



Section 3. Food processing industry

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EFFECTS OF DIFFERENT STARTER CULTURES ON THE SENSORY CHARACTERISTICS OF BULGARIAN RAW-DRIED MEAT PRODUCT

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Abstract

The microorganisms used for the biotechnology of the fermented meat products are very diverse but their roles are clearly defined for the different stages of the technological process, thus contributing to the end product's specificity. The study presents the evaluation of the sensorial characteristics of the Strandzhansko djado, products to which starter cultures were added. The method used was the point-scale method, values between 0 and 5 were attributed to each characteristic, according to STAS11061–88 and comparing them to samples with no starter culture addition. The sensorial analysis was made by a commission of 5 specialists on products declared as finite.

Keywords: raw-dried meat products, microorganism starter cultures, sensorial characteristics

Introduction

The starter cultures used in the composition of raw salami are usually lactic bacteria (lactobacilli, pediococci, streptococci, micrococci), moulds and rarely sediments/yeast, used for the controlling of the fermentation process, resulting in an even product that is safe for the consumer. Their addition is made in order to:

- direct some biochemical processes by which a certain degree of innocuousness is guaranteed for the product, thus negatively influencing the development of pathogenic and alteration

microorganisms and by inhibiting the formation of some toxic substances (biogenic amines and carcinogenic nitrozamines);

- guarantee some sensorial characteristics: flavor, color, consistence (Mottram, D. S., 1998; Olesen, P. T., Meyer, A. S., Stahnke, L., 2004).

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Depending on the main action undertaken, starter cultures can be categorized as follows: acidic cultures, cultures that lead to the formation of color and flavor, cultures for surface covering, cultures for bio-protection (Leroy, F., Verluyten J., Vuyst L., 2006; Patarata, L., Judas, I., Silva, J. A., Esteves, A., Martins, C., 2008; Pennacchia, C., D. Ercolini, G. Blaiotta, O. Pepe, G., 2004). For the present study we used cultures from the first two categories: acidic cultures made up of lactobacilli and pediococi, the *Lactobacillus*, *Pediococcus* types. Cultures leading to color and flavor formation: consisting of the *Staphylococcus type*.

The ripening-drying process at 25 °C and the addition of nitrites, nitrates and NaCl, individually or combined, inhibit the developing of the *Salmonella* and *Clostridium* (*Clostridium botulinum*) bacteria. The water activity reduction from 0.96 to 0.86 during this process also leads to the product's stabilization, by controlling the development of unwanted bacteria such as *Clostridium* and *Staphylococcus aureus*. In the case of the salami with long-term ripening and drying processes, the probability that these products contain enterohemorrhagic *Escherichia coli* is smaller than for the products with a short-

lived ripening-drying process, because the water activity reduction has a lethal effect on these bacteria (Holzapfel, W. H., Haberer P., Geisen R., Bjorkroth J., Schillinger U., 2001; Lücke, F. K., 2000; Pennacchia, C., D. Ercolini, G. Blaiotta, O. Pepe, G., 2004).

Experiment

In order to make the determinations we produced bulks (2–3 kg/bulk) of raw-dried Strandzhansko djado, the composition's fermentation being made by means of three starter culture types, which are displayed in table 1. The starter cultures available on the market at the moment assure the addition of some quality-adequate microorganisms and in sufficient quantity in order to develop the wanted fermentation. During the fermentation process a drop of the pH value occurs as a result of sugar conversion into lactic acid. Thus a gradual degradation of the pathogenic flora and unwanted microorganisms takes place. The acid medium also contributes to the nitrite's rapid reduction, which is initially added for the stability of the finite product's red color.

The sausage formulations were made from basic components and adequate ingredients for 100 kg composition, displayed in table 2.

Table 1. The starter culture types

Bulk	Name of culture	Microorga-nisms/Culture	Use for 100g/kg
SD1	Baktoferment 61	<i>S.carnosus</i>	50
SD2	Rowu-Ferm	<i>S.carnosus</i> <i>L.plantarum</i>	60
SD3	Biobak Sal Plus	<i>L.plantarum</i> <i>P.acidilactici</i>	50

The diagram of technological processing of Strandzhansko djado shows the following

stages: cooling, leaving in the drying, airing, drying and ripening.

