American Journal of Food Science and Technology, 2023, Vol. 11, No. 2, 57-60
Available online at http://pubs.sciepub.com/ajfst/11/2/5
Published by Science and Education Publishing
DOI:10.12691/ajfst-11-2-5

Sensory Evaluation of the Sirloin Tip Side Steak Beef Treated with Plant-Derived and Commercial Food Preservatives

Tehilah Feye G. Bautista*, Dan Daniel B. Neri, Nicole F. Diaz, Imma Avril Lucero, Ian Jay P. Saldo, Mary Jade P. Dandoy, Jhovel Roy D. Calo

Integrated Basic Education Department, San Isidro College, Malaybalay City, 8700 Philippines
*Corresponding author: tehilahfeyeofficial@gmail.com

Received May 25, 2023; Revised June 27, 2023; Accepted July 5, 2023

Abstract Antimicrobial agents, or preservatives, are food additives that protect stored food from bacteria. Plant-derived preservatives from leaves, fruits, and seeds inhibit microbial development in food, extending shelf life. The study aimed to assess and compare the quality of meat treated with plant-derived and commercial preservatives on meat through sensory evaluation Plant-derived preservatives from lemon (*Citrus limon*), citrus peels, basil *(Ocimum basilicum*), lemongrass (*Cymbopogon citratus*), and peppermint (*Mentha piperita L.*) were extracted using maceration extraction, and commercial preservatives (Sodium Nitrite). The quality of Sirloin Tip Side Steak beef treated with plant-derived and commercial preservatives was assessed using a purposive survey by the eight established meat sellers assessing the meat's color, texture, and smell. The result's significance was analyzed using T-test. The result of the study showed that plant-derived preservatives preserved the beef with a rate of good quality, averaging 2.88, SD=0.57, while commercial preservatives preserved meat with a rate of poor quality with a mean=2.22, SD=0.54. Generally, the study's result indicates that the plant-derived preservatives have significantly preserved the meat's color, texture and smell compared to commercial preservatives. Based on the result, it is recommended to use plants that could enhance the color of the meat, not plants that could alter the meat's color.

Keywords: *basil, citrus peels, commercial preservatives, lemon, peppermint, plant-derived preservatives, preservatives, purposive survey, sodium nitrite*

Cite This Article: Tehilah Feye G. Bautista, Dan Daniel B. Neri, Nicole F. Diaz, Imma Avril Lucero, Ian Jay P. Saldo, Mary Jade P. Dandoy, and Jhovel Roy D. Calo, "Sensory Evaluation of the Sirloin Tip Side Steak Beef Treated with Plant-Derived and Commercial Food Preservatives." *American Journal of Food Science and Technology*, vol. 11, no. 2 (2023): 57-60. doi: 10.12691/ajfst-11-2-5.

1. Introduction

Food preservation is crucial to preventing food spoilage and contamination. Preservatives, such as antimicrobial agents, extend the shelf life of stored food by protecting it against deterioration caused by microorganisms [1] [2]. The interest in plant-derived food preservatives has increased in the last decade. Plant-derived preservatives are chemicals collected from plants such as leaves, fruits, and seeds that can suppress the growth of microbes in food, thereby extending its shelf life [3]. Plant-derived food preservatives include essential oils, plant extracts, and natural chemicals.

Various food preservation strategies, including natural or synthetic chemicals or substances, keep food from decaying, yet the problem continues [3]. Nowadays, artificial preservatives are more commonly utilized than natural preservatives. However, researchers found that artificial or commercial preservatives such as nitrites, benzoates, sulfites, sorbates, parabens, formaldehyde, BHT, BHA, and others might cause significant health problems like hypersensitivity, allergy, asthma, hyperactivity, neurological damage, and cancer [4] and artificial preservatives is vital for numerous reasons. The food industry continually seeks ways to improve quality and shelf life. A comparison study of natural and artificial preservatives can provide crucial information on the most effective methods for food preservation [5]. It can help assess the safety and usefulness of natural preservatives as an alternative to commercial preservatives [6] as the concern about commercial preservatives' safety and health impacts increase. According to the study [4], extracts of basil and citrus are better alternatives to preservatives such as benzoic acid, nitrates, MSG, BHA, and BHT. One such natural preservative with notable antimicrobial and antioxidant activity is lemongrass, whose essential oil contains a group of terpenes that oversee these effects [7].

