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RESEARCH ARTICLE

Assessment of Toxicity and Influence of Three Types of Gum Arabic on Blood Glucose, Body Weight, Total Protein and Lipid Profile on Diabetic Rats

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Abstract

This experiment aimed to study the effect of three types of Gum Arabic *A. senegal* (Hashab), *A. seyal* (Talha), *A. polyacantha* (Kakmut), and *Cyamopsis tetragonoloba* (Guar gum) on blood glucose, total protein, lipid profile and body weight. It is also assess the toxicity of three types of Gum Arabic and guar gum on liver and kidney of diabetic rats. The histological study revealed three types of Gum Arabic and guar gum were free from toxic at 5 % (w/v), lowering blood glucose and body weight at 5% (w/v). Three types of Gum Arabic have no affect on the total protein at 5% (w/v), in lipid profile, at 5% (w/v). HDL was increased for Hashab, Talha and Kakmut, but it is not affected by guar, LDL was decreased Talha and was increased for Hashab, but it is not affected by for Kakmut and TG was increased for Hashab and was decreased for Talha, Kakmut and Guar.

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Introduction

Dietary fibers are found naturally in the plants that we eat. They are parts of plant that do not break down in our stomachs, and instead pass through our system undigested. In fact, there are two fibers: Water-soluble fiber may lower cholesterol by preventing the re-absorption of bile acids. Bile acids are made from cholesterol, and after they aid fat digestion, also lower the total cholesterol and the bad cholesterol (LDL) without affecting the good cholesterol (HDL) (Brown 1999), Lowered LDL cholesterol without affecting HDL- cholesterol (Anderson 1999). Water-soluble fiber may also stabilize blood sugar. The other type of fiber is water-insoluble fiber which primary function of its, is to collect water that increases stool bulk in the large intestine. It promotes bowel movement, and as the bulk works through the intestine, it scours the intestinal walls of waste matter, reducing the risk of colon-related problems. Gum Arabic has no off-taste. Nutritional experts can regard Gum Arabic as 95% soluble Fiber, Tsai *et al*, (1976) indicated that the effect of dietary fiber on the lipid profile is dependent

on the composition of the diet. Moundras *et al*, (1994) stated that some studies have suggested that the viscosity of fermentable dietary fiber contributes substantially to the reduction of lipids in animals and humans. Moundras *et al*, (1994) said that the mechanism involved is clearly linked to increased bile acid excretion and fecal neutral sterol or a modification of digestion and absorption of lipids. Furgał-Dierżuk (2004) said that LDL-Cholesterol and Triglycerides level in serum were significantly ($P \leq 0.01$) lower in guar gum when compared with other gums. Annison, *et al*, (1995) said that consumption of the gums had no significant effects on concentrations of plasma or liver cholesterol. Plasma triacylglycerol concentrations were higher in rats fed Gum Arabic, whereas liver triacylglycerol were lower in rats fed the gums. Abd-Razig *et al*, (2010) said that there is significant decrease in triglyceride for gum that supplement of laying hens. Samia *et al*, (2006) indicated that 5% Gum Arabic have some positive effect on decreasing glucose level in the blood stream of the animals studied. Therefore, the present study was carried out with the objectives:

1- to estimate effect of water soluble fiber of gums, *A. senegal* (Hashab) *A. seyal* (Talha) *A. polyacantha* (Kakmut) and *Cyamopsis tetragonoloba* (Guar gum), using Diabetic rats on : Lipid profile (Cholesterol, HDL, LDL and Triglyceride level), Glucose level, Protein level and body weight and; 2- to study toxicity of Gums Arabic (Hashab, Talha, and Kakmut) and guar gum on liver and kidney of rats that treated with four types of gums.

