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SECTION

Effect of pH value on the development of consistency of dry sausage

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The acceleration and stabilization of the ripening process of dry sausage has lately been an object of a rather active research work. Two different courses have been followed in the attempts to shorten the manufacturing process: the use of bacterial pure cultures and the use of additives like glucono-delta-lactone (GDL). The use of lactic acid bacteria has been rather common in the USA already since the year 1955 (NIVEN et al., 1955). In Europe micrococci have been used during the same period (NIINIVAARA, 1955). Investigations of the significance of bacterial pure cultures, lactobacilli and micrococci in the first place, have lately been performed by NURMI (1966b). He found out that by using these bacterial cultures it was possible to accelerate essentially the ripening process of dry sausage. Similar results were obtained by using an addition of GDL.

Te development of the proper consistency of dry sausage has genrally been explained to be a result of the evaporation of water whereas the decrease of the pH value has been considered much less significant. However, NURMI (1966b) has shown that both the initial pH value and the rate of the decrease of the pH value are of great importance in regard to the development of the desired consistency and slicing quality. The quantity of the sugar added is of significance in regard to the decrease of the

pH value(ANDERSEN and Ten CATE, 1965; CORETTI and TÄNDLER, 1965). However, in this case the final pH is affected in the first place, not the rate of the decrease of the pH value.

Material and methods.

During the present investigation 10 experimental series of dry sausages were prepared. Each series included three different types of sausages:

1. Control group
2. Lactobacilli + micrococci group
3. GDL (glucono-delta-lactone) group

Each group differed only regarding the additions mentioned. The control and lactobacilli + micrococci groups, however, were prepared by using nitrate and the GDL group by using nitrite. The addition of lactobacilli was done by using a broth culture and the number of lactobacilli added was 1-10 million per gram of sausage mixture. As micrococci addition "Baktofermente" (manufacturer Rudolf Müller & Co, Giessen, W-Germany) was used. The number of micrococci added varied between 5 and 10 million per gram of sausage mixture. The addition of GDL was 0.6-0.75 per cent.

The sausages were ripened in an Autotherm cabinet. The examination of the sausages was done 0, 3, 7, 14 and 21 days after the preparation. A Beckman Zeromatic pH meter was used for the determination of the pH value. The consistency was measured by using a WOLODKEWITSCH (1938 and 1956) apparatus which was developed and made by the Technische Hochschule in Karlsruhe, Germany. In the apparatus a metal spike and a 1 kg spring device were used. The penetration was done uniformly at five different points of a three-centimeter thick slice. Three of these points were 0.5 cm from the edge, one in the center of the slice and one between the center and a point near the edge. First the average of the three readings obtained near the edges of the

slice was calculated, after which the average of this figure and of the two other readings was determined. Beside this measuring the consistency was determined manually in the organoleptic evaluation.

Results

The dependence of the consistency on a rapid decrease of the pH value is shown distinctly by Figure 1. In the control group the decrease of the pH value occurs very slowly and correspondingly the consistency and slicing quality improve slowly. On the other hand, in experimental sausages with a bacterial or GDL addition the pH value is decreasing rapidly and correspondingly the desired consistency is developing distinctly more rapidly than in the sausages of the control group. The decrease of the pH value occurs in the GDL sausages for the most part already about an hour after the addition of this substance. A corresponding decrease occurs in the sausages with a lactobacilli addition during the first two or three days after the preparation. In these groups no significant differences in the consistency were found three days after the preparation. In some cases when the GDL sausages were over 14 days old, they had become somewhat crumbly even though the consistency determined manually and measured objectively was still good.

Discussion

The development of the consistency in the experimental sausages depends very essentially on the rather rapid decrease of the pH value. The development of the desired consistency seemed to depend much less on the evaporation of water than on the changes occurring in the meat proteins during the rapid decrease of the pH value. Therefore, the weight losses in the control and lactobacilli + micrococci group are so similar that no statistically significant differences between these groups could

be found (NURMI 1966b). When some sausages of the control and lactobacilli + micrococci group were compared in a histological examination, it could be found that the muscle fibers in the sausages of the control group had remained more distinctly striated than in the sausages prepared with a lactobacilli + micrococci addition (NURMI, 1967). The crumbliness which was found in some GDL sausages can be due to the changes occurring too rapidly in meat proteins. This was found to be most distinct when the GDL addition was one per cent (NURMI, 1966a). Similar changes were found when lactic acid was added to the sausage mixture. The pH value decreased immediately and the normal consistency was not reached at all (NURMI and NIINIVAARA, 1966).

Preliminary experiments have been made in order to eliminate the disadvantages caused sometimes by a too rapid decrease of the pH value. This was done by combining GDL with lactobacilli and micrococci. When the GDL addition was only 0.4-0.5 per cent, a rapid decrease of the pH value was obtained right from the beginning and this decrease continued due to the activity of bacteria, mainly lactic acid bacteria. The results of these experiments have been promising and there is all reason to continue them.

