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Evaluation the role of Hydroalcoholic extract of *Moringa Oleifera Lam* Leaves in many Histological and Physiological parameters for male rats kidneys induced by Hyperlipidemia

Ghina Jasim Mohammed[1], Qays Assi Ahmed[2]

[1,2] Department of Life Science, College of Education for Pure Sciences, Kirkuk University, Iraq

[1] *Corresponding author: E-mail*: ***qaysassi77@uokirkuk.edu.iq***

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ABSTRACT

Hyperlipidemia is a common disease that causes serious diseases and damages the kidneys due to increased oxidative stress. The *Moringa* plant was chosen because it contains antioxidants, including flavonoids, to reduce the level of lipids. The experiment was conducted at the Animal House/Veterinary College/Tikrit University, for a period from 10/1/2023 to 11/7/2024. Experimental rats: 40. Form 8 groups of 5 rats each. The healthy groups were fed a standard diet throughout the experiment, while the infected groups were fed a high-fat diet with 2% cholesterol throughout the experiment. The groups were divided as follows: 1 healthy control, 2 infected control fed a high-fat diet, 3 infected control and dosed with *Moringa* extract, 4 infected and dosed with atorvastatin, 5 infected control and dosed with the extract + the drug, 6 healthy control fed a standard diet and dosed with the extract. 7 were healthy and were dosed with the drug only, 8 were healthy and were dosed with the extract + the drug. The study was designed to determine the role of *Moringa* extract compared to the drug atorvastatin in improving risk factors for kidney disease resulting from hyperlipidemia. Biochemical results showed an increase in the levels of urea, creatinine, and uric acid in the hyperlipidemia group, and in the groups that were dosed with the extract and the drug, there was a significant decrease ($P \geq 0.05$). As for histological results, they showed histological disorders in the kidneys. The extract and drug were more effective in normalizing tissue lesions.

تقييم دور المستخلص الكحولي المائي لأوراق نبات المورينجا اوليفيرا *Moringa Oleifera Lam* في عدد من المتغيرات النسيجية والفسلجية في كلى ذكور الجرذان المعرضة لفرط الدهون المستحث

[١] غنى جاسم محمد، [٢] قيس عاصي احمد

[١،٢] *قسم علوم الحياة، كلية التربية للعلوم الصرفة، جامعة كركوك، العراق*

الخلاصة

فرط الدهون مرض شائع، يسبب امراض خطيرة ويلحق الضرر بالكلى بسبب زيادة الاجهاد التأكسدي، تم اختيار نبات المورينجا بسبب احتوائه مضادات اكسدة منها الفلافونويدات لتخفض من مستوى الدهون. تمت التجربة في البيت الحيواني/ كلية البيطرة/ جامعة تكريت، لمدة من ٢٠٢٣/١٠/١ الى ٢٠٢٤/١١/٧. جرذان التجربة ٤٠ كونت ٨ مجاميع كل مجموعة ٥ جرذان. المجاميع السلمية غذيت على عليقة قياسية طول فترة التجربة، المجاميع المصابة غذيت على عليقة عالية الدهون ٢% كوليسترول طول فترة التجربة. تقسمت المجاميع كتالي: ١ سيطرة سليمة، ٢ سيطرة مصابة غذيت على غذاء عالي الدهون، ٣ مصابة جرعت بمستخلص المورينجا، ٤ مصابة وجرعت بعقار الاتورفاستاتين، ٥ مصابة جرعت بالمستخلص + العقار، ٦ سليمة غذيت على عليقة قياسية وجرعت بالمستخلص، ٧ سليمة وجرعت بالعقار فقط، ٨ سليمة جرعت بالمستخلص + العقار. صممت الدراسة لمعرفة دور مستخلص المورينجا مقارنة بعقار الاتورفاستاتين في تحسين عوامل الخطر للكلى الناتجة عن فرط الدهون. أظهرت النتائج الكيموحيوية ارتفاعاً في نسبة اليوريا، الكرياتينين، حمض البوليك في مجموعة فرط شحميات الدم، وفي المجموعات التي تم جرعتها بالمستخلص والدواء حدث انخفاض معنوي ($P\leq ٠.٠٥$). أما بالنسبة للنتائج النسيجية فقد أظهرت اضطرابات نسيجية في الكلى. وكان المستخلص والدواء أكثر فعالية في تطبيع الآفات الأنسجة.

الكلمات المفتاحية: الزيوت الطيارة، السمية الخلوية، الفعالية المضادة للسرطان، سرطان الثدي.