Material and methods

Experimental design: The experimental rats were conducted according to the guidelines of the Committee for purpose of control and supervision of experiments on Animals, Adult males albino rats, weighing 180–218 g, age 12–14 week, fed with a standard pellet diet (the mean component of this diet is carbohydrate and 23–24.5% protein (Table 1), kept for 15 days as adaptation period before the start of

the experiment. All rats were put in clean metal cages, were cleaned daily and kept under conditions that prevented them from experiencing unnecessary pain and discomfort according to guidelines approved by the Ethical Committee. These males rats are divided into four groups: Group 1 were given the standard diet + 5% Gum Arabic (Hashab) , group 2 received standard diet + 5% Gum Arabic (Talha) , group 3 received standard diet + 5 % Gum Arabic (Kakmut) and group 4 received standard diet + 5% guar gum. Types of Gum Arabic and Guar Gum samples were collected from Company of Sudanese Gum Arabic limited, Khartoum state and gaur gum was obtained from Sudanese Guar Gum Company. The samples were prepared as follows: each 5g of different type of Gum Arabic and Guar Gum were added to 100 ml of Distilled water and orally consumption daily till end of experiment.

Table I: Show compositional of basal diet and approximate analysis of diet of experimental rats

Compositional of basal diet		Approximate analysis of diet	
Ingredient	%	Ingredient	%
Sorghum	62.5	Moisture	11
Wheat bran	5.0	Protein	25
Ground cake	22.0	Fat	3
Concentrate	5.0	Ash	6
Salt	0.1	Carbohydrates	55
Antitoxic	0.1		
Vitamin	2.0		
Enzyme	0.1		
Calcium	2		

*Diet for experiment rat was analyzed according to AOAC (1983).

Collection of blood sample and specific organs

A sample of eye blood was collected from each groups by heparinize capillary tube and kept in specific labeled plain container (eppendorf tube and blood container). The serum had been separated by centrifugation at 5000 rpm and stored at 5°C until analysis. Rats were autopsied, then their liver and kidney organs were collected into labeled clean containers, and preserved in 10% formalin, then slides were made according to method described by Bancroft and Gamble (2002).

Methods

Measurement of lipid profile

Serum cholesterol mg/dl was measured according to method described by Allain *et al.*, (1974), Serum HDL, LDL and triglyceride mg/dl was measured according to method described by Mc Gowan (1983),

Measurement of glucose (mg/dl)

Glucose level mg/dl was measured according to method described by Brăslas et al (2005).

Measurement of total protein

It was measured according to method described by Gornall et al, (1994).

Measurement of body weight (g).

Average body weight for each group was measured at 7 days interval during experiment

Preparation slides of liver and kidney of rats (treated and control)

From the autopsied rats, liver and kidney tissues were collected in clean, labeled, sterilized containers. The liver tissues are cleaned with distilled water and preserved in 10% formal saline. Sequences of steps for slides preparation were carried out according to method described by Muawia and Murwan (2011).

Statistical analyses

Data obtained were analyzed and averaged, and assessed by using Analysis of Variance (ANOVA) as described by Gomez and Gomez, (1984).

Results and discussions

Lipid profile

Table 2 indicated that cholesterol level for Hashab group was reduced from 50 into 43 mg/dl and also for group Talha was reduced from 80 into 38 mg/dl for both group, at 0 and 5% gum consumption, respectively. , There was no effect on cholesterol level for group Kakmut, but it was increased in cholesterol level from 40 into 45 mg/dl at 0 and 5% gum consumption, respectively. These results shown that 5 % gum was significantly ($p \leq 0.05$) lowering the cholesterol level for Hashab and Talha, no change in cholesterol level in Kakmut while in guar cholesterol level was increased. These results are agreed with those results obtained by Tsai *et al*, (1976) who said that effect of dietary fiber is depend on composition of diet.

Table 3 HDL- cholesterol level for Hashab, Talha and Kakmut at 0 and 5% was increased from 30 -36,

30 -31 and 18 38 mg/dl, respectively. In guar group there is no change in HDL –cholesterol. There are significant variations in HDL –cholesterol among four groups at $p \leq 0.05$. The variation is due to chemical constituent of different types of gum fed to rats. These findings are not agree with those reported by Anderson(1999)² who reported that water soluble fiber lower total cholesterol and LDL- cholesterol without affecting the HDL-cholesterol.

