Journal of Home Economics
Volume 30, Number (1), 2020
http://homeEcon.menofia.edu.eg

Journal of Home Economics
ISSN 1110-2578

Hypocholesterolemic Effect Evaluation Of Qaisum, Oat Bran And Mustard When Used For Sprague Dawely Male Albio Rats

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Abstract:

This study aimed to investigate the effect of Oat Bran (*Avena sativa*), Mustard (*Brassica nigra*) and Qaisum (*Artemisia vulgaris*) on hypercholesterolemic rats induced by cholesterol powder.

Forty five adult male mature evaluated Albino rats, weighing 160-150 g each, were used in this study rats and divided into 9 equal groups. The first group was kept as a control -ve group, while the other groups were fed on hypercholesterolemic diet for 3 weeks to induce hypercholesterolemic rats. The tested Oat Bran, Mustard seeds and Qaisum were given to the rats at a percent of 3 and 5 % from the basel diet for 28 days. At the end of the experiment, serum total cholesretol (TC), triglycerides (TG), high density lipoprotein (HDL-c), GOT, GPT, ALP, urea, creatinine, uric acid were determined. Low density lipoprotein (LDL-c), very low density lipoprotein (VLDL-c), A.I and glucose were assessed. The results of the obtained data indicated that Oat Bran, Mustard and Qaisum significantly ($P \leq 0.05$) decreased serum TC, TG, LDL, VLDL and A.I while increased HDL.

Also, Oat Bran, Mustard and Qaisum diets improved liver and kidney functions. The obtained findings confirmed the hypothesis that tested plant parts contained several compounds, those are able to ameliorate the adverse effects of raised serum cholesterol and inhibited hypercholesterolemic in rats. The data recommended such plants by moderate amounts in our diets, to make use of health their benefits.

Keywords: TC, TG, HDL-c, LDL-c, liver and kidney function, hypercholesterolemic rats.

Introduction:

Hypercholesterolemia is widely known to be the major risk factor for the development of cardiovascular diseases. It was reported that hypercholesterolemia cause the enhanced production of reactive oxygen species (ROS). Oxidative stress induced by ROS plays an important role in the etiology of atherosclerosis, coronary heart disease **(Kruth, 2001) .**

Since cholesterol is insoluble in water, it is transported in the blood plasma within protein particles (lipoproteins). Lipoproteins are classified by their density; very low density lipoprotein (VLDL), intermediate density lipoprotein (IDL), low density lipoprotein (LDL) and high density lipoprotein (HDL) **(Biggerstaff and Wooten, 2004).**

Mustard is an annual herb that belongs to the division Magnoliophyta, class Magnoliopsida, order Brassicales and family Brassicaceae. The family Brassicaceae consists of 350 genera and about 3500 species like Sinapis, Thlaspi and Brassica **(Saini, 2009).**

The seeds of spice crops like yellow mustard (*Brassica campestris*), commonly known as 'field mustard', and small cardamom *(Elettaria cardamomum*), the 'Queen of spices', are consumed as culinary condiments in India and also across the globe. These spices are reportedly known to possess strong antioxidant, anti-inflammatory and antimicrobial properties **(Ghosh *et al.*, 2015).**

Rahman *et al.*, (2012) reported that the mustard oil treated group was found lower the body weight than that of the control group. The monounsaturated fatty acids and proper ratio of polyunsaturated fatty acid in mustard oil which improve heart health and keeps the balance of cholesterol levels in the body, also lowers triglycerides and prevent obesity.

Qaisum vulgaris (Mugwort or Common Wormwood Family; Compositae) is one of several species in the genus Qaisum with names containing mugwort. It is native to temperate Europe, Asia and northern Africa, but is also present in North America where it is an invasive weed. In traditional herbal medicine, aerial parts of *Qaisum vulgaris* are being used as anti-helminth, antiseptic, antispasmodic, a tonic for vital organs and in various disorders including hepatosis **(Duke *et al.*, 2002).**

Phytochemical analysis of *Qaisum vulgaris* extract revealed the presence of tannins, flavonoids, steroidal saponins, alkaloids, phenolics, and steroids **(Kumar and Kumud, 2011).**

Qaisum is an herbal medicine which has been prescribed for patients with phlegm-stagnation or heating damp in the digestive system including liver. ***Qaisum*** has mainly treated jaundice and liver diseases as a herb component in poly-herb formulae **(Kim and Seo, 2012).**

Kumar and Kumud (2011) has been reported that flavonoids intake decreased LDL-C and increased HDL-C that may hasten removal of cholesterol from peripheral tissue to liver for catabolism and excretion. Extract revealed the presence of tannins, flavonoids, steroidal saponins, alkaloids, phenolics, and steroids .

