinon) (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. Laparatomy 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:

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

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

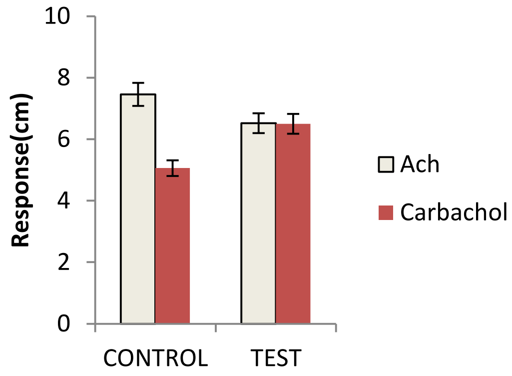

Figure 1: Responses to submaximum doses of acetylcholine and carbachol on sections of the ileum of the control and test groups.

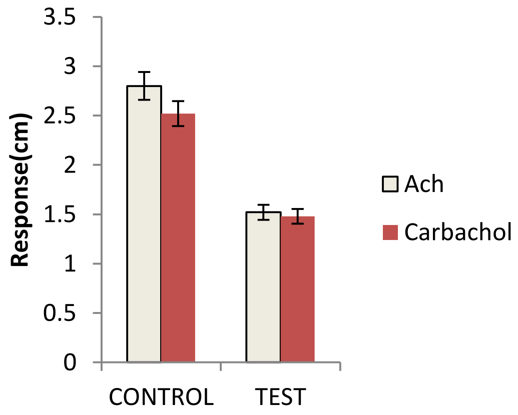

Figure 2: Responses to submaximum doses of Ach and carbachol following administration of atropine on sections of rat ileum of the control and test groups.

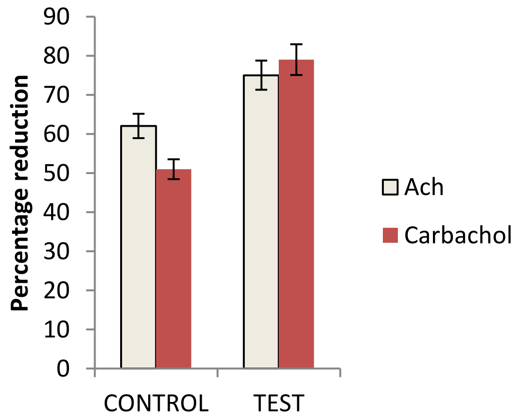

Figure 3: Percentage reduction to submaximum doses of Ach and carbachol following administration of atropine on sections of rat ileum of the control and test groups.

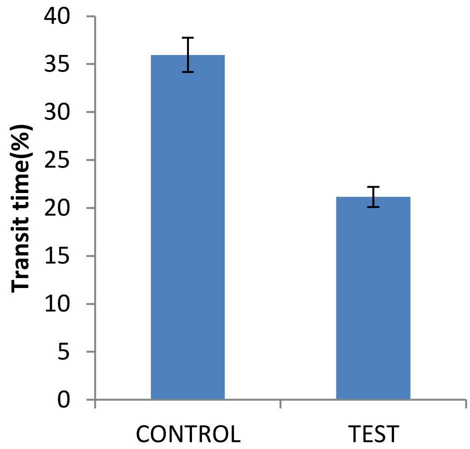

Figure 4: The effects of honey on intestinal transit in rats.

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 interferded 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.

REFERENCES

Ajibola A., Idowu G.O., Ambali A.A., Oyefuga O.H., Iquot I.S. (2007). Improvement of some haematological parameters in albino rats with pure natural money. *J. Biol. Sc. Res.* 2:67-69.

Alagwu E.A., Nneli R.O, Okwari O.O. and Osim E.E. (2009). Bile secretion in albino rats following chronic honey intake. *Nigerian Journal of Physiological Sciences* 24(2): 203-206.

Alagwu E.A., Nneli R.O., Egwurugwu J.N., Osim E.E. (2011). Gastric Cytoprotection and Honey Intake in Albino rats. *Nigerian Journal of Physiological Sciences*, 26(1): 39-42.

Ali A.T.M.M. (1995). Natural honey accelerates healing of indomethacin-induced antral ulcers in rats. *Saudi Medical Journal*, 16:18-26.

Ali A. T. M. M. (1997). Natural honey prevents ischaemia-reperfusion induced gastric mucosal lesions and increased vascular permeability in rats. *Eur. J. Gastroenterol. Hepatol*. 9:1101-1107.

