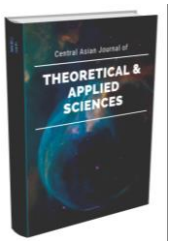

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Article

Study of the Histological Effects of Frying Fodder with Olive Oil, Bay Leaf, and Ginger Root on the Heart of Healthy Mice

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Abstract: The research was conducted to investigate the effect of virgin olive oil on heart tissue, the effect of adding bay leaves and ginger roots separately, and to evaluate the possible tissue effects of damage and treatment. The study included (20) male and female mice that were subjected to the necessary laboratory conditions for 30 days. It was divided as follows: a control group; A group for frying its fodder in olive oil; A group that fried its feed in olive oil with ginger roots and a group that fried its feed in olive oil with bay leaves. The results of the group whose feed was fried in olive oil showed the occurrence of congestion and hemolysis, in addition to the presence of degeneration and disintegration of the cardiac muscle fibres and bleeding between the muscle fibres. Dense infiltration of inflammatory cells was also observed, while there was a significant improvement in the group whose feed was fried in olive oil with bay leaves. Muscle fibres appeared normally and there was no improvement in the group whose feed was fried in olive oil with ginger roots compared to the group whose feed was fried in olive oil alone. Our study concluded that the use of olive oil in the frying process has harmful histological effects on the heart, and the use of bay leaves during the frying process can have a significant therapeutic effect on the histological structure of the heart, while the use of ginger roots does not have any therapeutic effect on the histological structure of the heart against toxicity. Induced by the frying process of olive oil.

Keywords: heart, ginger root, bay leaves, fried olive oil

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1. Introduction

Frying is one of the oldest methods of preparing food and is still among the most common methods of preparing food. This is due to its unique sensory properties. During the frying process, the food absorbs part of the oil used in frying, thus becoming part of the diet [1]. The more often frying oils are used, the worse they get. This is caused by three distinct factors: the moisture content of the food, which can lead to hydrolysis and the production of free fatty acids; atmospheric oxygen seeping into the oil from the container's surface, which intensifies the oxidative change; and the high temperature during the frying process, which causes thermal changes. Oxidation causes physical changes in the oil, such as a darker colour, increased viscosity, and the appearance of smoke [2]. Studies indicate that the behaviour of olive oil during frying is usually equal to or superior to the behaviour of refined vegetable oils due to its low smoke point [3]. Studies have confirmed that using olive oil for frying can have a harmful effect because it has a relatively low smoke point (≈205°C) compared to other oils (peanut oil at ≈225°C, soybean oil at ≈242°C, oil sunflower

at ≈255°C, palm oil at ≈227°C), where a lower smoke point is thought to mean that the fat is oxidized [4].

Research has shown that while cooking oils high in polyunsaturated fatty acids, like olive oil, produce high levels of cytotoxic aldehyde products from the fragmentation of conjugated fatty acids, frying has little to no effect on the protein or mineral content of food. Numerous substances from the thermally induced autoxidation process are absorbed from the gastrointestinal tract into the systemic circulation and impact heart tissue when hydroperoxide precursors are present [5, 6]. Studies on animals have also shown that the smaller particles that are released during frying olive oil cause more harm than their larger counterparts [7], so we wanted to evaluate the effect of the frying process of virgin olive oil on the heart and discuss the therapeutic effect of adding ginger roots and bay leaves to the olive oil during the process. Frying is because many studies have proven the effectiveness of ginger root and bay leaves in reducing fat oxidation and preserving the cellular structure of the heart by inhibiting the oxidants released as a result of the frying process [8, 9].

2. Materials and Methods

Materials Used in the Experiment

- Virgin olive oil
- Ginger roots
- Bay leaves

Experiment design

The 20 Albino/c mice, aged from 12 to 15 weeks and weighing between (120-124) grams, were distributed into four groups, with 5 animals for each group, as shown below.

