

# 12 Changes in some biochemical indices characterizing the technological properties of fermented sausages manufactured using starter cultures

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The enzymatic nature of the ripening processes of fermented meat products, in which the properties of finished products are formed (colour, flavour, and texture), conditions the possibility to intensify their production. Ripening processes can be influenced and accelerated, on the one hand, by adding chemical substances, e.g., GDL, etc. (Gallert, 1973; Liepe, 1972, etc.), and on the other, by the application of microbial cultures of a definite enzymatic activity (Schiefner, 1980; Scharner, 1980; Buyanov, 1980).

An important property of microbial cultures is their capacity to reduce carbohydrates to lactic acid while pH-values drop rapidly, water release is accelerated, and water activity decreases (Frey, 1983; Sippach et al., 1982).

According to Leistner (1973), Puolanne (1977), and Bozhkova and Danchev (1981), fermented meat products manufactured using starter microorganisms demonstrate a fast and stable pigment formation, a specific flavour, and storage stability, with a shortened technological process.

The possibility offered by the application of an additional microflora, to raise the efficiency of production by the guidance of biochemical and microbiological processes, determined the objective of the present work: to follow the effect of a freeze-dried microbial preparation on some biochemical indices characterizing the technological properties of fermented sausages. The following major indices were selected: changes in the levels of the pigment formed, total solids and pH of the product, and levels of residual nitrites, proteins and fats in the finished product.

## Materials and Methods

To guide and accelerate ripening processes in fermented sausages, use was made of a microbial preparation of micrococci and lactobacilli, which were introduced into two experimental fermented sausage products. The preparation was made at the Meat Technology Research Institute, Sofia. In the beginning of the production process, two ripening temperatures were employed, 18°C and 25°C, for 36-48 hours. Then the sausages were allowed to age and dry at 15°C and gradually reduced values of relative air humidity from 95 down to 70%. In this manner, 6 experimental series were manufactured under industrial or semi-industrial conditions. Variants obtained under the same conditions, only without the introduction of a starter preparation, were used as controls.

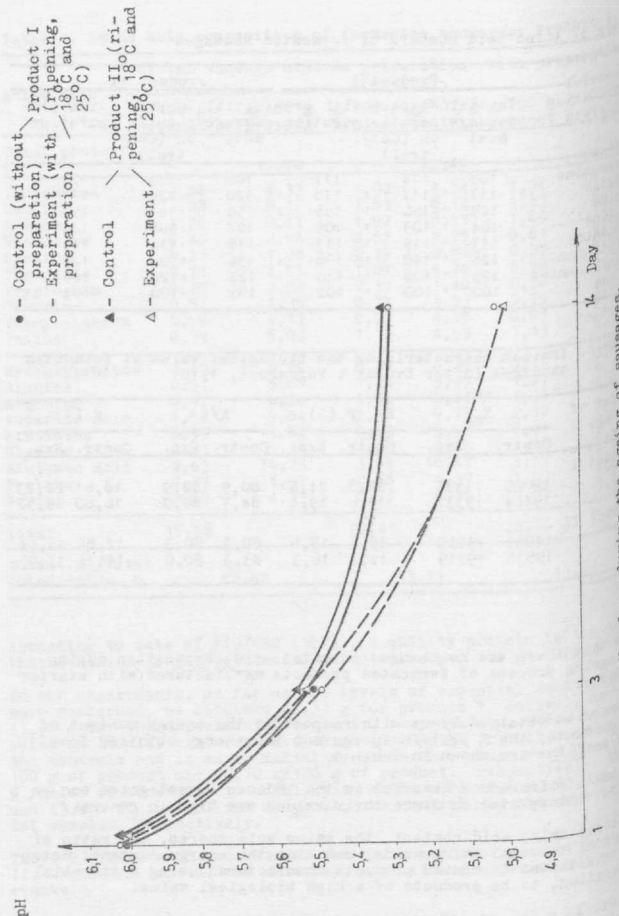


FIG. 1. Changes in the pH-values during the ageing of sausages.

