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The pH in ham muscles 24 hours after slaughter in relation to canned ham quality.

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INTRODUCTION

Previous work in our factory was concentrated on sorting of pig carcases at the slaughter line on meat quality to be expected, using pH_1 and rigor value as criteria. This procedure however is not always applicable, for instance in the case hams are purchased from outside the factory. Experiments were carried out to investigate the possibilities to classify hams by means of pH 24 hours after slaughter. As very little is known of purchased hams, hams from pigs slaughtered in the factory slaughterhouse were used.

METHODS

The pigs (Dutch Landrace) were stunned by carbon dioxide and bled and scalded in a vertical position. In order to obtain equally large groups of hams of to be expected good and poor quality, on four days 12 carcases having a $pH_1 \geq 6.3$ and 12 with a $pH_1 \leq 5.6$ were chosen. The pH was measured approximately 40 minutes after death, always in the top side (M. gracilis).

After sorting out, the carcases followed the routine factory procedure.

Next day the hams were dissected from the carcase and deboned.

The fresh meat colour and texture was judged visually while the pH_2 (pH 24 hours after slaughter) was measured in five different muscles.

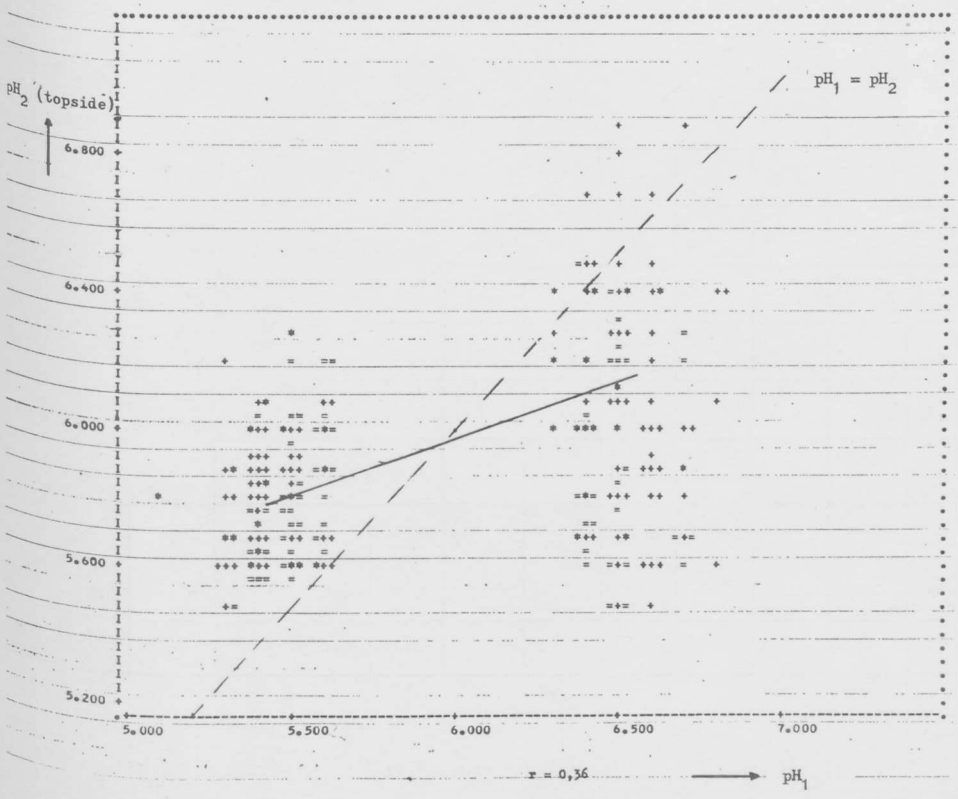
Following this the hams were stitch pumped with a polyphosphate containing brine and stored for three days in containers to mature, trimmed, canned and pasteurised. The pasteurisation took place at 74° C; the centre temperature reached was 66 to 68° C.

After cooking the hams were stored under refrigeration for three to four weeks, judged visually on quality while the pH values in four different places and the amount of jelly cooked out were determined. In total 197 hams were examined.