- The control group was given drinking water and food daily for 30 days. The feed consisted of yellow corn-soybean meal (44%) - corn gluten (62%) - barley - a mixture of vitamins and mineral salts - limestone - dicalcium phosphate - salt. Food – L-lysine monohydrochloride (98.5%)-methionine.
- The feed was fried in olive oil at the smoke point for 10 minutes, then filtered to get rid of the remaining oil, and then mixed with the non-fried feed in a ratio of (1:1), because the fried feed alone caused the death of the mice.
- The feed was fried in olive oil mixed with fresh and chopped ginger roots at the smoke point for 10 minutes, then filtered to get rid of any remaining oil, and then mixed with the unfried feed in a ratio of (1:1).
- The feed was fried in olive oil mixed with bay leaves at the smoke point for 10 minutes, then filtered to get rid of any remaining oil, and then mixed with the unfried feed in a ratio of (1:1).

Preparing histological sections

Fixation, Washing, Dehydration, Clearing, Infiltration, Embedding, Sectioning and Trimming, Staining, and Mounting were done based on the Luna method [10].

3. Results

Control group

Microscopic examination showed the normal structure of the heart tissue, where the cardiac muscle fibres are closely packed together with central oval nuclei, as in Figure 1.

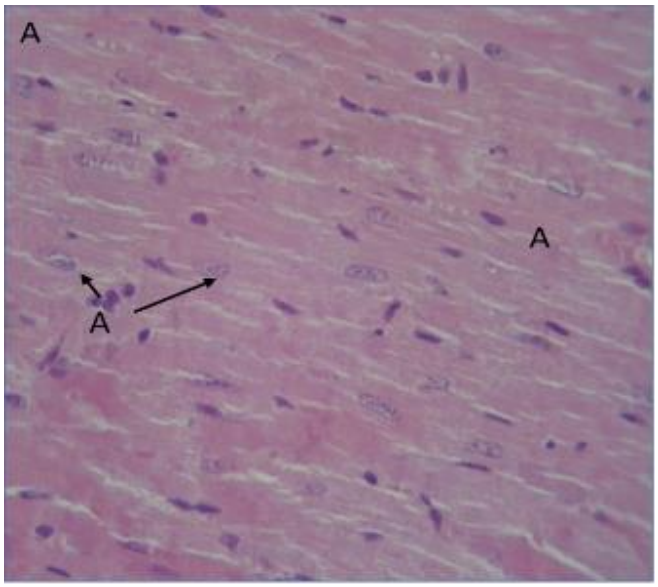

Figure 1. A section of the heart of a mouse from the control group, showing the normal structure of the muscle fibres (A), as well as their central, oval-shaped nuclei (B). (H&E, X400)

The group whose feed was fried in olive oil

The results showed congestion and hemolysis, as well as degeneration and disintegration of the cardiac muscle fibres and bleeding between the muscle fibres. A dense infiltration of inflammatory cells was also observed. As in Figures 2 and 3.

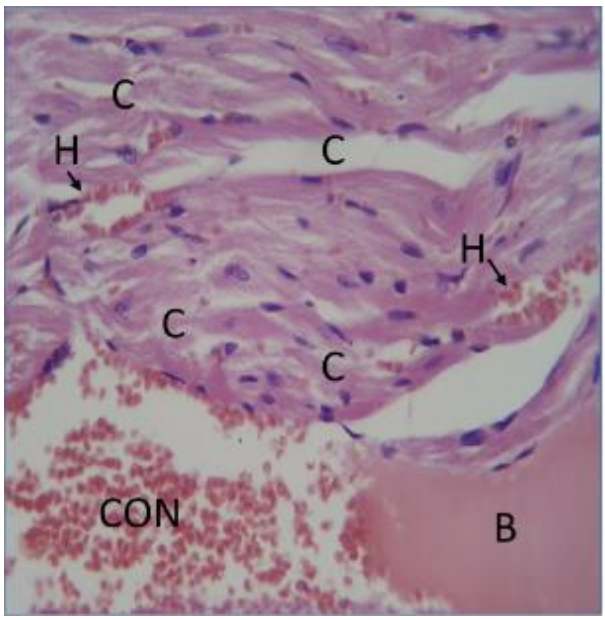

Figure 2. A section of the heart of a mouse from the group whose feed was fried in olive oil, showing congestion (CON), hemolysis (B), degeneration and disintegration of cardiac muscle fibres (C), and bleeding between muscle fibres (H). (H&E, X400)