INTRODUCTION

The term hyperlipidemia expresses an abnormal increase in the levels of fats or lipoproteins that occurs as a result of a disorder or defect in the metabolic processes and function of fats. This increase may occur due to diet, obesity, a hereditary factor, diabetes, or hypercholesterolemia (Ahmed *et al*., 2020). Patients with hyperlipidemia are likely to have an increased risk of developing cardiovascular disease, and for this reason hyperlipidemia is considered particularly important for predicting the development of atherosclerosis (AS), coronary artery diseases, and cerebral vascular diseases (Vaghefi *et al*., 2024). As a result, the elevation of blood cholesterol levels can cause atherosclerosis, hypertension, and kidney failure in addition to raising the blood pressure (Przykaza, 2021). Additionally, research has demonstrated that renal ischemia, tubule atrophy, and inner tissue fibrosis can all be brought on by hypercholesterolemia. Due to the production of lipid peroxidation and free radicals, excess fat leads also to the oxidative stress (Du *et al*., 2023). *Moringa* is the only genus in the Moringaceae family it comprises13 species *Moringa oleifera Lam* due to it is health benefits, the *Moringa* tree has several uses. Its leaves can help prevent cancer by acting as a good source of antioxidants (Padayachee and Baijnath, 2022).Also, because it reduce oxidative stress and inhibits the production of free radicals, it performs as an antioxidant to improve renal function and suppress tissue problems in addition to working to lower blood levels of cholesterol and fat profile M. oleifera leaves are rich with active compounds including vitamins such as B groups, A, C, and E, sterols as well as flavonoids. Through a process known as competitive inhibition, plant sterols reduce the cholesterol (Sari and Suwondo, 2022). In addition to its anti-inflammatory properties, atorvastatin lowers blood cholesterol and suppresses tissue and physiological abnormalities in the kidneys caused by obesity (Yeramaneni *et al*., 2017) The aim of the study is to know the therapeutic and preventive role of

Moringa extract compared with the drug atorvastatin to reduce and normalize the histological and physiological variables of the kidneys.

MATERIALS AND METHODS

Experimental animals and Nutrition

Forty male Sprague Dawley rats, and the mean weight 150 grams and aged between 12 to 14 weeks, were obtained from Tikrit University's College of Veterinary Medicine. Following hygienic guidelines, experiments were carried out in the animal facility at the College of Veterinary Medicine, Tikrit University, from October 1, 2023, until July 11, 2023. For two weeks, the animals were let to acclimate to their surroundings and make sure they were disease-free. The rats were fed with 35% wheat flour, 35% yellow corn, 20% soybeans, 10% concentrated animal protein, barley, bran, and limestone, and antifungal substances were added to these percentages, according to (Al-Janabi, 2008).

M. oleifera leaves extract preparation

Leaves of *Moringa oleifera Lam* were collected from cultivated plants in Salah al-Din Governorate, Shirqat District, washed and dried well at room temperature, an aqueous alcoholic solution containing ethanol absolute was used in the extraction procedure to produce an extract in accordance with the protocol (Al-Amri, 2003). The findings of an experiment to find the effective dose for concentrations (100, 200, 300, and 400) mg/kg indicated that 400 mg/kg is the most effective concentration and is therefore regarded as the effective dose.

Design of experiments

Forty rats that utilized in the experiment were divided into eight groups five rats for each group, based on comparable weights. post two-week of preparatory phase, the healthy groups were fed a regular diet, while the sick groups with hyperlipidemia were fed a diet has 2% fat and cholesterol (Yang *et al*., 2019).

Experiment groups

1. Group1 is control with a basic diet
2. Group 2 negative control group with a high-fat diet
3. Group 3 had a high-fat diet with only *Moringa* extract at a concentration of 400 mg/kg
4. Group 4 with a high-fat diet dosed with atorvastatin only
5. Group 5 with a high-fat diet dosed with the extract + the drug
6. Group 6 with a basic diet dosed with the extract only
7. Group 7 with a basic diet dosed with the drug only
8. Group 8 with a basic diet dosed with the extract + the drug

Collecting blood and kidney samples

Five weeks after the experiment began, the rats were dissected after the animals were rendered unconscious using chloroform. According to the protocol, blood samples were taken from the heart, transformed into serum, and then preserved in tubes. After that, kidneys were taken out and put in boxes fixed with 10% formalin and kept to forther use (Al-Hajj, 1998).Next, tissue sections were processed according to (Bankfort and Stevens, 1982).

Serum analysis

Rat serum samples were subjected to three different analyses in order to determine the concentrations of urea, creatinine, and uric acid. Urea, uric acid and creatinine were estimated using a ready-made analysis kit (Rifai,2022).

Statistical analysis

The Analysis of Variance test was used to perform a statistical analysis of the data, and Duncan's multiple ranges test was used to identify significant differences between the average of treatments at a significance level of ($p \leq 0.05$). (Wahib and Al-Sahuki, 1990).

RESULTS

Physiological result

Creatinine concentration in a blood serum

The results, in Figure (1), showed a significant increase ($0.05 \geq P$) in the concentration of creatinine (2.52±0.30) in the group of animals in which hyperlipidemia was induced compared to the healthy control group (0.52±0.10). Groups of animals induced with hyperlipidemia that were dosed with *Moringa* leaf extract, ATOR drug, and *Moringa* leaf extract + ATOR drug showed a significant decrease ($P \geq 0.05$) in creatinine concentration (2.07±0.12, 1.39±0.21, 1.31±0.23), respectively, compared to With a control group that induced hyperlipidemia. As for the groups of animals dosed with *Moringa* leaf extract, ATOR drug, and *Moringa* leaf extract + ATOR drug alone, they did not show a significant increase in total cholesterol concentration (0.51±0.03, 0.55±0.13, 0.56±0.03), respectively, compared to the healthy control group.

