10.21608/avmj.2025.326457.1428 Assiut University web-site: www.aun.edu.eg

EVALUATION OF WALNUT OIL AS ANTIOXIDANT ON ALBINO RATS SALIVARY GLANDS (BIOCHEMICAL AND HISTOLOGICAL STUDY)

BANAN NABEEL ALHUSSARY; SHEMAA ABAS AYOB AND OMAR WADULLAH SALEH

Department of Dental Basic Sciences, College of Dentistry, University of Mosul, Mosul, Iraq

Received: 15 December 2024; **Accepted:** 13 March 2025

ABSTRACT

There is a demand to find alternative medicine to treat the salivary glands, as any injury to the salivary glands generates an abscess. The study aimed to evaluate the antioxidant impact of walnut oil on lowering the state of oxidative stress caused by hydrogen peroxide. Thirty rats were divided into three groups of ten rats each. G1, control received a daily dose of 0.2 g/kg of walnut oil. G2 was given 0.5% H2O2 drinking water every day. G3 was given 0.5% H2O2 drinking water every day. Walnut oil at a dose of 0.2 g/kg was given orally once a day. The treatment periods were 3, 7, and 14 days. The results revealed that the level of total antioxidant capacity TAC increased significantly with a drop in MDA in the walnut oil group over time, whereas the level of TAC decreased dramatically with an increase in MDA in the H2O2 group. This finding was reversed when walnut oil was added to the administration, especially after 14 days of treatment. The histopathological changes revealed the presence of an improving effect of walnut oil against the oxidizing effect of H2O2, as the pathological effects associated with the use of H2O2 with walnut oil were reduced when compared to the H2O2 group alone, which showed necrosis of the striated ducts, and degeneration of the convoluted tubules and mucous acinar cells. Vascularisation as well as increased fibrous tissue. We concluded that walnut oil has antioxidant properties that can counteract the oxidative effects of H2O2 in rat salivary glands.

Keywords: Antioxidants, Oxidants, Salivary gland, Walnut oil.

INTRODUCTION

Oxidative stress, also known as reactive oxidative stress, is the physiological condition caused by the imbalance between the generation of reactive oxygen species and the body's ability to eliminate them and repair damage caused by them (Checa and Aran, 2020). Reactive Oxygen Species (ROS) are highly reactive molecules containing oxygen that can be both beneficial and damaging to the human body. It is caused by exposure to pollutants, chemicals, and some foods, and when these substances are exposed to metabolic processes, they form free radicals in the body (Sahoo et al., 2022).

The presence of ROS species in moderate amounts is required for many physiological activities, including cell signaling,

Corresponding: Banan Nabeel Alhussary
E-mail address: bananalhussary@uomosul.edu.iq
Present address: Department of Dental Basic Sciences, College of Dentistry, University of Mosul, Mosul, Iraq

immunological function, and pathogen protection (Sies and Jones, 2020; Alabdaly, 2021). Sometimes the amount of free radicals is large and the body is unable to confront them and get rid of them by known methods, which are through the various antioxidants present in the body (Raza *et al*., 2020)

The body may obtain antioxidants through plant foods that contain them. Notable antioxidant herbs with health advantages include rosemary, turmeric, thyme, oregano, cinnamon, and walnut oil (Diniz do Nascimento *et al*., 2020). They function as antioxidants, assisting in the neutralization of free radicals in the body, protecting cells from oxidative stress, and lowering the risk of chronic diseases (Engwa *et al*., 2022). Walnut oil is a form of oil derived from plant seeds. The walnut (Juglans regia), a tree that produces walnuts (Rébufa *et al*., 2022). The oil obtained from nut kernels is well known for its rich flavor and nutritional value (Di Nunzio, 2019).

It is rated as high in omega-3, which is necessary for heart health and brain function (Lange, 2020). It contains antioxidants, including vitamin E, which aids against oxidative stress in the body also contain Minerals such as manganese, copper, and magnesium (DE, 2020; Zahed Mahmood *et al*., 2019).

The purpose of the study is to assess the antioxidant activity of walnut oil in protecting salivary glands from H_2O_2-induced oxidative stress injury.

MATERIALS AND METHODS

Medicines and chemicals

The utilized materials were the pure walnut oil (99%, India Mart's) and H_2O_2 (hydrogen peroxide, Scharlau® ultra-pure complex solution, Spain). The solution was diluted daily with the distilled water to make an effective 0.5% H_2O_2 solution. To make a 0.5% H_2O_2 solution, the Scharlau® ultra pure H_2O_2 stock solution was diluted every day in distilled water to give the desired final concentration of 0.5% (v/v).

Preparing therapy dosages

Walnut oil was orally administered at a dose of 0.2 g / kg. The dose was determined on the assumption that 1 gram equals 1 ml. The dose was given to each rat based on its weight. Additionally, rats were provided with drinking water.

Ethical approval: Ethical approval was obtained to complete this study according to the instructions of the Ethics Committee for Animal Handling at the University of Mosul No. 35 dated 2024.

