Egyptian Journal of Veterinary Sciences

https://ejvs.journals.ekb.eg/

Evaluating The impact of Certain Herbal Essential Oils on The Shelf Life and Chemical Composition of Beef Steak

Samar M. Ibrahim[1*], Fatin S. Hassanin[2], Nahla S. Abou-Elroos[3] and Fahim A. Shaltout[2]

[1] *Directorate of Veterinary Medicine, Qalubiya Governorate, Egypt.*
[2] *Food Hygiene and Control Dept., Faculty of Vet. Med., Benha University, Egypt.*
[3] *Food Hygiene Dept., Animal Health Research Institute, ARC, Egypt.*

Abstract

NOWADAYS, spices and herbal characteristics, including essential oils have been recommended as an essential meat additive for its strong antimicrobial and antioxidant which elongate the meat and meat products shelf-life. It, also, improve meat safety and enhance its acceptability. The current study was aimed to investigate the impact of 1.0 and 1.5% of each of ginger (GEO), lemon (LEO) and pomegranate (PEO) peels essential oils on beef steak freshness criteria i.e. pH, total volatile nitrogen (TVN) and thiobarbituric acid (TBA) along of 15 days in the refrigeration. Generally, oils addition revealed significant extension of the treated samples acceptability up to 12 days of storage. Whereas, the control samples spoiled within 6 days of storage. Moreover, the control group exceeded the acceptable limits after the 3rd day of storage, while the treated samples proved their potent antioxidant and antimicrobial traits with higher acceptability score. In addition, GEO, LEO and PEO appeared to add-value of the chemical freshness criteria and shelf-life as a consequence. So, it is recommended to use GEO, LEO and PEO as useful treatments to meat steak for more compatible beef steak with longer shelf-life.

Keywords: Food preservation, Food safety, Shelf life.

Introduction

Freshness issues about meat and meat products in the human diet are significant [1]. In addition, to provide the body with readily digested proteins, meat also contains all the nutrients that are essential for maintaining a healthy diet [2, 3].The meat is prepared into wholesale or retail cuts once the animal has been killed. Meat trimmings and other cuts are subsequently ground and processed further. This increases the meat's surface area, which promotes the bacteria's adherence and proliferation [4].

Meat is perishable, and during storage, endogenous enzymes and microorganisms cause changes in its chemical composition [5]. Total volatile nitrogen (TVN) is a biomarker for the breakdown of amines and proteins [6, 7, 8]. Furthermore, thiobarbituric acid (TBA) is a good measure of rancidity, especially in meat[8].

The most popular way to preserve fresh meat and meat products is to store them in a refrigerator [9]. The antimicrobial and antioxidant chemicals, particularly synthetic ones, are added to beef products to increase their shelf-life in the refrigerator [10]. However, as the safety of synthetic additives has been questioned in recent years, consumers recommend to use the natural ingredients as alternative preservatives in the meat and meat products [11].

Extracts of essential oils (EOs) from common culinary herbs, spices, and aromatic plants that have antibacterial and antioxidant properties were used for meat preservation lately [12]. These chemicals used to slow down or stop the growth of foodborne bacteria, which affect the meat's chemical acceptability standards and its shelf life [13].

Medicinal plants have been used for a wide range of purposes throughout history, including food preservation and flavoring spices, which has sparked interest in replacing chemical additions [14]. The efficacy of aromatic herbs and their extracts for applications involving food safety and preservation has been assessed [15]. The active ingredients in their essential oils (EOs) and other secondary plant metabolite components were responsible for the majority of their preservation qualities[16]. Essential

*Corresponding authors: Samar Ibrahim, E-mail: samarphd2024@gmail.com, Tel.: +201005764399
(Received 19 October 2024, accepted 23 December 2024)
DOI: 10.21608/EJVS.2024.329509.2439

oils are known to possess antibacterial and antioxidant qualities [17].

Lemon essential oil (LEO), derived from the peel of lemon fruit (*Citrus limon*), contains several active compounds that contribute to its antimicrobial and antioxidant properties [18]. These compounds include limonene, citral, linalool, α-terpineol, β-pinene and terpinene-4-ol which gave the LEO its specific aroma and functionality as antimicrobial agent through microbial cell wall disruption and death[19]. In addition, LEO contains significant amounts of flavonoids such as hesperidin and naringin, which possess antioxidant properties[20]. These compounds can scavenge free radicals and reduce oxidative stress, thereby preserving the quality of meat products by preventing lipid oxidation and delaying spoilage [21, 22].

Several bioactive components found in ginger essential oil, which is extracted from the rhizome of the ginger plant (*Zingiber officinale*), give it antibacterial and antioxidant qualities. β-Sesquiphellandrene, zingerone, gingerols, shogaols, and gingerdione are some of these active components. These components help scavenge free radicals and lessen oxidative stress because of their potent antioxidant qualities[23]. The growth of foodborne pathogens and spoilage microorganisms in meat products is also effectively inhibited by gingerols, which have been demonstrated to possess antibacterial action against a broad variety of bacteria and fungi.

