Faculty of Home Economics

Journal of Home Economics
Print ISSN: 2735-5934, Online ISSN: 2735-590X
Menoufia University, Shibin El Kom, Egypt
https://mkas.journals.ekb.eg

Nutrition and Food Sciences

Article Type
Original Article

Nutraceutical Effect of Loquat (*Eriobotrya Japonica*) on Hypercholesterolemic Rats

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DOI:*10.21608/mkas.2023.178157.1195*

Cite as:
Elsherif et al., 2023, Nutraceutical Effect of Loquat (Eriobotrya japonica) on Hypercholesterolemic Rats. J Home Econ. 33(2), 29-40.

Received: 01 Dec 2022
Accepted: 01 Feb 2023
Published: 1 Apr 2023

Printed in Menoufia University, Egypt.

Abstract:
This work aimed to study the effect of loquat leaves and fruits on hypercholesterolemic rats. Thirty-six adult male Sprague Dawley rats were divided into two main groups; the first group was the control negative (-C; n=6), and the other second groups were administered orally (hypercholesterolemic rats) and were divided randomly into five sub-groups (Control positive +C). Groups (G3 & G4) were fed a basal diet supplemented with loquat leaves (4% and 7%, respectively). Groups (G5 & G6) were fed a basal diet supplemented with loquat fruits (4% and 7%, respectively). After 28 days of feeding, the rats were sacrificed, and their serum was collected. Samples. Serum lipids profile and enzyme activity of the liver and kidneys were determined. Hypercholesterolemia caused a significant decrease in HDL-c while a significant increase was recorded in BWG, FI, FER, TC, TG, VLDL-c, LDL-c, uric acid, creatinine, urea, AST, ALT, ALP, and glucose. Hypercholesterolemic rats treated with various diets showed improvement in all previous parameters, especially 7% loquat leaves. In conclusion, rats treated with supplemented7% loquat leaves improved lipid profiles and kidney function; therefore, such leaves are highly recommended for helping with hypercholesterolemia; however, many more human studies are needed.

Keywords: Loquat - Lipid profile - Hypercholesterolemia - Serum -Rats

Introduction

Hyperlipidemia refers to a group of inherited and acquired illnesses characterized by high lipid levels in the body. It is a persistent condition, particularly in the Western hemisphere, but also globally. Hyperlipidemia does not usually cause significant symptoms, yet this underlying pathology frequently leads to primary conditions that can lead to mortality. Establishing an early diagnosis and preventing disease progression is crucial to reduce morbidity and fatality rates associated with this ailment. [1]. Cholesterol is a waxy, fat protein produced by the liver. It is a necessary component of cell barrier construction and signaling transduction, which are involved in many critical physiologic processes. As a result, cholesterol metabolism must be strictly regulated [2]. Hypercholesterolemia, also called high cholesterol, is clinically defined by increased total and low-density lipoprotein (LDL-c) cholesterol levels in the blood. It carries a greater risk of developing atherosclerosis. It is a type of hyperlipidemia, also known as high blood lipids and hyperlipoproteinemia (elevated levels of lipoproteins in the blood) [3].

Loquat (*Eriobotrya japonica, L*.), an evergreen fruit tree in the Rosaceae family, is planted in many countries, including Iran, Spain, Turkey, Tunisia, and Egypt. The leaves and flowers of the loquat tree are used in the treatment of many diseases such as coughs, cancers, skin diseases, colds, and diabetes [4].

Studies indicate the loquat plant has many vital activities such as improvement of, lung, renal, neuronal cells, and liver function. and it has an opposite effect to both anti-allergic, anti-thrombotic potential, antiaging, antinociceptive activities, obesity and hypolipidemic activity [5]. loquat (*Eriobotrya Japonica*) leaves powder has high content of health and nutritional value, loquat leaves can be used to as antidiabetic, anti-hyperlipidemia, and an anti-oxidative damage, anti-hepatic, and kidney damage [6].

sesquiterpene glycosides separated from the loquat leaves led to a decrease triglyceride, total cholesterol [7]. However, the segregated corosolic acid from loquat leaf showed lower blood fat levels, including triglycerides, total cholesterol, HDL cholesterol, and malondialdehyde, blood glucose and increase level HDL-c. The decrease of TC and TG may be due to loquat leaves contain high amount of total sesquiterpene glycosides compounds. Loquat ethanol extracts improved blood, and hepatic lipid profiles and lipid excretion in mice fed a high-cholesterol diet [8, 9].

the explanation of reduction in serum LDL cholesterol, serum VLDL cholesterol, and increase of serum HDL cholesterol after administration of loquat extract may be due to presence of glycosides, alkaloids, and flavonoids [10].