Another study found that the natural antimicrobial and antioxidant properties of tropical citrus peel extracts, especially Kaffir lime, can potentially increase the shelf life of chicken drumettes by inhibiting microbial growth and lipid oxidation [8]. Peppermint essential oil can be

used as a food preservative because it is natural and generally harmless for human consumption [9].

The study aims to learn more about the effectiveness of plant-derived preservatives in preserving goods like beef meat. Moreover, the research intends to advance plant science by elucidating plants' fascinating qualities as food preservatives. This would also allow us to create plant-derived preservatives as an alternative to synthetic preservatives.

2. Methodology

2.1. Preparation of Plant-Derived Preservatives

Three plant leaves, basil, peppermint, and lemongrass, as well as lemon and citrus peels, are used to make plant-derived preservatives, which are present and collected in Bukidnon Province, specifically from Binahon Agro Farm in Purok 3, Sitio Bul-organ, Songco, Lantapan, Bukidnon. The leaves and peels were then extracted using a maceration technique. The plants were dried in an incubator at 40 degrees Celsius until dried before being pulverized, yielding 10 grams for each plant. They were then placed in a beaker containing 95% ethanol and wrapped in aluminum foil for 24 hours [10]. After 24 hours, the cover was removed and placed in a dark oven set to 80 degrees Celsius for two hours [11]. The plants were then filtered, yielding 5 mL of extract from each plant and 25 mL of solution. The plant extracts gathered were then added to the 35-gram beef specimen.

2.2. Collection and Preparation of Specimen

The slaughterhouse (Zone 8, Barangay 9, Malaybalay City) produced fresh cattle meat. The sample was stored on ice in insulated polystyrene crates for an hour before being transferred to the laboratory to protect the quality of the beef meat. The samples were separated into two equal groups (Groups A and B). Plant-derived preservatives were used in Group A, while commercial preservatives were used in Group B. Each group specimen weighed 35 grams, was a portion of beef, and had the exact dimensions of 50 cm x 40 cm x 15 cm. After that, the meat was stored in a separate container with 25 mL of plant-derived preservatives and 25 mL of commercial preservatives. The beef was then wrapped in aluminum foil and stored at room temperature for seven days at 4 degrees Celsius [12] [13].

2.3. Data Gathering

The study utilized several standardized procedures to achieve its objectives. After acquiring the necessary permission and preparing the specimens, A purposive sampling method was employed among the eight established meat sellers within the community. The meat samples preserved for seven days were inspected using sensory evaluation. The meat sellers inspected the meat using quality indicators, namely color, texture, and smell. Furthermore, before the meat specimens were subjected to sensory evaluation, a bacterial swab was performed, and the sample was brought to the CMU Microbiology Laboratory for bacterial isolation.

2.4. Instrumentation

To collect and interpret the data, the researchers used purposive sampling and a Likert-scale format to assess and compare the meat quality of beef treated with plant-derived preservatives and commercial preservatives, specifically sodium nitrite.

The plant-derived preservatives that were applied to the sliced beef meat were measured and applied evenly to the sliced beef meat. Furthermore, the treatment was carried out in a petri dish for 7 days at 4 degrees [12] [13]. On the seventh day, the researchers swabbed the meat using a sterilized and standardized method and brought it to the CMU laboratory for bacterial testing. On the same day, a sensory evaluation was performed using the purposive survey.

To analyze the scales given by the meat quality experts, the following table was used.