Pomegranate essential oil (PEO), derived from the seeds and peel of the pomegranate fruit (*Punica granatum*). It contains several bioactive compounds that contribute to its antimicrobial and antioxidant properties[24]. These active compounds include punicic acid, ellagic acid, punicalagins and anthocyanins; which, exhibit significant antioxidant activities and can help scavenge free radicals, preventing oxidative damage to lipids and proteins in meat products[25]. They also contribute to the preservation of meat freshness and quality[26]. Moreover, PEO contains flavonoids (such as quercetin and kaempferol) and vitamin C; which have a potent antioxidant effects and help maintaining their effectiveness in protecting meat products from oxidative damage[27]. In addition, phytosterols have antioxidant properties and can help stabilize cell membranes in meat products, reducing lipid oxidation and preserving product quality[24].

The antibacterial positive impacts effects of the previously stated essential oils on meat preservation might be due to the prevention the formation of foodborne pathogens and spoilage bacteria, increasing of their shelf life and guaranteeing food safety. Moreover, its antioxidant properties can also stop lipid oxidation, maintaining the quality and flavor of meat products. Therefore, the current study was carried out to determine the impact of ginger, lemon, and pomegranate peel essential oils (EOs) on beef steak preservation during refrigerator storage in terms of the meat quality chemical parameters (pH, TVN, and TBA).

Material and methods

Essential oils

From CAP PHARM Co., which extracts natural oils, plants, and cosmetics in Al-Obour City, Qalubiya Governorate, Egypt, the ready-to-use oils from ginger, lemon, and pomegranate peels were acquired. Every chemical that was utilized was of food quality. Until they were needed, these oils were kept at 4°C in amber-colored bottles.

Fresh beef meat steak

A 3.5 kg of the fresh beef steak used in this study. The samples were separated into 7 equal groups, each one weighed 500 g. Then treated by adding essential oils in varying amounts (1.0 and 1.5% conc.). They were then further divided into equal subgroups, each weighing roughly 85 g, and stored in the refrigerator until analyses.

Experimental design

The main 7 groups named as G1 to G7, representing control untreated sample, and treated samples with ginger EO (1% and 1.5%), lemon EO (1% and 1.5%) and pomegranate EO (1% and 1.5%), respectively. After addition of EOs, mixed thoroughly by gently squeezing the bags by hand and were left for 30 seconds for complete adaptation between oils and beef steak samples.

Initial pH, TVN and TBA values were determined after 30 seconds of refrigeration and every 3 days of storage until exceeding the permissible limits (6.8 for pH, 20 mg% for TVN and 0.9 mg malonaldhyde% for TBA). All samples were kept in refrigerator during all the experimental period. Tests were performed in triplicate.

Estimation of the chemical criteria

The pH, total volatile nitrogen (TVN), and thiobarbituric acid (TBA) values were conducted according to EOS 63-11 [28] using a calibrated pH meter (Adwa, AD1200) dipped in 50g of minced meat sample, EOS: 63-9 [29] in which ten grams of minced meat sample was mixed with magnesium oxide and Dist. water and place to boiler for distilling vapor in mixture of boric acid and methyl red reagent; which will furtherly neutralized by sulphoric acid 0.1N. % for TVN = Sulphoric acid (ml) needed to neutralize the end product - Sulphoric acid (ml) needed to neutralize the control test x 14 (mg/100 g of meat); and EOS 63-10 [30] through mixing of ten grams of well-minced meat distilled water + hydroaluric acid 4N, followed by heating of the flask containing the mixture to distill about 50

ml of the distillate; from which, 5 ml were mixed with thiobarbituric acid reagent and was kept in a boiling water bath for 35 minutes. Optical density of the end product was measured at wavelength 538; where, TBA = Light absorption x 7.8 (mg malonaldhyde/kg), respectively.

Statistical analysis

A one-way ANOVA was used to data analysis; and Duncan's post hoc multiple range test was used to compare between treatments using the SPSS software for Windows (Version 16) (SPSS Inc., Chicago, IL, USA). The P value of less than 0.05 was considered statistically significant.

Results

Referring to the shown obtained results in Fig. (1), gradual increases in pH values were recorded; where, the control group exceeded the acceptable limit (6.8) after the 3rd day of storage, while the treated samples showed longer acceptability; where the treated samples with PEO (1%) and LEO 1% recorded >6.8 pH in the 9th and 12th day of storage, respectively. After 15 days of storage, all the examined groups exceeded the acceptable limit.

Referring to the recorded results in Fig. (2), gradual increases in TVN values were recorded; where, the control group exceeded the acceptable limit (20 mg%) after the 9th day of storage, while the treated samples showed longer acceptability. After 15th days of storage, all the examined groups exceeded the acceptable limit, except GEO (1.0% and 1.5%) treated samples.