The oat **(*Avena sativa*)** is a species of cereal grain, and the seeds of this plant, are used for food for people and animals, especially poultry and horses **(Anderson *et al.*, 1994) .**

Oat ***(Avena sativa, L.),*** even if consumed in lower quantities, has an increasing production trend (>25 million tons in 2017) due to its recognition as a healthy food with high bioactive content. Oat whole grains, and specifically their outer parts, are considered rich sources of phenolic compounds with significant antioxidant activity **(Zhang *et al.*, 2014) .**

AL-Rawi, (2007) reported that the cereal grain oat may have potent beneficial health effects in reducing LDL cholesterol and should be included in the prudent diet of individuals with hyperlipidemia. Oat is an important source for water-soluble fibers, and the beneficial effects of oat products on the lipoprotein profile are ascribed to their soluble fiber compound, β-glucan. In addition, oat is a source of antioxidants, such as tocols and various phenolic compounds **(Aly, 2012).**

El Rabey *et al.*, (2013) reported that oat bran had protective effects against induced hyperlipidemia and improved histological alterations. Oat bran appeared more efficient than barley bran in lowering the lipid profile levels in hypercholesterolemic rats.

Materials and Methods:

Plant materials:

Mustard seeds, Oat Bran and Qaisum were obtained from the Ministry of Agriculture. All plants were ground into a powder using an electric grinder which was kept in a frozen plug stopper in a cool, dry place until using. The Oat bran, Mustard and Qaisum was kept in a cool, dry and dark place to reduce the oxidation of their contents.

Rats and diets:

Male albino rats weighing 150-160 g each were purchased from Medical Insects Research Institute, Cairo, Egypt. Cholesterol and basal diet constituents were obtained from El-Gomhoria Company for trady Drug Chemicals and medicals, Cairo, Egypt.

Experimental design:

Forty five male albino rats were housed in healthy condition (21-23ºC) and fed on basal diet for one week before starting the experiment for acclimatization, after this, rats were divided into two main groups, the first group (5 rats) fed on basal diet as a negative control (ve-) and the other main group (40 rats) was fed on 1.5% cholesterol for 3 weeks to induce hypercholesterolemia. All rats classified into 9 groups as follows:

Group (1): Fed on basal diet as negative control (ve+).
Group (2): Fed on basal diet as a positive control (ve+).
Group (3): Fed on diet containing 1.5% cholesterol + 3% Oat Bran.
Group (4): Fed on diet containing 1.5% cholesterol + 5% Oat Bran.
Group (5): Fed on diet containing 1.5% cholesterol + 3% Mustard.
Group (6): Fed on diet containing 1.5% cholesterol + 5% Mustard.
Group (7): Fed on diet containing 1.5% cholesterol + 3% Qaisum .
Group (8): Fed on diet containing 1.5% cholesterol + 5% Qaisum .
Group (9): Fed on diet treated with equalized mixture of all powders.

At the end of the experimental (4 weeks), rats were fasted for 12-h then scarified. Blood samples were collected from the portal vein into dry clean centrifuge tubes for serum separation. Blood samples centrifuged for 10 minutes at 3000 rpm to separate the serum according to **Schermer (1967).**

Serum lipid profile assay:

Cholesterol, TG, HDL-c, LDL-c and VLDL-c were determined according to **Allain *et al.*, (1974), Lopez (1977), Fossati and Prencipe (1982)** and **Lee and Nieman (1996)** respectively. Low density lipoprotein cholesterol and very low density lipoprotein cholesterol calculated according to the following equation:

LDL-Cholesterol = Total cholesterol-(HDL-c + TG/5 (VLDL-c) .

Liver functions assay:

Glutamic oxalic transaminase (GOT), Glutamicpyrovic transaminase (GPT) and alkaline phosphatase (ALP) were determined according to the methods described by **Bergmeyer and Harder (1986), Kachmar and Moss (1976)** and **Varley *et al.*, (1980)** respectively

Kidney functions assay:

Urea, Creatinine and Uric acid were determined according to the methods of **Patton and Crouch (1977), Henry (1974), Trinder (1959),** and **Schultz (1984)** respectively.

Statistical Analysis:

Data were expressed as mean ± standard deviation. In order to compare the groups. Analysis of Variance (ANOVA) test was used. Values with different letters in same column significant different as ($P \leq 0.05$) were considered to be statistically significant according to **SAS (2006).**

Results and Discussion:

Effect of Oat Bran, Mustard and Qaisum on total cholesterol (T.C.) and triglycerides (T.G), (mg\dl) of hypercholesterolemic rats.

