EARLY POST MORTEM DETECTION OF PSE AND INTRAMUSCULAR FAT USING THE MQM-EQUIPMENT

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INTRODUCTION

The MQM-equipment measures reflectance profiles at 940 nm to a depth of 10 cm. It was primarily developed as an on-line method of measuring the PSE-status of the longissimus dorsi muscle the day after slaughter, PSE-status being defined as the solubility of the sarcoplasmic and myofibrillar proteins. Initial work, however, showed that the reflectance profiles could also be used to give an indication of intramuscular fat content, if the angle of insertion was such that the probe traversed across the marbling present. It was therefore also possible to divide pork loins roughly into three groups with low, moderate and high levels of intramuscular fat respectively. The equipment has been used to find pork loins with a good eating quality in experimental work. Thus, removing loins with PSE-meat as well as loins with a low intramuscular fat content, improved the eating quality of pork loin consignments.

Sorting on cutting lines the day after slaughter, while possible, is not very practical. The detection of meat quality characteristics at an earlier time post slaughter, which would allow incorporation of the sorting process into existing slaughterhouse regimes would find much more application in practice.

The early post mortem detection of PSE using optical probes has been investigated by many workers, mainly using existing equipment for the classification of the carcasses (Fat-o-Meater, Hennessy grading probe). The consensus is that such probes only give limited information on PSE, mainly because PSE is not fully developed 45 mins. after slaughter, especially in pig populations with a low frequency of the halothane gene (Jones et al., 1984, Seidler et al., 1984, Van der Wal et al., 1986, Lundström et al., 1987). In pig populations with a high frequency of the halothane gene probe measurements carried out on the slaughter line give more useful information, as it is known that it is mainly halothane sensitive animals, which have a very rapid PSE-development (Barton-Gade, 1984). Even here, however, a significant percentage of pigs ultimately developing PSE-meat will not be detected at this time.

While 45 mins. after slaughter is generally too early for detection of PSE in most countries, some work seems to show that the structural changes leading to PSE have progressed to such an extent by 1 1/2-2 hrs. after slaughter, that it is possible to distinguish which carcasses will develop PSE-meat (Swatland, 1981).

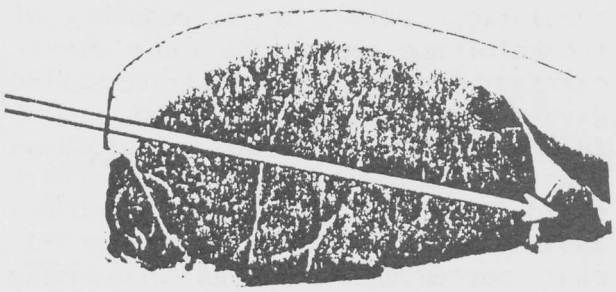
At this time Danish carcasses are leaving the chilling tunnel i.e. before the sorting into weight and marketing classes takes place, and hence a measurement carried out at this time, if the surface of the carcasses are not frozen, could perhaps find practical application on meat plants.

The aim of this experiment was to investigate the relationship between probe measurements carried out at various times post mortem and soluble sarcoplasmic and myofibrillar proteins and moreover, to investigate the application of probe measurements to estimate intramuscular fat content.

MATERIALS AND METHODS

Pig carcasses were randomly chosen on the slaughter line. About 45 mins. after slaughter probe measurements were carried out using the MQM-equipment at 2 points in the longissimus dorsi, between the 2nd and 3rd lumbar vertebræ and 2 cm lower down. The

probe was inserted in such a way that the longitudinal cross section was obtained:



The pre-slaughter treatment of the pigs was not known, but stunning took place in the CO_2-compact equipment and the factory used a moderate chilling tunnel.

Probe values were repeated close to the above measuring points about 2 hrs. after slaughter and on the basis of these measurements a maximum of 90 carcasses were chosen, as follows:

	Probe IMF		
Probe level	<1.0	1.0-1.9	≥2.0
<35	10	10	10
36-59	10	10	10
≥60	10	10	10

In this way it was hoped that the experimental material would contain a wide variation in soluble proteins as well as intramuscular fat level.