The ethanol fruit extract of *Eriobotrya japonica* (by maceration, 48h) showed significant hypolipidemic action in streptozotocin-stimulated diabetic rats [11].

Loquat fruit was effective in ameliorating the high-fat-diet-induced hyperglycemia, hyperleptinemia, hyperinsulinemia, and hypertriglyceridemia, as well as in reducing the levels of free fatty acid [12].

This work was carried out to investigate the therapeutic effect of loquat leaves and fruits in prevention of side effect of hypercholesterolemia in rats.

2. Materials and methods

2.1. Materials:

Loquat leaves and fruits were obtained from Agricultural Research Station at Sakha, Kafr El-Sheik Governorate, Egypt. In Spring, after drying, the components were crushed to a soft powder using an electric grinder and stored in tightly stoppered glass bottles in a cool and dry location until use according to **[13].** Cholesterol powder was purchase from El-Gomhoria Co. for Trading Chemicals, Drugs and Medical Instrument, Cairo, Egypt. Thirty-six (36) adult male Sprague Dawley rats, average body weight (140 ± 10 g) were used in this study. Rats were obtained from Research Institute of Ophthalmology, Medical Analysis Department, Giza, Egypt.

2.2. Methods:

2.2.1. Basal Diet:

According to **[14]**, the basal diet in the trial consisted of casein (12%), maize oil (10%), mineral mixture (4%), vitamin mixture (1%), cellulose (5%), choline chloride (0.2%), methionine (0.3%), and corn starch (67.5%).

2.2.2. Preparation of hypercholesterolemia:

Rats were housed in wire cages under the normal laboratory condition, and were fed on basal diet for a week as an adaptation period.

According to **[15]** the hypercholesterolemic diet is the basal diet with addition of 1.5% cholesterol and 10% animal fat and 0.02 % bile for feeding rats 3 weeks before beginning the experiment.

2.2.3. Experimental and animal models' design:

Thirty-six adult male rats, weighting 140±10 g was used in the study. The experimental part was done in the Faculty of Home Economics, Menoufia University, Shebin El-kom. Rats were housed in wire cages in a room temperature 25°C and kept under normal healthy conditions. The rats were divided into 6 groups (6 rats in each group). The groups of rats were as follows: **G1 (-ve):** Fed on basal diet only, as negative control. **G2 (+ve):** Hypercholesterolemic rats fed on basal diet. **G3:** Hypercholesterolemic rats fed on basal diet + 4% loquat leaves. **G4:** Hypercholesterolemic rats fed on basal diet + 7% loquat leaves. **G5:** Hypercholesterolemic rats fed on basal diet + 4% loquat fruits. **G 6:** Hypercholesterolemic rats fed on basal diet + 7% loquat fruits.

2.2.4. Biochemical blood analysis:

The rats were sacrificed first under ether anesthesia, and blood samples were obtained at the end of the experiment after 12 hours of fasting via the abdominal aorta. Blood samples were collected in clean, dry centrifuge tubes, where they were allowed to clot at room temperature before being centrifuged for 10 minutes at 3000 r.p.m. to separate the serum. As described by **[16]**, serum was thoroughly extracted and placed into clean cuvette tubes before frozen at -20°C for biochemical analysis. The following parameters were determined for all samples:

Urea levels were tested using the enzymatic method **[17]**. In contrast, creatinine and uric acid levels were obtained using the kinetic method **[18]** and the enzymatic colorimetric test **[19]**. serum glucose was determined according to **[20]**, and e serum levels of total cholesterol (TC), triglyceride (TG), and HDLc were determined according to **[21- 23]**. In addition, LDLc and VLDLc estimation were performed using the equation published by **[24]** as follows:

VLDL-c (mg/dl) = Triglycerides/5

LDL-c (mg/dl) = Total cholesterol – HDL-c – VLDL-c.

Enzymatic colorimetric determination of ALP was carried out according to **[25].** AST and ALT activities were measured according to method described by **[26**, **27]**.

