Protective Effect of Nettle and Olive Leaves on Hyperlipidemia in Experimental Rats

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ABSTRACT

Dyslipidemia is a major contributor to atherosclerotic cardiovascular disease. Recently, World Health Organization (WHO) reported that cardiovascular diseases (CVD) account for 46% of ever all mortality in Egypt. So that; the present study investigated, the protective effect of nettle and olive leaves on hyperlipidemia in experimental rats. Thirty six male albino rats weighing 130 ± 20 g used in this study and divided into equal six groups (6 rats each),the first kept as anegative control group (-ve) received basal diet throughout the experiment period, while the second was the (+ve) control group which fed on hyperlipidemic diet for four weeks, while the four others groups given hyperlipidemic diet supplemented with nettle leaves (5%) ,(10 %) and olive leaves(5 %), (10%) respectively for four weeks (astreatment groups) .The chemical composition and phenolic compounds of both leaves were done . At the end of the experiment, biological data were calculated; blood samples were taken to biochemical analysis. In addition, histopathological examination was done. The results revealed that hyperlipidemic diet in the (+ve) control group increased body weight gain ,relative organ weight, serum lipid profile, Malondialdhyde (MDA), liver enzymes and serum glucose, decreased in serum HDL-C, serum Superoxide Dismutase (SOD), and Glutathione Peroxidase (GPx) . All treated groups with two leaves showed improvement previously parameters compared with positive control group. In conclusion, the consumption of nettle and olive leaves could be used for improving lipid profile, liver function and protect from hyperlipidemia in experimental rats.

Key words: *lipid profile- nettle - olive - leaves – antioxidant enzymes- liver function*

INTRODUCTION

Hyperlipidemia (HLD) is a condition that incorporates various genetic and acquired disorders that describe elevated lipid levels within the human body **(Hill and Bordoni, 2021).** HLD is characterized by high levels of low-density lipoprotein cholesterol (LDL-C) or high triglycerides (TG), and plays an important role in the pathogenesis of cardiovascular diseases **(Li *et al.*, 2021).**

From ages, human diseases are treated by herbal medicines in almost every infection. In modish age,it choice to make use of them instead of the synthetic ones as there are fewer side effects of traditional medicines .Plants are natural source of treatment and are used from ages for food and medicine **(Shah *et al.*, 2021).** Herbal plants have also been found to nourish the body and provide vitamins, minerals, and many trace elements that are easy to absorb **(Melkegna and Jonah, 2021).**

Stinging nettle (*Urticadioica L.*) is a perennial herb with a long history of traditional medicinal uses in many countries.Nettle leaves are rich in chlorophyll, carotenoids, vitamins, proteins, fats, carbohydrates, organic acids, minerals, and trace elements. The leaves of stinging nettle contain abundant amounts of natural phenolic compounds, which may function as effective natural antioxidants **(Paulauskienė *et al.*, 2021).** This herb has a history of use in traditional medicine to treat diverse conditions including lipid disturbances. Positive effect of *Urticadioica L*. against lipid derangements has been demonstrated in vivo studies **(Namazi *et al.*, 2018).**

Olive tree leaves have been widely used as traditional remedies to cure several diseases Chemical characterization analysis revealed that olive tree leaves contain several bioactive compounds that may exert beneficial effects in certain morbidities such as metabolic syndrome, and hypertension **(Ranieri *et al.*, 2021).**

Since little information is available regarding the preventive influences of *Uritcadioica L*. and *Oleaeuropaea L.* leaves, on hyperlipidemia in vivo, this study was carried out.

MATERIALS & METHODS

***Plant materials*:**

Dry *Uritcadioica L. and Oleaeuropaea L.* leaves were purchased from The Local Company for Herbs and Medicinal Plants, Cairo Governorate, Egypt.

Preparation of plant:

Dry *Uritcadioica L. and Oleaeuropaea L.* leaves were homogenized in the blender then stored at room temperature in closed glass bottles in the dark until using.

Animals:

Thirty-six adult male albino rats *Sprague Dawley* strain weighing (130 ± 20 g) were housed in well-aerated cages under hygienic condition and were fed on basal diet for one week to adapt.

Methods:

Chemical analysis

- Chemical composition (protein, fat, moisture, ash and carbohydrates calculated by difference) determined according to **(A.O.A.C, 2010).**
- Phenolic compounds and flavonoids of both powder evaluated by method of **Tarola *et al.*, (2013).**

Experimental design:

The Animals were divided into equal six groups. The first group (6 rats) fed on basal diet according to **Reeves *et al.*, (1993)**, and served asa negative control group (-ve) control, while the second was the (+ve) control group which fed on hyperlipidemic diet for four weeks according to **Rashwan (1994)**, the third and fourth groups fed on hyperlipidemic diet supplemented with nettle leaves powders (5%) and (10 %) respectively. The fifth and sixth groups fed on hyperlipidemic diet supplemented with olive leaves powders (5%) and (10 %) respectively for four weeks (astreatment groups). At the end, animals were weighed, fasted overnight, and then sacrificed after anesthesia ones this. Blood samples will be was collected from hepatic portal vein of each rat into dry clean centrifuge tubes. Serum was carefully separated by centrifugation of blood samples at 3500 rpm (round per minute) for 15 minutes at room temperature, transferred into dry clean Eppendorf tubes, then kept frozen at - 20˚C for latter determinations. Liver, kidney and hearthas been removed from rats by careful dissection and washed in saline solution (0.9%), dried using

filter paper and independently weighed.

Biological evaluation

During the experiment (28days), feed intake was recorded every day and body weight was recorded every week. Biological evaluation of the different diets was carried out by calculating of body weight gain % (BWG %) and feed efficiency ratio (FER) according to **Chapman *et al.*, (1959).**

Biochemical analysis of serum

Serum was analyzed for various biochemical parameters like lipid profile, total cholesterol, triglycerides and HDL-C were evaluated on the authority of **Allain *et al.*, (1974); Trinder and Ann, (1969)** and **Lopes –Virella *et al.*, (1977)** but LDL-C and VLDL-C calculated as claimed by **Friedwald *et al.*, (1972).** The atherogenic indexe was calculated as stated by **Tilvis and Miettinen (1986).** Antioxidant enzymes super oxide dismutase (SOD), glutathione peroxidase (GPx) and Malon-dialdehyde (MDA) level as a parameter for the lipid peroxidation were evaluated in the opinion of **Kakkar et al., (1984), Ellman (1959) and Draper *et al* ., (1993).** Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), Alkalinephosphatase (ALP) were measured on the report of **Bergmeyer *et al.*, (1986)** and **Roy, (1970).** Glucose was estimated in the serum as maintained by **Trinder (1959)**.

