

'Roasted' Šunkarica

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SUMMARY

Many traditional technologies are being replaced by new, faster and improved ones. Šunkarica has been produced for decades, but the warm smoking of those types of sausages was almost forgotten. Therefore, 'roasted' Šunkarica is rarely seen on Slovenian market, although 'cooked' Šunkarica, a cognate product that belongs to the group of cured and pasteurized sausages, is known for the Balkan territories (e.g., ex-Yugoslavia). In this study the physico-chemical parameters (proximate composition and salt content) as well as sensory properties of 'roasted' and 'cooked' Šunkarica were determined; two samples of 'cooked' sausages were produced in industry plants, one was made by the students of the Biotechnical Faculty during practical work, while 'roasted' Šunkarica and information about its manufacture were acquired from the Babič farm. On average, these 'roasted' Šunkarica contained moisture at 61.61 g/100 g, protein at 22.76 g/100 g, fat at 13.26 g/100 g, and NaCl at 2.20 g/100 g; in conventionally 'cooked' Šunkarica the moisture (67.83 g/100 g) was higher and the protein content (18.64 g/100 g) was lower as compared with 'roasted' Šunkarica. Sensory evaluation of 'roasted' and 'cooked' Šunkarica samples was carried out by two panels, a panel of twenty students and a panel of four experts. Students evaluated liking of each sample, ranked samples by preference, as well as assessed the texture and the intensity of aroma; meanwhile experts used descriptive analysis method to determine characteristics of a sample.

Keywords: 'roasted' Šunkarica, pasteurised meat product, traditional recipe, sensory properties, composition

INTRODUCTION

Šunkarica is a popular Slovenian cured and cooked sausage. Sausage is produced from around 75% pork and 10% solid back fat, both cut into pieces (2 cm × 2 cm), as well as from 10% meat batter, combined from ground beef, water (5%) and phosphate preparation (0.7% of Mesol UK). The pork (neck, shoulder, leg (ham), tenderloin and loin) has to be previously cured (nitrite salt, 1.8%-2.2%). The meat-fat mixture has to be seasoned (0.2% of total weight) with pepper, garlic and coriander (*Coriandrum sativum* L.), and is usually filled in artificial or natural casings. For classic or 'cooked' Šunkarica in the artificial casing formed sausages are then pasteurised (core temperature in sausage of at least 70 °C) by moist heat (Gašperlin and Rajar, 2005). The traditional recipe requires after formation and drying up of filled sausages (in natural, permeable cellulose or collagen ca-

sings, suitable for roasting) the process of hot smoking (60-90 °C) with beech wood chips, until sausages turn a red-brown in colour (Janeš, 2002; Dominko, 2004; Babič, 2016). These products are known as 'roasted' Šunkarica. In both types of Šunkarica obligatory air cooling to 8 °C follows the thermal process and the final chilled product is stored at 4 °C.

Šunkarica belongs to a group of cured and pasteurized sausages, known for the Balkan territories (e.g., ex-Yugoslavia). Today, as 30 years ago, the composition of that product is still determined by the regulations of various countries, especially content of myofibrillar (at least: 12% in Croatia, 14% in Serbia and 15% in Slovenia) and stroma proteins (not higher than 2.1% from myofibrillar in Serbia and 2% from myofibrillar in Slovenia) (NN 131/2012, UL RS 59/2012, Sl. glasnik SCG 33/2004 i 31/2012). Product has a smooth cross-sectional surface

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with bigger pieces of meat and fat evenly distributed across the slice, and is juicy and meaty-fibred texture, with the typical aroma from the cured pork, spices, especially coriander and in case of 'roasted' *Šunkarica* also smoke.

In Slovenia, there is a progressive tendency for a return to traditional products that have a wide dissemination and strong identity (Gašperlin et al., 2014; Žlender and Čepin, 2003). Therefore, the aim of this study was to determine the main characteristics of 'roasted' *Šunkarica*, as the first step towards the obtaining of recognition for this relatively little known product and comparison to the classic ones. One of the aims of this study was also to check in practice some methods of sensory analysis for consumer testing in the students training "at the BSc Food Science and Nutrition program.

