THE TEMPERATURE OF HAMS, MEASURED SUBCUTANEOUS AND IN THE BICEPS FEMORIS DURING SLAUGHTER AND CHILLING.
I. CHANGES IN TEMPERATURE FROM EXSANGUINATION TILL THE END OF SCALDING.

VAN DER WAL P.G., VEERKAMP C.H., VAN BEEK G. and ENGEL B.

DLO-Institute for Animal Science and Health (ID-DLO), Research Branches Zeist and Beekbergen, Zeist, The Netherlands, DLO-Agricultural Mathematics Group (GLW-DLO), Wageningen, The Netherlands.

S-III.02

SUMMARY

Subcutaneous temperature and that of the biceps femoris muscle at a depth of 5 cm below the skin surface remained constant in the period from stunning to scalding. During scalding at 60 °C skin temperature increased rapidly according to an asymptotic curve from 30 °C to about 53 °C, while muscle temperature increased slowly, less than 1 °C, during a 12 minutes scalding period. With a mathematical flat layer model changes in temperature of hams at different positions below the skin surface could be calculated.

No indication was found for meat quality defects as a consequence of duration of scalding. Therefore, it was concluded that scalding at 60 °C till about 9 min, corresponding with normal slaughter house routine, hardly affects pork quality of clinically healthy pigs.

INTRODUCTION

Soon after stunning and exsanguination porcine carcasses are scalded in order to enable removal of bristles with a minimum force. Most common is tank-scalding where carcasses are immersed in hot (about 60 °C) water (SNIJDERS & GERATS, 1976; KOHNEN, 1989). Scalding prevents heat loss from the carcass, while it cannot be excluded that heat from the surrounding scalding water penetrates into the carcasses.

When carcass temperature is high and this high temperature level is maintained over a longer period, the frequency of meat quality aberrations increases (VAN DER WAL & EIKELENBOOM, 1984). Such aberrations become visible by paler colour and reduced water holding capacity of the muscular tissue. Therefore, chilling of carcasses should start as soon as possible after stunning. The effects on subcutaneous and muscle temperature till chilling were studied by continuous temperature registrations from stunning till the end of scalding.

MATERIAL AND METHODS

Temperature was observed continuously on the hams of six gilts (gilts: weighing about 100 kg) with copper-constantan thermocouples (outer diameter 2.5 mm) connected to a recorder. Registrations were subcutaneously and intramuscularly at a depth of 5 cm in the biceps femoris (BF) muscle of the right hams of carcasses that were shackled on the left hind legs following stunning (350 V, 1.5 s). Measuring started immediately after stunning and was continued till the end of a 12 minutes scalding period (60 °C). The interval between exsanguination and scalding was 5 min.

Additionally, changes in temperature were registrated in 20 carcasses submitted to scalding from 3.5 to 12 min. Besides the registrations, temperature profiles were calculated, using a mathematical flat layer model for heat transport. The thermo-physical properties were calculated with the computer programme Costherm (MILES et al., 1983).

Meat quality was evaluated 24 hrs post mortem by measuring pH and FOP values in the lumbar region of the longissimus muscle (LL).

RESULTS AND DISCUSSION

The subcutaneous temperature, just below the rind, was 31.1 ± 0.7 °C and 39.7 ± 0.6 °C in the BF immediately after stunning. Till scalding, a period of about 5 min, no remarkable changes occurred, neither in the temperature of the skin, nor in muscle temperature. During scalding, skin temperature increased rapidly over a period of 5 to 6 min, after which the rise leveled off at about 52 to 53 °C, according to an asymptotic curve. Muscle temperature remained constant till scalding started, after which a slight increase occurred from 39.6 to 40.5 °C at scalding periods lasting up to 12 min. Since the duration of scalding is much shorter in practice, normally about 7 to 9 min, the rise in muscle temperature also will be less. This latter statement was confirmed by the continuous temperature registrations (Table 1). These data offered the possibility to calculate changes in temperature, not only for the two positions the thermocouples were inserted into the carcass, but for other positions as well. The calculations showed a slight increase in BF-temperature at 2.5 cm below the skin surface at the end of the scalding process. This increase was less than that at the interface between lard and muscle, but more than that at a depth of 5 cm in the BF. Therefore, we concluded that heat production by metabolism, if present, and the influx of heat from the hot environment, i.e. the hot water in the scalding tank, exceeds heat delivery during the scalding process. This made it plausible that the penetration of heat into the carcass is more important than an extraordinary heat production within the BF muscle.

Immediately after scalding, subcutaneous temperature decreased sharply till about 45 °C, while at 45 min post mortem, after slaughter and evisceration had finished, skin temperature was at about the same level as at the moment slaughter started, as could be deduced from the additional measurements. The same held for temperature in the BF muscle.

As only complete carcasses could be scalded during a fixed period, meat quality was evaluated by comparing ultimate pH and FOP values, obtained from identically treated groups of carcasses. Any effect of duration of the scalding process should result in lower pH and higher FOP values related to an increasing duration of the heat treatment. Such a relationship would also be reflected by higher correlation coefficients between the duration of scalding and the meat quality traits. These correlations, however, were quite low and not significantly different from 0 (pH: -0.17; FOP: 0.08); although increases in muscle temperature showed a weak relationship with the length of the scalding procedure ($r = 0.39$; $P \leq 0.05$). In practice, scalding lasts about 2.5 to 9 min. Therefore, we concluded that scalding till about 9 min at 60 °C will hardly affect pork quality of the more internal situated muscular tissue of clinically healthy pigs.

REFERENCES

Kohnen, B. (1989). Technologie des Brühens und Enthaarens. Auswirkungen auf die Schweinehaut. I. Literaturzusammenstellung. Fleischwirtschaft, 69: 844-854.

Miles, C.A., Beek, G. Van and Veerkamp, C.H. (1983). Calculation of thermophysical properties of food. Physical properties of foods. Ed. R. Jowitt et al., Applied Science Publisher, London. p. 269-312.

Snijders, J.M.A. and Gerats, G.E. (1976). Hygiene bei der Schlachtung von Schweinen. III. Der Einfluss verschiedener Faktoren auf die Enthaarung. Fleischwirtschaft, 56: 238-241.

Wal, P.G. van der and Eikelenboom, G. (1984). Effect of muscle temperature soon after slaughter on pork quality: a pilot study. Neth. J. Agric. Sci., 32: 245-247.