



Impact of Oak Stem Extract on Blood and Serum Lipid in Hyperlipidemic Rats with Histopathological Examination of Kidneys, Liver and Spleen

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ABSTRACT

Residents around Duhok City commonly use secondary growth from Oak stems (OS) as a natural remedy for managing lipid levels, yet no scientific studies have examined its safety or effectiveness. This research investigated how OS water extract (200mg/kg) affects glucose levels, lipid profiles, kidney and liver function, as well as tissue changes in both normal and high-cholesterol rats. Thirty-two adult male rats were divided equally into four groups of eight animals each. The control group received standard food, while the second group got OS extract alongside a regular diet. The third group ate high-cholesterol food without treatment, and the fourth group combined a high-cholesterol diet with OS extract treatment. Following the experimental period, researchers collected blood samples through cardiac puncture after anesthetizing the animals.

Liver, kidney, and spleen tissues were preserved in formalin solution for microscopic examination. Results showed that fasting blood sugar (FBS) levels remained unchanged across all groups. However, triglycerides (TG) and total cholesterol (TC) increased significantly (79.2 ± 2.62 , 84.0 ± 1.98) in untreated high-cholesterol rats compared to control group (56.7 ± 2.35 , 56.9 ± 2.09) respectively. Animals receiving OS extract showed significantly ($P < 0.05$) reductions in TG (64.3 ± 2.15) and TC (73.67 ± 4.28) levels. Other measured parameters showed no significant differences between groups. The four-week study demonstrates that Oak stem extract effectively reduces total cholesterol and triglyceride levels in rats with elevated lipids. No adverse effects were observed during treatment, suggesting this traditional remedy may offer a safe approach for managing dyslipidemia. These findings support the folk medicine use of Oak stems water extract while providing scientific evidence for their lipid-lowering properties.

Keywords: Cholesterol, Hyperlipidemic Rats, Improving, Oak Stem Extract, Triglyceride.

INTRODUCTION

Cardiovascular diseases are one of the most life-threatening risk factors for global mortality, and hyperlipidemia progression contribute to their advancement (Hussain *et al.*, 2024; Yang *et al.*, 2025). Higher levels of low-density lipoprotein (VLDL), reduced levels of high-density lipoprotein (HDL), TC and TG are directly associated with coronary artery disease, hepatic dysfunction and atherosclerosis development (Bagenda *et al.*, 2025). The hyperlipidemia heavily relies on pharmacological agents, which exhibit an inadequate response, causing cardiovascular risk (Nițu *et al.*, 2025). Moreover, long-term administration of conventional lipid-lowering drugs is associated with adverse effects, hepatic dysfunction, myalgia, and an increased risk of new-onset diabetes (Kosmas *et al.*, 2018). High-cholesterol diets induce hyperlipidemia in rats, leading to organ dysfunction that resembles human conditions and elevating TG and serum TC levels (Kelle *et al.*, 2024). Furthermore, the histopathological assessment reveals potential toxicities in the liver, kidneys, and spleen of the hyperlipidemic rats (Kadhim *et al.*, 2024). The natural compounds are traditionally consumed as a natural remedy for hyperlipidemia in rodents and to treat metabolic disturbances, as well as the pathophysiology of lipid disorders (Asad *et al.*, 2024; Hao *et al.*, 2024).

Bile acid sequestrants, statins, and fibrates are modern pharmacological agents prescribed to control lipid disorders (Wierzbicki, 2025). However, these medicines are frequently inadequate, with adverse effects including myopathy, gastrointestinal disturbances, and hepatotoxicity, leading to increased interest in plant-derived substitutes with fewer side effects (Armani *et al.*, 2024; Jianu *et al.*, 2025).

Bioactive compounds, including phenolic acids, tannins, flavonoids, and terpenoid derivatives, in plants are known to enhance antioxidant defenses, regulate lipid metabolism, and mitigate oxidative stress (El-Saadony *et al.*, 2025). These traditional treatment systems have long been utilized across various cultures for metabolic disorders and lipid imbalances (Natesan and Kim, 2021).