Small specimens from liver, heart and kidneys were collected from all experimental groups, fixed in 10% neutral buffered formalin, dehydrated in ascending concentration of ethanol

(70, 80, and 90%), cleared in xylene and embedded in paraffin. Sections of (4 - 6) µm thickness were prepared and stained with Hematoxylin and Eosin according to **[28]**.

2.2.5. Statistical Analysis:

The SPSS Program was used to examine the data statistically. One-way ANOVA and Duncan's Multiple Range Test were used to determine statistically significant differences. Results are provided as mean and standard deviation, and differences between treatments were considered significant at $P< 0.05$ **[29]**.

Results and Discussion

The mean value of body weight growth (g/week) of hypercholesterolemic rats fed various diets is shown in Table 1. The mean value of BWG in control (+) group was more significant than in control (-) group, being 5.64±0.005 and 1.67±0.009, respectively, indicating a significant decrease when compared to the control (+) group. All hypercholesterolemic rats fed on different levels of loquat leaves and fruits in basal diets had significantly different mean values compared to the control (+) group. Compared to the control (+) group, group 6 (hypercholesterolemic rats fed on loquat fruits 7%) had the highest BWG.

It was demonstrated that the mean value of (FI) of the control (+) group was greater than that of the control (-) group, being 26.60±0.02 & 20.89±0.008 respectively. The best treatment for FI (g/day\rat) recorded for group 4 (rats fed on basal diet with loquat leaves 7%) followed by group 6 as compared to control positive group.

Table (1) also shows that the mean value of (FER) in control (+) group was lower than in the control (-) group, at 0.212±0.0001 and 0.746±0.0008, respectively. There is a substantial change compared to the control (+) group. All hypercholesterolemic rats fed different diets had significantly different mean values compared to the control (+) group when compared to the control (+) group the optimal treatment for FER for group 3 (hypercholesterolemic rats fed on loquat leaves 4%).

Our results of table 1 are in the same line with that obtained by **[30]** loquat significantly decreased the body weight gain in high fat fed mice.

the loquat leaf ethanol extract reduced body weight gain (BWG) and feed intake (FI) of rats with damaged liver **[31]**.

Table (1): Effect of loquat leaves and fruits on body weight gain (BWG), food intake (FI) and feed efficiency ratio (FER) of hypercholesterolemic rats at the end of study

Parameters Groups	BWG (g) Mean ± SD	FI (g) Mean ± SD	FER Mean ± SD
G1: Control –ve	20.89^{c} ± 0.008	0.08^{a} ± 0.0008	
G2: Control +ve	5.64^{a}± 0.005	26.6^{a} ± 0.02	0.21^{b} ± 0.0001
G3: Loquat leaves (4%)	4.25^{b} ± 0.008	21.4^{b} ± 0.009	0.20^{c} ± 0. 009
G4: Loquat leaves (7%)	2.88^{c} ± 0.002	18.48^{e} ± 0.007	0.16^{d} ± 0.0007
G5: Loquat fruit (4%)	2.616^{d} ± 0.0004	19.63^{d} ± 0.003	0.13^{e} ± 0.0005
G6: Loquat fruit (7%)	2.03^{e} ± 0.005	19.57^{d} ± 0.004	0.10^{f} ± 0.0004
LSD	0.01	0.067	0.007

Each value is representing Mean ± SD for each group. Data in the same column with different superscript letters are significantly difference (P≤0.05).
BWG: Body Weight Gain; FI: Food Intake; FER: Feed Efficiency Ratio

According to the data in table (2), the mean value of liver organ (g) in control (+) group was more significant than in control (-) group, at 8.860.005 and 5.820.008, respectively. Compared to the control (+) group, group 4 (fed on 7% loquat leaves) had the highest liver weight .

The mean value of heart (g) in the control (+) group was higher than in control (-) group, with values of 0.920.009 and 0.650.005 g, respectively. Compared to the control (+) group. Group 4 fed on (7% loquat leaves) had the highest heart weight .

Furthermore, the mean value of lung weight (g) of the control (+) group was higher than that of the control (-) group, being 1.380.003 and 1.000.009 g, respectively. Compared to the control (+) group, group 4 (fed on 4% loquat leaves) had the best lung weight .

The mean value of kidney (g) in control (+) group was higher than in the control (-) group, at 1.880.008 and 1.350.003 g, respectively. Compared to the control (+) group, group 4 (fed on 7% loquat leaves) had a higher kidney weight .

