Possible Hypercholesterolemic Effect of Some Phytogenic and Animal Colloids Using Male Albino

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ABSTRACT

This investigation was conduced to explore the protective effect of Carob seeds , Arabic gum were used at 500 mg/kg body weight in diet for 42 days as hypercholesterolemic agent to improve the blood glucose level , the lipids profile (Triglycerides(TG) - T.C - LDL - HDL - VLDL) , in addition ,the oxidants (MDA) and antioxidants enzymes activities including SOD, GSH , CAT& GPX. Twenty five(25) male nature albino rats weighting between 180 ± 200 g were used , divided to five main groubs ,(5 rats in each group), one of them used as control-ve while other groups had given 1.5% cholesterol plus 10% sheep tail for 15 days as a positive group . One of these group left as control+ve and other groups with orally administration of carob seed powder , carob seeds extract, arabic gum at doses of 500 mg /kg B. W. T , respectively for 42 days. Such treatments lowerd the TC,TG,VLDL,LDL,& AI, While raised the HDL, Also colloids diets reduced serum glucose while Triglycerides (TG) ,HDL increased, the antioxidant enzymes (SOD,CAT ,GPX,GSH) also ,increased.These treatments improved also; the histopatholgical changes due to hypercholesterolemia; being in line with the biochemical changed moreover,Therefore, the study recommends that the colloids can be used in the treatment of the hypercholesterolemic, the family food, should tend to envent food with colloids, specially the carob powder and carob extract, that easily (can be) added to baking goods ,similarly arabic gum many be blended with foods.

Keywords: hypercholesterolemic – colloids - carob seed, Arabic gum.

Introduction:

Cholesterol is a waxy substance made by animal liver and also supplied in diet through animal products such as meats, poultry, fish and dairy products. Cholesterol is needed in the body to insulate nerves, make cell membranes. there are 102.3 million American adults who have total blood cholesterol values of 200mg/dl and higher and about 41.3 million American adults have levels of 240 mg/dl of cholesterol or above, Total blood cholesterol is the most common measurement of blood cholesterol .Cholesterol is measured in milligrams per deciliter of blood (mg/dl). A person`s health cholesterol content is based on other risk factors such as age ,gender ,family history ,race ,smoking ,high blood pressure ,physical inactivity, obesity and diabetes**. (Hongbao, 2004)**

Hyperlipidemia refers to elevated levels of lipids and cholesterol in the blood, as identified as dyslipidemia, to describe the mainfestations of different disorders of lipoprotein metabolism. Although elevated low density lipoprotein cholesterol (LDL)is thought to be the best indicator of atherosclerosis risk ,dyslipidemia can also describe elevated total cholesterol (TC) or triglycerides (TG) or low levels of high density lipoprotein cholesterol (HDL) **(Jacobson,1998).**

Many herbs are known as excellent sources of natural antioxidants, and consumption of fresh herbs in the diet many therefore contribute to the daily antioxidant intake **(Justesen and knuthsen, 2001).**

Insoluble fiber from carob pulp has been found to affect blood lipids in animals in a similar manner as soluble dietary fiber. Lipid lowering effects were more pronounced in females than in males. Daily consumption of food products enriched with carob fiber shows beneficial effects on human blood lipid profile and may be effective in prevention and treatment of hypercholesterolemia,(**Zunft et al ., 2003).**

Rima et al., (2015) reported that hyperlipidemia especially low density lipoprotein cholesterol (LDL-C) is a major risk factor for developing ischemic heart disease. Soluble dietary fiber has lipid lowering characteristics. Gum Arabic (GA) is 95% soluble fiber calculated on dry bases. The beneficial effect of GA on lipid profile needs further verification.

MATERIALS AND METHODS

1. Materials:

- Casein, all vitamins, all minerals, cellulose, choline chloride, Methionine, Cholesterol was obtained from Morgan Company, Cairo, Egypt.
- Oil and corn starch were obtained from local market Menoufia, Egypt.
- **Colloids: The first one was Carob Seeds powder (Ceratonia siliqua), the second was Carob Seeds extract (Ceratonia siliqua) the third was Arabic gum,(acasiagum), these colloids crushed Arabic gum,(acasiagum) Powder were purchased as dried material from the local market in Egypt**

- **Preparation of Basal diet:**

The basal diet wasprepared according to **Reeves *et al., (1993)***. It was consisted of 20% protein (casein), 10% sucrose, 4.7% corn oil 0. 2% choline chloride, 1% vitamin mixture, 3.5% salt mixture and 5% fiber (cellulose). The remainder was corn starch as recorded in table (1). The composition of salt mixture***(*Hegested*, *et al.*, 1941*)***andvitamin mixture ***(*Campbell, 1963*)***.