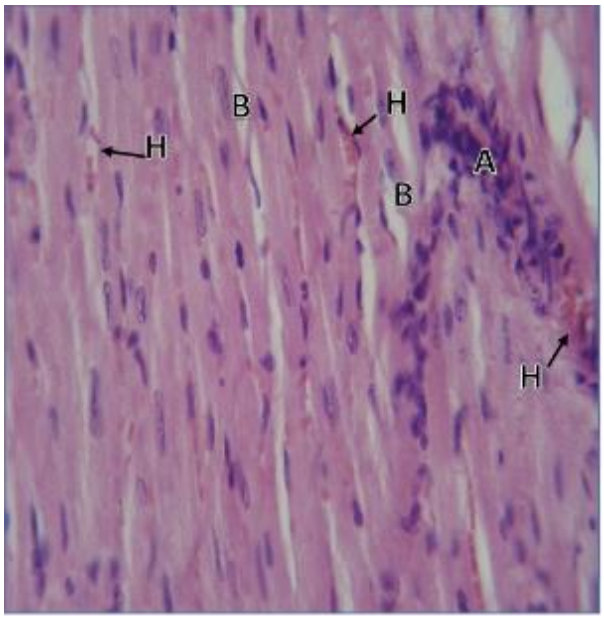

Figure 3. A section of the heart of a rat from the group whose feed was fried in olive oil, showing dense infiltration of inflammatory cells (A), hemolysis (B), the disintegration of cardiac muscle fibres (C), and bleeding between muscle fibres (H). (H&E, X400)

The group whose feed was fried in olive oil with ginger roots

The results showed the appearance of tissue lesions in both forms (4 and 5), including congestion and degeneration of the cardiac muscle fibres and their disintegration, in addition to the presence of blood bleeding between the fibres. There was no improvement compared to the group whose fodder was fried with fried olive oil alone.

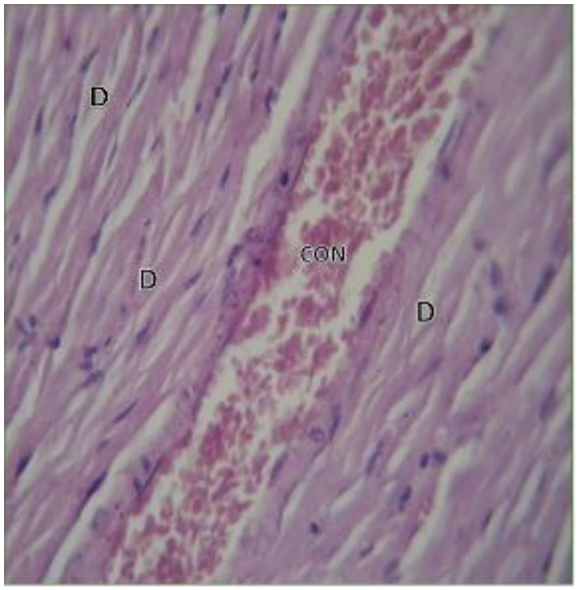

Figure 4. A section of the heart of a mouse from the group whose feed was fried in olive oil with ginger roots, showing congestion (CON), degeneration of the cardiac muscle fibres and their disintegration (D). (H&E, X400)

