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Characteristics of dry fermented "Sremska kobasica" produced in traditional smoking house

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Abstract

The aim of this research was to examine the characteristics of *Sremska kobasica* produced in traditional smoking house. Chemical composition composition and pH was followed during the processing, while colour and rheological (TPA) characteristics were determined on the final product. During the production, the significant reduction in moisture and the increase in protein, fat and ash contents ($p<0.05$) was observed, which is characteristic for this type of sausages. Value of pH dropped moderately and reached the minimum (4.98) 14 days after the beginning of the. Processed sausages have a high proportion of red color (a^* value) and the texture profile parameters characteristic for dry fermented sausages. compared to literature data, hardness values were slightly lower, probably due to different fat content and pH value of the sausages.

Key words: Sremska kobasica, traditional smoking house, proximate composition, instrumental colour, rheological properties

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Introduction

In Europe, there is a great variety of dry fermented sausages, depending on raw material and manufacturing processes. Consequently, each European country has at least few of its own typical types (Casaburi et al., 2007). *Sremska kobasica* is a very popular sausage in Serbia and entire Balkan region. This dry fermented sausage is produced in the north-western part of Serbia (Srem region), traditionally without conservating agents (nitrate, nitrite, glucono-γ-lactone, etc) and starter cultures and is characterized by specific hot taste, aromatic and spicy flavour, dark red colour and hard consistency (Stanišić et al., 2012).

Traditionally, *Sremska kobasica* was produced during winter season in traditional smoking houses (Stajić et al., 2011). Nowdays, the manufacturing technology for majority of dry fermented sausages is based on modern technology, controlled ripening rooms and rapid curing techniques, resulting in lower production time (Flores et al., 1997) and safer product (Malti and Amarouch, 2008). The sausages obtained are excellent in appearance, but their typical sensory characteristics are poor. Above all, they have a vigorous acidic taste that is not accepted by the consumer (Sanz et al., 1998). On the other hand, traditional dry fermented sausages produced by spontaneous meat fermentation at low temperatures are of very high quality (Marcos et al., 2007).

The scientific knowledge of traditionally produced *Sremska kobasica* is limited and its quality is very variable, as there is very little uniformity in the production practices applied by different home producers and meat industries. Within the current trends of promotion and support of sustainable traditional food production

systems and in order to preserve the quality of traditional Sremska kobasica, the present trial was set to examine physico-chemical characteristics of this sausage produced in a traditional smoking house.

Materials and methods

Sausages were prepared in the meat processing plant of the Institute for Animal Husbandry (Belgrade, Serbia) in the period January-February 2015. For the production of Sremska kobasica, meat of 10 commercially reared Swedish Landrace pig breed (average live weight 105±5 kg and 180±10 days of age) from shoulder and back fat (in the ratio of 75:25) were minced (8 mm of particle size) and mixed with a cutter, latter to be mied other ingredients were added: 2.2% NaCl, 0.3% glucose, 0.17% garlic (powder), 0.55% hot red paprika (powder) and 0.5% sweet red paprika (powder). No starter culture was added, thus fermentation was spontaneous.

The sausage mixture (app. 700-800 g) was stuffed into natural casings (pig small intestines) of around 32 mm diameter. Sausages were drained in a cold store (4 ± 1°C) for 12 h, for the surface to dry and afterwards hung in a traditional smoking house. The ripening was as follows: the first stage lasted 14 days in a traditional smoking house at 10-15°C with 75–90% relative humidity (RH), where the sausages were smoked for 6 h each day; for the next 7 days sausages were processed in a drying room at 14–16°C with about 75% RH, to reach about 35.0% moisture content. The total processing time lasted for 21 days.

Sampling of sausages was carried out after stuffing (day 0) and on production days 3, 7, 14 and 21, whereas each analysis was done in duplicate. Proximate composition and pH analyses were done at previously mentioned periods of the process. Sausage colour and rheological characteristics (TPA test) were determined at the end of production process (day 21). All samples were analysed after removing the outer casing and grounding in a mixer (Ultra Turrax T18, IKA, Germany).

The chemical composition of sausages was determined in the following manner: moisture content by drying samples at 105°C (ISO 1442, 1997); protein content by Kjeldahl method and multiplying by factor 6.25 (ISO 937, 1978); total fat content by Soxhlet method (ISO 1443, 1973), and ash content by mineralization of samples at 550 ± 25° (ISO 936, 1998).

The value of pH was measured by Hanna HI 83141 pH-meter (Hanna Instruments, USA), equipped with an puncture electrode. The pH meter was calibrated using standard phosphate buffer (ISO 2917, 1999).

Each sausage was transversally cut and the colour was measured three times using Chromameter CR-400 (Minolta Co. Ltd, Tokyo, Japan), configured with the following parameters: D65 light source, 10° observer, and 8 mm aperture size and calibrated using a white ceramic tile. The measurements were done according to CIE L*a*b* system: lightness (L*), redness (a*) and yellowness (b*) (CIE, 1976). The colour measurements were performed at room temperature (20 ± 2°C). C* (chroma) and h (hue angle) were calculated using the available software.

Texture analyses (TPA) were performed using a universal testing machine (Instron model 4301, Instron Ltd., England) and nine readings were taken for each variant of sausage. In order to equilibrate, the samples (2 cm in height and 2.54 cm in radius) were held at room temperature for 30 min and then compressed twice to 50% of their original height, with a compression aluminium platen, 75 mm in diameter (P/75) and a 250 kg load cell. Pre-test speed was 3 mm/s, test speed was 1 mm/s and post-test speed was 1 mm/s. The following parameters were obtained: hardness, adhesiveness, springiness, cohesiveness, and chewiness.