Scale	Range	Descriptive Rating	Qualitative Description
4	3.26-4.00	Excellent quality	Criteria are excellently met, indicating high-quality beef meat.
3	2.51-3.25	Good quality	Criteria are well met, indicating good quality beef meat.
2	1.76-2.50	Poor quality	Criteria are barely met, indicating below average quality beef meat.
1	1.00-1.75	Very poor quality	Criteria are not met, indicating poor quality beef meat.

2.5. Statistical Tool

Data from this study were analyzed using mean, standard deviation, and T-test.

3. Results and Discussion

Table 1. Overall Data for Beef Color, Texture, and Smell of Both Preservatives

	Plant-derived Preservatives		Commercial Preservatives	
	Mean and SD	Descriptive Rating	Mean & SD	Descriptive Rating
Color	2.40±0.53	Poor Quality	1.73±0.59	Very Poor Quality
Texture	3.31±0.72	Excellent Quality	2.38±0.63	Poor Quality
Smell	2.90±0.44	Good Quality	2.56±0.41	Good Quality
Overall Mean	2.87±0.57	Good Quality	2.22±0.54	Poor Quality

Table 1 shows the result of a purposive survey assessing the meat quality treated with plant-derived and commercial preservatives. The mean, standard deviation, descriptive rating, and qualitative description of the color, texture, and smell of the meat as assessed by the evaluators. As shown in the table, the color of the meat treated with plant-derived preservatives obtained a mean of 2.40 with a standard deviation of 0.53, with a descriptive rating of "poor quality," which indicates that the criteria are barely met, implying below-average quality in terms of color. While the meat treated with commercial

preservatives scored a mean of 1.37 with a standard deviation of 0.50 and a descriptive rating of "very poor quality." Moreover, in terms of texture, the meat treated with plant-derived preservatives obtained a mean of 3.31 and a standard deviation of 0.50, achieving a descriptive rating of "excellent quality," indicating that the criteria are met excellently, indicating high-quality beef.

In comparison, the texture of the meat treated with commercial preservatives had a mean of 2.38 and a standard deviation of 0.63, which has a descriptive rating of poor quality in texture, indicating below-average quality meat. Meanwhile, in terms of smell, the meat treated with plant-derived preservatives obtained a mean of 2.90 and a standard deviation of 0.44, which attained a descriptive rating of "good quality; meaning that the criteria are well met, indicating good-quality meat. In comparison, the smell of the meat treated with a standard deviation of 0.41, and a descriptive rating of "good quality"; the criteria are well met, indicating good-quality meat.

The overall mean of both slices of meat preserved with plant-derived and commercial preservatives was 2.87 and an overall standard deviation of 0.57, attaining a descriptive rating of good quality. The meat treated with commercial preservatives had very poor quality in color, poor texture, and good smell. This result implied that the commercial preservative could not preserve the meat, indicating below-average quality beef meat. The results of a study by [14] [15] showed that plant-based preservatives derived from basil, peppermint, lemongrass, citrus segments, and lemon successfully preserved meat at 4 degrees Celsius for seven days. This result may be attributable to the meat-preserving antioxidant properties of these plants, which prolongs the shelf life of meat by preventing or delaying certain types of cell injury.

Observing the means provided in the table shows that the smell attains the highest rating, indicating the excellent quality of the meat, and its description is excellently met, indicating high-quality beef meat. This is due to the fragrance brought on by the plant-derived preservatives. The study of [16] [17] found that various spices and herbs have been valued due to their antibacterial properties and their additional flavor and fragrance qualities. Citrus, citrus peels, and lemongrass greatly impact the meat, and a review study by [18] stated that lemon aroma increased the length of stay of customers and the amount of purchasing. However, the smell of the meat treated with commercial preservatives was not pleasing to the olfactory sensation of the evaluators.

Additionally, the meat treated with commercial preservatives obtained a poor color quality due to the formation of sulfmyoglobin and an excess of nitrite applied to raw beef meat. Moreover, the commercial preservatives were able to preserve the texture of the meat, but the overall rating of the quality of meat treated with commercial preservatives is poor quality.