Histopathology investigation

The heart and liver were fixed in 10% buffered neutral formalin immediately following excision from animals. Fixed tissues were subsequently processed for histopathology examinations as previously described by **Carleton (1979).**

Statistical analysis

Results are expressed as mean ± standard deviation (SD). Differences between means indifferent groups were tested for significance using a one-way analysis of variance (ANOVA) followed by Duncan's test and probability value of 0.05 or less was considered significant. Comparative of means were performed according to least significant differences test (LSD) according to **(Snedecor, 1969)** using SPSS (version 20).

RESULTS & DISCUSSION

Table (1) showed the averages (g) of moisture, protein, fat, carbohydrate and ash (g/100gm) in nettle and olive leaves powder. The results of chemical composition for nettle revealed that ashrecorded the highest average followed by carbohydrate, crude protein, fiber, moisture and crude fat respectively. While, the results of chemical composition for olive leaves powder revealed that carbohydrate recorded the highest average followed by fiber, crude protein, ash, moisture and crude fat respectively. These results agree with **Maria *et al., (2019*)who** revealed that carbohydrates, protein and minerals of nettle leaves powder were high. While, moisture and crude fat contents were relatively low. **Salama *et al.*, (2020)** who reported that the olive leaves powder have high carbohydrate, Crude protein contents while moisture and crude fat contents were relatively low.

Data in table (2) clarified the nettle leaves powder recorded the higher content from Benzoic acid, rosemarinic, Neringein, Myricetin, 3-Hydroxytyrosol, Quercitin, Resvertol, p- Hydroxy benzoic acid, Catechol, Ellagic, Kampherol and Quinol , o-Coumaric acid, Catechin, Syringic acid ,Gallic acid, Ferulic acid, Cinnamic acid as shown in fig.(1). This is accordance with **Repajić *et al.*, (2021)** who reported that nettle leaves accumulate higher amounts of polyphenols and chlorophylls. In general, leaves are the richest part of a nettle in bioactive compounds; therefore, they are mostly used in processing.

Statistical data in **table (3)** observed the olive leaves powder recorded the higher content from rosemarinic, Ellagic, Quercitin ,Myricetin, Benzoic acid, Rutin, Kampherol, Resvertol, 3-, Catechol, p- Hydroxybenzoicacids, Caffeic acid, Vanillic acid , Chlorogenic ,Ferulic acid ,cinnamic acid as shown in fig. (2). This is accordance with **Ghanem *et al* ., (2019)** who reported that Chemically, leaves of olive contain considerable biophenols such as the other parts of the olive tree Oleuropein and its metabolites, including tyrosol and hydroxytyrosol, are the most abundant phenolic compounds known in the olive leaf. Oleuropein has antibacterial, antiviral, antitumor, blood pressure, and blood lipid-reducing factor, anticancer, and

cardio-protective activities.

In table (4) hyperlipidemic control (+ve) group revealed more BWG %, FI and FER compared with the control (-ve). All hyperlipidemic rats fed on olive and nettle leaves showed significant decreases in mean values as compared to control (+ve) group. The mean value of (FI) control (-ve) group was lower than control (+ve) group, being 20.95±2.38 and 23.23±2.94 respectively, the best results for FI (g/day) recorded by group fed on olive leaves 10% which closed to normal group. It could be noticed that the mean value of FER of control (-ve) group was higher than control (+ve) group, being .087 ±.02 and 0.15±.02 respectively, the best results for FER recorded by hyperlipidemic rats fed on Nettle 5%being.0.14 ±.015. This result is harmony with **Fan *et al.*, (2020)** who reported that the high fat (HF) diet supplemented with *U. dioica* (HFUT) had significantly reduced weight gain compared to the HF diet over the 12 weeks. *U. dioica* protects against diet-induced obesity through mechanisms involving lipid accumulation and glucose meta-bolism in skeletal muscle, liver, and adipose tissue. It may be due to the U. dioica are likely attributed to the high fiber content, phytochemical components, high protein content.

The finding in **table (5)** suggest that, significant ($p \leq 0.05$) increased in (cholesterol and triglyceride) in (+ve) control group compared with (-ve) control group. While, these parameters decreased in all treated groups especially Olive 10% and Nettle 10%. On the other hand, HDL parameter recorded high increase in Olive 10%followed by Nettle 10% group. These results agree with **Eldamaty, (2018**) who observed that the *Urticadioica* leaves powder has lowered the levels oflipids and lipoproteins in blood. The significant decrease was found in lipid profile as total cholesterol, cholesterol fractions and LDL/HDL ratios via lower concentrations of LDL**.** On the other hand, these results agree with **Fki *et al* ., (2020)** who indicated the hypolipidemic effect of the olive leaf phenolic in high-fat and high-cholesterol diet rats It is mainly due to the typical phenolic composition linked to potent biological activities . The major active component in olive leaves is oleuropein.

Results in table (6) revealed that, significant ($p \leq 0.05$) increased in (LDL, VLDL and AI)

in (+ve) control group compared with (-ve) control group. While, these parameters decreased in all treated groups especially Olive 10%and Nettle 10%. On the other hand, HDL parameter recorded high increase inOlive 10% followed by Nettle 10%group . Leaves of olive might be an excellent and promising source of bioactive-compounds, which in turn have high antioxidative properties as reported by **Elmaadawy and Alsadeq (2015).** Also, these results agree with **Eldamaty, (2018)** observed that the *Urticadioica* leaves powder has lowered the levels of lipids and lipoproteins in blood;this is due to that the uniquely high level of polyphenols in*Urticadioica* leaves may play an important role in contributing to the health benefit such as lowering cholesterol and hyperlipidmia level. The protective effect of U. dioica leaf hydro-alcoholic extract against atherosclerosis in rats. Athero-sclerosis was experimentally induced in the laboratory by high-fat diet atherosclerotic rats (UD) that received 100 mg/kg/day of ethanolic extract of UD orally. Authors showed, through histopathological evaluations of the aortic arch, that UD group had an improvement of atherosclerotic. UD significantly reduced medial ($p < 0.05$) but not intimal thickness. The LDL-C/HDL-C ratio significantly decreased in UD groupas reported by **(Grauso*et al.*, 2020).** More than hypolipidemic effects of olive leaf extracts have been proved in a number of studies. It was found that 50 and 100 mg/kg/day doses of olive leaf extract may positively affect atherosclerosis by decreasing total cholesterol and low-density lipoprotein (LDL) cholesterol levels in rats **(Tek and Ağagündüz 2020).**

Biomarker data in **table (7):** showed that, significant ($p \leq 0.05$) decreased in (SOD and GPx) in (+ve) control group compared with (-ve) control group. While, MDA was increased in (+ve) control group. However, the reverse recorded for treated groups especially Olive 10% and Nettle 10%. This significant observation could be explained by the capacity of oleuropein to reduce free radical accumulation, generated after the lipid per-oxidation **(Jemai *et al.*, 2020).** These results agree with **Telo *et al.*, (2017)** who administrated that the group fed

withnettle showed a slight increase in SOD and GPx activities and decreased in the lipid peroxidation.

