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Serum Hypercholesterolemia Lowering By Seeds Of Doum And Leek In Albino Rats

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Abstract:

This investigation aimed to study the hypocholesteroiemic action of doum palm and leek seeds by the ratio 3 and 5% and probable effect on the weight gain, internal organs weight, feed intake and feed efficiency ratio as calculated for albino rats, and also to clear out their possible therapeutic impacts on the levels of serum glucose, lipid profile, liver functions and kidneys functions via feeding trials. The obtained results showed that the best treatment showing maximum decreasing of serum glucose observed for leek seeds as 5% and for alkaline phosphatase was observed for doum palm seeds as5%. The seeds of doum palm was benefical for correcting the serumlipid profile. The best treatments of serum glutamic oxaloacetate transaminase was that of doum palm seeds and also for serum glutamic pyruvate transaminase. Leek seeds was the best for kidneys functions.

Keywords: Hypercholesterolemic, albino rats, doum palm seeds *(Hypheanethebaica,L.)* and, leek seeds (*Allium. ampeloprasem L.),* serum glucose, lipidprofile,liver functions and kidneys function.

Introduction

According to the lipid hypothesis, abnormal cholesterol levels (hypercholesterolemia¯)actually higher concentrations of low density lipoprotein particles and lower concentrations of functional highdensity lipoprotein particlesare strongly associated with cardiovascular disease because these promote atheroma development in arteries (atherosclerosis'). This disease process leads to myocardialinfarction (heart attack), stroke, and peripheral vascular disease. Since higher blood LDL, especially higher LDL particle concentrations and smaller LDL

particle size, contribute to this process more than the cholesterol content of the HDL particles *(Brunzell et al.,2008).*

LDL particles are often termed "bad cholesterol" because they have been linked to atheroma formation. On the other hand, high concentrations of functional HDL, which can remove cholesterol from cells and atheroma, offer protection and are sometimes referred to as "good cholesterol". These balances are mostly genetically determined, but can be changed by body build, medications, food choices, and other factors Resistin. a protein secreted by fat tissue, has been shown to increase the production of LDL in human liver cells, and also degrades LDL receptors in the liver. As a result, the liver is less able to clear cholesterol from the bloodstream. Resistin accelerates the accumulation of LDL in arteries, increasing the risk of adversely impacts the effects of statins, the main cholesterol- heart diseaseResistin also isreducing drug used in the treatment and prevention of cardiovascular disease*(Durringto,2003).*

Conditions with elevated concentrations of oxidized LDL particles, especially "small dense LDL particles, are associated with atheroma formation in the wall? of arteries, a condition known as atherosclerosis, which is the principal cause of coronary heartdisease and other forms of cardiovascular disease. In contrast, HDL particles (especially large HDL) have been identified as a mechanism by which cholesterol and inflammatory mediators can be removed from atheroma. Increased concentrations of HDL correlate with lower rates of atheroma progressions and even regression. A 2007 study pooling data on almost 900,000 subjects in 61 cohorts demonstrated that blood total cholesterol levels have an exponential effect on cardiovascular and total mortality, with the association more pronounced in younger subjects. Still, because cardiovascular disease is relatively rare in the younger population, the impact of high cholesterol on health is still larger in older people *(Lewingtonet al.,2007).*

A hot water extract from the fruit of *Hyphaenethebaica* was examined for its hydrogen donating activity, Fe^{2+}-chelating activity, hydroxyl radical-scavenging activity, inhibition of substrate site-specific hydroxyl radical formation, superoxide radical-scavenging activity, and reducing power. The total phenolic content of the fruit extract is also determined in order to quantitate antioxidant activity as gallic acid

equivalent (GAE) per ml reaction(*Zenebe etal*.,*2003).*

The total phenolic content of the Doum fruit is low, but the extract exhibited potent antioxidant activity in terms of GAE. The activities expressed as mmol pure compound equivalent per g GAE content of extract are: 2.85 mmol ascorbic acid equivalent, 1.78 mmolethylenediaminetetraacetic acid equivalent,and 192 mmolgallic acid equivalent. These values were of the same magnitude as antioxidant activity in black tea except for Fe^{2+}-chelating activity which was about 14 times more potent. The results show that the fruit of *Hyphaenethebaica"* s fruit is a source of potent antioxidants *(Zenebe etal*.,*2003).*

Other study *Hetta and Yassin (2006)* reported that constituents of the doum exhibited a significant decrease in serum total cholesterol and Non-HDL cholesterol in rats; this can reduce the risk of atherosclerosis and subsequent cardiovascular diseases.

The use of some plants as medicinal plant is due to the presence of flavonoids and saponins (*Waterhouse 2003).* Doum was reported to contain important substances including saponins, tannins, and flavonoids (*Dosumu et al., 2006)* hence the use of doum, which is rich in flavonoids and saponins, in folk medicine is not surprising.

Ehsanpoor et al.,(2001) indicated that leek belongs to the lily family (*Liliaceae*). The main components in leek seeds essence are pentanol (18%), 5,2-methyl furan (7%), octadecan (9%), dipropyldisulphide (5.6%), methyl aliisulphide (4.3%), tetra hydro 5-2 dimethyl tiophone (4.4%) and kamphore (3.2%). These components in leek may cause intestinal cancer reduction while 2-methyl furan causes blood cholesterol reduction, and camphor is also considered as a disinfection component. Differentenzymes such as maltase, doctrinase and invertase are available in leaves, as well as important amounts of iron and vitamin C. Vitamin B_x and B_2 can be found in summer. In addition, leek contains manganese, calcium, phosphorus, sodium, potassium, vitamin A and B_6.Plant tissue- culture technology is very important in agriculture and in industry. (*Ehsanpoor et al.,2001).*

Aim of the study

The present work aimed to investigate the effect of Doum palm and Leek seeds (as 3,5%) on hypercholesterolemic rats and also study the:

1- Effect of above mentioned seeds on body weight gain, feed intake, feed efficiency ratio.
2- Impact of feeding with seeds on lipid profile (TC, TG, HDL_C, LDL_C, $VLDL_C$).
3- Evaluation of serum AST, ALT, ALP ofhypercholesterolemic rats.
4- Influence of feeding with different treatments on kidney function of hypercholesterolemic rats.
5- The histopathological changes of liver & heart of hyper-cholesterolemic rats.

