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Quality study of homemade sausages with rosemary smoked using plum wood

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Abstract
Homemade smoked sausages are a beloved culinary preparation in Romanian culture, being obtained through a series of technological stages, from choosing the meat, grinding and seasoning it, to filling it into membranes and smoking it. In the present work, the aspects analyzed had as their main purpose the obtaining of an assortment of homemade smoked sausages, using pork (80%) and bacon (20%) as raw materials. The obtained samples were analyzed from a physico-chemical and sensory point of view, following their characteristics and their classification within the standard quality parameters. The particularity of the preparation consists in the addition of rosemary in addition to the classic spices: salt, pepper, paprika and the use of plum wood sawdust for smoking the sausages. Rosemary is one of the most popular aromatic plants and dominates the list of natural antioxidants used in the food industry, having better performance compared to synthetic antioxidants. Smoking with plum wood gives the sausages a slightly reddish color, very pleasant from an olfactory point of view and increases the shelf life of the product.

Keywords: meat, smoked product, aromatic herbs, antioxidants, culinary preparation

1. Introduction

Globally, pork is distinguished as one of the most consumed and appreciated types of meat, due to its essential protein content, unique chemical composition and remarkable nutritional value [1,2]. Meat quality assessment is of paramount importance for consumer safety, health and satisfaction [3,4]. A significant aspect of meat quality that has attracted attention in recent years is its nutritional composition. Understanding the nutritional characteristics of meat is vital not only for consumers seeking to make informed food choices, but also for producers and policymakers seeking to improve food quality standards [5,6]. Before the advent of modern methods of meat preservation and preparation, such as refrigeration or freezing, drying, smoking, homemade sausages represented an effective way to preserve and use pork for a longer period of time [7,8,9,10]. By grinding meat, adding spices, and stuffing it into natural casings, people were able to preserve the meat for longer periods of time and use it more efficiently. Thus, sausages became an important food source for communities in times when modern means of food preservation did not exist [11,12]. Rosmarinus officinalis L. is a medicinal plant belonging to the Lamiaceae family and is commonly known

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as rosemary [13,14,15]. In addition to its culinary uses due to its characteristic aroma, this plant is also widely used by indigenous populations, where it grows wild [16,17]. Extracts obtained from rosemary are used as a natural antioxidant, improving the shelf life of perishable foods [13,18,19]. In many studies, rosemary extracts have been shown to be effective in significantly reducing the level of lipid oxidation, delaying color degradation and rancidity by decreasing the level of oxidative reactions. Phenolic compounds in rosemary have been identified as having better performance compared to synthetic antioxidants, thus qualifying them for use as a natural alternative for a similar antioxidant effect [20,21,22]. Smoking sausages has become a popular method of preservation and improvement of taste and aroma, extending shelf life only if the entire treatment significantly decreases the water activity of the product, both due to added salt and partial drying, lowers the pH as a result of lactic acid fermentation, reduces the viable population of microflora damaged by heating, and impregnates the meat with wood smoke, which contains components with antimicrobial and antioxidant properties. The smoke from burning wood adds a distinctive note and unique flavor to the sausages [23]. The present study aims to comparatively analyze the quality of commercially smoked sausages with that of homemade sausages, smoked with plum wood and enriched with rosemary, from a sensory and physico-chemical point of view. The results obtained may contribute to the development of innovative products, with nutritional and functional benefits, while preserving the traditional specificity of the preparation.

2. Materials and Methods

The pork and bacon are cut into small pieces, then minced in a meat grinder with a medium sieve. The salt and spices (rosemary powder, paprika, pepper) are dissolved in a liter of lukewarm water, and the resulting solution is added to the meat paste, continuously homogenizing. The entire composition is left to macerate for two hours, after which the membranes are filled with the paste obtained. After the filling stage, the sausages are subjected to the fanning process and then placed in the smoking cell, where they are exposed to hot smoke for 3-4 hours. Finally, they are taken out to air and left to fan for 12-24 hours. For the comparative study, 2 types of sausages (commercially smoked sausages and sausages smoked with plum wood and added rosemary) were analyzed from a sensory and physico-chemical point of view.For the sensory analysis, samples were taken from the two types of sausages (commercially smoked sausages and plum wood smoked sausages with rosemary). Both types of sausages were evaluated by 12 people aged between 18 and 55 years, without food allergies. The samples submitted for evaluation were presented to each evaluator in turn, on disposable plates, separately for each sausage assortment.

