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LIPID –LOWERING EFFECT OF ARTICKOKE ON PLASMA LIPIDS IN HYPERLIPIDEMIC RATS

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ABSTRACT: The present study was designed to investigate: The chemical composition of *artichoke* fruit and leaves, the phenolic compounds content, antioxidant activity of fruit and leaves extracts of *artichoke*, and evaluation the effect of *artichoke* fruit and leaves on plasma lipid profile. Treatment with artichoke fruit and leaves reduced all lipid profile significantly (triglycerides, total cholesterol, LDL-cholesterol, risk ration and atherogenic index) and that artichoke leaves gave more effect than that of fruit. Reducing power and DPPH assay were used to evaluate the antioxidant activity of aqueous, acetone, methanolic extracts of *artichoke* fruit and leaves. For reducing power assay the reducing power of methanolic extract of fruit and leaves was higher than the other two extracts. For DPPH assay, the antioxidant potential of *artichoke* leaves and fruit extracts were further highlighted by the quenching of DPPH free radicals. The values of absorbance for fruit extract ranged from 74.2 to 92.1 and 74.3 to 92 for leaves extracts .

The antimicrobial activities against 6 types of bacterial strains, Proteus vulgaris, Escherichia coli, Klebsiella pneumonia, Staphylococcus aureus, Bacillus subtilis, and Streptococcus. The obtained results indicate that 400 mg / ml concentration exhibited the highest inhibitory effect on bacteria activity.

Key words: Artickoke, hyperlipidemia, plasma lipids.

INTRODUCTION

Since disease, decay and death have always coexisted with life, the study of diseases and their treatment must also have been contemporaneous with the dawn of the human intellect. About a generation ago, the use of plants and herbs as remedial agents was greatly discredited. In the same way as we divide the civilization into 4 stages, we may recognize that 4 stage crude drugs were employed, in the first one , they were prepared in the roughest manner such as powder form . In the next stage, these were converted into more active and more manageable forms, such as extracts or solutions . In third stage pure active principles, separated from the crude drugs were employed. In the fourth stage instead of attempting to extract our medicines from the natural products acoording to Lupattelli et al ., (2004)

We seek to make for ourselves such substances as shall possess the particular action we desire. From this, It can be said that the study of medicinal plants serve as a basis of synthetic chemistry also. The study of medicinal plants is neglected by medical men all over the world . It is our misfortune that the chemistry and pharmacology of most of these plants have not been properly investigated. The easy and cheapness of which make them procurable and marvelous powers in the cure of different diseases encourage us to investigate their properties and prove their pharmacological actions .

Hyperlipidemia is a condition when abnormally high levels of lipid i.e. the fatty substances are found in the blood. This condition is also called hypercholesterolemia and hyperlipoproteinemia. The human body is complex machinery and for maintaining the home ostasis of various organs and organ systems, any undesirable change will disturb the balance resulting in the diseased state. Lipids or fats in the blood stream, commonly divided into cholesterol and triglycerides. Cholesterol circulates in the blood stream and is involved in the structure and function of cells. Triglycerides (TG) are best viewed as energy, that is either

used immediately or stored in fat cells . TG is manufactured in the liver from the foods or by being absorbed from the intestine . Virch and Thrombose (1856) identified cholesterol crystals in atherosclerotic . *Artichoke (Cynara scolymus L.)* belongs to the family Asteraceae . *Artichoke* leaves have been used as herbal medicines for a variety of diseases such as dyspepsia and digestive disorders **(**Thompson-Coon and Ernst , 2003)**.** They added that hypercholesterolemia , higher concentrations of LDL (low density lipoprotein) and lower concentrations of HDL (high density lipoprotein) , is strongly associated with atherosclerosis . This disease process leads to myocardial infarction, stroke and peripheral vascular disease. Many plants were explored to reduce blood cholesterol such as fenugreek, *artichoke*, yarrow , red yeast rice and eggplant . *Artichoke* fruit and leaves have high medical value as well as, different plant parts which possess varied uses to mankind . Different parts of the *artichoke* were also used for its antimicrobial, antioxidant, antibacterial, antifungal, and radical scavenging. *Artichoke (Cynara scolymus L.)* is a perennial thistle originating in southern Europe around the Mediterranean (Lupattelli et al ., 2004) .

