PRESALTING OF MEAT RAW MATERIALS

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INTRODUCTION

Comminuted meat systems are very complex since their properties depend both on the hierarchial structure of the biological material and on new structures formed by decomposition of the muscle tissues during processing. Different meat raw materials can give rise to considerable differences in functional properties due to differences in the structural behaviour of components such as muscle fibres, collagen, solubilized and aggregated proteins, fat cells and dispersed fat (Hermansson, 1984, 1986, 1987). They may also respond differently to treatments such as ageing, freezing and presalting. Presalting has been a controversial subject for a number of years (Gumpen and Sørheim, 1987). Factors that have been considered to influence the effect of presalting are particle size, salt concentration, presalting time, type of meat raw material and the degree of comminution of the final product.

In this study, three meat raw materials from beef and pork were compared with regard to the effect of presalting as well as the particle size of the presalted meat and the degree of comminution of the final product. The experimental design of the project is illustrated below.

MATERIALS AND METHODS

Raw materials

Three types of meat raw materials that are commonly used in comminuted meat products, namely meat from pork shoulder, pork foreleg and beef foreleg were studied. The choice of pork shoulder and pork foreleg made it possible to compare meat from the same animal with different functional properties as well as structural behaviour (Hermansson, 1987). When comparing meat from pork and beef it was considered of importance to study meat from the same type of muscles. The chemical composition and pH of the meat raw materials were as follows. Pork shoulder meat contained 5.5% fat, 73.9% water, 20.1% protein, of which 1.2% was collagen and the pH was 5.6. Pork foreleg contained 14.7% fat, 67.2% water, 20.9% protein, of which 2.6% was collagen and

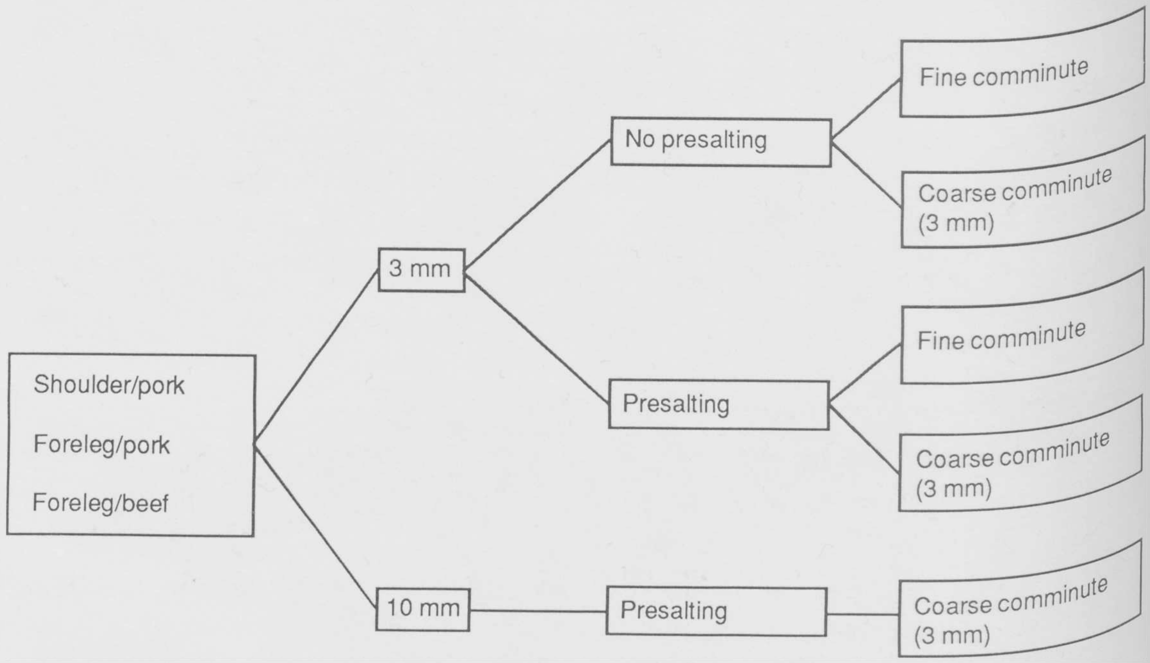

Figure 1. Experimental design.

water and the pH was 5.9. Beef foreleg contained 7.3% fat, 70.9% water, 20.9% protein, of which 2.8% was collagen and the pH was 5.7.