Table 2. T-test. Determining the Significant Difference of Meat Treated with Plant-Derived Preservatives and Commercial Preservatives

Sample	N	Mean	StDev	T-Value	DF	P-Value
PDP	8	2.87	0.32	5.16	12	0.00
CP	8	2.16	0.23			

Significant at 0.05 level

The mean meat quality score was 2.87 (SD=0.32) for plant-derived preservatives and 2.16 (SD=0.23) for commercial preservatives. Moreover, the T-value for both plant-derived and commercial preservatives was 5.16, with 12 degrees of freedom and a calculated P-value of 0.00. The independent samples t-test shows that the p-value<0.05 indicates a significant difference between plant-derived and commercial preservatives' meat quality.

This aligns with the study of [19], which stated that lemongrass Lemongrass oil (LG) could be an ideal alternative. Additionally, the study of [20] states that the extracts of lemon and citrus extracts in beef meatballs showed a positive effect on beef meatballs without a negative impact on the acceptability and sensory analysis of the beef products. Due to the strong antimicrobial, antifungal, and antioxidant properties acquired by these plants, a significant effect was evident in preserving the beef compared to the meat preserved with commercial preservatives.

4. Conclusion

The meat quality of beef treated with plant-derived preservatives is considered good quality in terms of color, texture, and smell. The average mean is 2.87, indicating that the conditions are well met compared to the meat treated with commercial preservatives, which are considered poor meat quality in color, texture, and smell. The average mean is 2.22, indicating that the criteria are barely met, indicating a below-average meat quality.

The t-test results suggest a significant difference between Group A (plant-derived preservatives) and Group B (commercial preservatives) in terms of their properties since the P value is 0.000. It means that plant-derived preservatives significantly preserve the meat's quality in terms of color, texture, and smell compared to the commercial one.

Acknowledgement

The authors would like to express their immense gratitude to the Integrated Basic Education Department of San Isidro College for allowing the conduct of this work and for all the assistance provided for this research, to the families and friends who showed constant and undying support throughout the research journey. The same gratitude is also expressed to the following individuals who significantly impacted the success of this research: Ian Jay P. Saldo, Mary Jade P. Dandoy, and Jhovel Roy D. Calo, who shared their knowledge and skills in conducting unique research. Above all, to God almighty, who made things possible and attainable with his guidance.

References

[1] Weiss, J., Loeffler, M., & Terjung, N. (2015). The antimicrobial paradox: why preservatives lose activity in foods. *Current Opinion in Food Science*, *4*, 69–75.

[2] Zalán, Z. (2015). Handbook of natural antimicrobials for food safety and qualityHandbook of natural antimicrobials for food safety and quality Taylor T.M. Cambridge, UK.

[3] Baindara, P., & Mandal, S. M. (2022). Plant-Derived Antimicrobial Peptides: Novel Preservatives for the Food Industry. *Foods*, *11*(16), 2415.

[4] Anand, S. P., & Sati, N. (2013). Artificial preservatives and their harmful effects: Looking toward nature for safer alternatives. *International Journal of pharmaceutical sciences and Research.* https://ijpsr.com/bft-article/artificial-preservatives-and-their-harmful-effects-looking-toward-nature-for-safer-alternatives/.

[5] Gao, Y., Li, Y., & Wang, H. (2018). *Plant-Based Preservatives: A Safe Alternative to Synthetic Preservatives.* (19(3), Vol. 711). International Journal of Molecular Sciences.

[6] Kumar, A., & Pandey, A. (2013). Antimicrobial activity of cinnamon and clove essential oils and their synergistic effect with food preservatives against foodborne pathogens. (50(4), Vols. 757–764). Journal of food science and technology.