MATERIALS AND METHODS

Plant and collection and identification:

Fruit and leaves of Egyptian Artichoke (Cynara scolymus L.) were obtained from research center department of medical and aromatic plants, Giza, Egypt. The fruit and leaves of plant were identified by botanical members of the department of botany, faculty of agriculture, Menoufia university. The fruit and leaves were allowed to dry in a shady and well-aired place, then dried at 50 ^{o}C and grinded into a powder state using commercial blender and finally used for analysis.

Chemical composition of *artichoke (Cynara scolymus L.)* fruit and leaves:

Determination of moisture content: According to A.O.A.C., (2000).

Determination of ash : According to A.O.A.C., (2000).

Determination of crude fiber : The crude fiber in fat free sample was estimated by digesting firstly with 1.25 % H_2SO_4 for 30 min and then with 1.25 % NaOH solution as described in AOAC Method by Koly , et al ., (2011) ,

Determination of crude protein: Total nitrogen was determined (dry basis) according to the modified method of Kjeldahl , and Pekka . (1996)**,** the crude protein contents were calculated using the conversion factor 6.25 .

Protein % = TN (Total Nitrogen) x 6.25 .

Extraction and determination of crude lipid according to A.O.A.C., (2000).

Determination of total carbohydrate: Total carbohydrate or non-nitrogen extract was determined by :

Difference = 100 – (% ash + % Protein + % Fat + % crude Fiber)

Determination of free phenolic compounds: The concentration of free phenolic compounds in the methanol extract, was determined colorimetrically by the method of folin as described by Gulcin, and Oktay., (2002) ,

On the side, The total flavonoid contents were determined using the method reported by Dewanto and Wu., (2002)**.** On the same concept, the quantitative analysis of phonilic components was determined using by

High Performance Liquid Chromatography (HPLC), A modified method of Zao, et al., (2002).

In vitro antioxidant activity diphenly-α-picrylhydrazyl (DPPH) radical scavenging activity:

The antioxidant activity of the fruit and leaves watery, acetone, methanol extracts, and the standard were assessed on the basis of the radical scavenging effect of the stable 2,2-diphenyl -2- picrylhydrazyl (DPPH) - free radical activity by modified method of Baraka et al. (2001)**.** The diluted working solution of the test extracts was prepared in solvent, (ascorbic acid was used as standard) and mixed with 1.0 ml of sample solution and standard solution separately.

these solution mixtures were kept in dark for 30 min and optical density was measured at 517 nm using spectrophotometer . Methanol (1 ml) with DPPH solution (0.002% , 1.0 ml) was used as blank . The optical density was recorded and % inhibition was calculated using the formula given below :

Percent (%) inhibition of DPPH activity =

$$A - B / A \times 100$$

Where A = optical density of the blank and

B = optical density of the sample .

Determination of reducing power (ferric chloride method):

A spectrophotometric method of (Oyaizu., 1986) , was used for each aqueous , acetone , methanol extracts where it mixed with 2.5 ml of 200 mmol /L sodium phosphate buffer (PH 6.6) and 2.5 ml of 1% potassium ferricyanide . The mixture was incubated at 50 ^{O}C for 20 min . after adding 2.5 ml of 10 % trichloroacetic acid (w/v) , the mixture was centrifuged at 650 rpm for 10 min . The upper layer (5 ml) was mixed with 5.0 ml deionized water and 1 ml of 0.1 % ferric chloride, and the absorbance was then measured at 700 nm. Higher absorbance indicates higher reducing power. Vit.C was used as standard.

Experimental animals: Adult male albino rats (100 ± g) were obtained from the memorial institute of ophthalmology in Giza , Egypt . All the animals were kept in plastic cages and placed in a well-ventilated rat house (room temperature and lighting condition were natural light from large windows during the day and complete darkness during the night), and were acclimatized to laboratory conditions for 2 weeks prior to the start of the experimental period . Rats were kept on balanced diet (Table 1,2,3) throughout the experimental period .