Al Swayeh O.A., Ali A.T.M.M. (1998). Effect of ablation of capsaicin sensitive neurons on gastric protection by honey and sucralfate. *Hepato. Gastroenterol.* 45:297-302.

Al Waili N.S. (2003). Effects of daily consumption of honey solution on haematological indices and blood levels of minerals and enzymes in normal individuals. *J. Med. Food.* 6:135-140.

Al Waili N.S. (2004). Natural honey lowers plasma glucose, C-reactive protein, homocystein, and blood lipids in healthy, diabetic, and hyperlipidemic subjects: Comparison with dextrose and sucrose. *J. Med. Food* 7: 100-107.

Alvarez-Suarez J.M., Tulipani S., Diaz D., Estevez Y., Romandini S., Giampieri F., Damiani E., Astolfi P., Bompadre S., Battino M. (2010). Antioxidant and antimicrobial capacity of several monofloral Cuban honeys and their correlation with color, polyphenol content and other chemical compounds. *Food Chem.Toxicol*. 48: 2490-2499.

Bergman A., Yanai J., Weiss J., Bell D. and David M. P. (1983). Acceleration of wound healing by topical application of honey. An animal model. *The American Journal of Surgery* 145: 374-376.

Bogdanov S., Jurendic T., Sieber R., Gallmann P. (2008). Honey for nutrition and health: A review. *J. Am. Coll. Nutr.* 27:677-689.

Busserolles J., Gueux E., Rock E., Mazur A., Rayssiquier Y. (2002). Substituting honey for refined carbohydrates protects rats from hypertriglyceridemic and prooxidative effects of fructose. *Journal of Nutrition*, 132(11): 3379-3382.

Chepulis L.M. (2007). The effects of honey compared with sucrose and a sugar-free diet on neutrophil phagocytosis and lymphocyte numbers after long-term feeding in rats. *J. Compl. Integrat. Med.* 4(1): 1-7.

Chepulis L.M. and Starkey N.J. (2008). The long-term effects of feeding honey compared to sucrose and a sugar-free diet on weight gain, lipid profiles, and DEXA measurements in rats. *Journal of Food Science*, 73(1):S1-S7.

Chepulis L.M., Starkey N.J., Waas J.R., Molan P.C. (2009). The effects of long-term honey, sucrose or sugar free diets on memory and anxiety in rats. *Physiol. Behav.* 97:359-368.

Earnest C.P., Lancaster S.L., Rasmussen C.J., Kerksick C.M., Lucia A., Greenwood M.C., Almada A.L., Cowand P.A., Kreider R.B. (2004). Low versus high glycemic index meals carbohydrate gel ingestion during simulated 64 km cycling time trial performance. *J. Strength Cond. Res.*18: 466-472.

Efem E.E. (1988). Chemical observation on the wound healing properties of honey. *Br. J. Surg.* 75: 679-681.

Emarah M.H. (1982). A clinical study of the topical use bee honey in the treatment of some ocular diseases. *Bull. Islam Med.* 2(5): 422-425.

English H.K., Pack A. R., Molan P. C. (2004). The effects of manuka honey on plaque and gingivitis: A pilot study. *J. Int. Acad. Periodontol.* 6:63-67.

Forest R.D. (1982). Early history of wound treatment. *J. R. Soc. Med.* 75: 198-205.

Frankel S.M., Robbinson G.E., Berenbaum M.R. (1998): Antioxidant capacity and correlated characteristics of 14 unifloral honeys. *Journal of Apicultural Research*, 37:27-31.

Gharzouli K., Amira S., Gharzouli A., Knenouf S. (2002). Gastroprotective effects of honey and glucose-fructose-sucrose-maltose mixture against ethanol-, indometacin-, and acidified aspirin induced lesions in the rat. *Exp.Toxicol. Patho*. 54: 217-221.

Gheldof N., Engeseth N.J. (2002). Antioxidant capacity of honeys from various floral sources based on the determination of oxygen radical absorbance capacity and inhibition of in-vitro lipoprotein oxidation in human serum samples. *J.Agric.Chem.* 50:3050-3055.

Haffejee I.E., Moosa A. (1985). Honey in the treatment of infantile gastroenteritis. *British Medical Journal,* 290: 1866-1867.

Jeffrey A.E. and Echazarreta C.M. (1996). Medical uses of honey. *Rev. Biomed.*7: 43-49.

Khotkina M.L. (1955). Honey as part of therapy for patients with stomach ulcers. *Collection of papers Irkutsk State Med. Inst*. 252-262.

Kreider R.B., Rasmussen C.J., Lancaster S.L., Kerksick C., Greenwood M. (2002). Honey: An alternative sports gel. S*trength Conditioning Journal*, 24:50-51.