The pork meat was cut and ground one day after slaughter and the beef meat was cut and ground 2 days after slaughter.

Presalting of meat samples
The meat was either ground through a 10 mm plate and presalted or ground first through a 10 mm plate and then through a 3 mm plate. Part of the latter meat was presalted and the rest was used as a control where the salt was added when the model systems were made. A relatively low salt concentration of 2% was used throughout the experiment. The salt was dissolved in water and added to the meat in portions. The presalted meat was stored for 41 hours and the controls for 17 hours at 3.5°C before the model systems were made and analysed.

Production of model systems
The composition of the model systems was: 88% meat, 10% water and 2% sodium chloride. Model systems were made with different degrees of comminution. The so-called coarse comminute was ground through a 3 mm plate. The presalted meat already ground through a 3 mm plate was used directly without additional grinding.

The fine comminute was ground through a 3 mm plate, salt was dissolved in water and added. The mince was then further comminuted in a Moulinex for 30 sec so that most of the fibre structure was broken down.

Functional properties
The liquid loss was determined according to the previously described net test (Hermansson, 1984, 1986). Samples of 15 g were heated to 75°C for 30 min and cooled to 37°C for 10 min. According to the net test, the fat and water loss are determined after a mild centrifugation (1500 rpm for 10 min). In this study, we also determined the spontaneous liquid loss on heat treatment prior to centrifugation. 12 replicates were made of each product.

RESULTS AND DISCUSSION

The effects of presalting on the liquid loss of the finely comminuted model system are shown in Figure 2.

No fat loss was observed in any of the fine comminutes. The moisture loss decreased considerably due to presalting for all three meat raw materials. The highest moisture loss of the controls was obtained for the beef foreleg system and the lowest for the pork foreleg systems. Microstructure analysis showed that these two meat raw materials differed mainly with regard to the structural behaviour of collagen. In the case of pork foreleg, collagen/gelatin formed a continuous network structure intertwined with that of myofibrillar proteins. This was not the case for the beef foreleg system. The ranking in moisture loss of the presalted meat raw materials was the same as that of the controls even if the effect of presalting varied. The largest presalting effect was observed for beef foreleg with the highest original moisture loss. Here presalting resulted in a decrease in moisture loss of as much as 9.7% by weight. This is not in agreement with the results of Gumpen and Sørheim (1987). They reported a substantial effect of presalting on pork meat but a much weaker effect of presalting on beef meat. However, they did not specify what type of meat they used and it may be dangerous to generalize before meat from different types of muscles has been analysed and compared.

Figure 3 shows the corresponding moisture loss which takes place spontaneously on heat treatment and cooling.

The weight losses were smaller but the trends are the same as after the mild centrifugation included in the net test. Here again it is obvious that the strongest improvement with presalting was obtained for the beef foreleg system with the highest weight loss of the control sample. With this test presalting resulted in a decrease of 9.4% by weight for the beef foreleg system. The spontaneous weight loss of the presalted pork foreleg was less than 0.1%.

Presalting gives rise to a firmer texture for all the finely comminuted model systems, which is illustrated by the rigidity modulus in Figure 4.

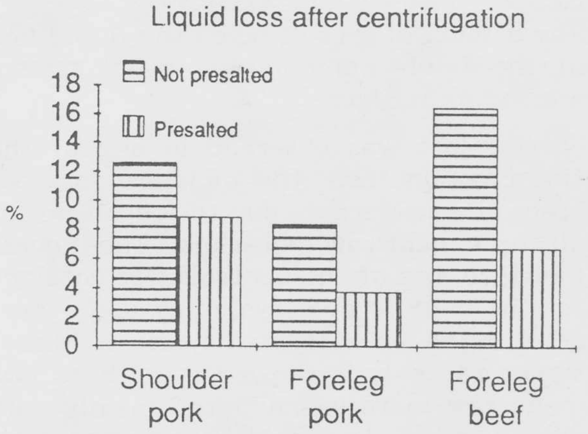

Figure 2. The effect of presalting on the weight loss of fine comminutes.