Various parts of the oak tree, including galls, leaves, and bark, contain anti-inflammatory and antimicrobial properties, as well as astringent and rich bioactive compounds (Anwar *et al.*, 2025).

The compounds contain various pharmacological activities and have potential hypolipidemic effects such as the inhibition of dietary lipid absorption in the intestine, modulation of hepatic cholesterol synthesis, and lipid-lowering effects (Hernández-Lorca *et al.*, 2025). Moreover, polyphenolic compounds are rich in hydrolyzable tannins and condensed tannins present in oak are known to reduce inflammatory signaling pathways, inhibit lipid peroxidation, and have antioxidant properties (Burlacu *et al.*, 2020). Furthermore, phytochemicals are also involved in protecting vital organs, such as the kidneys and liver, while simultaneously reducing circulating lipid levels (Haines *et al.*, 2024).

Medicinal plants belonging to the genus *Quercus* are most crucial and have attracted scientific attention because of the wide distribution that contains rich phytochemicals, high concentrations of tannins, polyphenols and flavonoids, strongly associated with anti-inflammatory, antioxidant properties (Arzani *et al.*, 2025). Several plant extracts, supplemented with *Moringa oleifera* leaves, have improved antioxidant enzyme activities and reduced serum cholesterol in hyperlipidemic rats (Owais *et al.*, 2025). Furthermore, extracts of *Camellia sinensis* have also improved the hepatoprotective properties and are involved in lipid-lowering and modulation of lipid metabolism, resulting in a reduction of oxidative stress (Xiao *et al.*, 2025).

The effects OS extracts on hyperlipidemia and its associated metabolic parameters remain limited, while the biological activities of oak fruits, bark and leaves extracts are recognized.

Therefore, the present study was designed to investigate the protective and lipid-lowering effects of water extract of OS in hyperlipidemic rat model.

MATERIALS AND METHODS

Animal and housing

The current study used *Rattus norvegicus* (albino rats; adult males weighing 170 to 200 g and around 8-10 weeks of age) collected from the Animal House of the Science Department at the University of Duhok, Iraq, and the Department of Biology. The albino rats were brought ventilated polypropylene cage (30×25×17cm) to the experimental site. The standard diet and water were provided to rats during the acclimatization period under optimal laboratory conditions (at 23±2 °C, 12 h light: 12 h dark photoperiod).

Ethics

The study protocol related to animal ethics (Code: AE-01) was signed by the scientific committee and the Head of Biology of the Biology Department, College of Science, University of Duhok before processing the research.

Preparation of oak stem extract

One liter of distilled water and 100g of OS powder were suspended at room temperature in a dark place for 24 hours. The extracts were subsequently obtained by using 4.0µm Whatman filter papers, passing the mixture through white cheesecloth. A Rotary Evaporator (Eyela-United Kingdom) was then used to dry filtered the mixture for separation of OS extract from distilled water under vacuum at 45 °C. The OS extract was daily prepared. in order to obtain fresh extract. The OS extract dissolved in water and 200mg/kg the extract was daily administered orally to the rats via gavage (Mhammad *et al.*, 2015).

Standard diet

Standard diet was formulated by including the ingredients such as vitamins 0.58g, limestone 14.9g, soya 256.2g, wheat 665.5g, sunflower oil 43.5g, Ca₂(PO₄) 6.4, lysine 2.4g, methionine 1.5g, salt 6.3g, enzymes 0.8g, choline chloride 0.6g, and trace elements 0.5g.

Preparation of a high cholesterol diet

A high-fat diet was prepared by adding 5g of cholesterol powder, 3g bile salt, 10 ml of coconut oil, 250 ml of cooked oil, and 25 g of cow brain to one kg of the standard diet (Barany *et al.*, 2023).