Experimental design: The experimental animals were divided into 5 groups, each having 5 rats as follow :

Group 1 : Rats allowed without any treatment fed on standard diet , named negative control or healthy group (I) .

Group 2: Rats allowed to feed hyperlipidemic diet to induce hyperlipidemia through the feeding period, named positive control or hyperlipidemic control or diseased group (II) .

Group 3: Rats were allowed to feed hyperlipidemic diet plus fruit powder of *artichoke (Cynara scolymus L.)* at 5 % of meal.

Group 4: Rats were allowed to feed hyperlipidemic diet plus leaves powder of *artichoke (Cynara scolymus L.)* at 5 % of meal .

Group 5: Rats were allowed to feed mixing of hyperlipidemic diet plus fruit and leaves powder of *artichoke (Cynara scolymus L.)* at 5 % of meal.

Preparation of samples: Blood samples were collected from orbital sinus veins technique using heparinized capillary tubes at the end of experimental period, into clean, dry, and labeled eppendorf tubes (1.5 ml). The tubes contained heparin as anticoagulant (7.5 I.U/ml blood) according to Sechalm, (1986)**.** Because disturbance stress which can alter the metabolic profile, several precautions to minimize stress during sampling were taken into account as shown by Martin, and Green, (1994)**.** Samples were centrifuged at 4000 rpm for 15 min. in a refrigerated centrifuge to separate plasma. Plasma samples were divided into aliquots to avoid repeated freezing and thawing then kept in a deep freeze at (-20 ^{O}C) till the different assays were carried out.

Biochemical analysis:

Determination of lipid profile:

Determination of plasma total cholesterol (TC) : Plasma total cholesterol was determined colormetrically according to the method described by Fossati and Prencipe (1982) .

Determination of plasma triglycerides : Plasma triglycerides were determined according to the method described by Fossati and Prencipe (1982) .

Determination of plasma HDL-cholesterol : Plasma HDL-C was determined by enzymatic colorimetric method according to the method of Lopez , and Stone ., (1977) .

Determination of plasma LDL – cholesterol: Plasma LDL-c calculated according to the formula of Fiede waid , et al ., (1972) .

Risk ratio: Risk ratio was calculated according to the formula of Lopez , and Stone ., (1977) .

Atherogenic index: Atherogenic index was calculated as the LDL-c: HDL-c ratio according to the formula of Lopez , and Stone ., (1977) .

Antimicrobial activity of *artichoke (Cynara scolymus L.)* fruit and leaves:

Media used : Mueller- Hinton Agar media and potato dextrose media :

The media used in the present investigation were Mueller Hinton Agar from Diamond company , Cairo , Egypt . The compositions of the used media are presented in table

Antimicrobial bioassay: Preparation of inoculums: The test bacterial strains were transferred from the stock cultures and streaked on MHA plates and incubated for 24 h at 30 ^{O}C , incubator well separated bacterial colonies were then used as inoculums . The MHA and medias were autoclaved at 121^{O}C and 1.30 bars for 15 minutes in order to be sterilized and cooled to about 45 ^{O}C in water bath. The microorganism were then transferred to their media using sterile petri plates, allowed to solidify and used for bioassay test according to Baur et al ., (1996) .

Disc diffusion method: The antimicrobial activity was determined by the paper disc diffusion method using Mueller – Hinton agar plates (MHA) (for all bacteria) , according to Baur et al ., (1996) .

Antibiotics used: The antibiotics standard used in this investigation were Imipenem (IPM 10 OXOIDLTD) susceptibility test discs (10 mg / ml per disc) which was obtained from Diamond company , Cairo , Egypt .

Results and Discussion Proximate analysis of *artichoke (Cynara scolymus L.)* fruits and leaves :

The obtained results in Table (1) indicates that, *artichoke (Cynara scolymus L.)* fruit contain moisture (83.8 %) , crude fiber (6.60 %) , ash (1.078 %) , crude protein (3.056 %) , crude fat (0.130 %) and total carbohydrate (89.136 %) . Meanwhile, *artichoke (Cynara scolymus L.)* leaves showed percentage of moisture (79.4 %) , crude fiber (26.2 %) , ash (1.349 %) , crude protein (1.976 %) , crude fat (0.18 %) and total carbohydrate (70.295 %) .