Table 4 LDL- cholesterol for Hashab and Talha at 0 and 5% was decreased from 13 – 18 and 39 – 13 mg/dl, respectively. In Kakmut group there is no change in LDL –cholesterol. There is variation on the effect of different types of dietary fiber in LDL – cholesterol at $p \leq 0.05$. These observations are agree with those found by Tsai *et al*, (1976).

Table 5 Triacylglycerol level for Talha and guar at 0 and 5% concentration was decreased from 54 – 49 and 53- 50 mg/dl, respectively but increased from 39 – 41 mg/dl (Hashab) and 35 – 47 mg/dl (Kakmut).These findings are supported the results reported by Abd-Razig *et al*, (2010) ⁷ for lowering triacylglycerol by gum.

Table 2: show effect of four types of gums with 0 and 5% concentration on Cholesterol.

Sample	Hashab	Talha	Kakmut	Guar
0% Gum	50	80	40	40
5 % Gum	43	38	40	45

Table 3: show effect of four types of gums with 0 and 5% concentration on HDL.

Sample	Hashab	Talha	Kakmut	Guar
0% Gum	30	30	18	44
5 % Gum	36	31	38	44

Table 4: show effect of four types of gums with 0 and 5% concentration on LDL

Sample	Hashab	Talha	Kakmut	Guar
0% Gum	13	39	15	ND
5 % Gum	18	13	15	19

Table 5: show effect of four types of gums with 0 and 5% concentration on Triglyceride

Sample	Hashab	Talha	Kakmut	Guar
0% Gum	39	54	35	53
5 % Gum	41	49	47	50

Glucose level

Table6 indicated that glucose level for Hashab, Talha, Kakmut and guar gum at 0 and 5% concentration was decreased from 157 -124, 124 - 116, 184 -121 and 205 -122 mg/dl, respectively. The variation in reduction for glucose level is due to chemical composition of different types of dietary fibers. It was observed that there is significant difference among the four groups of gum at $p \leq 0.05$,

in both concentrations. These results are agree with those results obtained by Samia *et al*, (2006).

Table 6 indicated that total protein for Hashab and gaur at 0 and 5% concentration was increased from 7 -8 and 6 – 7 g, respectively but for Talha and Kakmut was fixed. This variation in total protein is due to chemical composition of different types of gum. These results were indicated that rats do not suffer from carbohydrates and lipid deficiency. Therefore, all the rats were located in category of positive N₂

balance, which means protein is metabolism for yield nitrogen. This is used as precursor for synthesis enzyme, hormone and antibodies

Table 7 indicated that body weight for all groups were slightly reduced from 218 – 207 g (Hashab), 191 -189 g (Talha), 189 -184 g (Kakmut) and 180 - 167 g (guar). These results were similar to those results Obtained by Rasha *et al*, (2012)¹⁷, but it is not agree with Melnick *et al*, (1983) and Samia *et al*, (2006).

4.0 Study toxicity of Gums on liver and kidney of rats (treated and control) Figure 2, 3, 4, 6, 7, 8 and 9) indicated kidney and liver tissue of rats that treated with 5% Hashab, 5% Talha, 5% Kakmut and 5% guar gum were normal as compared with Figure 1(Control for kidney) and Figure(Control for liver.

Conclusion: The results are concluded for lipid profile: An increasing HDL for rats treated with Hashab, Talha and Kakmut, but it is not change for rats treated with guar, lowering LDL for rats treated with Talha and increasing for rats treated with Hashab, but it is not change for rats treated with Kakmut, increasing TG for rats treated with Hashab and lowering for rats treated with Talha, Kakmut and guar. Blood glucose for treated rats was lower than control group. Total protein for rats treated with Hashab and guar, but it is not change for retreated with Talha and Kakmut. There is slight decreasing of body weight for rats treated with three types of Gum Arabic and guar gum. Gum Arabic and guar are free from toxicity.

