SENSORY PROPERTIES OF PETROVSKÁ KLOBÁSA (DRY-FERMENTED SAUSAGE) RIPENED IN TRADITIONAL AND INDUSTRIAL CONDITIONS

SENZORNE KARAKTERISTIKE PETROVSKE KLOBÁSE (FERMENTISANE SUVE KOBASICE) SUŠENE TRADICIONALNO I U INDUSTRIJSKIM USLOVIMA


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ABSTRACT

The sensory properties, as well as the overall sensory quality of dry-fermented sausage Petrovska kobasa, were evaluated in relation to different processes of drying and ripening. Raw sausages were divided into two groups: ripened in the traditional way in households under climate conditions (sausages T) and in an industrial chamber with controlled conditions (sausage I). Drying process in an industrial plant was to some degree faster, and sausages reached moisture content <35% after 45 days; at that moment the overall sensory quality was about 4.5. All evaluated sensory characteristics were scored better for sausages T after 45 days than for sausages I after 45 days. Sausages T reached moisture content <35% after 90 day, when the overall sensory quality was almost maximal 4.98. On 90th day the sensory characteristics of both sausage samples were very high and alike (P>0.05). After 120 days of processing sausages T retained the sensory quality, but the overall sensory quality of sausages I decreased significantly (P<0.05).

Key words: dry sausages, traditional sausage, petrovská klobása, sensory quality.

REZIME

U ovom radu ispitana su senzorna svojstva (spoljni izgled, izgled preseka, boja na preseku, aroma, tekstura i sočnost), kao i ukupni senzorni kvalitet fermentisanih suvih kobasica, Petrovska kobasa, tokom proizvodnje. Naved za kobasicu pripremljen je na isti način i napunjen u prirodne omotače. Kobasice su podeljene u dve grupe: procesi dimljenja, sušenja i zrenja odvijali su se na tradicionalan način u domaćinstvu, pod klimatskim uslovima – grupa T, odnosno u industrijskim, kontrolisanim uslovima, grupa I. Fermentisane suve kobasice grupe I postigle su sadržaj vode niži od 35% nakon 45 dana, a kobasice grupe T nakon 90 dana proizvodnje. Sausages T reached moisture content <35% after 90 day, when the overall sensory quality was almost maximal 4.98. On 90th day the sensory characteristics of both sausage samples were very high and alike (P>0.05). After 120 days of processing sausages T retained the sensory quality, but the overall sensory quality of sausages I decreased significantly (P<0.05).

Ključne reči: suše kobasice, tradicionalne kobasice, Petrovska kobasa, senzorni kvalitet.

INTRODUCTION

In Europe, naturally fermented sausages have a long tradition. Preparation of various sausages was a common practice throughout the Roman state in Europe and Mediterranean region well before the time of Caesar and it continued after decline of the Roman Empire (Comi et al., 2005; Savić and Savić, 2004).

There are many different types of naturally fermented sausages and almost all of them are only known at a local or regional level (Comi et al., 2005). These traditional foods often refer to specific ingredients, location of the production and know-how (Cayot, 2007). Very often, naturally (traditional) fermented sausages are obtained through traditional technologies without a starter culture added. In conventionally fermented sausage technologies, development of the desirable flora is completely hazardous in very long production and natural ripening period (Nazli, 1998). The required microorganisms originate from the meat itself or from the environment, and constitute a part of the so-called “house-flora” (Casaburi et al., 2007). In modern technologies, ripening process is carefully controlled by introducing selected microbial strains and using climatized drying rooms (Nazli, 1998).

In general, the qualitative characteristics of naturally fermented sausages are known to be largely dependent on the quality of the ingredients and raw materials, the specific conditions of processing and ripening, and the composition of the microbial population (Aquilanti et al., 2007).

The manufacture of traditional sausages is an art depending on the skill and experience of the meat manufacturer rather than a process fully based on scientific and technological means. These traditional practices lead to a great variability in the quality of the products (Talon et al., 2007). A great variety of fermented sausages produced in European countries have been granted PDO (Protected Designation of Origin) and PGI (Protected Geographical Indication) labels.