Liver function enzymes in **table (8):** showed that, significant ($p \leq 0.05$) increase in (AST, ALT and ALP) in (+ve) control group compared with (-ve) control group. While, these parameters decreased in all treated groups especially Olive 10% and Nettle 10%.Similar results were obtained by **Shaheen and Elkersh (2019)** who revealed that, olive leaf extract had very high phenol content and possess strong antioxidant activity administration, which resulted in improved serum ALT , AST and ALP activities and increased serum total antioxidant capacity . So, the improving effect of olive may related to its antioxidant activity Hepato-protection is the ability to prevent damage to the liver, prevent the liver affections prophylactically and maintains balance in liver enzymes as reported by **Eldamaty, (2018)** who showed that diabetics rat fed on *Urticadioica* leaves in basal diet were decreasedin AST and ALT compared with control positive.

Data of glucose analysis in **table (9)** revealed that, significant ($p \leq 0.05$) increase in Serum Glucose in (+ve) control group compared with (-ve) control group. While, this parameter decreased in treated groups especially Olive 10% and Nettle 10%. These results agree with **Fan *et al.*, (2020)** revealed that U. *dioica* reduced fasting glucose determined by glucometer. Also **Eldamaty, (2018)** reported that Stinging nettle (*Urticadioica*) has a great medicinal value such as relieve of lowering glucose in blood. In the other study revealed that olive leave extracts ameliorated the level of glucose as reported by **Sakr *et al.*, (2016)** who concluded that theameliorative effect of olive leave extracts againsttoxicity of diabetes in rats may be attributed to thepresence of its phenolic compounds.

Histopathological examination of liver tissue:

This study examined the effect of high fat high on liver tissues using histological examination. Present results indicated that, Microscopic pictures of H&E stained liver sections showing normal hepatic architecture with radially arranged hepatic cords around central veins (CV) with normal portal areas (PA) and sinusoids in control normal group as

shown in **photo (1)**. Liver sections of (+ve) group showing highly disrupted hepatic architecture due to diffuse ballooning degeneration (black arrows) with multifocal necrosis (blue arrows) of hepatocytes, portal inflammation (yellow arrows)Low magnification X:100 bar 100 and high magnification X:400 bar 50 as shown in **photo (2)**. These results agree with **Giammanco *et al*., (2016)** examined the histological sections of liver tissue from high fat diet rats. Note the widespread intracellular vacuolization of hepatocytes and the resulting relocation of cell nuclei in a peripheral position. This results agree with **Lasker *et al* ., (2019)** who showed that the hepatic tissue from the control group revealed a normal architecture of hepatocytes, with no appearance of lipid/fat deposition and inflammatory cell infiltration , whereas HF diet-fed groups showed degenerative changes in hepatocyte along with lipid/fat droplet deposition and inflammatory cell infiltration.

While the group which received olive 5% showing mildly disrupted hepatic architecture due to moderate per portal hydropic degeneration (black arrows) of hepatocytes and mild lobular inflammation (yellow arrows)as shown in **photo (3)**. Liver sections from group received 10% olive showing greatly restored hepatic architecture with few cytoplasmic vacuoles (black arrows) in hepatocytes around PAas shown in **photo (4)**. Liver sections from group received nettle 5% showing moderately disrupted hepatic architecture due to hydropic degeneration (black arrows) and large cytoplasmic vacuoles in hepatocytes (red arrows) around CV and PAas shown in **photo (5)**. Liver sections from group received nettle 10% showing partially restored hepatic architecture with few minute cytoplasmic vacuoles in hepatocytes around CV (red arrows) and mild hydropic degeneration in hepatocytes (black arrows) around PA. Low magnification X: 100 bar 100 and high magnification X: 400 bar 50. As shown in **photo (6)**. This results agree with **Omagari *et al.*, (2021)** reported that Oleuropein, an active constituent of olive leaf, have protective effects against non-alcoholic fatty liver disease (NAFLD) in vivo. The oleuropein with which the HFD was supplemented reduced the hepatic mRNA level of the genes that

encoded the key regulators of the hepatic fatty acid uptake and transport. In addition, the oleuropein reduced the expression of a number of hepatic genes involved in the oxidative stress responses and detoxification of lipid peroxidation products and pro-inflammatory cytokine genes. These results agree with **Fan *et al.*, (2020)** who concluded that *U. dioica* protects against diet induced obesity through mechanisms involving lipid accumulation and glucose metabolism in skeletal muscle, liver, and adipose**.**

Histopathological examination of Heart tissue:

This study examined the Effect of high fat high on Heart tissues using histological examination. Our results indicate that,: Microscopic pictures of H&E stained heart sections showing normal longitudinally and crossly sectioned cardiac muscle fibers with normal blood vessels and interstitial tissue in control normal groupas shown in **photo (1)**. Heart sections of +ve group showed congested blood vessels (red arrows), marked perivascular edema (blue arrows) and macro-vesicular vacillations of crossly sectioned cardiac muscle fibers (black arrows) as shown in **photo (2)**. These results agree with **Sahraoui *et al.*, (2016)**revealed that**t** High fat diet induced structural disorganization and interstitial edema associated with the accumulation of infiltrating cells and lipids within the myocardium, suggesting cardiomyopathy. High fat diet exacerbated myocardial interstitial and perivascular fibrosis.

Microscopic pictures of H&E stained heart sections showing from group received olive 5% showing mildly congested blood vessels (red arrows), perivascular and interstitial edema (blue arrows) and few macro vesicular vacillations of crossly sectioned cardiac muscle fibers (black arrows)as shown in **photo (3)**. Heart sections from group received olive10 % showing greatly restored histological appearance as shown in **photo (4)**. Heart sections from group received nettle 5% showing congestion (red arrows), perivascular and interstitial edema edema (blue arrows) with some macro vesicular vacillations of crossly sectioned cardiac muscle fibers (black arrows) as shown in **photo (5)**. Heart sections from group received nettle 10% showing mild congestion (red arrows) as shown in **photo (6)**. These results agree with **Namazi *et al.*, (2018)** who Showed there was a significant decrease in The aortic arch thickness of

rats in groups treated with UD In histopathological evaluations of the aortic arch, which Conclusion Ethanolic extract of UD prevents establishment of atherosclerotic lesions in rat aorta, which is associated with positive effects on serum lipid profile without significantly affecting antioxidant status. **Also, Tesfaye *et al* ., (2021)** reported The cardio protective activity of the crude extract and solvent fractions of Urticasimensis leaves were confirmed by the histopathologic examination of the cardiac tissues The cardioprotective effect could be attributed to the antioxidant activity of the plant extracts. The cardioprotective activity of solvent fractions of Urticasimensis leaves were confirmed by the histopathologic examination of the cardiac tissues of treated animals. The cardiac tissues in the normal control group showed normal morphological architecture with no cellular necrosis, interstitial space edema and hemorrhage.