Study designs

After acclimatization, male albino rats (32 in number) were randomly distributed among the experimental groups for four weeks. Four groups were designed (8 rats in each group); the first group served as a normal control group and was fed a standard diet. The group second treated with the water extract of OS and consisted of normal rats. The third group fed a cholesterol diet to untreated hyperlipidemic rats, while the fourth group was treated with the water extract of OS (200 mg/kg. day) in hyperlipidemic rats for 4 weeks.

Anesthetize of rats

Rats were anesthetized by inhaling chloroform placing the rats in a tightly closed desiccator contain a clean sterile cotton ball soaked in chloroform and kept until the animals were fully anesthetized (Goodies *et al.*, 2015).

Estimation of biochemical parameters

In gel tubes (Arzer Grande- Italy), 5mthrougl of collected from rats was placed and centrifuged (at 4000 rpm for 15 minutes) and allowed to clot for 30 minutes to obtain serum. The Cobas 600(C501) automated chemistry analyzer (Roche/Germany) was used for biochemical tests, viz, liver function parameters, FBS, serum lipids.

Histopathological examination

The liver, kidneys, and spleen organs were removed and washed with distilled water after dissection of the animals, and were then immediately fixed in 10% formalin. The Auto Staining Apparatus (Leica/Germany) was used to stain thin sections (4 micrometers) of the organ's tissues with Hematoxylin (H) and Eosin (E) stains after preparing a paraffin block, as described by Mhammad *et al.* (2015).

Statistical Analysis

Data were analyzed by using Microsoft Excel 2010 and GraphPad Prism 5 (California, USA) using analysis of variance (ANOVA) followed by the Tukey test. All groups were compared with the control group, and results were expressed as mean $\pm$ standard errors (SE), and P-values < 0.05 were considered as a statistically significant value (pointed as *).

RESULTS AND DISCUSSION

The impact of Oak stem (OS) extract in various experimental groups is described in (Table 1), the data reveal no significant alterations in blood glucose in all groups while significant alterations in lipid profiles induced by dietary change were observed, which were modulated by OS treatment.

Induction of hyperlipidemia was successfully achieved, as evidenced by a profound dyslipidemia state in rats fed a high-cholesterol diet. This group exhibited a highly significant elevation in both total cholesterol and triglyceride (TG) levels compared to the control group ($P < 0.01$). Specifically, total cholesterol concentrations increased from 56.9 ± 2.09 mg/dl in controls to 84.0 ± 1.98 mg/dl in hyperlipidemic animals. Similarly, TG levels rose markedly from 56.7 ± 2.35 mg/dl to 79.2 ± 32.62 mg/dl. Administration of OS extract to hyperlipidemic rats produced a significant ameliorative effect on these elevated lipid parameters. Treatment resulted in a statistically significant reduction ($P < 0.05$) in both total cholesterol (73.67 ± 4.28 mg/dl) and TG levels (64.3 ± 2.15 mg/dl) compared to untreated hyperlipidemic animals, although these values remained elevated relative to the control group. Notably, the high-cholesterol diet induced a numerical decrease in HDL cholesterol (from 29.1 ± 1.31 mg/dl to 23.5 ± 1.71 mg/dl) and increases in VLDL (from 11.3 ± 0.47 mg/dl to 15.8 ± 0.53 mg/dl) and LDL cholesterol (from 15.5 ± 0.49 mg/dl to 21.7 ± 1.85 mg/dl).

However, these changes did not reach statistical significance. OS treatment in hyperlipidemic rats appeared to normalize these values toward control levels, particularly for HDL cholesterol (28.7 ± 1.28 mg/dl). Fasting blood glucose levels remained stable across all experimental conditions, with no significant differences observed between any of the treatment groups and the control group.

Administration of OS extract alone to normolipidemic rats did not produce any significant alterations in the measured parameters compared to the control group.