Animals

Thirty male albino rats aged between 10 and 12 weeks and weighing between 190 and 220 grams were sourced from the Laboratory Animal House facility. To mitigate any bias stemming from differences in age and weight, among the rats selected for the study groups, the rats were placed into groups through a simple randomization process involving the use of random numbers to ensure fair distribution. The study was structured based on a randomized design (CRD). Data collected from each group was examined using one way ANOVA, followed by post hoc tests to identify any significant differences between groups. Statistically significant results were determined with a P value of less, than 0.05. Rats were kept in typical housing circumstances, which included a temperature of 20-21°C, a 12-hour light/12-hour dark cycle, and humidity levels based on external environmental conditions.

Study design

30 albino rats separated into 3 groups of 10 rats each. G1 is the control group were fed a normal diet, provided with tap water, and received a daily dose of 0.2 g/kg of walnut oil.

• To produce oxidative stress, G2 rats were fed a normal diet and given 0.5% H_2O_2 drinking water every day (Eefan and Rahim, 2020).

•G3 The animals were fed a standard diet with 0.5% H_2O_2 drinking water every day and were administered 0.2 g/kg of walnut oil orally every day.

The therapy period was 14 days long. The animals were anesthetized by ether, and blood were collected, and salivary glands were extracted from them after 3, 7, and 14 days of therapy.

Sample preparation

Blood samples were obtained from the eye sockets using fine capillary tubes after the rats were anesthetized with ether, and roughly 5 ml of blood was deposited in tubes and maintained at the room temperature for coagulate. To collect the serum from the blood centrifuged the blood at 2500 rpm for 15 min. Serum transferred to the Eppendorf tubes and then stored in a deep freeze at -20°C until testing.

Biochemical tests used

1- Testing the total antioxidant capacity (TAC) with a company-supplied specific measuring kit from Biolabo.
2- Evaluate the MDA level from Biolabo.

Histopathological examinations

Following the completion of the therapy periods (3, 7, 14). Salivary glands were collected from 3 rats of each animals group at each period, and the salivary glands were put in containers containing 10% diluted formalin until histological analysis was performed on them. Histopathological analyses were performed to prepare tissue sections that could be read using optical microscopes.

Statically analysis

Analyzing statistics

The information was analyzed using a two-way analysis of variance (Two way ANOVA). This analysis aimed to understand how different treatments (Control group; H_20_2 group; H_20_2+ walnut oil group) time durations (3 days; 7 days; 14 days) and their interactions affected the variables under study. To delve deeper into the relationship between treatments and time periods on the variables measured in the study we calculated Least Square Means (LSMeans). These values were used to compare and investigate how the effects of treatments varied, across time points. In order to compare sets of data and their interactions accurately and effectively we utilized Tukeys Honest Significant Difference (HSD) test as a method for multiple comparisons. We deemed any outcomes with a P value of 0.05 or less statistically significant. The statistical analyses were carried out using the program IBM SPSS Statistics version 26 (IBM Corp., Armonk, NY, USA. (Field, 2018).

RESULTS

Biochemical results

After 3 days, TAC concentration in H_2O_2 + walnut oil group (14.2 U/ml) was considerably lower than in the Control (16.0 U/ml) and significantly higher than in the H_2O_2 group (12.4 U/ml). After 7 days, TAC levels in the H_2O_2 group (10.5 U/ml) were considerably lower than in the Control (16.4 U/ml) and H_2O_2 + walnut oil groups (15.1). After 14 days, T-AOC levels in the H_2O_2 group (6 U/ml) were considerably lower than in the Control (19 U/ml) and H_2O_2 + walnut oil groups (15.4 U/ml).

TAC levels differed significantly between time periods in all treatment groups. TAC levels in the Control group increased from 16.0 U/ml after 3 days to 19 U/ml after 14 days. TAC levels in the H_2O_2 group reduced from 15.4 U/ml after 3 days to 6 U/ml after 14 days.TAC levels in the H_2O_2 + walnut oil group ranged from 14.2 U/ml after 3 days to 15.4 U/ml after 14 days (Table 1).

A two-way ANOVA was conducted to assess the interaction effects between treatment groups and time periods on TAC levels. The analysis revealed a statistically significant interaction between treatment and time ($P \leq 0.05$), indicating that the effect of treatment on TAC levels varied depending on the duration of the intervention.

Table 1: levels of TAC U\ml between periods and treatment groups.

Treatments / Periods	Control (walnut oil)	H_2O_2 group	H_2O_2+ walnut oil
3 days	16.0 ±1.0 c	12.4±1.0 C	14.2±1 ab C
7 days	16.4 ±2.0 b	10.5±3.0 ac C	15.1±1.0 b
14 days	19 ±2.0 ab AB	6±1.0 a AB	15.4±2.0 a A

a: Different from the control group at P<0.05. b: Different from H_2O_2 group at P<0.05. c: Different from H_2O_2+walnut oil group at P<0.05. Uppercase letters indicate differences between periods within the same treatment group. A: Day 3 is significantly different from day 14. B: Day 7 is significantly different from day 14. C: Day 3 is significantly different from day 14.