Serum TC and TG in normal and hypercholesterolemic rats fed on diets without or with Oat Bran, Mustard and Qaisum are recorded in table (1). Rats fed on high cholesterol diet (control +ve) had a significant increased in serum concentration of TC and TG which recorded 260 ± 2.81 and 99 ± 1.75 mg/dl, respectively compared to control (–ve) group which recorded 80 ± 2.75 and 68 ± 1.19 mg/dl, respectively. Rats fed on high cholesterol diets with Oat Bran, Mustard, Qaisum and their mixture, at levels 3 and 5 % had significant decreases in serum

concentration of TC and TG. As compared to the positive control group. Hypercholesterolemia caused the elevated cholesterol and triglyceride levels in serum. Best treatment for TC and TG seems to be that of Qaisum 3% diet and Mustard 5% respectively.

Table (1): Serum total cholesterol and triglycerides (mg\dl) of hypercholesterolemic rats fed on Oat Bran, Mustard, Qaisum and their mixture

Groups	TC	% change of positive control	LSD (p≤0.05)	TG	% change of positive control	LSD (p≤0.05)
Control (-)	$80^{g} \pm 2.75$	-69.23		$68^{g} \pm 1`.19$	-31.31	
Control (+)	$260^{a} \pm 2.81$	------		$99^{a} \pm 1.75$	-------	
Oat Bran 3%	$146^{c} \pm 2.64$	-43.84		$82.25^{cd} \pm 1.34$	-16.91	
Oat Bran 5%	$189.75^{b} \pm 2.58$	-27.01		$92^{b} \pm 1.68$	-7.07	
Mustard 3%	$129.75^{d} \pm 2.34$	-50.09	4.52	$84.25^{c} \pm 1.63$	-14.89	2.62
Mustard 5%	$120.6^{e} \pm 2.72$	-53.61		$72^{f} \pm 1.84$	-27.27	
Qaisum 3%	$100.75^{f} \pm 2.84$	-61.25		$75^{e} \pm 1.52$	-24.24	
Qaisum 5%	$144.25^{c} \pm 2.94$	-44.51		$80^{d} \pm 1.13$	-19.19	
Mixture	$142.2^{c} \pm 2.11$	-45.30		$80.5^{d} \pm 1.52$	-18.68	

Values are expressed as mean ± SD. Means in the same column with different superscript letters are significantly different ($p \leq 0.05$).

Effect of Oat Bran, Mustard, Qaisum and their mixture on HDL-c, LDL-c, and VLDL-c (mg\dl) of hypercholesterolemic rats

Data in table (2) indicate that rats fed on high-cholesterol diet had suffered of reductions in serum levels of HDL-c (17.2 ± 0.01 mg/dl) when compared with rats fed on basal diet (40 ± 0.8 mg/dl). Rats fed on Oat Bran, Mustard, Qaisum and their mixture showed a higher value in serum level of HDL-c as compared to the positive control group. Results revealed that positive control group had observed increases in serum LDL-c and VLDL-c (223 ± 2.86 and 19.80 ± 0.25 mg/dl), respectively comparing with negative control group (26.4 ± 2.11 and 13.6 ± 0.25 mg/dl). Best treatment seems to be that of Qaisum 3% for LDL-c and the mixture for HDL.

Table (2): Serum HDL-c, LDL-c and VLDL-c (mg\dl) of hypercholesterolemic rats fed on Oat Bran, Mustard, Qaisum and their mixture

Groups	HDL-c	%change of positive control	LSD (p≤0.05)	LDL-c	%change of positive control	LSD (p≤0.05)	VLDL-c	%change of positive control	LSD (p≤0.05)
Control (-)	$40^{a} \pm 0.8$	132.55		$26.4^{g} \pm 2.11$	-88.16		$13.6^{g} \pm 0.25$	-31.31	
Control (+)	$17.2^{f} \pm 0.01$	--------		$223^{a} \pm 2.86$	-------		$19.80^{a} \pm 0.82$	-------	
Oat Bran 3%	$26.45^{bc} \pm 0.005$	53.77		$103.1^{c} \pm 2.48$	-53.76		$16.45^{d} \pm 0.009$	-16.91	
Oat Bran 5%	$26.4^{bc} \pm 0.02$	53.48		$144.25^{b} \pm 2.57$	-35.31		$18.40^{b} \pm 0.003$	-7.07	
Mustard 3%	$22^{e} \pm 0.9$	27.90	0.73	$90.90^{d} \pm 2.73$	-59.23	4.36	$16.85^{cd} \pm 0.002$	-14.89	0.58
Mustard 5%	$23.6^{d} \pm 0.03$	37.20		$82.5^{e} \pm 2.61$	-63.00		$14.40^{f} \pm 0.008$	-27.27	
Qaisum 3%	$24^{d} \pm 0.4$	39.53		$61.75^{f} \pm 1.94$	-72.30		$15^{e} \pm 0.4$	-24.24	
Qaisum 5%	$26.025^{c} \pm 0.008$	51.30		$102.23^{c} \pm 2.54$	-54.15		$16^{d} \pm 0.1$	-19.19	
Mixture	$27.2^{b} \pm 0.06$	58.139		$98.9^{c} \pm 2.86$	-55.65		$16.1^{d} \pm 0.36$	-18.68	

Values are expressed as mean ± SD. Means in the same column with different superscript letters are significantly different ($p \leq 0.05$).