Referring to the recorded results in Fig. (3), gradual increases in TBA values were recorded; where, the control group exceeded the acceptable limit (0.9 MDA mg%) after the 6th day of storage, while the treated samples showed longer acceptability. After 10th days of storage, all the examined groups exceeded the acceptable limit, except GEO (1.0% and 1.5%) treated samples.

Referring to the overall obtained results, ginger oil revealed superior better preservation effect than the other examined essential oils.

Discussion

Recent interest in the antioxidant qualities of polyphenols derived from ginger, lemon, and pomegranate peels has arisen because the use of natural antioxidants is thought to be a helpful tactic in postponing or slowing lipid oxidation as well as preventing the production of harmful oxidation products in meat products, improving the shelf-stability of food products [31].

Essential oils can meet some of the growing demand for "green food" items made from natural sources as people shift toward consuming food free of chemicals [32].

Meat's high moisture content and readily used nutrients make it prone to spoiling quickly, even during chilling conditioning, and have a short shelf life [33]. This is linked to an initial loss of freshness that affects the food's bacteriological and sensory quality. So, sensory evaluation is important when it comes to food acceptability, as human response determines the eating quality of any food [34].

According to many studies, the usage of chemicals and other produced food additives might cause malignant neoplasms as well as degenerative illnesses[35, 36]. In order to cover various antibacterial qualities and extend the duration of realistic usage, it became necessary to look for elective procedures. Natural plant byproducts have recently attracted a lot of attention in food conservation measures due to their ability to inhibit the growth of harmful microorganisms through their antioxidant activity [11].

Medicinal plants have been used for a wide range of purposes throughout history, including food preservation and flavoring spices, which has sparked interest in replacing chemical additions [14]. A variety of methods, including dipping, spraying, and adding, can be used to include essential oils into food products [37].

Regarding with the present results, significant ($P \leq 0.05$) retardation in the pH values raising up, as a results of fatty acids and amino acids degradation, in the treated groups. Inter-groups comparison revealed that the control group exceeded the acceptable limit (6.8) after the 3rd day of storage, while the treated samples showed longer acceptability; where the treated samples with PEO (1%) and LEO 1% recorded >6.8 pH in the 9th and 12th day of storage, respectively revealing superiority of LEO as an enhancer for pH values of the treated meat samples; which may be attributed to the bioactive contents of lemon oil such as vitamin C, citric acid, phenolics and flavonoids which are believed to be responsible for a range of protective benefits including anti-oxidative and antimicrobial activities[38].

Because pH is correlated with the metabolic changes that take place in meat during storage, it is a crucial indicator of meat quality and freshness. The pH of fresh meat is normally mildly acidic, though this might vary based on the animal's species, muscle type, and diet. Meat's pH variations might reveal important details about its quality and freshness. Meat spoilage can also be detected by changes in pH that occur during storage. Because microbial growth and metabolic processes produce ammonia and other alkaline substances, spoiled meat may experience an alkaline shift, or an increase in pH. Thus, it is possible to detect microbial spoiling and guarantee the safety and quality of meat products by keeping an eye on pH variations during storage [39].

However, TBA and TVN are frequently utilized as markers of the quality and freshness of meat. The volatile nitrogenous chemicals that are created as meat's proteins break down are measured by TVN. Ammonia, amines, and other volatile nitrogenous chemicals are released as meat spoils due to the breakdown of proteins by proteolytic enzymes and microbial activity. Elevated TVN levels in meat are a sign of advanced protein breakdown and spoiling, which can produce unpleasant smells and aromas [7]. Malondialdehyde (MDA), a sign of lipid oxidation in meat, is also measured by the TBA assay. When meat's unsaturated fats react with oxygen, reactive oxygen species are created, which causes lipid oxidation and subsequent lipid breakdown [4].

However, gradual rise up in the both TVN and TBA parameters were observed in the current study as a result of enzymatic and microbial lipolytic and proteolytic activities. It was faster in the control group than in the EOs treated groups; which acceptability for consumption extended to the 12th day of storage.

Ginger EO showed higher enhancement effect on TVN and TBA values among the used EOs. The current obtained results can be attributed to the potent antimicrobial and antioxidative effects of the used EOs referring to its contents of bioactive polyphenols compounds that have significant antimicrobial and antioxidative activity in meat matrix[21, 23, 24].

Recorded results agreed with those of Elbalsy *et al.* [40], Eldahrawy *et al.* [41] and Zhang *et al.* [42] who recorded significant antibacterial and antioxidant effects of the used herbal extracts in the treated meat products; which was reflected on the pH, TVN and TBA values and meat freshness, quality and shelf-life as consequences.

