GLYCOLYTIC POTENTIAL OF RSE PORK.

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SUMMARY

RSE (Red, Soft, Exudative) pork is red like normal meat and exudative like PSE (Pale, Soft, Exudative) pork. The cause of RSE pork is unknown. In the present study, we determined if the occurrence of RSE is related to the presence of the RN-gene. Glycolytic potential (GP = glucose + glycogen + glucose-6-phosphate + 2 x lactate) was used as indicator of the RN-gene. GP of normal (n = 25, $pH_u = 5.6$), RSE (n = 42, $pH_u = 5.5$) and PSE (n = 28; $pH_u = 5.3$) longissimus samples was determined. In RSE meat GP (137) was significantly higher ($p < 0.05$) than in normal meat (110), but lower ($p < 0.05$) than in PSE meat (161). Assuming a GP > 180 as indicative of RN-carriers, 4 out of the 42 RSE samples were from RN-carriers. By the same criteria, the PSE group contained 9 possible RN-carriers. Based on glycolytic potential measurements, RSE is not related to the RN-gene.

INTRODUCTION

RSE (Red, Soft, Exudative) pork is red like normal meat, and exudative like PSE (Pale, Soft, Exudative) pork. Since many procedures to select meat with poor water-holding capacity are based on the (presumed) association between color and water-holding capacity, it is difficult to separate RSE from other quality categories.

Currently, the cause of RSE pork is unknown. As reviewed by Offer and Knight (1988), protein denaturation, specifically myosin denaturation, results in a decrease in water-holding capacity (WHC). However, although the WHC of RSE pork is significantly lower than the WHC of normal pork, protein solubility (a measure of protein denaturation) in RSE and RFN meat is similar. Warner (1994) reported that the one consistent difference between RSE and normal (RFN = Red, Firm, Non-exudative) pork, is a slightly lower ultimate pH (pH_u) in RSE pork. Based on this observation, she suggested that RSE pork might be associated with the presence of the RN-gene. The RN-gene, also called the Hampshire gene, is associated with a high concentration of glycogen in the muscle (Naveau, 1986; Fernandez et al. 1992). Meat from RN-carriers, called acid meat or Hampshire-type meat, has a lower ultimate pH. Identification of Hampshire-type meat from RN-carriers is based upon the glycolytic potential (GP = glucose + glycogen + glucose-6-phosphate + 2 x lactate) being high (> 200 μmol lactate/g meat; Fernandez et al. 1992) compared to that of non RN-carriers.

To test the hypothesis that the occurrence of RSE meat is related to the presence of the RN-gene, we determined the GP in longissimus samples of different qualities.

MATERIALS AND METHODS

Samples were collected at a commercial slaughter plant, one day after slaughter. Based upon visual evaluation, RFN, RSE, and PSE loins were selected. Loins were transported to the laboratory. A 10 cm section of the longissimus thoracis et lumborum was used for further analysis. Ultimate pH, drip loss and color L^*-values were assessed using procedures described by Warner (1994). Based upon drip loss and L^*-values, samples were classified as either RFN (L^*-value = 42.0-50.0 and drip loss < 6%), RSE (L^*-value = 42.0-50.0 and drip loss > 6%) or PSE (L^*-value > 50.0 and drip loss > 6.0). Samples were ground and protein solubility in 0.55 KI/0.05 K-phosphate, pH 7.4. was assessed. In addition, one cut of each loin was packaged and frozen at -20°C. Frozen samples were pulverized and glycogen, glucose and lactate concentration were determined as described by Monin et al. (1987). GP, expressed in μmol lactate/g meat, was calculated.

Data were analyzed using analysis of variance using the GLM procedure of SAS (1996).

RESULTS AND DISCUSSION

Results are presented in Table 1. As expected, PSE was paler (higher L^*-values) than RSE or RFN. The difference between L^*-value of RSE and RFN, although significant, was small. As reported by Warner (1994), pH_u of RSE meat was slightly, but significantly, lower than pH_u of RFN. Also, pH_u of RSE meat was significantly higher than the pH_u of PSE meat. Protein solubility of RSE and RFN pork were equal and significantly higher (indicating less denaturation) than protein solubility of PSE meat. These results are in accordance with those reported by Warner (1994).

The GP of RSE meat was higher than GP of RFN meat. This suggests that, indeed, RSE is related to the RN-gene. However, GP of PSE meat is higher than GP of RSE meat. Moreover, the GP values of RSE pork are not as high as those reported for meat from RN-carriers (Monin and Sellier, 1985; Fernandez et al. 1992). According to Fernandez et al. (1992), the cut-off value for presence of RN-gene is 200 μmol lactate/g meat. In the present study, long pre-slaughter transport may have resulted in some breakdown of glycogen. Therefore, we decided to use a cut-off value of GP of 180 μmol lactate/g meat as an indicator of the presence of the RN-gene. Using this criterium, only 4 out of the 42 RSE samples were from RN-carriers. Using the same criterium, the PSE group contained 9 possible RN carriers out of 28 animals. Thus, based on glycolytic potential measurements, it seems unlikely that RSE is related to the RN-gene.

The higher GP in PSE samples as compared to RFN probably reflects the fact that PSE is more likely to occur in glycolytic white muscles. The white muscle is more prone to PSE because of its anaerobic metabolism and its higher glycogen content.

In addition to rate of glycolysis, extent of glycolysis (pH-decline) determines WHC and quality. It may be suggested that RSE pork is a mild form of PSE; RSE would have become PSE if pH_u would have been lower. The question then becomes "why didn't the pH decline further". Glycogen levels (GP), the substrate for lactate production, were not limiting; ultimate lactate concentration were 100 μmol/g whereas GP was 137 μmol, suggesting that an additional 37 μmol lactate could have been produced.

Based on the available information, we cannot rule out that the sole reason for the high drip loss in RSE is the difference in pH_u between RSE and RFN. Further studies are needed to establish the importance of pH_u without interference of protein denaturation. Also, we must determine why glycolysis stops while there is ample substrate left.

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Table 1: Quality characteristics, glycolytic potential (GP) and lactate concentration of pork longissimus muscle as influences by quality category.

	PSE (n = 28)	RSE (n = 42)	RFN (n = 25)
L*-value	55.9^{a}*	47.2^{b}	45.1^{c}
Drip loss (%)	11.2^{a}	8.2^{b}	4.2^{c}
pH	5.3^{a}	5.5^{b}	5.6^{c}
Protein solubility	109^{a}	190^{b}	197^{b}
GP (μmol lactate/g)	163	137	110
Lactate (μmol/g)	111	100	97

* Means bearing different superscripts on the same line differ significantly ($p < 0.05$).