Materials And Methods

Materials

Doum palm and leek seeds purchased from spices shop in Cairo. Casein,vitamins, minerals, cholesterol and bile salts were obtained from Ministry of Agriculture. Male albino rats weighing 150±10gwere get from Animal house, Faculty of Science, Helwan University.

Methods:

Preparation of basal diet:

Basal diet composition of tested rats consisted of casein 20%, sunflower oill0%, choline chloride 2%, vitamins mixture (1%), cellulose (5%), salt mixture (4%), corn starch (up to 100%) according to ***Reeves et al.*, (1993).**

The composition of salt and vitamins mixtures were that of ***Hegested et al.*, (1941*)*** and***Campbell* (1963)**respectively.

Preparation of hypercholesterolemic rats:

Thirty (30) male rats (Spargue - Dawley strain) weighing (150 ± 10) were fed on hypercholesterolemic diet which is the basal diet with addition of 1.5% cholesterol + 0.2% bile salts for feeding rats 3weeks before starting the experiment to induce hypercholesterolemia. All the period of the experiment, the inflicted rats consumed 1.5% cholesterol + bile salts 0.2% ***(Hegsted et al.*,1941).**

Experimental Designs:

All biological experiments were done in the Faculty of Home Economics, Menoufia University, Shebin EL-Kom. Rats were housed in wire cages at a room temperature 25°C and kept under normal healthy conditions.

The rats groups (5 ratspereach) were as follows:

- Group 1 (-ve):healthy rats fed on basal diet only, as negative control.

- Group (2): Hypercholesterolemic rats fed on the basal diet only (as control+ve).

- Group (3): Hypercholesterolemic rats were fed on basal diet containing (3% doum palm seeds) for 28 days.

-Group (4): Hypercholesterolemic rats were fed on basal diet containing (5%doum palm seeds) for 28 days.

-Group (5): Hypercholesterolemic rats were fed on basal diet containing (3% leek seeds) for 28 days.

-Group (6): Hypercholesterolemic rats were fed on basal diet containing (leek seeds 5%)

Each of the above groups was kept in single cage. The diets were introduced to rats in special non-scattering feeding cups to avoid loss of feed and contamination. Tap water provided to rats by means of glass tubes projecting through wire cages from inverted bottles supported.

Biological Evaluation :

Biological evaluation of the different diets was carried out by determination of feed intake daily, and body weight gain every week. The body weight gain g (BWG g/day) and feed efficiency ratio (FER) were calculated according to **Chapman *et*al.,** ***(1959).*** Using the following equations:

Body weight gain (BWG) = Final weight (g) - Initial weight (g)

Feed efficiency ratio (FER) = Gain in body weight (g)/ Feed intake (g).

Blood sample and organs collection:

From all the previously mentioned groups, blood samples collected after 12 hours fasting at tire end of experiment. Using the retro-orbital method, by means of amicrocapillary glass, blood was collected into a dry clean centrifuge tube, and left to clot at room temperature for half an hours. The blood was centrifuged for 10 minutes at 3000 r.p.m to separate the serum. Serum was quite fit plastic tubes and kept frozen at (-20°C) until the time of carefully aspirated and transferred into clean analysis. The organs (liver, kidney, heart, lungs and spleen) were removed and washed in saline solution & weighed.

Biochemical analysis:

The glucose (mg/dl) was estimated according to the methods described by **(AOAC, 2002).** Triglycerides was carried out according to **Fossati and Prencipe (1982)**. The principle used of total cholesterol determinationwas according to **Allian (1979)** and HDL fraction in tire

supernatant determined by the same method used for total cholesterol, according to **Lopez (1977)**. The calculation of serum VLDL (very low density lipoprotein) and LDL carried out according to the method of **Lee and Nieman (1996)**. GPT (ALT) was assessed according to the method of **Henry (1974) andYound (1975)**.GOT was determinedalso according to the method of **Henry (1974)** and**Yound (1975).**Foralkaline phosphatase (ALP): Kits were obtained from Bio-systems S.A.Kits, Barcelona (Spain). Seram ALP was determined according to **IFCC methods(1983).**Serum uric acid was determined in the serum according to the method described by **Barham and Trinder (1972) and Fossati et al., (1980)**.Serum urea was determined in the serum according to die method described by **Patton and Crouch (1977).**SerumCreatinine was determined from colored complex when reacts with alkaline picrate.SerumTotal Bilirubin wasdetermined in the serum according to the method described by***Doumas et al.,(1973).***Direct Bilirubin alsowas determined in the serum according to the method described by ***Charv and Sharma(2004)***.This reaction described by **Faulkner and King (1976).**

2.6-StaticaI Analysis:

The data were statically analysed using a computerized COSTAT program by one way ANOVA. The results are presented as Mean ± SD. Differences between treatments at $p < 0.05$ were considered significant **(Armitage and Berry,1987).**

Results and Discussion:

1- Effect of doum palm and leek seeds on body weight gain (BWG), feed intake (FI) and feed efficiency ratio (FER) of hypercholesterolemic rats.

Data of tables (1,2 and 3) revealed that hypercholesterolemia lowered pronouncedly the BWG of rats; control (-) rats revealed + 258.33% increase compared to that of hypercholesterolemia group. This occurred along with remarkable decrease of FI (from23.28±1.14 to 11.12±0.79 g per day). The reason for that was because of the disorder in metabolism and less utilization of carbohydrates (and energy) as indicated by the appreciably lower FER.