Table 6: show effect of four types of gums with 0 and 5% concentration on

Sample	Hashab	Talha	Kakmut	Guar
0% Gum	157	124	184	205
5 % Gum	124	116	121	122

Table 7: show effect of four types of gums with 0 and 5% concentration on Total protein

Sample	Hashab	Talha	Kakmut	Guar
0% Gum	7	7	6	6
5 % Gum	8	7	6	7

Table 8: show effect of four types of gums with 0 and 5% concentration on Body weight

Sample	Hashab	Talha	Kakmut	Guar
0% Gum	218	191	189	180
5 % Gum	207	189	184	167

Figure 1; Kidney tissue of rats that do not treat (Control)



Figure 2; Kidney tissue of rats that treated with 5% Hashab

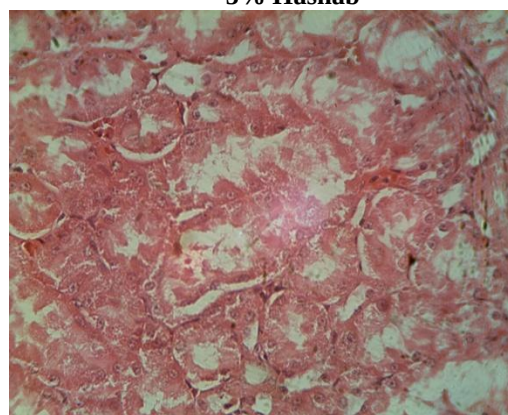


Figure 3; Kidney tissues of rats that treated with 5% Talha

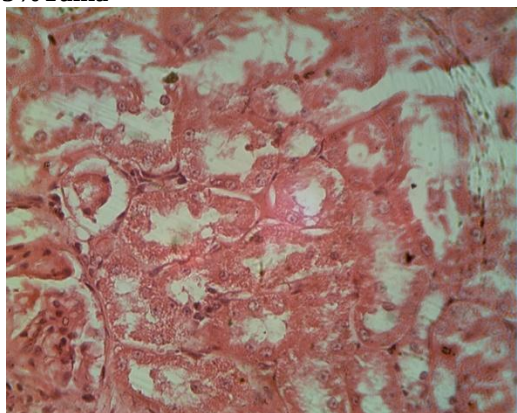


Figure 5; Liver tissue of rat that do not treat (Control)