The sensory characteristics analyzed by each individual evaluator are: appearance, color, consistency, smell and taste, using the consumer acceptability score, on a 5-point hedonic scale, as follows:

- 5 - extremly pleasant;
- 4 - slightly pleasant;
- 3 - regardless, neither pleasant nor unpleasant;
- 2 - slightly unpleasant;
- 1 - extremely unpleasant.

Regarding the physicochemical analysis, determinations were made of:

- dry matter content (according to SR ISO 1442:2010),
- sodium chloride (NaCl) content (according to SR ISO 1841-2:2000), and
- ash (according to SR ISO 936:2009 ver. eng).

3. Results and Discussios

The results of the sensory analysis carried out for the two types of sausages (commercially smoked sausages and smoked sausages with plum wood and added rosemary) are presented below. The analysis of the results shows that, in the case of commercial smoked sausages, the most appreciated sensory characteristics were appearance and smell, with average scores of 4.08 and 3.75 points, respectively. Consistency was evaluated with 3.33 points, while taste and color received average scores of 3.58 and 3.42 points, respectively. For the

assortment of smoked sausages with plum wood and added rosemary, the most appreciated sensory characteristics were taste, with an average score of 4.66 points, followed by color and smell, both obtaining an average score of 4.58 points. Consistency was evaluated with 4.08 points, and appearance received the lowest average score, of 4.00 points.

Table 1. Centralized sensory characteristics of smoked sausages

No.	Evaluator	Appearance	Color	Consistency	Smell	Taste
1.	E1	4	4	2	3	3
2.	E2	4	3	3	4	4
3.	E3	5	4	3	4	3
4.	E4	5	4	4	4	4
5.	E5	3	2	4	4	3
6.	E6	4	3	3	3	4
7.	E7	4	3	4	4	3
8.	E8	5	4	4	3	5
9.	E9	3	3	4	3	4
10.	E10	4	4	3	4	4
11.	E11	4	3	2	5	3
12.	E12	4	4	4	4	3
	Average score	**4,08**	**3,42**	**3,33**	**3,75**	**3,58**
	Total average score			**3,63**		

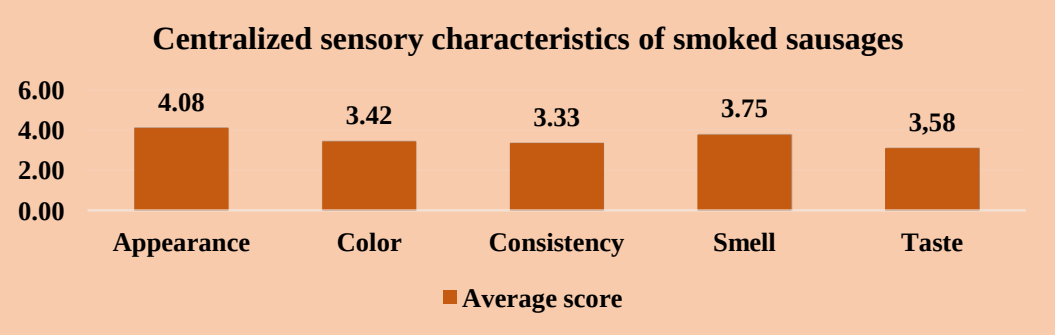

Figure 1. Graphic representation of centralized sensory characteristics of smoked sausages

Table 2. Centralized sensory characteristics of plum wood smoked sausages with rosemary addition

No.	Evaluator	Appearance	Color	Consistency	Smell	Taste
1.	E1	2	4	4	3	5
2.	E2	4	5	4	4	5
3.	E3	3	4	3	5	4
4.	E4	5	4	4	4	5
5.	E5	3	5	4	4	4
6.	E6	4	5	4	5	5
7.	E7	4	5	4	4	5
8.	E8	5	4	4	3	4
9.	E9	5	5	4	5	5
10.	E10	5	5	5	4	5
11.	E11	4	5	5	5	4
12.	E12	4	4	4	4	5
	Avrege score	**4**	**4,58**	**4,08**	**4,58**	**4,66**
	Total average score			**4,38**		