Table (1): Examination of FBS level and serum lipids on OS

Parameters	Control	OS	Hyperlipidemic	hyperlipidemic + OS
Glucose mg/dl	110.3 $\pm$ 3.08	108.3 $\pm$ 3.05	117.8 $\pm$ 1.89	111.7 $\pm$ 3.90
Cholesterol mg/dl	56.9 $\pm$ 2.09	52.93 $\pm$ 2.79	84.0 $\pm$ 1.98**	73.67 $\pm$ 4.28*
TG mg/dl	56.7 $\pm$ 2.35	50.4 $\pm$ 2.71	79.2 $\pm$ 2.62**	64.3 $\pm$ 2.15*
HDL mg/dl	29.1 $\pm$ 1.31	28.9 $\pm$ 0.92	23.5 $\pm$ 1.71	28.7 $\pm$ 1.28
VLDL mg/dl	11.3 $\pm$ 0.47	10.08 $\pm$ 0.54	15.8 $\pm$ 0.53	12.8 $\pm$ 0.43
LDL mg/dl	15.5 $\pm$ 0.49	14.2 $\pm$ 0.61	21.7 $\pm$ 1.85	18.5 $\pm$ 1.77

Values are mean $\pm$ SE, * = ($P < 0.05$), ** = ($P < 0.01$), *** = ($P < 0.001$) for comparison all groups with control group.

The evaluation of renal and hepatic function parameters across the experimental groups yielded findings presented in (Table 2). The biochemical markers for kidney and liver function showed no statistically significant alterations in any of the treatment groups when compared to the control group.

The concentrations of blood urea and serum creatinine, primary indicators of renal glomerular function, remained within normal physiological ranges across all groups. The hyperlipidemic group showed a slight numerical elevation in creatinine levels (0.39 ± 0.042 mg/dl) compared to the control (0.35 ± 0.017 mg/dl), but this change was not statistically significant. Treatment with OS extract in hyperlipidemic rats resulted in a value (0.36 ± 0.031 mg/dl) that closely approximated the control baseline. Urea levels similarly exhibited no significant variations, demonstrating stable renal function

despite the dietary and treatment interventions. The serum activities of key liver enzymes aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (ALP) were assessed to detect potential hepatotoxicity. While the hyperlipidemic group displayed a numerical elevation in all three enzymes (AST: 37.0 ± 2.51 IU/L; ALT: 44.1 ± 3.61 IU/L; ALP: 132.2 ± 4.45 IU/L) compared to the control group (AST: 32.2 ± 1.53 IU/L; ALT: 37.4 ± 2.31 IU/L; ALP: 125.3 ± 3.48 IU/L), these increases did not reach the threshold for statistical significance. The group receiving OS extract concurrently with the high-cholesterol diet showed intermediate enzyme values, which were not significantly different from those of the control animals. Additional markers of hepatic synthetic and metabolic capacity, including total serum bilirubin (TSB), total protein, and albumin concentrations, remained consistently stable. No significant differences were observed for these parameters in any of the experimental groups relative to the control, confirming the absence of overt liver dysfunction or impairment in protein synthesis. In summary, the administration of a high-cholesterol diet and/or OS extract at a dosage of 200 mg/kg bw/day for four weeks did not produce any statistically significant adverse effects on renal or hepatic function in the experimental rats, as determined by conventional serum biomarkers in comparison with control group.

Table (2): Examination of renal and liver function parameters on SO.