Probe measurements were repeated the day after slaughter on the carcasses chosen. Samples were then removed from the longissimus dorsi in the area measured. They were trimmed of fat and tendon, minced twice and frozen before measurement of soluble sarcoplasmic and myofibrillar proteins and intramuscular fat (SBR-method, Nordisk Metodik for Levnedsmidler, 1974).

RESULTS

Experimental material. It was not possible to find 10 longissimus dorsi muscles in each of the 9 PSE/IMF groups, as some of the combinations occurred relatively seldom. Thus, only 57 samples were taken with the following percentage distribution:

	Probe IMF			
Soluble proteins	<1.0	1.0-1.9	≥2.0	Total
< 0.150	4%	14%	4%	22%
≥ 0.150	12%	58%	9%	78%
Total	16%	72%	13%	

Soluble proteins <0.150 are indicative of PSE.

Probe values increased as post mortem processes progressed, being lowest on the slaughter line and highest the day after slaughter. The standard deviation was more or less constant for all times of measurement. Probe IMF decreased from 45 mins. to 2 hrs. after slaughter, whereafter it was relatively constant. The standard deviation in probe IMF values was highest at 45 mins. after slaughter:

		Time after slaughter 45 mins.	2 hrs.	22 hrs.
Probe value:	aver.	37.8	49.2	67.6
	s	18.7	22.6	20.3
Probe IMF :	aver.	2.05	1.51	1.67
	s	0.79	0.56	0.55

The average solubility of the sarcoplasmic and myofibrillar proteins was 0.165 extinction units per gm of meat, s = 0.027 and the average intramuscular fat content 1.50%, s = 0.67.

Relationship between probe values and soluble proteins. The relationship between soluble sarcoplasmic and myofibrillar proteins and probe values measured at various times post slaughter is shown in Figure 1. The relationship was, as expected, poorest for measurements taken at 45 mins. but was equally good for measurements taken 2 hrs. and the day after slaughter.

Normally, a probe value of 35 is considered limiting, values higher than this giving the risk of PSE-meat the day after slaughter (Andersen, I.E., unpublished material). 29.8% of the pigs in this material had probe values of 36 and above, of which only about half (16.7%) actually showed PSE-meat the day after slaughter. On the other hand 2 of the 12 PSE-muscles were not detected at this time.

Relationship between probe IMF and % intramuscular fat. The relationship between intramuscular fat determined analytically and probe IMF values measured at different times post mortem is shown in Figure 2.

In general, the relationships were poorer than with PSE-status. However, probe IMF measured 2 hrs. after slaughter was as good as that measured the day after slaughter as an indicator of % intramuscular fat.

Reflectance profiles obtained from PSE-muscle often have maxima, which are not caused by intramuscular fat. The undulations are often caused by the presence of meat juice around the probe as it is being removed from the muscle (when the reflectance profiles are measured). Removing PSE-muscles from the experimental material improved, but did not radically change above the relationships.

CONCLUSIONS

The results showed that measurements carried out on the slaughter line were least able to indicate PSE, whereas measurements carried out 2 hours after slaughter, even though the structural changes that occur from muscle to meat were not finished at that time, were as good as those carried out the day after slaughter.

Measurements carried out on the slaughter line were unsuitable as a measure of IMF with the present software. However, measurements carried out 2 hours after slaughter were again as good as those carried out the day after slaughter.

2 hours after slaughter corresponds more or less to the time when Danish carcasses leave the chilling tunnel, i.e. before the sorting into weight and marketing classes takes place. If the surface of the carcasses are not frozen at this time, then MQM-measurements carried out 2 hours after slaughter can perhaps find practical application on meat plants.