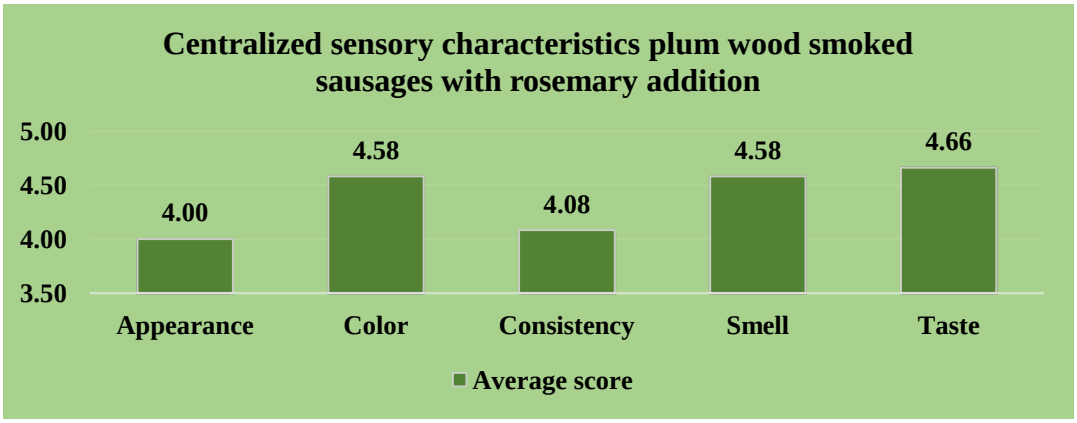

Figure 2. Graphic representation of centralized sensory characteristics of plum wood smoked sausages with rosemary addition

The physicochemical characteristics of the two types of sausages - those smoked commercially and those smoked with plum wood and added rosemary, are presented in Table 3, in the form of average values obtained from the analyses performed.

Table 3. Physicochemical average characteristics score of smoked sausages

Assortment of sausages	Humidity (%)	NaCl (%)	Ash (%)
Commercially smoked sausages	55,20±1,9	1,83±0,22	1,30 ± 0,10
Sausages smoked with plum wood and added rosemary	39,42±1,2	2,32±0,33	1,72 ± 0,49

The results obtained for the moisture content of the analyzed samples are 39,44±1,20% for sausages smoked with plum wood and added rosemary, respectively 56,00±2,00% for commercial sausages. The average value of the NaCl content is 2,32±0,33% for sausages smoked with plum wood and added rosemary, respectively 1,83±0,22% for commercial sausages.

Regarding the determination of ash, the average value of the content is 1,72±0,49% for sausages smoked with plum wood and added rosemary, while for commercial sausages, the average value is 1,30±0,10%.

4. Conclusions

The study highlighted significant differences between homemade smoked sausages, with plum wood and rosemary, and commercial sausages, both from a sensory and physico-chemical point of view.The sensory characteristics of smoked sausages with plum wood and rosemary were more appreciated than those of commercial sausages, especially in terms of taste, smell and color. They obtained average scores of 4.66 points and 4.58 points, respectively, which suggests a product with a superior sensory profile, due to the natural smoking process. Commercial sausages were better rated for appearance and smell, but with lower scores for taste and consistency, indicating a difference between the two products in terms of texture and flavor.

From a physicochemical point of view, plum wood and rosemary smoked sausages had a lower moisture content 39.44% which gives them a firmer consistency and greater durability compared to commercial sausages, which have a significantly higher moisture content 56.00%.

The NaCl content was higher in artisanal sausages 2.32% which may contribute to their better shelf life, while commercial sausages had a lower salt content 1.83% which may influence both taste and shelf life. Regarding ash, artisanal sausages showed a higher content 1.72% indicating higher mineral intake due to the natural smoking process, compared to commercial sausages 1.30%.

Smoked sausages are a traditional product, and by adding new ingredients, such as rosemary, innovative recipes can be explored, contributing to the development of delicious and healthy dishes. These changes not only improve the sensory profile, but can also add a distinctive character to the products, thus attracting a wide range of consumers who appreciate traditional products, but also new flavors. Thus, the combination of traditional smoking methods and modern ingredients offers excellent opportunities for innovation in the field of meat preparations.

Conflict of Interest. Authors has declared that no competing interests exist.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human /or animal subjects (if exist) respect the specific regulation and standards.

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