Parameters	Control	OS	Hyperlipidemic	hyperlipidemic + OS
Urea mg/dl	33.6 $\pm$ 0.96	30.5 $\pm$ 1.67	34.2 $\pm$ 1.49	33.4 $\pm$ 0.99
Creatinine mg/dl	0.35 $\pm$ 0.017	0.33 $\pm$ 0.041	0.39 $\pm$ 0.042	0.36 $\pm$ 0.031
AST (GOT) IU/L	32.2 $\pm$ 1.53	30.1 $\pm$ 2.89	37.0 $\pm$ 2.51	35.1 $\pm$ 2.12
ALT (GPT) IU/L	37.4 $\pm$ 2.31	36.87 $\pm$ 3.12	44.1 $\pm$ 3.61	40.2 $\pm$ 2.854
ALP IU/L	125.3 $\pm$ 3.48	121.5 $\pm$ 3.65	132.2 $\pm$ 4.45	131.0 $\pm$ 4.49
TSB mg/dl	0.19 $\pm$ 1.02	0.181 $\pm$ 1.13	0.21 $\pm$ 2.17	0.19 $\pm$ 2.04
Total Protein g/dl	6.41 $\pm$ 2.15	6.40 $\pm$ 2.19	6.43 $\pm$ 3.56	6.42 $\pm$ 3.048
Albumin g/dl	3.94 $\pm$ 1.32	3.89 $\pm$ 2.78	3.96 $\pm$ 4.79	3.92 $\pm$ 2.91

Values are mean $\pm$ SE

Histological investigation of kidneys, liver and spleen.

1- Kidneys

In all group kidney sections Fig. (1) were normal in histological appearance of renal tubules brush-borders and glomeruli with no congestion and inflammation under the light microscope in comparison with control group.

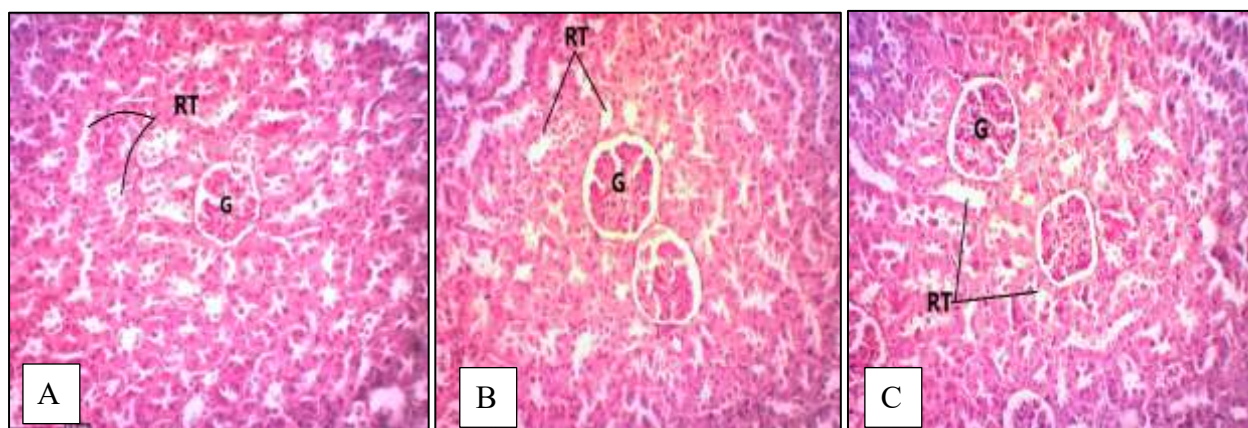


Fig. 1: Cross section of kidney at 20x (HE) in control group (A), group treated with OS only (B) and hyperlipidemic group (C) in which G = glomerulus and RT= renal tubules

2- Liver

Microscopical examination of the liver in all groups Fig. (2) revealed almost normal hepatocytes plates, central vein, portal triads within normal structure and hepatic cords were arranged radially with no pathological alteration in comparison with control group.