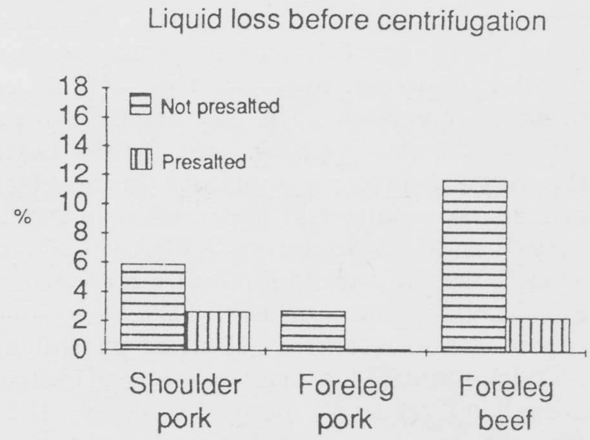

Figure 3. The effect of presalting on the spontaneous weight loss of fine comminutes.

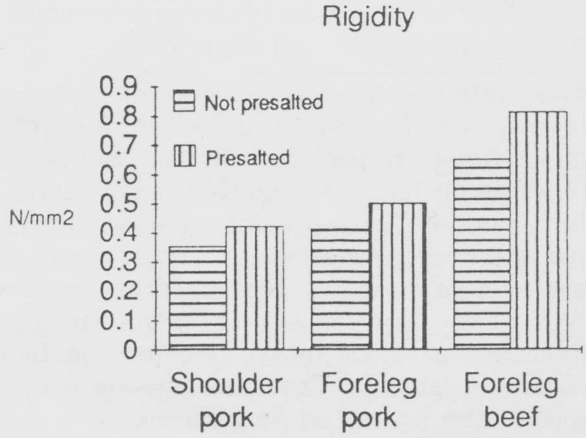

Figure 4. The effect of presalting on the rigidity modulus of fine comminutes.

Coarse comminutes

Apart from comparing the effect of presalting on different meat raw materials in coarse comminutes, the effect of the particle size of the presalted meat was also investigated.

Figure 5 shows the liquid loss according to the net test for the three meat raw materials and the effect of particle size on presalting.

Generally, the liquid loss was higher for the coarse comminutes than for the fine comminutes, regardless of raw material or treatment. The pork foreleg gave the lowest liquid loss and the pork shoulder system the highest liquid loss of the coarse comminutes. The main difference in microstructure between these two systems is the structural behaviour of the myofibrillar proteins released from the muscle fibres, which form a more continuous network structure in the pork foreleg system than in the pork shoulder system. Both pork and beef foreleg showed fat loss on heat treatment, which was not the case for the pork shoulder system. However, there is no strong correlation between fat content and fat loss, since pork foreleg contained twice as much as beef foreleg.

Presalting reduced the liquid loss for all three raw materials. The maximum decrease in weight loss due to presalting was 11.1% for pork foreleg, and 9.4% for pork shoulder. For all three systems, presalting of 10 mm pieces resulted in a lower weight loss than presalting of 3 mm pieces. Obviously, there was no limitation due to salt diffusion in particles of 10 mm. In a previous study, no effect of presalting was found on the weight loss of pork frankfurters, when 40 mm pieces of pork meat were presalted for 48 hours (Hermansson, 1982). This particle size was commonly used for presalting at that time. It is probable that this was due to limitations in salt diffusion due to particle size. However, this meat was used for the production of meat emulsions with added fat and further studies are needed in order to evaluate the function of presalted meat in meat emulsions versus lean meat comminutes.