In a normal industrial manufacturing, too, when the aim is a rapid and controlled production it is very important to follow the changes in the pH value. The age when the sausages are ready for sale seems to depend essentially on the initial pH value (NURMI, 1966b) and also on the decrease of the pH value occurring during the first days after the preparation.

The Wolodkewitsch apparatus used in the present investigation proved to be very suitable for the objective determination of the consistency of dry sausage. It was also found that the organoleptic evaluation performed manually by a trained panel was in a very good correlation with the objective measurement.

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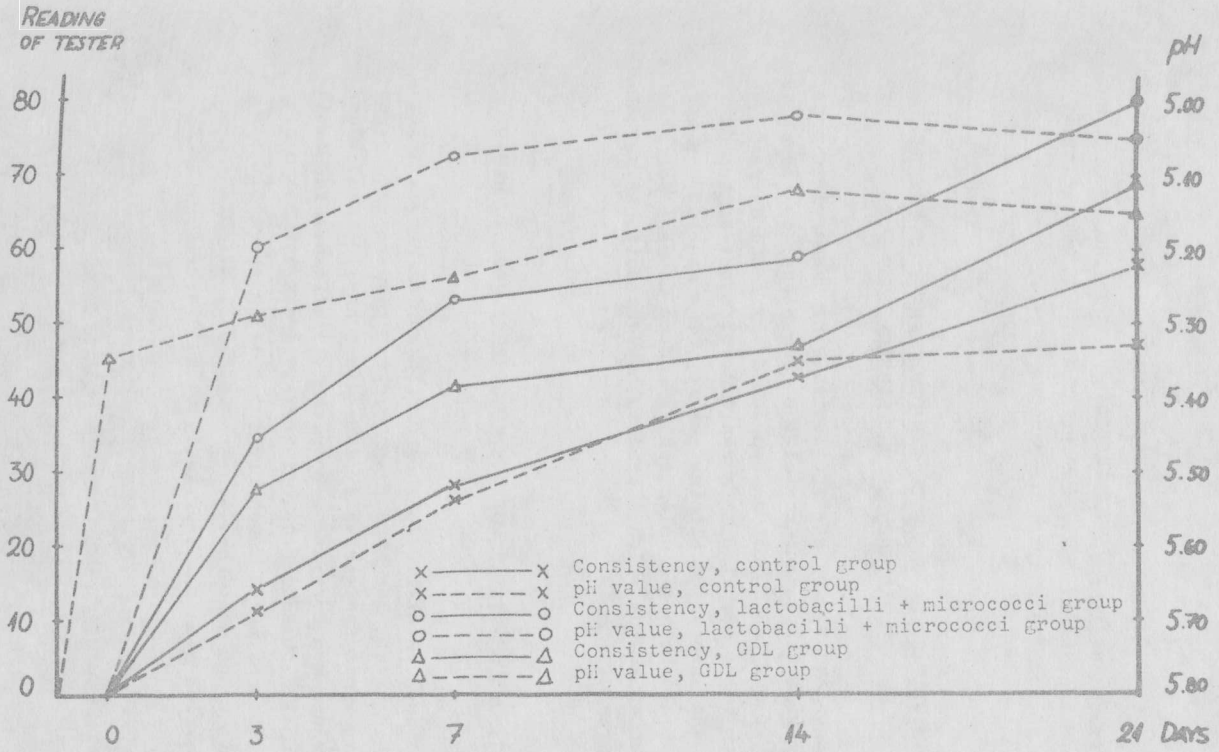

Figure 1. Comparison of relations between consistency and change of pH value in different dry sausage groups.

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EFFECT OF pH VALUE ON THE DEVELOPMENT OF CONSISTENCY OF DRY SAUSAGE.

10 experimental dry sausage series were prepared in order to examine the dependence of the consistency on the pH value. It was found that an appropriately rapid decrease of the pH value resulted in a rapid development of the desired consistency and slicing quality. The consistency was determined both organoleptically and by using a Wolodkewitsch apparatus which proved to be very suitable for this measurement.

EINFLUSS DES pH-WERTES AUF DIE KONSISTENZ VON DAUERWURST

10 experimentelle Rohwurstserien wurden hergestellt, um die Abhängigkeit der Konsistenz von dem pH-Wert zu untersuchen. Es wurde festgestellt, dass die schnelle Entwicklung der erwünschten Konsistenz und Schnittfestigkeit auf geeignet schnelle Absenkung des pH-Wertes zurückzuführen war. Die Konsistenz wurde sowohl organoleptisch beurteilt als auch mit einem Wolodkewitsch-Apparat bestimmt. Dieser Apparat erwies sich als sehr geeignet zu dieser Bestimmung.