[7] Faheem, F., Liu, Z., Rabail, R., Haq, I., Gul, M., Bryła, M., Roszko, M., Kieliszek, M., Din, A., & Aadil, R. M. (2022). Uncovering the Industrial Potentials of Lemongrass Essential Oil as a Food Preservative: A Review. Antioxidants, 11(4), 720.

[8] Klangpetch, W., Phromsurin, K., Hannarong, K., Wichaphon, J., & Rungchang, S. (2016). Antibacterial and antioxidant effects of tropical citrus peel extracts to improve the shelf life of raw chicken drumettes. *International Food Research Journal*, *23*(2), 700–707. https://www.cabdirect.org/cabdirect/abstract/20163102695.

[9] Damjanovic-Vratnica, B., Sukovic, D., & Perovic, S. (2016). Essential oil components and antimicrobial activity of peppermint (Mentha Piperita) from Montenegro. *Agriculture and Forestry*.

[10] Irfan, S., Ranjha, M. M. a. N., Nadeem, M., Safdar, M. E., Jabbar, S., Mahmood, S., Murtaza, M. A., Ameer, K., & Ibrahim, S. A. (2022). Antioxidant Activity and Phenolic Content of Sonication- and Maceration-Assisted Ethanol and Acetone Extracts of Cymbopogon citratus Leaves. *Separations*, *9*(9), 244.

[11] Bennour, N., Mighri, H., Eljani, H., Zammouri, T., & Akrout, A. (2020). Effect of solvent evaporation method on phenolic compounds and the antioxidant activity of Moringa oleifera cultivated in Southern Tunisia. *South African Journal of Botany*, *129*, 181–190.

[12] Hsouna, A. B., Boye, A., Ackacha, B. B., Dhifi, W., Saad, R. B., Brini, F., Mnif, W., & Kačániová, M. (2022). Thiamine Demonstrates Bio-Preservative and Antimicrobial Effects in Minced Beef Meat Storage and Lipopolysaccharide (LPS)-Stimulated RAW 264.7 Macrophages. *Animals*, *12*(13), 1646.

[13] Ijaz, M., Li, X., Zhang, D., Hussain, Z., Ren, C., Bai, Y., & Zheng, X. (2020). Association between meat color of DFD beef and other quality attributes. *Meat Science*, *161*, 107954.

[14] Lee, N., & Paik, H. (2016). Status, Antimicrobial Mechanism, and Regulation of Natural Preservatives in Livestock Food Systems. *Korean Journal for Food Science of Animal Resources*, *36*(4), 547–557.

[15] Jain, N., & Yadav, H. (2019). Antimicrobial efficacy of basil essential oil as a natural preservative in meat products. (73rd ed., Vols. 84–89). Food Science and Technology.

[16] Sah, S. K., Khanal, H., & Acharya, D. R. (2020). Antibacterial Activity of Common Spices Extracts on Bacterial Isolates found in Kachhila, a Newari Cuisine. *Tribhuvan University Journal of Microbiology*, *7*, 8–18.

[17] Chappalwar, A., Pathak, V., Goswami, M., & Mishra, R. (2019). Efficiency of Citrus Fruits to Improve Functional Properties of Livestock Products. *ResearchGate*.

[18] Girona-Ruíz, D., Cano-Lamadrid, M., Carbonell-Barrachina, Á. A., López-Lluch, D., & Sendra, E. (2021). Aromachology Related to Foods, Scientific Lines of Evidence: A Review. *Applied Sciences*, *11*(13), 6095.

[19] Degala, H. L., Mahapatra, A. K., Demirci, A., & Kannan, G. (2018). Evaluation of non-thermal hurdle technology for ultraviolet light to inactivate Escherichia coli K12 on goat meat surfaces. *Food Control*, *90*, 113–120.

[20] Horbańczuk, O. K., Kurek, M. A., Atanasov, A. G., Brnčić, M., & Brnčić, S. R. (2019). The Effect of Natural Antioxidants on Quality and Shelf Life of Beef and Beef Products. *Food Technology and Biotechnology*, *57*(4), 439–447.