THE EFFECT OF STARTER CULTURES ON SENSORY AND PHYSICOCHEMICAL PROPERTIES OF LONG RIPENED DRY SAUSAGE

Dusan Cavoski, Dragojilo Obradovic, Radomir Radovanovic, Marija Perunovic and Tomislav Fridl, Faculty of Agriculture, Institute of Food Technology and Biochemistry, Beograd - Zemun, Yugoslavia

SUMMARY

The effect of strain *Micrococcus M-104* and mixed culture *Streptococcus lactis AK-60* and *Micrococcus M-104* on taste, aroma and physicochemical properties of dry sausages with prolonged ripening time is discussed. The results showed that the sausages produced with mixed culture had a superior sensory properties and lowest weight losses. Sensory properties of sausages produced with single strain culture scored lower grades in comparison with control sausages (without starter culture).

INTRODUCTION

The processing of fermented meat product has been known for a long time ago as one of the natural ways of fermentative preservation. In fact, the use of starter cultures in the processing of long ripened dry sausages, dates some thirty years back, but its strong development has taken place during the last decade, owing to the knowledge that the mentioned microorganisms contribute to the safety of production, reduce the ripening process and improve the organoleptic properties (Lucke and Hechelmann 1987; Leistner 1987). Most of these cultures are actually natural isolates of lactic acid bacteria, micrococci and staphylococci which are able to control the fermentation processes and produce the products of uniform taste, aroma and consistency. Producing the lactic acid, the starter cultures increase the life of meat products. This is achieved through prevention of development of the unwanted microflora and through creation of some other antimicrobic compounds in addition. The role of catalases of the positive cocci is based on the stabilization of colour in the fermented meat products, prevention of rancidity by decomposition of peroxides produced by lactobacilli and improvement of taste and aroma as a consequence of fat degradation (Lucke 1986).

Having in mind above mentioned facts and results obtained by Sutic and Joksimovic (1973), in this work we have set ourselves the task to investigate the effect of the single-strain culture *Micrococcus M-104* and the mixed culture of *Micrococcus M-104* and *Streptococcus lactis AK-60*, on the organoleptic and physicochemical properties of long ripened dry sausages which are a typical for Yugoslavia.

MATERIALS AND METHODS

Dry sausage samples very similar to winter salami were examined. The primary make-up of the sausages included: pork, category A - 60%; beef, category A - 10%; and bacon - 20%. In 100 kg sausage mix were added 2.8 of nitrite salts for curing, 0.1 kg of black pepper and 0.05 kg of garlic. In sausages without the starter culture there was added 1% mix of glucono-delta-lactone, ascorbic acid and dextrose.

During the investigations were used the bacterial cultures of *Streptococcus lactis AK-60* and *Micrococcus M-104* (Sutic and Joksimovic 1973). These cultures were propagated in yeast dextrose broth - YDB (Naylor et al. 1958). The sausages were processed in three different variants. For each variant were used 200 kg of cut primary sausage make-up. Inoculation of the mix was carried out with 24-hour-old broth cultures as follows: variant I - without adding the starter; variant II - with *Micrococcus M-104* (1%); and variant III - with *Micrococcus M-104* and *Streptococcus lactis AK-60* (0.5% + 0.5%).

The yeast dextrose agar (YDA) was used to determine the total plate bacterial count; Rogosa agar was used to determine the lactobacilli (Rogosa et al. 1951); for determination of streptococci was used method from Terzahgi and Sandine (1975); for determination of micrococci was used the plate count agar (PCA) with 10% NaCl.

During the ripening of sausages the following properties were determined as well: pH value, the water content, the peroxide number, the acide number and the weight loss (Karan-Djurdjic 1968).

The dry sausage samples of the bacteriological and chemical analyses were taken after 1, 4, 7, 12, 19, 26, 33, 46, and 60 days of the ripening process.

The organoleptic evaluation of the finished products was conducted by a five-member board. The point rating system ranging from 1 to 5 points was applied. This evaluation included the appearance, appearance of composition and colour at the cut surface area, taste, aroma, and consistency.