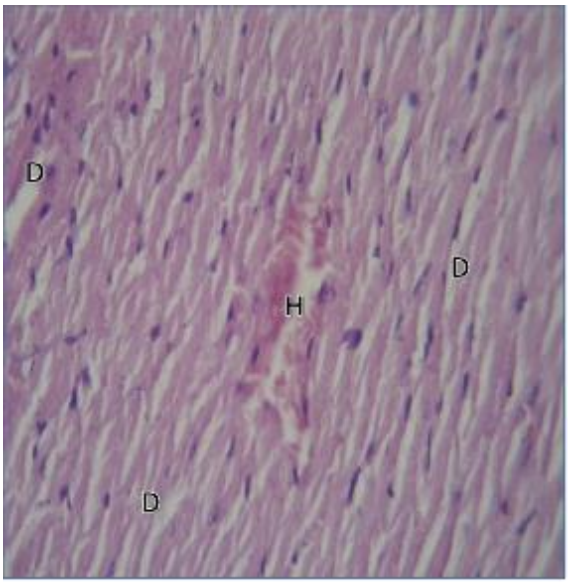

Figure 5. A section of the heart of a mouse from the group whose feed was fried in olive oil with ginger roots, showing degeneration and disintegration of the cardiac muscle fibres (D), and bleeding between the muscle fibres (H). (H&E, X400)

The group whose feed was fried in olive oil with bay leaves

The results showed an almost normal appearance, as there was disintegration in some cardiac muscle fibres and bleeding between the muscle fibres, as in Figure 6, and the normal appearance of one of the blood vessels, as well as smooth muscle fibres in their normal shape, as in Figure 7.

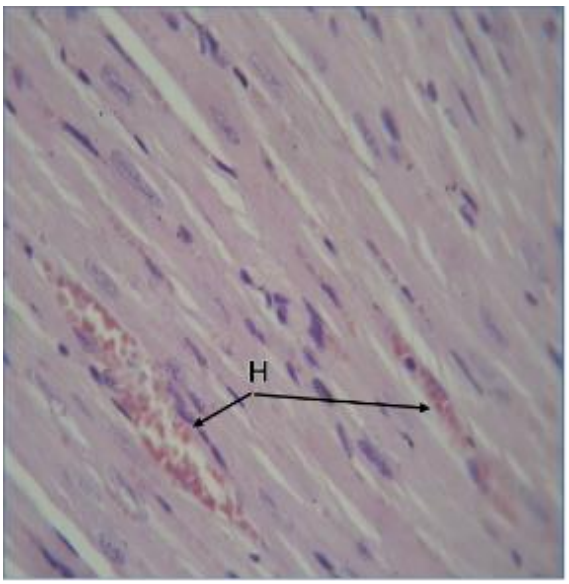

Figure 6. A section of the heart of a mouse from the group whose feed was fried in olive oil with bay leaves. It shows an almost normal structure, as there was disintegration in some of the cardiac muscle fibres (A), and bleeding between the muscle fibres (H). (H&E, X400)

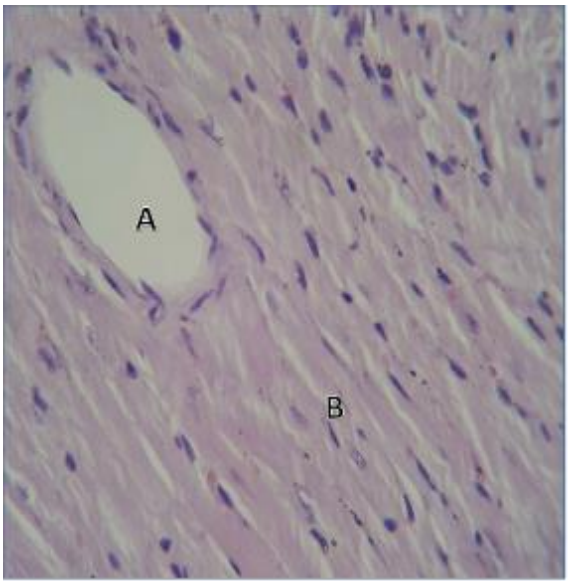

Figure 7. A section of the heart of a mouse from the group whose feed was fried in olive oil with bay leaves, showing the normal structure of one of the blood vessels (A), as well as the smooth muscle fibres in their normal shape (B). (H&E, X400)