2.Methods:

Preparation of samples:

1- The first one was Carob Seeds (Ceratonia siliqua), the second wasArabic gum,(acasiagum).
2- Twenty (20g) sample of each plants and herbs + 1000ml distilled water, were kept in conical flasks provided with glass condensers, then heated under reflux for one hour at 70°C.
3- The heated mixture was cooled and filtered.
4- The filtrate poured in different Petri dishes and dried in a fan oven at 70°C till dried as a film, separated then crushed and the dried powder solubilized in distilled water, That each rat oral administrated with 1 ml litter of distilled water containing 750 mg /kg B.wt.,of rat from herbs or plant extracts
5- Then kept in dark bottles to prevent oxidation then saved until the experiment **(Nagm, 2002).**
6- The mixture was cooled and filtered before filing in dark bottles.

Induction of experimental Cholesterol:

Cholesterol was induced in normal healthy male albino rats by intro peritoneal injection of 1.5% Cholesterol for 15days body weight, 50% Fat Les sheep according to the method described by **Drury and Wallington ,(1967)**

Biological Experiment:

Twenty five (25) white male albino rats, weighting between 180–200 g were used in the study. The rats were derived from Research Institute of Ophthalmology, Medical Analysis Department, Giza, Egypt. Rats were housed in individual stainless steel cages under controlled environmental conditions diets were introduced to rats in a special non scattering feeding cub to avoid loss of feed and contamination. Tab water was provided to rats by means of glass tubes projecting through wire cages from inverted bottles supported to one side of the cage. Food and water provided and checked daily. The animals were weighed twice weekly throughout the period of the experiment.

Grouping design and feeding of rats:

All groups were fed for 42 days on experimental diet as follows:

The rats were divided into 5 groups (5 rats each). The groups of rats were as follows:

Group 1(-ve): Fed on a besel diet only, as negative control for 42days.

Group 2(+ve): Fed on a basel diet with cholesterol Powder, as positive control for 42 days.

Group3: Cholesterol group Carob Seeds **(Ceratonia siliqua**) Powder in water orally, at a dose of 500mg/kg B.wt,and fed on Basel diet.

Group4: Cholesterol group carob seeds **(Ceratonia siliqua**) extract orally, at a dose of 500mg/kg B.wt, and fed on basel diet.

Group5: Cholesterol group Arabic gum, (*acasiagum*) Powder in water orally, at a dose of 500mg/kg B.wt, and fed on basal diet.

Blood sampling collections:

At the end of experiment period, blood samples were collected after 12 hours fasting from the portal vein; the rats were sacrificed under ether anesthesia. Blood samples were received into clean dry centrifuge tubes and left to clot at room temperature, then centrifuged for 10 minutes at 3000 r.p.m to separate the serum. Serum was carefully aspirated and transferred into clean covettee tubes and stored frozen at -20°C for analysis **(Malhotra, 2003)**.

2.6. Biological evaluation:

Biological evaluation of the differentdiets was carried out by determination of body weight gain% (BWG %) & feed efficiency ratio (FER) according to ***Chapman et al., (1959).*** using the following formulas:

$$\mathbf{BWG\%} = \frac{\text{Final weight} - \text{Initial weight}}{\text{Initial weight}} \times 100$$

$$\mathbf{FER} = \frac{\text{Body Weight Gain (g/day)}}{\text{Food Intake (g/day)}} \textbf{/42 days}$$

