Agriculture and Food

AIMS Agriculture and Food, 4(2): 244–250.
DOI: 10.3934/agrfood.2019.2.244
Received: 04 January 2019
Accepted: 05 March 2019
Published: 20 March 2019

http://www.aimspress.com/journal/agriculture

Research article

Effects of tarragon essential oil on some characteristics of frankfurter type sausages

Celale Kirkin*, Seher Melis Inbat, Daniel Nikolov and Sabah Yildirim

Department of Gastronomy and Culinary Arts, School of Applied Sciences, Ozyegin University, Nisantepe District, Orman Street, 34794 Cekmekoy, Istanbul, Turkey

*** Correspondence:** Email: celale.kirkin@ozyegin.edu.tr; Tel: +902165649376; Fax: +902165649999.

Abstract: Tarragon (*Artemisia dracunlus*) essential oil was obtained from fresh leaves by hydrodistillation. The isolated essential oil was added to frankfurter type sausages at a concentration of 0.1% (v/w). Samples without the essential oil were used as control. The effects of the addition of the tarragon essential oil on the sensory properties, such as odor, color intensity, flavor, spiciness, hardness and overall acceptance of the sausages were evaluated using a hedonic scale and compared to the control. In addition to the hedonic test, a sensory triangle test was conducted. The CIE L*, a* and b* values of the samples were also measured. The addition of the essential oil did not cause any changes in the odor, color intensity, and hardness of the frankfurters. The spiciness of the frankfurter samples added with the essential oil was higher than the control. However, the flavor and overall acceptability of the control samples were higher compared to that of the essential oil containing samples. The difference between the treatments was also significant according to the triangle test. The addition of the tarragon essential oil did not cause any changes in the instrumentally measured color values of the sausages.

Keywords: sausage; tarragon; essential oil; sensory; color

1. Introduction

Sausages are processed meat products; and frankfurters are of emulsion type sausages, which are cured and added with seasonings [1]. Sausages are added with several food additives, such as nitrites and nitrates, in order to control the growth and toxin production of *Clostridium botulinum* as well as the development of desired flavor and color [2,3]. Nitrite can also be utilized as an

antioxidant in cured meat products [3–5]. However, these compounds can have adverse health effects and cause N-nitrosamine production [3,6]. Thus, it is crucial to control and limit the level of nitrites and nitrates used in the production of cured meat products.

The undesired effects of the additives used in the processed meat products as antioxidants, antimicrobials, and color enhancers can be prevented by replacing them with natural plant extracts. For instance, Viuda-Martos, Ruiz-Navajas, Fernández-López and Pérez-Álvarez [7] reported that bologna sausages exhibited lower lipid oxidation and residual nitrite and higher sensory acceptance when they were added with citrus fiber washing water and rosemary essential oil. Moreover, addition of cassia and holy basil essential oils in fresh chicken sausages was also recommended by Sharma, *et al.* [8]. In addition, Alirezalu, Hesari, Eskandari, Valizadeh and Sirousazar [9] observed that ethanolic extracts of several plants, such as stinging nettle, olive leaves, and green tea, were effective on increasing the shelf life of frankfurter sausages.

It has been stated that tarragon has good antioxidant and antimicrobial properties [10–12]. For instance, Sharafati-Chaleshtori, *et al.* [13] reported that tarragon essential oil addition decreased microbial growth and increased overall acceptability of beef burgers. It was also stated that tarragon essential oil was effective on shelf life extension of beef slices [11].

There have been no studies in literature evaluating the addition of tarragon essential oil to sausages. The aim of the study was to investigate the effects of tarragon essential oil on the sensory properties and color of the frankfurter type sausages.

2. Materials and methods

2.1. Material

Fresh tarragon (Artemisia dracunculus) leaves were obtained from a local producer. All other ingredients were purchased from local market.

2.2. Isolation of essential oil

A 100 g of fresh tarragon leaves were added with 1500 mL distilled water and hydrodistillated for 3 h using a Clevenger-type apparatus. The amount of essential oil obtained was measured using the volumetric scale of the apparatus. The essential oil yield from the fresh tarragon leaves was calculated as 0.3% (v/w). The essential oil (EO) was stored in amber vials at −18 °C.