4. Discussion

Olive oil and other oils with a high proportion of unsaturated fatty acids are more vulnerable to the hydrolysis, heat oxidation, polymerization, and fission of the feed that takes place during deep-frying [11]. This explains the incidence of hemolysis and congestion in the group whose feed was cooked in olive oil, as well as the degeneration and disintegration of the cardiac muscle fibres and the bleeding between the muscle fibres.

Hydrolysis reactions during the frying of foods in oil lead to reactive oxygen species (ROS) and trans fatty acids that can cause histological lesions in various organs such as the heart [12]. Furthermore, the oxidation of oils during frying results in the production of trans fatty acids and lipid peroxidation as well as modifications to the nature of enzymes and antioxidant status [13]. Moreover, polymerization reactions produce total polar compounds, which inactivate the genes of key lipolysis-related enzymes and cause lipid deposition, oxidative stress, and cytotoxicity [14]. These compounds include triglyceride dimer (TGD), triglyceride oligomer (TGO), aldehyde byproducts, alcohols, hydrocarbons, and acrolein [15]. This explains why the group whose meal was cooked in olive oil and ginger roots did not show any discernible improvement.

The results showed that the fried group treated with olive oil and bay leaves showed a normal appearance of smooth muscle fibres. This is due to the unique properties of bay leaves because they are full of antioxidants, some mineral compounds, and phenolic compounds, which enhanced the olive oil's content of phenolic compounds, which helped in resisting the oxidative stress generated by the frying process, which reduced Histological lesions are widespread [16].

5. Conclusion

The use of olive oil in the frying process has harmful histological effects on the heart, and the use of bay leaves during the frying process can have a therapeutic effect on the histological structure of the heart, while the use of ginger roots does not have any therapeutic effect on the histological structure of the heart against the toxicity induced by the frying process of olive oil.