RESULTS AND DISCUSSION

a. Relation between pH_1 and pH_2 both measured in the top side (figure 1). The correlation between both parameters is rather poor (r = 0.36). The

Figure 1.



pH in muscles with a low pH_1 rises afterwards, while in muscles with a relatively high pH_1 the pH tends to decrease as can be seen when the position of the measured values relative to the dotted line, representing $pH_1 = pH_2$, in figure 1 is considered. This shift in pH-values is in accordance with expectation.

b. The relation between pH_1 of the top side and pH_2 of the other ham muscles also is poor, as can be seen in table I.

c. pH_2-values in the different muscles correlate well, with the exception of that in the M. quadriceps. The ham, however being composed of various muscles, to a certain extent reacts as a whole.

		pH_1	pH_2					pH after pasteurisation						
		M. gracilis	M. gracilis	M. biceps femoris	M. quadriceps	M. gastroc-nemius	M. glutaeus	M. gracilis	M. biceps femoris	M. quadriceps	M. gastroc-nemius	injection yield	matured yield	cooked out jelly
pH_1	M. gracilis													
pH_2	M. gracilis	0,36												
	M. biceps femoris	0,31	0,86											
	M. quadriceps	0,23	0,69	0,72										
	M. gastroc-nemius	0,26	0,81	0,85	0,48									
	M. glutaeus	0,25	0,79	0,84	0,62	0,78								
pH past.	M. gracilis	0,20	0,45	0,46	0,42	0,37	0,41							
	M. biceps femoris	0,15	0,38	0,47	0,40	0,35	0,41	0,84						
	M. quadriceps	0,19	0,48	0,51	0,46	0,40	0,45	0,83	0,84					
	M. gastroc-nemius	0,06	0,21	0,26	0,24	0,19	0,20	0,91	0,93	0,93				
Injection yield		0,08	-0,05	-0,11	-0,09	-0,09	-0,16	-0,05	-0,08	-0,01	-0,11			
Matured yield		0,27	0,18	0,14	0,09	0,14	0,03	0,09	0,05	0,15	-0,04	0,62		
Cooked out jelly		-0,73	-0,53	-0,47	-0,40	-0,43	-0,41	-0,31	-0,23	-0,38	-0,09	-0,18	-0,41	

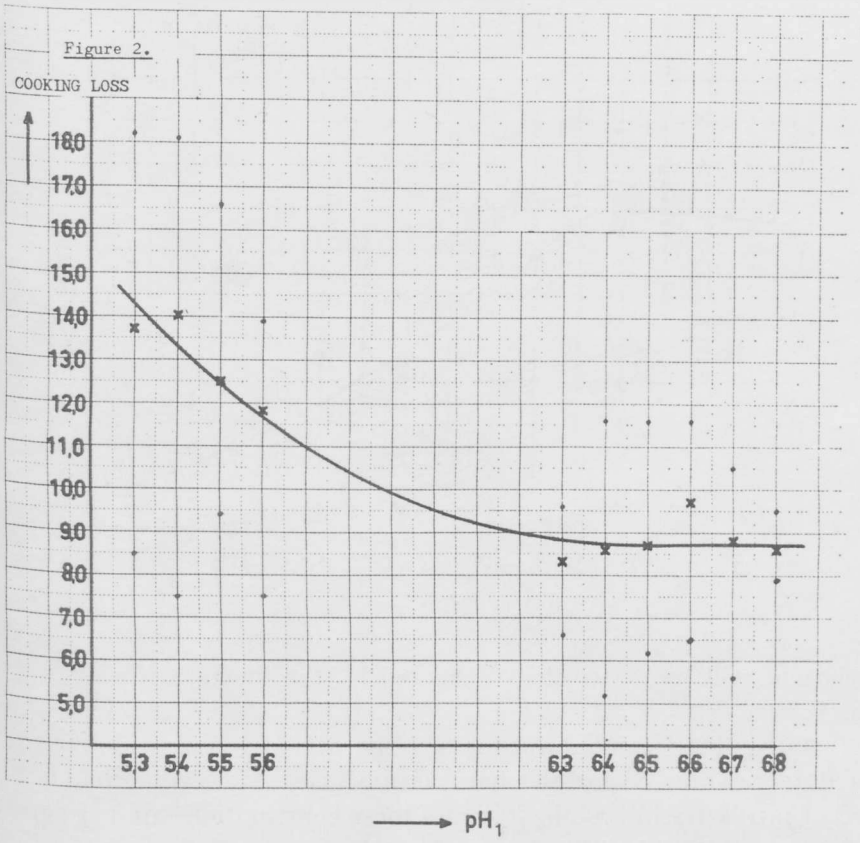
The pH_2 of the M. gracilis can be considered representative for the ham as a whole.

d. pH_1 and pH_2 in relation to injection yield and matured yield. No correlation seems to exist between pH_1 and pH_2 in the top side and injection yield; as far as the matured yield is concerned a weakly positive correlation is found. It must be kept in mind that the hams were injected with polyphosphates (0.5 % on cured meat) and that probably the effect of pH on water binding of meat is masked by these substances. There is however a rather weak negative correlation ($r = -0.20$) between both pH_1 and pH_2 and the weight loss during maturing. This indicates that the masking effect of polyphosphates (and salt) is not complete.

e. The correlation between injection yield and matured yield ($r = 0.62$) is clear, but not strong.