2.3. Preparation of the samples

The control samples were prepared using the following ingredients per kg: 620 g beef meat, 175 g ice-water, 94 g starch, 75 g sunflower oil, 12 g salt, 12 g white pepper, 6 g granulated garlic, and 6 g ground cumin. Samples with tarragon essential oil (0.1% EO, v/w) were prepared by adding a 100 μL of the essential oil to a 100 g of the prepared sausage batter. The samples without the essential oil were used as the control (0% EO, v/w).

The prepared sausage batter was stuffed into 21 mm-diameter synthetic casings manually. The internal temperature of the samples was maintained below 4 °C during preparation. The sausages heated in a steam oven to 74 °C internal temperature. The heat-treated sausages were then cooled to

4 ℃ in a blast chiller (RBC201, Electrolux, Sweden). In addition, one random sample of the heat treated frankfurters and the sausage batters (samples before the heat treatment) from each level of essential oil addition and replication were separated in order to be used for color measurement.

2.4. Sensory analysis

A hedonic test and a triangle test were used in the assessment of the sensory properties of the samples. Sausages were cut into approximately 6 g pieces (20 mm × 21 mm) and cooked in a microwave oven (Menumaster RCS511TS, ACP Inc., USA) for 60 s before serving the panelists.

The hedonic test was conducted with 12 panelists. Odor, color intensity, flavor, spiciness, hardness, and overall acceptability properties of the samples were assessed using a 7-point hedonic scale (1: very weak or very unacceptable, 7: very strong or very acceptable).

The triangle test was conducted with 30 panelists. The panelists were given with 3 samples (2 of them were the same and 1 was different), and asked to find the odd sample and whether they prefer any of the samples.

2.5. Color measurement

The CIELAB L* (lightness, 0–100), a* (negative: greenness, positive: redness) and b* (negative: blueness, positive: yellowness) values were measured using a color meter (CR-400, Konica Minolta Sensing, Inc., Japan). The device was calibrated using a white plate before the measurement. Three different measurements were taken, and the averages were recorded. Chroma (C*) values were also calculated according to Eq 1.

$$C^* = \sqrt{a^{*2} + b^{*2}} \quad (1)$$

2.6. Statistical analysis

All treatments were replicated twice in the study. Statistical analysis of data was performed using Minitab 17 statistical software. The hedonic test data were assessed using a completely randomized block design. The data obtained by the triangle test was assessed according to Roessler, Pangborn, Sidel and Stone [14].

3. Results and discussion

Tarragon essential oil was added to the sausages at a concentration of 0.1% (v/w), and similar amounts of tarragon essential oil was reported to exhibit antimicrobial activity in meat products previously [11,13]. It was also reported that tarragon essential oil may contain 75% estragole (methyl chavicol) [15–17]. However, the consumption of estragole should be limited, as it was reported to have carcinogenic and genotoxic properties [15,16]. Thus, higher concentrations of tarragon were not assessed in this study.

The effects of tarragon essential oil on the sensory properties of the frankfurters are demonstrated in Table 1. The sensory odor, color intensity, and hardness of the tarragon essential oil added frankfurters were not significantly different than those of the control ($P > 0.05$). The spiciness

of the frankfurters added with the tarragon essential oil was stronger than the control ($P < 0.05$). The flavor of the control was more acceptable compared to the samples with the essential oil ($P < 0.05$). Thus, it could be said that the difference in the flavor of the samples is due to the difference in spiciness rather than odor. In addition, the overall acceptability of the control was also higher compared to samples with the essential oil ($P < 0.05$). Similarly, da Silveira, *et al.* [18] reported that Tuscan sausages without essential oil had higher acceptability compared to 0.05% and 0.1% bay leaf essential oil added samples. The sensory scores of cooked pork sausages containing aqueous extract of mint were lower compared to control samples without the extract in a study by Latoch and Stasiak [19]. According to Kos, *et al.* [20] addition of 0.005% and 0.01% bay leaf essential oil decreased the consumers' willingness to buy and acceptability of dry game sausages.