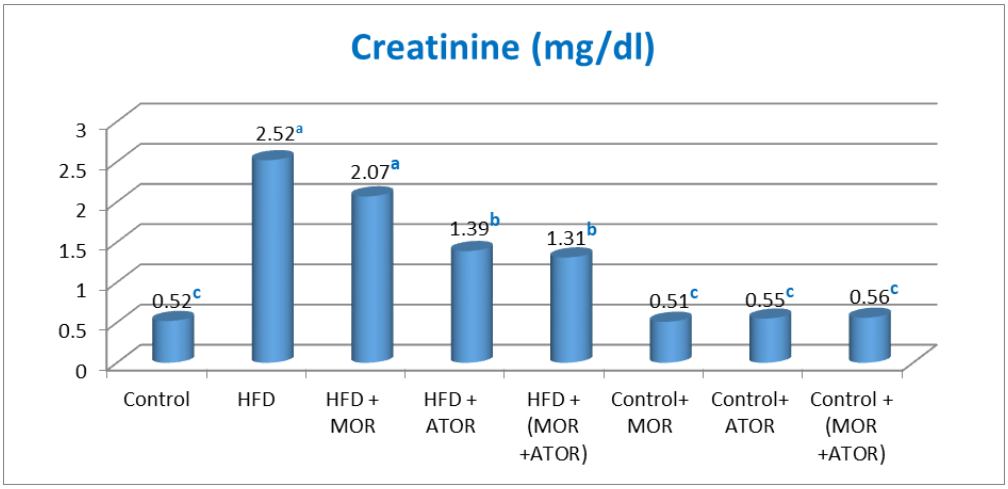


Figure (1): The effect of treatment with *Moringa* leaf extract, the drug ATOR, and *Moringa* leaf extract + the drug ATOR on the concentration of creatinine in the blood sera of healthy white male rats in which hyperlipidemia was induced.

Number of rats (5) in each group.

Uric acid concentration in blood serum

The results in Figure (2) showed that there was no significant increase ($0.05 \geq P$) and there was a slight increase in the concentration of uric acid in the blood serum of the rats in which hyperlipidemia was

induced (7.52±0.08) compared to the healthy control group (6.82±0.29). The results of the analyzes also showed that in the groups in which hyperlipidemia was induced and which were dosed with *Moringa Oleifera* leaf extract, the drug ATOR, and the extract + the drug, there was a significant decrease (P≥0.05) in the concentration of Uric acid (5.46±0.14, 5.44±0.05, 5.14±0.18). Respectively compared to the negative fat control group. The results of analyzes of healthy groups that were not fed fat and were given *Moringa* extract, the drug atorvastatin, and the extract + the drug showed a significant decrease (P≥0.05) in the concentration of uric acid (5.01±0.09, 5.20±0.14, 5.25±0.15) respectively in comparison. With a healthy control group.

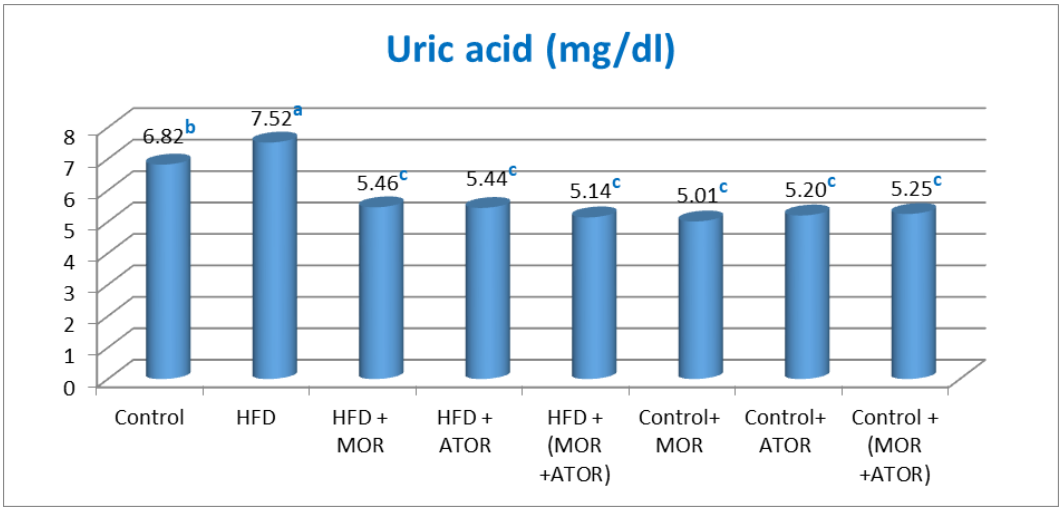


Figure (2): The effect of treatment with *Moringa* leaf extract, the drug ATOR, and *Moringa* leaf extract + the drug ATOR on the concentration of uric acid in the blood sera of healthy white male rats in which hyperlipidemia was induced.