Conclusion

Essential oils offer beneficial antioxidant effects on the treated steak samples. Among them, pomegranate essential oil (1.5%) demonstrated the most effectiveness, followed by ginger and lemon essential oils as antioxidant agents in the meat model. Consequently, it is advisable to incorporate ginger, lemon, and pomegranate essential oils, along with GMP, in meat production and preservation.

Acknowledgments

Authors want to present great appreciation for the all staff of Food Hygiene Department, Faculty of Veterinary Medicine, Benha University, Egypt; and Animal Health Research Institute, Agriculture Research Center for their valuable help and guidance.

Funding statement

This study didn't receive any funding support

Declaration of Conflict of Interest

The authors declare that there is no conflict of interest.

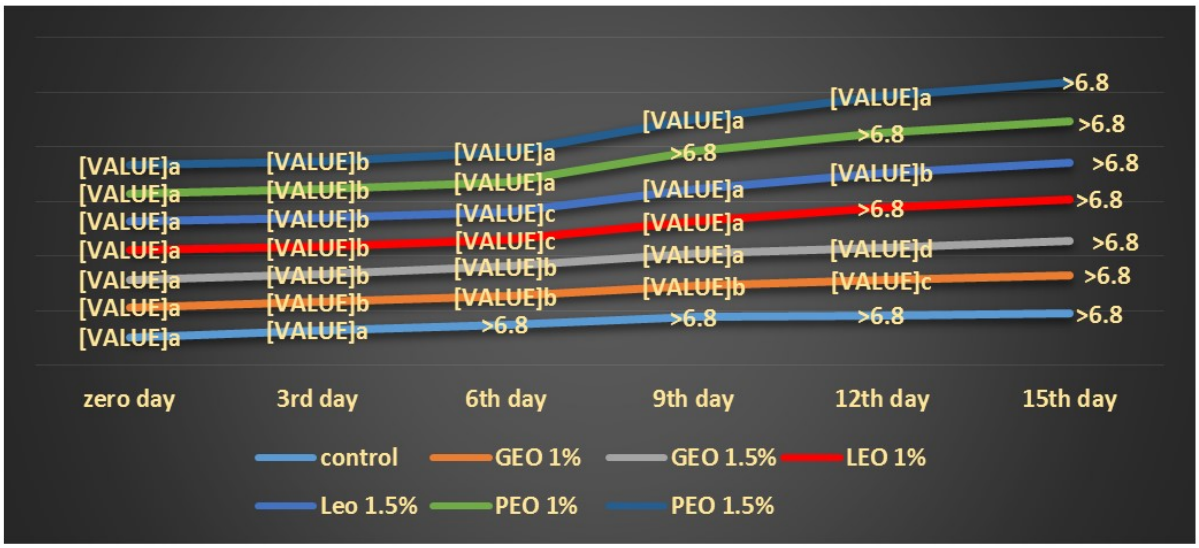

Fig. 1. Effect of different concentrations of EOs on meat pH values

*Means with different superscript are significantly different ($P < 0.05$). Values > 6.8 represent decomposed samples

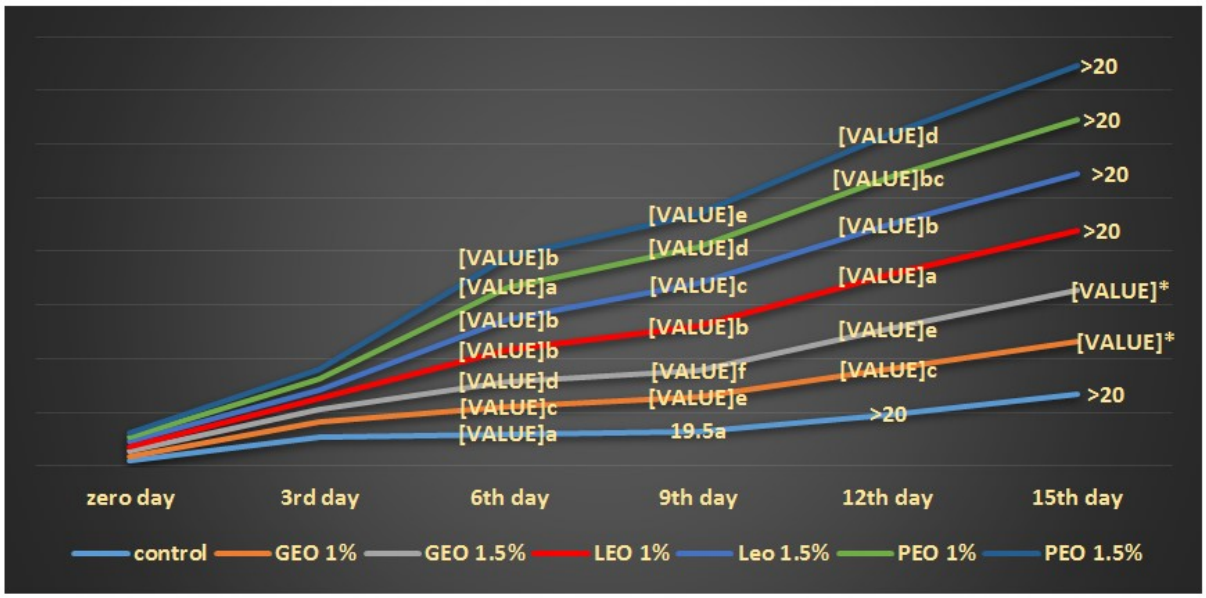

Fig. 2. Effect of different concentrations of EOs on meat TVN values

*Means with different superscript are significantly different (P < 0.05)