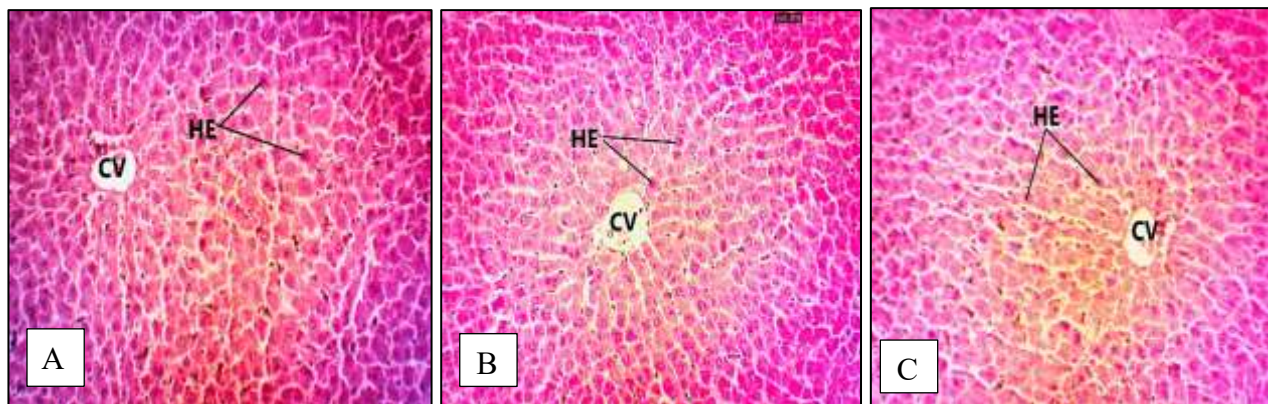


Fig.2: Cross section of liver at 20x magnification (HE) in in control group (A), group treated with OS only (B) and hyperlipidemic group (C) showing central vein (CV) and hepatocytes (HE).

3- Spleen

In control group and other groups rats treated with OS, spleen sections showed normal histological appearance of white pulp, red pulp, germinal center and central arterioles of spleen.

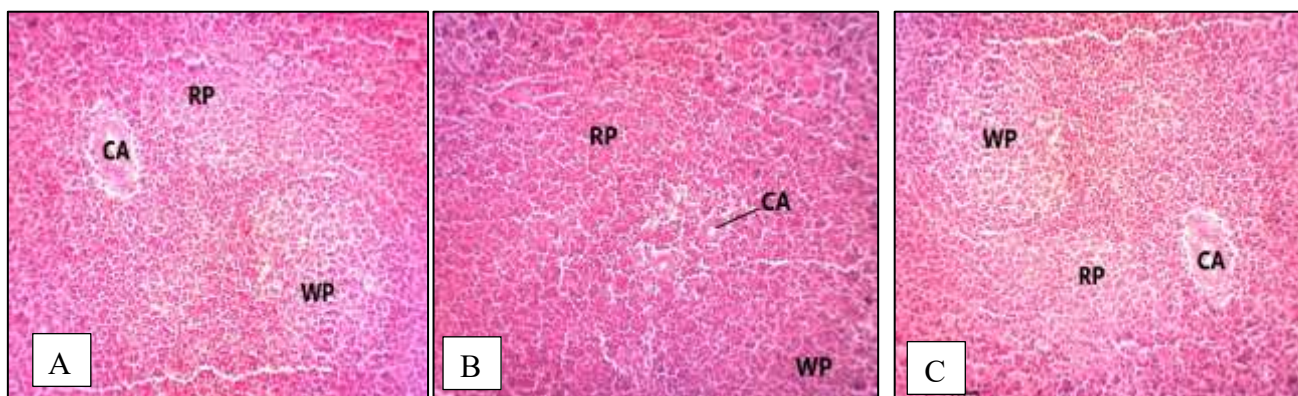


Fig.3: Cross section of spleen at 10x magnification (HE) in in control group (A), group treated with OS only (B) and hyperlipidemic group (C) showing normal structure of white pulp (WP), red pulp (RP) and central artery (CA).