Petrovska kobasa, Serbian dry-fermented sausage, with protected designation of origin at the national level, is produced in a large amount in an area nearby City of Bački Petrovac in the Autonomous Province of Vojvodina (Northern Serbia). Petrovska klobása is manufactured traditionally, according to the original recipe of the ancestors. Kobása is produced from pork meat and pork backfat, with addition of spices, salt and sugar, however, with no additives (nitrate, nitrite, GDL, or others) or starter culture addition. Microflora that gives its own special
properties to Petrovská klobása sausage occurs and develops hazardously, depending on primary and secondary contamination.

Specific spices added to klobása are red-hot paprika powder and caraway. Basic ingredients (meat and fat) are grinded and thoroughly mixed with salt and spices. Obtained sausage mixture (batter) is filled into natural casings and raw sausages are smoked and dried under environmental (non-hygienic) conditions.

Petrovská klobása is produced in three stages: the first stage is smoking, followed by the fermentation phase and finally by drying. Smoking is performed with cold smoke from a specific kind of wood. Fermentation is provided by inoculation from the raw material or environment during manufacturing and drying of the klobása under the climatic condition. The combination of these stages is known as the ripening period, which usually lasts for not less than 120 days, depending on the climatic conditions. In village households, this sausage is made at the end of November and during December, when temperatures are around 0°C or lower. The main physical and chemical changes take place during the ripening period, and the desired sensory quality attributes of klobása (colour, flavour and texture) are mainly developed in this period. At the end of ripening Petrovská klobása is characterised by specific savoury taste, aromatic and spicy flavour, dark red colour and hard consistency.

Sensory analysis is a widely used method used for testing sensory properties of food products. In this study, the criterion demanded was that the industrial way of sausage production, with controlled conditions, should either maintain or improve the sensory characteristics of the traditional dry fermented sausage - Petrovská klobása.

The aim of this work was to determine sensory properties (appearance, cross section quality, colour, flavour, texture and juiciness) of Petrovská klobása produced in the traditional way, according to original recipe, with the ripening period in naturally ventilated room under climatic conditions and, alternatively, in a ripening chamber under controlled conditions (temperature, relative humidity and air velocity) within a hygienic environment in an industrial plant.

MATERIAL AND METHOD

Dry fermented sausages (Petrovská klobása) were manufactured in the traditional way in a rural household. The sausage formulation included 80% lean pork and 20% pork fat tissue. Other ingredients added per kg of pork meat and fat were: red hot paprika powder, salt, garlic, caraway and sugar. The meat and fat were minced in a meat mincer to about 10 mm. After that, spices were added and mixed with minced meat and fat. Thus prepared sausage mixture was manually filled into natural casing, from the cleaned large intestines (colon) of pigs, of 35–45 cm length. Duplicate batches (T and I) were prepared and both were rested for 24h at 0-4°C. After the resting day, sausages were placed in smoking/drying chambers.

Smoking, drying and ripening of the first batch (samples T) took place in the household. Sausages were smoked for 10 days (with pauses) in a traditional way with specific kinds of wood. After smoking, sausages were placed in naturally ventilated storerooms for further drying and ripening until approximately 90th day of processing.

Samples from the second batch (I) were placed in an industrial type of smoking/drying chamber. Sausages were cold smoked for 6 hours during 3 days. Drying and ripening were under controlled (industrial) conditions of temperature, relative humidity and air velocity.

When the moisture content in all the analysed samples came down under 35% (according to Serbian legislation quality requirements for dry fermented sausages, 2004) the products were vacuum packaged in order to prevent further drying. Sausages T were packaged after 90 days, and sausages I after 45 days of processing.

Samples for the sensory evaluation from group T were taken on 30, 60, 90 and 120th day, and from groups I on 30, 45, 90 and 120th day of processing.

Sensory evaluation of Petrovská klobása was performed by a panel consisting of 7 trained members of different age, with previous experience in consuming traditionally fermented sausages. Evaluations were performed according to a point system of analytical descriptive test, using scale from 1 to 5, with sensitivity threshold of 0.25 points. Panellist were served with a section of sausage, about 25 cm long cut across its axis, and asked to evaluate the appearance according to the following scale:

Appearance: 5 = excellent, well stuffed, smooth and dry surface, red colour, visible meat and fat particles of similar size, 1 = unacceptable, separated casings, too wrinkled surface, other defects.