2.7. Biochemical parameters:

- **Determination of serum glucose:**
  Serum glucose was measured using the modified kinetic method according to **(Kaplan, 1984)**.
- **Determination of serum lipids:**
- **Determination of triglycerides (T.G):**
  Serum triglycerides (T.G) were measured using the modified kinetic method according to the method described by **Fossati and Principe (1982)**.
- **Determination of total cholesterol (T.C):**
  Serum cholesterol was measured using the modified kinetic method according to **Richmond (1973)**.
- **Determination of high density lipoprotein cholesterol (HDL):**
  Serum high density lipoprotein cholesterol (HDL-c) was measured using the modified kinetic method according to **Allain (1974).**
- **Determination of low density lipoprotein cholesterol (LDL):**
  Serum low density lipoprotein cholesterol (LDL-c) was calculated as mg/dl according to **Castelli et al., (1977)** equation:

LDL Concentration mg/dl =Total Cholesterol- HDL -VLDL

- **Determination of very low density lipoprotein cholesterol (VLDL):**

Serum very low density lipoprotein cholesterol (VLDL-c) was calculated as mg/dl according to **Lee and Nieman (1996)** equation:

$$\text{VLDL-C concentration mg/dl} = \frac{\text{T.G}}{5}$$

- **Estimation of antioxidant enzyme activity of superoxide dismutase (SOD):**

The activity of superoxide dismutase (SOD) wasassayed by the method of **Kakkar *et al*., (1984*)*** based on the formation of NADH-Phenazinemethosulfate-nitro blue tetrazoliumformazan.

- **Estimation of glutathione reduced (GSH) enzyme*:***

The activity of glutathione peroxidase was assayedby the method of **Rotruck *et al.*, (1973)**. A known amount of enzymepreparation was allowed to react with H202 in the presence of reduced glutathione. After a specified period of enzyme action; the remaining reduced glutathione content was measured by the method of **Beutler and Kelley (1963).**

- **Estimation of catalase enzyme (CAT):**

Catalase activity determined byGoth's colorimetric method, in which serum was incubatedin H_2O_2 substrate and the enzymatic reaction stopped by the addition of ammonium molybdate**(Goth, 1991)**.The intensity of the yellow complex formed by molybdate and H2O2 was measuredat 405 nm.

- **Estimation of glutathione peroxidase (Gpx) enzyme:**

The activity of glutathione peroxidase (Gsh-px) was assayed by following the oxidation of NADPH at 340 nm with t-butyl-hydroperoxide according to **Tamura *et al*. (1982).**

3- Histopathological study:

Autopsy samples were taken from the internal organs of rats and fixed in 10% buffered formlin for twenty four hours. Washing was done in tap water then serial dilutions of alcohol till absolute ethyl,were used for dehydration. Specimens were cleared in xylene, embedded in

paraffin at 56 degree in hot air oven for twenty four hours. Paraffin bees wax tissue blocks were prepared for sectioning at 4 microns thickness by slidingmicrotome. The obtained tissue sections were collected on glass slides, deparaffinized and stained by hematoxylin and eosin **(Banchroft *et al*., 1996)** for histopathological examinations bythe light microscope.

4. Statistical analysis of data:

Data were statistically analyzed using a computerized program at the Scientific Computer Center, Faculty of Home Economics, Menoufia University, using Duncan Multiple Range Test (one way ANOVA test) according to **(Armitage and Berry, 1987*).***

Result and discussion:

A-Biological parameters:

Effect of colloids on body weight gain (BWG %), feed intake (FI) and feed efficiency ratio (FR) of hypercholesterolemic rats.

Data presented in table (1) show the effect of colloids (carob powder, carob extract, and Arabic gum on hypercholesterolemic rats. It is evident that hypercholesterolemia increased the BWG% and FI of rats which in control(-) were (35.00±5.00% and 23.70±1.60g) respectively while for control + ve group and FI were (45.00±3.00 and 48.80 ±2.60g) respectively indicating lower BWG and FI in control(-) than control(+) groups. It is clear that hypercholesterolemia decreased the feed efficiency ratio (FER) of control (+ ve) group which was (0.33±0.013). On the contrary, maximum decrease of FI recorded for carob powder group .Also maximum decrease of BWG and maximum increase of FER recorded for the carob powder group (Table1).

The result of table (1)are in line with that of **Shoeb, Heba(2014)** who found that hypercholesterlemia raise BWG & FI while reduced FER feeding on diets containing phytogenic materials reversed these changes.