The mean value of the spleen (g) in control (+) group was higher than in control (-) group, at 0.930.009 and 0.580.005 g, respectively. Compared to the control (+) group, group 4 (rats fed a basal meal containing 7% loquat leaves) had the highest spleen weight.

Table (2): Effect of Loquat leaves and fruits on organs weight (g) of hypercholesterolemic rats at the end of study

Parameters Groups	Liver (g) Mean ±SD	Heart (g) Mean ±SD	Lungs (g) Mean ±SD	Spleen (g) Mean ±SD	Kidneys (g) Mean ±SD
G1: Control –ve	5.82^{f}±0.008	0.65^{e}±0.005	1.0^{d}±0.009	0.58^{e}±0.005	1.35^{e}±0.003
G2: Control +ve	8.86^{a}± 0.005	0.92^{a}±0.009	1.38^{a}±0.003	0.93^{a}±0.009	1.88^{a}±0.008
G3: Loquat leaves (4%)	6.97^{b}± 0.009	0.85^{b}± 0.008	1.26^{b}± 0.002	0.82^{b}±0.003	1.59^{b}±0.006
G4: Loquat leaves (7%)	6.21^{e}± 0.002	0.61^{f}± 0.007	1.10^{c}± 0.005	0.62^{d}±0.004	1.35^{e}±0.009
G5: Loquat fruits (4%)	6.63^{c}± 0.003	0.76^{c}± 0.001	1.31^{b}± 0.008	0.74^{c}±0.003	1.52^{c}±0.002
G6: Loquat fruits (7%)	6.30^{d}± 0.001	0.67^{d}± 0.004	1.12^{c}± 0.006	0.63^{d}±0.008	1.37^{d}±0.006
LSD	0.009	0.01	0.066	0.01	0.01

Each value is representing Mean ± SD for each group. Data in the same column with different superscript letters are significantly difference (P≤0.05).

Table (3) shows that the control (+) group's mean serum total cholesterol (mg/dl) value was more significant than the control (-) group's, at 202.1±71.65 and 63.1±41.25 mg/dl, respectively. Compared to the control (+) group, group 4 (fed on 7% loquat leaves) had the highest serum total cholesterol .

The control (+) group's mean triglyceride (mg/dl) value was more significant than the control (-) group's, at 112.30±1.39 and 32.00±1.28 mg/dl, respectively. When compared to the control (+) group, group 4 (fed on 7% loquat leaves) had the best blood triglycerides (mg/dl .(

The mean value of high-density lipoprotein (HDL-c) in the control (+) group was lower than in control (-) group, at 29.11±0.008 and 33.00±0.9 mg/dl, respectively. Compared to the control (+) group, all hypercholesterolemic rats fed on different diets showed significant changes in mean values. Serum high-density lipoprotein levels were highest in groups 4 and 6 (7% loquat leaves and 7% loquat fruits, respectively).

The control (+) group's mean value of (LDL-c) was higher than the control (-) group's, at 151.10±1.53 and 23.77±0.008, respectively. Group 4 (loquat leaves) had the highest serum concentration (7%) of LDLc.

The same table data showed the mean serum (VLDLc) (mg/dl) value of hypercholesterolemic rats fed varied diets. The mean value of (VLDLc) of the control (+) group was higher than that of the control (-) group, being 22.40±0.005 & 6.40±0.08, respectively. In terms of serum, the best therapy was reported for group 4 (loquat leaves) at 7%. (VLDLc). The findings are consistent with those of, loquat leaf extract enhanced HDLc while decreasing LDLc and VLDLc in rats with hepatotoxicity **[32]**. Furthermore, the findings are consistent with those of **[33]**, loquat leaf aqueous extract reduced TC and TG in mice fed a high-fat, high-glucose (HFG) diet for ten weeks. The inclusion of flavonoids may have contributed to the effects of the leaf compositions.