Drying lasted for 14 to 21 days, the finished state of the product being judged by its water content, for which the standard range is 40-42%, by the colour formation, the binding between meat particles (cutting ability) and by the sensory characteristics. The following indices were followed in dynamics in the ripening sausages: level of pigment formed, in terms of % total pigment converted into nitrosomyoglobin, by the method of Mirna and Schütz (1972); nitrate and nitrite contents by the accepted international standard ISO/DIS 2918.2.1974; total solids, by Bulgarian State Standard (BDS) 5712-74; pH, using a Radiometer pH-meter; total fat content, by Soxhlet's method in accordance with BDS 8549-74; protein content by Kjeldahl's method, in accordance with BDS 9374-74.

## Results and Discussion

Changes in pH during the ripening of the sausages with or without a starter preparation are shown in Figure 1 by pooled graphs. As obvious, in the presence of a preparation, pH decreases, upon which, ripening processes are stimulated, especially colour formation (Winter, 1980), drying is accelerated.

Dehydration processes expressed by changes in water content, are shown graphically in Fig. 2. The curves plotted there demonstrate that drying is accelerated with lower pH values. As obvious, drying is faster during the first week and is then slowed down. Since the technological process is considered completed on reaching a definite percentage of water content (40-42%), with faster drying up, this moment is arrived at earlier. According to this index, the necessary limits are attained on day 7-10 for experimental variants, while a minimum of 14 days is necessary for controls.

Data on total solids in the products during ageing are shown in Table 1.

Table 1. Changes in total solids in fast ripening sausages during ageing (%)

Ageing period, days	Product I			Product II		
	Ripening Temperature			Ripening Temperature		
	Control	Preparation	Preparation	Control	Preparation	Preparation
1	43.9-45.0	43.5-45.5	48.4-50.1	48.0-50.0	47.8-50.1	48.9-50.0
3	46.0-49.1	49.2-51.0	NE**	50.2-53.0	52.5-53.4	NE
7	53.5-56.3	57.7-60.0	NE	57.1-58.9	62.3-63.5	NE
14	56.6-58.0	59.2-63.3	59.3-60.5	62.2-63.4	64.5-66.3	61.7-62.5

\* All data are averages of the results of 6 experimental lots.  
\*\* NE = non-estimated.

Results indicate that the total solids of the products on day 14 reach 56-63% for controls and about 63-66% for the experimental variants, what is in compliance with requirements for this type of product. The higher ripening temperature (25°C) enhances dehydra-

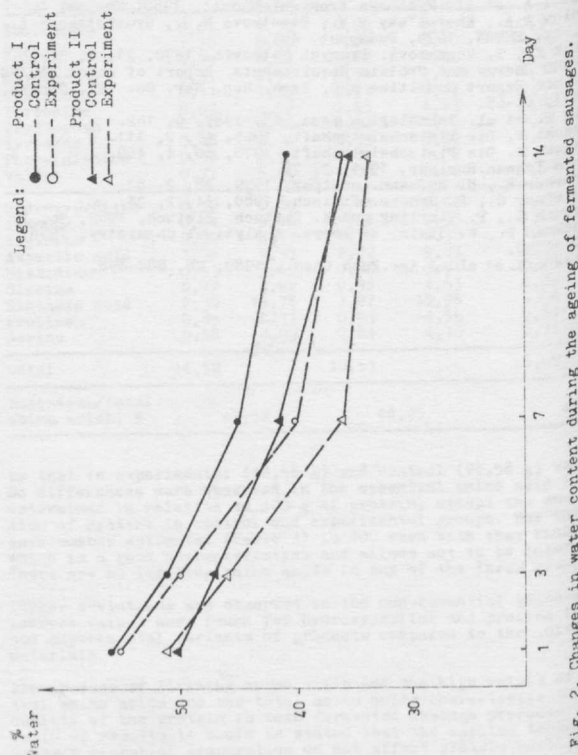


Fig. 2. Changes in water content during the ageing of fermented sausages.

tion. This is in line also with the statements of other authors (Dzhevizov, 1977). Product ripening at 18°C in some of the experiments resulted in obtaining lower total solids than in the controls ripening at 25°C, as can be seen from Table 1.