This is due to the large variation in values from ham to ham. When stitch pumping is applied the ham has to be deboned and membranes to a large extent have to be trimmed away before brining. This gives rise to leaking out of considerable quantities of injected brine with, as it happens to be, rather big differences from ham to ham.

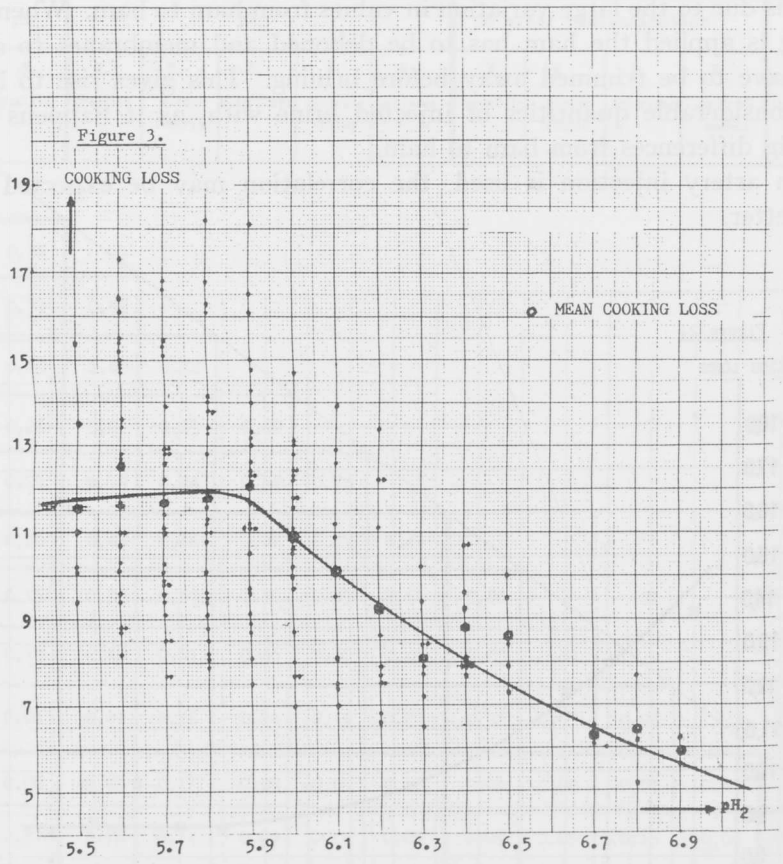
When artery injection is used, the correlation may be expected to be much better.



f. Amount of cooked out jelly (per cent of total can content) in relation to pH_1 and pH_2, both measured in the top side is presented in graphs 2 and 3. The curve for pH_1 shows that when the value is 6.3 or above, no influence of pH_1 values below 6.3 the cooking loss increases gradually.

The curve for pH_1 is completely different from that for pH_2. At values of 5.9 or below no clear influence of pH_2 on cooking loss is visible, but above 5.9 this quantity decreases gradually.

As the relation between the two pH's and cooking loss is not linear, the



correlations will be better than indicated by the linear coefficients given in table I.

g. As has been pointed out under *c* the pH_2 of the top side may be considered representative for the ham as a whole. However, each individual muscle contributes to cooking loss and these contributions are pH dependent. When the sum of the pH values measured in five different muscles is given against cooking loss, the results can be seen in graph 4, showing a better linear relationship than using the pH_2 of the top side alone.

Actually a multiple correlation computation should be and will be done.

h. Visual judgement of fresh meat colour and texture in relation to cooking loss, see graph 5.

From the curve follows that the better the visually judged meat quality is, the lower is the cooking loss. However no clear relationship was found between fresh meat quality characteristics and colour and texture of the cured, cooked finished product.

Figure 4.