MATERIAL AND METHODS

Sampling and preparation of samples for analysis

As was mentioned previously, the aim of this study was to determine the physico-chemical parameters (proximate composition and salt content) as well as sensory properties of 'roasted' *Šunkarica* and to compare with the 'cooked' ones. For this purpose two types of *Šunkarica* were collected. 'Cooked' sausages were produced in two different industry plants (named CŠ1 and CŠ2) and collected in the same shop; the third one (CŠ3) was made by the students of the Biotechnical Faculty during practical work according to the recipe described in Introduction, while 'roasted' *Šunkarica* (RŠ) and information about their manufacture were acquired at the farm named Babič who has registered supplemental economic activity, namely meat processing. On the samples CŠ1 and CŠ2 was labelled that they contained pork meat, pork solid back fat, water, salt, spices and spice extracts, dextrose, stabilizers: sodium diphosphate, sodium triphosphate, antioxidants: sodium erythorbate, citric acid, ascorbic acid, and preservatives: sodium acetate, and sodium nitrite. A total of three units were randomly selected from each sample, at 7 to 12 days after their production, and transported to the laboratory in refrigerated boxes at 4 °C. One of each of the three units from each sample was used for the analysis of moisture, protein, fat and salt (NaCl) content, and the remaining two for the sensory analysis. Collected samples were stored until sensory analysis in a fridge at 4 °C.

Methods

Determination of proximate composition and salt content: The moisture, protein and fat content in samples was determined by apparatus Food Scan™ Meat

Analyser (FOSS, Dansk), specifically designed for meat and meat products. Apparatus on the base of the near-infrared (NIR) technique provides information on the content of water and macro nutrients in meat and meat products. NaCl was determined by the Volhard method, using AOAC 941.18 (Official Methods of Analysis, 1997). Analysis results are expressed as the mean of three parallel determinations per sample, as a percentage (%) mass with an accuracy of 0.01%.

Sensory evaluation: Evaluation of sensory profile of 'roasted' and 'cooked' *Šunkarica* was carried out by two panels, a panel of four experts and a panel of twenty students. Evaluations of both panels were carried out in defined, precisely prescribed, controlled and reproducible operating conditions. This includes: arrangement of laboratory, samples, accessories and organization of assessment (ISO 8589:2007). Samples were taken out of the refrigerator and left at the room temperature (temperature of slices during analysis was around 15 °C). For the sensory evaluation, the visual attributes of samples were evaluated on the whole (undivided) sausages, and for evaluation of other sensory properties 2-mm-thick slices of the samples were prepared. To neutralise the taste, the panel used the central dough of white bread.

To evaluate the sensory qualities, a panel of four qualified and experienced panellists in the field of meat products was appointed (Gašperlin et al., 2014). Assessment of coded (blinded) samples took place in a standard sensory laboratory. On the basis of preliminary tasting for the purpose of the evaluation, the panel decided in favour of, and applied, the analytical-descriptive test (Golob et al., 2005). The analysis was performed by scoring the sensory attributes on a structured scale from 1 to 7 points, where a higher score indicated greater expression of a given property. The exceptions here were for some of the appearance attributes (i.e., granulation, proportion meat and fat) and the toughness and saltiness, which were evaluated by scoring on a structured scale of 1 to 4 to 7 (1-4-7). Here, a score of 4 points was considered optimal, with scores of 4.5 or higher indicating greater expression of a property, and those of 3.5 or lower indicating insufficient expression of a property. These sensory profiles of the *Šunkarica* samples were assessed using 24 descriptors that were grouped into four blocks. The first block related to the visual attributes of the sausage and the cross-section of a slice: formation of sausage and surface wrinkling, granulation, mosaic, proportion of meat in fat particles, cross-sectional colour and porousness. The second block related to the texture: juiciness and toughness. The third block related to the olfactory attributes, like odour of roasted, coriander, garlic, pepper, an odd smell, and characteristic of the odour. The fourth block

related to the aroma attributes, such as saltiness, aroma of roasted, coriander, garlic, pepper, an odd aroma, and characteristic of the aroma.