CONCLUSION:

This is study evaluated the protective effect of the nettle and olive leaves on hyperlipidemia in rats. Which in the leaves of nettle and olive have contain abundant amounts of natural phenolic compounds, flavonoids, phenolic acids, anthocyanins, and other phenols, which may function as effective natural antioxidants. The consumption of nettle and olive leaves could be used for improving lipid profile, liver function and protect from hyperlipidemia in experimental rats.

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Table 1: The averages of moisture, protein, fat, carbohydrate and ash (g/100g) dryin nettle and olive leave powder

Proximate composition(g/100g)	nettle leaves	olive leaves
Moisture	9.4	**7.1**
Crude protein	18.60	**10.36**
Crude fat	1.15	**3.42**
Ash	41.61	**8.39**
Carbohydrate	29.24	**69.73**
Fiber	17.16	**22.60**

Table 2: The phenolic and flavonoids profiles in *Urticadioica*

Flavonoids	mg / g leaves	Penolic acids	mg / g leaves
Pyrogallol	-	Gallic acid	**6.74126**
Quinol	18.75611	p- Hydroxy benzoic acid	**31.97594**
3-Hydroxytyrosol	148.37622	Vanillic acid	**-**
Catechol	29.86980	Caffeic acid	**4.41400**
Catechin	8.31606	Syringic acid	**6.89341**
Chlorogenic	-	p- Coumaric acid	**3.78981e-1**
Rutin	-	Benzoic acid	**1137.97205**
Ellagic	25.24869	Ferulic acid	**4.77484**
Resvertol	53.28780	o- Coumaric acid	**11.61914**
Quercitin	102.62865	Cinnamic acid	**1.00435**
rosemarinic	420.34409		
Neringein	261.62098		
Myricetin	189.87756		
Kampherol	22.11440		

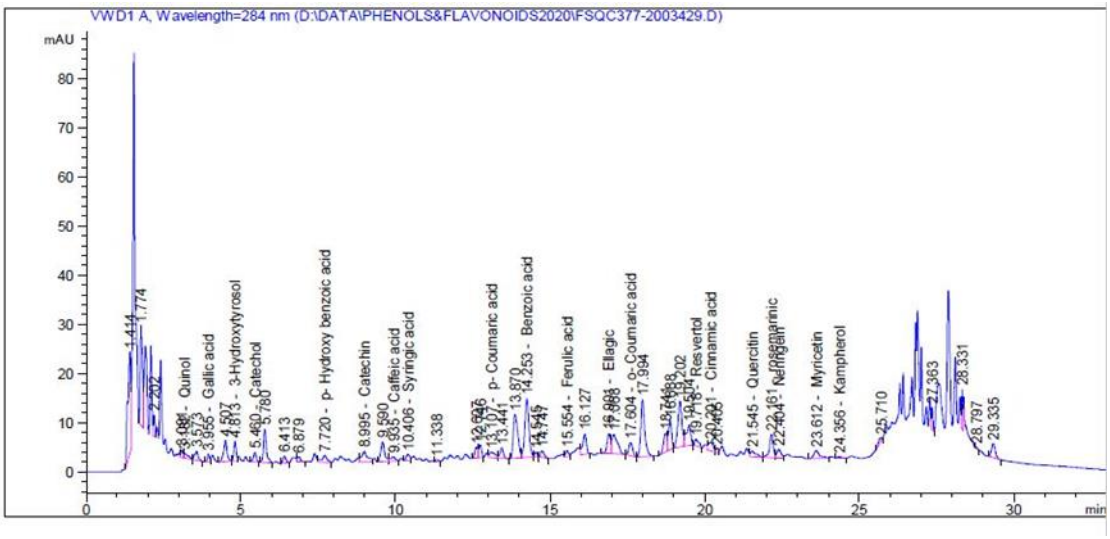

Fig 1. Phenols & flavonoids of nettle leaves

Table 3: The phenolic and flavonoids profiles in olive leaves

Flavonoids	mg / g leaves	Penolic acids	mg / g leaves
Pyrogallol	-	Gallic acid	-
Quinol	-	p- Hydroxy benzoic acid	**182.71399**
3-Hydroxytyrosol	430.31062	Vanillic acid	**102.01740**
Catechol	280.73027	Caffeic acid	**157.46667**
Catechin	-	Syringic acid	-
Chlorogenic	61.71219	p- Coumaric acid	-
Rutin	809.39698	Benzoic acid	**1153.61157**
Ellagic	1916.31634	Ferulic acid	**40.43528**
Resvertol	609.78548	o- Coumaric acid	**111.57746**
Quercitin	1288.72774	Cinnamic acid	**29.61781**
rosemarinic	3181.04967		
Neringein	-		
Myricetin	1232.29864		
Kampherol	621.19737		

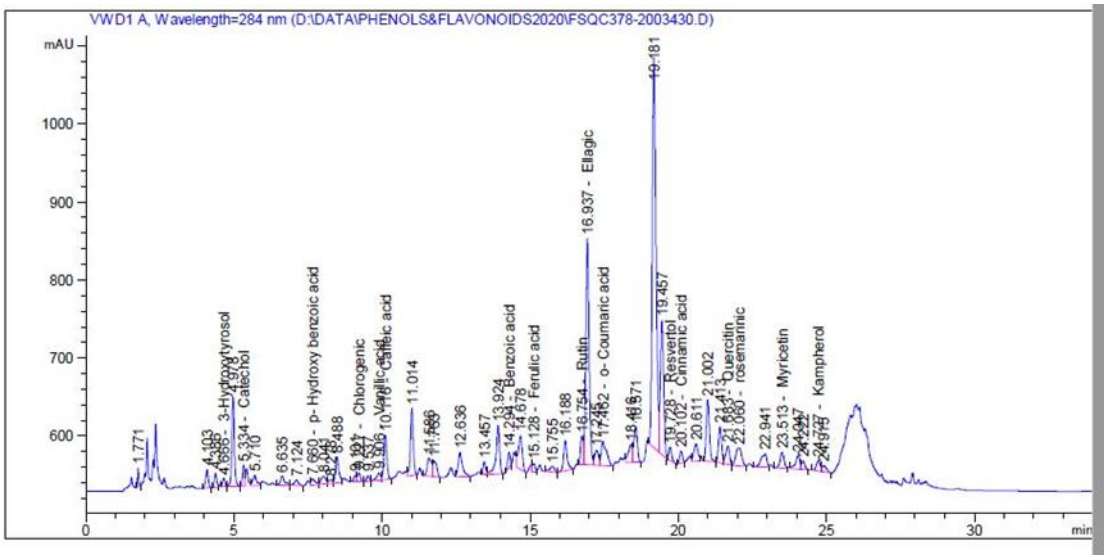

Fig 2. Phenols & flavonoids of olive leaves

Table 4: Protective effect of nettle and olive leaves on body weight gain (BWG %) and feed efficiency ratio (FER) of hyperlipidemia rats (n= 6 rats)

Parameters / Groups	FI (g)	BWG (%)	FER
Control – ve	20.95±2.38^{f}	42.93±12.35^{c}	**.087±.02^{c}**
Control + ve	23.23±2.94^{b}	78.23±19.66^{a}	**0.15±.02^{a}**
Nettle 5%	22.8 ±4.26^{c}	73.03±12.78^{a}	**0.14 ±.015^{ab}**
Nettle 10%	27.6±6.44^{a}	53.97±9.50^{bc}	**0.09±.012^{c}**
Olive 5%	22.4 ±7.49^{d}	63.25±16.24^{ab}	**0.12±.02^{b}**
Olive 10%	21.23 ±5.93^{e}	46.70±14.12^{bc}	**.09±.02^{c}**
LSD	**6.19**	**17.06**	**0.02**

Values denote arithmetic means ± SD. Means with different letters (in the same column are significantly at ($p \leq 0.05$) using one-way ANOVA test, while those with similar letters are non-significant.

