



Sensory and chemical characteristics of dry fermented sausages

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ABSTRACT

The aim of this study was to investigate the sensory and chemical characteristics of dry fermented sausages produced according to two recipes (group I and group II), which differed in the amount of pork meat and solid fat tissue, while the amount of other ingredients, and the technological process were the same. The obtained results showed higher scores in taste, consistency, salinity, and seasoning for group I dry fermented sausages. Chemical results show higher protein content in group I (35.57%) than in group II, which had 30.70%. The collagen content in meat proteins was higher in group II compared to group I (5.53% and 4.52%, respectively). The average moisture content in both sausage groups was less than 35%. The chloride content in sausages was 5.15% (group I) and 4.42% (group II). The fat content in group II was higher than in group I (33.70% and 21.50%, respectively). The results of this study indicate that different quantities of pork meat and solid fat tissue can influence the sensory and chemical properties of dry fermented sausages.

1. Introduction

Fermentation and drying can be considered to be the oldest way to preserve raw food materials. The first documented sausage production was in ancient Greece, and the Romans inherited this tradition, from where the production of fermented sausages spread through Europe (Vignolo, 2010). Fermented sausages are considered high-quality products. They are made from minced meat and fatty tissue, with added spices, sugars, additives, starter cultures, and other ingredients, stuffed into casings (natural or artificial) and then preserved by drying, with or without smoking, during which the sausages mature and acquire characteristic quality properties (Vuković *et al.*, 2009). The drying process is carried out at a low temperature, and only then do sausages

get their characteristic aroma, solid consistency, and extended product shelf life during the ripening process (Vuković, 2012). The shelf life of fermented sausages is based on low values of pH and water activity (a_w), on the basis of which they can be stored at higher temperatures than are usual for meat (Teodorović *et al.*, 2015). According to the degree of drying and consistency, fermented sausages are divided into dry fermented sausages and semi-dry fermented sausages. Dry fermented sausages contain less than 35% moisture, and their a_w is less than 0.90. In Serbia, this type of sausage is mostly industrially produced, which means the quality of this product is not standardized, but it is acceptable for the majority of the population because it is charac-

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terized by an attractive appearance, good grinding ability, and pleasant aroma (Lazic *et al.*, 2019a).

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2. Materials and methods

Fermented dry sausages examined in this study were produced according to two recipes, which differed in the amount of pork meat and solid fat tissue, while the technological process was the same for both sausage groups. Table 1 shows the percentage distribution of the used ingredients.

The technological processing of the sausages took place in industrial conditions. The raw materials, pork meat (−3.6°C), and solid fat tissue (−4°C) were minced in the cutter. After that, the other ingredients were added, while the starter culture was added at the end of the process. The homogenization was carried out until a 5 mm granulation mosaic was attained. The sausage filling was stuffed into collagen casings, diameter of $\varnothing 55$ mm. After that sausages were hung on horizontal bars of drying racks and left in the anteroom of the automatic air conditioning chamber for about 3 h. This procedure was used to optimize the process of fermentation/ripening because it is necessary to raise the tempera-

ture of the filling as close as possible to the optimal temperature (recommendation: to achieve at least 18–19°C, and ideally, 22–24°C) before the fermentation process starts to ensure optimal conditions for the metabolism of starter cultures (Lazic *et al.*, 2019b). The production process (fermentation/drying and smoking, ripening) was a combination of automatic air conditioning and a traditional smoke chamber. This process lasted for 26 days.

2.1. Laboratory analyses

Sausages were analysed after production in sensory and chemical laboratories accredited according to SRPS ISO/IEC17025:2017.

2.1.1. Sensory analyses

Sensory properties of sausages (appearance, surface colour, cross-section colour, cross-section appearance, odour, taste, consistency, salinity, seasoning, and overall acceptability) were assessed using a quantitative descriptive test (SRPS ISO, 2018), with a grading scale from one to five (1 – unacceptable, 5 – extremely acceptable) (Table 2). A panel consisting of five trained members of different ages performed the sensory evaluation. Panellists were previously tested for detecting and recognizing various tastes (SRPS ISO, 2016) and odours (SRPS ISO, 2014). Sensory property results were the mean value given by the five panellists.

Table 1. The ingredients used to produce two groups of fermented dry sausages

Raw material	Fermented dry sausage — group I (%)	Fermented dry sausage — group II (%)
Pork meat category 1	70	60
Pork meat category 2	15.9	15.9
Solid fat tissue	10	20
Nitrite salt	2.5	2.5
RADAferm	0.05	0.05
Dextrose	0.2	0.2
Ascorbic acid	0.05	0.05
Sweet pepper (oleoresin)	0.8	0.8
Cayenne pepper (oleoresin)	0.1	0.1
Garlic	0.2	0.2
Onion	0.2	0.2

Table 2. Numerical descriptive scale for the assessment of sensory properties

Number rating	Descriptive rating
5	extremely acceptable
4	very acceptable
3	acceptable
2	at the margin of acceptability
1	unacceptable

The sausages were prepared as follows: after removing the casing, sausages were cut into slices thick 5 mm and served at room temperature on white, plastic plates. Three slices of each product were served to each panellist.

