USE OF DRIED FERMENTED MEAT IN PRODUCTION OF DRY SAUSAGE

Kathrin Ulmer[1], Ulrich Leutz[2] and Albert Fischer[1]
[1]University of Hohenheim, Institute of Food Technology, Department of Meat Technology, D-70599 Stuttgart, Germany
[2]Ness & Co. GmbH, D-73626, Germany

Background

Traditional processing of typical German dry sausage followed by ripening in drying chambers takes a long time (up to 20 days), requires a huge capacity of storeroom, is energy intensive and often results in low production rates. A faster method of producing dry sausage would allow considerable energy savings while raising the production rate. This could have interesting applications in the meat industry.
In earlier investigations, freeze dried meat was added into the production process not only to shorten the ripening time [1], but also to improve the drying process, to stabilize the meat batter microbiologically and finally, to decrease the water activity of the mass at the beginning of the process [2], [3].

Objectives

The objective of this work was to develop a novel method to shorten the ripening time of dry sausage by adding a certain amount of dried fermented meat. In comparison with the traditional product, similar quality standards such as color, section, texture, taste and shelf life should be reached.

Methods

Production of dried fermented meat: Preparation of meat: Refrigerated lean pork (estimated fat content of 10%) was coarsely cut into pieces. 2.8% nitrite curing salt, 1.2% mixture of spices, 0.3% dextrose and 0.5% starter cultures *L. sakei* + *P. pentosaceus* were added. All ingredients were mixed in a blender and minced through an 8 mm plate. Fermentation: The meat was fermented in vacuum-packed bags at 24°C for at least 40 hours depending on the change of the pH value (below pH 5.0). Drying: The fermented meat was chopped with a cutter on low speed and spread on perforated sheet metal on a trolley. The meat was dried at different temperatures (20°C - 70°C). The drying process was completed when the weight was reduced by 60%. The dried fermented meat was chopped again on high speed in the cutter, packed in bags and stored frozen at –18°C (Figure 5).
Production of dry sausage (Figure 6, top):
Traditional dry sausages were prepared according to the following weight based formula: 35% lean frozen pork, 30% 3 mm minced beef (estimated fat content of 8%), 25% frozen pork back fat (estimated fat content of 90%) and 10% 3 mm minced lean pork. Additives and spices were added per kilogram: 28 g nitrite curing salt, 12 g mixture of spices and 0.5 g starter cultures *L. sakei* + *P. pentosaceus*. The mass was stuffed into 65 mm diameter regenerated collagen casings (R2, Naturin, Germany).
Production of dry sausage with dried fermented meat (Figure 6, bottom):
Dry sausages were prepared according to the following weight based formula: 30% 3 mm minced beef, 25% frozen pork back fat, 12.5% lean frozen pork, 10% 3 mm minced pork and 7.5% dried fermented meat. Additives and spices were added per kilogram (except dried fermented meat): 28 g nitrite curing salt, 12 g mixture of spices, 1 g sodium diphosphate and 0.5 g starter cultures *L. sakei* + *P. pentosaceus*. The lack of freezing capacity makes it necessary to add liquid N_2 periodically. The mass was stuffed into 60 mm diameter regenerated collagen casings (R2, Naturin, Germany).
Ripening: The sausages were placed in a drying chamber under the following conditions: 2 days at 24°C, 88 – 92% relative humidity (RH); 2 days at 20°C, 85 – 88% RH; 2 days (traditional 4 – 6 days) at 18°C, 82 – 86% RH and finally the dry sausages were ripened another 1 or 2 days (traditional 4 – 6 days) at 14°C, 75 –85% RH until a weight loss of 25% was reached. The sausages were smoked after 2, 3 and 5 days under friction smoke conditions for 30 minutes each time.
pH measurement: The course of pH while ripening was measured using a spear tip electrode (Schott, Germany). The electrode was calibrated with two buffer solutions of pH 4.000 and 7.000.
A_w measurement: The water activity was measured by an AquaLab, model CX 2 (Decagon, USA).
Weight loss: The sausages were weighed once a day (Sartorius Universal pro 32/34 F, Germany) until a weight loss of 25% was reached.
Color measurements of dried fermented meat: Fermented meat dried at different temperatures were evaluated using a Chromameter CR 200 (Minolta, Germany).
TBARS of dried fermented meat: TBARS [4], [5] of fermented meat dried at different temperatures were determined on fresh and stored dried meat (stored under air; -18°C; 13.5 and 24 weeks).