Considerable losses in BWG and FER by hypercholesterolemia were evidently corrected by feeding on basal diets contained doum palm and leek seeds. It is clear that maximum increase of BWG recorded for 5% doum palm seeds group (G4).This group revealed prunounced appetite and FI. At the same time highest FER was found for doum palm seeds 3% remarkable (G3).**El-*Masry, Soheir(2012)*** reported that consumption of doum andmethionine has a best significant treatment effect against increasing of weight gain, food efficiency ratio of hepatic rats.***AL-amer,***

Huda; Rashwan, Nabila (2012)found that values of weight gain, food intake,were increased of hepatic rats fed on doum and doum +selenium.

Zanna et al.,(2008)revealedthatrats administered aqueous root suspension of the doum plant caused increase in body weight compared to the control group.***Anon (2013)***found that Leeks are great for weight loss programs as they have a low calorific value. Also, the significant fiber content helps keep one satiated for long and boosts metabolism.

Table (1): Effect of doum palm and leek seeds on body weight gain (BWG) (g/day/rat) of hypercholesterolemic rats

Parameter / Groups	BWG (g/day/rat) (Mean ± SD)	% of Change
Control-ve (Gl)	**5.59^{a} ± 1.44**	**+ 258.33**
Control+ve (G2)	**1.56^{e}± 1.00**	**--------**
3% Doum palm seeds (G3)	**3.58^{d}± 1.45**	**+ 129.48**
5% Doum palm seeds (G4)	**4.82^{b} ± 1.60**	**+ 208.90**
3% Leek seeds (G5)	**3.62^{d} ± 0.96**	**+ 132.05**
5% Leek seeds (G6)	**4.06^{c} ± 1.48**	**+ 160.25**
L.S.D:P≤ 0.05	**2.42**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤ 0.5.

Table (2): Effect of doum palm and leek seeds on feed intake (FI) (g/day/rat) of hypercholesterolemic rats

Parameter / Groups	FI(g/day/rat) (Mean±SD)	% of Change
Control-ve (Gl)	**23.28^{a} ±1.14**	**+109.30**
Control+ve (G2)	**11.12^{d}± 0.79**	**---------**
3%Doum palm seeds (G3)	**16.28^{c} ±1.28**	**+46.40**
5%Doum palm seeds (G4)	**19.34^{b} ±0.79**	**+73.20**
3% Leek seeds (G5)	**21.28^{ab} ±1.25**	**+91.20**
5%Leek seeds (G6)	**22.28^{a} ±0.6**	**+102.9**
L.S.D:P<0.05	**1.97**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤ 0.5.

Table (3): Effect of doum palm and leek seeds on feed efficiency ratio (FER) of hypercholesterolemic rats

Parameter / Groups	FER (Mean±SD)	% of Change
Control-ve (Gl)	**0.24^{a} ±0.015**	**+71.00**
Control+ve (G2)	**0.14^{d}± 0.01**	**---------**
3%Doum palm seeds (G3)	**0.22^{b} ±0.01**	**+57.10**
5% Doum palm seeds (G4)	**0.19^{bc} ±0.015**	**+35.70**
3%Leek seeds (G5)	**0.17^{c} ±0.02**	**+21.40**
5% Leek seeds (G6)	**0.18^{c} ±0.56**	**+28.50**
L.S.D:p<0.05	**0.024**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤ 0.5.

2-Effect of doum palm and leek seeds on organs weight (g) of hypercholesterolemic rats

Liver weight :

Data of table (4) showed that hypercholesterolemia resulted in an increase of liver weight (%) may be due to infliction with the disease and inflammations; control (-) rats revealed- 39.72% less in weight% than observed for the hypercholesterolemic, both fed on the basal diet seeds used in experimental diets indicated pronounced decreasing of liver weight (%), percent decrease(%) ranging from -39.72% to -11.75%. The doum seeds 3% (group 3) and better treatment showed maximum decreasing ofliver weight was observed for doum palm seeds 3% (group3).

Table (4):Effect of doum palm and leek seeds on liver weight of hypercholesterolemic rats

Parameter / Croups	Liverweight(g) (Mean±SD)	% of Change
Control-ve (Gl)	**4.31^{b} ± 0.77**	**- 39.72**
Control+ve (G2)	**7.15^{a} ±1.04**	**------**
3% Doum palm seeds (G3)	**4.32^{b} ± 1.25**	**-39.58**
5%Doum palm (G4)	**4.40^{b}± 0.807**	**- 38.46**
3%Leek seeds (G5)	**5.36^{ab} ± 0.97**	**- 25.03**
5% Leek seeds (G6)	**6.31^{ab}± 1.20**	**- 11.75**
L.S.D:p<0.05	**1.82**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤ 0.5.

Heart weight:

Data of table (5) indicated that hypercholesterolemia resulted in an increase of heart weight (%) may be caused by infliction with the

disease; control (-) rats revealed -51.74% less in weight than observed for the hypercholesterolemic rats fed on the basal diet, seeds used in experimental dietsrevealed pronounced decreasing of heart weight (%). The doum palm 3% (group 3) was the treatmentandshowed maximum decreasing of heart weight.

Table (5): Effect of doum palm and leek seeds onHeart weight(g) ofhypercholesterolemic rats

Parameter / Groups	Heart weight(g) (Mean±SD)	% of Change
Control-ve (Gl)	**0.69 c ±0.155**	**- 51.74**
Control+ve (G2)	**1.43 a ±0.67**	-------
3%Doum palm seeds (G3)	**0.71 b± 0.105**	**- 50.34**
5%Doum palm seeds (G4)	**0.79 b ± 0.083**	**- 44.76**
3%Leek seeds (G5)	**0.78 b ± 0.141**	**- 45.45**
5%Leek seeds (G6)	**0.76 b ±0.07**	**- 46.85**
L.S.D:p<0.05	**0.52**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤ 0.5.