2.1.2. Chemical analyses

After sensory analyses, samples from both sausage groups were taken for chemical composition analysis. Hydroxyproline content (SRPS ISO, 2002), moisture content (SRPS ISO, 1998a), total fat content (SRPS ISO, 1998b), NaCl (SRPS ISO, 1999), and pH (SRPS ISO, 2004) were determined using standard reference methods. Nitrogen content was determined by an in-house method, the Kjeldahl method, and protein content was estimated by mul-

tiplying the nitrogen content by 6.25 (Kjeltec Auto 1030 Analyzer, Tecator, Sweden).

3. Results and discussion

The results of sensory analyses performed by professionally trained assessors are presented in Figure 1.

The sensory results showed the average scores for all tested sensory properties were similar between the two groups of dry fermented sausages. A higher rating was given to group I, which contained a slightly higher amount of pork meat category 1 and a slightly lower amount of solid fat tissue. These higher scores of group I sausages were noticed in taste, consistency, salinity, and seasoning, while group II had better ratings in appearance and cross-section colour. These results confirm that the quality of the raw material has a great influence on the sensory characteristics of fermented sausages (Vuković et al., 2009; Živković et al., 2011). However, in the study conducted by Mendoza et al. (2001), sausages with a smaller fat content were less juicy, have more solid consistency, and uneven and wrinkled surfaces.

The chemical composition of the two groups of dry fermented sausages is given in Table 3. The obtained results showed that group I sausages had a higher protein content (35.57%) than group II which had 30.70%, while collagen content in meat proteins was higher in group II compared to group I (5.53%

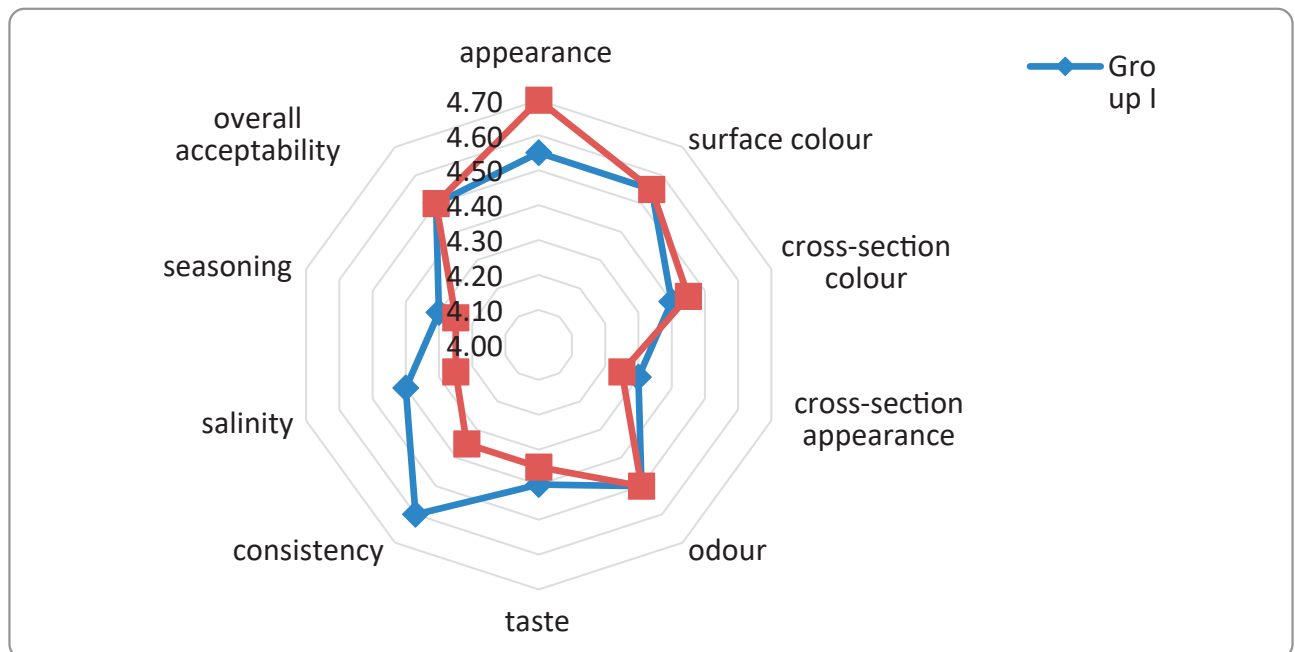


Figure 1. Sensory properties of dry fermented sausages (group I and group II)

Table 3. Chemical composition of fermented dry sausages

Attribute	Group I	Group II
Protein (%)	35.57	30.70
Collagen (%)	4.52	5.53
Water (%)	34.24	33.00
Fat (%)	21.50	33.70
NaCl (%)	5.15	4.42
pH	5.30	5.32
a _w	0.855	0.846

respectively 4.52%). The average moisture content (e.g. water) in both sausage groups was less than 35%, and the pH was at least 5.0, which meets the

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