* Means, of 15th day, carrying superscript star are significantly different by independent T test ($P \leq 0.05$)

Values > 20.0 represent decomposed samples

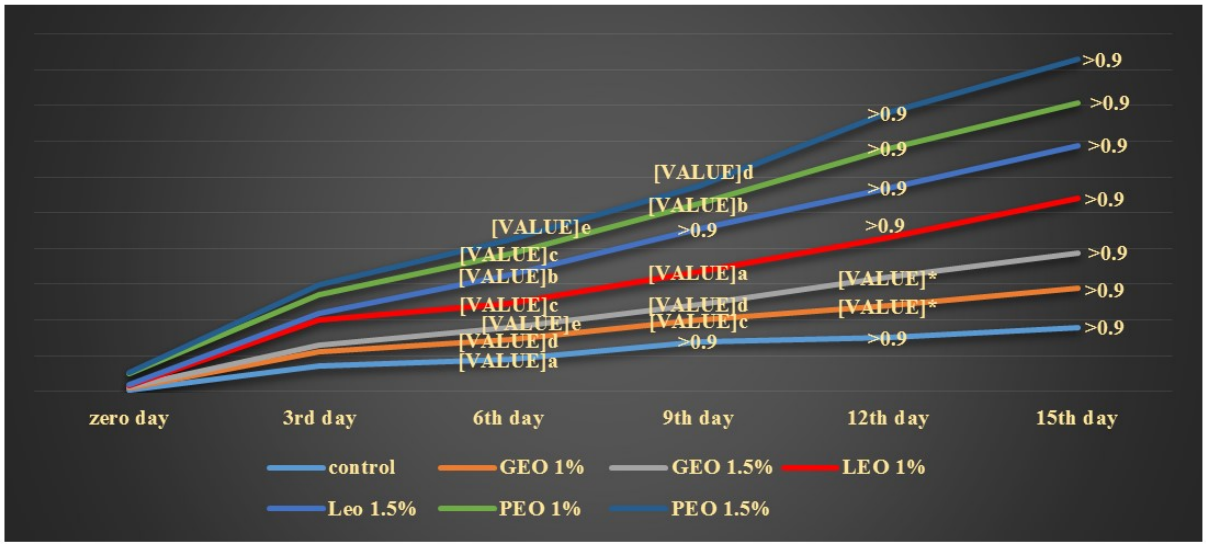

Fig. 3. Effect of different concentrations of EOs on meat TBA values

*Means with different superscript are significantly different (P < 0.05)

* Means, of 15th day, carrying superscript star are significantly different by independent T test ($P \leq 0.05$)

Values > 0.9 represent decomposed samples

References

1. Geiker, N.R.W., Bertram, H.C., Mejborn, H., Dragsted, L.O., Kristensen, L., Carrascal, J.R., Bügel, S. and Astrup, A. Meat and human health-current knowledge and research gaps. *Foods,* **10**(7), 1556 (2021). doi: 10.3390/foods10071556

2. Saleh, E., Shaltout, F. and Abd Elaal, E. Effect of some organic acids on microbial quality of dressed cattle carcasses in Damietta abattoirs, Egypt. *Damanhour J. Vet. Sci.*, **5**(2), 17-20 (2021).doi: 10.21608/DJVS.2021.186008

3. Ragab, A., Edris, A., Shaltout, F., Salem, A. Effect of titanium dioxide nanoparticles and thyme essential oil on the quality of the chicken fillet. *Benha Vet. Med. J.,* **41**(2), 38-40 (2022). Doi: 10.21608/BVMJ.2021.107456.1488

4. Domínguez, R., Pateiro, M., Gagaoua, M., Barba, F.J., Zhang, W. and Lorenzo, J.M. A Comprehensive review on lipid oxidation in meat and meat products. *Antioxidants*, **8**, 429 (2019). Doi: 10.3390/antiox8100429

5. Zhou, G.H., Xu, X.L., Liu, Y. Preservation technologies for fresh meat – A review. *Meat Science*, **86**, 119-128 (2010). Doi: 10.1016/j.meatsci.2010.04.033