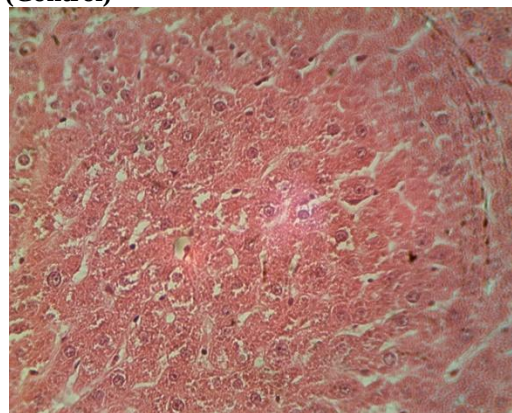


Figure 3; Kidney tissues of rats that treated with 5% Kakmut

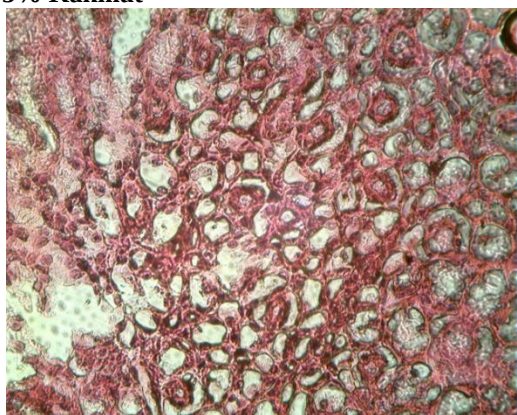


Figure 6; Liver tissue of rats that treated with 5% Hashab



Figure 4; Kidney tissue of rats that treated with 5% guar

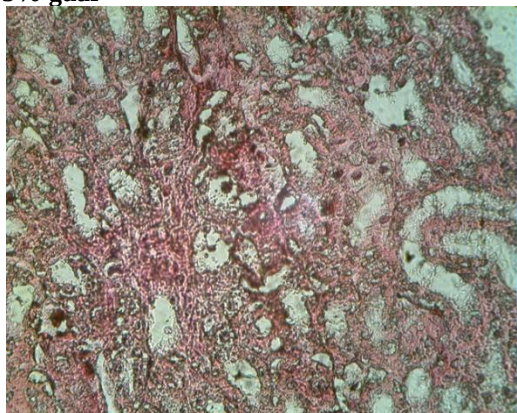


Figure 7; Liver tissue of for rats that treated with 5% Talha

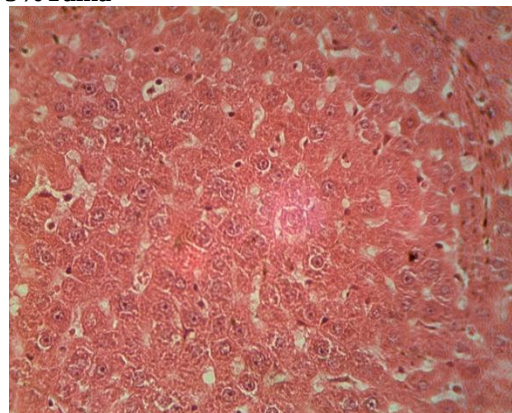


Figure 8; tissue liver for rats that treated with 5%Kakmut

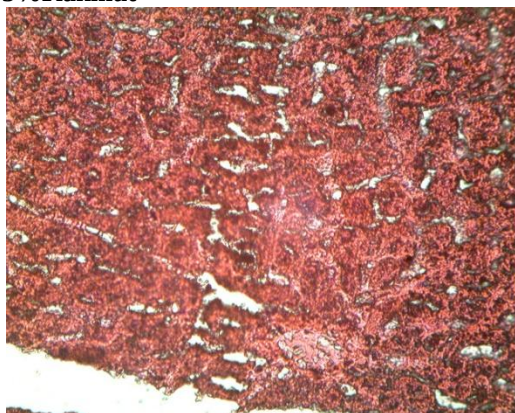
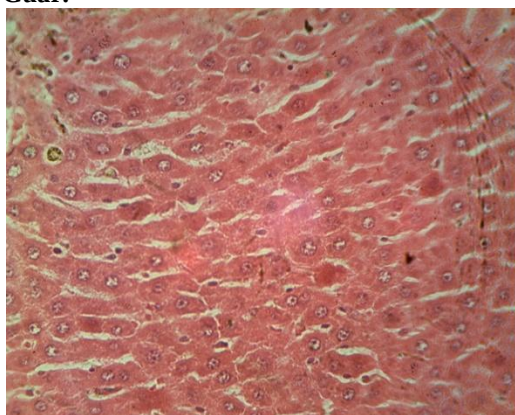


Figure 9: liver tissue for rats that treated with 5% Guar.



References

Abd-Razig N.M., Sabahelkhier M.K., And Idris O.F.(2010). Effect of Gum Arabic (Acacia Senegal, L. Wild) on Lipid Profile and Performance of Laying Hens. *Journal of Applied Biosciences* 32: 2002 – 2007. ISSN 1997–5902.

Anderson JW. Allgood LD., Turner C., Oelgten PR. And Daggy BP.(1999). Effects of Psyllium on Glucose and Serum Lipid Responses in Men with Type 2 Diabetes and Hypercholesterolemia. *Am J Clin Nutr.* 1999;70: 466–473.

Annisson G., Trimble RP.,and Topping DL.(1995).Feeding Australian Acacia Gums and Gum Arabic Leads to Non-Starch Polysaccharide Accumulation In the Cecum of Rats. 11: *J Nutr* 1995 Feb;125(2):283-92.

AOAC, 1984. Official Methods for Analysis. 13th Ed., Association of Official Analytical Chemists, Washington.

Badreldin HA., Amal Z. And Gerald B . (2008). Biological Effects of Gum Arabic: A Review of Some Recent Research. Departments Of Pharmacology And Clinical Pharmacy, College of Medicine And Health Sciences, Sultan Qaboos University, P.O. Box 35, Al Khod 123, Oman. Department Of Physiology, College Of Medicine And Health Sciences, Sultan Qaboos University, P.O. Box 35, Al Khod 123, Oman .School Of Pharmacy And Biomedical Sciences, University Of Portsmouth, St. Michael's Building, White Swan Road, Portsmouth PO1 2DT, UK.