Effect of Oat Bran, Mustard, Qaisum and their mixture on atherogeric index (AI) (mg\dl) of hypercholesterolemic rats

Data in table (3) show that mice fed a high-cholesterol diet were increased in atherosclerosis index (VLDL + LDL / HDL) (14.17 ± 0.75 mg / dL) when compared with the negative control group (0.99 ± 0.003 mg / dL). The groups treated with Oat Bran, Mustard, Qaisum and their mixture showed lower values the AI index compared to the positive control group. Best treatment seems for Qaisum 3% diet.

Our results of tables 1,2&3 are parallel with that obtained by **Abohager ,Sheren(2016); Salah,Aya(2018) ;Taha,Iman(2019); Sherif, Shymaa (2020)** working on other plants of hypercholesterolemic rats. Many authors confirmed our results . The soluble fiber, which is found in oat, has a potential to reduce LDL-C through the increase in intestinal viscosity that may lower cholesterol absorption, although reduced cholesterol absorption was not found in other studies **Naumann *et al.*, (2006). Sayar *et al.*, (2006)** also described a significant reduction of plasma triglyceride concentrations following prolonged intake of diets with high soluble fiber contents. The major mechanism involved in the

hypocholesterolemic effect of soluble fiber (most often consumed as β-glucan from oat) is mediated by increased excretion of bile acids which might explain its cholesterol lowering activity. **AL-Rawi (2007)** reported that the cereal grain oat may have potent beneficial health effects in reducing LDL cholesterol and should be included in the prudent diet of individuals with hyperlipidemia. **Charlton *et al.*, (2011)** concluded that both oat bran and barley bran succeeded in lowering the lipid profile levels in the blood of hypercholesterolemic rats. **El Rabey *et al.*, (2013)** found that hypercholesterolemic rats supplemented with oat bran and barley bran showed significant decrease in lipid parameters, significant increase in high density lipoprotein-cholesterol. **Khan *et al.*, (2014)** showed that the cholesterol, LDL and triglycerides level reduction was found significantly different when raw and processed oat bran diets fed to normal, hypercholesterolemic and diabetic rats. The highest reduction was recorded when fed on diet containing 30% processed oat bran. The processed oat bran exhibited more reduction as compared to raw oat bran. Conclusively, it is suggested that processed oat bran should be introduced in diet based therapy to control lifestyle-related disorders. Dietary fiber is able to bind to bile acids, monoglycerides, free fatty acids and cholesterol. Dietary fiber also decreases absorption and increases the fecal excretion of these chemical substances. The structure of insoluble dietary fiber enables them to directly bind to bile acids and they may lower blood cholesterol levels in this manner, whereas soluble dietary fiber may increase the viscosity of the chyme, thus reducing bile acid diffusion. **Sima *et al.*, (2018)** reported that over the past several decades, it has been suggested that increasing levels of oat fiber, including β-glucans, in the diet leads to a reduction in cholesterol levels.

Biswas *et al.*, (2007) reported that mustard protein hydrolysates (MPH) reduce plasma lipid profiles, LDL lipid peroxidations and liver lipid profiles, suggesting its beneficial effect. **Rahman, *et al.*, (2012)** found that the monounsaturated fatty acids and proper ratio of polyunsaturated fatty acids in mustard oil which improve heart health and keeps the balance of cholesterol levels in the body, also lowers triglycerides. **Mustafizur *et al.*, (2014)** reported that the mustard oil reduce the serum TC, LDL and TG, but had increase the good cholesterol HDL level in the hypercholesterolemic rats. The stronger anticholesterol activity of mustard oil is because of ω-6 PUFAs. **Al-Fartosi *et al.*, (2017)** investigated the effect of mustard oil on body weight and lipid profile in normal and hyperlipidimic mice. The results

showed that mustard oil has effect on reduce serum lipid profile and atherogenic index. **Tiwari and Kumar, (2018)** investigated the anti-diabetic effect of mustard in alloxan induced rats. The results showed that decrease of total cholesterol after diabetic rats treated with aqueous extract *B. nigra* seeds (AEBN) (400 mg/kg) for 21 days.

Dineshkumar *et al.*, (2010) showed that *(Qaisum)* extract significantly ameliorated serum lipid profiles by reducing the values of TC, TG, LDL, VLDL and ratios of TC/HDL and LDL/HDL and elevating HDL levels. **Alkhateeb and Bonen 2010)** reported that *A. absinthium* extract had effects on lipid components, it can be assumed as a potential hypolipidimic agent. **Jang *et al.*, (2012)** investigated the hypolipidemic and antioxidant effects of *Qaisum* using rat model induced by poloxamer-407 injection. The results showed that *Qaisum* ameliorated the elevation of serum total cholesterol, triglyceride and LDL-cholesterol level. **Helal *et al.*, (2014)** reported that supplementation of diabetic rats with Qaisum extract significantly ameliorated serum TC, TG, LDL, VLDL and ratios of TC/HDL and LDL/HDL (risk factors).