Table 2. The raw-dried sausage formulations' components (Strandzhansko djado)

Component/ ingredient	Quantity, kg			
	SD1	SD2	SD3	Witness
Pork- Quality I:	70	70	70	70
Partially fatty pork	30	30	30	30
Salt	3.000	3.000	3.000	3.000
Nitrite	0.015	0.015	0.015	0.015
Savory	0.400	0.400	0.400	0.400
Red pepper	1.000	1.000	1.000	1.000

Component/ ingredient	Quantity, kg			Witness
	SD1	SD2	SD3	
Chilli	0.150	0.150	0.150	0.150
Sugar	0.200	0.200	0.200	0.200
Starter culture	+	+	+	–

Results and discussion

The evaluation of sensorial characteristics in Strandzhansko djado was made by using the hedonic scale with a starter culture addition of *Staphylococcus carnosus* (SD1), *Staphylococcus carnosus* combined with *Lactobacillus plantarum* (SD2) or *Lactobacillus plantarum* associated with *Pediococcus acidilactici* (SD3). This in turn was compared to samples with no starter culture addition.

The sensorial analysis was made by an expert commission (consisting of 5 experts: 2 veterinary surgeons and 3 food industry specialists) on products declared finite, by using a five-point scale for every palatable sensorial indicator of raw-dried sausages, flavor, smell, color, consistency and general aspect. The statistic data obtained for each qualitative attribute are shown in table 3.

Table 3. The medium average of the analysed bulks

Bulk Sausages	Shape and aspect	Color	Consistency	Smell	Flavor
SD Witness	3.8	3.8	3.6	3.8	3.8
SD1	4.4	4.8	4.4	4.8	4.8
SD2	4.4	4.4	4.6	4.6	4.6
SD3	4.4	4.0	4.6	4.2	4.2

The exterior aspect of the Strandzhansko djado was characterized by specific shape typical for products, even, with a clean surface, with no air holes or excessive fat or water content at the products' edges. The cover was adherent to the composition for each product.

On cutting the witness sausage sample recurrent fat amounts and small air holes were noticed, which led to its being ranked at an average 3.8 points.

The color of the Strandzhansko djado with starter culture addition developed much faster and was more intense than that of the samples with no starter culture addition. The strong and fast acidification of fermented sausages compositions accelerated the chemical reactions as well as the biochemical reactions for the degradation of the nitrite added into NO, a product involved in the making of the pink-reddish color by forming the nitrozo-myoglobin components. For the Strandzhansko djado with a *Staphylococcus carnosus* (SD1) addition the group of experts noticed the development of a more pleasant color and the products received the highest score (4.8 points). It is also possible that the bulks with an ad-

dition of *Staphylococcus carnosus* combined with *Lactobacillus plantarum* or *Lactobacillus plantarum* associated with *Pediococcus acidilactici* as a result of strong acidification, rapid drop of the pH level (below 5.6). The nitrite must be converted in high proportions into NO and a part of this reactive product must disappear from the complex matrix of the products obtained by means of volatilization and the salami's color must be pale red. With a pH value under 5.2 the NO formation is virtually inhibited (Demeyer, D. I., and L., 2002; Leroy, F., Verluyten J., Vuyst L., 2006). The color's development for all experimental bulks had a positive correlation with lactic acid accumulation in the sausage matrix and with the pH drop, the bacteria growth and the nitrite's disappearance from the system. Basically, the color formation took place during the initial production stages i.e. fermentation and smoking, when the medium conditions were favorable to the development of chemical and biochemical reactions that are involved in the meat pigments' conversion into salt pigments.

For the color formation in the Strandzhansko djado witness sausages, only

the following were used: the enzymatic meat equipment and the one secreted from the microflora of the raw-dry salami components prone to spontaneous contamination. The microflora consists of lactic acid bacteria, micrococci, staphylococci, pediococci, yeast, enterobacteria and other microorganisms.