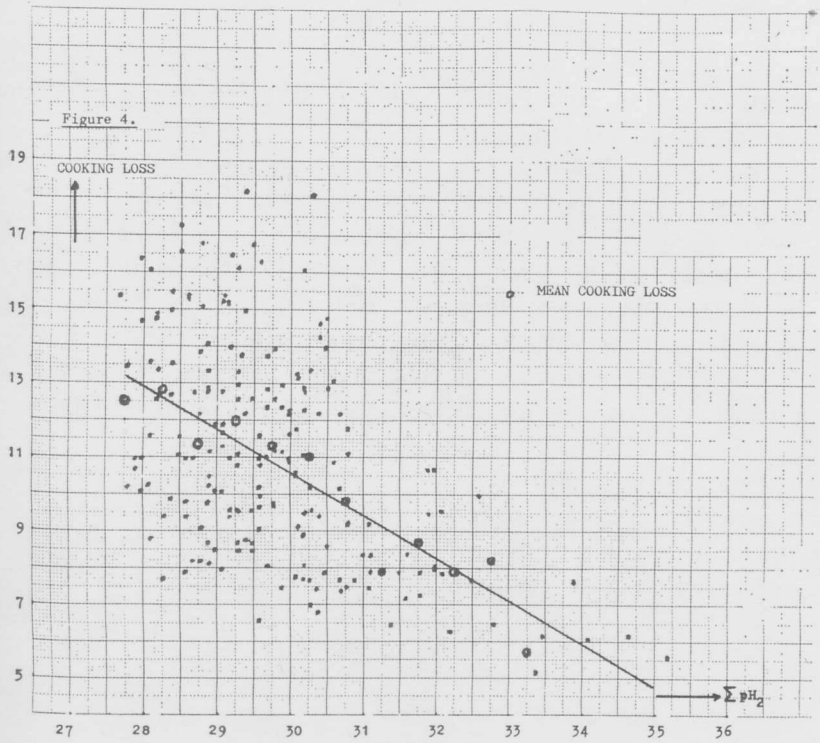
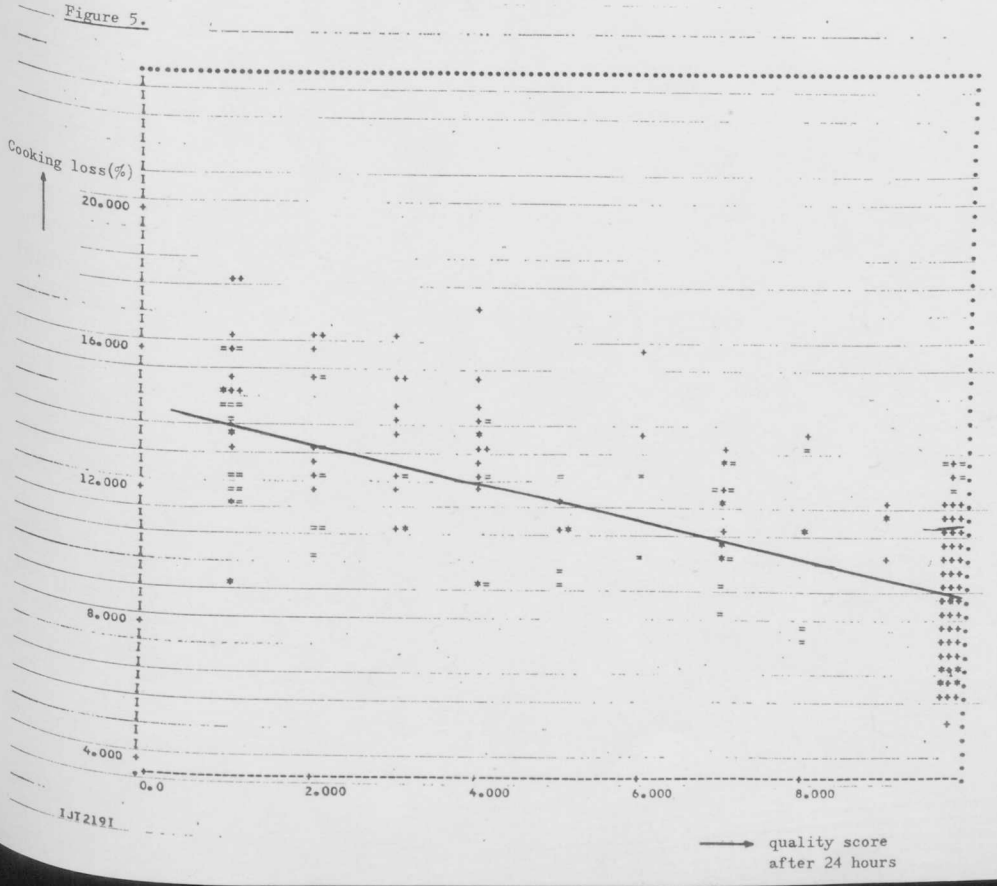


Figure 5.



CONCLUSION

In order to divide hams into groups of different average cooking loss the measurement of pH_2 may be applied.

Under practice conditions it is not feasible to measure pH_2 values in different ham muscles and, as the pH_2 in the top side represents the behaviour of the ham as a whole best, this pH_2 as a single value is to be prefered.

On the strength of the experiments described however it is not possible to decide whether pH measurement can provide a criterion for the selection of purchased hams. For this the figures show too large a scattering.

Furthermore it is very probable that the pH has not yet reached its ultimate value at 24 hours post mortem and the »age» of purchased hams is unknown.

It must be kept in mind that the results of the experiments reported must not be generalized as these are influenced to a large extent by race of pigs, transport conditions, stunning and slaughtering procedure, curing process, pasteurisation and other local factors.