Post hoc comparisons were performed using Tukey's Honest Significant Difference (HSD) test to identify significant differences among the least square means (LSMeans). As shown in Table (2), the control group consistently maintained higher TAC values across all time points, with significant differences observed compared to the H_2O_2 group. After 14 days, the H_2O_2 group exhibited the lowest TAC levels (6.0 ± 1.0 U/ml), significantly different from both the control and the H_2O_2+walnut oil groups (P≤0.05). The group receiving H_2O_2 in combination with walnut oil showed intermediate TAC levels, suggesting a partial protective effect of walnut oil against oxidative stress.

The different superscript letters (a, b, c, d) denote statistically significant differences between group means within the same time point. These results confirm that both treatment and time had significant effects on TAC, and the interaction between them was meaningful.

Table (3) shows the impact of therapy on MDA. After three days, the MDA level in the Control group (30.0 nmol/ml) was substantially less than these in the H_2O_2 group (50.4 nmol/ml) and H_2O_2+walnut oil group (45.2 nmol/ml). After 7 days, MDA levels in the Control group (28.4 nmol/ml) were substantially lower than those in the H_2O_2 group (86.5 nmol/ml) but not different from H_2O_2+walnut oil group (45.1 nmol/ml). After 14 days, MDA levels in the Control group (25.0 nmol/ml) were considerably lower than in the H_2O_2 group (139.0 nmol/ml) and the H_2O_2 + walnut oil group (38.4 nmol/ml).

Table 2: Least Square Means (LSMeans) of Total Antioxidant Capacity (TAC) levels (U/ml) showing the interaction effects between treatment groups and time periods with Tukey's HSD multiple comparisons.

Time (days)	Treatment	LSMeans (TAC U/ml)	SE	Signi. (Tukey)
3	Control	16.0	±1.0	a
3	H_2O_2	12.4	±1.0	b
3	H_2O_2 + walnut oil	14.2	±1.0	ab
7	Control	16.4	±2.0	a
7	H_2O_2	10.5	±3.0	c
7	H_2O_2 + walnut il	15.1	±1.0	ab
14	Control	19.0	±2.0	a
14	H_2O_2	6.0	±1.0	d
14	H_2O_2 + walnut il	15.4	±2.0	ab

Note: Different letters indicate statistically significant differences at P≤ 0.05 according to Tukey's HSD.

MDA levels differed significantly between time periods in all treatment groups. MDA levels in the Control group declined from 30.0 nmol/ml after 3 days to 25.0 nmol/ml after 14 days. MDA levels in the H_2O_2 group increased from 50.4 nmol/ml after 3 days to 139.0 nmol/ml after 14 days. MDA levels in the H_2O_2 + walnut oil group fluctuated from 45.2 nmol/ml after 3 days to 38.4 nmol/ml after 14 days. (Table 2).

Table 3: levels of MDA nmol/ml between periods and treatment groups.

treatments / periods	Control (walnut oil)	H_2O_2 group	H_2O_2+ walnut oil
3 days	30.0 ±3.0 bc	50.4±1.0 a	45.2±3.3a
7 days	28.4 ±2.0 bc	86.5±3.0 acA	45.1±1.0ab
14 days	25 ±2.0 bc A	139±4.0 ac AB	38.4±.0ab AB

A: The output is significantly different from the control group. B: The output is significantly different from the H 2 O 2 group. C: The output is significantly different from the H 2 O 2 + walnut oil group. Upper case letters indicate the differences between the periods within the same treatment group. A: It is significantly different from day 3. B: It is significantly different from day 7.

In Table (4), A two-way ANOVA was used to analyze the interaction effects between treatment groups and time periods on malondialdehyde (MDA) levels, a marker of lipid peroxidation and oxidative stress. The results indicated a significant interaction between treatment and time ($P<0.05$), suggesting that the influence of treatment on MDA levels changed over the course of the experiment.

Post hoc comparisons using Tukey's Honest Significant Difference (HSD) test were applied to the Least Square Means (LSMeans). At each time point, the H_2O_2-treated group showed significantly elevated MDA levels compared to the control group and the H_2O_2 + walnut oil group ($p < 0.05$). This elevation was most pronounced on day 14, where the H_2O_2 group reached 139.0 ± 4.0 nmol/ml, highlighting the progressive oxidative damage over time.

Conversely, the group receiving both H_2O_2 and walnut oil exhibited significantly lower MDA levels than the H_2O_2-only group at all time points, indicating a protective effect of walnut oil. Within-group comparisons over time (denoted by uppercase letters A and B) further showed that MDA levels increased significantly in the H_2O_2 group between days 3 and 14, emphasizing the cumulative oxidative stress in untreated animals.

These findings demonstrate that both treatment and time significantly affected MDA levels, and their interaction was substantial. The inclusion of walnut oil markedly attenuated the H_2O_2-induced oxidative stress, supporting its potential antioxidant role.

