EVALUATION OF THE FREQUENCY OF RSE PORK IN FINNISH SLAUGHTER PIGS AND ITS TECHNOLOGICAL EFFECTS

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INTRODUCTION

RSE (reddish-pink, soft and exudative) pork is a quality class which has recently been described (Kauffman *et al.* 1992, Warner *et al.* 1995). However, the existence of pork of acceptable colour but high drip loss has been previously reported (Warris and Brown 1987). Warner *et al.* 1995 found that RSE samples were similar to normal samples (reddish-pink, firm, non-exudative) in protein solubility and myosin denaturation, but RSE had lower protein solubility values than DFD samples (dark, firm, dry). They concluded that although RSE pork had unacceptably high water loss, muscle protein denaturation was minimal and would not influence the functionality of processed meats. The purpose of this study was to evaluate the frequency of RSE pork in Finnish slaughter pigs and its technological effects

MATERIAL AND METHODS

The test material consisted of 1806 pigs which were slaughtered at two slaughterhouses, 941 in the first and 865 pigs in the second one. The M.longissimus dorsi (LD) was subjected to the following measurements on line: temperature after splitting (36 min p.m.), reflectance values with the Hennessy Grading Probe (GP4) and pH_1-value (45 min p.m.). On the day after slaughter, 58 LD and 29 M. adductor (AD) samples were cut to evaluate surface lightness (L*) and water-holding capacity (WHC). The aim was to collect 30 LD and 15 AD samples from both slaughterhouses. Colour was measured with the Minolta Chroma Meter CR 200 (L*, a*, b* values). WHC of LD samples was analysed by the filter paper method (Kauffman *et al.* 1986) whereas WHC of AD samples was analysed by the Pohja method (1974). Bag drip of the LD was analysed after 24 hours at 4 °C. A suggestion for classification of pork quality is presented in Table 1.

Table 1. Suggestion for classification of pork quality.

	Temperature °C	PSE1 and PSE2 (GP4 values)	pH_1	L*	WHC
Normal	below 41.0	30 - 58	above 5.80	42 -50	good
RSE	above 42.0	30 - 58	below 5.81	42 -50	poor
PSE	above 42.0	above 58	below 5.81	above 50	poor

RESULTS AND DISCUSSION

Table 2 shows the average values of variables measured on line. In this study the average PSE frequency ($pH_1 \leq 5{,}80$) was 6,6 %. When all carcasses were included, there was a significant positive correlation between carcass temperature (36 min p.m.) and PSE1 and PSE2 values ($P<0.05$). Moreover, there was a highly significant negative correlation between pH_1 values and carcass temperature, PSE1 and PSE2 values ($P<0.001$).

Table 2. Average values of variables measured on line.

Variable	Mean ± std	n
Temperature, °C	40.7 ± 0.7	1799
PSE1 value (GP4)	43.2 ± 5.9	1741
PSE2 value (GP4)	42.7 ± 5.8	1741
pH_1	6.28 ± 0.30	1801
PSE, %	6.6	1806

However, Hennessy GP4 classified 104 of the 119 PSE carcasses ($pH_1 \leq 5.80$) as normal. In addition, when pH_1 was less than 5.80 there was no significant correlation between pH_1 and GP4 values. But pH_1 was negatively related to carcass temperature ($p<0.001$). Warner *et al.* proposed that pre-rigor conditions in RSE pork caused precipitation of the sarcoplasmic proteins which are most sensitive to pH/temperature conditions existing immediately p.m.

When pH_1 was higher than 5.80 (=normal carcasses) there was a significant negative correlation between pH_1 and carcass temperature and GP4 values ($P<0.001$). This and the previous results showed that GP4 cannot differentiate PSE from normal pork in the present study.

The results of Table 3 are in satisfactory agreement with the suggestion of Table 1. PSE and RSE types had significantly higher carcass temperature than normal types 36 min p.m. ($P<0.001$ and 0.01, respectively). Furthermore, PSE types had significantly higher GP4 values than RSE or normal types ($P<0.001$). However, in PSE carcasses the mean PSE1 value of 52.2 was classified as good using the GP4. Thus GP4 values could not be relied on to separate PSE from RSE and normal types.