Table (3): Effect of Loquat leaves and fruits on some lipid profiles of hypercholesterolemic rats at the end of study

Parameters / Groups	TC (mg\dl) Mean ± SD	TG(mg\dl) Mean ± SD	VLDL(mg/dl) Mean ± SD	HDL(mg/dl) Mean ± SD	LDL(mg/dl) Mean ± SD
G1: Control –ve	63.14^{f} ±1.25	32^{d} ±1.28	6.4^{f}±0.08	33^{a} ±0.9	23.77^{e} ±0.01
G2: Control +ve	202.2^{a} ±1.65	112.3^{a} ±1.39	22.40^{a}±0.00	29.11^{d} ±0.01	151.10^{a} ±1.5
G3: Loquat leaves (4%)	107^{d} ±1.84	87.49^{b} ±1.68	17.50^{d} ±0.00	32^{b} ±0.1	57.50^{c} ±0.01
G4: Loquat leaves (7%)	101^{e} ±1.49	56.68^{c}±1.53	11.34^{e} ±0.00	32.5^{ab} ±0.06	57.16^{c} ±0.01
G5: Loquat fruits (4%)	120^{b} ±1.38	90^{b} ±1.27	18^{b}±0.20	31.8^{c} ±0.04	70.2^{b} ±1.26
G6: Loquat fruits (7%)	114^{c} ±1.71	89^{b} ±1.84	17.8^{c} ±0.07	32.29^{ab}±0.00	63.91^{d} ±1.64
LSD	2.87	2.91	0.16	0.66	1.87

Each value is representing Mean ± SD for each group. Data in the same column with different superscript letters are significantly difference (P≤0.05).

TC: Total Cholesterol; TG: Triglyceride; VLDL: Very Low Density Lipoprotein; HDL: High Density Lipoprotein; LDL: Low Density Lipoprotein

The mean value of blood glucose (mg/dl) in control (+) group was more significant than in control (-) group, as shown in Table (4), at 221.40±1.38 and 98.40±1.22 mg/dl, respectively. Group 4 (given 7% loquat leaves) had higher serum glucose levels than the control (+) group . According to **[10],** an ethanolic extract of loquat fruits reduced blood glucose in diabetic rats. Furthermore**,** loquat leaf extract lowered blood glucose levels in mice fed a high-fat, high-glucose (HFG) diet. The effects could be because loquat leaves contain minerals and polyphenols **[32]**.

Table (4): Effect of loquat leaves and fruits on serum glucose level of hypercholesterolemic rats at the end of study

Treatments Groups	Glucose (mg/dl) (Mean ± SD)
G1: control –ve	98.40^{e} ± 1.22
G2: Control +ve	221.40^{a}± 1.38
G3: Loquat leaves (4%)	129.00^{b} ± 1.58

G4: Loquat leaves (7%)	$111.70^{d} \pm 1.74$
G5: Loquat fruits (4%)	$119.80^{c} \pm 1.39$
G6: Loquat fruits (7%)	$113.50^{d} \pm 1.91$
LSD	2.76

Each value is representing Mean ± SD for each group. Data in the same column with different superscript letters are significantly difference (P≤0.05).

The data in the table (5) show the mean value of serum urea (mg/dl) in hypercholesterolemic rats fed different diets. The control (+) group's mean serum urea value was more significant than the control (-) group's, at 38.20±0.002 and 29.70±0.007 mg/dl, respectively . Group 4 was the most effective treatment for serum urea.

The same table data showed that the mean serum creatinine (mg/dl) value of the control (-) group was lower than the control (+) group, at 0.68±0.009 and 1.10±0.001 mg/dl, respectively. Group 4 (7% loquat leaves) was the most effective treatment for serum creatinine .

Regarding the mean serum (U. A) (mg/dl) value of hypercholesterolemic rats fed different diets. The control (+) group's mean serum uric acid level was more significant than the control (-) group's, at 7.01±0.003 and 5.41±0.004 mg/dl, respectively. Compared to the control (+) group, group (4) received the best treatment .

These findings are consistent with those of **[34]**, who found that an ethanolic extract (50%) of *Eriobotrya japonica* seeds and fruits lowered serum creatinine and urea levels in diabetic rats. In addition, the loquat leaf polysaccharides administration effectively reduced serum creatinine and blood urea nitrogen levels in rats. This action is attributed to the presence of loquat alkaloids, flavonoids, and glycosides **[35]**.