Serum glucose:

It could be cleared in table (2) that rats fed on hypercholesterolemic diet (control +ve group) showed significant increase in the serum level of glucose as compared to control(–ve)

healthy group which were (137.4 ±2.20and 61.2±1.20mg\dl) respectively. Rats of hypercholesterolemia and orally administrated with (500 mg/kg .B.Wt.) of carob powder , carob extract , Arabic gum showed significant decreases in serum glucose as compared to control positive group (c+ ve group). Rats of hypercholesterolemic and orally administrated with (500mg/kg b.w.t) of carob powder showed the highest decrease in serum glucose which was (46.1±13.00mg\dl)when compared to control positive group which was (137.4 ±2.20 mg\dl) .

The result of table (4) was in line with that reported by **Shoaeb, Heba(2014)** who found that the serum glucose in urea due to hypercholesterolemia was connected by feeding on diets consuming vegetable & fruits peals formulation corank peels , pomegranate peels parsley and celery.

Phillips and Phillips (2011) found that gum Arabic showed compatibility in diet of patient suffering with diabetes mellitus and reduction of systolic blood preasure , whil may translate into influved cardio vasulars outlnae and reduction in the propolise of renal disease.

Nasir (2013) reported that gum Arabic may be used in treatment of pations with chronic kidney disease GA treatment increase creatinine clearance and decreased urinary excetion of phosphateand plasma urea concentration, urinary, flowfat, glucose uria ,protein urea as well as blood pressure .

Omaima (2014) found that feeding on diets containing gum Arabic *(*Acacia Senegal) in drinking solution reduced serum glucose in 20% glucose solution fed mice.

Effect of collids and their formulation on lipid profile of hypercholesterolemic.

1- Total cholesterol (TC) and triglyceride (TG).

Data recorded in table (3) show the effect of oral administration on total cholesterol ((TC) of hypercholesterolemic rate. Control (+ ve) groups showed significant increase in total cholesterol as compared to healthy rats which were (220±4.00mg\dl) and (68±2.00mg\dl) respectively indicating increase TC of control (+ ve) group . Rats of colloids treatments reversed the change occurring in control (+ve) rats leading to decrease Tc show significant high decrease Maximum

decrease of total cholesterol recorded for carob powder group. All rats administrated with all colloids showed significant decreases in TG as compared to control (+ve) group. It is evident that the best treatment were of groups 3 that orally given carob powder recorded 55 ±3.00 similar trends of change recorded by **Shoaeb, Heba(2014).**

2- HDLc, LDLc & VLDLC.

It is evident in table (4) That rats fed on hypercholesterolemic diet control(+ ve group) indicated significant decrease in HDLc but significant increase in LDLC and VLDLc as compared to normal healthy rats . All rats of hypercholesterolemia , and orally administrated with 500 mg/kg .b.w.t of carob powder , carb extract, arabic gum showed significant increase in HDLC but significant decrease in LDLc and CLDLc levels. Treatment of carob powder showed the highests increase in HDLc but the highest decrease in LDLc and VLDLc compared to control (+ve) positive group .

Shoaeb, Heba (2014) came to same conclusion, reporting that feeding of hypercholesterolemic rats on diets containing admixture of orange peels, pomegranate peals, parsley and celery connected the changes of VLDL, LDL and HDL disorder that the hypercholesterolemia.

Fernandes *et al.*, (2006) found that atherogenic diet (0.14gcholesterol daily):duced hyperlipidemia in rabbits ,with significant increase in TC,LDL,VLDL ,&TG. But treatment with ethanol extract of porpolis (EEP) reversed these changes significant. HDL was also raised

Phillips &Phillips (2011) found that gum Arabic *(Acacia Senegal)* could may be suggested to control the progression of renal disease. **Gado and Aldahmash (2013)** came to same conclusion in rats with renal toxicity leading to correcting of creatinine , urea TBA to control values .

Also **Ali et al., (2013)** confirmed the results indicating that gum Arabic treats the renal disorder inflammations and generation of free radicals.

3- Arthenogenic index (AI)

The obtained results shown in table(5) concerning rats fed on hypercholesterolemic diet (+ ve group) showed significant high increase in arthenogenic index (AI) as compared to healthy rats which were (7.8±1.60and 0.7± 0.20) respectively. All administration rats with all tested colloids showed significantly high decreases in arthigonic index when compared to control (+ve) group. The best of treatments numerically was group3 that of orally administrated rats with carob powder recording AI of (1.1± 0.20), because this group caused the highest decrease of arthenogenic index.