Khan (2015) evaluated the hypolipidemic activity of aqueous root extract of Qaisum in cholesterol diet induced hyperlipidemic rats. Qaisum extract showed a significant serum lipid lowering effects in hyperlipidemic rats.

Table (3): Atherogeric Index (mg\dl) of hypercholesterolemic rats fed on Oat Bran, Mustard, Qaisum and their mixture

Groups	AI (HDL/ T.C)	% change of positive control	LSD (p≤0.05)
Control (-)	$0.99^{f} \pm 0.003$	-93.01	
Control (+)	$14.17^{a} \pm 0.75$	----------	
Oat Bran 3%	$4.52^{cd} \pm 0.004$	-68.10	0.43
Oat Bran 5%	$6.18^{b} \pm 0.002$	-56.38	
Mustard 3%	$4.90^{c} \pm 0.008$	-65.41	
Mustard 5%	$4.10^{e} \pm 0.003$	-71.06	
Qaisum 3%	$3.20^{d} \pm 0.007$	-77.41	
Qaisum 5%	$4.54^{cd} \pm 0.005$	-67.96	
Mixture	$4.22^{d} \pm 0.006$	-70.21	

Values are expressed as mean ± SD. Means in the same column with different superscript letters are significantly different ($p \leq 0.05$).

Effect of Oat Bran, Mustard, Qaisum and their mixture on GOT, GPT, and ALP (u\l) of hypercholesterolemic rats.

Data in table (4) show that control negative group was significantly lower in serum level of GOT which was 136.3 ± 10.5 u/l

when compared with control positive group (246 ± 34.12 u/l) . Rats treated with Oat Bran, Mustard, Qaisum and their mixture showed lower values in serum level of GOT as compared to the positive control group. With regard to serum levels of GPT and ALP, results revealed that positive control group had increases in serum GPT and ALP which were 104 ± 3.6 and 276 ± 2.64 u/l respectively comparing with negative control group (38 ± 7.5 and 119 ± 1 u/l). The best treatment was observed for GOT was Qaisum 5% diet and for ALP the Mixture.

Our results of table (4) are agreed with that obtained by **Abohager ,Sheren(2016); Salah,Aya(2018) ;Taha,Iman(2019); Sherif, Shymaa (2020)** who working on other plants of hypercholesterolemic rats. Many authors confirmed our results of the same tables, **Kaur *et al.*, (2006)** assumed that the hepatoprotective factor in of mustard is due to presence of alkaloids, flavonoids, saponins, tannin and terpenoids. **Khaled (2018**) showed that mustard seed has possible potent hepatoprotective action against paracetamol induced hepatic damage in rats. Mustard has powerful antioxidant and hepatoprotective properties against paracetamol induced free radicals damage in the liver. **Khaled, (2018)** evaluated the effects of *Brassica juncea* leaf extracts on carbon tetra chloride albino rat .He concluded that the petrolium ether and ethanolic leaf extract of *Brassica juncea* could be a better drug of choice as a hepatoprotective plant source for the liver patients and decreased serum levels of alanine amino transferase (ALT), aspartate amino transferase (AST), alkaline phospahtase (ALP) significantly. **Tiwari and Kumar (2018)** showed that aqueous extract *B. nigra* seeds (AEBN) seeds might be useful for management of hepatic damage, and other abnormalities associated with this metabolic disorder in alloxan induced rats.

Afifi and Kasabri (2013) reported the reduction in activity of transaminases and GGT in diabetic rats post administration of Qaisum extract for 30 days. This may be due to flavonoids which are active constituents of Qaisum extract and have a potent antioxidant action attenuating the oxidative stress induced by free radicals.

De Miranda *et al.*, (2014) observed that liver enzymes (ALT and AST) were significantly decreased induced hyperlipidemic and treatment by β-glucan from cereals often in male rats compared to positive control group. **Debnath *et al.*, (2018)** studied the antioxidant

had hepatoprotective effects of oat bran extracts. They showed that extracts (50 mg/kg mouse) significantly reduced the levels of malondialdehyde and hepatic damage marker enzymes (aspartate transaminase and alanine transaminase). **Radwa *et al.*, (2019),** reported that the oat bran extracts treatment significantly decreased the activities of AST and ALT compared to those observed in mice with LPS induced liver damage ($p< 0.05$).