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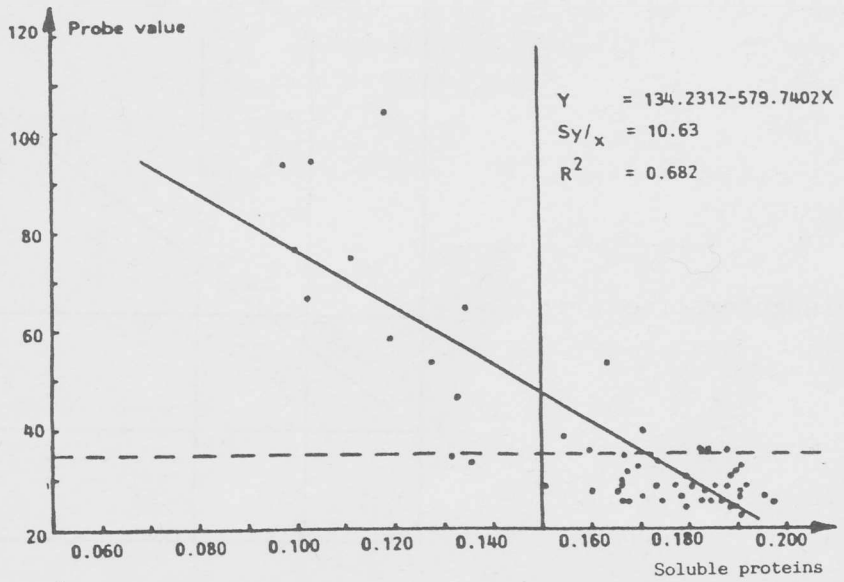
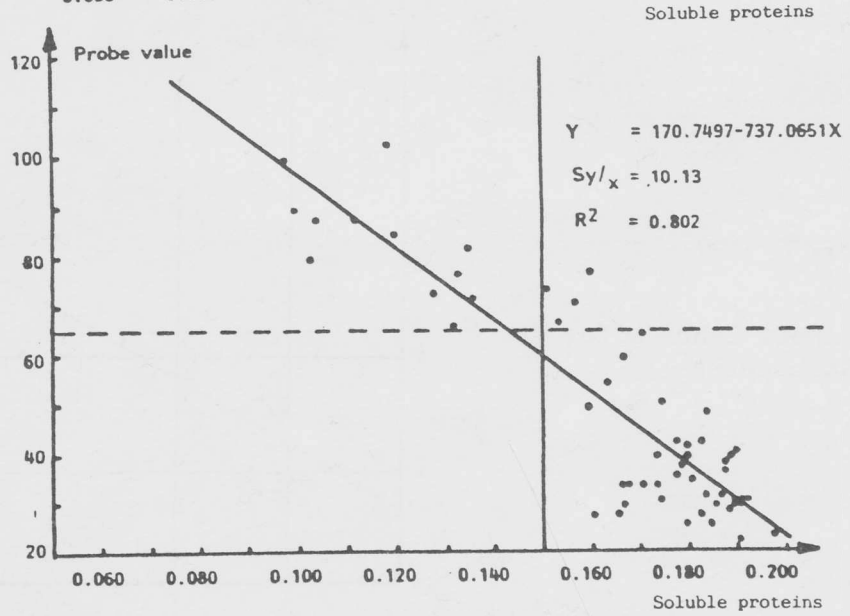
Figure 1. Relationship between probe value and soluble proteins