The dynamics of nitrosopigment formation is shown in Fig. 3. A high level of nitrosomyoglobin is observed already on day 3: 70-72% in the variants with a starter preparation and 60-64% in control variants, with a ripening temperature of 25°C. In the variants ripening at 18°C, analyses were made upon the initiation of the experiments and on day 14. Data indicate that the pigment percentage reached for that period is considerably lower, i.e., nitrosomyoglobin corresponds to 40-42% of total pigment. This is explained by the better development of microbiological processes at the higher ripening temperature (Winter, 1982).

Table 2 shows the summarized results on the changes in nitrate and nitrite contents of fermented sausages during the production process.

Table 2. Changes in nitrate and nitrite contents during the ageing of fermented sausages (mg%)

Variant	Period of ageing (days)			
	1	3	7	14
<b>Nitrate level</b>				
Product I				
Control 25°C	0.28 - 0.30	0.19 - 0.21	0.10 - 0.11	0.09 - 0.10
Experiment 25°C	0.45 - 0.52	0.18 - 0.20	0.10 - 0.10	0.08 - 0.10
Product II				
Control 25°C	0.38 - 0.41	0.27 - 0.30	0.10 - 0.12	0.18 - 0.20
Experiment 25°C	0.47 - 0.51	0.39 - 0.40	0.12 - 0.13	0.11 - 0.11
<b>Nitrite level</b>				
Product I				
Control 25°C	6.10 - 6.20	1.10 - 1.30	0.28 - 0.30	0.18 - 0.20
Experiment 25°C	7.00 - 7.30	1.60 - 1.70	0.30 - 0.31	0.17 - 0.20
Product II				
Control 25°C	7.50 - 7.80	3.00 - 3.05	0.31 - 0.32	0.45 - 0.52
Experiment 25°C	0.78 - 0.82	0.32 - 0.36	0.38 - 0.42	0.18 - 0.20

The results obtained indicate that there are no significant differences in nitrate and nitrite levels among the individual variants. Residues are within the range of standard allowances for the manufacture of fermented sausages.

No reliable changes were found further in the protein contents of the finished products manufactured with or without a starter preparation. On day 14, they varied between 20.90 and 21.50% in all variants. Fat content varied in the range between 40.90 and 43%.

The results obtained indicated that, using a starter preparation

and an initial ripening temperature of 25°C, the ageing process can be accelerated, which is expressed in a better and more stable pigment, an earlier acquisition of the necessary sensory properties, and a faster drying of the fermented sausages, without that acceleration of processes affecting product quality.

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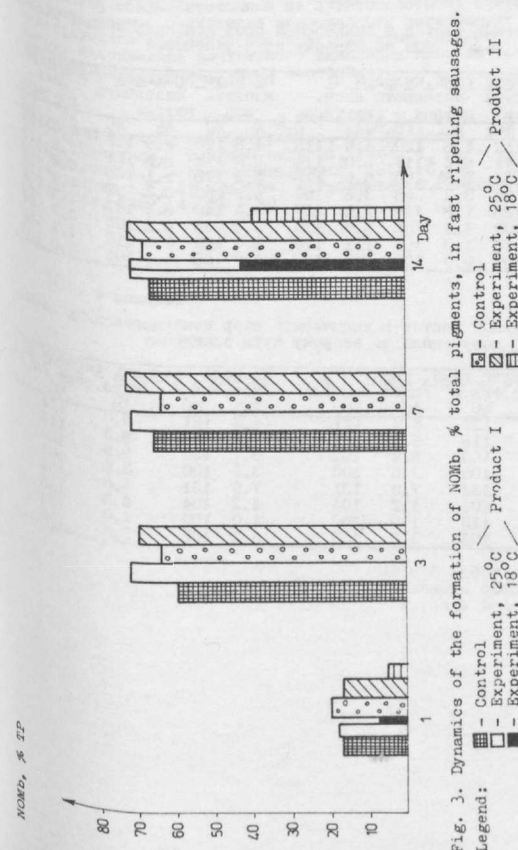


Fig. 3. Dynamics of the formation of NOMB, % total pigments, in fast ripening sausages.

Legend:  
 □ - Control 25°C  
 ▨ - Experiment 25°C  
 ▤ - Control 18°C  
 ■ - Experiment 18°C