Kidney weight :

Data of table (6) showed that hypercholesterolemia resulted in an increase of kidneys weight (%) may be due to infliction of the disease; control (-) rats revealed -51.74% less than noticed for the hypercholesterolemic rats fed on the basal diet, seeds used in experimental dietsindicatedpronounced decreasing of kidneys weight (%).The best treatment showed maximum decreasing of kidneys weight was noticed for doum palm seeds 5% (groups4).

Table(6): Effect ofdoum palm andleek seeds on kidney weight (g)of hypercholesterolemic rats

	Kidney(g) (Mean±SD)	% of Change
Control - ve (Gl)	1.00^{d} ±0.10	- 52.38
Control + ve (G2)	2.10^{a} ± 0.10	-------
3% Doum palm seeds (G3)	1.20^{d} ±0.12	- 42.85
5%Doum palm (G4)	1.006^{d} ± 0.09	- 52.00
3%Leek seeds (G5)	1.60^{b}± 0.105	- 23.80
5%Leck seeds (G6)	1.40^{b} ±0.11	-33.33
L.S.D:p<0.0s	0.18	

Values of the same letter in the same column do not differ significantly and vice versa at p ≤0.5.

Spleen Weight:

Data of table (7) illustrated that hypercholesterolemia resulted in an

increase of spleen weight (%) may be caused by inflammation of the disease; control (-) rats revealed -74.26% less in spleen weight than observed for the hypercholesterolemicrats fed on the basal diet, seeds used inexperimental dietsrevealed pronounced decreasing of spleen weight *(%)* compared to control (+) group. Accordingly the better treatment showed maximum decreasing of spleen weight was observed for doumpalm seeds 5% (group 4).

Table(7): Effect ofdoum palm andleek seeds on spleen weight (g) of hypercholesterolemic rats

Parameter / Groups	Spleen(g) (Mean±SD)	% of Change
Control-ve (Gl)	**0.35^{b} ±0.152**	**- 74.26**
Control+ve (G2)	**1.36^{a} ±0.25**	**-------**
3%Doum palm seeds (G3)	**0.700^{b} ± 0.20**	**-48.53**
5%Douin palm seeds (G4)	**0.53^{b} ± 0.15**	**- 61.02**
3%L eek seeds (G5)	**0.93^{b}± 0.15**	**-31.62**
5%Lcek seeds (G6)	**0.93^{b}± 0.15**	**-31.62**
L.S.D:P<0.05	**0.32**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤ 0.5.

Lungs Weight :

Data of table (8) show that hypercholesterolemia resulted in an increase of lungs weight (%) may be due to infliction with the disease; control (-) rats revealed - 47.62% less in weight than noticed for the hypercholesterolemic rats fed on the basal diet. Seeds used in experimental dietsindicated pronounced decreasing of lungs weight (%).The best treatment showed maximum decreasing of lungs weight was noticed for doum palm seeds at 3% level(group3).

Table(8):Effect ofdoum palm andleek seeds on lung weight (g) of hypercholesterolemic rats

Parameter / Groups	Lungs(g) (Mean±SD)	% of Change
Control-ve (Gl)	**1.10^{b} ±0.115**	**- 47.62**
Control+ve (G2)	**2.10^{a} ±0.105**	**-------**
3% Doum palm seeds(G3)	**1.19^{b}± 0.215**	**- 43.33**
5%Doum palm seeds (G4)	**1.21^{b}± 0.215**	**- 42.38**
3%Leek seeds (G5)	**1.42^{d}± 0.22**	**- 32.38**
5%Leck seeds (G6)	**1.31^{b}± 0.205**	**- 37.62**
L.S.D:p<0.05	**0.301**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤ 0.5.

4- Effect of doum palm and leek seeds on serum total cholesterol (T.C.), triglycerides (T.G), high density' lipoprotein cholesterol (H.D.L-c), low density lipoprotein cholesterol (L.D.L-c), very low density lipoprotein cholesterol (V.L.D.L-c) &atherogenic index (A.I) of hypercholesterolemic rats

Total Cholesterol:

Data of table (9) revealed that hypercholesterolemia resulted in marked increase of serum total cholesterol (mg/dl) may be caused by inflicting of the disease; control (-) rats indicated - 53.72% less than observed for the hypercholesterolemic rats fed on the basal diet. seeds used in experimental dietsshowed pronounced decreasing of serum TC ranging from -34.67% to – 45.93%. Therefor numerically the best treatment showed significantly maximum decreasing of serum TC was observed for doum palm seeds 5% (group 4).

Table(9): Effect of doum palm and leek seeds on serum total (T.C.) mg/dl of hyercholesterolemic rats

Parameter / Groups	Cholesterol Total(mg/dl) (Mean±SD)	% of Change
Control-ve (Gl)	**60.11^{e} ± 1.06**	**- 53.72**
Control+ve (G2)	**129.50^{a} ±1.10**	--------
3% Doum palm seeds (G3)	**71.00^{c} ±1.00**	**- 45.93**
5% Doum palm seeds (G4)	**67.66^{d} ± 1.45**	**-47.91**
3% Leek seeds (G5)	**81.16^{b} ± 0.95**	**- 34.67**
5%Leek seeds (G6)	**82.93^{b} ± 1.15**	**-36.10**
L.S.D:P<0.05	**2.01**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤ 0.5.

Serum Triglycerides:

Data of table (10) illustrated that hypercholesterolemia resultedin an increase of serum triglycerides (mg/dl) may be caused by inflicting of the disease; control (-) rats revealed-50.60% -63.70% less than observed for the hypercholesterolemic rats fed on the basal diet, seeds used in experimental dietsrevealed pronounced decreasing of serum TG ranging from -50.60% to -63.70%. The better treatment showed significantly maximum decreasing of serum TG was observed for doum palm seeds 5% (group4).

