EFFECT OF STARTER CULTURE ADDITION ON FATTY ACID PROFILE, OXIDATIVE AND SENSORY STABILITY OF TRADITIONAL FERMENTED SAUSAGE (PETROVSKÁ KLOBÁŠA)

Branislav V. Šojić1*, Natalija R. Džinić1, Vladimir M. Tomović1, Predrag M. Ikonić2, Marija R. Jokanović1, Snežana Ž. Kravić1, Tatjana A. Tasić2 and Snežana B. Škaljac1

1 University of Novi Sad, Faculty of Technology, Bulevar Cara Lazara 1, 21000 Novi Sad, Serbia
2 University of Novi Sad, Institute of Food Technology, Bulevar Cara Lazara 1, 21000 Novi Sad, Serbia

This work is concerned with the oxidative stability and sensory characteristics of traditional fermented sausage Petrovská klobása, produced with the addition of commercial starter culture (SC). Fatty acids profile, thio-barbituric acid-reactive substance (TBARS) values and sensory properties of odor and taste have been determined at the end of drying and after 2 and 5 months of storage. The sum of saturated, unsaturated and poly-unsaturated fatty acids was not significantly different (P>0.05) in SC and control sausage at the end of storage. After 5 months of storage TBARS value of SC sausage amounted to 0.57 mg MDA/kg, and it was significantly lower (P<0.05) compared to control (0.84 mg MDA/kg). Also, sensory properties of odor and taste of SC sausage (3.66) were better in comparison to control (3.55). This study demonstrated that the addition of starter culture can hinder lipid oxidation and contribute to the preservation of desirable sensory characteristics of fermented sausages during a long storage period.

KEY WORDS: traditional sausage, starter cultures, lipid oxidation

INTRODUCTION

Petrovská klobása is a traditional fermented sausage produced in small-scale facilities in the municipality of Bački Petrovac (Republic of Serbia). This sausage has been produced during winter period for a long time by a traditional technique without the use of nitrate/nitrite, glucono-delta-lactone (GDL) and bacterial starters. Because of its specific and recognizable texture, color and aroma, Petrovská klobása has been protected as designation of origin at the national level, by the Serbian law (1-3).

Fermented sausages can undergo different chemical, sensory and microbiological deteriorations. The cause of this might be variability of the quality of used ingredients (meat, spices) and different processing and storage conditions. The most common chemical deterioration is lipid oxidation (2,4). One way to slow down the oxidation of lipids is the use of starter cultures. Bacterial starter cultures (Lactic acid bacteria - LAB and

* Corresponding author: Branislav V. Šojić, University of Novi Sad, Faculty of Technology, Bulevar Cara Lazara 1, 21000 Novi Sad, Serbia, e-mail: bsojic@gmail.com
Coagulase Negative Staphylococci (CNS) are widely used to accelerate the process of fermentation and ripening, as well as to improve the quality and safety of the final product (5-7). The protective effect of LAB starter cultures is in relation to pathogenic, as well as to spoilage bacteria through the antimicrobial properties of their metabolites (8-10). CNS participates in the development of red color and oxidative stability of final product. Hence, catalase and superoxide dismutase activities of CNS promote degradation of hydrogen peroxide and prevent lipid oxidation (6,11).

Small-scale production of Petrovská klobása is currently being transferred to industrial, and the main task is preservation of products quality in different stages of production, storage and distribution. Thus, the aim of this research was to investigate the effects of commercial starter culture addition on oxidative and sensory stability of fermented sausage (Petrovská klobása) during storage period. The results of this research can be of use to manufacturers of Petrovská klobása, as well as manufactures of similar traditional products of the type of fermented sausage.

EXPERIMENTAL

Sausage preparation

The batter for sausages was made according to a recipe described by Šojić et al. (2). Half of the obtained batter was inoculated with 0.015% of commercial starter culture (Quick-starter, Lay, Germany) which contained equal percentages of Lactobacillus sakei, Pediococcus pentosaceus, Staphylococcus carnosus and Staphylococcus xylosus (SC group). The other half of batter was assigned as control. Both groups of sausages were subjected to ripening process in an industrial room (average temperature, t=11.1 ± 4.58°C; average relative air humidity, rH = 76.1 ± 8.48%) for 2 months. After the ripening process, sausages were stored in the industrial room (t=10°C and rH=75%) for five months.

Methods

Fatty acid profile determination. Extraction of lipids was performed by the method of Folch et al. (12). The fatty acid composition was determined by gas chromatography, as described by Šojić et al. (2). Fatty acids methyl esters were quantified as percentage of total methyl esters.

TBARS determination. TBARS (2-thiobarbituric acid reactive substances) test was performed using the method of Bostoglou et al. (13). TBARS values were expressed as milligrams of malondialdehyde per kilogram of sample.

Sensory evaluation of odor and taste. Sensory evaluation was performed by 7 trained panelist, according to quantitative descriptive analysis (QDA), using a scale from 0 (visible mechanical or microbiological contamination, atypical product) to 5 (extraordinary, typical and optimal quality), with a sensitivity threshold of 0.25 points (4).