Table 5: Protective effect of nettle and olive leaves on Total cholesterol (T.C) and Triglycerides (T.G) of hyperlipidemic rats (n= 6 rats)

parameters / Groups	Total cholesterol (mg/dl)	Triglycerides (mg/dl)
Control – ve	68.0 ±7.87^{d}	**86.16 ± 12.38^{d}**
Control + ve	150.8 ± 11.90^{a}	**200.5 ± 22.58^{a}**
Nettle 5%	116.3 ±15.90^{b}	**153.6 ± 22.43^{b}**
Nettle 10%	89.0 ± 9.31^{c}	**118.3 ± 17.61^{c}**
Olive 5%	112.0 ± 10.80^{b}	**145.83 ± 16.30^{b}**
Olive 10%	75.3 ± 5.78^{d}	**106.66 ± 14.19^{cd}**
LSD	**12.6**	**21.23**

Values denote arithmetic means ± SD. Means with different letters (in the same column are significantly at ($p \leq 0.05$) using one-way ANOVA test, while those with similar letters are non-significant.

Table 6: Protective effect of nettle and olive leaves on lipoprotein fractions (HDL-C, LDL-C, VLDL-C) and atherogenic index (AI) of hyperlipidemia

Parameters / Groups	HDL-C mg/ dl	LDL-C mg/ dl	VLDL-C mg/ dl	AI
Control – ve	47.33 ± 4.41^{a}	7.36 ± 4.12^{d}	17.23 ± 2.47^{d}	**.445 ± .163^{e}**
Control + ve	32.00 ± 5.79^{c}	78.73 ± 10.52^{a}	40.10 ± 4.51^{a}	**3.82 ± .781^{a}**
Nettle 5%	34.16 ± 4.26^{bc}	51.43 ± 10.98^{b}	30.73± 4.48^{b}	**2.43 ± .552^{b}**
Nettle 10%	45.00 ± 4.93^{a}	20.33 ± 7.22^{c}	23.67± 3.52^{c}	**.995 ± .277^{d}**
Olive 5%	38.83 ± 4.26^{b}	44.0 ± 4.21^{b}	29.17± 3.26^{b}	**1.89 ±.157^{c}**
Olive 10%	45.33 ± 4.41^{a}	8.66 ± 2.93^{d}	21.33±2.83^{cd}	**.671 ± .154de**
LSD	**5.56**	**8.5**	**4.24**	**0.49**

Values denote arithmetic means ± SD. Means with different letters (in the same column are significantly at ($p \leq 0.05$) using one-way ANOVA test, while those with similar letters are non-significant.

Table 7: Protective effect of nettle and olive leaves on SOD, GPX and MDA of hyperlipidemic rats (n= 6 rats)

Parameters / Groups	SOD U/L	GP_Xng/ml	MDA m mol/gm
Control – ve	52.06±3.826[a]	91.4±6.82[a]	**10.5±2.41[d]**
Control + ve	27.46±3.75[d]	54.03±7.11[d]	**26.4±3.66[a]**
Nettle 5%	36.23±6.13[c]	64.3±8.24[c]	**21.3±2.71[b]**
Nettle 10%	42.43±5.52[bc]	82.3±3.74[b]	**12.4±2.07[d]**
Olive 5%	39.40±5.88[bc]	70.3±5.78[c]	**17.2±1.55[c]**
Olive 10%	45.63±5.25[b]	83.7±7.97[ab]	**13.1±1.32[d]**
LSD	**6.07**	**8**	**2.8**

Values denote arithmetic means ± SD. Means with different letters (in the same column are significantly at ($p \leq 0.05$) using one-way ANOVA test, while those with similar letters are non-significant.

Table 8: Protective effect of nettle and olive leaves on serum liver function enzymes of hyperlipidemic rats (n= 6 rats)

Parameters / Groups	AST U/L	ALT U/L	ALP U/L
Control – ve	70.67±12.92[d]	26.6 ± 6.86[d]	**126.0±23.7[d]**
Control + ve	185.33±31.65[a]	61.5 ±12.21[a]	**258.1±38.9[a]**
Nettle 5%	142.33±20.22[b]	50.1 ±9.45[b]	**216.1±31.5[b]**
Nettle 10%	105.83±14.83[c]	39.1 ±9.10[bc]	**169.3±19.9[c]**
Olive 5%	123.50±19.72[bc]	44.6 ±9.77[bc]	**190.3±32.2[bc]**
Olive 10%	98.83±17.03[c]	35.6 ±5.24[cd]	**160.5±19.7[c]**
LSD	**23.9**	**10.67**	**33.7**

Values denote arithmetic means ± SD. Means with different letters (in the same column are significantly at ($p \leq 0.05$) using one-way ANOVA test, while those with similar letters are non-significant.

Table 9: Protective effect of nettle and olive leaves on serum glucose of hyperlipdemic rats (n= 6 rats)

parameters / Groups	Serum Glucose (mg/dl)
Control – ve	**78.1±10.79^{d}**
Control + ve	**136.5±22.1^{a}**
Nettle 5%	**116.0±14.02^{b}**
Nettle 10%	**94.6±13.17^{cd}**
Olive 5%	**108.5±17.07^{bc}**
Olive 10%	**93.3±8.80^{cd}**
LSD	**17.6**

Values denote arithmetic means ± SD. Means with different letters (in the same column are significantly at ($p \leq 0.05$) using one-way ANOVA test, while those with similar letters are non-significant.