Table (1): Proximate analysis of *artichoke (Cynara scolymus L.)* fruit and leaves.

Chemical composition	Percentage (w / w %)	
	Fruits	Leaves
Moisture	83.8	79.4
Crude fiber	6.60	26.2
Ash	1.078	1.349
Crude protein	3.056	1.976
Crude fat	0.130	0.18
Total carbohydrate	89.136	70.295

Table (2): Total phenolics and total flavonoids of Artichoke (Cynara scolymus L.) extracts.

Compounds	Methanol extracts of fruit mg / g	Methanol extracts of Leaves mg / g
Phenolics	32.7	19.5
Flavonoids	12.3	5.7

Table (3): DPPH assay of *artichoke (Cynara scolymus L.)* fruit.

Extract	Concentration (µg / ml)			
	25	50	75	100
Acetone	76.3	84.6	88.0	91.2
Methanolic	87.6	88.2	90	92.1
Aqueous	74.2	79.1	80	82
Vitc	90	91.2	92.7	93.2

Total phenolic compounds and total flavonoids of *artichoke (Cynara scolymus L.)* extracts:

Data in Table (2) showed that high total phenolic compounds and total flavonoids contents for fruits extracts of *artichoke (Cynara scolymus L.)* are higher than that in leaves extracts . Total phenolic compounds in fruit of *artichoke (Cynara scolymus L.)* extracts has been 32.7 mg / g , while total flavonoids has been 12.3 mg / g , comparing with 19.5 and 5.7 of phenolics and total flavonoids respectively in leaves extracts .

DPPH assay: DPPH is a stable nitrogen-centered free radical , the color of which changes from violet to yellow upon reduction by either the process of hydrogen or electron donation. Substances which are able to perform this reaction can be considered as antioxidants and therefore radical scavengers , (Dehpour et al ., 2009). In fact , free radical scavenging method (DPPH) show the reduction of alcoholic DPPH solutions in the presence of an hydrogen donating antioxidant (Koleva et al ., 2002) and phenolic compounds have been reported and provided to be potent hydrogen donators to the DPPH radical (Von et al ., 1997) because of their prominent chemical structure (Rice et al ., 1997) **.** Table (3 and 4) show the antioxidant potential of Artichoke fruit and leaves extract . Extract were further highlighted by the quenching of DPPH free radicals. The values of absorbance for fruit extracts ranged from 74.2 to 92.1, and 74.3 to 92 for leaves extracts.

Reducing power assay (ferric chloride method): Fe (III) reduction is often used as an indicator of electron - donating activity , which is an important mechanism in phenolic antioxidant action Nabavi et . al. (2009) , in this assay , the presence of reductants (antioxidants) in the samples would result in the reduction of Fe^{+3} to Fe^{+2} by donating an electron . The amount of Fe+2 complex can be then be monitored by measuring the formation of Perl's Prussian blue at 700 nm . Increasing absorbance at 700 nm indicates an increase in reductive ability . Table (5 and 6) show the response of reducing powers for acetone, methanolic or aqueous extracts of *artichoke (Cynara scolymus L.)* fruit and leaves . It was found that the reducing power of methanolic extracts for both fruits and leaves was higher than that of aqueous or acetone extracts . Reducing power increased for all of them with an increase in their concentrations . At the highest concentration (100 µg / ml) of *artichoke (Cynara scolymus L.)* fruit showed highest activity (1.3) , while that of *artichoke (Cynara scolymus L.)* leaves was (0.9) , at the same concentration . The observed increase in reducing power of the methanol extracts which were concentrations dependent suggested that they are good electron donors . Studies have shown that the reducing power capacity of a compound may serve as a significant indicator of its potential antioxidant activity (Sofidiya et al ., 2006) .