Number of rats (5) in each group.

Urea concentration in blood serum

The results of the analyzes in Figure (3) showed that there was a significant increase (0.05≥P) in the concentration of urea in the blood serum of the group of rats that were fed a high-fat diet (55.18±1.77) compared to the healthy control group (35.90±0.90). b). The results of groups of animals in which hyperlipidemia was induced and were dosed with *Moringa* leaf extract, atorvastatin, and the extract + drug showed that there was a significant decrease (P≥0.05) in the urea concentration (33.84±1.29, 33.41±0.53, 31.47±1.18), respectively, compared to Negative control group induced hyperlipidemia. The group of healthy animals that were given *Moringa* leaf extract and the extract + the drug there showed a significant decrease (P≥0.05) in the urea percentage concentration, respectively (38.18±1.58, 33.49±0.87). While the group with ATOR drug only (35.00±1.56) did not show a significant decrease compared to the healthy control group.

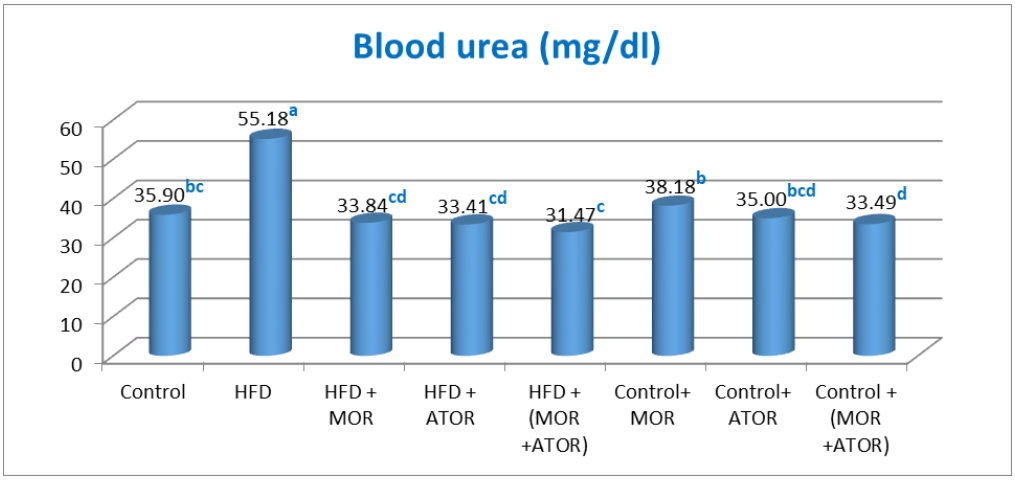


Figure (3): The effect of treatment with *Moringa* leaf extract, the drug ATOR, and *Moringa* leaf extract + the drug ATOR on the concentration of urea in the blood sera of healthy white male rats in which hyperlipidemia was induced.

Number of rats (5) in each group.

H&E stain of kidney tissue

The results of the current study for the healthy control group showed the normal shape of the renal glomerulus (G), Bowman's Capsule Space (BCS), Proximal Convoluted Tubular (PCT), and Distal Convoluted Tubular (DCT) as shown in the image (1).

