Assessment of sensory and chemical parameters of tea sausage

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Abstract. In the former Yugoslavia, the production of tea sausage started just over half a century ago. This type of sausage is mostly industrially produced, which means the quality of this product is not standardized, but it is acceptable to the majority of the population. In this study, the sensory proprieties and chemical characteristics of tea sausage were examined. Two types of tea sausage were made, which differed depending on the percentage of different categories of pork meat, while the amount of beef meat, solid fat tissue and other ingredients were the same. The results obtained show the average scores for all tested sensory properties almost equal. Chemical results show that tea sausage-group 1 had higher protein content (27.96%) than tea sausage-group 2, which had 25.25 % protein in meat, while the content of collagen in meat protein was similar in the two sausage groups. Moisture in these sausages was less than 35%, while the values of other parameters were similar. This study demonstrated that different quantity and quality of pork meat could influence the sensory properties and chemical composition of tea sausage.

1. Introduction

Fermented sausages are much appreciated, high-quality products of the meat industry. There are many historical accounts about the production and consumption of sausages in ancient civilizations, going back thousands of years. However, there is no specific date when the first sausage was produced, because this dates from the period before written history [1]. The first records of fermented sausages are from 3000 BC, but more information dates from China and the Mediterranean region from about 2000 BC [2]. During the Middle Ages, great migrations led to the mixing of different cultures and customs, and therefore, knowledge of food conservation was transmitted worldwide more rapidly. After the Second World War, development and modernization of product technology and equipment for fermented meat products continued [3]. The available literature provides information on authentic of fermented sausage production with special emphasis on microclimate conditions. Also, detailed microbiological, physicochemical, sensory and other investigations have been conducted in this area [4,5].

According to Serbian Regulation on the quality of ground meat, meat preparations and meat products [6], fermented sausage can legally contain category 1 or 2 domestic pork, beef or equine meat, category 1 poultry meat and game meat, solid fat tissue, and additives, mixed, and which, after filling in casings, are conserved by drying and fermentation, with or without smoking. Additives for fermented sausages can be salt, curing salt, spices, spice extracts, sugars, additives, starter culture and beverages (wine and others). Fermented sausages are produced as fermented dry sausages, fermented semi-dry sausages for cutting and fermented sausages for spreading. Fermented dry sausages must contain less than 35% water. The drying process is carried out at a low temperature, and only then does sausage get its characteristic, spicy aroma, solid consistency and extended shelf life of the product during the ripening process [7]. Fermented dry sausages vary greatly, and their diversity depends on the country/region, climate, heritage, and culture [8,9,10,11]. There are many formulations for sausage batters, even for products with the same name. The time, temperature and moisture during
the drying process are variable parameters which influence the quality of ready to eat the product [12,13].

The retail market hosts different types of fermented sausages such as kulen, winter salami, srem sausage, sudžuk and tea sausage, but other types of related products also exist. The name tea sausage originates from the German word *tee wurst*, which refers to sausage that was produced in the town of Rugenwald in the 19th century, nowadays called Darlowo and situated in Poland. This type of sausage was prepared from pork meat and solid fat tissue, and after stuffing into pork small intestine and a quick and short ripening period, it was cut and served in sandwiches with tea, thus the name *tee wurst*.

In the former Yugoslavia, production of tea sausage started just over half a century ago in the Mesopromet meat company in Zemun. This type of sausage is mostly industrially produced, which means that the quality of this product is not standardised, but it is acceptable for the majority of the population because it is characterised by an attractive outward appearance, good grinding ability and pleasant aroma. Nowadays, the national market offers dry fermented sausages with similar sensory properties, but, unfortunately, with an overemphasized acidic flavour, often unacceptable to consumers [14,15].

The aim of this paper is to point out the existence of differences in the sensory and chemical parameters of tea sausages produced using two different recipes. These recipes differ only according to the quality of raw pork meat.

2. Materials and Methods

Tea sausage was produced according to two recipes, which differed only in the category of some meat ingredients used, while the technological production process was the same for both sausage groups. The tea sausage-group 1 recipe included slightly better quality raw pork meat. Table 1 shows the percentage distribution of the ingredients used.

| Raw material          | Percentage (%) | Raw material          | Percentage (%) |
|-----------------------|----------------|-----------------------|----------------|
| Pork meat category 1  | 29             | Pork meat category 1  | 25             |
| Pork meat category 2  | 24             | Pork meat category 2  | 28             |
| Beef meat category 1  | 19.1           | Beef meat category 1  | 19.1           |
| Solid fat tissue      | 25             | Solid fat tissue      | 25             |
| Nitrite salt          | 2.5            | Nitrite salt          | 2.5            |
| RADAferm              | 0.05           | RADAferm              | 0.05           |
| Dextrose              | 0.2            | Dextrose              | 0.2            |
| Ascorbic acid         | 0.05           | Ascorbic acid         | 0.05           |