The second panel of twenty students applied three sensory tests, assessment of liking on 100-mm scale, the ranking of samples by preference, and assessment

of the texture and intensity of aroma with the 7-point Just About Right Scale (Figure 1).

Assessment of liking on 100-mm scale: Each panellist marked the level of liking a certain sample on the scale with verbal anchors at both ends (Golob et al., 2005).

1. Assessment of liking

2. Ranking of samples by preference

at least liked

the most liked

3. Assessment of the intensity of aroma on JAR scale

Much too Weak	Moderately too Weak	Slightly too Weak	Just About Right	Slightly too Strong	Moderately too Strong	Much too Strong
-3	-2	-1	0	1	2	3

4. Assessment of the texture on JAR scale

Much too Soft	Moderately too Soft	Slightly too Soft	Just About Right	Slightly too Rough	Moderately too Rough	Much too Rough
-3	-2	-1	0	1	2	3

Figure 1. Forms for sensory evaluation

Ranking of samples by preference: panellist at the same time ranked a series of samples according to the likeability (Golob et al., 2006).

Assessment of the texture and intensity of aroma: Methods are used to estimate the order or size of differences, or the categories or classes to which samples should be allocated (Golob et al., 2006). Differences in texture and intensity of aroma were showed with structured bipolar 7-point JAR (Just About Right) scale. Here, a score of 0 points was considered optimal (just about right), with scores of 1 or higher indicating greater expression of a property and those of -1 or lower indicating insufficient expression of a property.

Dana analysis: The data were analysed for normal distributions using the UNIVARIATE procedure (SAS/STAT). The differences according to the producers of the samples were analysed through a general linear model procedure and least squares mean tests (SAS/STAT), with a 0.05 level of significance. The experiments had three replications.

RESULTS AND DISCUSSION

Basic chemical composition

The quality of meat products is based on the content of protein, fat, water and salt. The highest content of

protein from all samples was found in RŠ, as well as comparable salt content (Table 1). The moisture in the RŠ samples was the lowest, which is in accordance with a different technology of heat treatment as compared with conventionally cooked *Šunkarica*.

Table 1. Basic chemical composition of the 'roasted' (RŠ) and 'cooked' *Šunkarica* of three different producers (CŠ1, CŠ2 and CŠ3).

Sample	Parameter determined (g/100 g)			
	Protein	Fat	Moisture	NaCl
RŠ	22.76	13.26	61.61	2.20
CŠ1	15.13	15.15	66.14	2.21
CŠ2	19.23	10.60	67.22	2.21
CŠ3	21.57	5.44	70.14	2.19
Average on CŠ	18.64	10.40	67.83	2.20
SEM	0.55	1.26	1.10	0.23

SEM, standard error of mean.

Sensory properties

Measuring liking and preference with 100-mm scale: Student's panel classified samples RŠ and CŠ3 as the most liked, their values on 100-mm scale were 73 mm and 70 mm, respectively. The CŠ1 sample (62 mm) followed, while the CŠ2 sample was classified as at least likeable (46 mm) (Table 2).

Table 2. Sensory attributes of the 'roasted' (RŠ) and 'cooked' Šunkarica of tree different producers (CŠ1, CŠ2 and CŠ3).