Ali *et al*., (2009) found that gum Arabic ingestion reduced plasma cholesterol concentration in rats.

Melo *et al* ., (2008) inducted that addition of gum Arabic to the diet allocated with flaxseed was beneficial to lipid metabolism leading in particular to the decrease of serum cholesterol.

Abdelwahed *et al.,* (2011) concentrated that the addition of gum Arabic to rats diet has positive effect in lowering serum cholesterol and triacyl glyceral .**Rima et al., (2015)** confirmed these results.

Daily consumption of food products enriched with carob fiber shows beneficial effects on human blood lipid profile and may be effective in prevention and treatment of hypercholesterolemia,(**Zunft *et al ., 2003)***.

Antioxidant enzymes and malondialdehyde (MDA) of hypercholestrolemic rats.

1- MDA, GSH, CAT

Data presented in table (6) indicate the effect of oral treatments with carob powder, carob extract, and Arabic gum on malondialdehylde (MDA) of hypercholesterolemic rats. From the above results it could be observed that there was significant increase of MDA in control (+ ve) as compared to (control– ve) group normal rats. It's evident that the best treatment was that of group 3 where rates administrated with carob powder recording (24.00±3.00 nmol\ml).

Regarding the effect of treatment of hypercholesterolimic rats with colloids on GSH of serum. Result donate that there were significant increase in normal rats as compared to (control + ve) group which were (16±1.00 and 7.00 ± 1.000 u/g) Respectively. All rats administered with colloids showed asignificant increase in GSH as compared to controld + ve groups , it is evident that the best treatment was carob powder which showed GSH value of (16.00+2.00 u/mg) ,bing the same as in control (-) rats ..

In addition on catalase (CAT) activity in hypercholestrolemic rats. It could be cleared that rats fed on hypercholesterolemic diet (c+ve) groups indicated that the mean CAT value was lower than for negative group (healthy rats) which were (41.00±2.00 and 82.00 ± 2.004 u/ mg) respectively.

These results agree with **Makris and Kefalas (2004)** the assessment of the antioxidant potency of carob pod extracts employing two characteristic in vitro models showed that carobs contain polyphenols with appreciable antiradical and reducing properties. The values obtained were compared to the data on red wines and pure polyphenolic antioxidants.

These result similar to **Custodio *et al.*,(2011)** suggested that the antioxidant and cytotoxic activities of carob tree fruit pulps are strongly influenced by gender and cultivar, and provide new knowledge about the advantages of hermaphrodite trees over female cultivars, namely, as a source of compounds with biological interest, which may represent an increase of their agronomic interest.

Gado and Aldahmash (2013) indicate that AG is an efficient cytoprotective agent against Hg-induced nephrotoxicity by a mechanism related at least in part to its ability to decrease oxidative and nitrosative stress and preserve the activity of antioxidant enzymes in kidney tissues.

2- GPX, SOD

According to data illustrated in table (7) the lowering effect of oral treatment of colloids on serum superoxide dismutase (SOD) of hypercholesterolemic rats is evident . There was significant increase of SOD in normal rats (control –ve) as compared to hypercholestrolemic rats which received high fat diet with cholesterol without any colloids

treatment. Values for control (-) and control (+) groups were for them (32.00 ±1.50 and 11.00 ±2.00 u/mg) respectively .The results donated that there were significant increase with all tested of colloids diets as compared to control positive group (c+ ve). It is evident that the best treatment was that of group 3 that orally administrated with carob powder recording (30.00±2.00 u/mg), because this group (3) caused the highest increase in SOD of hypercholesterolemic rats.

Regarding glutathione peroxidase (GPX) of hypercholestero-lemic rats. Such result indicated that rats fed on hypercholesterolemic diet (control + ve group) showed significant decrease in glutathione peroxidase activity as compared to normal rats which revealed (18±2.00 and 43±1.20 ng\ml) respectively. Rats of hypercholesterolemia and orally fed with all tested colloids showed significant increases in glutathione peroxidase when compared to control positive(+ ve) group which were (35±3.00, 25±2.00 and, 31±1.00 ng\ml) for carb powder, carb extract, Arabic gum, respectively. Rats of hypercholesterolemic showed the highest increase GPX in carob powder treatment which was (35±3.00 ng\ml), when compared to control +ve group.