Table (4): Serum GOT, GPT, and ALP (U/L) of hypercholesterolemic rats fed on Oat Bran, Mustard, Qaisum and their mixture

Groups	GOT	% change of positive control	LSD ($p\leq0.05$)	GPT	% change of positive control	LSD ($p\leq0.05$)	ALP	% change of positive control	LSD ($p\leq0.05$)
Control (-)	$136.3^{e} \pm 10.5$	-44.5		$38^{g} \pm 7.5$	-63.46		$119^{g} \pm 1$	-56.8	
Control (+)	$246^{a} \pm 34.12$	-------		$104^{a} \pm 3.6$	-------		$276^{a} \pm 2.64$	-------	
Oat Bran 3%	$185^{bc} \pm 2$	-24.8		$86^{b} \pm 1$	-17.3		$238^{b} \pm 2.64$	-13.7	
Oat Bran 5%	$191^{bc} \pm 1$	-22.35		$65.3^{d} \pm 1.52$	-37.21		$151^{f} \pm 1$	-45.28	
Mustard 3%	$204.6^{b} \pm 4.16$	-16.82	20.83	$68^{d} \pm 1$	-34.61	4.75	$229.6^{c} \pm 1.527$	-16.81	5.247
Mustard 5%	$198.6^{b} \pm 4.04$	-19.26		$76.6^{c} \pm 2.081$	-26.34		$198.6^{d} \pm 3.21$	-28.04	
Qaisum 3%	$148^{de} \pm 1$	-39.83		$55^{e} \pm 2.64$	-47.11		$196.6^{d} \pm 1.52$	-28.76	
Qaisum 5%	$145.3^{de} \pm 1.527$	-40.93		$50^{f} \pm 1$	-51.92		$149.6^{f} \pm 8.62$	-45.79	
Mixture	$166.6^{cd} \pm 1.527$	-32.27		$47^{f} \pm 1$	-54.80		$157^{e} \pm 2$	-43.1	

Values are expressed as mean ± SD. Means in the same column with different superscript letters are significantly different ($p \leq 0.05$).

Effect of Oat Bran, Mustard, Qaisum and their mixture on urea, creatinine and uric acid (mg\dl) of hypercholesterolemic rats.

Data in table (5) indicated that control negative group was significantly lower in serum levels of urea, creatinine, and uric acid which were 11 ± 0.9, 0.44 ± 0.009, and 1.1 ± 0.02 mg/dl, respectively when compared with control positive group which were 46 ± 0.25, 1.146 ± 0.0007, and 4.5 ± 0.01 mg/dl, respectively. Rats treated with Oat Bran, Mustard, Qaisum and their mixture showed significantly lower values in serum levels of urea, creatinine and uric acid compared to the positive control group. Best diet revealed for the mixture treatment considering the three parameters.

Our results of table 5 are in agreement with that obtained by **Abohager ,Sheren(2016); Salah,Aya(2018) ;Taha,Iman(2019); Sherif, Shymaa (2020)** working on other plants of hypercholesterolemic rats.

The hypercholesterolemia leads to reduced renal blood flow and increased renal vascular resistance which are factors directly related with the impairment of renal function **(Gervais *et al.*, 2003)**. On the other hand, **El Rabey *et al.*, (2013)** reported that treated and protected rats with β-glucan groups showed significant decrease in urea and creatinine levels when compared to hyperlipidemic group. **Bayrak *et al.*, (2008)** reported that β-glucan protects the tubular epithelium effectively from injury as β-glucan has antioxidant capacity attenuated the renal injury. **Nigam *et al.*, *(*2015)** stated that Oats are important transporters in the proximal tubule of the kidney that are responsible for the excretion of various endogenous substances and organic anion compounds from the body. **Jaikumkao *et al.*, *(2016*)** found that Oat isoforms which have been shown to play a major role in renal excretion are Oat1 and Oat 3. **Wanchai *et al.*, (2018** showed that xylooligosaccharide (XOS) from Oat could indirectly restore renal function and Oat3 function via the reduction of oxidative stress and apoptosis through the modulating of AT1R-PKCα-NOXs activation in obese insulin-resistant rats.

Tunc *et al.*, (2010) reported that methanol extract of *B. nigra (Mustard)* leaves exhibit protective effect against d-GalN-induced renal injury. Biochemical observations were supported by histological examinations of kidney. The group treated with *B. nigra* extract alone proved that the extract is non-toxic and is safe. Based on the antioxidant and anti-inflammatory effects of extract from *B. nigra* leaves may be suggested as a remedy in treatment of renal injury. **Rajamurugan *et al.*, (2012)** demonstrated the protective effect of the methanol extract of *B. nigra* leaves against d-galactosamine (d-GalN)-induced nephrotoxicity in Wistar rats. They showed that the crude methanol extract of *B. nigra* leaf lacks inherent toxicity and exhibits nephroprotective effects against d-GalN-induced toxicity in Wistar rats.