RESULTS AND DISCUSSION

The results of the bacteriological analysis are presented on the graphs 1 to 4. After examination of the dynamics of development of the total plate count (Graph 1) it appears that in all the variants the biggest plate count was achieved on the 12th ripening day. Comparing the given sausage variants, it has been established that the biggest plate count occurred with the variant III.

Table 1: Average values of organoleptic evaluation test (point)

	Variants I	II	III
Appearance	3,45	3,15	3,80
Appearance of composition and colour at the cut surface area	3,87	3,50	4,32
Taste	3,70	3,50	4,20
Aroma	3,65	3,40	4,20
Consistency	3,30	3,20	3,90

The dynamics of micrococci growth (Graph 2) shows that in all the sausage variants the biggest plate count appeared on the fourth ripening day, and then afterwards it was slowly decreasing by the end of examination. Comparing the given sausage variants, it has been observed that on the first ripening day the biggest micrococci count occurred in the sausage variant II. However, after that period, and all through the end of the ripening process, a bigger plate count was found in the variant III sausages.

These results are identical with the findings of Sutic and Joksimovic (1973).

The dynamics of development of streptococci (Graph 3) shows that the maximum plate count was achieved on the twelfth ripening day. Among the sausages of the examined variants no bigger differences were found in the total plate count of streptococci after the twelfth ripening day all through the and of the examination.

In all the examined sausage variants the development of lactobacilli was achieved on the seventh ripening day (Graph 4). After this period, the lactobacilli count showed a slow, but permanent decrease all through the and of the experiment. However, when comparing the development of lactobacilli among the given sausage variants, it was found that the biggest count occurred in the sausages with *Micrococcus M-104* culture added (variant II).

The analysis of the pH values during the sausage ripening (Graph 5) show that the lowest pH in all the examined variants occurred after the fourth ripening day. After that period, the pH values gradually increased all through the end of the ripening process. In the sausage variant I (without starter culture), however, the pH value was the lowest during the entire ripening period.

The results obtained after the analysis of the water content (Graph 6) revealed no essential differences among the examined sausage variants. Yet, is should be pointed out that during the ripening periods mentioned, the variant III sausages had a somewhat higher water content than the remaining two.

On the basis of the analysis of the course of the acid number curve (Graph 7), it is apparent that the free fatty acids content was constantly increasing and that it was very high at the end of the experiment. In addition, during the experiment, the variant II sausages always had the biggest acid number.

Such a high acid number during the ripening period of dry sausages, is in accordance with findings of Pfeifer and Gacesa (1971), Korolija and Barna (1972), Zivkovic et al. (1983) and Nagy et al. (1987).

In all the sausage variants, the peroxide number (Graph 8) increased slowly during the ripening process, but at the end it was within the allowed limits. These results are in accordance with the findings of Pfeifer and Gacesa (1971), Zivkovic et al. (1983) and Nagy et al. (1987), but they are contradictory to the findings of Korolija and Barna (1972).

Examining the weight losses of sausages (Graph 9), it can be noticed that the least losses were suffered by the variant III sausages, while the biggest ones were suffered by the variant II sausages. Also, the obtained results show that the weight losses in the tested sausage variants were more intensive up to the 26th ripening day, and then after that period they were decreasing very slowly.

The organoleptic evaluation date (Table 1) show that there are considerable differences in quality between the sausages of variant III and those of the other two variants (I and II). Namely, all the organoleptic properties of the variant III sausages have received significantly higher points. However, the organoleptic properties of the variant II sausages are slightly worse than the variant I sausages (without the starter culture added).

The results of the organoleptic evaluation have proved the former findings of Stuic and Joksimovic (1973) that by application of the mixed culture (*Micrococcus M-104* and *Streptococcus lactis AK-60*) we obtain the sausages of the best taste and aroma.

CONCLUSION

Summarizing the obtained results and observations, it can be concluded that for the processing of the long ripened dry sausages it is possible to use successfully the mixed culture of micrococci and streptococci (*Micrococcus M-140* and *Streptococcus lactis Ak-60*). In this way better organoleptic properties are achieved, and the weight loss of sausages is somewhat lesser than in sausages without the starter culture added. However application of the (*Micrococcus M-104*) only, does not improve the organoleptic properties and in addition, the weight loss of sausages is somewhat higher than with the sausages without the starter culture added.

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