In this trial, the technological production processing was in industrial conditions. The raw materials, pork and beef meat (3°C), solid fat tissue (-5°C) were minced in the cutter. After that, other ingredients were added, while starter culture was added at the end of the process. The homogenization was carried out until a 3 mm granulation mosaic was obtained. Tea sausage batters were stuffed using a vacuum filler into collagen casings. Sausages were then hung on horizontal bars of drying racks and left in the anteroom of the automatic air conditioning chamber for about 4 h. This procedure is carried out in order to optimize the process of fermentation/ripening, as the temperature of the filling needs to be raised as near as possible to the optimal temperature (recommendation: to achieve at least 18-19°C, and ideally to 22-24°C) before the fermentation process starts to ensure optimal conditions for the metabolism of starter cultures. The production process (fermentation/drying and smoking, ripening) was a combination of automatic air conditioning chamber and traditional smoke chamber. This process lasted for 23 days.
2.1. Laboratory analyses
After production, the sausages were analysed in sensory and chemical laboratories accredited according to SRPS ISO/IEC 17025:2006.

2.1.1. Sensory analyses
Sensory properties of sausages (appearance, surface colour, cross-section colour, cross-section, odour, taste, consistency, salinity, seasoning, overall acceptability) were assessed using a quantitative-descriptive test [17], with a grading scale from one to five (1 = unacceptable, 5 = extremely acceptable) (Table 2). A five-person panel was assembled in order to evaluate the sensory properties. Panellists were previously tested for detection and recognition of various tastes (SRPS 3972, 2001) [18] and odours (SRPS 5496, 2002) [19]. Sensory property results were the median value given by the five panellists (Figure 1).

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              |

2.1.2. Chemical analyses
After sensory evaluation, samples from each tea sausage were taken for chemical composition analysis. Total fat content [20], NaCl [21], hydroxyproline content [22], moisture content [23] and pH [24] were determined using standard references methods. Nitrogen content was determined by an in-house method, the Kjeldahl method and protein estimated by multiplying the nitrogen content by 6.25 (Kjeltec Auto 1030 Analyzer, Tecator, Sweden), while the sodium chloride was determined by AOAC 24.010 method.

3. Results and Discussion

3.1. Sensory Properties
Two variants of tea sausage with different categories of pork meat were prepared, while the amount of beef meat, solid fat tissue and other ingredients were the same. The results of sensory analyses by professionally trained assessors are presented in Figure 1.
The obtained results showed the average scores for all tested sensory properties were similar between the two tea sausage groups. A higher rating was given to tea sausage-group 2, which contained a slightly higher amount category 2 pork meat. These higher scores reflected the better odour, taste and consistency of tea sausage-group 2, while the cross-section was slightly better in tea sausage-group 1, which had a higher amount of category I pork meat. The odour and taste, as well as the other sensory properties of fermented products were influenced by the quality of raw material, ingredients, the metabolic activity of the microbiota present, the physicochemical changes due the drying and ripening processes, and enzymatic degradation of proteins and fats [25,26]. Sausages with a smaller content of fatty tissue are less juicy, have a more solid consistency, and the surface is uneven and wrinkled [27].

### 3.2. Chemical characteristics

The chemical composition of the two different groups of tea sausages is shown in Table 3. Results show that tea sausage-group 1 has higher protein content (27.95%) than tea sausage-group 2, which had 25.25% protein in meat, while the content of collagen in meat protein was similar in both sausage groups. The final protein contents in these sausages were similar to the majority of reported protein contents in a range of different fermented sausages [28, 29]. Moisture contents in our sausages were less than 35%. Low moisture content is typical of similar products from Greece, Hungary, and Croatia [30], and is a consequence of not only drying, but also of the quality and quantity of the input ingredients for the raw sausage, which resulted in relatively high contents of fat (37.00-40.85%) and protein (25.25-27.96%) in the final products. The ingredients used in the two sausage groups did not influence the salt content in finished sausages.

The naturally fermented dry sausages from the Mediterranean region are generally characterized by low acidity with a final pH ranging from 5.2 to 6.4 [28,31], which concurs with our results. According to Heinze and Hautzineru [32], the water activity (aw) of fermented dry sausage is in the range from 0.70 to 0.96, but mostly is 0.91. In our study, aw was 0.832 and 0.827 for group 1 and 2 tea sausages, respectively.
Table 3. Chemical composition of tea sausages

| Traits    | Tea sausage-group 1 | Tea sausage-group 2 |
|-----------|---------------------|---------------------|
| Protein (%) | 27.95               | 25.25               |
| Collagen (%)  | 6.92                | 7.01                |
| Water (%)     | 28.84               | 27.16               |
| Fat (%)       | 37.00               | 40.85               |
| Salt (%)      | 3.92                | 3.85                |
| pH value      | 5.26                | 5.25                |
| aw value      | 0.832               | 0.827               |

4. Conclusion

The results of this study demonstrated that different quantity and quality of pork meat did not have a great influence on the sensory properties of tea sausage. However, these differences in quantity and meat quality resulted in different protein and fat contents in the final products. Therefore, the raw materials and the other ingredients used in the technological production process had an influence on product quality.