Sausages were cut into 3 mm thick slices and served to the panelists who were asked to evaluate cross section quality, colour on the cut surface, flavour (odour and taste), and texture and juiciness according to the following scales: Cross section quality: 5 = excellent, visible meat and fat particles, uniform size of fat particles, no cavities, clear cutting surface, without sinews and gristles, 1 = unacceptable, melting of fat during cutting, no clear surface, intensive discoloration.

Colour: 5 = uniform in dark red colour, without coloration of fat particles, 1 = dark brown colour, intensive discoloration, visible external dark ring, light red internal ring.

Flavour: 5 = excellent with good seasoning composition (dominated with red hot paprika), not too fatty, salty or acid, 1 = totally unpleasant odour and taste.

Texture and juiciness: 5 = very hard, easy to masticate, very juicy, 1 = very soft or very dry and tough.

Taking into account the above sensory attributes, and factors of significance for each characteristic, the overall sensory quality of sausages was evaluated using the following formula:

Overall sensory quality = 1/20 \((a^2 + b^5 + c^3 + d^7 + e^3)\) (Eq. 1), where a, b, c, d and e are the scores given by the panelist for appearance, cross section quality, colour, flavour, texture and juiciness, respectively.

Statistical analysis. All data are presented as mean values. The results were evaluated statistically using the analysis of variance and Duncan's multiple range test in the Statistical Analysis System (SAS, 1991).

RESULTS AND DISCUSSION

Sensory properties of sausages T and I were followed during the ripening period, and statistical analysis was performed to determine the effect of time and conditions of ripening on the sensory properties, and overall sensory quality of Petrovská klobása. Sensory evaluations of subjected sausages are presented in Table 1.

From the very beginning of the sensory evaluation of the processed sausages (after 30 days of ripening) the external appearance of T sausages was evaluated with high average grade (4.5). At the same time the appearance of the sausages I scored only 3.74, which is 75% of maximal quality. The favourable external appearance (score 4.50) was reached by sausage I after 45 days of processing. As ripening was going further the appearance of both sausages was getting better, and after 90 days T sausages reached maximal quality (score 5). This quality re-
mained the same even after 120 days for the vacuum packed sausages T. The best quality of the appearance was reached by sausages I on 90th day of production, with no significant difference comparing to 120th day. According to the results of statistical analyses, sausages T during the whole period of ripening had significantly better appearance quality than sausages I.

Cross section quality for T and I sausages after 30 days of processing was evaluated with average marks of 4.17 and 4.04, which represent approximately 80% of the maximal quality, respectively. This could be explained by the fact that Petrovská klobása is a slow fermented type of sausage, with no additives, and after 30 days of processing meat and fat particles were not totally banded, particles were easily separated, and some cavities were observed at the cut surface when cutting. Significant increase in cross section quality was observed with ongoing ripening processes due to the decrease in the moisture content and gelation of protein (Bozkurt and Bayram, 2006). The controlled conditions (temperature and relative humidity) in the industrial ripening chamber led to faster drying, so sausages I reached very good quality (4.5) of cross section after 45 days. After 60 days cross section quality improved significantly. Sausages I reached excellent quality of cross section after 90 and 120 days. Sausages T achieved excellent cross section quality after 60 days, and it remained at same high level until the day 120.

The colour on the cutting of the sausages on the day 30th was light orange-red, dominantly from the colour of red-hot paprika powder. Colour scores increased (P < 0.05) from 4.13 after 30 days to 5.00 after 60 days for sausages T, and from 3.90 after 30 days to 4.50 after 45 days for sausages I. During ripening significant improvement (P < 0.05) in colour was obtained for both types of sausages. Sausages T and I reached the maximal quality after 60 and 90 days of ripening, respectively, and the quality remained the same till the end of the research (120 days), with no significant differences (P > 0.05).