Table 4: Least Square Means (LSMeans) of Malondialdehyde (MDA) levels (nmol/ml) showing the interaction effects between treatment groups and time periods with Tukey's HSD multiple comparisons.

Time Period	Control (walnut oil)	H_2O_2 group	H_2O_2 + walnut oil
3 days	30.0 ± 3.0 **bc**	50.4 ± 1.0 **a**	45.2 ± 3.3 **a**
7 days	28.4 ± 2.0 **bc**	86.5 ± 3.0 **ac A**	45.1 ± 1.0 **ab**
14 days	25.0 ± 2.0 **bc A**	139.0 ± 4.0 **ac AB**	38.4 ± 1.0 **ab AB**

- **Different lowercase letters (a, b, c)** indicate significant differences between treatments within the same time period (*Tukey's HSD, $p < 0.05$*).
- **Different uppercase letters (A, B)** indicate significant differences between time periods within the same treatment group.
- **LSMeans** were calculated using two-way ANOVA with Tukey's post hoc test to explore interaction effects between time and treatment.

Histopathological Finding

The photomicrographs depict histological sections of rat submandibular salivary glands from different experimental groups. The control group (G1) at 3, 7, and 14 days, showed a normal architecture of mucous acini, convoluted granular tubule and the striated ducts (Figure 1). At higher magnifications, the consistent normalcy appeared in glandular structures over the specified time periods (Al-Taee and Saeed, 2023).

In contrast, Figure (2) illustrates the effects on the salivary gland in the experimental group G2. The images revealed necrosis of striated ducts, degeneration of the granular tubules and mucous acini cells, along with congestion of blood vessels and increased fibrous tissue. These pathological changes are observed, indicating a significant alteration in glandular architecture.

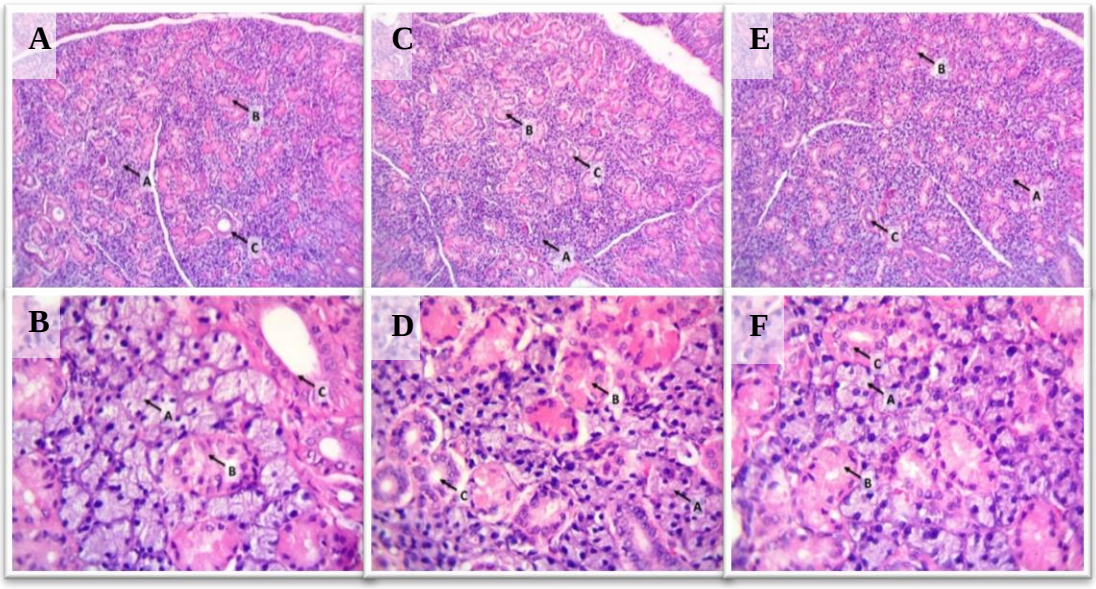

Figure 1: rat submandibular salivary gland of G1. A&B: 3 days, C&D: 7 days, E&F: 14 days showing normal architecture of mucous acini (A), convoluted granular tubules (B) and the striated ducts (C). H&E stain, (upper panel: 100X; lower panel: 400X).