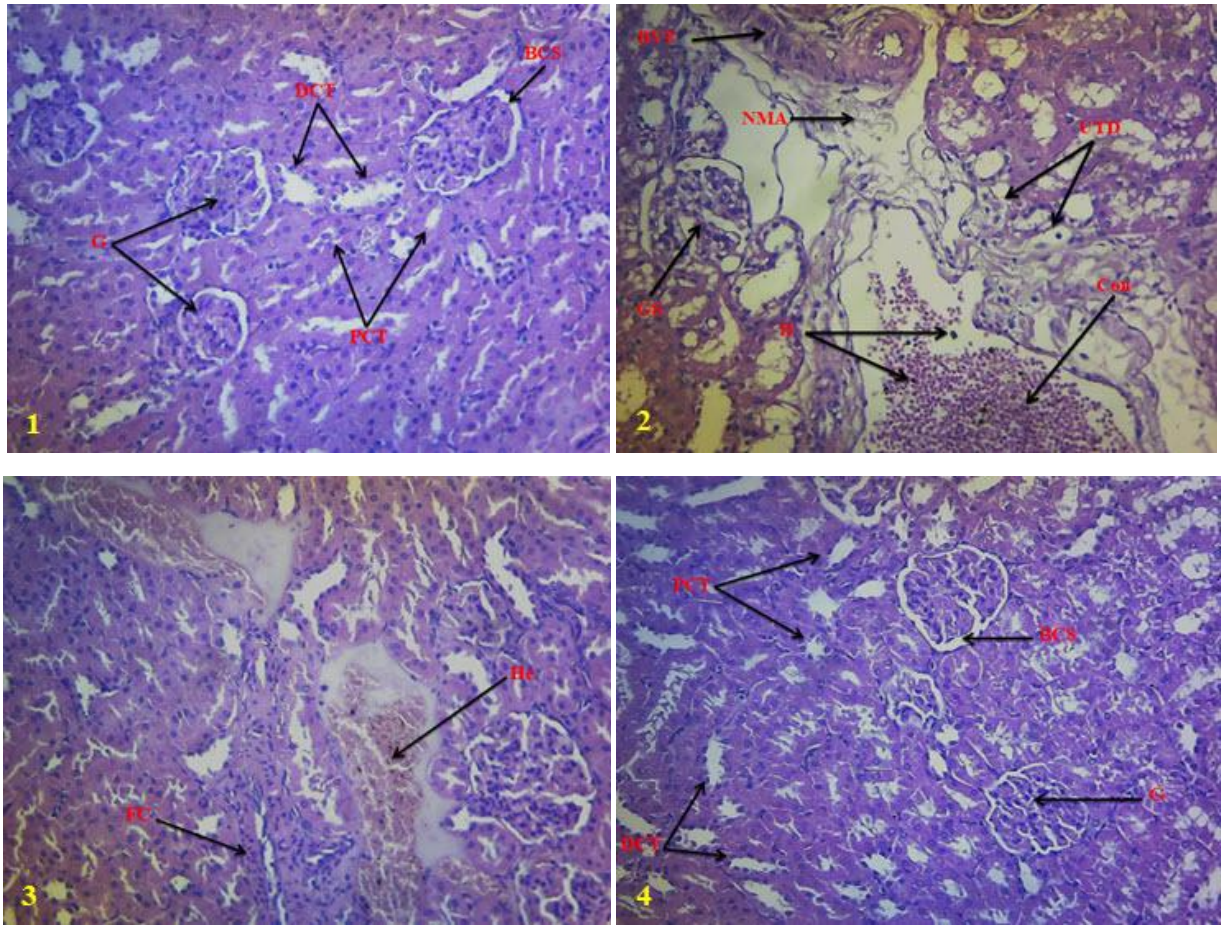
As for the group in which hyperlipidemia was induced, there were many histological changes in the kidneys, including congestion (Con) at a high rate (+++), inflammatory cell infiltration (II) at a moderate rate (++), and accumulation of necrotic materials. Accumulation (NMA) in the kidneys is at a high rate (+++), Blood Vessel Fibrosis (BVF) is at a high rate (+++), Glomerulus Segmentation (GS) is at a moderate rate (++), and Urinary Tubules Damage (UTD)) with a high percentage (+++), hemolysis (He) with a high percentage (+++), and Fibroblast Collection (FC) cells with a moderate percentage (++) as in images (2,3).

Regarding the infected control group, wherein the hydroalcoholic extract of *Moringa* leaves was the only medication used to induce hyperlipidemia, it was observed that, as shown in pictures (4), urinary tubule damage (UTD) was reduced to a small percentage (+), hemolysis (He) to a rare percentage (Trace), and fibroblast collection (FC) to a small percentage (+). Additionally, the accumulation of necrotic materials accumulation (NMA) in the kidneys was reduced to a low percentage (+), blood vessel fibrosis (BVF) to a moderate percentage (++), and glomerulus segmentation (GS) remained at a moderate percentage (++).

The infected control group, which received a dose of atorvastatin alone after being given an induced hyperlipidemia, showed the following changes: congestion (Con) decreased to a moderate percentage (++), inflammatory cell infiltration (II) to a small percentage (+), and the kidneys' accumulation of necrotic materials accumulation (NMA) to a moderate rate (++). Blood vessel fibrosis (BVF) also decreased to a moderate rate (++), glomerulus segmentation (GS) survived to a moderate rate (++), and urinary tubule damage (UTD) was reduced. As shown in images (5), Hemolysis (He) to a moderate rate (++), Fibroblast Collection (FC) to a rare rate.

Regarding the infected control group, wherein the drug atorvastatin and the hydroalcoholic extract of *Moringa* leaves were used to induce hyperlipidemia, it was observed that the accumulation of necrotic materials decreased, inflammatory cell infiltration (II) was absent, and congestion (Con) decreased to a small percentage (+). Decreased glomerulus segmentation (GS) to a rare rate (Trace), absence (Nil), accumulation (NMA) to a rare rate (Trace), and urinary tubule damage (UTD) to a rare rate are all associated with blood vessel fibrosis (BVF). As seen in images (6), a rare proportion (Trace) and hemolysis (He) to a tiny percentage (+) and no (Nil) Fibroblast Collection (FC) cells.

As for the healthy groups dosed only with the hydroalcoholic extract of *Moringa* leaves, the drug atorvastatin, and (the hydroalcoholic extract of *Moringa* leaves + the drug atorvastatin), there were no significant histological changes compared with the control group, as the normal shape of the central vein (CV), hepatocytes (HC), and sinusoids was observed. Blood cells (S) and Cover cells (KC) in their natural form, as in images (7,8,9).