Table (4): DPPH assay of *artichoke (Cynara scolymus L.)* leaves.

Extract	Concentration (µg / ml)			
	25	50	75	100
Acetone	75.2	78	83	88.6
Methanolic	76.3	80.2	88.4	92
Aqueous	74.3	76.4	80.6	84
Vitc	90	91.2	92.7	93.2

Table (5): Reducing power assay of *artichoke (Cynara scolymus L.)* fruit.

Extract	Concentration (µg / ml)			
	25	50	75	100
Acetone	0.2	0.43	0.53	0.57
Methanolic	0.3	0.5	0.77	1.3
Aqueous	0.19	0.4	0.46	0.49

Table (6): Reducing power assay of *artichoke (Cynara scolymus L.)* leaves.

Extract	Concentration (µg / ml)			
	25	50	75	100
Acetone	0.12	0.33	0.42	0.63
Methanolic	0.20	0.41	0.75	0.9
Aqueous	0.04	0.1	0.19	0.22

Plasma total cholesterol and plasma triglycerides: Several factors are known to influence plasma cholesterol concentration just like the total amount and types of fats and other lipids in diet, where dietary cholesterol raises plasma total cholesterol, LDL- cholesterol levels and subsequently the risk of atherosclerosis and coronary heart diseases. The effect of adding *artichoke (Cynara scolymus L.)* fruit or leaves to the diet of hyperlipidemic rats comparing with rats fed on normal diet for (30 days) on the level of plasma total cholesterol and plasma triglyceride are illustrated in Fig (1) which represent the mean values through the whole period of experiment (30 days) .

Data indicated that plasma total cholesterol and plasma triglyceride of rats were 72.6 and 42 mg / dl respectively for negative group (group I) which fed on standard diet , while Positive control (group II) where fed on hyperlipidemic diet, plasma total cholesterol and plasma triglyceride levels reached 124 and 79.6 mg / dl respectively. The addition of *artichoke (Cynara scolymus L.)* fruit and leaves to diet of hyperlipidemic rats for (30 days) (group III and IV) showed significant reduce for both plasma total cholesterol and plasma triglyceride to 104 and 59.6 mg / dl for fruits group (group III) and to 98 and 55 mg / dl for leave treatment group (group IV) . lastly to 99.5 and 57.2 mg / dl for fruit and leaves treatment group (group V) .

Plasma HDL- cholesterol and LDL-cholesterol: The inverse association between the incidence of coronary heart diseases and HDL - cholesterol (good cholesterol) levels has been known , while accumulation of LDL-cholesterol (bad cholesterol) within the arterial wall appears to play a crucial role in the

initiation and progression of atherosclerosis . The effect of adding *artichoke (Cynara scolymus L.)* fruit and leaves to the diet of rats fed on hyperlipidemic diet compared with rats fed on normal diet for 30 days on the level of HDL- c and LDL- c in plasma are illustrated in and Fig. (2) which represent the mean values through the whole period of the experiment . Data of the experiment indicated that plasma HDL- c and LDL- c of rats were 39.6 and 24.6 mg / dl respectively for negative control which fed on standard diet and after 30 days of feeding on hyperlipidemic diet , (positive control) HDL- c and LDL- c levels in plasma of rats reached 27.6 and 80.48 mg / dl respectively .