Results and discussion

In the following, differences with regard to characteristics such as weight loss, pH and water activity between the traditional and new technology were investigated.
A fundamental advantage of the new technology is the shortening of ripening time. Figure 1 shows the weight loss during ripening. In comparison with the traditional product the batch with dried fermented meat reaches a weight loss of 25% after 7 days. As can be seen, the dry sausage already has a 15% weight loss at the beginning of the ripening process. This can be explained by the fact that moisture has already been removed from the fermented meat during drying.
After adding the starter cultures to the meat mixture a decrease in the pH value over a period of 4 days was obtained (Figure 2). In comparison, the traditional product and the new technology started at different pH values but met after 2 days. The traditional product began at a higher pH level with a steeper decrease within the first day. The batch produced with dried fermented meat started at pH 5.43 and fell more slowly the first day. This can be explained by the fact that the water activity of this batch was lower than the traditional one and for this reason the starter cultures needed a longer period to grow and to produce lactic acid (Table 1). Advantages of the new technology in general, however, were the lower pH and a_w values. They gave the mass a better microbiological stability at the beginning of the process which is necessary for raw materials with a higher bacterial load or higher ripening temperature.

A_w value	Traditional	New Technology
Dry sausage mass	0.963	0.946
25% weight loss	0.920	0.921
30% weight loss	0.892	0.901

Table 1: A_w values during ripening process

Differences in color and TBARS of fermented meat, dried at different temperatures are presented in Figures 3 and 4. With increasing temperatures, the color of the samples becomes lighter and less red. Fermented meat dried at 20°C is darker and more red. The tendency of TBARS values says that the lower the drying temperature the higher the TBARS. Also drying at 70°C leads to a worse result as regards to rancidity. The time factor plays an important role here as does the temperature factor. For this reason drying temperatures in the middle range should be used.