- ***Liver tissue***

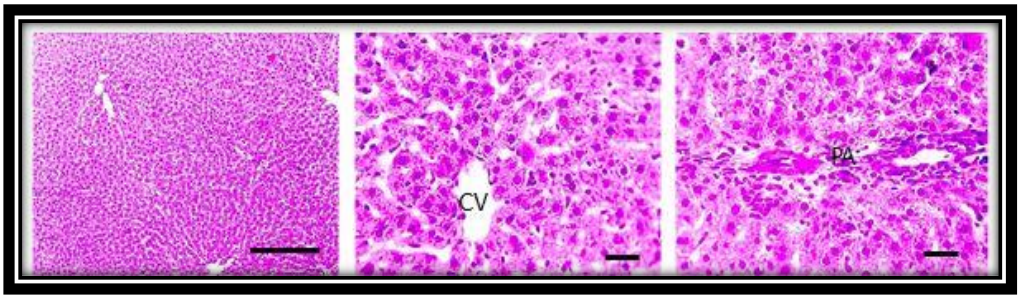

Photo 1: *Microscopic pictures of H&E stained liver sections showing normal hepatic architecture with radially arranged hepatic cords around central veins (CV) with normal portal areas (PA) and sinusoids in control normal group.*

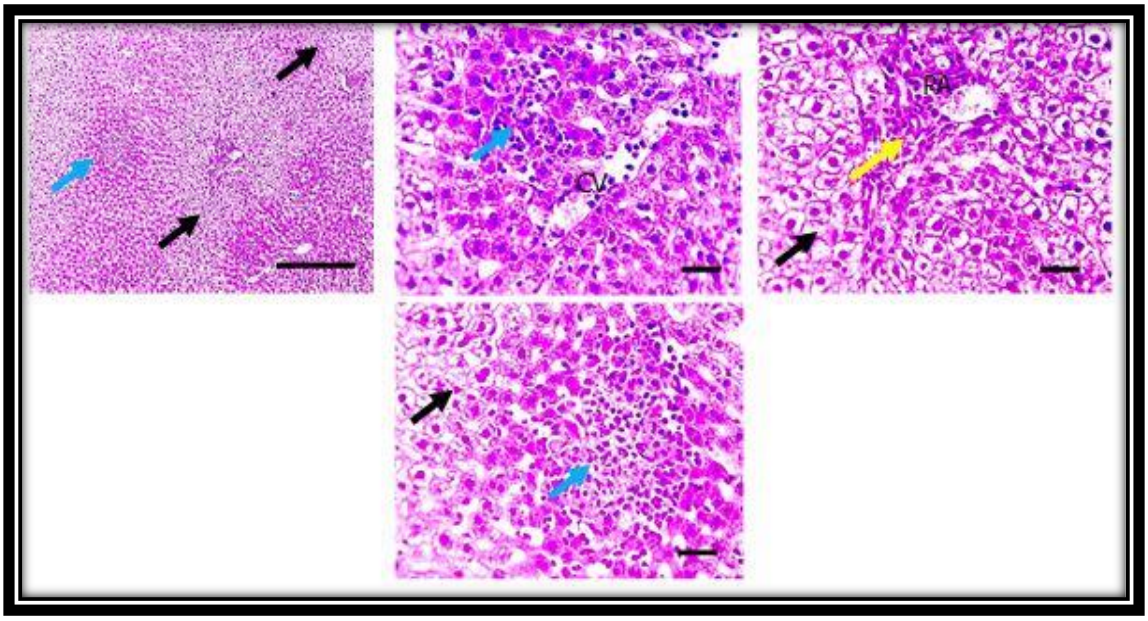

Photo 2*: liver sections from untreated rat group kept on Liver sections of +ve group showing highly disrupted hepatic architecture due to diffuse ballooning degeneration (black arrows) with multifocal necrosis (blue arrows) of hepatocytes, portal inflammation (yellow arrows).*

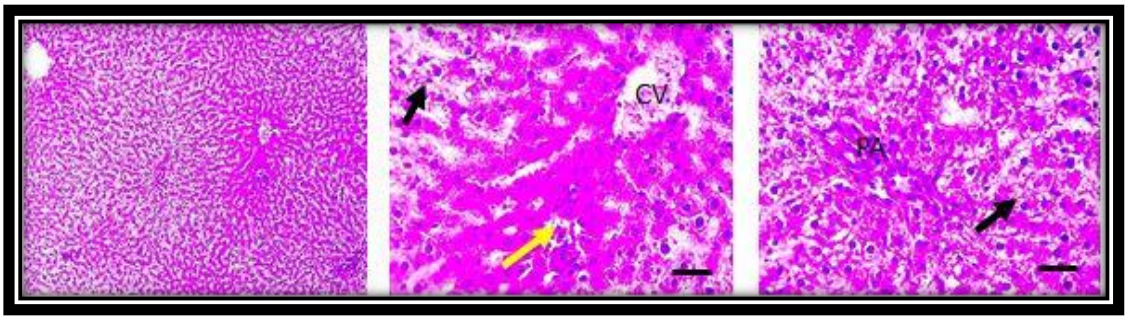

***Photo 3**: Liver sections from group treated with olive5% showing mildly disrupted hepatic architecture due to moderate periportalhydropic degeneration (black arrows) of hepatocytes and mild lobular inflammation (yellow arrows).*

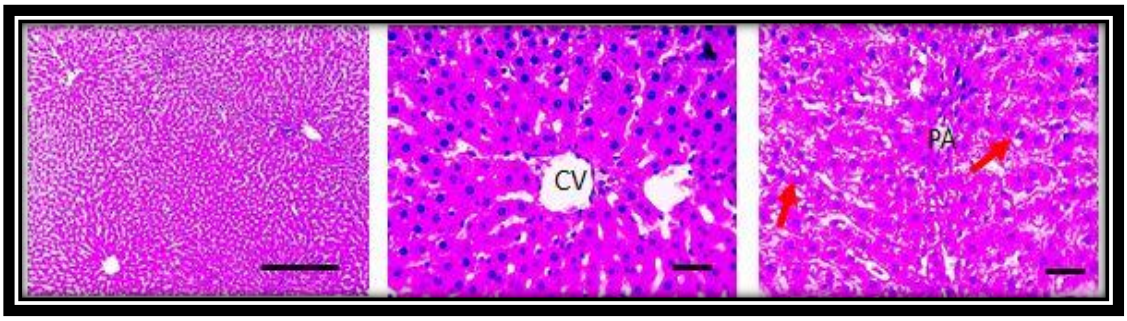

***Photo 4**: Liver sections from group treated with olive 10 % showing greatly restored hepatic architecture with few cytoplasmic vacuoles (red arrows) in hepatocytes around PA.*

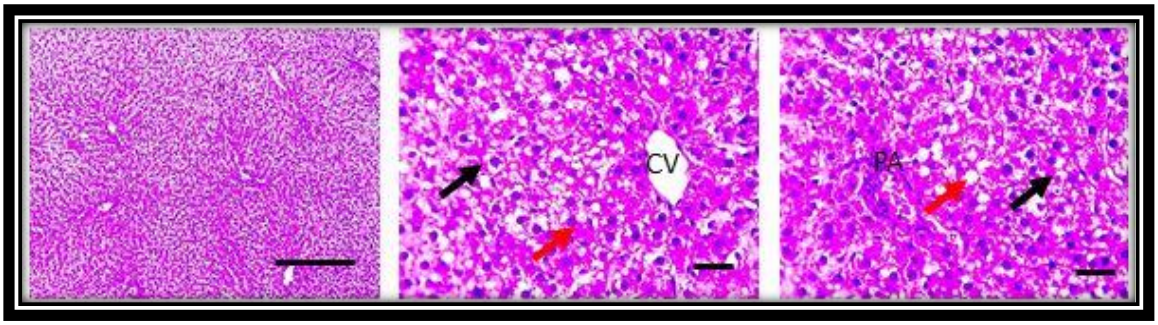

Photo 5*: Liver sections from group treated with nettle 5% moderately disrupted hepatic architecture due to hydropic degeneration (black arrows) and large cytoplasmic vacuoles in hepatocytes (red arrows) around CV and PA.*