In PSE and RSE types, the mean pH_1 values were significantly lower than with the normal type ($P<0.001$, Table 3). Moreover, the surface of PSE loin was paler than that of RSE or normal types ($P<0.01$). This agrees with the results of Warner *et al.* that the lightness of RSE pork is between that of PSE and normal pork. However, in this study the colour of RSE and normal loin was paler than in the reference study. Murray and Johnson (1995) presented mean L* values of 59.3 and 52.6 for pale and normal LD types, respectively.

Table 3 shows that with the filter paper method, the WHC of the LD of the normal type was significantly ($P<0.05$) higher than that of PSE or RSE types, with losses of 3.0, 4.2 and 4.1 % respectively. The bag drip of the LD of the PSE type was significantly higher ($P<0.05$) than that of normal pork. The differences in the WHC of the comminuted AD emulsions were insignificant between the tested groups.

There was a significant positive correlation between drip loss of LD 24 hours after cutting and PSE1 and PSE2 values ($P<0.001$ and 0.01, respectively.). In addition, the higher the PSE1 values, the lower the WHC in LD ($P<0.05$, Kauffman method) and AD (0.01, Pohja method).

Table 3. Mean values of PSE, RSE and normal pork variables measured on the slaughter line and a day after slaughter or later. The filter paper method indicates the percentage of water absorbed by the paper. Pohja's cooking method indicates the amount, grammes of added water bound by 100 grammes of meat during the heating of the sausage emulsion.

Variable	PSE	RSE	Normal
Carcass temperature 36 min p.m., °C	41.6 ± 0.6A	41,2 ± 0,7a	40.6 ± 0.8Bb
Hennessy GP4 PSE1 value	52.2 ± 8.2A	41.0 ± 3.7B	42.6 ± 3.8B
Hennessy GP4 PSE2 value	60.4 ± 19.9A	41.1 ± 3.0B	41.6 ± 3.4B
pH_1 value of LD	5.60 ± 0.17A	5.60 ± 0.13A	6.40 ± 0.14B
L* value of LD 24 hours p.m.	54.9 ± 3.7a	52.8 ± 3.0b	52.3 ± 2.7b
WHC of LD 24 hours p.m., filter paper method, %	4.2 ± 1.8a	4.1 ± 1.6a	3.0 ± 1.0b
Drip loss of LD 24 hours after cutting, %	2.9 ± 1.8a	2.6 ± 1.2	1.9 ± 1.1b
Water content of AD, %	75.2 ± 1.4	75.1 ± 0.5	75.1 ± 1.0
Fat content of AD, %	2.6 ± 0.9a	1.8 ± 0.5b	2.7 ± 1.0a
Ultimate pH of AD	5.47 ± 0.10	5.45 ± 0.04	5.46 ± 0.06
WHC of AD, cooking method, %	70.0 ± 34.2	93.6 ± 26.6	91.9 ± 31.9

Means within a row marked with letters are significantly different, (a, b: $P<0.05$) and (A, B: $P<0.001$).

There was a significant negative correlation between pH_1 values and WHC of LD ($P<0.01$, Kauffman method) and drip loss of LD 24 hours after cutting ($P<0.01$). No significant correlation was found between WHC of AD (Pohja method) and pH_1 values.

CONCLUSIONS

The results showed that the Hennessy GP4 PSE1 and PSE2 values were bad predictors for PSE carcasses 45 min p.m. In this study PSE frequency was 6.6 %. The majority (87 %) of the carcasses showed RSE characteristics in LD: high temperature 36 min p.m, normal GP4 values, low pH_1 values, normal lightness (L*) values and low WHC. Due to its high drip loss, RSE pork is not suitable for retail cuts which are sold as fresh meat. The results showed that RSE pork had no effect on WHC of AD. This suggest that RSE ham can be used for cooked ham manufacture without technological losses. This should, however, be tested in practice.

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