Table (10): Effect of doum palm and leek seedson serum (T.G) (mg/dl) of hypercholesterolemic rats

Parameter / Groups	Serum triglycerides (mg/dl) (Mean±SD)	% of Change
Control-ve (Gl)	**41.00^{f}± 1.39**	**- 80.90**
Control+ve (G2)	**215.03^{a}+ 1.35**	**-------**
3% Doum palm seeds (G3)	**77.93^{d} + 1.30**	**- 63.70**
5% Doum palm seeds (G4)	**63.10^{e}± 1.35**	**- 70.60**
3%Leek seeds (G5)	**106.00^{b}± 1.20**	**- 50.60**
5%Leek seeds (G6)	**82.00^{c} ± 1.40**	**-61.80**
L.S.D:p< 0.05	**2.37**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤0.5.

Serum very low density lipoprotein cholesterol:

Data of table (11) indicated that hypercholesterolemia resulted in the increase of serum and VLDLc (mg/dl) may be caused by inflicting of the disease; control (-) rats indicated -80.97% less than observed for the hypercholesterolemic rats fed on the basal diet. Seeds used in experimental dietsrevealed pronounced decreasing of serum VLDLc ranging from -63.64% to-70.67%. The best treatment showed significantly maximum decreasing of serum VLDLc was noticed for doum palm seeds at 3% (group 3).

Table (11): Effect of doum palm and leek seeds on serum very lowdensity lipoprotein cholesterol (VLDLc) (mg/dl) of hypercholesterolemic rats.

Parameter / Groups	Serum (VLDL-c) (mg/dl) (Mean±SD)	% of Change
Control-ve (Gl)	**8.20^{d}± 1.10**	**- 80.97**
Control+ve (G2)	**43.11^{a} ±1.06**	**--------**
3% Doum palm seeds(G3)	**12.64^{c} ±1.45**	**- 70.67**
5% Doum palm seeds (G4)	**13.96^{c} ±3.31**	**- 67.61**
3% Leek seeds (G5)	**21.23^{b}± 1.15**	**- 50.60**
5% Leek seeds (G6)	**15.75^{c} ±0.91**	**- 63.64**
L.S.D:P<0.05	**3.17**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤0.05.

Serum low density lipoprotein cholesterol:

Data of table (12) illustrated that hypercholesterolemia resulted in an increase of serum LDLc (mg/dl) may be caused bv inflicting of the disease; control (-) rats indicated -71.45% less than observed for the hypercholesterolemic rats fed on the basal diet, seeds used in experimental dietsshowed pronounced decreasing of serum LDLc

ranging from -38.23% to -65.40%, There for the better treatment indicating maximum decreasing of serum LDLc was observed for doum palm seeds at 5% (group 4).

Table (12): Effect of doum palm and leek seedson serum low density lipoprotein cholesterol (LDLc) (mg/dl) of hypercholesterolemic rats.

Parameter / Groups	Serum (LDL-c) (mg/dl) (Means±SD)	% of Change
Control-ve (Gl)	**16.70^{e}± 1.45**	**- 71.45**
Control+ve (G2)	**58.50^{a} ±1.10**	---------
3% Doum palm seeds (G3)	**27.76^{c} ±1.50**	**- 52.54**
5% Doum palm seeds (G4)	**20.24^{d}± 1.10**	**-65.40**
3% Leek seeds(G5)	**29.63^{c} ±1.45**	**- 49.35**
5% Leek seeds (G6)	**36.13^{b} ±1.04**	**- 38.23**
L.S.D:P<0.05	**2.29**	

Values of the same letter in the same column do not differ significantly and vice versa at $p \leq 0.05$.

Serum high desnity lipoprotein cholesterol :

Data of table (13) revealed that hypercholesterolemia resulted in the decrease of serum HDL (mg/dl) may be caused by inflicting with the disease; control (-) rats indicated +24.10% more than observed for the hypercholesterolemic rats fed on the basal diet .seeds used in experimental diets showed pronounced increasing of serum HDLc ranging from +6.10% to +20.67*%.* The best treatment showed maximum increasing of serum HDLc was observed for leek5% (group6).

Table (13): Effect of doum palm and leek seeds on scrum high density lipoprotein cholesterol (HDL-c)(mg/dl) of hypercholesterolemic rats

Parameter / Groups	Serum (HDL-c) (mg/dl) (Mean±SD)	% of Change
Control-ve (Gl)	**35.14^{a} ± 1.06**	**+ 24.10**
Control+ve (G2)	**28.34^{c} ±1.26**	-------
3%Doum palm seeds (G3)	**30.50^{bc} ±1.10**	**+ 7.73**
5% Doum palm seeds (G4)	**32.03^{b} ±1.05**	**+13.02**
3%Leek seeds (G5)	**34.20^{a} ±1.10**	**+ 20.67**
5% Leek seeds (G6)	**30.04^{bc} ±1.10**	**+ 6.10**
L.S.D:P<0.05	**1.97**	

Values of the same letter in the same column do not differ significantly and vice versa at $p \leq 0.5$.