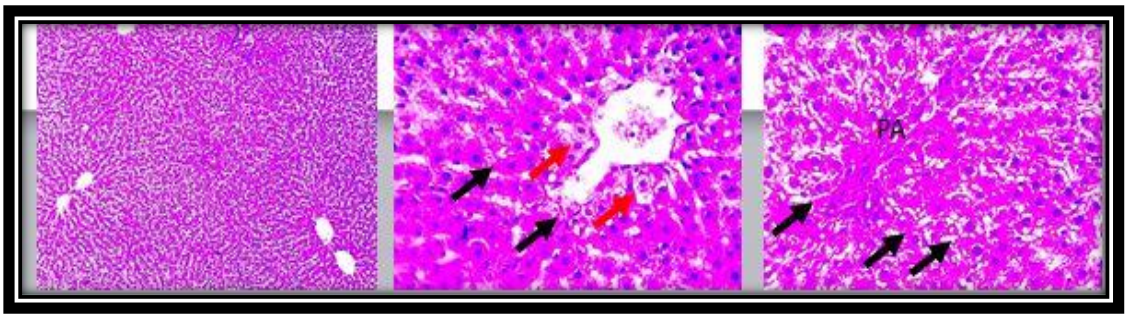

Photo 6: *Liver sections from group treated with nette 10% showing partially restored hepatic architecture with few minute cytoplasmic vacuoles in hepatocytes around CV (red arrows) and mild hydropic degeneration in hepatocytes (black arrows) around PA.*

- ***Heart tissue***

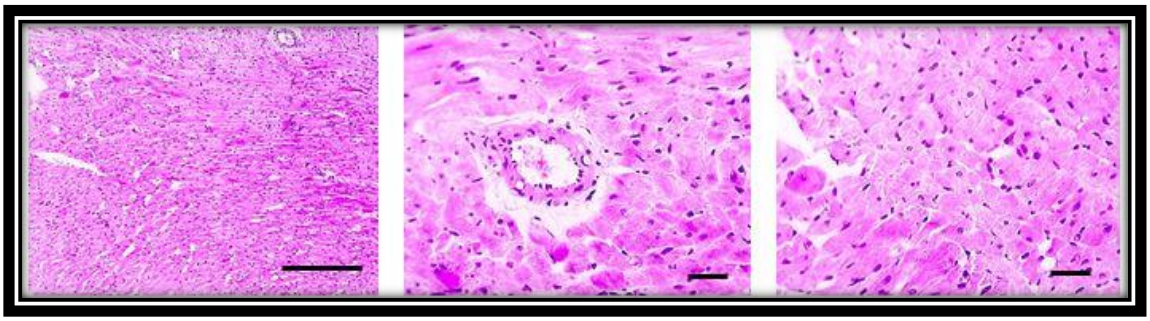

Photo 1: *Microscopic pictures of H&E stained heart sections showing normal longitudinally and crossly sectioned cardiac muscle fibers with normal blood vessels and interstitial tissue in control normal group.*

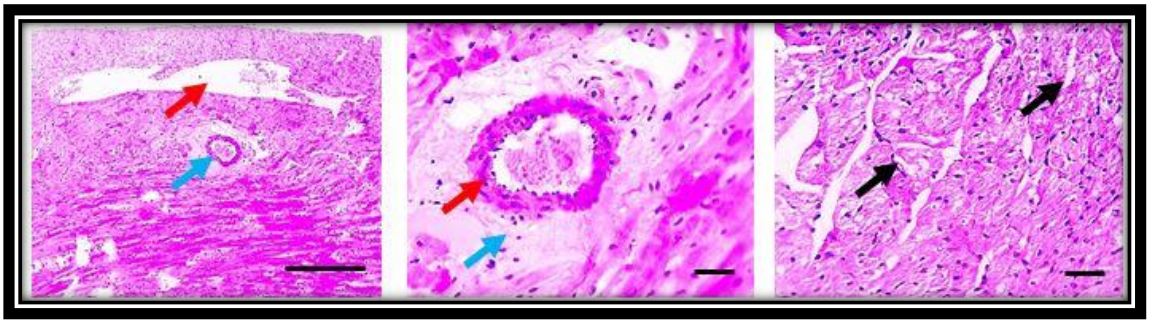

Photo 2*: Heart sections of +ve group showing congested blood vessels (red arrows), marked perivascular edema (blue arrows) and macro vesicular vacillations of crossly sectioned cardiac muscle fibers (black arrows).*

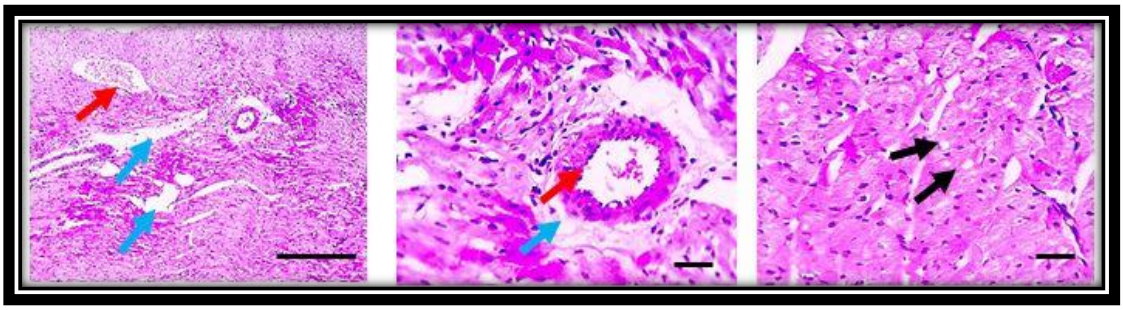

Photo 3: *Heart sections from group treated with olive 5% showing mildly congested blood vessels (red arrows), perivascular& interstitial edema (blue arrows) and few macrovesicular vacuolations of crossly sectioned cardiac muscle fibers (black arrows).*