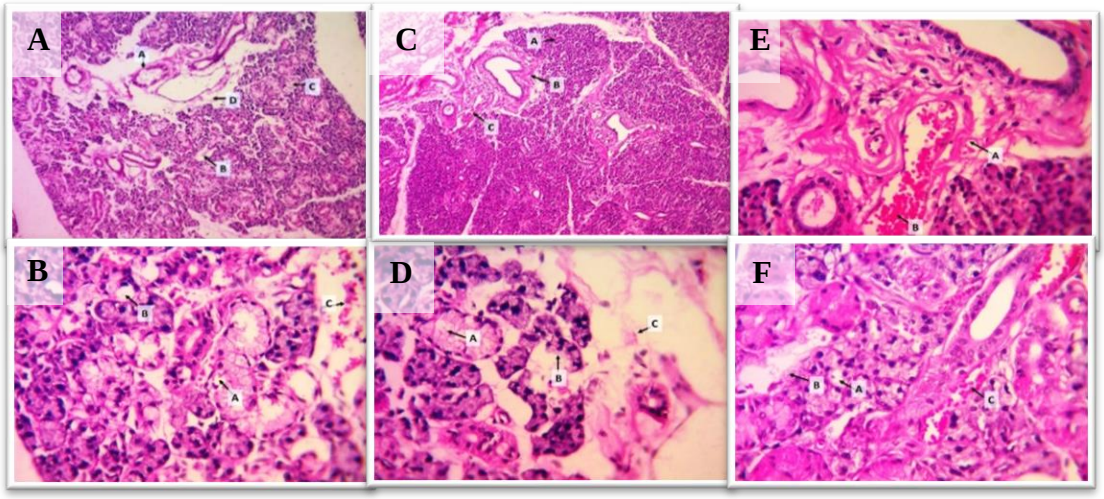

Figure 2: rat submandibular salivary gland of G2. A&B: 3 days: showing the necrosis of the striated duct (A), convoluted granular tubules (B) and the mucous acini (C) edema surround the striated ducts (D). C&D: 7 days: showing degeneration of the convoluted granular tubules (A) and the mucous acini cell (B) with the congestion of the blood vessels (C). E: (14 days) increase the fibrous tissue surrounded interlobular duct (A) and the congestion of the blood vessels (B). F: (14 days) decreasing numbers of the convoluted granular tubules (A), increasing the fibrous tissue surrounded interlobular duct (B) and congestion of the blood vessels. H&Estain (upper panel: 100X; lower panel: 400X).

Figure (3) depict the impact on the salivary gland in the G3 group over 3, 7, and 14 days. The photomicrographs reveal a normal structure of gland tissue suggesting return to normal condition particularly at 14 days, further highlighting the deteriorating condition of the submandibular salivary gland.

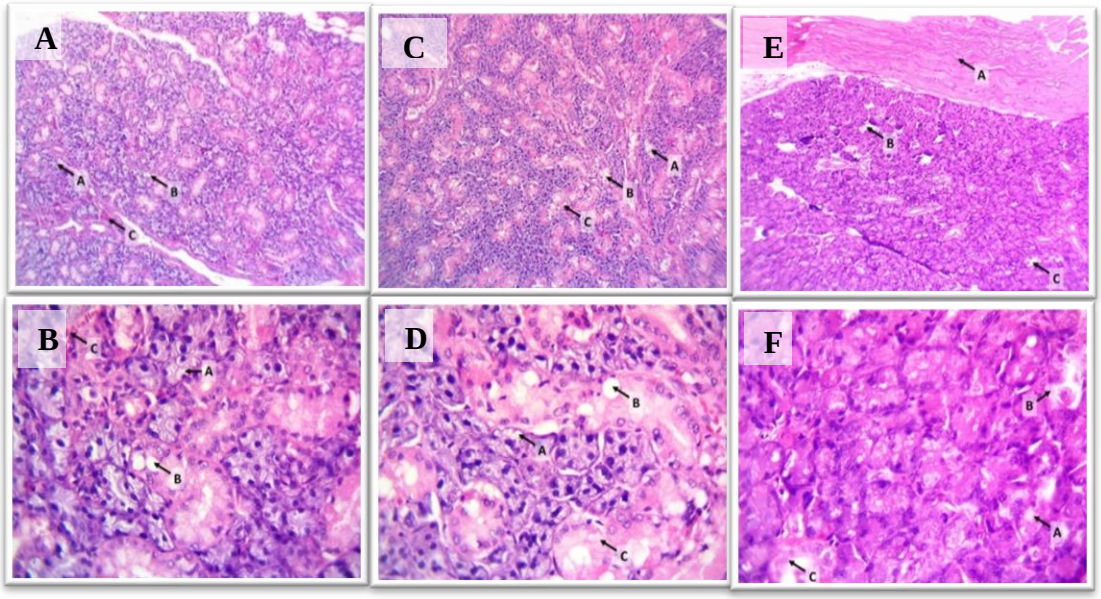

Figure 3: rat submandibular salivary gland of G3. A&B: 3 days, C&D: 7 days: showing mild vacuolar degeneration of cells lining the mucous acini (A), and the granular convoluted tubule (B) hemorrhage (C). showing mild increase fibrous tissue in the capsule (A), mild necrosis of the cells lining mucous acini (B) and granular convoluted tubules (C). E: (14 days): showing mild increase fibrous tissue in the capsule (A), mild necrosis of the cells lining mucous acini (B) and granular convoluted tubules (C). F: (14 days): vacuolar degeneration (A) and necrosis (B) of the cells lining mucous acini and striated ducts (C). H&E stain (upper panel: 100X; lower panel: 400X).

DISCUSSION

The relationship between treatment and time in this study is visible, especially in the H_2O_2 and walnut oil groups, where TAC levels increased in (7 and 14 days). This group showed that walnut oil has a positive effect as antioxidant capacity. The H_2O_2 group consistently demonstrated greater oxidative stress, as evidenced by decreased TAC and higher MDA levels. TAC and MDA levels changed significantly over time as well, showing different reactions to therapy.