Daradka *et al.*, (2014) showed increase in serum urea and creatinine concentrations, which are considered as a marker of kidney dysfunction and has been corrected by administration of *Qaisum* extracts in alloxan-induced diabetic rats. This effect is due to the antihyperglycemic activity of the *Qaisum*, which might have increased the uptake of glucose by the tissue and its utilization and correct kidney function.

Table (5): Serum urea, creatinin, and uric acid (mg\dl) of hypercholesterolemic rats fed on Oat Bran, Mustard, Qaisum and their mixture

Groups	Urea	%change of positive control	LSD (p≤0.05)	Creatinin	%change of positive control	LSD (p≤0.05)	Uric Acid	%change of positive control	LSD (p≤0.05)
Control (-)	$11^{g} \pm 0.9$	-76.08		$0.44^{h} \pm 0.009$	-61.60		$1.1^{i} \pm 0.02$	-75.5	
Control (+)	$46^{a} \pm 0.25$	-------		$1.146^{a} \pm 0.0007$	-------		$4.5^{a} \pm 0.01$	-------	
Oat Bran 3%	$25.6^{b} \pm 0.02$	-44.34		$0.82^{b} \pm 0.002$	-28.44		$3.5^{b} \pm 0.09$	-22.2	
Oat Bran 5%	$26.3^{b} \pm 0.08$	-42.82		$0.69^{f} \pm 0.008$	-39.79		$3.2^{d} \pm 0.08$	-28.8	
Mustard 3%	$25.5^{b} \pm 0.07$	-44.56	0.67	$0.783^{c} \pm 0.0004$	-31.67	0.008	$3.3^{c} \pm 0.07$	-26.6	0.092
Mustard 5%	$23.26^{c} \pm 0.004$	-49.43		$0.716^{e} \pm 0.0005$	-37.52		$2.8^{e} \pm 0.06$	-37.7	
Qaisum 3%	$22.16^{d} \pm 0.008$	-51.82		$0.74^{d} \pm 0.0003$	-35.42		$2.3^{f} \pm 0.05$	-48.8	
Qaisum 5%	$18^{e} \pm 0.7$	-60.86		$0.716^{e} \pm 0.0004$	-37.52		$1.95^{g} \pm 0.004$	-56.6	
The mixture	$14.6^{f} \pm 0.04$	-68.26		$0.56^{g} \pm 0.006$	-51.13		$1.81^{h} \pm 0.003$	-59.7	

Values are expressed as mean ± SD. Means in the same column with different superscript letters are significantly different ($p \leq 0.05$).

Effect of Oat Bran, Mustard, Qaisum and their mixture on glucose (mg / dl) of hypercholesterolemic rats.

Data in table (6) indicate the mean value of serum glucose (mg\dl) of hypercholesterolemic rats fed on various diets. It could be noticed that the mean value of glucose of control (+) group was higher than control (-) group, being 237 ± 3.71 & 52 ± 2.89 mg\dl respectively, showing significant difference and percent of decrease -78.05 % as compared to control (+)group. All hypercholesterolemic rats fed on

different diets revealed significant decreases in mean values as compared to control (+) group. The percent of decreases were from -37.13 to -69.30 % for different groups . The better treatment was observed four group7 (Qaisum 3%).

Our result of table (6) are in parallel with that obtained by **Abohager,Sheren (2016); Salah,Aya (2018) ;Taha,Iman (2019); Sherif, Shymaa (2020)** working on other plants of hypercholesterolemic rats .

Many authors confirmed our result of the same table. **Sierra *et al.*, (2002)** found that Oat β-glucan was reported to have glucose regulating activity that may be related to the ability of soluble fiber types to hold water and swell, resulting in highly viscous gastric contents that may delay gastric empting and/or intestinal absorption, thereby, reduce postprandial glucose levels and improve insulin sensitivity in both diabetic and non-diabetic persons. **Tapola *et al.*, (2005)** suggested that Oat bran flour high in beta-glucan had a low glycemic response and acted as an active ingredient decreasing postprandial glycemic response of an oral glucose load in subjects with type 2 diabetes. **Chen *et al* ., (2007)** cocluded that consuming food rich in soluble fibers as oats might be a safe, effective and low cost approach for diabetic people at risk of developing heart disease.

Grover *et al.*, (2002) studied the hypoglycemic and anti-hyperglycemic of various strengths (5, 10 and 15%) of *Brassica juncea* seed diet in alloxan and streptozotocin induced diabetes in albino rats. The results showed that *Brassica juncea* diet (10 and 15%) showed significant anti-hyperglycemic effect in alloxan (35 mg/kg) but not in STZ (60 mg/kg) rats. **Biswas *et al.*, (2007)** reported that mustard protein hydrolysates (MPH) reduced serum glucose and increased insulin response on postprandial glucose in diabetic-induced animals, using both the whole plant and mucilaginous extracts. **Tripathi *et al.*, (2011)** stated the hypoglycemic effect of the *Brassica juncea* plant extract on serum insulin levels in STZ-induced diabetic animals. **Thirumalai *et al.*, (2011)** found that the aqueous seed extract of *Brassica juncea* has potent hypoglycemic activity in male albino rat. **Tiwari and Kumar, (2018)** showed that the aqueous extract *B. nigra* seeds (AEBN) showed highly significant blood glucose lowering effect when they investigated the anti-diabetic effect of mustard in alloxan induced rats.