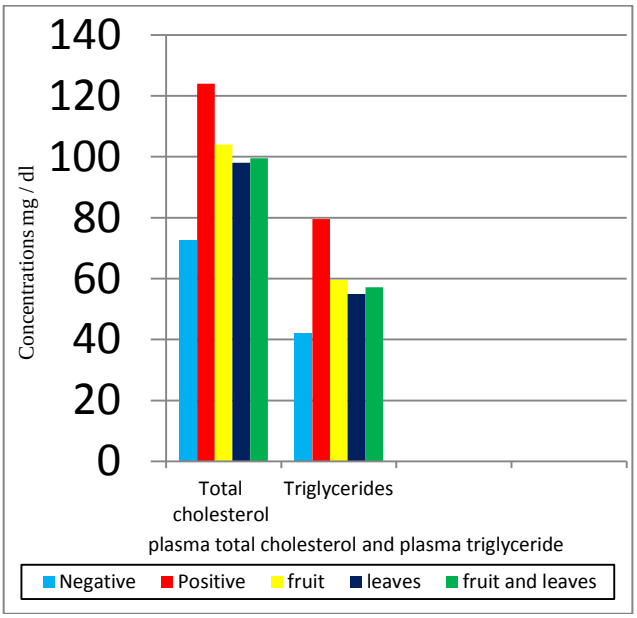

Fig (1): Effect of *artichoke (Cynara scolymus L.)* fruit and leaves on plasma total cholesterol and plasma triglyceride of tested rats after 30 days of experiment .

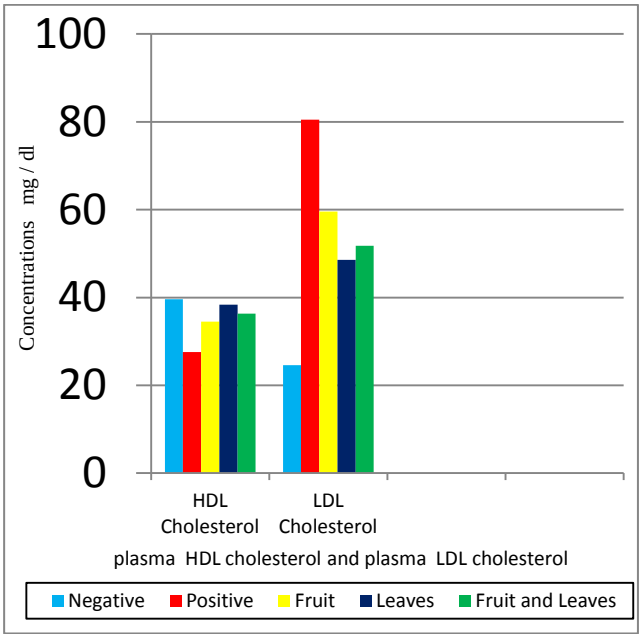

Fig (2): Effect of *artichoke (Cynara scolymus L.)* fruit and leaves on plasma HDL cholesterol and plasma LDL cholesterol of tested rats after 30 days of experiment .

The addition of *artichoke (Cynara scolymus L.)* fruit and leaves to hyperlipidemic diet for 30 days (group III and IV) increased plasma HDL-c to 38.4 mg / dl for leaves treatment group and 34.5 mg / dl for fruit treatment group , and reduced plasma LDL-c to 59.6 mg / dl for fruit treatment group and 48.6 mg / dl for leaves treatment group , comparing with positive control . Data of the experiment indicated also that plasma HDL- c and LDL- c of rats were 36.3 and 51.76 mg / dl respectively for fruits and leaves treatment group (V) .

Risk ratio and atherogenic index :

Risk ratio and atherogenic index , which are considered as the predictors of atherogenisis were calculated through the experimental period to assess the effect of blended *artichoke (Cynara scolymus L.)* fruit and leaves supplementation to the hyperlipidemic rats . Results given in Fig (3) represented the mean values through the whole period of the experiment . Data indicated that risk ratio and atherogenic index of rats were 1.83 and 0.62 respectively for negative control (group I) which feed on standard diet , and after 30 days of feeding on hyperlipidemic diet (group II) , risk ratio and atherogenic index of rats reached 4.49 and 2.92 respectively . The addition of *artichoke (Cynara scolymus L.)* fruit and leaves hyperlipidemic diet for 30 days (group III and IV) reduced risk ratio to 3.02 and 1.73 and atherogenic index to 2.55 and 1.27 respectively . The results revealed that *artichoke (Cynara scolymus L.)* fruit and leaves treatment groups showed decreases in both risk ratio and atherogenic index in comparison with the positive control (group II) . Group (V) which fed on fruits and leaves , risk ratio and atherogenic index of rats reached 2.74 and 1.42 respectively .