The histological changes of submandibular salivary gland of the rats treated with different groups (G1, G2, and G3) provides insight into the impact of the walnut oil on reducing the oxidative injury induced by hydrogen peroxide (H_2O_2) in drinking water on the glandular structure over time, particularly after 14 days of Transaction.

Walnuts oil contains many antioxidants, such as the presence of tocopherol (a minor component of walnut oil), squalene (an unsaturated triterpenoid), and phytosterol (4-methylsterol). The polyphenols present in walnut oil contain a wide range of phenolic compounds such as tannins, which they can be divided into hydrolytic tannins to esters, condensed tannins to flavones or proantho-cyanidins, and polyphenols secondary to natural phenols such as catechin, ursolic acid, ellagic acid, gallic acid, and anthocyanins (Gao *et al*., 2019a; Gao *et al*., 2019b). In addition, natural antioxidants found in walnut oil include vitamins C, E, and alpha-linolenic acid. These compounds help to improve the body's oxidative state and combat oxidative stress induced by internal or external sources (Rébufa *et al*., 2022).

The increase in antioxidants, on the other hand, will work to reduce oxidants, such as

lipid peroxidation, which is formed because of the accumulation of free radicals that attack and destroy the cell membrane, as well as the destruction of proteins and fats in the cells, which influences the increase in malondialdehyde (Fregapane *et al*., 2019). This condition develops as a result of exposure to oxidizing compounds such as hydrogen peroxide in drinking water resulted in oxidative stress (Demirci-Cekic et al., 2022; Al-Abdaly, 2023).

The use of antioxidant-rich walnut oil has demonstrated a decrease in the level of MDA in the third group treated with both walnut oil and water containing H_2O_2, despite the walnut oil group demonstrating a significant increase in the level of TAC after 7 to 14 days of treatment.

The histopathological abnormalities seen in G2 were consistent with the biochemical changes, indicating that the presence of hydrogen peroxide in drinking water causes gradual and severe pathological changes in submandibular salivary gland of rats over time. Because hydrogen peroxide is a strong oxidizing substance that causes a wave of free radicals in the body, which begin to attack cell membranes, proteins, and fats (Madkour, 2019; Al-Jammas *et al.*, 2024).

Causing a defect in cell membrane and exposing the cell to degeneration and necrosis, presence of vacuolar degeneration, necrosis, and an increase in fibrous tissue indicates the occurrence of major tissue damage, especially after a period of 7-14 days of treatment.

G1 histological data show that the submandibular salivary glands of rat retain their normal shape during the periods investigated. Furthermore, the group treated with walnut oil in the presence of hydrogen peroxide in drinking water experienced an improvement in histological alterations, particularly after 14 days of treatment, as the tissues reverted to nearly normal after 14 days of therapy when compared to the other periods. It is clear from the above that walnut oil has an antioxidant capacity, in addition to its high nutritional value (Gao *et al*., 2019).

The presence of antioxidants such as vitamin A and polyphenol enables walnut oil to provide protection for cells from oxidative damage (Akbari *et al*., 2022; Saeed *et al*., 2023).

The presence of ellagitannins in walnut oil makes it an anti-inflammatory substance, as it limits the production of enzymes that help in the development of inflammation, such as cyclooxygenase, tumor necrosis factor, interleukins, and nitric oxide (Ni *et al.*, 2022; Fan *et al*., 2023; Nguyen and Vu, 2023)

The presence of some flavonoids and polyphenols in walnut oil makes it an antioxidant and protects against oxidative stress (Grajzer *et al*., 2020; Alnuimi and Alabdaly, 2022).

These chemicals function as natural antioxidants and help to keep the antioxidant state. In addition to everything mentioned previously, walnuts contain alpha-linolenic acid and linoleic acid, which are one of the substances that have effective antioxidant effects (Tomer *et al*., 2020; Abdulrazaq and Alabdaly, 2023).

CONCLUSION

The findings indicate that walnut oil may protect against oxidative stress by modifying antioxidant capacity and lipid peroxidation levels, as well as lowering hydrogen peroxide-induced histopathological alterations.

ACKNOWLEDGMENT

We extend our thanks and gratitude to the University of Mosul for providing support to complete the research.

CONFLICTED INTEREST

None

REFERENCES

Diniz Do Nascimento, L.; Barbosa De Moraes, A.A.; Santana Da Costa, K.; Pereira Galúcio, J.M.; Taube, P.S.; Leal Costa, C.M.; Neves Cruz, J.; De Aguiar Andrade, E.H. and Guerreiro De Faria, L.J. (2020): Bioactive natural compounds and antioxidant activity of essential oils from spice plants: new findings and potential applications. Biomolecules, 10(7), 988.