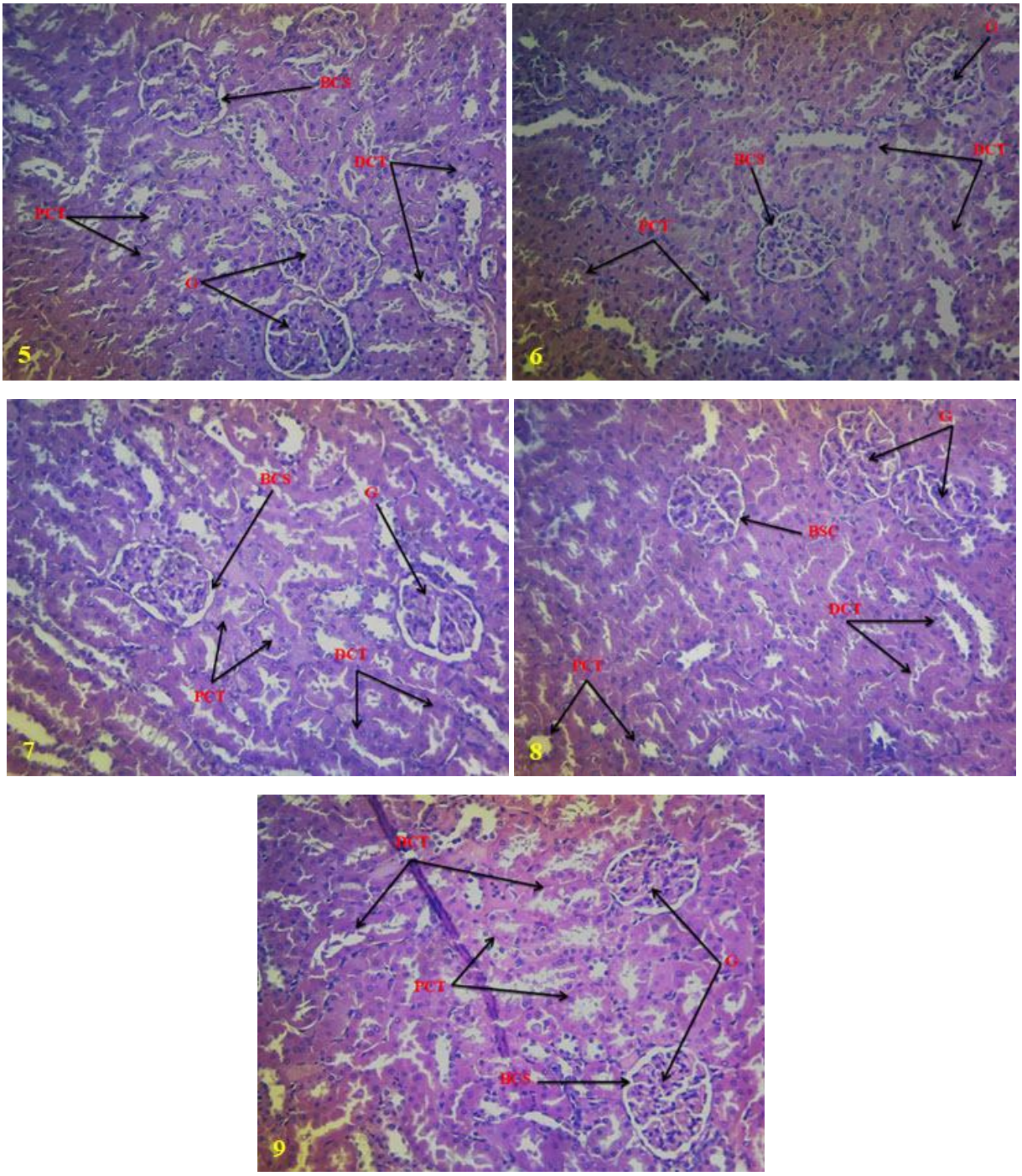


Image (1) A healthy control group kidney section showing the normal appearance of Glomerulus (G), Bowman's Capsule Space (BCS), Proximal Convoluted Tubular (PCT) and Distal Convoluted Tubular (DCT), H&E 400X.

Image (2) A section of the kidneys of the control group with hyperlipidemia showing congestion (Con), inflammatory infiltration (II), accumulation of necrotic materials (NMA), blood vessel fibrosis (BVF), glomerulus segmentation (GS), and damage to the urinary tubules. Tubules Damage (UTD), H&E 400X.

Image (3) A section of the kidney of a control group with hyperlipidemia showing hemolysis (He) and Fibroblast Collection (FC), H&E 400X.

Image (4) A section of the kidney of a control group with hyperlipidemia that was dosed with hydroalcoholic extract of *Moringa* leaves showing the normal shape of the renal glomerulus (G), Bowman's Capsule Space (BCS), Proximal Convoluted Tubular (PCT), and Distal Convoluted Tubular (DCT).), H&E 400X.

Image (5) A section of a kidney from a hyperlipidic control group treated with atorvastatin showing the normal shape of the glomerulus (G), Bowman's Capsule Space (BCS), Proximal Convoluted Tubular (PCT), and Distal Convoluted Tubular (DCT), H&E 400X.