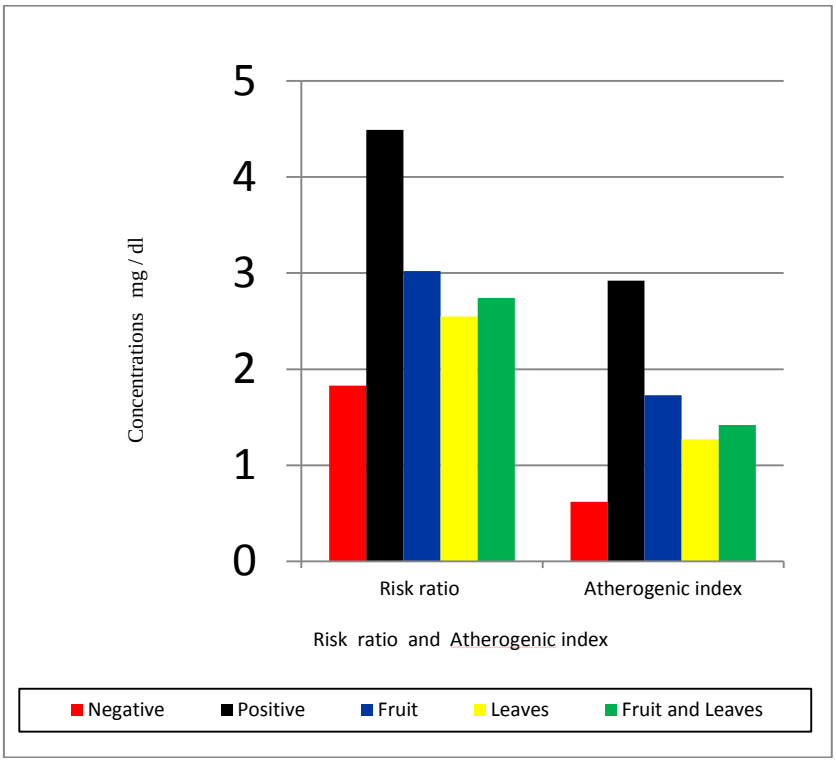

Fig (3): Effect of *artichoke (Cynara scolymus L.)* fruit and leaves on Risk ratio and atherogenic index of tested rats after 30 days of experiment .

Antimicrobial activity of *artichoke (Cynara scolymus L.)* fruit and leaves :

In Table (7) Four concentration of Methanol extracts 50 , 100 , 200 , 400 mg / ml were used for treating the six bacteria strains Proteus vulgaris, E . coli , S . aureus , K . pneumonia , Bacillus subtilitis and Streptococcus . The obtained results indicate that 400 mg / ml concentration exhibited the highest inhibitory effect on bacteria activity. While the lowest effect shown in lowest conc. 50 mg / ml of Methanol extract resulted Proteus vulgaris (3.79 cm) and (3.23 cm) for leaves and fruit respectively compared to the control positive antibiotic Imipenem (3.57 cm). E. coli (3.96 cm) and (3.17 cm) for leaves and fruit respectively compared to the antibiotic Imipenem (3.89 cm) . Staphylococcus aureus (3.54 cm) and (3.40 cm) for leaves and fruit respectively compared to positive control antibiotic Imipenem (2.76 cm) . Klebsiella pneumonia (2.1 cm) and (2.0 cm) for leaves and fruit respectively compared to positive control antibiotic Imipenem (2.9 cm) . Bacillus subtilitis (2.77 cm) and (2.5 cm) for leaves and fruit respectively compared to positive control antibiotic Imipenem (3.7 cm) . Streptococcus (2.99 cm) and (2.88 cm) for leaves and fruit respectively compared to positive control antibiotic Imipenem (2.76 cm

Table (7): Antimicrobial activity of *artichoke (Cynara scolymus L.)* fruit and leaves