Table 1. The effect of the tarragon essential oil on the sensory properties of the frankfurters with 0% and 0.1% essential oil (EO).

Sensory Attribute	Treatment	
	0% EO (Control)	0.1% EO
Odor	4.4 ±0.5 ^{A}	4.7 ±0.2 ^{A}
Color intensity	4.1 ±0.5 ^{A}	4.7 ±0.1 ^{A}
Flavor	3.6 ±0.0 ^{A}	3.0 ±0.1 ^{B}
Spiciness	3.7 ±0.2 ^{B}	5.0 ±0.2 ^{A}
Hardness	3.7 ±0.1 ^{A}	4.2 ±0.7 ^{A}
Overall acceptability	4.1 ±0.3 ^{A}	2.9 ±0.1 ^{B}

Data that were labelled with different superscript letters (A, B) in a row are significantly different ($P < 0.05$).

The flavor and overall acceptability of the frankfurters can be increased by decreasing the amount of the essential oil. Garcia-Diez, *et al.* [21] reported that the consumer acceptance of dry cured sausages (*churiço*) was significantly decreased with 0.05% addition of essential oils from several herbs and spices, such as bay, garlic, nutmeg, oregano, rosemary, and thyme to the formulation; however, it was higher when the concentration of the essential oils were reduced to 0.005%. Moreover, Sharafati-Chaleshtori, *et al.* [13] reported that addition of tarragon essential oil at 0.125% concentration increased overall acceptability of beef burgers compared to the samples with 0%, 0.25% and 0.062% essential oil.

The difference between the control and the samples with the essential oil was significant according to the triangle test ($P < 0.05$). A 27% of the panelists participated in the triangle test preferred the essential oil containing sausages, whereas a 63% of the panelists preferred the control.

The essential oil addition did not significantly affect the L*, a*, b*, or C* values of the frankfurters (heat treated) (Figure 1) or the sausage batter samples that were not heat treated (Figure 2). Similarly, it has been stated that the addition of oregano essential oil did not affect the L*, a*, b* values of fermented sausages [22]. Sojic, *et al.* [23] reported that nutmeg essential oil addition did not change the color of cooked sausages similar to our results. However, frankfurters added with rosemary essential oil had different L* and b* values compared to the samples without the essential oil [24]. On the other hand, the a*, b*, and C* values were decreased after the heat treatment ($P < 0.05$).

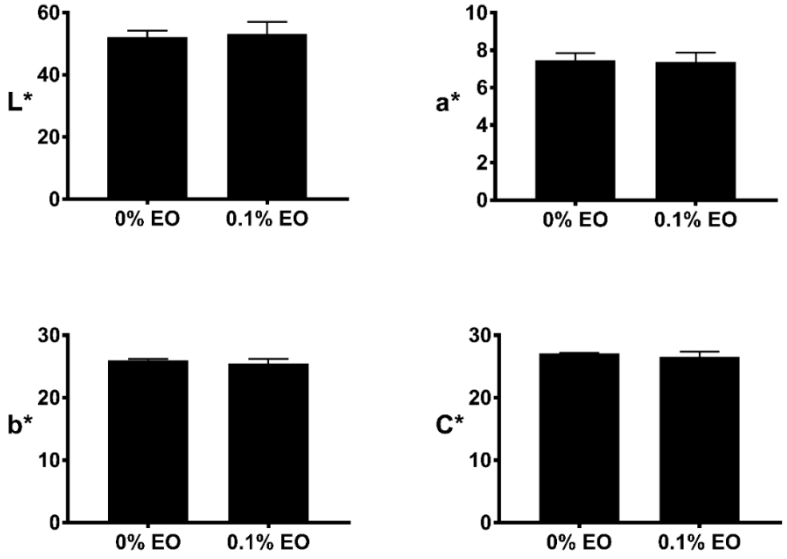

Figure 1. The effect of the tarragon essential oil on the L*, a*, b* and C* values of the frankfurters with 0% and 0.1% essential oil (EO).