Ladas S.D., Haritos D.N., Raptis S.A. (1995). Honey may have a laxative effect on normal subjects because of incomplete fructose absorption. *A. J. Clin. Nutr.* 62:1212-1215.

Ladas S.D. and Raptis S.A. (1999). Honey, fructose absorption, and the laxative effect. *Nutrition*, 15:591-592.

Mahawar M.M., Jaroli D.P. (2006). Animals and their products utilized as medicines by the inhabitants surrounding the Ranthambhore National Park, India. *J. Ethnobiol. Ethnomed.* 2:46.

Mobarok Ali A.M., and AL Swayeh O.A. (2003). Honey potentiates the gastric protection effects of Sucralfocte against ammonia induced gastric lesions in rats. *Saudi J. Gastroenterol.* 9: 117-23.

Molan P.C. and Allen R.L. (1996). The antibacterial activity of honey. *J. Pharm. Pharmacol*.48: 1206-1209.

Molan P.C. (1999). The role of honey in the management of wounds. *Journal of Wound Care* 8(8): 415-418.

Molan P.C. (2001): The potential of honey to promote oral wellness. *Gen. Den*.49: 584-589.

Nasuti C., Gabbianelli R., Falcioni G., Cantalamessa F. (2006). Antioxidative and gastro-protective activities of anti-inflammatory formulations derived from chestnut honey in rats. *Nutr Res.* 26:130-137

Osim E.E., Nneli R.O., Alagwu E.A. and Okwari O.O. (2009). Biliary secretion in albino wistar rats following chronic consumption of honey. *Nigerian Journal of Physiological Sciences* 24(2): 210.

Ranjit Singh A.J.A. and Padmalatha C. (2004). Ethno-entomological practices in Tirunelveli district, T amil Nadu. *Indian J. Trad Knowl*. 3: 4442-4446.

Salem S.N. (1981): Treatment of gastroenteritis by the use of honey. *Islamic Medicine*, 1:358-362.

Salem S.N. (1987). Honey regimen in gastrointestinal disorders. In Al Awada A.R.A ed. Proceeding of the First International Conference on Islamic Medicine Kuwait. *Bull. Islam med.* 1:358-62.

Sanz M.L., Polemis N., Morales V., Corzo N., Drakoularakou A., Gibson G.R., Rastal R.A. (2005). In vitro investigation into the potential prebiotic activity of honey oligosaccharides. *J. Agric. Food Chem.* 53:2914-2921.

Schild H. D. (1980). Applied Pharmacology. 12th Edition. Churchill Livingstone Medical Division of Longman group Ltd.

Schramm D.D., Karim M., Schrader H.R., Holt R.R., Cardetti M., Keen C.L. (2003). Honey with high levels of antioxidants can provide protection to healthy human subjects. *J. Agric. Food Chem*. 51: 1732-1735.

Slobodianiuk A.A. and Slobodianiuk M.S. (1969). Complex treatment of gastritis patients with high stomach secretion in combination with (and without) a 15-20% solution of honey In: Conference. Resorts of Bashkiria in the Service of Health. Bashkir: Khniz. izd-vo, Ulfa. 249-53

Uwagboe P.E. and Orimilikwe S.O. (1995). Effect of Histamine H_2 receptor blockers on gastrointestinal tract in the conscious albino rats. *Nigerian Journal of Physiological Sciences* 11: 56-58.

White, J.W. Jr., Doner L.W. (1980). Honey Composition and Properties. In: Beekeeping in the United States. Agricultural Handbook 335. Science and Education Administration. Superintendent of Documents, US Government Printing Office, Washington, D.C.

White J.W. (1975). Physical characteristics of honey. In Crane Ed. Honey, a comprehensive survey. London : Bee Research Association and Chalfont St Peter, 207-239.

White J.W. (1978): En: Chichester C.O., ed. Advances in food research. New York: Academic Press, 287-374.

World Health Organization (2005). The treatment of diarrhoea: a manual for physicians and other senior health workers. 4th revision. Geneva, Switzerland.

Yaghoobi N., Al Waili N., Ghayour-Mobarhan M., Parizadeh S.M., Abasalti Z., Yaghoobi Z., Yaghoobi F., Esmaeli H., Kazemi-Bajestani S.M., Aghasizadeh R., Saloom K.Y., Ferns G.A. (2008): Natural honey and cardiovascular risk factors: effects on blood glucose, cholesterol, triacylglycerol, CRP, and body weight compared with sucrose. *Sc. World*