nfluence of Post Mortem Changes, Transport and Cutting on the Electric Conductivity Measurements in Pork

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UMMARY

s the electric conductivity (EC) is a fast often applied method for the detection of meat quality at various times after slaughter, he performed studies served to study the influence of post mortem changes, transport and cutting on the EC measurements in ork. In "normal" glycolyzing pig carcasses the chilling rate is the most decisive factor for the resulting pork quality, as the iochemical processes in the muscles slow down with decreasing temperature. This fact is reflected in the development of the nal EC readings in the primal cuts. The EC_{24}-values in loin and top round were lower ($\leq$ 7mS/cm) after a sufficient chilling rocess including a blast freezer period of 60 min than after silent and slow chilling procedures. Furthermore before transport, arcasses should be cooled down to the legally required core temperatures of 7°C. Chilled transport at low temperatures had no nfluence on the resulting EC. The final EC-values in top round and loin of pigs were also independent of the time of cutting (hot- or cold-boning) after slaughter.

INTRODUCTION

Since many years meat scientists are looking for fast and reliable methods for the detection of meat quality at various times after slaughter. Most of the methods known are either limited in their detection period post mortem or allow only limited conclusions on some meat quality aspects. The more reliable methods in this context are e.g. the measurement of pH (SCHMITTEN et al., 1984; SCHWÄGELE et al., 1990) colour and electric conductivity (EC) (SCHMITTEN et al., 1986). The latter can be detected over a long period of time with satisfactory results. Thus during the last few years the determination of EC became an important tool in this respect with the increase of "quality-pork" programmes (BALLING, 1989) offered by different cooperatives on the German meat market.

The aim of the studies performed was to investigate the connection between post mortem changes in muscle and the development of the electric conductivity in dependence upon the chilling method, transport and cutting.

MATERIALS AND METHODS

The studies were performed with 107 carcasses belonging to a "brand name programme", which were arbitrarily selected at the slaughter-line. The animals originated from the Bundeshybridzuchtprogramm (BHZP) or a cross-breed called "PIG". The average slaughter-weight of the pigs was 88,7 kg with a lean meat percentage of 54,4%.

For the evaluation of the pork quality the electric conductivity (EC), pH-value, colour brightness (L^*), temperature (T) and drip-loss (DL) (HONIKEL, 1987) were measured. Measurements were performed in the intact carcasses as well as in the resulting primal cuts like M. semimembranosus and M.long. dorsi (12./13. vertebrae). Two slices from these muscles with an average weight of 100 g were used for the determination of the drip-loss and the measurement of the brightness. In the scope of the "brand-name-programme" an upper limit for the EC in loin and top round of 8 mS/cm after a period of 24 hours was defined.

RESULTS AND DISCUSSION

Dependence of the meat quality of intact carcasses upon the chilling method

Carcasses of a "brand-name-programme" were chilled under different conditions in two slaughterhouses. For the evaluation of the meat-quality in loin and top round, EC, pH, temperatures and drip-losses were measured. In both slaughter houses the carcasses were weighed after 40 minutes and chilled. One chilling procedure comprised a period of one hour in a blast freezer at -28°C with subsequently chilling at 3°C until the legally required storage temperature was attained ("two-step-chilling"), whereas the other procedure ("normal chilling") was performed at a constant temperature of 3°C.

In comparison of both methods the following results were obtained: Within 90 minutes the core temperature in loin decreased to about 24°C by "two-step-chilling". In the same period of time a decrease of about 9°C (29 - 30°C) was achieved in this muscle using the"normal chilling" method. After the same time the differences in temperature measured in top round (34 - 37°C) were much smaller than in the case of loin (figure 1). With respect to the pH-fall as a function of temperature there were no conditions triggering PSE-properties (HONIKEL and KIM, 1985) in these muscles.

The average EC-values in the primal cuts of the carcasses chilled at 3°C ("normal chilling") were without exception higher than in the "two-step-procedure". There were only small differences between the EC-values in top round and loin during "two-step-chilling", whereas under conditions of "normal chilling" the electric conductivity showed always higher values in loin compared

