PORK MEAT TUMBLING. BINDING ABILITY OF EXUDATE.

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Key words: meat tumbling, myofibril fragmentation index, myofibril proteins, meat binding

Introduction

In meat processing a variety of mechanical methods is used to disintegrate the musculature. The meat tissue damage facilitates quick penetration and uniform distribution of salt solution, swelling of myofibrils and release of dissolved proteins. The extracted proteins, mainly myosin and actomyosin, coagulate after heat treatment and bind meat pieces together. Cooked meat products demonstrate therefore cohesiveness and textural firmness, the key elements for so called sliceability. Swollen and dissolved myofibrillar proteins elevates brine-holding capacity of meat improving tenderness and juiciness of the product and increasing the production yield.

The most common method of mechanical disrupting the meat tissue is the process of massaging or tumbling. The exudate formed in that process contains considerable amounts of dissolved proteins and fragmented muscle fibres and myofibrils (Theno et al. 1978, Katsaras and Budras 1993). It has not been fully established, yet, what properties of the exudate are the most relevant for its binding ability.

To contribute to the elucidation of that question was the aim of the study.

Materials and methods

Pork ham muscles were mechanically tenderized (meat activator, Günther Wensing, Germany and meat grinder equiped with a two-blade knife and a kidney plate) and tumbled for a distance of about 11500m. Not tenderized intact muscle was used as a control sample. Brine solution of two salt concentrations (7,9 and 11,3%) and two addition levels (30 and 50%) was added to meat in a tumbler. In course of the tumbling process (Hoffman tumbler model HS operating at 19 rpm; tumbling cycle consisted of 20 min. of rotation and 10 min. of rest)), meat and exudate were sampled continuously. In the exudate samples the myofibril proteins concentration and myofibril fragmentation index (MFI) were determined according to Davey and Gilbert (1969). Meat was canned and pasteurised (core temperature 68°C) and after cooling the slice breaking force was determined (Universal Testing Machine Zwick model 1445) and presented as slice strength.

Results and discussion

As it could be expected, myofibril proteins content of exudate rised considerably and almost linearly in concomitance with increasing tumbling distance. Its initial value variation resulted from the meat pretreatment method. The method of meat pretreatment was also a relevant factor for initial MFI, which then increased exponentially. The results are summarized in Table 1 and Fig. 1 - 3. According to sensoric evaluation, the slice strength equivalent to 0,7 N/cm^2 was chosen as the lowest value representing still good sliceablity. Other authors (Motycka and Bechtel 1983) suggested higher values in such cases. The data presented in Table 1 show no direct relation of slice breaking strength to MFI nor to myofibril proteins contents of the exudate. In Fig. 4 the three-dimensional diagram illustrates the interrelationships among slice strength and both myofibril factors. As it can be seen, the good binding ability of exudate could be achieved if not only a sufficient amount of myofibril proteins was present but also if the myofibril fragmentation index was high enough to ensure, after heat treatment, the specific structure and strength of junctions .

Conclusion

Basing on the results of the experiments it can be concluded, that meat binding ability of the exudate did not depend on the total myofibril proteins contents of exudate, nor the MFI value but on the relationship of both factors.Under the conditions of experiment good binding ability was demonstrated by the exudate containing at least 1% of myofibril proteins and MFI over 400.

Table 1. Results of the experiments

Meat treatment	Myofibril proteins contents of exudate[%]	MFI in exudate	Slice strength [N/cm^2]
C-1	0,6	214	0,17
C-2	0,9	319	0,17
C-3	1,2	357	0,17
MG-1	1,4	382	0,42
MG-2	1,7	440	0,77
MG-3	1,9	440	1,11
MA-1	0,8	346	0,67
MA-2	1,1	400	1,28
MA-3	1,4	467	1,56
C-control sample; MG-meat grinder treated sample; MA-meat activator treated sample Tumbling distances: 1 = 765 m; 2 = 6900 m, 3 = 14500 m			

Literature

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FIG. 1 Myofibril proteins conteints of exudate affected by sample pretreatment and tumblin distance (30% added brine)

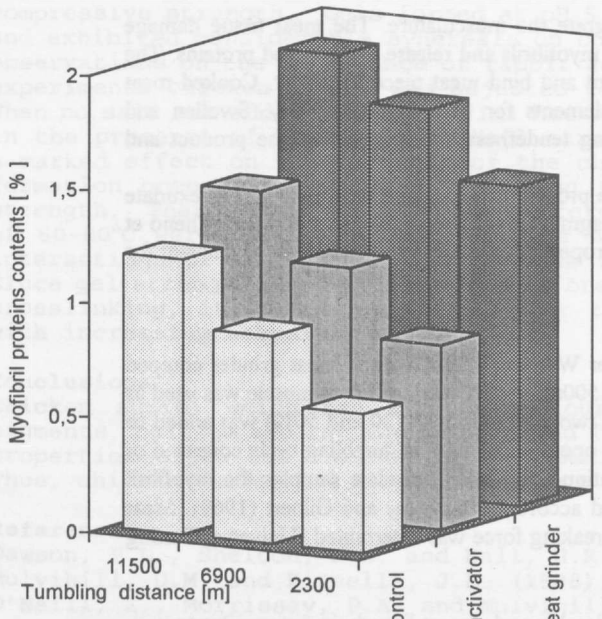

FIG. 2 MFI in exudates formed during long-distance tumbling of control and pretreated samples (30% added brine)

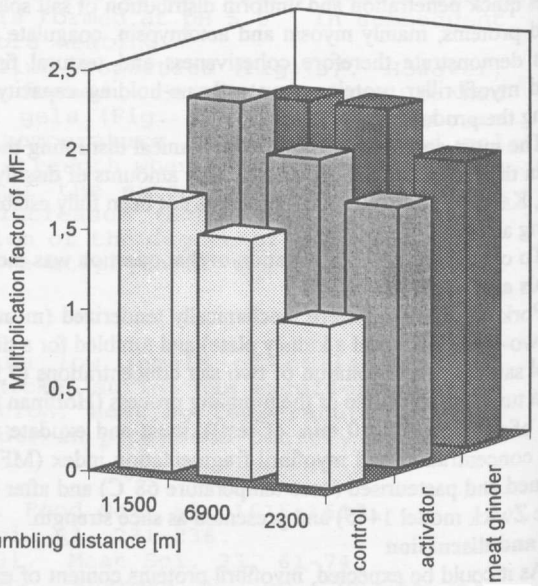

FIG. 3 Slice strengh in relation to brine amount and concentration, tumbling distance and pretreatment of muscle

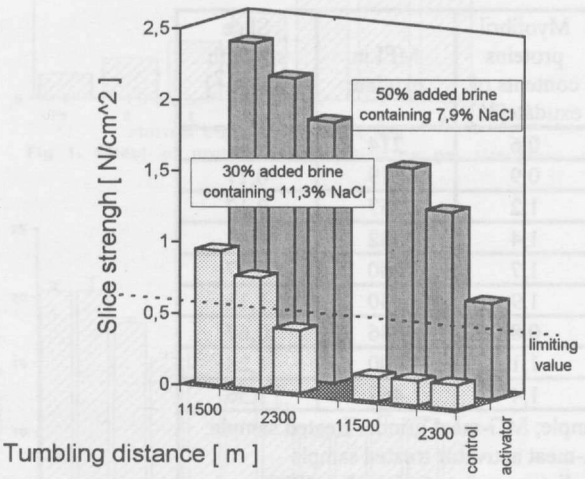

FIG. 4 Interrelation of slice strenght, myofibril proteins contents and fragmentation index