The desired Petrovská klobása flavour would be obtained from fermentation and drying, so after 30 days the flavour was not developed and it was characterized by low marks for both sausages 3.5 and 3.74 for T and I, respectively. Scores for flavour estimated after 45 and 60 days were statistically lower than on the day 90 (P < 0.05). The optimal flavour for both sausages was evaluated after 90 days of processing, and the scores (4.95 for T, and 4.91 for I sausages) were slightly lower than maximal. At the end of ripening Petrovská klobása was characterised by aromatic and spicy-hot flavour. After 120 days the flavour quality of sausages T did not change significantly (P > 0.05); on the contrary, the flavour of sausages I was statistically worse on the day 120, compared to the day 90.

<table>
<thead>
<tr>
<th>Ripening day</th>
<th>Sausage</th>
<th>Appearance</th>
<th>Cross section quality</th>
<th>Colour on the cut surface</th>
<th>Flavour</th>
<th>Texture and juiciness</th>
</tr>
</thead>
<tbody>
<tr>
<td>30th</td>
<td>T</td>
<td>4.50ab</td>
<td>4.17ab</td>
<td>4.13ab</td>
<td>3.50a</td>
<td>3.63a</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>3.74b</td>
<td>4.04b</td>
<td>3.90b</td>
<td>3.74b</td>
<td>4.17b</td>
</tr>
<tr>
<td>45th</td>
<td>I</td>
<td>4.50ab</td>
<td>4.50</td>
<td>4.50</td>
<td>4.48b</td>
<td>4.47b</td>
</tr>
<tr>
<td>60th</td>
<td>T</td>
<td>4.67ab</td>
<td>4.97a</td>
<td>5.00</td>
<td>4.71b</td>
<td>4.92b</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>4.78ab</td>
<td>4.93a</td>
<td>5.00</td>
<td>4.95b</td>
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<tr>
<td>90th</td>
<td>T</td>
<td>5.00a</td>
<td>5.00</td>
<td>5.00</td>
<td>4.95b</td>
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<td>4.93a</td>
<td>4.97b</td>
<td>4.91b</td>
<td>5.00b</td>
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<tr>
<td>120th</td>
<td>T</td>
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<td>5.00</td>
<td>5.00</td>
<td>4.96b</td>
<td>4.86b</td>
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<td>4.80</td>
<td>4.92a</td>
<td>4.62b</td>
<td>4.82b</td>
</tr>
</tbody>
</table>

**Table 1. Average scores for evaluated sensory properties of sausages T (traditional processing) and I (industrial processing)**

As it can be seen on the Fig. 1 the overall quality of sausages T and I after 30 days of processing was not satisfactory – it was lower than score 4, which is lower than 80% of quality. During ripening significant improvement (P < 0.05) in the overall quality was obtained for both types of sausages. Owing to faster drying, industrial processed sausages (I) reached the defined (national legislation) content of moisture (<35%) after 45 days of processing and at that moment the overall sensory quality of sausages I was on average 4.5. Sausages T even after 60 days did not reach the required moisture content, but was characterised by significantly (P < 0.05) higher scores (4.84, statistical second best) for the overall sensory quality than sausage I on the day 45. On the day 90 both sausages had very high overall sensory quality, on average 4.98 and 4.92 for sausages T and I, respectively, with no statistical differences (P > 0.05). Having in mind that Petrovská klobása sausage is a slow fermenting product characterised by low salt content and absence of additives or supplements which enable shorter periods of drying and ripening, i.e. faster formation of colour, faster binding and firming, there was no chance that the best overall sensory quality would be evaluated until the day 90. The overall sensory quality of sausages T also remained very high after 120 days (P > 0.05), but the quality of sausages I decreased significantly (P < 0.05) on the day 120, compared to the day 90.

**CONCLUSION**

The overall sensory quality of traditional dry fermented sausage Petrovská klobása improved during the ripening period, both ripened in the traditional (T) and industrial (I) way. Sausages of the group T reached the best and optimal overall sensory quality when the drying process was finished (after 90 days). On the other hand, sausages of the group I had the best overall sensory quality after 45 days packed in vacuum, i.e. on 90th day of production.

Results of this research indicate that parameters of drying process in the industrial production should be changed in order...
to produce traditional dry fermented sausage during winter, with the same specific sensory properties compared to the traditional production.

ACKNOWLEDGMENT: This study was supported by the Ministry of Science and Technological Development of the Republic of Serbia, Project No. TR20037.

REFERENCES


Received: 18.06.2010. Accepted: 25.08.2010.