Value of property according to producer						2.20
RŠ	CŠ1	CŠ2	CŠ3	P _p	SEM	Average on CŠ
73 ^a	62 ^b	46 ^c	70 ^{ab}	<0.0001	63	59

SEM, standard error of mean. P_p, statistical probability of producer effect. Data with different superscript letters within a row differ significantly (least-squares means; P < 0.05)

Ranking of samples by preference: From Figure 2 it is evident that the panellists preferred a sample CŠ3 at most, as none of the testers assigned it with least liked anchor. A sample RŠ as slightly less likeable was the second most preferred, and CŠ2 was proved to be the least preferred sample. The results are partly consistent with the results of liking assessment with 100-mm scale. In both trials the RŠ and CŠ3 were assessed as the most likeable choice, and CŠ2, in both cases received the lowest ratings.

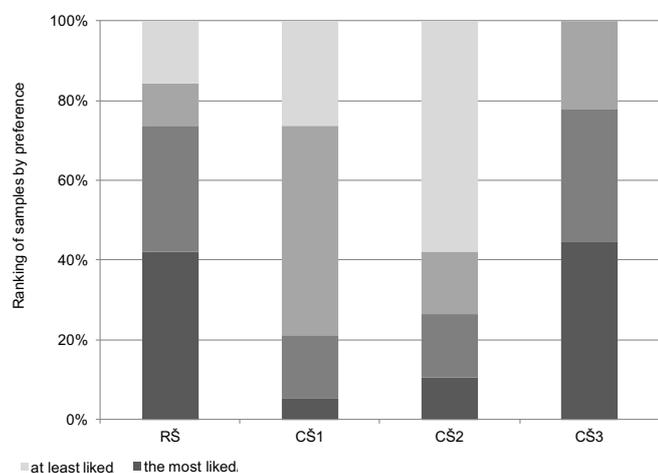
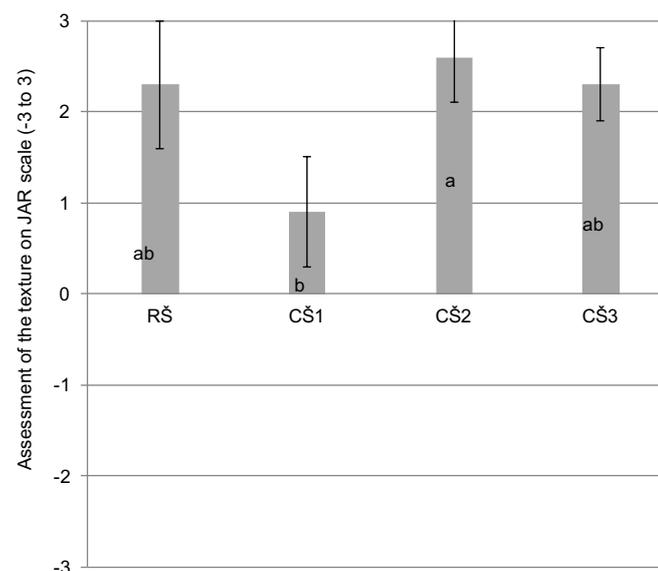


Figure 2. Results of ranking the 'roasted' (RŠ) and 'cooked' Šunkarica of three different producers (CŠ1, CŠ2 and CŠ3) by preference.



a, b bars with different letters differ significantly (least-square means; P < 0.05)

Assessment of the texture and intensity of aroma with JAR scale: As seen in Figure 3 (left), the panellists found out the texture of sample CŠ1 as the most appropriate (described as slightly too rough, mean value 0.9). Almost much too rough textures were noted for RŠ and CŠ3, as well as for CŠ2 (mean values 2.3 and 2.6, respectively).

From Figure 3 (right) it is evident that the samples CŠ1 and CŠ3 were estimated by value of 0.9, describing the intensity of aroma as slightly too strong. Samples RŠ (1.3) and CŠ2 were assessed by student panellists as moderately too strong in aroma (values 1.7 and 2.1).