References

[1] Savić I V 1985 Small-scale sausage production http://www.fao.org/docrep/003/x6556e/X6556E00.htm
[2] Petäjä-Kanninen E and Puolanne E 2007 *Handbook of Fermented Meat and Poultry* pp 31–6
[3] Babić Lj and Babić M 2000 *Sušenje i skladištenje* Poljoprivredni fakultet, Novi Sad
[4] Moretti V M, Madonia G, Diaferia C, Mentasti T, Paleari M A, Panseri S, Pirone G and Gandini G 2004 *Meat Sci.* 66 845–54
[5] Vesković Moračanin S, Obradović D 2009 *Tehnol. mesa* 50(1–2) 60–7
[6] Serbia 2015, 2017 Regulation on the quality of ground meat, meat preparations and meat products *Official Gazette of the Republic of Serbia* 94 (104) p 19
[7] Vuković I 2012 *Osnove tehnologije mesa* Četvrto izdanje
[8] Toldră F, Sanz Y and Flores M 2001 *Meat Sci.* 37 537–61
[9] Talon R, Lebert I, Lebert A, Leroy S, Garriga M, Aymerich T, Drosinos E H, Zanardi E, Ianieri A, Fraqueza M J, Patarata L and Laukova A 2007 *Meat Sci.* 77 570–79
[10] Roseiro L C, Gomes A and Santos C 2011 *Food and Chem. Toxicol.* 49 1340–45
[11] Santos C, Gomes A and Roseiro L C 2011 *Food and Chem. Toxicol.* 49 2343–47
[12] Ockerman H W and Basu L 2007 *Handbook of Fermented Meat and Poultry* pp 9–15
[13] Tabanelli G, Coloretti F, Chiavari C, Grazia L, Lanciotti R and Gardini F 2012 *Food Control* 26 416–26
[14] Petrohilou I and Rantsios A 2005 *Tehnol. mesa* 3(4) 138–42
[15] Vesković Moračanin S, Karan D, Okanović D, Jokanović M, Đžinić N, Parunović N and Trbović D 2011 *Tehnol. mesa* 52(2) 245–51
[16] SRPS ISO/IEC 17025:2006 General requirements for the competence of testing and calibration laboratories
[17] SRPS ISO 6658:2001 Sensory analysis – Methodology – General guidance
[18] SRPS ISO 3972:2001 Sensory analysis – Methodology – Method of investigating sensitivity of taste.
[19] SRPS ISO 5496:2002 Sensory analysis – Methodology – Initiation and training of assessors in the detection and recognition of odours
[20] SRPS ISO 1444:1998 Meat and meat products – Determination of free fat content
[21] SRPS ISO 1841–1:1999c Meat and meat products – Determination of chloride content – Part 1: Volhard method
[22] SRPS ISO 3496:2002 Meat and meat products – Determination of hydroxyproline content
[23] SRPS ISO 1442:1998 Meat and meat products – Determination of moisture content
[24] SRPS ISO 2917:2004 Meat and meat products – Measurement of pH value
[25] Virgili R, Parolai G, Soresi BC and Schivazzappa C 1999 J. Muscle Foods 10 119–30
[26] Vuković I, Saičić S, Vasilev D, Tubić M, Vasiljević N and Milanović-Stevanović M 2009 Tehnol. mesa 50(1–2) 68–74
[27] Mendoza E, Garcia M L, Casas C and Selgas M D 2001 Meat Sci. 57 387–93
[28] Comi G, Urso R, Iacumin L, Rantsiou K, Cattaneo P, Cantoni C and Cocolin L 2005 Meat Sci. 69 381–92
[29] Saldago A, Fontan MCG, Franco I, Lopez, M and Carballo J 2005 Food Chem. 92 413–424
[30] Kozačinski L, Drosinos E, Čaklovica F, Cocolin L, Gasparik-Reichardt J and Vesković S 2008 Food Tech Biotechnol. 46(1) 93–106
[31] Fista G A, Bloukas J G and Siomos A S 2004 Meat Sci. 68(2) 163–72
[32] Heinz G and Hautzinger P 2007 Food and Agriculture Organization of the United Nations Regional office for Asia and Pacific, RAP Publication 2007/20, Bangkok