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CHARACTERISTICS OF SAUSAGES AND SMOKED AND CURED PRODUCTS MANUFACTURED FROM *PRE-RIGOR* MEAT IN SEMI-TECHNICAL CONDITIONS

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Key words: sausages, smoked hams, cured meat, *pre-rigor* meat, chilled meat, cured loins

In semi-technical conditions sausages were produced as well as cured and smoked hams and loins. There were found no significant differences in chemical composition of sausages from *pre-rigor* and chilled meat. Two groups of experimental sausages (fine and coarse comminution grade) were superior to those from chilled meat in respect to final yield and organoleptic quality. Microorganism number found in experimental and control sausages did not exceed the industrial standards. Production of *pre-rigor* meat sausages consumed over twice less time than the traditional technology. In the case of products produced from intact muscles no satisfactory results were obtained. Experimental cured and smoked hams and loins were tougher, too succulent and not uniform in colour.

INTRODUCTION

Laboratory investigations proved that utilization of *pre-rigor* (hot) meat is a very rational approach [1, 4, 5], however, some limits must be considered. As the main factor in *pre-rigor* meat processing should be stressed curing time. The earlier NaCl will be introduced, the lower will be ATP decomposition, and the better will be conserved high protein solubility [4, 6]. The addition of NaCl should be performed within 2-3 hrs of *post mortem*, because between third and fourth hrs of *post mortem* there was already observed in pork the onset of *rigor mortis* [2].

Basing on earlier laboratory investigations the aim of our study was the examination of benefits which *pre-rigor* meat processing would bring in conditions close to the industrial scale.

The lower losses and the higher yields of the experimental products are undoubtedly a consequence of increased water binding capacity of *pre-rigor* meat. However, distinct differences were found in absolute loss and yield values between the two sausages. It was partially due to differences in their formulae. Besides that another factor, i.e. comminution grade, should be considered. For instance, only one third of the batch was treated by a cutter in the case of the coarsly comminuted sausage, whereas the other one was entirely ground on a cutter.

Chemical composition of the experimental and the control sausages showed no significant differences, while organoleptic evaluation proved distinctly better quality of hot meat sausages. The differences were especially expressive in terms of surface appearance of cross section and taste. Further the colour of the experimental sausages was more intensive, just as in earlier model studies [3].

Although the temperature was relatively high during boning, grinding and at the beginning of curing process (Table 2) the number of microorganisms ranged from 1.3×10^5 to 3.5×10^5 cells per gram and did not exceed the actual standards.

Table 2. Temperature in °C recorded at several sausage production steps

Production step		Sausages manufactured from	
		pre-rigor meat	cooled meat
After slaughter	beef	37	37
	pork	38	38
After boning		26	7
After pre-grinding		21	7
After curing		7	7
Cutting (max)		18	17
After cooking		69	69
After packing		6	6

The new approach consumed over twice less time than the traditional technology (Table 3).

Less satisfactory results were obtained in manufacturing of smoked and cooked hams and loins. Even though there was stated a sufficient weight increase after pumping and some lower loss after cooking and cooling, as well as final yield close to industrial standards (Table 4), the experimental hams proved to be only trial of better organoleptic quality than the control ones (Table 5). Curing time exerted a great effect on organoleptic quality than the control ones (Table 5). Curing time exerted a great effect on organoleptic characteristic of hams (Table 5). The 20 hrs cured product was tougher, less succulent and its cross section was not uniform in colour. Extension of curing time to

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Table 3. Duration of technological processes for sausages and hams and loins (hours *post mortem*)

Production step		Sausages		Hams and loins	
		pre-rigor	cooled	*pre-rigor*	cooled
Slaughter		1	1	1	1
Cooling:	pork	0	24	0	24
	beef	0	30		
Boning		1	1	1	1
Curing:	pork	21	48	46	46
	beef	0	48		
Cutting—cooking		6	6	12	12
Cooling		15	15	10	10
Total:	pork	44	95	70	94
	beef	23	101		

Table 4. Selected determinations performed on experimental and control hams and loins

Determinations	Hams				Loins	
	curring for 20 hours		curring for 46 hours		*pre-rigor*	cooled
	pre-rigor	cooled	*pre-rigor*	cooled		
Weight increase after curing, %	14.8	6.0[a]	11.1	6.0[a]	8.8	12.0[a]
Cooking and cooling loss, %	12.3	10.7	11.0	12.7	9.9	12.8
Yield, %	88.8	91.0[a]	89.4	91.0[a]	87.2	85.5[a]
Salt content, %	2.9	4.0[a] (max.)	2.2	4.0[a] (max.)	2.4	4.0 (max.)

Table 5. Organoleptic evaluation of the experimental hams and loins in comparison to control products

Product	Number of trials with the quality		
	better	similar	worse
Hams: 20 hr cured ($n = 2$)	1	1	2
46 hr cured ($n = 4$)			2
Loins ($n = 4$)			4

46 hrs and additional vacuum tumbling resulted in improving of ham quality. This mechanical treatment caused better distribution of cure ingredients as well as modified ham structure.

The experimental smoked and cooked loins had substantially lower organoleptic characteristic than the control product (Table 5). The procedure including only 10 minute tumbling of the injected muscles proved to be inadequate.

In high final yield (above industrial standards) (Table 4) resulted in excessive succulence, too low saltiness and low desirability of taste.

CONCLUSIONS

1. Processing of *pre-rigor* meat into finaly comminuted products proved to be a very rational approach.
2. Manufacture of smoked and cured hams and loins from *pre-rigor* meat needs further investigation.

LITERATURE

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CHARAKTERYSTYKA WĘDLIN ORAZ WĘDZONYCH I PEKLOWANYCH PRODUKTÓW OTRZYMYWANYCH Z MIĘSA *PRE-RIGOR MORTIS* W WARUNKACH PÓŁPRZEMYSŁOWYCH

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Streszczenie

W warunkach półprzemysłowych wyprodukowano z mięsa ciepłego kiełbasę drobno- oraz średniorozdrobnioną, szynkę wędzoną i polędwicę. Składniki peklujące dodano przed upływem 2 h od momentu kłucia zwierząt. Ocenę gotowych produktów przeprowadzono w oparciu o oznaczenie składu chemicznego, wydajności, wycieku termicznego, ilości drobnoustrojów i ocenę organoleptyczną. Pod względem składu chemicznego nie znaleziono różnic pomiędzy produktami z mięsa ciepłego i wychłodzonego. Kiełbasy z mięsa ciepłego oceniono jako lepsze ze względu na ich wydajność oraz ocenę organoleptyczną. Przy zastosowaniu nowej technologii nie

zaobserwowano pogorszenia się stanu mikrobiologicznego gotowych wyrobów, chociaż odkostnianie i rozdrabnianie mięsa prowadzono w temperaturach wyższych niż tradycyjnie. Zawartość drobnoustrojów wahała się od $1{,}3 \times 10^5$ do $3{,}5 \times 10^5$ na 1 g i nie przekraczała wielkości określonych normami przemysłowymi. Przy użyciu ciepłego mięsa wołowego i wieprzowego możliwe było skrócenie cyklu produkcyjnego kiełbas ze 101 do 44 h. Mniej obiecujące wyniki uzyskano w przypadku produktów otrzymanych z nierozdrobnionych mięśni. Szynka wędzona i polędwica otrzymane z mięsa ciepłego nie miały wymaganej kruchości, wykazywały niską zdolność utrzymywania wody i niejednolitość barwy na przekroju. Wyraźną poprawę tych cech uzyskano po zastosowaniu masowania próżniowego szynek.