Custodio *et al*., (2011) found that carob seeds were rich in phenolic compound of considerable antioxidant activities, specially the tleoplylline raised. **Ramasamy et al., (2011)** came to same conclusion.

Carob seeds oil **(Matthaus & Ozcan , 2011)** contained much tecopherols important as antioxidants.

Tilili *et al*., (2011) found that seeds of carob contained good level polyphinolic compounds .the oil of seeds contained n-6 and n-3 FA which gives these seeds a dietetic and pharmaceutical importance, especially as antioxidants.

Histopathological results:

The Histopathological structure of the internal organs revealed pronounced changes due to hyperclosterolemia, While feeding on diets containing the tested of the carob seeds group (photos, 1,2,3,4,5,6,7,8).This was in line with the histological &biochemical changes table (1: 7)

Table(1):Effect of oral administration of carob powder , carob extract , and Arabic gum on body weight gain (BWG%), feed intake(FI) and feedefficiency ratio (FER) of hypercholesterolemic rats

Groups & Colloids			BWG (g/42day) Mean ± SD	FI (g/day) Mean ± SD	FER Mean ± SD
Control	(-)	1	35.00±5.00bc	23.70±1.60 c	0.053±0.003a
Control	(+)	2	45.00±3.00a	48.80±2.60a	0.033±0.013a
Carob seeds	Powder	3	30.00±1.00d	17.00±2.00d	0.063±0.01a
	Extract	4	40.00±2.00b	31.80±2.20b	0.045±0.01a
Arabic Gum		5	35.00±2.00bc	25.00±4.00c	0.05±0.03a

Values denote arithmetic means ± Standard deviation of the mean. Means with different letters (a, b, c, d) in the same column differ significantly at p≤0.05 using one way ANOVA test, while those with similar letters denote non-significant difference.

Table (2): Effect of oral administration with carab powder, carob extract, and Arabic gum on serum glucose levels of hypercholesterolemic rats

Groups & Colloids			Serum levels of glucose(mg/dl) Mean ± SD
Control	(-)	1	61±1.20b
Control	(+)	2	137.4±2.20a
Carob seeds	Powder	3	46.1±1.30c
	Extract	4	55.7±3.10b
Arabic Gum		5	60.5±1.1 b

Values denote arithmetic means ± Standard deviation of the mean. Means with different letters (a, b, c, d) in the same column differ significantly at p≤0.05 using one way ANOVA test, while those with similar letters denote non-significant difference .

Table (3): Effect of oral administration of corb powder, carob extract, and Arabic gum on total cholesterol (Tc) and triglyceride (TG) of hypercholesterolemic rats

Groups & Colloids			TC Mean ± SD	TG Mean ± SD
Control	(-)	1	68±2.00c	50±1.00c
Control	(+)	2	220±4.00a	117±2.00a
Carob seeds	Powder	3	72±3.00bc	55±3.00bc
	Extract	4	81±2.00b	65±2.00b
Arabic Gum		5	77±11.00b	59±9.00b

Values denote arithmetic means ± Standard deviation of the mean.Means with different letters (a, b, c, d) in the same column differ significantly at p≤0.05 using one way ANOVA test, while those with similar letters denote non-significant difference.

Table (4): Effect of oral administration with carob powder, carob extract and Arabic gum on the serum levels of lipoproteins fractions (HDLc- LDLc and VLDLC) of hypercholesterolemic rats

Groups & Colloids			HDLc Mean ± SD	LDLc Mean ± SD	VLDLC Mean ± SD
Control	(-)	1	40±2.00a	18±1.00f	10±2.00b
Control	(+)	2	25±3.00d	171.6±2.20a	23.4±2.30a
Carob seeds	Powder	3	35±3.00b	26±2.00e	11±2.00b
	Extract	4	28±3.00c	40 .71±2.00b	13±2.00b
Arabic Gum		5	32±3.00bc	33.2±2.60cd	11.8±1.20b

Values denote arithmetic means ± Standard deviation of the mean. Means with different letters (a, b, c, d) in the same column differ significantly at p≤0.05 using one way ANOVA test, while those with similar letters denote non-significant difference .