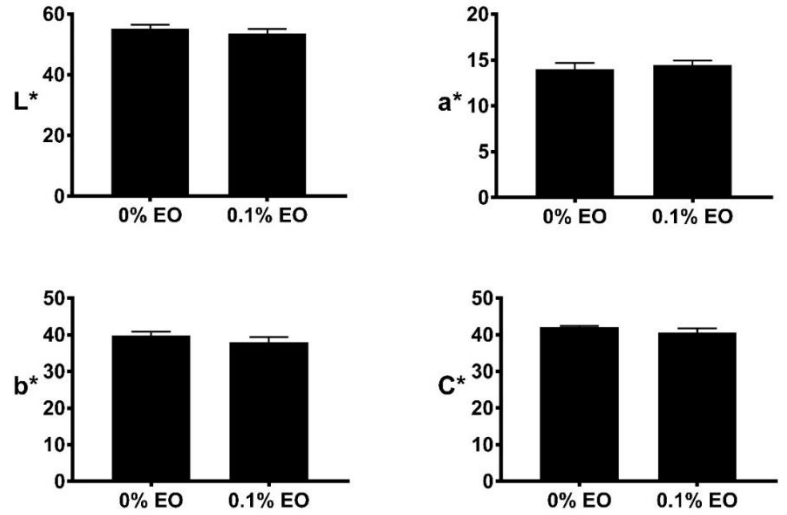

Figure 2. The effect of the tarragon essential oil on the L*, a*, b* and C* values of the sausage batters with 0% and 0.1% essential oil (EO).

4. Conclusion

The 0.1% (v/w) addition of tarragon essential oil decreased the flavor and overall acceptability of the frankfurter type sausages. The spiciness of the frankfurters with the essential oil was higher compared to the control. However, the effects of the treatment on the other sensory properties and the color were not significant. In conclusion, it can be said that the undesired effect of the tarragon essential oil on the flavor and the overall acceptability could be eliminated by modifying the amount of the

essential oil added. The amount of the tarragon essential oil that could be used in frankfurter type sausage formulation should be optimized by further studies also evaluating the antioxidant and antimicrobial properties.

Acknowledgments

We would like to thank Prof. Dr. Gurbuz Gunes of Istanbul Technical University for letting us use the laboratory facilities and reading the manuscript. Yildiz Gıda Yapi A.S. (Istanbul, Turkey) is also acknowledged for providing the sausage casings.

Conflict of interest

The authors declare no conflict of interests in this research.

References

1. Essien E (2003) Sausage Manufacture: Principles and Practice. Woodhead Publishing Limited, England, 104.
2. Christiansen LN, Johnston RW, Kautter DA, et al. (1973) Effect of nitrite and nitrate on toxin production by *Clostridium botulinum* and on nitrosamine formation in perishable canned comminuted cured meat. *J Appl Microbiol* 25: 357–362.
3. Pegg RB, Shahidi F (2000) Nitrite Curing of Meat: The N-Nitrosamine Problem and Nitrite Alternatives. Food and Nutrition Press, Inc., Trumbull, CT, 268.
4. Igene JO, Yamauchi K, Pearson AM, et al. (1985) Mechanisms by which nitrite inhibits the development of warmed-over flavour (WOF) in cured meat. *Food Chem* 18: 1–18.
5. Mac Donald B, Gray JI, Gibbins LN (1980) Role of nitrite in cured meat flavor: Antioxidant role of nitrite. *J. Food Sci.* 45: 893–897.
6. Lijinsky W (1999) N-Nitroso compounds in the diet. *Mutat Res Genet Toxicol Environ Mutagen* 443: 129–138.
7. Viuda-Martos M, Ruiz-Navajas Y, Fernández-López J, et al. (2010) Effect of adding citrus fibre washing water and rosemary essential oil on the quality characteristics of a bologna sausage. *LWT - Food Sci Technol* 43: 958–963.
8. Sharma H, Mendiratta SK, Agrawal RK (2017) Use of various essential oils as bio preservatives and their effect on the quality of vacuum packaged fresh chicken sausages under frozen conditions. *LWT-Food Sci Technol* 81: 118–127.
9. Alirezalu K, Hesari J, Eskandari MH (2017) Effect of green tea, stinging nettle and olive leaves extracts on the quality and shelf life stability of frankfurter type sausage. *J Food Process Preserv* 41: e13100.
10. Behbahani BA, Shahidi F, Yazdi FT, et al. (2017) Antioxidant activity and antimicrobial effect of tarragon (*Artemisia dracunculus*) extract and chemical composition of its essential oil. *J Food Meas Charact* 11: 847–863.
11. Behbahani BA, Yazdi FT, Shahidi F, et al. (2017) Principle component analysis (PCA) for investigation of relationship between population dynamics of microbial pathogenesis, chemical and sensory characteristics in beef slices containing tarragon essential oil. *Microb Pathog* 105: 37–50.