Serum atherogenic index :

Data of table (15) illustrated that hypercholesterolemia resulted in an increase of serum atherogenic index may be caused by inflicting of the disease; control (-) rats indicated -79.72% less than observed for the hypercholesterolemic rats fed on the basal diet. seeds used in

experimental diet showed pronounced decreasing of serum (Al) ranging from -48.16% to -61.89%. There for the better treatment indicating maximum decreasing of serum (Al) was observed for doum palm seeds at 5%(group4). In since far study***Hetta and Yassin(2006)*** reported that the three fractions of the Doum plant exhibited a highly significant decrease in serum cholesterol and Non-HDL cholesterol of rats. One fraction exhibited a highly significant decrease in cholesterol level but with only a moderately significant effect in decreasing the Non-HDL level. Decreasing Non-HDL, especially LDL, cholesterol, can reduce the risk of atherosclerosis and subsequent cardiovascular diseases. The natural, safe and non-toxic Doum plant could be of great merit for use as a hypercholesterolemic drug.***El-Masry, Soheir(2012)***found that consumption of doum and methionine has a best significant treatmnt effect against the lowest values of Serum cholesterol, total lipid in hepatic rats.***Josline Y. Salib, et al.,(2014)*** evaluate the water extract of the fruits of *Hyphaenethebaica*which were given orally to male albino rats for 30 days toshow its effect on serum cholesterol, triglycerides, lipoproteins: HDL - LDL & VLDL (high - low and very low densitylipoprotein) and apolipoproteins (A-1 & B). Their findings exhibited a highly significant decrease ($p < 0.05$) in all parameters except for HDL which showed insignificant decrease when compared to control group. Thus the water extract can reduce hyperlipidemia in nephrotic syndrome.***Salahet al.,(2011)*** reportedthat diabetes increased serum total lipids, cholesterol, triglycerides and LDL but serum HDL was decreased whilst the induction of flavonoids extract (by methanol) of Kafta, Somma,Araar and Doum reduced these TC,TG,LDLc,VLHLc and increased HDLc in albino rats.***Anon (2015)***reported that many herbalists use the fruit of the *H. thebaica* palm to treat hypertension, diabetes, and other health problems. In early *2010*, researchers at Egypt's Mansoura University studied the effects of extracts from the palm. They found that it lowered high blood pressure, lowered bad cholesterol, and raised the good cholesterol. More studies may reveal more benefits. Archeologists found seeds of the doum palm in tombs of pharaohs, which may indicate that the ancient Egyptians used them medicinally. ***Al-Amer, Huda; Rashwan, Nabila (2012)*** showed that In compared with control (+ve), the values of liver total lipid and cholesterol were significantly decreasedof hepatic rats fed on doum and doum +selemium. ***Zanna et al.,(2008)*** revealed that no statistically significant ($p<0.05$) change in the triglyceridelevelsand increase of cholesterolin the groups of rats administered aqueous root suspension of the doum plant.In since far study***Anon 2015*** reported that studies have shown that members of the allium family have a slight blood pressure lowering effect and may help prevent platelets from clotting which could potentially lead to a heart attack. Leeks can help rid of homocysteine, a molecule that can be very detrimental to cardiovascular health.***Ahmad et al.,(2006)***found thatplasma total cholesterol decreased in all groups treated with *A. porrum* extract in a dose-dependent fashion. Changes in

the distribution of cholesterol in HDL or LDL were found, and LDL cholesterol decreased significantly in all of the groups treated with *A. porrum* extract with respect to the hypercholesterolemic group.

Table (14): Effect of doum palm and leek seeds on **Serum atherogenic index (Al) ratio** of hypercholesterolemic rats

Parameter / Groups	Atherogenic index (Al) (Mean±SD)	% of Change
Control - ve (Gl)	**0.75^{b} ± 0.32**	**-79.72**
Control + ve (G2)	**3.70^{a} ± 1.44**	--------
3% Doum palm seeds (G3)	**1.77^{ab} ± 1.16**	**-52.16**
5% Doum palm seeds (G4)	**1.41^{ab} ± 0.80**	**-61.89**
3%Leck seeds (G5)	**1.44^{ab} ± 0.94**	**-61.080**
5% Leek seeds (G6)	1.92^{ab} ±0.26	**-48.10**
L.S.D:P< 0.05	**1.73**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤ 0.5.

4-Serum Totalproteins (g/dl):

Total protein(g/dl):

Data of table (19) illustrated that hypercholesterolemia resulted in an increase of serum total protein (g/dl) may be caused by inflicting of the disease; control (-) rats indicated +41.42% less than observed for the hypercholesterolemic rats fed on the basal diet. seeds used in experimental diets showed pronounced decreasing of serum total protein ranging from +8.03 to+38.86%. The better treatment indicating maximum decreasing of serum total protein (g/di) was observed forleek seeds at 5% (group6).

Table (19): doum palm and leek seeds on total protein(g/dl)in hypercholesterolemic rats

Parameter / Groups	Total protein (g/dI) (Means ± SD)	% ofChange
Control-ve (Gl)	**7.75^{a} ± 0.68**	**+41.42**
Control+ve (G2)	**5.48^{b} ± 0**.66	-------
3%Douni palm seeds (G3)	**5.92^{b} ± 0.82**	**+8.03**
5% Doum palm seeds (G4)	**6.16^{ab} ± 0.69**	**+12.40**
3% Leek seeds (G5)	**6.82^{ab}**± 0.61	**+24.45**
5% Leek seeds (G6)	**7.61^{a}± 0.61**	**+38.86**
L.S.D:p<0.05	**2.38**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤ 0.5.

Serum albumin (g/dl)

Data of table (20) illustrated that hypercholesterolemia resulted in an increase of serum albumin (g/dl) may be caused by inflicting the disease; control (-) rats indicated +296.95% less than observed for the hypercholesterolemic rats fed on the basal diet.Seeds used in

experimental diets showed pronounced decreasing of serum Albumin (g/dl) ranging from +287.02% to +38.17%. The better treatment indicating maximum decreasing of serum albumin (g/dl) was observed for leek seeds5% (groups 6).

Table (20): doum palm and leek seeds level as effecting on albumin (g/dl) of hypercholesterolemic rats.