Table (5): Effect of oral administration of carob powder, carob extract and Arabic gum on atherogenic index (AI) of hyper- cholesterolemic rats

Groups & Colloids			AI Mean ± SD
Control	(-)	1	0.7±0.20b
Control	(+)	2	7.8±1.60a
Carob seeds	Powder	3	1.1±0.20b
	Extract	4	1.9±0.70b
Arabic Gum		5	1.4±0.20b

Values denote arithmetic means ± Standard deviation of the mean. Means with different letters (a, b, c, d) in the same column differ significantly at p≤0.05 using one way ANOVA test, while those with similar letters denote non-significant difference.

Table (6): Effect of oral administration of carob powder, carob extract and Arabic gum on serum malondialdehyde (MDA) , glutathione (GSH) and catalase (CAT) of hypercholesterolemic rats

Groups & Colloids			MDA (u\mg) Mean ± SD	GSH (u\mg) Mean ± SD	CAT(u\mg) Mean ± SD
Control	(-)	1	17.00±2.00d	16±1.00a	82.00±2.00ab
Control	(+)	2	55.00±2.00a	7.00±1.00c	41.00±2.00d
Carob seeds	Powder	3	24.00±3.00c	16.00±2.00a	83.00±3.00a
	Extract	4	28.00±2.00b	11.00±2.00b	73.00±3.00c
Arabic Gum		5	27.00±2.00bc	12.00±2.00b	79.00±4.00ab

Values denote arithmetic means ± Standard deviation of the mean. Means with different letters (a, b, c, d) in the same column differ significantly at p≤0.05 using one way ANOVA test, while those with similar letters denote non-significant difference.

Table (7): Effect of oral administration of Carob powder, Carob Extract and Arabic gum on superoxide dismutase (SOD) & glutathione peroxidase (GPX) of hypercholesterolemic rats

Groups & Colloids			SOD (u\l) Mean ± SD	GPX (mg/ml) Mean ± SD
Control	(-)	1	32.00±1.50a	43±1.20a
Control	(+)	2	11.00±2.00e	18±2.00e
Carob seeds	Powder	3	30.00±2.00ab	35±3.00b
	Extract	4	22.00±2.00d	25±2.00d
Arabic Gum		5	26.00±2.00bc	31±1.00c

Values denote arithmetic means ± Standard deviation of the mean. Means with different letters (a, b, c, d) in the same column differ significantly at $p \leq 0.05$ using one way ANOVA test, while those with similar letters denote non-significant difference .

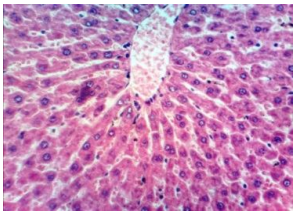
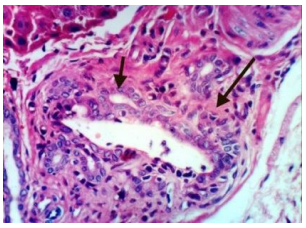
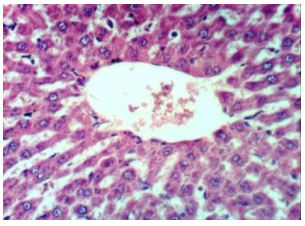
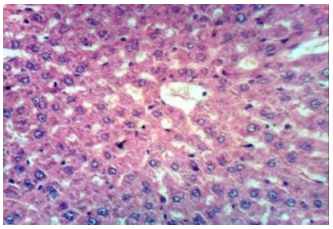
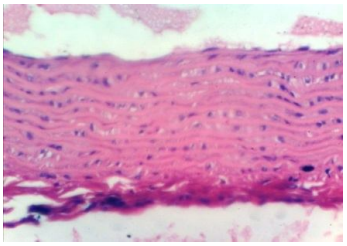
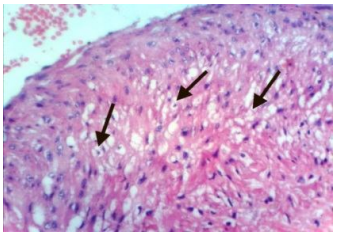
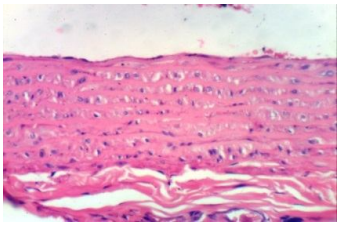
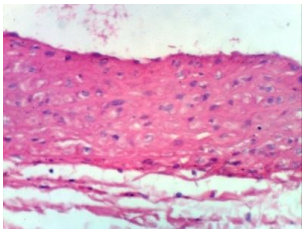
Liver	PHOTO (H & E X 400).
Photo. (1): Liver of rat from group 1(control"_") rats showing the normal histological structure of hepatic lobule.	
Photo. (2): Liver of rat from group 2(hypercholesterolemic rats control"+"basel diet) showing hyperplasia of epithelial lining bile duct and fibrosis in the portal triad	
Photo. (3): Liver of rat from group 5(hypercholesterolemic , carob seeds powder) showing no histopathological changes.	