6. Shaltout, F.A., Thabet, M.G. and Koura, H.A. Impact of Some Essential Oils on the Quality Aspect and Shelf Life of Meat. *J. Nutr. Food Sci.*, **7**, 647 (2017). Doi: 10.21608/BVMJ.2017.30503

7. Hassanin, F., Shaltout, F., Homouda, S. and Arakeeb, S. Natural preservatives in raw chicken meat. *Benha Vet. Med. J.,* **37**, 41-45 (2019). Doi: 10.21608/BVMJ.2019.18144.1117

8. Bekhit, A., Holman, B., Giteru, S. and Hopkins, D. Total volatile basic nitrogen (TVB-N) and its role in meat spoilage: A review. *Trends in Food Sci. & Technol.*, **109**, 280-302 (2021). Doi: 10.1016/j.tifs.2021.01.006

9. Piranavatharsan, U., Jinadasa, B. and Jayasinghe، C. Validation of thiobarbituric acid reactive substances (TBARS) method for measuring secondary lipid oxidation products in fresh Indian mackerel (*Rastrelliger kanagurta*). *Food and Humanity*، **1**, 1194-1199 (2023). Doi: 10.1016/j.foohum.2023.09.009

10. Paul, S.R. and Russell, C. *Meat processing*. *Encyclopedia Britannica* (2024). https://www.britannica.com/technology/meat-processing

11. Cunha, L., Monteiro, M., Lorenzo, J., Munekata, P., Muchenje, V., de Carvalho, F. and Conte-Junior, C. Natural antioxidants in processing and storage stability of sheep and goat meat products. *Int. Food Res.*, **111**, 379-390 (2018). Doi: 10.1016/j.foodres.2018.05.041

12. Aminzare, M., Hashemi, M., Ansarian, E., Bimkar, M., Azar, H., Mehrasbi, M., Daneshamooz, S., Raeisi, M., Jannat, B. and Afshari, A. Using natural antioxidants in meat and meat products as preservatives: A review. *Adv. Anim. Vet. Sci.*, **7**, 417-426 (2019). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3439618

13. Bhavaniramya, S., Vishnupriya, S., Al-Aboody, M., Vijayakumar, R. and Baskaran, D. Role of essential oils in food safety: Antimicrobial and antioxidant applications. *Grain & Oil Sci. Technol.*, **2**, 49-55 (2019). Doi: 10.1016/j.gaost.2019.03.001

14. Bolouri, P., Salami, R., Kouhi, S., Kordi, M., Asgari Lajayer, B., Hadian, J. and Astatkie, T. Applications of essential oils and plant extracts in different industries. *Molecules*, **27**, 8999 (2022). Doi: doi: 10.3390/molecules27248999

15. Martínez-Graciá, C., González-Bermúdez, C., Cabellero-Valcárcel, A., Santaella- Pascual, M. and Frontela-Saseta, C. Use of herbs and spices for food preservation: advantages and limitations. *Cur. Opinion Food Sci.*, **6**, 38-43 (2015). ISSN 1013-5316;CODEN: SINTE 8

16. Campolina, A.G., das Graças Cardoso, M., Rodrigues-Silva-Caetano, A., Lee Nelson, D. and Mendes Ramos, E. Essential oil and plant extracts as preservatives and natural antioxidants applied to meat and meat products: A review. *Food Technol. Biotechnol*., **61**(2), 212–225 (2023). doi: 10.17113/ftb.61.02.23.7883

17. Falleh, H., Ben Jemaa, M., Saada, M. and Ksouri, R. Essential oils: A promising eco-friendly food preservative. *Food Chem.*, **330**, 127268 (2020). Doi: 10.1016/j.foodchem.2020.127268

18. Laranjo, M., Fernández-León, A., Agulheiro-Santos, A., Potes, M. and Elias, M. Essential oils of aromatic and medicinal plants play a role in food safety. *J. Food Process & Preserv.*, **2019**, 1-7 (2019). Doi: 10.1111/jfpp.14278

19. Xiao, W., Gao, Z., Liu, T., Zhong, W., Jiang, S., He, M., Fu, F., Li, G., Su, D., Guo, J. and Shan, Y. Lemon essential oil nanoemulsions: Potential natural inhibitors against *Escherichia coli*. *Food Microbiol.*, **119**, 104459 (2024). Doi: 10.1016/j.fm.2023.104459

20. Sander, A., Bival Štefan, M., Radetić, A., Petračić, A., Kučić Grgić, D., Cvetnić, M. and Parlov Vuković, J. Advanced spectroscopic characterization, antioxidant and antibacterial activity evaluation, and trace metal analyses of essential oils from star anise, nutmeg, clove, oregano, bay leaves, and lemon peel. *Appl. Sci.,* **14**, 11094 (2024). Doi: 10.3390/app142311094