Mahmood, A.M.Z.; Qamar, S.A.; Munir, N.; Jahangeer, M.; Fatima, G.; Hussain, S. and Zulfiqar, A. (2019): Comparative assessment of biomedical and nutritional status of dry fruits: a review. Magnesium, 39(62g), 73g.

Demirci-Cekic, S.; Özkan, G.; Avan, A.N.; Uzunboy, S.; Çapanoğlu, E. and Apak, R. (2022): Biomarkers of oxidative stress and antioxidant defense. Journal of Pharmaceutical and Biomedical Analysis, 209, 114477.

Alabdaly, Y.Z. (2021): Effect of diclofenac on the pharmacokinetics of ciprofloxacin in quail. *Iraqi Journal of Veterinary Sciences, 35*(4), 777-781.

Akbari, B.; Baghaei-Yazdi, N.; Bahmaie, M. and Mahdavi Abhari, F. (2022): The role of plant-derived natural antioxidants in the reduction of oxidative stress. BioFactors, 48(3), 611-33.

Saeed, M.G.; Al-Hamdany, E.K. and Ismail, H.K. (2023): Pathological and histomorphometric study of comparative gastric ulcer induced by indomethacin, aspirin, and ethanol in rats. Iraqi Journal of Veterinary Sciences, 37(2), pp.339-346.

Ni, Z.J.; Zhang, Y.G.; Chen, S.X.; Thakur, K.; Wang, S.; Zhang, J.G.; Shang, Y.F. and Wei, Z.J. (2022): Exploration of walnut components and their association with health effects. Critical Reviews in Food Science and Nutrition, 62(19), 5113-29.

Grajzer, M.; Szmalcel, K.; Kuźmiński, Ł.; Witkowski, M.; Kulma, A. and Prescha, A. (2020): Characteristics and antioxidant potential of cold-pressed oils: possible strategies to improve oil stability. Foods, 9(11), 1630.

Lange, K.W. (2020): Omega-3 fatty acids and mental health. Global Health Journal, 4(1), 18-30.

Di Nunzio, M. (2019): Hazelnuts as a source of bioactive compounds and health value underestimated food. Current Research in Nutrition and Food Science Journal, 7(1), 17-28.

Al-Taee, Z.T. and Saeed, M.G. (2023): Correlation incidence between infectious bursal disease and aflatoxicosis in broilers chicken farms in Nineveh province, Iraq. Iraqi Journal of Veterinary Sciences, 37(1), pp.183-190.

Field, A. (2018): Discovering Statistics Using IBM SPSS Statistics. 5th edn. London: SAGE Publications.

Gao, P.; Liu, R.; Jin, Q. and Wang, X. (2019): Comparison of solvents for extraction of walnut oils: lipid yield, lipid compositions, minor-component content, and antioxidant capacity. LWT, 110, 346-52.

Abdulrazaq, O.M. and Alabdaly, Y.Z. (2023): Effect of alkaline drinking water on vitamin D3 toxicity in female rats.

Al-Jammas, S.; Al-Allaf, L.I.K. and Saeed, M.G. (2024): Attenuating Effects of α-tocopherol on Cytarabine-Induced Toxicity in Parotid Salivary Gland of Rabbits: A Histological and Immunohistochemical Study. Iranian Journal of Veterinary Medicine, 18(1), pp.33-42.

Fregapane, G.; Ojeda-Amador, R.M. and Salvador, M.D. (2019): Virgin walnut (Juglans regia L.) oil. In: Fruit Oils: Chemistry and Functionality, 133-47.

Madkour, L.H. (2019): Function of reactive oxygen species (ROS) inside the living organisms and sources of oxidants. Pharmaceutical Sciences and Analytical Research Journal, 2, 180023.

Gao, P.; Liu, R.; Jin, Q. and Wang, X. (2019): Comparison of solvents for extraction of walnut oils: lipid yield, lipid

compositions, minor-component content, and antioxidant capacity. LWT, 110, 346-52.

Checa, J. and Aran, J.M. (2020): Reactive oxygen species: drivers of physiological and pathological processes. Journal of Inflammation Research, 1057-73.

Sies, H. and Jones, D.P. (2020): Reactive oxygen species (ROS) as pleiotropic physiological signaling agents. Nature Reviews Molecular Cell Biology, 21(7), 363-83.

Al-Abdaly, Y.Z. (2023): Neurobehavioral evaluation of quail treated with omega-3 and chlorpyrifos. Iraqi Journal of Veterinary Sciences, 37(5 Supplement I-IV).

Raza, M.A. Malik, M.S. and Azam, M. (2020): Impact of natural antioxidants on biological systems. Lahore Garrison University Journal of Life Sciences, 4(02), 139-62.

De, L.C. (2020): Edible seeds and nuts in the human diet for immunity development. International Journal of Recent Scientific Research, 6(11), 38877-81.

Eefan, A.H. and Rahim, S.M. (2020): The role of Rheum ribes roots alcoholic extract in reducing the effect of oxidative stress on the reproductive system of male rats. Tikrit Journal of Pure Science, 25(5), 22-26.