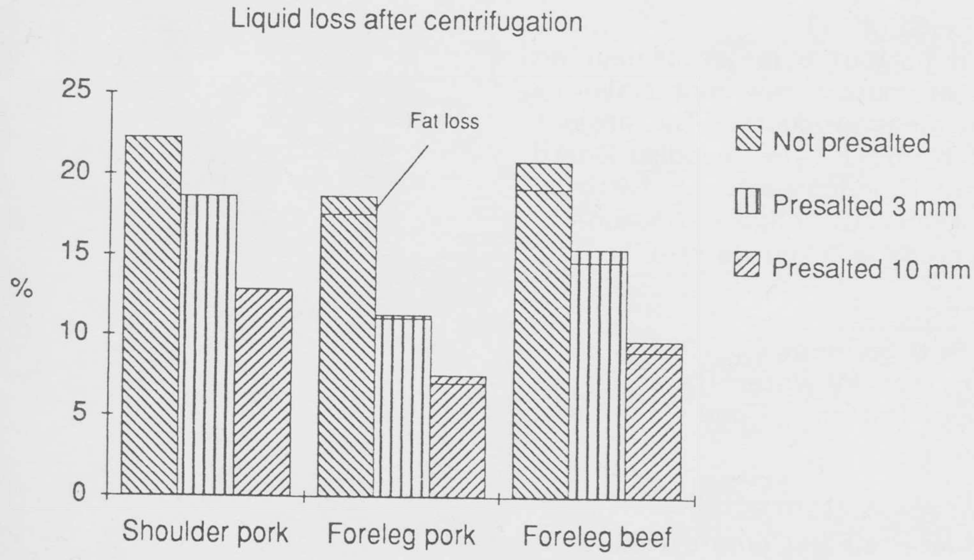

Figure 5. The effect of presalting on the weight loss of coarse comminutes.

In this study, a lower liquid loss was obtained when the larger particles were presalted, which seemed surprising at first sight. However, the two presalted systems had been treated differently mechanically. The larger particles were ground after presalting through a 3 mm plate, whereas the meat already ground through a 3 mm plate prior to presalting was used directly without additional grinding. Studies were therefore made in order to elucidate the effect of additional mechanical treatment on presalted meat as well as on the control.

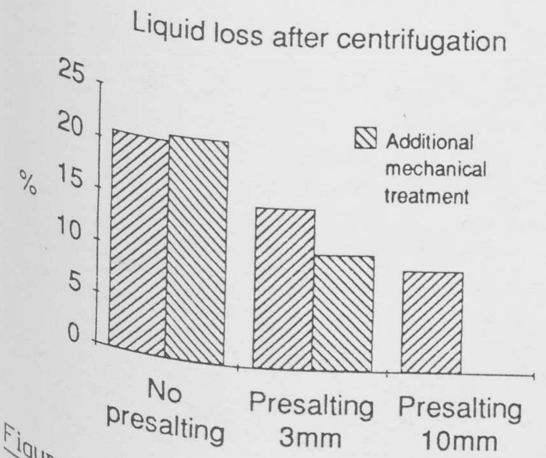

Figure 6. The effect of mechanical treatment on coarse comminutes.

Figure 6 shows that additional grinding of the control meat through a 3 mm plate prior to the addition of salt and water did not reduce the liquid loss at all. Additional mechanical treatment of the corresponding presalted sample resulted in a substantial decrease in liquid loss and the liquid loss was close to that of the presalted 10 mm sample. The results shown in Figure 6 were obtained from studies of pork foreleg meat. Similar results were obtained for pork shoulder meat.

In the case of the coarse comminutes as well presalting resulted in a firmer texture than that of the controls. Microstructure analysis showed that presalting improved the continuous network structures.

CONCLUSIONS

Different meat raw materials give rise to differences in functional properties due to differences in the microstructure of comminuted products. A pronounced effect on water retention was found in presalting of 3 mm as well as 10 mm meat pieces at a salt concentration as low as 2%, regardless of the type of meat raw material used or the degree of comminution of the model products. Presalting of 10 mm pieces resulted in a lower weight loss than presalting of 3 mm pieces. The reason for this was found to be a synergistic effect between presalting and mechanical treatment.

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