The present study on albino rats assessed the hypolipidemic and protective potential of OS against diet-induced hyperlipidemia. The findings of this study confirmed that serum total cholesterol and triglyceride levels were significantly lowered, with no adverse effects on renal function, in hyperlipidemic animals. Moreover, histopathological assessment revealed no detectable abnormalities in vital organs such as the liver, kidney, and spleen, confirming the safety of OS administration. The elevation of triglycerides and total cholesterol in rats fed a high-cholesterol diet effectively induced hyperlipidemia, similar to earlier rodent models of lipid disorder (Al-Sulivany *et al.*, 2024a). Treatment with OS extract lessened these raises; phytochemicals such as polyphenols, tannins, and flavonoids present in OS play a role in controlling lipid metabolism. This observation aligns with recent evidence that plant-derived bioactive compounds control hepatic cholesterol synthesis, prevent intestinal lipid absorption and encourage faecal bile acid elimination

(Kumar *et al.*, 2025). The lowering effects of triglycerides and cholesterol align with prior studies on medicinal plants with polyphenolic content and high tannin, such as dietary supplementation with *Moringa oleifera* leaves, which have been shown to improve antioxidant enzyme activity and reduce hyperlipidemia in rats (Abdelazim *et al.*, 2024). Similarly, Wei *et al.*, (2025) studied extracts of *Camellia sinensis* and demonstrated modulation of lipid metabolism, reduction of oxidative stress, with hypolipidemic and hepatoprotective effects. They also found that plant-based extracts rich in bioactive compounds serve as adequate replacements or assistants to conventional lipid-lowering therapies. Notably, in both normal and hyperlipidemic rats, fasting blood glucose levels with OS treatment remained unaffected; the hypolipidemic action of OS is not mediated through alterations in glucose homeostasis. Stoleru *et al.*, (2024) reported similar results, without significantly inducing glycemic control, and with phytochemicals targeted at lipid pathways. They also described how this approach can reduce lipid disorders and minimize risks associated with hypoglycemia. There were no significant changes in hepatic biochemical parameters or renal function, although a numerical increase in liver enzymes was observed in hyperlipidemic rats. These changes did not reach statistical significance, and co-administration of OS extract was found to be normal. These outcomes are similar to those of previous experiments, which have shown that polyphenolic-rich extracts protect against oxidative and inflammatory stress, and also decrease lipid accumulation in vital organs (Hassanen *et al.*, 2024).

In this study, the biochemical findings and histopathological evaluation corroborate the normal cytoarchitecture of the spleen, kidney, and liver in all groups, including those supplemented with OS extract and hyperlipidemic rats. Furthermore, nephrotoxic, inflammatory infiltration, necrosis and degenerative lesions were also not observed, which is consistent with other recent reports demonstrating protective effects on vital organs in metabolic disorders on plant-derived polyphenolic extracts (Direito *et al.*, 2024). Moreover, Ullah *et al.*, (2024) found that the hypolipidemic action of OS extract, which contains tannins and polyphenols, is achieved by downregulating HMG-CoA reductase activity, thereby inhibiting hepatic cholesterol synthesis and reducing endogenous cholesterol production. Tannins also have hydrolyzable anti-inflammatory properties that may suppress cytokine pathways and NF- κ B, thus refining lipid metabolism and reducing inflammation (Rudrapal *et al.*, 2024; Hirsa *et al.*, 2025). Furthermore, Jiang *et al.* (2025) reported that oak-derived phytochemicals improve neutral sterols, thereby lowering systemic lipid load and fecal excretion of bile acids, and have also been studied in conjunction with other tannin-rich plant extracts. OS extract has been also reported which mitigates scavenging reactive oxygen species and oxidative stress by reducing lipid peroxidation, which is important for hyperlipidemia-induced vascular and hepatic damage (Khoi *et al.*, 2024). Santacroce *et al.* (2024) investigated plant-derived alternatives and discovered lipid-lowering, antioxidant, and anti-inflammatory properties. The current findings highlight that OS extract with statins and fibrates induces adverse effects such as myopathy, onset of diabetes, and hepatotoxicity.