Tomer, V.; Kumar, A.; Gupta, K.; Shukla, S. and Rafiq, S. (2020): Walnut. In: Antioxidants in Vegetables and Nuts - Properties and Health Benefits, 385-422.

Sahoo, B.M.; Banik, B.K.; Borah, P. and Jain, A. (2022): Reactive oxygen species (ROS): key components in cancer therapies. Anti-Cancer Agents in Medicinal Chemistry, 22(2), 215-22.

Alnuimi, S.I. and Alabdaly, Y.Z. (2022): Role of Coenzyme Q-10 in Copper Sulphate Toxicity in Chick's Model. *Egyptian Journal of Veterinary Sciences*, *53*(3), pp.431-441.

Engwa, G.A.; Nweke, F.N. and Nkeh-Chungag, B.N. (2022): Free radicals, oxidative stress-related diseases, and antioxidant supplementation. Alternative Therapies in Health & Medicine, 28(1).

Rébufa, C.; Artaud, J. and Le Dréau, Y. (2022): Walnut (Juglans regia L.) oil chemical composition depending on variety, locality, extraction process, and storage conditions: a comprehensive review. Journal of Food Composition and Analysis, 110, 104534.

Fan, N.; Fusco, J.L. and Rosenberg, D.W. (2023): Antioxidant and anti-inflammatory properties of walnut constituents: focus on personalized cancer prevention and the microbiome. Antioxidants, 12(5), 982.

Nguyen, T.H. and Vu, D.C. (2023): A review on phytochemical composition and potential health-promoting properties of walnuts. Food Reviews International, 39(1), 397-423.

Alfathi, M.; Alabdaly, Y. and Al-Hayyali, F. (2023): Ameliorative Effect of Spirulina against gentamicin toxicity in liver and kidney tissues of male rat. *Egyptian Journal of Histology*, *46*(4), 1666-1675.

تقييم زيت الجوز كمضاد للأكسدة في الغدد اللعابية للجرذان المهقاء (دراسة كيموحيوية ونسيجية)

بنان نبيل الحصري ، شيماء عباس ايوب ، عمر وعدالله صالح
فرع العلوم الأساسية لطب الأسنان ، كلية طب الأسنان ، جامعة الموصل، الموصل ، العراق

Email: bananalhussary@uomosul.edu.iq Assiut University web-site: www.aun.edu.eg

هناك احتياج لإيجاد بدائل طبية لعلاج الغدد اللعابية، حيث أن أي إصابة لهذه الغدد قد تؤدي إلى التهابات او تكوين خراج. هدفت هذه الدراسة إلى استكشاف التأثير المضاد للأكسدة لزيت الجوز في تقليل حالة الإجهاد التأكسدي الناتج عن بيروكسيد الهيدروجين. تم تقسيم ثلاثين فأرًا إلى ثلاث مجموعات، تضم كل مجموعة عشرة فئران. المجموعة الأولى (G1) كانت المجموعة الضابطة وتلقت جرعة يومية من زيت الجوز بكمية 0.2 جرام لكل كيلوجرام من وزن الجسم. المجموعة الثانية (G2) تم إعطاؤها ماء شرب يحتوي على 0.5% بيروكسيد الهيدروجين يوميًا. المجموعة الثالثة (G3) تم إعطاؤها أيضًا ماء شرب يحتوي على 0.5% بيروكسيد الهيدروجين يوميًا، بالإضافة إلى زيت الجوز بجرعة 0.2 جرام لكل كيلوجرام مرة واحدة يوميًا. استمرت فترة العلاج لمدة 3، 7، و14 يومًا.

أظهرت النتائج أن مستوى السعة الكلية لمضادات الأكسدة (TAC) زاد بشكل ملحوظ مع انخفاض مستوى المالوندايالديهيد (MDA) في مجموعة زيت الجوز بمرور الوقت، بينما انخفض مستوى (TAC) بشكل ملحوظ مع زيادة في مستوى (MDA) في مجموعة بيروكسيد الهيدروجين. وتم عكس هذه النتيجة عند إضافة زيت الجوز إلى العلاج، خاصة بعد 14 يومًا من العلاج. وكشفت التغيرات النسيجية عن وجود تأثير تحسيني لزيت الجوز ضد التأثير المؤكسد لبيروكسيد الهيدروجين، حيث انخفضت التأثيرات المرضية المرتبطة باستخدام بيروكسيد الهيدروجين عند استخدام زيت الجوز مقارنة بمجموعة بيروكسيد الهيدروجين وحدها، والتي أظهرت نخرًا في القنوات المخططة، وتلفًا في الأنابيب المتعرجة وخلايا الغدد المخاطية، بالإضافة إلى زيادة في الأوعية الدموية والأنسجة الليفية. خلصت الدراسة إلى أن زيت الجوز يمتلك خصائص مضادة للأكسدة يمكنها مواجهة التأثيرات المؤكسدة لبيروكسيد الهيدروجين في الغدد اللعابية للفئران.

الكلمات المفتاحية: الغدد اللعابية، مضادات الاكسدة، المؤكسدات، زيت الجوز