Image (6) A section of the kidney of a control group with hyperlipidemia that was dosed with hydroalcoholic extract of *Moringa* leaves + the drug atorvastatin showing the normal shape of the renal glomerulus (G), Bowman's Capsule Space (BCS), the proximal convoluted tubule (PCT), and the distal convoluted tubule. Tubular (DCT), H&E 400X.

Image (7) A section of the kidneys of a healthy control group that was dosed with hydroalcoholic extract of *Moringa* leaves showing the normal shape of the renal glomerulus (G), Bowman's Capsule Space (BCS), Proximal Convoluted Tubular (PCT), and Distal Convoluted Tubular (DCT). H&E 400X.

Image (8) A section of the kidneys of a healthy control group that was dosed with atorvastatin showing the normal shape of the glomerulus (G), Bowman's Capsule Space (BCS), Proximal Convoluted Tubular (PCT), and Distal Convoluted Tubular (DCT), H&E 400X.

Image (9) A kidney section of a healthy control group that was dosed with hydroalcoholic extract of *Moringa* leaves + the drug atorvastatin shows the normal shape of the renal glomerulus (G), Bowman's Capsule Space (BCS), the Proximal Convoluted Tubular (PCT), and the Distal Convoluted Tubular (DCT), H&E 400X.

Dissection

Dissection of the Physiological finding

The results of the study showed that there was a significant increase in the creatinine concentration of the control group in which hyperlipidemia was induced and was treated with cholesterol compared to the healthy control group. The reason for this is that excessive cholesterol leads to damage to the interstitial tissue of the kidney and atrophy of the renal tubules and thus a decrease in renal perfusion. There are reasons, including: Thyroid diseases, chronic nephronitis, heart failure, muscle diseases, or dehydration, all of which may contribute to raising the levels of creatinine urea, uric acid, and salts, or cause an increase in the resistance of the glomerular arterioles in the kidney, or cause a decrease in glomerular filtration (Ebrahimi-Mameghani *et al*. 2020; Ahmed *et al*.,2022). Also, the increase in, creatinine urea, salts, and uric acid can interfere with metabolism and with the regulation of hormones, which follow multiple mechanisms, and also an imbalance in endocrine functions, such as an increase in the concentration of hormones in the blood, and also an increase in the activity of the adrenergic gland, and each of these conditions may be the reason for the increase in the concentration of urea. And salts, creatinine and uric acid (2023, Al Obaidi and Rzoqi). As for the groups in which hyperlipidemia was induced and were dosed with *Moringa* leaf extract, it may be due to the role of the extract in

maintaining the normal range of urea and creatinine concentrations by maintaining kidney health (Alkhudhayri *et al*., 2021). The reason for this is due to the high capacity of antioxidants found in the leaves of the *Moringa* plant, as they contain plant sterols, which also reduce the level of cholesterol in the blood and thus prevent infections that can affect the kidneys (Di Lorenzo *et al*., 2021). *Moringa* also due to what... It contains substances that lower blood sugar levels, lower blood pressure, and works to protect the kidneys and liver from damage due to antioxidants and active substances that lower the lipid profile in the blood, which may harm the kidneys (Arika *et al*., 2019). As for the drug atorvastatin, it works to reduce the level of cholesterol in the blood serum and works to prevent any damage to the kidneys and prevent high levels of creatinine, urea, salts, and uric acid. It is considered the most appropriate and most common treatment, and therefore it works with the extract perfectly in reducing the level of creatinine, urea, uric acid, and salts in the blood Serum, The reason for this is that it protects the kidneys from the damage that can occur from excessive fat, high cholesterol, and atherosclerosis, whether in groups suffering from hyperlipidemia and treated with the drug and the extract together, or the drug separately, and in the healthy groups that were given the drug and the extract for the preventive purpose, its effect was positive. By preserving the kidneys, preventing an increase in creatinine, urea, salts, and uric acid, preventing kidney damage when fat is high, as well as in healthy groups, and preventing physiological and histological changes compared to the affected control group. The drug also works to reduce the oxidative stress that occurs due to free radicals, thus reducing and preventing damage to the kidneys (Karami *et al*.,2023).