12. Mumivand H, Babalar M, Tabrizi L, et al. (2017) Antioxidant properties and principal phenolic phytochemicals of Iranian tarragon (*Artemisia dracunculus* L.) accessions. *Hortic Environ Biotechnol* 58: 414–422.
13. Sharafati-Chaleshtori R, Rokni N, Rafieian-Kopaei M, et al. (2014) Use of tarragon (*Artemisia dracunculus*) essential oil as a natural preservative in beef burger. *Ital J Food Sci* 26: 427–432.
14. Roessler EB, Pangborn RM, Sidel JL, et al. (1978) Expanded statistical tables for estimating significance in paired—preference, paired–difference, duo–trio and triangle tests. *J Food Sci* 43: 940–943.
15. Agency EM (2014) Public statement on the use of herbal medicinal products containing estragole.
16. European Commission (2001) Opinion of the scientific committee on food on estragole (1-allyl-4-methoxybenzene).
17. Bahmani L, Aboonajmi M, Arabhosseini A, et al. (2018) Effects of ultrasound pre-treatment on quantity and quality of essential oil of tarragon (*Artemisia dracunculus* L.) leaves. J Appl Res Med Aromat Plants 8: 47–52.
18. da Silveira SM, *et al.* (2014) Chemical composition and antibacterial activity of *Laurus nobilis* essential oil towards foodborne pathogens and its application in fresh Tuscan sausage stored at 7 C. *LWT - Food Sci Technol* 59: 86–93.
19. Latoch A, Stasiak DM (2015) Effect of *Mentha piperita* on oxidative stability and sensory characteristics of cooked pork sausage. *J Food Process Preserv* 39: 1566–1573.
20. Ivica K, Bedeković D, Širić I, et al. (2017) Technological characterization and consumer perception of dry fermented game sausages with bay leaf (*Laurus nobilis* L.) essential oil. *J Cent Eur Agric* 18: 794–805.
21. Garcia-Diez J, Alheiro J, Pinto AL, et al. (2016) Behaviour of food-borne pathogens on dry cured sausage manufactured with herbs and spices essential oils and their sensorial acceptability. *Food Control* 59: 262–270.
22. Chaves-López C, Martin-Sánchez, AM, Fuentes-Zaragoza E, et al. (2012) Role of oregano (*Origanum vulgare*) essential oil as a surface fungus inhibitor on fermented sausages: Evaluation of its effect on microbial and physicochemical characteristics. *J Food Prot* 75: 104–111.
23. Sojic B, Tomovic V, Kocić-Tanackovet S, et al. (2015) Effect of nutmeg (*Myristica fragrans*) essential oil on the oxidative and microbial stability of cooked sausage during refrigerated storage. *Food Control* 54: 282–286.
24. Estevez M, Ventanas S, Cava R (2005) Protein oxidation in frankfurters with increasing levels of added rosemary essential oil: Effect on color and texture deterioration. *J Food Sci* 70: C427–C432.