Brăslas CM., Ciobotaru Emilia, Militaru Manuella, Sonea AL.,Brăslas Elena Daniela, Dinescu Georgeta, Diaconescu AL.II., Soare Teodoru And Stănculescu Cornelia.(2005). Corelația Dintre Disfuncția Endotelială Si Afectarea Miocardică La Pacienții Cu Diabet Zaharat. Contract Cercetare CEEEX, 55/2005. Contract VIASAN. Director De Contract. Prof. I.Bruckner.

Brown L, Rosner B, Willett WW and Sacks FM.(1999). Cholesterol Lowering Effects of Dietary Fiber: A Meta-Analysis. *Am J Clin Nutr.* 1999;69:30–42.

Furgal-Dierżuk.(2004). The Effect Of Different Dietary Fibres On Short-Chain Fatty Acid Concentrations In The Caecum And Lipid Profile In Pig Serum. *Journal Of Animal And Feed Sciences*, 13, Suppl. 2, 2004, 31–34

Gomez TP And Gomez AA. Statistical Procedure For Agriculture Research .John Wiley And Sons Inc. New York, USA, 1984

Gornall AG., Barda CS. and David M.M. (1994).Determination Of Serum Proteins Or Means Of The Buret Reaction .*J Biol Chem*:1949;177:751-766.

Mcgowan M W., Artiss JD., Strandberg DR., And Zake B. (1983). Determination Of Total Lipid. *Clin. Chem.* 29,538- 642.

Mclean Ross AH., Eastwood MA., Brydon WG., Anderson JR. And Anderson D.M. (1983). A study of the effects of dietary Gum Arabic In Humans. *Am J Clin Nutr*, 37, 368-375

Melnick RL., Huff J., Haseman JK., Dieter MP., Grieshaber CK., Wyand DS., Russ Field AB., Murthy AS., Fleischman RW. And Lilja HS. (1983). Chronic Effects of Agar, Guar Gum, Gum Arabic, Locust-

Bean Gum, Or Tara Gum In F344 Rats And B6C3F1 Mice. *Food Chem Toxicol.* 21(3):305-11.Men.J. Lipid Res. 33: 1183-1 192.

Moundras C., Behr SR., Demigné C., Mazur A. And Rémésy C. (1994). Fermentable Polysaccharides That Enhance Fecal Bile Acid Excretion Lower Plasma Cholesterol And Apolipoprotein E-Rich HDL In Rats. *Journal Of Nutrition*, Vol. 124, No.11,(November 1994), Pp. 2179–2188, ISSN 0022-3166

Muawia IA Omer FI., Murwan KS.(2011). Effect of Pendimethalin Herbicide On Fish (*Tilapia Nilotica*) Skeletal Muscles, Gills And Its Influence On Human. *World J Life Sci. And Medical Research* 2011; 1:5.

Rasha B. , Tarig H. Merghani, Khalifa Elmusharaf, Rehab M. Badi, Florian Lang5 and Amal M. Saeed. (2012). Effects Of Gum Arabic Ingestion On Body

Mass Index And Body Fat Percentage In Healthy Adult Females: Two-Arm Randomized, Placebo Controlled, Double-Blind Trial. *Nutrition Journal* (2012).

Samia T., Kamal FE. And Khadija A. (2006). The Effects of Gum Arabic On Body Weight And Some Blood Elements In New Zealand Cross California And Baladi Rabbits. *Pakistan Journal Of Biological Sciences*, 9: 96-98.

Sharma R.D.(1985). Hypocholesterolemic Effect Of Gum Acacia In Men. *Nutr Res*, 5, 1321-1326.

Tsai AC., Elias J., Kelley JJ., Lin RS. and Robson JR. (1976). Influence of Certain Dietary Fibers on Serum And Tissue Cholesterol Levels In Rats. National Center For Biotechnology Information, U.S. National Library Of Medicine 8600 Rockville Pike, Bethesda MD, 20894 USA.