The descriptive analysis: Table 3 shows the professional panel data for the sensory analysis of the Šunkarica, with the basic statistical parameters calculated regarding the sample, as least-squares means and standard error of the mean (SEM). The sensory profile of 'roasted' Šunkarica (RŠ) can be divided into the assessment of four profiles: appearance and cross section, texture, smell, and aroma. On average, these RŠ show optimal form with smooth surface of sausage, and with a relatively too big meat particles, in too big proportion of meat regarding to the back fat particles (granulation, 5.7, proportion meat: fat, 2.8), and with not optimal mosaic due to uneven distributed particles of meat and fat on slice (5.2 points). There was intense cross-section colour and barely noted porousness. The texture in the mouth was evaluated according to two characteristics, as juiciness and toughness, where RŠ was slightly too dry (not juicy enough) (5.8 points), and had a slightly too tough texture (4.7 points). In the profile of the olfactory attributes, as well as the characteristic odour (e.g., roasted, coriander, garlic and pepper), there was no odd smells detected. The absence of odd smells and almost optimal

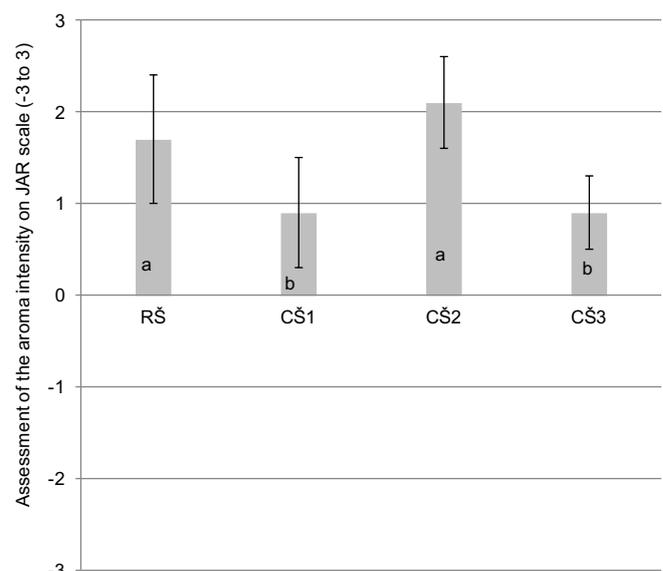


Figure 3. Results of assessment of the texture (left) and aroma intensity (right) of the 'roasted' (RŠ) and 'cooked' Šunkarica of tree different producers (CŠ1, CŠ2 and CŠ3) on 7-point JAR scale performed by the panel of students.

seasoning of meat mixture affected the relatively high average rating of the odour harmony (5.7 points). The relatively characteristic aroma of the RŠ (6.0 points) was dominated by distinctive pepper, coriander and roast aromas, as well as by optimally intensive garlic aroma. The saltiness of the RŠ was slightly too high (4.2 points).

The panel used the same method also for the descriptive analysis of 'cooked' Šunkarica samples for the comparison of a sensory profile of the two types of this

product. In the present study, despite limitation – just one producer of 'roasted' Šunkarica, some comparisons with 'cooked' ones can be made; 'roasted' Šunkarica showed some speciality such as a very high proportion of meat compared to back fat, comparable juiciness, slightly too tough texture (not significant), slightly too high saltiness, as well as characteristic smell and aroma, with very strongly noted roasted component in comparison with the average 'cooked' Šunkarica.

Table 3. Sensory attributes of the 'roasted' (RŠ) and 'cooked' Šunkarica of three different producers (CŠ1, CŠ2 and CŠ3) evaluated by descriptive analysis with professional panel.