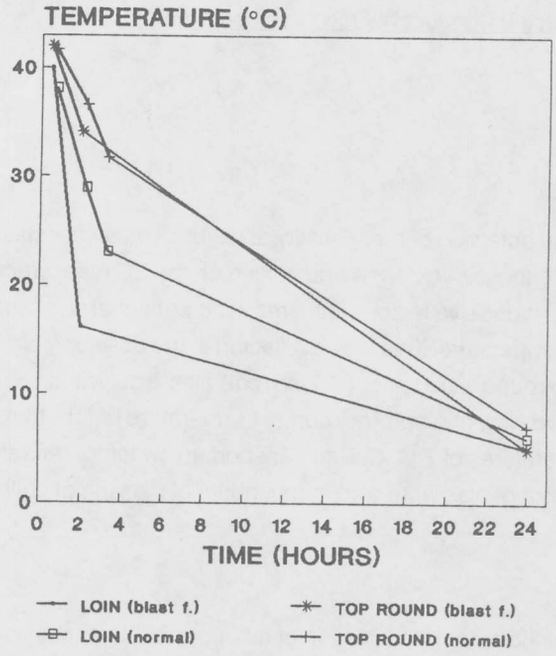

Fig. 1: Development of the temperature in loin and top round as a function of time using a "two-step-chilling" including a blast-freezer period and a "normal chilling" method

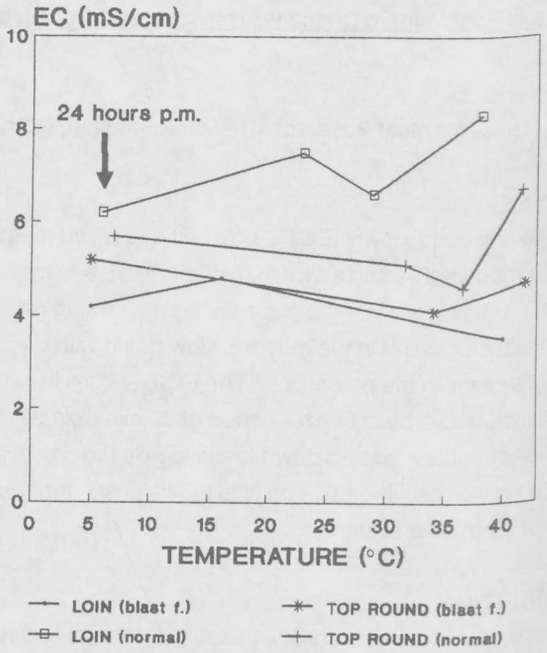

Fig. 2: EC-development in loin and top round as a function of temperature in dependence of the chilling method

with top round. After 24 hours the average EC-values in loins of "normal chilled" carcasses were 2 mS/cm higher than those measured in loins after the chilling procedure including the period in the blast-freezer (figure 2). These differences in EC are also expressed by the water-holding-capacity. Loins of "normal chilled" carcasses showed an average of 2,5% higher drip-losses.

These results show, that besides the animals chilling has an important influence on the meat-quality, as high temperatures cause accelerated biochemical reactions leading to meat with PSE-properties. Because of the early intensive chilling less cell membranes are destroyed and less myofibrillar proteins are denatured. After the application of the "two-step-chilling" 12% of the carcasses could not be used for the "brand-name-programme", whereas in the case of "normal chilling" 25% of the carcasses showed higher EC_{24}-values than 8 mS/cm in one of the two primal cuts.

Dependence of the meat quality of intact pig carcasses upon the time of loading and transport

The meat quality of pig carcasses of the "brand-name-programme" was investigated in dependence of the time of shipping and transport to the customer. The carcasses were selected at the slaughter line and chilled using a two-step-procedure including 60 minutes blast freezer at -13°C. One group of carcasses was shipped after a chilling period of 7 hours ("warm-shipping"), whereas the other group was chilled until the core temperature in top round had attained the legally required temperature of 7°C ("cold-shipping"). The carcasses were transported over a distance of 350 km (7 hours). Because of the breed slaughtered and the inital chilling there existed no pH-temperature conditions for the two different shipping-procedures leading to the expression of PSE-properties in the meat.

The course of the EC in loin was different in comparison of warm- and cold-shipping, but the EC_{24}-values were almost identical (figure 3). During transport the expected and reported increase of the EC could not be detected. Actually a decrease of the average EC-value of about 3 mS/cm was observed in the case of cold-shipping.

Drip-losses in loin and top round of warm-shipped carcasses were 1 respectively 2% higher than in cold-shipped. A similar tendency was detected for the brightness in the primal cuts, as the L^*-values measured in warm-shipped carcasses were about 3 (top round) and 4 (loin) units higher than in the case of cold-shipping.