One way analysis of variance using the SPSS 20.0 software (IBM SPSS Statistics, Version 20, IBM Corp, USA) was performed for chemical composition and pH value at the level of significance of $p<0.05$. For colour and texture parameters data were expressed as means ± standard deviation.

Results and discussion

The changes in chemical composition during ripening of *Sremska kobasica* are shown in Table 1. The reduction in moisture during ripening caused the increase in protein, fat and ash contents ($p<0.05$). Low moisture content at the end of ripening is typical for similar products (Kozacinski et al. 2008). During the drying period, the moisture content decreased as a result of moisture loss at high ripening temperature and low relative humidity. The final values (30.21%) were similar to those found by other authors for similar products (i.e. dry-fermented sausages) (Gimeno et al., 2000; Salgado et al., 2006), while Franco et al. (2002) and Salgado et al. (2005) observed final values below 30% in Spanish dry-cured sausages.

Duration and temperature throughout the smoking procedure are also very important factors for pH development. Value of pH dropped moderately and reached the minimum on day 14 of the processing, and remained approximately the same until the end of the production process – day 21 (Table 1), possibly due to the production of organic acids by bacteria (Lücke, 1994). At the end of the production process, sausages had pH value was 4.9, which is lower than values reported by other authors (5.2 to 6.4) for naturally fermented dry sausages (Comi et al., 2005; Chevallier et al., 2006). For dry fermented sausages made in controlled ripening rooms, at the end of the ripening process, pH values are usually lower than 5 (Gimeno et al., 2000; Muguerza et al., 2002; Salgado et al., 2005; Van Schalkwyk et al., 2011). Lower pH values established in this research are probably the result of added sugar in the sausage stuffing and the possible presence of sugar in spices, such as paprika (Oberdick, 1988).

Table 1. Changes in the proximate composition and pH of Sremska sausage during the production process (means ± standard deviation)

Parameter	Day				
	0	3	7	14	21
Moisture (%)	58.13 ± 1.06^{a}	55.93 ± 0.80^{b}	49.22 ± 1.9^{c}	38.45 ± 0.88^{d}	30.21 ± 0.96^{e}
Fat (%)	21.23 ± 1.43^{a}	21.69 ± 0.98^{a}	24.50 ± 1.02^{b}	30.98 ± 2.54^{c}	38.42 ± 1.43^{d}
Protein (%)	17.65 ± 0.98^{a}	19.36 ± 1.53^{ab}	21.79 ± 0.28^{b}	25.23 ± 1.52^{c}	25.59 ± 2.21^{c}
Ash (%)	2.85 ± 0.05^{a}	3.04 ± 0.13^{a}	4.41 ± 0.07^{b}	5.31 ± 0.22^{c}	5.67 ± 0.09^{d}
pH	5.85 ± 0.02^{a}	5.48 ± 0.05^{b}	5.35 ± 0.07^{c}	4.98 ± 0.07^{d}	4.98 ± 0.09^{d}

$^{a-e}$ Different letters within the same row denote significant differences between means ($p<0.05$)

Table 2. Instrumental colour (means ± standard deviation) of Sremska kobasica at the end of the production process (day 21)

Instrumental colour	
L*	39.94 ± 2.25
a*	20.69 ± 0.65
b*	20.42 ± 1.70
C*	29.10 ± 1.20
h	44.56 ± 2.73

Table 3. TPA parameters (means ± standard deviation) of Sremska kobasica at the end of the production process (day 21)

TPA parameters	
Hardness (N)	76.41 ± 9.33
Gumminess (N)	34.69 ± 0.69
Chewiness (N*mm)	17.76 ± 0.77
Springiness (mm)	0.51 ± 0.01
Cohesiveness	0.46 ± 0.06

The CIE L*a*b* colour parameters at the end of production process are presented in Table 2. Redness (a*) values were high compared to literature data for similar traditional dry fermented sausages, which may be due to the addition of higher amount of powdered red paprika, as stated by Živković et al. (2012). Regarding this, Ikonić et al. (2010) attribute very high shares of red (a*) and yellow (b*) colour on cut surfaces of Perovská klobása to the addition of a high amount of red hot paprika powder.

Textural characteristics of food are important aspects of consumer acceptance and have been related to fat, salt and pH values (Bourne, 2002). TPA parameters (hardness, gumminess, chewiness, springiness and cohesiveness) of Sremska kobasica at the end of the production process (day 21) are presented in Table 3. In the research of Herrero et al. (2007) commercial brands of dry fermented sausages (chorizo, salchichon, salami, fuet and mini-fuet) purchased in retail shops, showed cohesiveness values between 0.40 and 0.45 and springiness values ranging from 0.4 to 0.6 mm, which have similar values as in the present study. The

hardness of sausages was slight lower than range reported in research of Herrero et al. (2007) for different dry fermented sausages (from 69 to 272 N, with around 60% of the analysed sausages showing values higher than 100 N), although they had higher fat content (approx. 40%) compared to Sremska kobasica. This divergence were probably due different fat content and final pH values (that were higher for Sremska kobasica) at the end of ripening. Overall, the TPA values of Sremska kobasica were in the range reported for different varieties of dry fermented sausages (Bruna et al., 2000; Gimeno et al., 2000; Herranz et al., 2005).

Conclusions

Traditionally produced Sremska kobasica is characterized the reduction in moisture content during ripening which caused the increase in protein, fat and ash contents, which is in agreement with majority of research. The lowest drop of pH was determined in day 14 of ripening process and remained unchanged until the end of the production process.

At the end of production process sausages had a high proportion of red color and the characteristic texture profile parameters. Hardness values were slightly lower compared to literature data, probably due to different fat content and pH value.

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