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REFERENCES

[1] K. Bernhard and E. Scheitlin, "Absorption of mineral oils.," 1952.
[2] A. C. Sánchez-Gimeno, A. I. Negueruela, M. Benito, A. Vercet, and R. Oria, "Some physical changes in Bajo Aragón extra virgin olive oil during the frying process," *Food Chem.*, vol. 110, no. 3, pp. 654–658, 2008.
[3] A. Chiou and N. Kalogeropoulos, "Virgin olive oil as frying oil," *Compr. Rev. Food Sci. Food Saf.*, vol. 16, no. 4, pp. 632–646, 2017.
[4] D. E. Schraufnagel, "The health effects of ultrafine particles," *Exp. Mol. Med.*, vol. 52, no. 3, pp. 311–317, 2020.
[5] M. Vaisey-Genser, L. J. Malcomson, R. Przybylski, and N. A. M. Eskin, "Consumer acceptance of stored canola oils in canola. 12th Project report research on canola, seed, oil meal," *Canada Canola Counc. Canada*, pp. 189–202, 1999.
[6] V. Messina, A. Biolatto, A. Descalzo, A. Sancho, R. Baby, and N. W. De Reca, "Effect of pan-frying in extra-virgin olive oil on odour profile, volatile compounds and vitamins," *Int. J. food Sci. Technol.*, vol. 44, no. 3, pp. 552–559, 2009.
[7] K. S. Woo *et al.*, "The impact of particulate matter air pollution (PM2. 5) on atherosclerosis in modernizing China: a report from the CATHAY study," *Int. J. Epidemiol.*, vol. 50, no. 2, pp. 578–588, 2021.
[8] C. Nutakor, J. A. Essiedu, P. Adadi, and O. N. Kanwugu, "Ginger beer: An overview of health benefits and recent developments," *Fermentation*, vol. 6, no. 4, p. 102, 2020.
[9] S. Batool, R. A. Khera, M. A. Hanif, and M. A. Ayub, "Bay leaf," in *medicinal plants of South Asia*, Elsevier, 2020, pp. 63–74.
[10] L. G. Luna, "Manual of histologic staining methods of the Armed Forces Institute of Pathology," in *Manual of histologic staining methods of the Armed Forces Institute of Pathology*, 1968, pp. xii–258.
[11] Y.-S. Lin, D.-L. Chen, H.-M. Shaw, G.-J. Wang, and P.-M. Chao, "Consuming oxidative frying oil impairs cardiac energy production and calcium recycling, causing cardiac hypertrophy, fibrosis and diastolic dysfunction in male Sprague Dawley rats," *J. Nutr. Biochem.*, vol. 98, p. 108816, 2021.
[12] A. Patsioura, A. M. Ziaiifar, P. Smith, A. Menzel, and O. Vitrac, "Effects of oxygenation and process conditions on thermo-oxidation of oil during deep-frying," *Food Bioprod. Process.*, vol. 101, pp. 84–99, 2017.
[13] R. P. Venkata and R. Subramanyam, "Evaluation of the deleterious health effects of consumption of repeatedly heated vegetable oil," *Toxicol. reports*, vol. 3, pp. 636–643, 2016.
[14] K. Ganesan, K. Sukalingam, and B. Xu, "Impact of consumption and cooking manners of vegetable oils on cardiovascular diseases-A critical review," *Trends Food Sci. Technol.*, vol. 71, pp. 132–154, 2018.
[15] H. Amsalu, T. Wondimnew, T. Mateos, M. Fekadie, and G. Bogale, "The effect of palm oil-fried street kokor on liver and kidney biomarkers of Swiss albino mice," *J. Lipids*, vol. 2020, no. 1, p. 8819749, 2020.
[16] M. González-Rodríguez *et al.*, "Oleocanthal, an antioxidant phenolic compound in extra virgin olive oil (EVOO): a comprehensive systematic review of its potential in inflammation and Cancer," *Antioxidants*, vol. 12, no. 12, p. 2112, 2023.
[17] M. J. Saleh and K. A. Al-Badrany, "Preparation, Characterization of New 2-Oxo Pyran Derivatives by AL2O3-OK Solid Base Catalyst and Biological Activity Evaluation," *Cent. Asian J. Med. Nat. Sci.*, vol. 4, no. 4, pp. 222–230, 2023.
[18] A. W. A. S. Talluh, "Preparation, Characterization, Evaluation of Biological Activity, and Study of Molecular Docking of Azetidine Derivatives," *Cent. Asian J. Med. Nat. Sci.*, vol. 5, no. 1, pp. 608–616, 2024.
[19] A. Talluh, J. N. Saleh, and M. J. Saleh, "Preparation, Characterization and Evaluation of Biological Activity and Study of Molecular Docking of Some New Thiazoli-dine Derivatives," 2024.
[20] A. W. A. S. Talluh, M. J. Saleh, J. N. Saleh, K. Al-Badrany, and H. mohammed saleh Al-Jubori, "Preparation, characterization, and evaluation of the biological activity of new 2, 3-dihydroquinazoline-4-one derivatives," *Eur. J. Mod. Med. Pract.*, vol. 4, no. 4, pp. 326–332, 2024.
[21] J. N. Saleh and A. Khalid, "Synthesis, Characterization and Biological Activity Evaluation of Some New Pyrimidine Derivatives by Solid Base Catalyst AL2O3-OBa," *Cent. Asian J. Med. Nat. Sci.*, vol. 4, no. 4, pp. 231–239, 2023.

[22] Y. M. Ahmed and R. Z. Sulaiman, (2018). Detection some active Compounds in the Leaves and Stems of Local Coriander Plant-Coriandrum sativum L. *Tikrit Journal of Pure Science*, *23*(3), 6-15.