21. Saini, R.K., Ranjit, A. and Sharma, K. Bioactive compounds of citrus fruits: A review of composition and health benefits of carotenoids, flavonoids, limonoids, and terpenes. *Antioxidants,* **11**(2), 239 (2022). Doi: 10.3390/antiox11020239

22. Mahmoud, E.A. Essential oils of citrus fruit peels antioxidant, antibacterial and additive value as food preservative. *J. Food Dairy Sci., Mansoura Univ.*, **8**, 111-116 (2017). https://journals.ekb.eg/article_37135_565bdf7c9e7e4dd3cae2b494ef26bde4.pdf

23. Miroslava, K., Natália, Č., Nenad, V., Andrea, V., Alessandro, B., Stefania, G., Ben Saad, R., Ben Hsouna, A., Ban, Z. and Milena, V. *Citrus limon* essential oil: Chemical composition and selected biological properties focusing on the antimicrobial (In Vitro, In Situ), antibiofilm, insecticidal activity and preservative effect against *Salmonella enterica* inoculated in carrot. *Plants*, **13**, 524 (2024). Doi: 10.3390/plants13040524

24. Mao, Q.Q., Xu, X.Y., Cao, S.Y., Gan, R.Y., Corke, H., Beta, T. and Li, H.B. Bioactive compounds and bioactivities of ginger (*Zingiber officinale* Roscoe). *Foods,* **8**, 185 (2019). doi: 10.3390/foods8060185.

25. Siddiqui, S., Singh, S. and Nayik, G. Bioactive compounds from pomegranate peels - Biological properties, structure–function relationships, health benefits and food applications – A comprehensive review. *J. Functional Foods*, **116**, 106132 (2024). Doi: 10.1016/j.jff.2024.106132

26. Ain, H.B.U., Tufail, T., Bashir, S., Ijaz, N., Hussain, M., Ikram, A., Farooq, M.A. and Saewan, S.A. Nutritional importance and industrial uses of pomegranate peel: A critical review. *Food Sci. & Nutr.*, **11**(6), 2589–2598 (2023). doi: 10.1002/fsn3.3320

27. Valero-Mendoza, A.G., Meléndez-Rentería, N.P., Chávez-González, M.L., Flores-Gallegos, A.C., Wong-Paz, J.E., Govea-Salas, M., Zugasti-Cruz, A. and Ascacio-Valdés, J.A. The whole pomegranate (*Punica granatum.* L), biological properties and important findings: A review. *Food Chem. Adv.,* **2**, 100153 (2023). Doi: 10.1016/j.focha.2022.100153

28. Tornese, R., Montefusco, A., Placì, R., Semeraro, T., Durante, M., De Caroli, M., Calabrese, G., Caprifico, A. E. and Lenucci, M.S. Antiangiogenic potential of pomegranate extracts. *Plants*, **13**(23), 3350 (2024). Doi: 10.3390/plants13233350

29. EOS "Egyptian Organization for Standards & Quality" No. 63-11. Methods of examining and testing meat and its products. Pt. 11, pH estimation (2006).

30. EOS "Egyptian Organization for Standards & Quality" No. 63-9. Methods of examining and testing meat and its products. Pt. 9, Total volatile nitrogen (TVN) estimation (2006).

31. EOS "Egyptian Organization for Standards & Quality" No. 63-10. Methods of examining and testing meat and its products. Pt. 10, Thiobarbituric acid (TBA) estimation (2006).

32. Lorenzo, J., Munekata, P.E., Gómez, B., Barba, F.J., Mora, L., Pérez-Santaescolástica, C. and Toldrá, F. Bioactive peptides as natural antioxidants in food products—A review. *Trends Food Sci. Technol.*, **79**, 136–147 (2018). Doi: 10.1016/j.tifs.2018.07.003

33. Ashaolu, T.J. and Ashaolu, J.O. Perspectives on the trends, challenges and benefits of green, smart and organic (GSO) foods. *Int. J. Gastron. Food Sci.*, **22**, 100273 (2020). Doi: 10.1016/j.ijgfs.2020.100273

34. Li, Z., Cai, M., Liu, Y., Sun, P. and Luo, S. Antibacterial activity and mechanisms of essential oil from *Citrus medica* L. var. sarcodactylis. *Molecules*, **24**, 1577-1587 (2019). Doi: 10.3390/molecules24081577

35. Mlian, K.S., Hafiz, R.S. and Muhammad, N. Sensory evaluation of consumers acceptability. Hand Book of Food Sci. Technol., 4th ed., pp. 362-386 (2017). Doi:10.3390/foods9091334

36. Abbott, P.J. Carcinogenic chemicals in food: Evaluating the health risk. *Food and Chem. Toxicol.*, **30**, 327-332 (1992). doi: 10.1016/0278-6915(92)90011-9

37. European Research Council. The health impact of food additives. (2022), [Internet source]. Retrieved on Dec. 2024. Available on: https://erc.europa.eu/projects-statistics/science-stories/health-impact-food-additives