Table (5): Effect of Loquat leaves and fruits on urea, creatinine and uric acid of hypercholesterolemic rats at the end of study

Parameters Groups	Urea (mg/dl) Mean ± SD	Creatinine (mg/dl) Mean ± SD	U.A (mg/dl) Mean ± SD
G1: Control –ve	$29.70^{f} \pm 0.007$	$0.68^{f} \pm 0.009$	$5.41^{f} \pm 0.004$
G2: Control +ve	$38.20^{a} \pm 0.002$	$1.10^{a} \pm 0.001$	$7.01^{a} \pm 0.003$
G3: Loquat leaves (4%)	$31.08^{d} \pm 0.008$	$0.79^{d} \pm 0.007$	$6.59^{c} \pm 0.005$
G4: Loquat leaves (7%)	$30^{e} \pm 0.1$	$0.74^{e} \pm 0.004$	$5.50^{e} \pm 0.008$
G5: Loquat fruits (4%)	$35.20^{b} \pm 0.005$	$0.92^{b} \pm 0.005$	$6.8^{b} \pm 0.06$
G6: Loquat fruits (7%)	$33.50^{c} \pm 0.006$	$0.85^{c} \pm 0.003$	$5.8^{d} \pm 0.03$
LSD	0.073	0.009	0.049

Each value is representing Mean ± SD for each group. Data in the same column with different superscript letters are significantly difference (P≤0.05). UA: Uric Acid

Table (6) shows the mean serum (AST) (U/L) value of hypercholesterolemic rats fed various diets. The mean value of (AST) of the control (+) group was higher than that of the control (-) group, being 961.5 and 711.11, respectively. Compared to the control (+) group, group (4) had the best treatment .

Furthermore, the mean value of (ALT) of the control (+) group was greater than that of the control (-) group, being 112.7±1.46 & 61.47±1.28, respectively. Group (4) demonstrated superior serum (ALT) (U/L) therapy .

Regarding ALP, the control (+) group's mean value was higher than the control (-) group's, at 240.0±1.85 and 111.6±1.5, respectively. In terms of serum ALP therapy, group 4 performed the best .

In ethanol-damaged liver rats, **Lee *et al* [31]** discovered that loquat (*Eriobotrya japonica Lindl*.) leaf extract lowered AST, ALT, and ALP. In addition, *Eriobotrya japonica* leaf extract reduced AST, ALT, and ALP levels in rats with hepatotoxicity. The inclusion of flavonoids may have contributed to the effects of the leaf compositions **[32]**.

Table (6): Effect of Loquat leaves and fruits on AST, ALT, and ALP (U/L) of hypercholesterolemic rats at the end of study

Parameters Groups	AST (U/L) Mean ± SD	ALT(U/L) Mean ± SD	ALP (U/L) Mean ± SD
G1: Control –ve	71^{d} ± 1.11	61.47^{e} ± 1.28	111.6^{d} ± 1.5
G2: Control +ve	96^{a} ± 1.5	112.7^{a} ± 1.46	240^{a} ± 1.85
G3: Loquat leaves (4%)	86^{c} ± 1.8	100.2^{c} ± 1.63	128^{b} ± 1.4
G4: Loquat leaves (7%)	84^{c}± 1.25	89.4^{d}± 1.85	100.2^{e} ± 1.46
G5: Loquat fruits (4%)	91^{b}± 1.4	107^{b}± 1.94	125.5^{b} ± 1.78
G6: Loquat fruits (7%)	89^{b} ± 1.34	103^{c} ± 1.73	122.2^{c}± 1.49
LSD	2.52	2.96	2.83

Each value is representing Mean ± SD for each group. Data in the same column with different superscript letters are significantly difference (P≤0.05).

AST: Aspartate Amino Transferase; ALT: Alanine Aminotransferase; ALP: Alkaline Phosphatase

4. Histopathological results:

4.1. Histopathological examination of liver:

Microscopically, liver sections from group 1 (control -ve) rats revealed the usual histological architecture of hepatic lobules with normal central veins and hepatocytes (Photos 1). On the other hand, animals in group 2 (control +ve) had hepatic vacuolar degeneration (Photo 2) and sinusoidal leukocytes (Photo 3). Meanwhile, rats from Group 3 (4% loquat leaves) had hepatic vacuolar degeneration and mild fibroplasia in the portal triad (Photos 4). However, certain sections from group 4 (7% loquat leaves) showed no histopathological changes (Photo 5), while others showed mild activation of Kupffer cells and hepatic vacuolar degeneration. Otherwise, rats in group 5 (4% loquat fruit) had activated Kupffer cells and congestion of the central vein (Photos 6). However, a few sections from group 6 (loquat fruit 7%) showed minor hepatic vacuolar degeneration of centrilobular hepatocytes (Photo 7), although the majority of sections showed no histological changes (Photos 8).