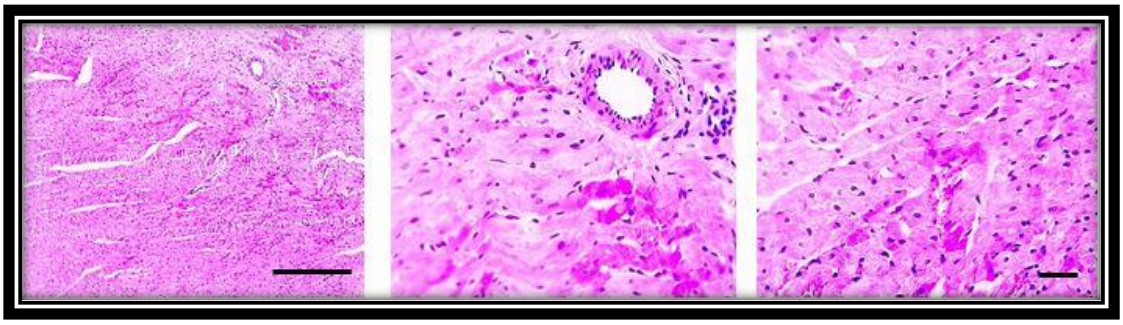

Photo 4: *Heart sections from group treated with olive 10% showing showing greatly restored histological appearance.*

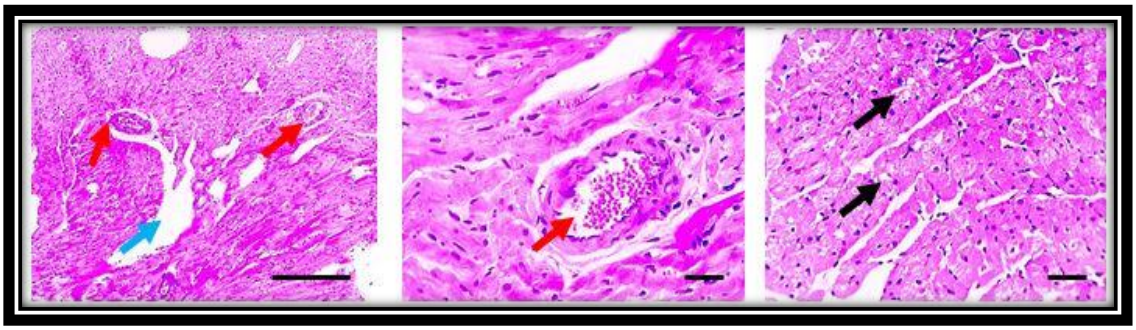

Photo 5: *Microscopic pictures of H&E stained heart sections showing from group treated with nettle 5% congestion (red arrows), perivascular&interstitial edema edema (blue arrows) with some macrovesicularvacuolations of crossly sectioned cardiac muscle fibers (black arrows).*

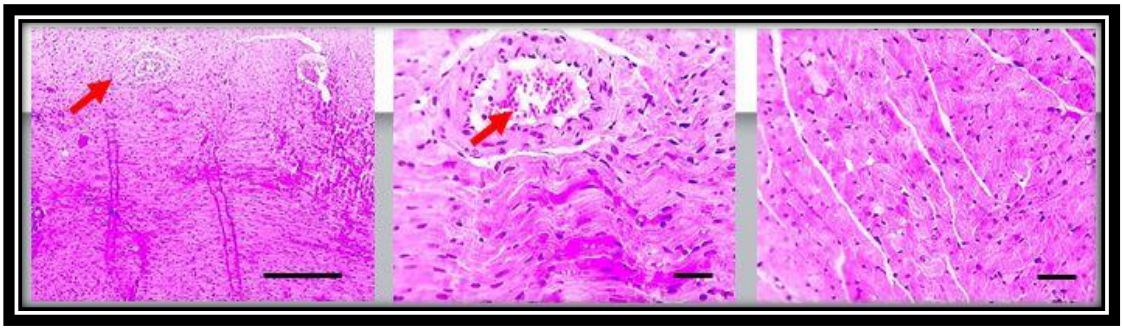

Photo 6: Heart sections from group treated with nettle 10% showing mild congestion (red arrows).

التأثير الوقائي لأوراق نبات القراص والزيتون على ارتفاع دهون الدم في جرذان التجارب

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الملخص العربي

يعتبر ارتفاع دهون الدم هو السبب الرئيسي في حدوث تصلب الشرايين وأمراض القلب والأوعية الدموية. فقد ذكرت منظمة الصحة العالمية أن أمراض القلب والأوعية الدموية تمثل٤٦ ٪ من إجمالي الوفيات في مصر. ولهذا السبب؛ تتناول الدراسة الحالية التأثير الوقائي لأوراق نبات القراص والزيتون على ارتفاع دهون الدم في جرذان التجارب. تم استخدام ستة و ثلاثين من ذكور الجرذان البيضاء وزنها ١٣٠ ± ٢٠ جرامًا وتم تقسيمهم إلى ست مجموعات متساوية كل مجموعة تحتوي علي (٦ جرذانلكل منها) ، المجموعة الأولى تم تغذيتها على الغذاء الأساسي طوال فترة التجربة كمجموعة ضابطة سالبة (٧ -) ، بينما كانت المجموعة الثانية (٧ +) المجموعة الضابطة الموجبة التي تغذت على نظام غذائي عالي الدهون لمدة أربعة أسابيع ، في حين أن المجموعات الأربع الأخرى أعطيت نظامًا غذائيًا عالي الدهون مدعما بأوراق نبات القراص (٥٪), (١٠٪) ، أوراق الزيتون (٥٪) ,(١٠٪) على التوالي لمدة أربعة أسابيع (كمجموعات معالجة). تم إجراء التحليل الكيميائي والمركبات الفينولية لكلا من اوراق القراص والزيتون. وفي نهاية التجربة تم حساب البيانات البيولوجية وأخذ عينات الدم للتحليل البيوكيميائي. بالإضافة إلى ذلك ، تم إجراء فحص الأنسجة. وأظهرت النتائج أن النظام الغذائي المرتفع الدهن في المجموعة لجرذان التجارب المصابة الموجبة أدي إلى زيادة نسبة كلا من وزن الجسم ، ووزن الأعضاء النسبي ، ونسبة الدهون في الدم ، و انزيم المالون داالدهيد (مؤشر حدوث الأكسدة) ، وإنزيمات الكبد وجلوكوز الدم بينما انخفض البروتين الدهني عالي الكثافة في الدم HDL، و سوبر أكسيد ديسميوتاز (إنزيم هام في مضادات الأكسدة) وانزيم الجلوتاثيونبيروكسيديز. وقد أظهرت جميع المجموعات المعاملة في كلا من النباتين تحسنًا في المؤشرات السابقة مقارنة بالمجموعة المصابة الموجبة.في الختام ,يمكن استخدام أوراق القراص وأوراق الزيتون لتحسين مستوى الدهون ووظائف الكبد والحماية من ارتفاع دهون الدم في جرذان التجارب.

الكلمات المفتاحية:: *صورة الدهون – أوراق نبات القراص / الزيتون – أنزيمات مضادات الأكسدة – وظائف الكبد*