Photo. (4): Liver of rat from group 6 carob extract, hypercholesterol-emic rats showing no histopathological changes.	
AORTA	**Photo (H & E X 400)**
Photo(5): Aorta of rat from group(1cotrol"-"rats) showing no histopathological changes.	
Photo.(6): Aorta of rat from hypercholesterolemic,(control"+"rats) group 2 showing marked vacuolations of tunica media.	
Photo. (7): Aorta of rat from hypercholesterolemic carob seeds group 5 showing no histopathological changes.	
Photo. (8): Aorta of rat from group hypercholesterolemic carob extract 6 showing no histopathological changes.	

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التأثير المحتمل الخافض للكوليسترول لبعض الغرويات النباتية والحيوانية باستخدام ذكور فئران الألبينو

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أخصائى تغذية

المستخلص العربى

أجريت هذة الدراسة لمعرفة التأثير الوقائى للحد من إرتفاع الكوليسترول بإستخدام (بذور الخروب ،الصمغ العربى والتى إستخدمت بجرعة ٥٠٠ ملجم /كجم من وزن الجسم ولمدة ٤٢يوم لتحسين مستوى الجلوكوز(سكر الدم) ومستويات الدهون(TC,TG,HDL,LDL,VLDL) بالإضافة إلى العوامل المؤكسدة (MDA) والإنزيمات المضادة للأكسدة والتى تشمل(SOD,GSH,CAT&GPX) ٠

تم استخدام٢٥فأر من ذكور الألبينو البيضاء والتى تتراوح أوزانهم بين ١٨٠ ±٢٠٠جم عند بداية التجربة .تم تقسيمهم إلى خمس مجموعات تضم كل مجموعة ٥ من الفئران استخدمت إحدى المجموعات كمجموعة ضابطة سالبة بينما المجموعات الأخرى تم إعطائهم ١,٥% +١٠% دهن (لية خروف) ولمدة ١٥يوم وتم عزل واحدة منهم كمجموعة ضابطة موجبة وباقى المجموعات تم إعطائهم الحقن الفموى من مسحوق بذور الخروب،مستخلص بذور الخروب ،الصمغ العربى بجرعات ٥٠٠ملجم/كجم /من وزن الجسم على التوالى ولمدة ٤٢ يوم . خفضت الجرعات مستوى الكوليسترول الكلى،الجليسريدات الثلاثية والدهون الكلية ومعامل تصلب الشرايين بينما إرتفع معدل الليبوبروتين عالى الكثافة (HDL) وأدى أيضاً العلاج بالغرويات إلى إنخفاض مستويات الجلوكوز (سكر الدم) وزيادة الإنزيمات المضادة للأكسدة مثل (SOD,CAT,GPX)، وأثبتت الدراسات الهيستوباثولوجية توافقاُ مع النتائج البيوكيميائية وعلاوة على ذلك أدت الي تحسن فى معدل كفاءة الإستفادة من الطعام وتوصى الدراسة بأن الغرويات يمكن إستخدامها فى علاج إرتفاع الكوليسترول فى الدم وخاصة إستخدام مسحوق بذور الخروب ومستخلص الخروب ويستخدم بصورة مبسطة بإضافتها إلى الأطعمة وكذلك الصمغ العربى والذى يضاف لكثير من الأطعمة.