Statistical analysis. Statistical analysis was carried out using STATISTICA 12.0 (StatSoft, Inc., Tulsa, OK, USA). All data were presented as mean value with their stan-
RESULTS AND DISCUSSION

Table 1 shows the fatty acid profile of the control and SC sausages after drying and after 2 and 5 months of storage. The addition of SC did not affect on fatty acid profile. Namely, at the end of drying and after 2 and 5 months of storage ΣSFA, ΣUFA and ΣPUFA were not significantly different for both tested sausages (P>0.05). In the sum of fatty acids, oleic acid (C18:1) content was the highest. During storage, the oleic acid content significantly decreased (P<0.05) for both groups of sausages. Decreasing content of oleic acid in fermented sausages was also reported by Ansonera and Astiasarán (14). Polyunsaturated fatty acids are very reactive and oxidize easily (15). During the storage period, both in SC and control sausages a downward trend of linoleic and linolenic acid (C18:3) contents was observed. This is likely due to oxidative changes. Similar results were also reported by Ansonera and Astiasarán (14) and Krkić et al. (16).

The thiobarbituric acid test (TBARS) is widely used to evaluate secondary lipid oxidation products in meat and meat products. TBARS values in sausages during storage are shown in Figure 1. At the end of drying, the TBARS values ranged from 0.21 mg MDA/kg (control) to 0.26 mg MDA/kg (SC). These values are in good correlation with the literature data registered in similar meat products (14, 15, 17).

During storage, there was an increase in TBARS values for both examined groups of sausages, probably as a result of lipid oxidation (18). After 5 months of storage, TBARS value in the SC samples amounted to 0.57 mg, and was significantly (P<0.05) lower,

<table>
<thead>
<tr>
<th>Fatty acid</th>
<th>End of drying</th>
<th>2 months of storage</th>
<th>5 months of storage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>SC</td>
<td>Control</td>
</tr>
<tr>
<td>C14:0</td>
<td>0.80±0.04</td>
<td>0.86±0.03</td>
<td>1.00±0.03</td>
</tr>
<tr>
<td>C16:0</td>
<td>18.50±0.41</td>
<td>19.00±0.45</td>
<td>20.07±0.53</td>
</tr>
<tr>
<td>C17:0</td>
<td>0.11±0.01</td>
<td>0.16±0.01</td>
<td>0.16±0.04</td>
</tr>
<tr>
<td>C18:0</td>
<td>11.30±0.01b</td>
<td>10.60±0.03</td>
<td>10.57±0.10</td>
</tr>
<tr>
<td>C16:1</td>
<td>2.48±0.04</td>
<td>2.19±0.06</td>
<td>2.59±0.03</td>
</tr>
<tr>
<td>C17:1</td>
<td>0.14±0.01</td>
<td>0.23±0.03</td>
<td>0.19±0.05</td>
</tr>
<tr>
<td>C18:1</td>
<td>44.42±0.19</td>
<td>44.65±0.18</td>
<td>43.96±0.13</td>
</tr>
<tr>
<td>C20:1</td>
<td>2.16±0.04</td>
<td>1.99±0.00</td>
<td>1.99±0.02</td>
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<tr>
<td>C18:2</td>
<td>18.55±0.27a</td>
<td>18.76±0.12</td>
<td>17.77±0.08</td>
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<tr>
<td>C18:3</td>
<td>1.48±0.01</td>
<td>1.55±0.02</td>
<td>1.70±0.30</td>
</tr>
<tr>
<td>Σ SFA</td>
<td>30.71±0.35</td>
<td>30.61±0.52</td>
<td>31.79±0.50</td>
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<tr>
<td>Σ UFA</td>
<td>69.23±0.31a</td>
<td>69.35±0.51a</td>
<td>68.18±0.05</td>
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<tr>
<td>Σ PUFA</td>
<td>20.03±0.28</td>
<td>20.30±0.10</td>
<td>19.47±0.38</td>
</tr>
</tbody>
</table>

*a,b,c* The values of the same row significantly differ with 95% probability (P<0.05); SC – sausages produced with the addition of commercial starter culture
compared to the value measured for control (0.84 mg MDA/kg). The reducing lipid oxidation in fermented sausages could be attributed to the antioxidative activity of CNS (11).

Figure 1. TBARS values in traditional sausage *Petrovská klobása*
Different letters abcd mark significantly different means with 95 % probability (P<0.05); SC – sausages produced with the addition of commercial starter culture

Sensory evaluation of odor and taste of sausages during storage is shown in Figure 2. During two months of storage, no significant difference was observed between two examined groups of sausages (P>0.05).

After five months of storage, the score for odor and taste for SC sausage was 3.66, and it was higher (P<0.05) than the score for control (3.55). This result is in negative correlation with the TBARS values in SC and control sausage after 5 months of storage. Similar results were reported by Krkić et al. (16).

Figure 2. Sensory properties of odor and taste of traditional sausage *Petrovská klobása*
Different letters abc mark significantly different means with 95 % probability (P<0.05); SC – sausages produced with the addition of commercial starter culture
CONCLUSION

The addition of the commercial starter culture led to a lower lipid oxidation and improvement of the sensory properties of traditional fermented sausage Petrovská klobása during a long storage period (five months).

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REFERENCES


сеци чувања. Сума засићених, незасићених и полинезасићених масних киселина није била статистички значајно (P>0,05) различита у кобасици SC групе у поређењу са кобасицом контролне групе на крају периода чувања. Након 5 месеци чувања TBARS вредност кобасице SC групе износила је 0,57мг MDA/кг и била је статистички значајно (P>0,05) мања у поређењу са контролом (0,84 мг MDA/кг). Такође, сензорска својства мириса и укуса кобасице SC групе (3,66) била су боља у поређењу са контролом. Ова студија указује да додатак стартер културе доводи до смањења оксидације липида и очувања сензорских својстава мириса и укуса традиционалне ферментисане кобасице (Petrovská klobása) током дужег времена складиштења.

Кључне речи: традиционална кобасица, стартер култура, оксидација липида

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