Dissection of the histological finding of the kidney

The results in the current study of the group in which hyperlipidemia was induced showed that there were many histological changes in the kidneys, including congestion at a high rate, inflammatory cell infiltration at a moderate rate, accumulation of necrotic materials in the kidneys at a high rate, fibrosis of blood vessels at a high rate, fragmentation of the glomerulus at a moderate rate, and damage to the urinary tubules at a rate. It has a high rate of hemolysis and a moderate rate of fibroblasts, and the results of our study are consistent with the results of a study (Tiss *et al*., 2020) In his study, he demonstrated the effect of excess fat on kidney tissue by comparing the effect of a high-fat diet and a control group with a diet containing fat on the kidneys of male rats. The results showed that the high-fat diet caused kidney imbalances represented by an increase in the concentration of total cholesterol and low-density lipoproteins and a decrease in Concentration of high-density lipoproteins, in addition to interstitial inflammation of the kidneys and lipofuscin deposition in the renal tubules. The reason may be due to the increase in fat, which leads to energy stimulation, the generation of reactive oxygen species, and an increase in oxidative stress due to the increased formation of free radicals, which may be the main cause of tissue damage. It is also accompanied by a depletion in glutathione, its level decreases, and an increase in the MDA level. This leads to fat peroxidation. Which is one of the causes of nephron toxicity and kidney tissue damage, and this weakness in the action of antioxidants is linked to high levels of cholesterol in the blood (Adwas *et al*., 2019; Ebrahimi-Mameghani *et al*., 2020). Excessive fat also leads to kidney dysfunction, leading to an increase in the levels of creatinine, urea, and uric acid. The main cause of damage to kidney tissue is oxidative stress, which increases the formation of free radicals, and these lead to cell sloughing in the collecting tubules that function. It inhibits the function of the nephrons, as a result of the interaction between antioxidants and free radicals, which results in necrosis of the renal tubules and also leads to the formation of holes in the lining of the blood vessels, which causes the exit of red blood cells and leads to bleeding (Dos Santos *et al*., 2022).

As for the role of *Moringa* leaf extract in an infected control group that induced hyperlipidemia and was dosed with the hydroalcoholic extract of *Moringa* leaves only, it was noted that congestion decreased to a small percentage, inflammatory cell infiltration to a small percentage, accumulation of necrotic substances in the kidneys to a small percentage, vascular fibrosis to a moderate percentage, and fragmentation remained. The glomerulus was reduced to a moderate percentage, while it also reduced urinary tubule damage to a small percentage, hemolysis to a rare percentage, and fibroblast aggregation to a small percentage. These results are consistent with the study (Alkhudhayri *et al*., 2021), which showed the role of *Moringa* extract in improving histological results in the kidney compared to With a negative control group with hyperlipidemia. The reason for this is due to the antioxidants that *Moringa* contains, including vitamin E, which acts as an antioxidant, and it also contains flavonoids that reduce lipid peroxidation, which results from oxidative stress, as *Moringa* works to reduce lipid levels due to the fatty acids and plant sterols it contains, as well as It contains flavonoids, saponins, and phenolic acids (Abd El-Hack *et al*., 2022).

The active substances in *Moringa* work to remove free radicals and thus work to protect kidney tissues from free radical damage, protect them from necrosis and fat deposition in the blood vessels, and prevent inflammation. *Moringa* also works to reduce the levels of creatinine, urea, and uric acid compared to the control group with hyperlipidemia (Madane *et al*. 2019). A study (El-Shehawi *et al*., 2021) also showed positive results when using *Moringa* extract and a significant improvement in protecting kidney tissue from damage because the extract works to reduce the level of cholesterol in the blood and also remove free radicals, reduce oxidative stress, and improve kidney functions, which include creatine and urea. And uric acid.

As for the role of the drug atorvastatin in the infected control group that induced hyperlipidemia and was dosed with the drug atorvastatin only, it was noted that congestion decreased to a moderate percentage, inflammatory cell infiltration to a small percentage, accumulation of necrotic substances in the kidneys to a moderate percentage, fibrosis of blood vessels to a moderate percentage, and the fragmentation of the glomerulus remained to a moderate percentage and reduced. Damage to the urinary tubules to a moderate rate, hemolysis to a moderate rate, and aggregation of fibroblasts to a rare rate. It showed improvement in the histological lesions of the kidneys, as mentioned, compared to the control group affected by hyperlipidemia, and this is consistent with (Zarei *et al*., 2019). When hyperlipidemia was induced by 1% cholesterol with standard food for 75 days and the drug ATOR was used at a dose of (20 mg/kg/day) on the thirtieth day, for 45 consecutive days to treat histological changes in the kidneys, treatment with (ATOR) significantly reduced One of the kidney injuries caused by a high-fat diet is glomerular hypertrophy and narrowing of Bowman's space. The reason for this is due to the effect of the drug on reducing the level of fats represented by cholesterol, triglycerides, low-density lipoproteins and very low-density lipoproteins, and raising the level of proteins. High-density fatty acids, improved levels of antioxidants, reduced MDA and increased GSH levels compared to the infected control group-. The results of examining kidney tissue in male rats in a study (Al-Obaidi, 2019) also showed when the drug simvastatin was used to treat hyperlipidemia, the positive role in protecting the kidneys from tissue damage to the kidneys and thus reducing the infiltration of lymphocytes, the destruction of glomeruli and tubules, and ending the bleeding condition. These results are similar to the results of our current study.

CONCLUSIONS

It was concluded from the current study that *Moringa* leaf extract has an effective role in normalizing the physiological and histological changes in the kidneys resulting from excess fat. *Moringa* had a role in reducing the level of fat and cholesterol, and thus worked to reduce the levels of urea, creatinine and uric acid, and it also has a role in suppressing the tissue changes. And to preserve the kidneys, therefore *Moringa* can be used as a nutritional supplement and treatment against diseases caused by hyperlipidemia and as an effective antioxidant.

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