Slaughter line



About 2 hrs after slaughter



Day after slaughter

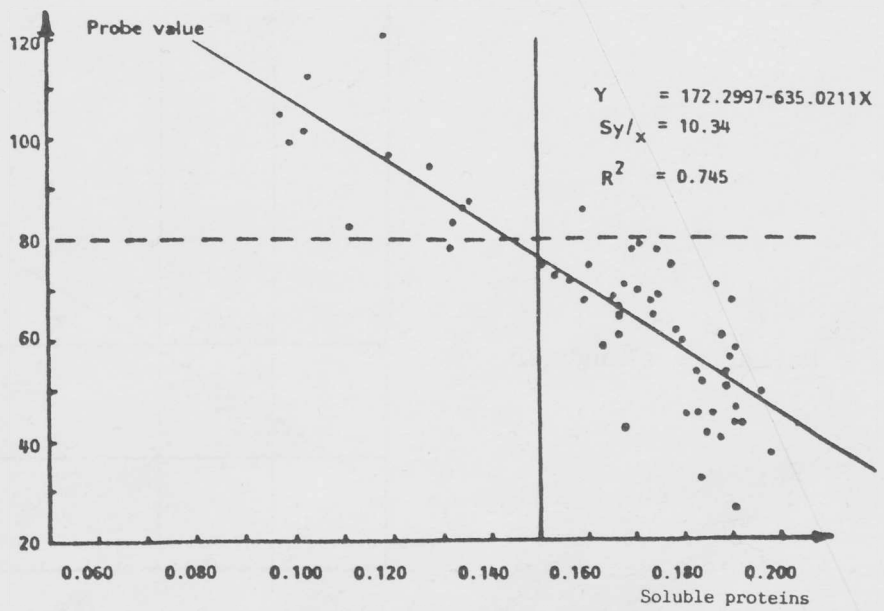
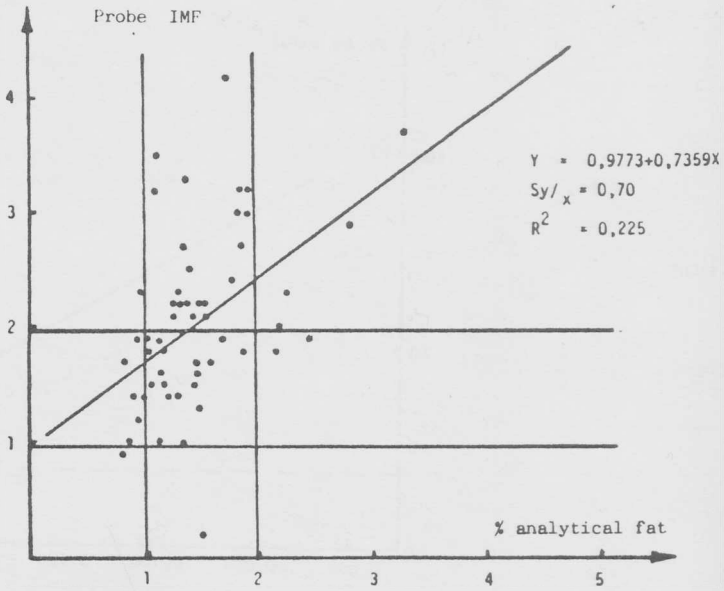
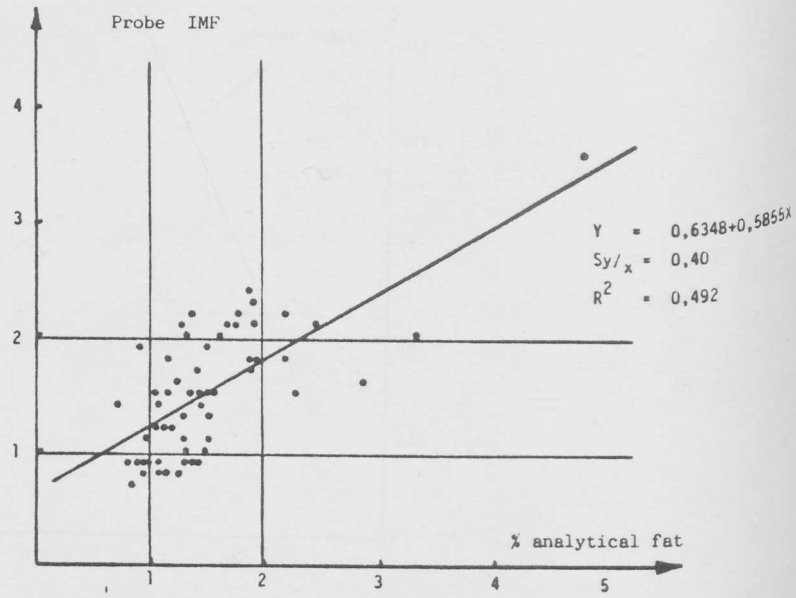


Figure 2. Relationship between probe IMF and % analytical fat

Slaughter line



About 2 hrs after slaughter



Day after slaughter