The consistency – the main physical-chemical change that occurs during the ripening process of the raw salami and sausages is the composition's tying up i.e. the raw formula's transformation into a bound, form, elastic structure, typical for a finite product. To the restructuring of the raw-dry salami and sausage components the following contributed: the formula's acidification, salt concentration, water evaporation, especially throughout the last drying phase.

The texture characteristics of the Strandzhan-sko djado were conditioned by the presence of the starter culture product matrix and their nature. The texture had a better development as a result of the addition of starter cultures with a great acidification capacity such as *Lactobacillus plantarum* and *Pediococcus acidilactici*. The averages for the consistency indicator were the highest in the case of all bulks where these starter cultures were included in the formulations (4.6 points). The samples for both product types had a lower consistency compared to those with a starter culture addition (3.6 points for the Strandzhansko djado, reference sample). The development of the texture in the salami and sausages had a positive correlation with the multiplying of the acidolactic bacteria, the formula's acidification, with the salt concentration growth in the medium, with product's humidity drop and concentration of some substances (pro-

teins and lipids). The obtained average on sensorial consistency testing are tantamount to the results obtained by appreciation of the texture formation by calculating the protein/water coefficients and the protein/(water+fat). These coefficients evolved positively as the products ripened and dried. The sausage firmness growth and the improvement the slicing capacity had progressed throughout the entire fabrication process but differently, all depending on the starter culture used.

Flavor and Smell – the chemical and biochemical changes, that occur during the ripening phase of the fermented and dry salami, which determine the development of the flavor and smell in finite products, refer to the composites' acidification determined by the glucid's turning into lactic acid by lactic bacteria and the nitrite's reduction to NO by micrococcus, as well as the change of most of components (protein, lipids).

The micro-organisms' development in salami combined with the endogenous enzyme activity are responsible for the development of an important number of aroma components and for sapidity.

Salt, added to the initial composition contributes largely to the raw-dry sausage aroma. This ingredient's level rose progressively, most notably during last stage of drying and ripening while the water was evaporated.

According to our results the Strandzhansko djado with a starter culture addition had an equally general acceptability degree (4.4 points), superior to the witness sample (3.8 points). The final score set on the basis of the total medium score, is compared to a scale from 0 to 20 points, displayed in table 4.

Table 4. Qualitative attribute by the medium total average

Experimental Bulk Sausages	The medium total average	Qualitative attribute
SD Witness	16.03	Good
SD1	18.68	Very good
SD2	18.12	Very good
SD3	17.24	Good

The Strandzhansko djado with a starter culture addition had modified flavor profiles compared to the samples. The Strandzhansko djado bulk with a *Staphylococcus carno-*

sus starter culture addition (4.8 points for both indicators) with a slightly picante flavor was the most appreciated from the taste and flavor viewpoints. This is followed by the

Strandzhansko djado with a starter culture addition had modified flavor profiles compared to the samples with a *Staphylococcus carnosus* combined with *Lactobacillus plantarum* (4.6). The combination of *Lactobacillus plantarum* and *Pediococcus acidilactici* (4.2) led to the development of a predominantly acid aroma.

According to the results displayed in table 4, the Strandzhansko djado bulk with a singular starter culture addition or in mixed were qualified on a scale from good to very good, the last one being given to the bulks of raw sausages with *Staphylococcus carnosus* addition and to the bulk with a mixture of *Staphylococcus carnosus* and *Lactobacillus plantarum*.

Conclusion

The analyzed raw-dried salami had a firm and elastic texture, an adequate color for every section, acid aroma and little noticeable ripening smell, typical characteristics for short-term ripening products. An important component for the product's flavor is *the lactic acid*, obtained during the fermentation process. The sensorial analysis confirms the obtaining results of physical-chemical and microbiological analyses during the stages of technological processing of the experimental bulk raw-dried sausages made with starter cultures.

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