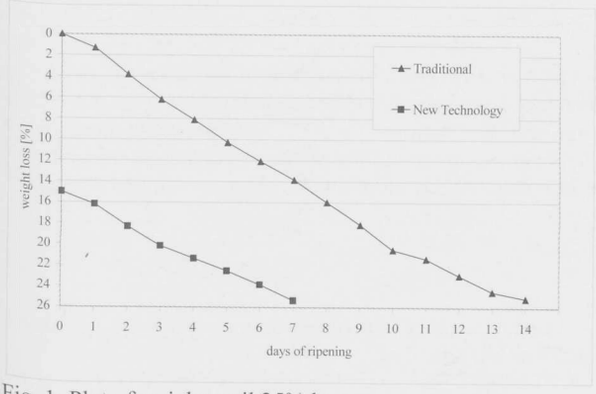

Fig. 1: Plot of weight until 25% loss

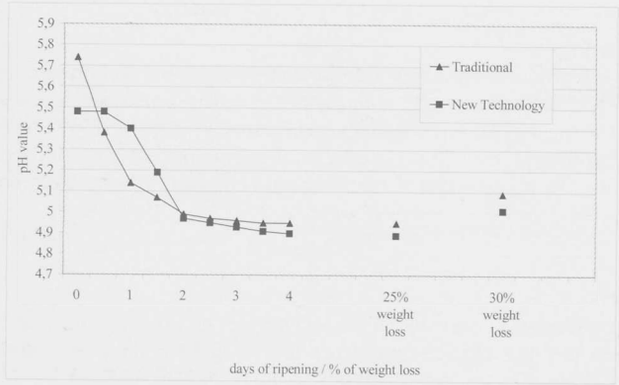

Fig. 2: Plot of pH change during ripening

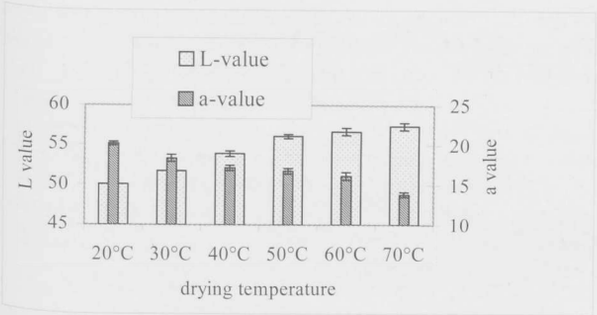

Fig. 3: L and a values of fermented meat dried at different temperatures

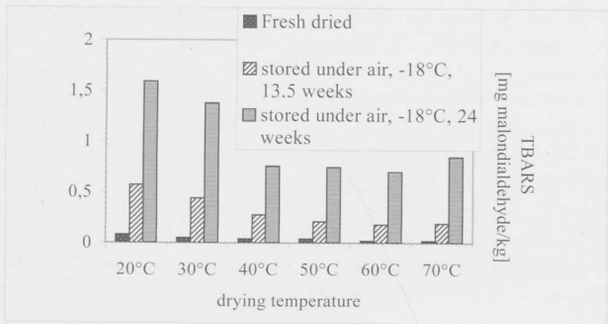

Fig. 4: TBARS of fermented meat dried at different temperatures

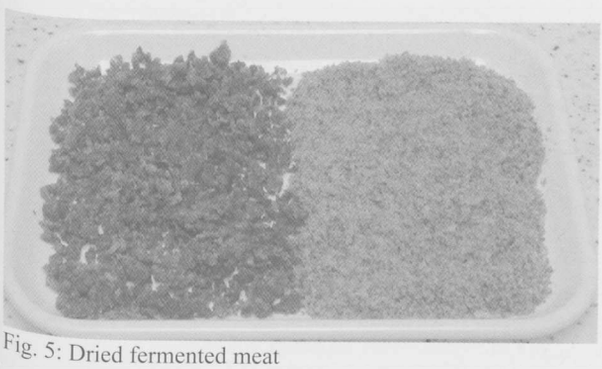

Fig. 5: Dried fermented meat

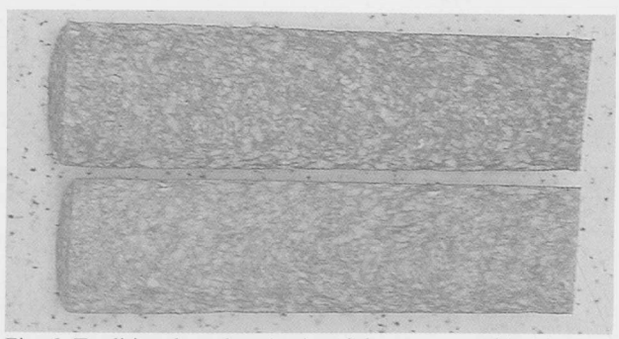

Fig. 6: Traditional product (top) and dry sausage with dried meat (bottom)

Conclusions

The aim of this study was to show that the use of dried fermented meat in the production of dry sausage can shorten the ripening time by about one week. At the beginning of the ripening process a better microbiological stability of the meat batter is ensured due to lower pH and a_w values in comparison to the traditional product. The investigations also have shown that the optimum drying temperature is about 40 to 50°C. Regarding the color and the rancidity a compromise must be made since there is an inverse relationship.

Pertinent literature

[1] Klettner, P.-G. and W. Rödel (2001). Fleischwirtschaft 11, 120 - 122
[2] Stiebing, A. and R. Becker (1995). Fleischwirtschaft 75 (11), 1311 – 1316
[3] Pörtner, A. (1977). Fleischwirtschaft 67, 1149 – 1153
[4] Tarladgis et al. (1960). J. Am. Oil Chemists´ Soc. 37, 44 - 48
[5] Zipser, Watts (1962). Food Technology 16, 102