Parameter / Groups	Albumin(g/dl) (Mean±SD)	% of Change
Control-ve(G l)	**5.2^{a}± 1.30**	**+296.95**
Control+ve (G2)	**1.313^{b} ±1.02**	**--------**
3% Doum palm seeds (G3)	**1.806^{b}± 1.01**	**+38.17**
5% Doum palm seeds (G4)	**2.25^{b} ±1.045**	**+71.75**
3% Leek seeds (G5)	**4.63^{a} ±1.38**	**+253.43**
5% Leek seeds (G6)	**5.07^{a} ± 1.385**	**+287.02**
L.S.D:p<0.05	**2.14**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤ 0.5.

Serum Globulin (g/dl)

Data of table (21) illustrated that hypercholesterolemia resulted in an increase of serum Globulin (g/dl) may be caused by inflicting the disease; control (-) rats indicated -38.13% less than observed for the hypercholesterolemic rats fed on the basal diet.Seeds used in experimental dietsshowed pronounced decreasing of serum(g/dl) ranging from -47.48% to -1.44%. The better treatment indicating maximum decreasing of serum globuline (g/dl) was observed for leek seeds 5% (groups 6).

Table (21): doum palm and leek seeds level as effecting on globulin (g/dl) of hypercholesterolemic rats.

Parameter / Groups	Globulin (g/dl) (Mean+SD)	% of Change
Control-ve(G l)	**2.55^{a}± 0.779**	**-38.13**
Control+ve (G2)	**4.17^{b}±0.612**	**------**
3% Doum palm seeds (G3)	**4.11^{b}± 0.515**	**-1.44**
5% Doum palm seeds (G4)	**3.91^{c}± 0.755**	**-6.23**
3% Leek seeds (G5)	**2.19^{d}±0.529**	**-47.48**
5% Leek seeds (G6)	**2.54^{a}± 0.703**	**-39.02**
L.S.D:p<0.05	**1.16**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤ 0.5.

5- Effect of doum palm and leek seeds level on kidney function hypercholesterolemic rats

Serum Creatinine (mg/dl)

Data of table (22) illustrated that hypercholesterolemia resulted in an

increase of serum creatinine (mg/dl) may be caused by inflicting the disease; control (-) rats indicated -58.67% less than observed for the hypercholesterolemic rats fed on the basal diet. seeds used in experimental diets showed pronounced decreasing of serum creatinine (mg/dl) ranging from -13.30% to -44.00%. Thebetter treatment indicating maximum decreasing of serum creatinine (mg/dl) was observed for leek seeds3% (groups 5).

Table (22): Doum palm andleek seeds level as effecting on creatinine (mg/dl) of hypercholesterolemic rats.

Parameter / Groups	Creatine(mg/dl) (Mean±SD)	% of Change
Control-ve(G l)	**0.31^{c} ±0.110**	**- 58.67%**
Control+ve (G2)	**0.75^{a} ± 0.0980**	**-------**
3% Doum palm seeds (G3)	**0.65^{ab}± 0.098**	**- 13.30%**
5% Doum palm seeds (G4)	**0.45^{bc} ± 0.090**	**- 40.00%**
3% Leek seeds (G5)	**0.42^{bc} ±0.115**	**- 44.00%**
5% Leek seeds (G6)	**0.44^{bc} ± 0.087**	**-41.33%**
L.S.D:p<0.05	**0.178**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤0.5.

Serum Urea (mg/dl):

Data of table (23) show that hypercholesterolemia resulted in an increase of serum urea (mg/dl) may be caused by inflicting the disease; control (-) rats indicated -68.00% less than observed for the hypercholesterolemic rats fed on the basal diet. seeds used in experimental diets showed pronounced decreasing of serum urea (mg/dl) ranging from -60.10% to -51.50%, the best treatment revealed maximum decreasing of serum urea (mg/dl) was observed for leek seeds at 3% (group 5).

Table (23): doum palm andleek seeds level as effecting on urea (mg/dl) of hypercholesterolemic rats

Parameter / Groups	Urea (mg/dl) (Mean±SD)	% of Change
Control-ve (G1)	**11.31^{e}± 0.97**	**-68.00**
Control+ve (G2)	**35.40^{a} ± 1.086**	**-------**
3% Doum palm seeds (G3)	**17.35^{be} ±0.74**	**-51.50**
5% Doum palm seeds (G4)	**16.17^{c} ±1.056**	**- 54.32**
3% Leek seeds (G5)	**14.10^{d}± 1.29**	**-60.10**
5% Leek seeds (G6)	**19.25^{b} ±1.47**	**- 45.60**
L.S.D:P<0.05	**2.05**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤0.5.

Serum uric acid (U.A.) (mg/dl)

Data of table (24) illustrated that hypercholesterolemia resulted in an increase of serum uric acid (mg/dl)may be caused by inflicting the disease; control(-) rats indicated -59.90% less than observed for the rats fed on the basal diet, Seeds used in experimental diets showed pronounced decreasing of serum uric acid (mg/dl)ranging from -29.50% to -51.54%. Significantly the better treatment indicating maximum decreasing of serum uric acid (mg/dl) was observed for leek seeds 5% (group 6).***Zannaetal.,(2008)***reported that there was no statistically significant ($p<0.05$) change in the levels of urea, potassium &chloride in the treatment groups,however levels of sodium ions decreased and that of creatinine increased significantly ($p<0.05$) in all the groups administered aqueous root suspension of the doum plant compared to the control group.

Table (24): doum palm and leek seeds on serum uric acid (mg/dl) of hypercholesterolemic rats

Parameter / Groups	Uric acid (mg/dl) (Mean±SD)	% of change
Control-ve (Gl)	**0.91^{b}±0.19**	**- 59.90**
Control+ve (G2)	**2.27^{a}±0.39**	-----
3% Doum palm seeds (G3)	**1.60^{ab}±0.45**	**- 29.50**
5% Doum palm seeds (G4)	**1.46^{ab}±0.46**	**- 35.60**
3% Leek seeds (G5)	**1.37^{ab}±0.65**	**- 39.60**
5% Leek seeds (G6)	**1.10^{b}±0.10**	**- 51.54**
L.S.D:P<0.05	**0.73**	

Values of the same letter in the same column do not differ significantly and vice versa at $p\leq 0.5$.