After cutting the EC in loin and top round was measured and the values were compared with EC_{24}, which were detected just before this step in processing. For both shipping-methods cutting caused an increase of the EC-values. In contrast to cold-

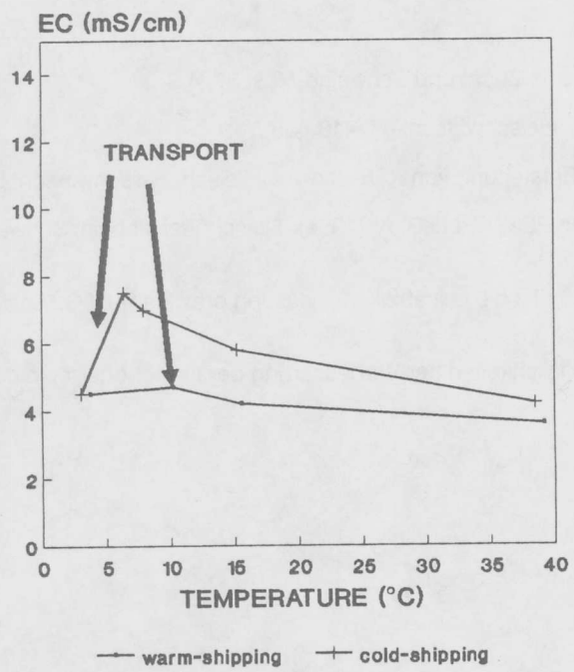

Fig. 3: Course of the EC in loin in dependence of the core temperature in the case of warm- and cold-shipping

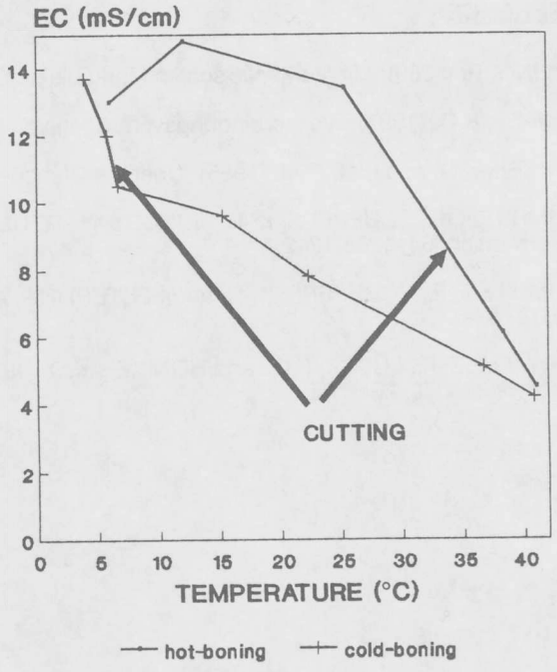

Fig. 4: Development of the EC as a function of the core temperature in top round in the case of hot- and cold-boning

shipping with an increase of about 2,5 mS/cm in the primal cuts during boning the measured increase of the EC-values in the case of warm-shipping was about 3,5 mS/cm.

Dependence of pork quality in the primal cuts upon time of cutting

The intention of the following studies was to elucidate the influence of the time of cutting on the meat quality in the primal cuts. In contrast to the already presented investigations, this time not the carcasses but the primal cuts were transported to the processing plant. Carcasses of the "brand-name-programme" were arbitrarily selected at the slaughter-line and the one group (hot-boning) was cut 2,5 hours post mortem. The other group of carcasses (cold-boning) was chilled over a period of 24 hours as described before, cut and the primal cuts together with loin and hams of the first group were transported to the customer.

A very rare and not defineable phenomenon was observed with regard to the development of the pH-value. Immediately after warm and cold-boning the pH-value increased at once for about 0,5 units in loin and top round, although it had already reached the final value in the case of cold-boning.

The final EC-values measured in top round after hot and cold-boning were similar (13 mS/cm) (figure 4). Also very similar, but in the average 4 mS/cm lower EC-values were determined in M. long. dorsi. Therefore the conclusion can be drawn, that the time of cutting before transport is not important for the resulting value of the electric conductivity.

CONCLUSIONS

Fast chilling including a blast freezer period leads in contrast to slow and silent chilling to lower EC-values and smaller drip-losses.

Transport has no influence on the final EC-values in pork.

Because of hygienic reasons warm-shipping of pig carcasses is legally not permitted. It shows in comparison with cold-shipping no differences in the EC-values; in the case of warm-shipping, however, the colour brightness is reduced and the drip-loss is higher.

Cutting causes an increase of EC-values in pork.

The time of cutting has no influence on the EC-values in pork.

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