See Supplementary file

4.2. Histopathological examination of kidneys:

Microscopically, kidneys from group 1 (control -ve) rat demonstrated normal renal parenchyma histological structure (normal renal cortex and renal medulla) (Photos 9). However, kidney sections from rats in group 2 (control +ve) revealed vacuolar degeneration

of the epithelial lining of the renal tubules and the endothelial lining of the glomerular tuft (Photos 10). However, the kidneys of rats from Group 3 (4% loquat leaves) showed no alterations other than vacuolar degradation of the epithelial lining of some renal tubules (Photos 11). Sections from group 4 (loquat leaves 7%), on the other hand, showed no histopathological changes (Photos 12). Meanwhile, rats from Group 5 (4% loquat fruit) had vacuolar degeneration of the epithelial lining of several renal tubules (Photos 13). Otherwise, kidneys from Group 6 (7% loquat fruit) showed no histological changes (Photos 14).
See Supplementary file

Conclusion

To conclude up, from obtained results that the consumption of loquat leaves and fruits improved the serum lipid levels especially the leaves 7% rat groups. Therefore, intake of loquat leaves and fruits could be recommended to exposed hypercholesterolemic patients.

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التأثير التغذوي للبشملة على الفئران المصابة بفرط كوليسترول الدم

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الملخص العربي:
يهدف هذا البحث إلى دراسة تأثير أوراق وثمار البشملة على ذكور الفئران البيضاء المصابة بارتفاع كوليسترول الدم. تم تقسيم ستة وثلاثون من ذكور الفئران من سلالة سبراج داولى أوزانهم (140± 10) جم إلى مجموعتين رئيسيتين ؛ الأولى هي المجموعة الضـــابطة الســـالبة (-C) والثانية تم تغذيتها على نظام غذائي مرتفع الكوليتسرـــول للإصـــابة بفرط كوليسترول الدم ، وقسمت المجموعة الثانية عشوائياً إلى خمس مجموعات المجموعة الضابطة الموجبة (+C) وأربع مجموعات أخرى المجموعة الثالثة والرابعة تغذت على أوراق البشـــملة بنســـبتي (4، 7% على التوالي) ، والمجموعة الخامسة والسادسة تغذت على ثمار البشملة بنسبتي (4، 7% على التوالي) واستمرت التجربة لمدة 20 يوم وفي نهاية التجربة تم وزن الاعضـاء الداخلية (الكبد ،القلب، الكلى، الرئتين والطحال) و تقدير وزن الجسـم المكتسـب والمأخوذ من الغذاء و معدل الاســـتفادة من الغذاء وعينات ســـيروم الدم المجمعة لمســـتويات الجلوكوز في الدم ودهون الدم (الكوليســـترول الكلي والجليسر ـــيدات الثلاثية و والليبوبروتينات مرتفعة الكثافة والليبوبروتينات منخفضـــة الكثافة والليبوبروتينات منخفضة الكثافة جدا) بالإضافة إلى وظائف الكلى (الكرياتينين ، واليوريا وحمض اليوريك). و وظائف الكبد (الجلوتامك أوكســاليك ترانس أمينيز- الجلوتامك بيروفيك ترانس أمينيز- الألكالين فوســفاتيز). أظهرت النتائج أن ارتفاع كوليسترول الدم تسبب في انخفاض معنوي في وزن الجسم المكتسب و المأخوذ الغذائى و معدل الاستفادة من الغذاء والليبوبروتينات مرتفعة الكثافة و زيادات كبيرة في اليوريا والكرياتينين وحمض اليوريك و الكوليســـترول الكلي والجليسر ـــيدات الثلاثية والليبوبروتينات منخفضـــة الكثافة والليبوبروتينات منخفضـــة الكثافة جدا و الجلوتامك أوكســـاليك ترانس أمينيز و الجلوتامك بيروفيك ترانس أمينيز والألكالين فوســـفاتيز بينما اظهرت المجموعات المصـــابة والمتناول كل من اوراق وثمار البشـملة تحســن معنوي في كل القيم الســابقة. الخلاصـة: أظهرت الفئران التي عولجت بأوراق وثمار البشملة تحسنًا في مستوى الدهون ، لذلك توصي الدراسة بضرورة تناول اوراق وثمار البشملة وخصوصا للمرضي المعرضين للارتفاع كولسترول الدم.

الكلمات المفتاحية: البشملة - دهون الدم – ارتفاع كوليسترول الدم - الفئران.