All elevated blood serum markers induced by the alloxan treatment were reduced to significant levels in rats treated with *(Qaisum)* at both medium and high doses (P<0.01 and P<0.001) and also after glibenclamide treatment (P<0.001). **(Daradka *et al.*, 2014). Helal *et al.*, (2014)** demonstrate that Qaisum extract may be of advantage in inhibiting hyperglycemia and ameliorating metabolic abnormalities induced by diabetes in male albino rats.

Table (6): Serum glucose (mg / dl) of hypercholesterolemic rats fed on Oat Bran, Mustard, Qaisum and their mixture

Groups	Glucose mmol\dl	% change of positive control	LSD (p≤0.05)
Control (-)	**$52^{i} \pm 2.89$**	**-78.05**	
Control (+)	**$237^{a} \pm 3.71$**	**----------**	
Oat Bran 3%	**$149^{b} \pm 2.26$**	**-37.13**	**4.73**
Oat Bran 5%	**$90.25^{e} \pm 2.31$**	**-61.91**	
Mustard 3%	**$104.25^{d} \pm 2.36$**	**-56.01**	
Mustard 5%	**$137.25^{c} \pm 2.59$**	**-42.08**	
Qaisum 3%	**$72.75^{g} \pm 2.81$**	**-69.30**	
Qaisum 5%	**$81.50^{f} \pm 2.68$**	**-65.61**	
Mixture	**$105^{d} \pm 2.94$**	**-55.69**	

Values are expressed as mean ± SD. Means in the same column with different superscript letters are significantly different ($p \leq 0.05$).

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Journal of Home Economics, Volume 30, Number (1), 2020

تقييم التاثير الخافض للكوليسترول بالخردل , نخالة الشوفان والقيصوم عند استخدامها للفئران البيضاء

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الملخص العربى:
أجريت هذه الدراسه لمعرفة التأثير المضاد لارتفاع الكوليستيرول لنخالة الشوفان , الخردل , القيصوم ومخلوطهم على الفئران المصابة بارتفاع الكوليسترول . لذلك تم استخدام 45 فأر من ذكور فئران الألبينو والتي تزن 150 - 160 جم حيث تم تقسيمها بالتساوي الى 9 مجموعات , أحدهما استخدمت كمجموعه ضابطه سالبه , بينما باقى المجموعات المختبره 40 فأر قد تم تغذيتهم على الوجبة المرتفعة الكوليسترول لمدة ثلاثة أسابيع لاحداث ارتفاع في الكوليسترول للفئران . ثم تم اضافة نخالة الشوفان , الخردل , القيصوم محل الدراسه الى الوجبه الأساسيه للفئران بنسبة 3 % , 5 % وذلك لمدة 28 يوم . وفي نهاية التجربه تم عمل التحاليل التاليه:
تقدير الكوليستيرول الكلى , الجليسريدات الثلاثيه , الليبوبروتينات مرتفعة الكثافه , الليبوبروتينات منخفضة الكثافه , الليبوبروتينات المنخفضه جدا فى الكثافه ومعامل تصلب الشرايين , كما تم أيضا تقدير كل من وظائف الكبد والكلى . النتائج المتحصل عليها ايدت النظريه التي تقول بوجود تاثير خافض للكوليسترول وكذلك لاثاره الجانبيه بالنسبه للنباتات المذكوره . هذا وقد دلت النتائج على وجود انخفاض معنوي ($p\leq0.05$) في مستويات دهون الدم ووظائف الكبد والكلى , بينما لوحظ وجود ارتفاع معنوي ($p\leq0.05$) في مستوى الليبوبروتينات المرتفعة الكثافه . ويرجع هذا التحسن الى احتواء نخالة الشوفان , الخردل , القيصوم محل الدراسه على العديد من المكونات الحيويه الفعاله التي تحسن من صورة دهون الدم ووظائف الكبد والكلى , نوصى بالاهتمام باستخدام هذه النباتات بكميات معتدلة في وجباتنا اليومية .

الكلمات المفتاحية : الكوليسترول الكلى , الجلسردات الثلاثية , اللبوبروتينات مرتفعة الكثافه , الليبوبروتينات منخفضة الكثافه , وظائف الكبد والكلى , الفئران المصابة بارتفاع الكوليستيرول .