CHANGES IN SQUID MEAT INDUCED BY COOKING

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Introduction

Traditionally commercial squid fisheries has been known in Japan, in the Southeast Asian countries, and in South Europe. Recently, however, also American, New Zealand Canadian, Soviet, and Polish fishermen started to exploit cephalopod resources, mainly for export to Japan. As the international trade in cephalopods is very significantly influenced by the fluctuating yearly landings and by cold storage holdings, it should be of great economic advantage for the newcomers to this trade to develop domestic markets for squid products. However, squid is completely unknown to many East and North European populations. In 1984 the total catch of squid by Polish vessels exceeded 100 000 tons while only 250 tons of squid products could be sold in Poland. One of the main causes of very low acceptability of squid on the domestic market is the unusual texture of cooked squid, totally different from that of red meats and poultry. To increase the demand for cephalopods on the domestic market it is necessary to learn more about the properties of squid meat as raw material for the food industry as a prerequisite for developing new products satisfying the taste of the customers not used to cephalopods.

Experimental

Tubes of squid Illex argentinus, 23-28 cm long, frozen on board vessel in blocks, glazed and packed in polyethylene and cardboard boxes, stored about 1 year at -20°C were used in all experiments. The tubes were defrosted in running tape water, skinned by hand, and cooked in 2% sodium chloride solution. The hardness of the cooked mantle was measured in a penetrometer using a wedgelike plunger. The parameters of conditioning the tubes prior to cooking are given with the results. Changes in the myofibrillar proteins due to conditioning were followed by classical SDS PAG electrophoresis. The pure myofibrillar protein fraction was obtained by separating collagen fibers from a meat homogenate on a cloth and extracting the sarcoplasmic fraction from the homogenate with a phosphate buffer at pH 6.8 and ionic strength 0.17.

Results

Cooking the squid mantle in 2% NaCl solution caused a weight loss of 25-40% after the first 15 min. of boiling (Fig. 1), while the hardness of the meat decreased continuously up to at least 60 min. (Fig. 2). The shear value of the mantle after 45 min. of cooking was 1.8-6.2 N and was significantly higher in samples sheared across the circumferential fibers than parallel to them. Holding of the mantles in air at room temperature for 16 h or in the cooking solution for 2 h at 35°C or 1 h at 60°C did not improve the texture of the cooked product as determined in the

Fig.1 The influence of cooking time on the weight of cooked squid mantle

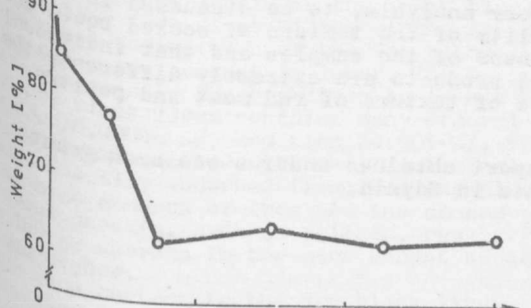
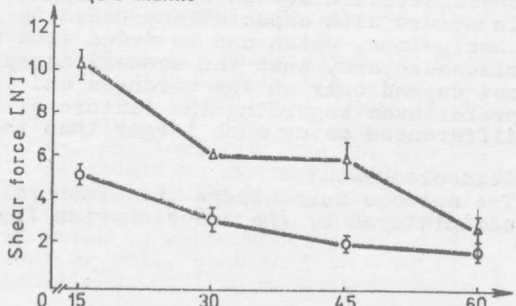


Fig.2 The influence of cooking time on the hardness of squid mantle



Shearing from inside of the mantle across the circumferential fibers Δ-Δ, and parallel to the fibers from outside o-o

Table 1. The hardness of squid meat conditioned 18 h in CH_3COOH solution at 2°C

Conditioning solution	Shear force N[1] Shearing in respect to circumferential fibers		Cooking loss %	pH before cooking
	across	parallel		
-	4.3±0.1	1.9±0.1	28	6.6
2% CH_3COOH	7.4±0.6	2.6±0.3	47	4.5

1/ the shear value was measured on 5 samples from 1 squid

Table 2. The hardness of squid meat conditioned 16 h in NaCl and polyphosphate solutions at 2°C

Conditioning solution	Hardness Shearing in respect to circumferential fibers		Cooking loss %	pH before cooking
	across	parallel		
	Shear force N			
- [1]	1.8-5.0 100%	0.8-2.0 100%	31±7	6.6±0.1
1% Hamine [2]	73±13	79±15	20±3	6.9±0.2
2% Hamine [2]	42±20	62±13	15±3	7.1±0.1
3% Hamine [2]	39±10	55±10	9±6	7.2±0.1
3% Hamine + 5% NaCl [1]	58±14	60±14	19±7	6.8±0.1

The results represent mean values obtained in 1/ 9 and 2/ 3 experiments. Within each experiment the shear value was measured on 5 samples taken from 1 squid.

penetrometer, although it caused significant proteolysis in samples conditioned at 18° and 35°C. The intensity of the band of heavy chain of myosin was reduced and new bands of proteins of lower molecular weight appeared on the disc gels. Conditioning 18 h at 4°C in 2% acetic acid solution, causing similar autolytic effects, increased markedly the hardness and added a slight sour and bitter note to the taste of the cooked squid (Table 1). The cooking loss in the conditioned samples was about 70% larger than in the controls, the meat was less juicy, and tended to break during handling. Soaking the mantle 16 h in 5% NaCl + 3% polyphosphate (Hamine) solution at 4°C decreased the hardness and cooking loss by about 40% (Table 2)while conditioning in 2% Hamine solution without NaCl decreased the hardness of the cooked mantle up to 75% and the cooking loss by 50%. In the polyphosphate treated samples no proteolytic changes could be detected by electrophoresis.

Conclusions

No simple relationship between the proteolytic changes in squid meat prior to cooking and the hardness of the cooked meat could be found. On the other hand, the influence of pH, as modified by soaking in polyphosphate solutions, and the characteristic action of the phosphates, brought about significant tenderization in accord with expectations based on results known in meat science. The preliminary conclusions, which can be drawn from sensory analysis, to be discussed in details elsewhere,are, that the sensory acceptability of the texture of cooked squid does not depend only on the hardness and juicyness of the samples and that individual preferences regarding the texture of squid products are extremely different, the differences being much larger than in case of texture of red meat and poultry.

Acknowledgement

The authors acknowledge the financial support obtained under a research grant administered by the Sea Fisheries Institute in Gdynia.