6-Effect of doum palm and leek seeds level on serum bilirubin hypercholesterolemic rats

Serum total bilirubin :

Data of table (25) illustrated that hypercholesterolemia resulted in an increase of serum totalBilirubin(u/L may be caused by inflicting the disease; control (-) rats indicated -50.61% less than observed for the hypercholesterolemic rats fed on the basal diet.Seeds used in experimental dietsshowed pronounced decreasing of serum total bilirubin(u/l) ranging from-19.25% to -39.50%. The better treatment indicating maximum decreasing of serum total bilirubin(u/l) was observed for doum palm seeds 5% (groups 4).

Table (25): doum palm and leek seedson serum totalbilirubin (T.Bil)(U/L) of hypercholesterolemic rats

Parameter / Groups	Total Bilirubin(U/L) (Mean±SD)	% of change
Control-ve (Gl)	**0.40^{b}+ 0.10**	**-50.61**
Control+ve (G2)	**0.81^{a} + 0.10**	**-----**
3% Doum palm seeds (G3)	**0.503^{b} ±0.10**	**- 37.90**
5% Doum palm seeds (G4)	**0.49^{b} ± 0.67**	**- 39.50**
3% Leek seeds (G5)	**0.60^{b} ± 0.10**	**- 25.92**
5% Leek seeds (G6)	**0.65^{ab}± 0.07**	**- 19.25**
L.S.D:P<0.05	**0.17**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤ 0.5.

Serum Direct Bilirubin:

Data of table (26) illustrated that hypercholesterolemia resulted in an increase of serum direct bilirubin(u/l) may be caused by inflicting the disease; control (-) rats indicated -55.70% less than observed for the hypercholesterolemic rats fed on the basal diet. Seeds used in experimental diet showed pronounced decreasing of serum direct bilirubin(u/l) ranging from -14.20% to -57.20%. The better treatment indicating maximum decreasing of serum direct bilirubin (u/l) was observed for doum palm seeds 5% (groups 4).

Table (26): doum palm and leek seedson serum directbilirubin (D.Bil)(U/L) of hypercholesterolemic rats

Parameter / Groups	Directbilirubin(U/L) (Mean+SD)	% of change
Control+ve(Gl)	**0.31^{c}± 0.105**	**- 55.70**
Control+ve (G2)	**0.70^{a} ±0.11**	**-------**
3% Doum palm seeds (G3)	**0.306^{bc} ±0.11**	**- 56.20**
5% Doum palm seeds (G4)	**0.301^{c}± 0.0.10**	**- 57.00**
3% Leek seeds (G5)	**0.50^{abc} ± 0.10**	**- 28.50**
5% Leek seeds (G6)	**0.60^{ab} ± 0.10**	**- 14.20**
L.S.D:P<0.05	**1.05**	

Values of the same letter in the same column do not differ significantly and vice versa at p≤ 0.5.

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الخفض المحتمل لارتفاع الكولسترول في السيرم بواسطة بذور الدوم والكرات في الفئران البيضاء

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تم إجراء هذه الدراسة الحالية لمعرفة تأثير كل من بذورالدوم والكراتبنسبة ٣، ٥% على فئران مصابة بارتفاع كولسترول الدم. و قد أجريت هذه الدراسة على٣٠ فأر أبيض بالغ يتراوح وزن كل منهم (١٠٠ ±١٠ جم)، تم تقسيمهم إلى ٦ مجموعات (٥ فئران ذكر). المجموعة الأولى تم تغذيتها على الغذاء الأساسي (كمجموعة سالبة), أماباقي المجموعاتفتتغذى على الغذاء مضافا إليه(١.٥ % كولسترول +٠.٢ أملاح الصفراء) وذلك لإصابة الفئران بارتفاع كولسترول الدم,المجموعة الثانية تركت كمجموعة ضابطة موجبة وتم تغذيتها على الغذاء الأساسيوالمجموعات المتبقية للفئران المرتفعة الكولسترول تم تغذيتها على الغذاء الأساسي مضافا إليه بذور الدوموبذور الكرات بنسبة (٣, ٥ %)لمدة ٤ أسابيع. وفى نهاية التجربة تم أخذ عينات الدم من جميع الفئرانوتم فصل السيرم لقياس المؤشرات البيولوجية التالية: الكولسترول الكلى (TC), الجليسريدات الثلاثية(TG), الليبوبروتينات (VLDL-c,HDL-c,LDL-c), وحساب مؤشرتصلب الشرايين (AI)، اليوريا والكرياتينين وحمض اليوريكوإنزيمات الكبد (ALT,AST,ALP) وجلوكوز الدم. كما تم أخذ وزن أعضاء الكبد والقلب والكلى والطحال والرئتين. أشارت النتائج إلى أنتغذية الفئران ببذور الدوم والكرات أدى إلى حدوث انخفاض كبير في (TC)، (TG)، (LDLc)، (VLDLc)مع ارتفاعHDL-cمع انخفاض فيمستوى السكر في الدم والكرياتينين وحمض اليوريك، ALT، AST وALP، بالمقارنة مع مجموعة المقارنة الموجبة.وهذه المعالجة يوصى بها لكى ينخفض مستوى دهون الدم للمرضى الذين يعانون من ارتفاع الكولسترول.

الكلمات المفتاحية:

بذور الدوم، بذور الكرات، مرض ارتفاع الكوليسترول, مستوى الجلوكوز في الدم، وظائف الكلى, وظائف الكبد, دهون الدم.