Bacterial Strain	Conc. mg / ml	Inhibition zone (cm) (leaves)	Inhibition zone (cm) (fruit)	Imipenem
Proteus vulgaris	50	2.17	1.96	3.57
	100	2.68	2.14	
	200	3.16	3.0	
	400	3.79	3.23	
Escherichia coli	50	2.44	2.14	3.89
	100	2.79	2.55	
	200	3.44	2.99	
	400	3.96	3.17	
Staphylococcus aureus	50	1.74	1.69	2.76
	100	2.10	1.97	
	200	2.69	2.03	
	400	3.54	3.40	
Klebsiella pneumonia	50	1.50	1.39	2.90
	100	1.77	1.77	
	200	1.84	1.80	
	400	2.1	2.0	
Bacillus subtilis	50	1.80	1.44	3.7
	100	1.92	1.77	
	200	2.46	2.20	
	400	2.77	2.50	
Streptococcus	50	1.70	1.80	3.9
	100	1.89	1.79	
	200	2.36	2.13	
	400	2.99	2.88	

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تاثير الخرشوف في خفض الدهون في بلازما فئران عالية الدهون

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الملخص العربى

تهدف هذه الدراسة إلى دراسة التركيب الكيميائي لثمار وأوراق نبات الخرشوف من ناحية محتواها من المركبات الفينولية والفلافونيدية وكذلك التحليل الكمي للمركبات الفينولية فيهما بالإضافة إلى دراسة تأثيرات مستخلصات الأوراق والثمار كمضادات أكسدة . ثم بعد ذلك دراسة تأثير إضافة كل من هذه الثمار والأوراق لعليقة ذات محتوى دهني مرتفع في عليقة الفئران ودراسة تأثيرها على محتوى الدهون والكوليسترول في بلازما الفئران لإلقاء الضوء على أهميتها في الحماية من تصلب الشرايين وكذلك دراسة تأثير مستخلصات الثمار والأوراق كمضادات للميكروبات.

المعاملة بثمار وأوراق الخرشوف أدى إلى خفض الزيادة الغير مرغوبة لكل قياسات الليبيدات المختلفة بالدم التي اشتملت على الجليسريدات الثلاثية الكوليسترول الكلى والكوليسترول منخفض الكثافة ، وكان تأثير أوراق الخرشوف يفوق مثيله في الثمار .

استخدمت طريقة reducing power وكذلك طريقة DPPH لتقدير نشاط المستخلص المائي ، والأسيتوني ، والميثانولى لكل من الثمار والأوراق

في طريقة DPPH للثمار : تم عمل 4 تركيزات مختلفة وهى 25 ، 50 ، 75 ، 100 وحدة التركيز ولوحظ النشاط المضاد للأكسدة وتراوحت نسبة التنشيط من 74.2 إلى 92.1 عند طول موجى 578nm .

في طريقة DPPH للأوراق : تم عمل 4 تركيزات مختلفة وهم 25 ، 50 ، 75 ، 100 من مستخلص مائي وميثانولي وأسيتوني أيضا ولوحظ النشاط المضاد للأكسدة وتراوحت نسبة التنشيط من 74.3 إلى 92 عند طول موجى 578 nm .

في طريقة reducing power للثمار : تم عمل 4 تركيزات مختلفة وهى 25 ، 50 ، 75 ، 100 وحدة التركيز ووجد أن المستخلص الميثانولى هو الأكثر نشاطا مضاد للأكسدة حيث أن المستخلص الميثانولى عند تركيز 100 أعطى 1.3 عند طول موجى 700 nm .

بينما في طريقة reducing power للأوراق : تم عمل 4 تركيزات مختلفة أيضا من كل مستخلص ووجد أن المستخلص الميثانولى هو الأكثر نشاطا مضاد للأكسدة حيث أعطى 0.9 عند تركيز 100 حينما كان الطول الموجي 700 nm .

عند دراسة النشاط المضاد للميكروبات ضد 6 أنواع من سلالات البكتريا الموجبة والسالبة وهى :-

Proteus vulgaris , Escherichia coli , Klebsiella pneumonia , Staphylococcus aureus , Bacillus subtilis , Streptococcus

وأظهر المستخلص الميثانولي عند تركيز 400 مجم / مل أعلى نشاط مضاد للسلالات البكتيرية تحت الاختبار

الكلمات الاسترشاديه: الخرشوف – عالية الدهون- بلازما الدما