Property	Value of property regarding the sample				P _p	SEM	Average on CŠ/
	RŠ	CŠ1	CŠ2	CŠ3			
Appearance and cross-section							
Formation of sausage (1-7)	7.0 ^a	6.7 ^{ab}	7.0 ^a	6.3 ^b	0.016	0.2	6.7
Surface wrinkling (1-7)	1.0 ^b	3.2 ^a	1.0 ^b	3.2 ^a	<0.001	0.2	2.4
Granulation (1-4-7)	5.7 ^a	6.0 ^a	3.5 ^b	5.3 ^a	0.007	0.6	4.9
Mosaic (1-7)	5.2	4.8	6.0	5.3	0.086	0.4	5.4
Proportion meat: fat (1-4-7)	2.8 ^b	4.2 ^a	4.5 ^a	4.0 ^a	0.017	0.4	4.2
Cross-section colour (1-7)	6.0 ^b	5.8 ^b	5.7 ^b	6.5 ^a	0.007	0.2	6.0
Porousness	1.3	1.3	1.8	1.2	0.166	0.3	1.4
Texture							
Juiciness (1-7)	5.8	5.8	5.7	6.2	0.316	0.3	5.9
Toughness (1-4-7)	4.7	4.8	4.2	4.2	0.198	0.4	4.4
Smell							
Characteristic (1-7)	5.7 ^b	4.3 ^c	5.3 ^b	6.3 ^a	0.002	0.3	5.3
Roasted (1-4-7)	4.3 ^a	1.0 ^b	1.0 ^b	1.0 ^b	<0.001	0.1	1.0
Coriander (1-4-7)	4.0	3.0	4.2	4.3	0.078	0.5	3.8
Garlic (1-4-7)	4.0	3.3	3.7	4.0	0.189	0.4	3.7
Pepper (1-4-7)	4.2 ^a	3.2 ^b	4.0 ^a	4.0 ^a	0.001	0.2	3.7
Odd smells	1.0 ^b	2.5 ^a	1.0 ^b	1.0 ^b	0.001	0.3	1.5
Aroma							
Saltiness (1-4-7)	4.2	4.0	4.0	4.0	0.893	0.3	4.0
Characteristic (1-7)	6.0 ^a	4.2 ^b	5.3 ^a	6.3 ^a	0.010	0.5	5.3
Roasted (1-4-7)	4.3 ^a	1.0 ^b	1.0 ^b	1.0 ^b	<0.001	0.1	1.0
Coriander (1-4-7)	4.2 ^a	3.2 ^b	4.7 ^a	4.2 ^a	0.007	0.3	4.0
Garlic (1-4-7)	4.0 ^a	3.2 ^b	4.2 ^a	4.2 ^a	0.008	0.3	3.8
Pepper (1-4-7)	4.2 ^a	3.3 ^b	4.0 ^a	3.8 ^{ab}	0.044	0.3	3.7
Odd aroma/ Tuđe arome (1-7)	1.0 ^b	2.3 ^a	1.2 ^b	1.0 ^b	0.003	0.3	1.5

SEM, standard error of mean/standardna greška aritmetičke sredine. P_p, statistical probability of producer effect/ statistička vjerojatnost uticaja proizvođača. Data with different superscript letters within a row differ significantly (least-squares means; P < 0.05)

CONCLUSION

Roasted Šunkarica is one of sausages known for Slovenia and also the Balkan territories in the past, but till now there is no data available on detailed description of these products. It can be concluded that the 'roasted' Šunkarica differs in the physico-chemical and sensory characteristics from 'cooked' Šunkarica; it has higher protein content and lower value for moisture due to thermal treatment with dry heat. In both trials of hedonic sensory evaluation with a panel of 20 students (liking on 100-mm scale and ranking by preference) the RŠ and CŠ3 were found as the most preferred, while in the assessment of appropriateness of the texture and aroma intensity on JAR scale, the texture of RŠ was found as much too rough, while its aroma was moderately too strong. Experts described the 'roasted' Šunka-

rica as a sausage with a very high proportion of meat compared to back fat, with appropriate juiciness and slightly too tough texture, with slightly too high saltiness, as well as with characteristic roast odour and aroma compared to the average 'cooked' Šunkarica.

This study also shows the practical application of sensory methods for testing the differences among the various types of a product, as well as the assessment of hedonic response to the products. Tests were found suitable for learning and training purposes of students interlacing the knowledge of different courses of the study program, as well as for professional and research work in companies for characterization of a product and testing its acceptability.

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