CONCLUSIONS

This study demonstrated that the water extract of oak stem exhibits a significant hypolipidemic effect in rats with diet-induced hyperlipidemia, as evidenced by a marked reduction in total cholesterol and triglyceride levels, without altering fasting blood glucose levels. Importantly, OS administration did not produce any adverse effects on renal or hepatic function, as confirmed by stable biochemical markers and standard histopathological architecture of the kidneys, liver, and spleen.

The presence of bioactive compounds such as polyphenols and tannins in OS likely contributed to the observed lipid-lowering activity and organ-protective effects. These findings suggest that oak stem extract may serve as a safe and effective natural adjunct for managing hyperlipidemia, warranting further investigations to elucidate its underlying mechanisms and evaluate its therapeutic potential in clinical settings.

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تأثير مستخلص جذع البلوط على الدهون في الدم والمصل في الفئران المصابة بفرط شحميات الدم مع الفحص النسيجي للكلى والكبد والطحال

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الملخص

تستخدم السيقان الثانوية للبلوط بشكل شائع في ضواحي مدينة دهوك كعلاج طبيعي لتنظيم مستويات الدهون، إلا أن الدراسات العلمية التي تناولت سلامة هذا الاستخدام ما تزال محدودة أو غير متوفرة. تهدف الدراسة لتقييم تأثير مستخلص سيقان البلوط (بجرعة 200 ملغم/كغم) على مستويات الغلوكوز، ومؤشرات الدهون، ووظائف الكبد والكلى، بالإضافة للتغيرات النسيجية في الجرذان الطبيعية والمصابة بفرط الكوليسترول. استخدمت في هذه الدراسة 32 من ذكور جرذان البالغة وقُسمت إلى أربع مجاميع متساوية (8 لكل مجموعة). أعطيت المجموعة الأولى غذاءً اعتيادياً، بينما أُعطيت المجموعة الثانية مستخلص سيقان البلوط مع الغذاء الاعتيادي. أما المجموعة الثالثة فتغذت على غذاء عالي الكوليسترول بينما جمعت المجموعة الرابعة بغذاء عالي الكوليسترول مع إعطاء مستخلص سيقان البلوط. بعد انتهاء فترة التجربة، اخذ الدم مباشرة من القلب بعد تخدير الحيوانات، وتم حفظ أنسجة الكبد والكلى والطحال في الفورمالين للفحص النسيجي المجهرى. أظهرت النتائج عدم وجود فروقات معنوية في سكر الدم بين جميع المجموعات. بينما، لوحظ ارتفاع معنوي في مستويات الدهون الثلاثية والكوليسترول في الجرذان المتغذية على غذاء عالي الكوليسترول مقارنة بالمجموعة الضابطة. في المقابل، أدى إعطاء المستخلص إلى انخفاض ملحوظ في تلك المستويات المرتفعة من الدهون. كما لم تُسجل فروق ذات دلالة إحصائية معنوية بين المجموعات في بقية المؤشرات المقاسة. أظهرت نتائج هذه الدراسة خلال 4 أسابيع أن مستخلص سيقان البلوط يمتلك تأثيراً خافضاً لمستويات الكوليسترول والدهون الثلاثية في الجرذان المصابة بفرط الدهون، دون آثار جانبية ملحوظة خلال فترة المعالجة. تشير هذه النتائج لإمكانية الاعتماد على هذا المستخلص كعلاجي طبيعي وآمن في معالجة اضطرابات شحوم الدم، كما تدعم الاستخدام التقليدي لسيقان البلوط وتؤكد خصائصها الخافضة للدهون من منظور علمي.

الكلمات الدالة: الكوليسترول، الجرذان المصابة بارتفاع دهون الدم، تحسين، مستخلص سيقان البلوط، الدهون الثلاثية.