38. Khalafalla, F.A., Ali, F.H. and Hassan, A.R.H. Quality improvement and shelf-life extension of refrigerated Nile tilapia (*Oreochromis niloticus*) fillets using natural herbs. *Beni-Suef Univ. J. Basic Appl. Sci.*, **4**, 33-40 (2015). Doi: 10.1016/j.bjbas.2015.02.005

39. Karimi, A., Mohammadi-Kamalabadi, M., Rafieian-Kopaei, M., Amjad, L. and Salimzadeh, L. Determination of antioxidant activity, phenolic contents and antiviral potential of methanol extract of *Euphorbia spinidens Bornm* (*Euphorbiaceae*). *Tropical J. Pharma. Res.*, **15**, 759-764 (2016). Doi: 10.4314/tjpr.v15i4.13

40. Lee, E.J. and Shin, H.S. Development of a freshness indicator for monitoring the quality of beef during storage. *Food Sci. Biotechnol.*, **28**, 1899-1906 (2019). doi: 10.1007/s10068-019-00633-5

41. Elbalsy, A., Ibrahim, H., Hassan, M., and Nada, S. Effect of different concentrations of lemon oil on some food poisoning bacteria and histamine residue in fish fillet. *Benha Vet. Med. J.,* **43**, 109-113 (2022). Doi: 10.21608/BVMJ.2022.154628.1568

42. Eldahrawy, M., Salem, A. and Nabil, M. The efficiency of citrus peel powders in the improvement of meat quality during cold storage. *Benha Vet. Med. J.*, **42**, 208-213 (2022). Doi: 10.21608/BVMJ.2022.144967.1535

43. Zhang, B., Liu, Y., Peng, H., Lin, Y. and Cai, K. Effects of ginger essential oil on physicochemical and structural properties of agar‑sodium alginate bilayer film and its application to beef refrigeration. *Meat Sci.*, **198**, 109051 (2023). Doi: 10.1016/j.meatsci.2022.109051

تقدير تأثير بعض الزيوت العطرية العشبية على مدة صلاحية شرائح اللحم البقري من حيث خصائصها الكيميائية

سمر محمد إبراهيم[1]*، فاتن سيد حسانين[2]، نهلة شوقي أبو الروس[3] وفهيم عزيز الدين شلتوت[2]

[1].مديرية الطب البيطري بالقليوبية، جمهورية مصر العربية.
2.قسم مراقبة الاغذية، كلية الطب البيطري – جامعة بنها، جمهورية مصر العربية.
3. قسم صحة الاغذية، معهد بحوث الصحة الحيوانية، مركز البحوث الزراعية، جمهورية مصر العربية.

الملخص

يوصى بإستخدام التوابل والمنتجات العشبية الطبيعية بما في ذلك الزيوت العطرية كإضافات أساسية للحوم ومنتجاتها بسبب خصائصها القوية كمضادات للميكروبات والأكسدة بهدف إطالة عمر التخزين مع تحسين الجودة وتعزيز قبولها. تهدف الدراسة الحالية إلى التحقق من تأثير معالجة شرائح اللحم البقري بالزيوت العطرية المستخلصة من قشور الزنجبيل والليمون والرمان بتركيزات (1 و 1.5٪) على معايير القبول الكيميائية الدالة على صلاحية اللحوم المتمثلة في الرقم الهيدروجيني ونسبة النيتروجين الكلي المتطاير وحمض الثيوباربيتيوريك على مدار 15 يومًا من التخزين المبرد. بشكل عام؛ أظهرت النتائج إطالة العمر التخزيني ومعايير القبول في المجموعات المعالجة بإضافة الزيوت العطرية حتى اليوم الثاني عشر من التخزين المبرد، في حين ظهرت علامات الفساد على عينات مجموعة المقارنة بعد ستة أيام من التخزين. تم تسجيل زيادات تدريجية في قيم الرقم الهيدروجيني والنيتروجين المتطاير الكلي وحمض الثيوباربيتيوريك حيث تجاوزت مجموعة المقارنة الحدود المقبولة بعد اليوم الثالث من التخزين، بينما أثبتت العينات المعالجة بزيوت قشور الزنجبيل والليمون والرمان تأثيرها المضاد للأكسدة من خلال إطالة فترة التخزين للعينات المعالجة بدرجة قبول أعلى مما سبق يمكن استنتاج أن إضافة زيوت قشور الزنجبيل والليمون والرمان إلى عينات شرائح اللحم البقري حسنت معايير القبول الكيميائية ومدة الصلاحية. لذلك، يوصى باستخدام تلك الزيوت محل الدراسة كإضافات ذات فائدة لشرائح اللحم مع اتباع الممارسات الصحية الموصى بها أثناء التصنيع والتخزين.

الكلمات الدالة: حفظ الاغذية، سلامة الغذاء، العمر التخزيني للحوم.