Abstract 3

Carcass chilling in large cattle from the Belgian Blue breed : time-temperature evolution and recommendations

B. Collignon, S. Dehard, A. Clinquart

University of Liège, Faculty of Veterinary Medicine, Department of Food Science, Sart Tilman B43bis, 4000 Liège, Belgium

Introduction

According to the Regulation (EC) No 853/2004 (Annex III, Chap. VII, point 1), "*post-mortem inspection must be followed immediately by chilling in the slaughterhouse to ensure a temperature throughout the meat of not more than 3ºC for offal and 7ºC for other meat along a chilling curve that ensures a continuous decrease of the temperature"*. This Regulation doesn't mention any requirement for the speed and/or the maximal duration of the chilling process. It is nevertheless well known that this process cannot be too long, in order to avoid microbial growth, particularly in the core of the carcass where putrefaction can occur quickly at high temperature, once anaerobic conditions have been reached. As an example, Rosset and Roussel-Ciquard (1984) recommend that an internal temperature of 15°C is reached in 24h *post-mortem*. Taking into account that the chilling speed is lower in carcasses with high muscular development, the objective of the present experiment was to study the feasibility of such recommendations in large cattle from the Belgian Blue (BB) breed, particularly in the centre of the hindquarter.

Material and methods

Three slaughterhouses representative of practical chilling conditions usually observed in Belgium were selected for the present experiment, two of them using a 2 steps chilling process (2h30 shock chilling + chilling room), the third one using a 1 step chilling process (chilling room). In each abattoir, the measurements were repeated at 6 different days for 4 half-carcasses (corresponding to 2 different animals) of BB large cattle (hot carcass weights : 494±49, 473±32 and 476±25 kg in slaughterhouses A, B and C respectively ; European classification types DS2 or AS2). The carcass weight was measured at the end of the slaughter chain (= "hot carcass weight") and 48h later (= "cold carcass weight") in order to estimate the weight loss associated with the chilling process.

Temperature was registered continuously (1 measurement/min.) during 48h with Testo 171-4 or 171-8 data-loggers and thermocouple or thermistance probes at three different locations : ambience near the carcass (measured at a height of 40 cm, between both half-carcasses distant of 10 cm), superficially (under the superficial aponevrosis of the fore-leg, at the level of the *radial extensor of the carpus*, at half-distance between the bend and the distal end of the leg) and core (the deepest point of the hindquarter i.e. near the proximal end of the femoral bone, the probe being inserted via the interface between the *pectineus* and *adductor* muscles). The temperature usually being measured in the *longissimus dorsi* muscle, it was also punctually measured 1, 2, 4, 8 and 48h *post-mortem* at this location (at the level of the 7-8-9th ribs) in combination with pH, using a Knick Portamess type 913 Calimatic pH meter, a Mettler Toledo LoT406-M6-DXK combined insertion probe and a Pt1000 temperature probe.

Results and discussion

The internal temperature (+ 7°C) required by the European Regulation (EC) No 853/2004 has been reached around the 48th hour of refrigeration in the deepest point of the hind-leg of the carcasses evaluated during the present experiment. An internal temperature of 15°C in 24 hours *post-mortem* is recommended to reduce microbiological risks (Rosset and Roussel-Ciquard, 1984). This limit of 15°C was reached after 23 hours on average in the present study. Proliferation of bacteria potentially present within meat has probably been limited. Nevertheless, when analyzing individual measurements, it can be observed that 1/12, 4/12 and 9/12 carcasses were not in conformity with this recommendation in slaughterhouses A, B and C respectively and that putrefaction in the deepest point of very heavy carcasses cannot be excluded. Furthermore, according to the CSIRO Australian Division of Food Processing (1989), the 15°C threshold has to be reached after 20h. This recommendation seems to be difficult to put into practice with BBB large carcasses. It has to be noticed that the temperature in the *longissimus dorsi* cannot be used as an indicator of the "core temperature" since the temperature at that point was 3.6, 6.2, 13.3, 15.6 and 4.5°C lower than the deep leg temperature at 1h, 2h, 4h, 8h and 48h *post-mortem* respectively. A final pH lower than 5.8 (considered as a normal value ; a higher pH being associated with abnormally *Dark, Firm* and *Dry* meat) has been observed in all the carcasses. Due to the electrical stimulation carried out in the slaughterhouse B, pH values tended to fall much faster while achieving a final value similar to the two other slaughterhouses. The values of temperature in deep leg and in deep *longissimus dorsi* muscle combined with those of pH, led to the conclusion that in the three slaughterhouses, no risk of "*cold shortening*" (= alteration of tenderness due to an excessive chilling rate early *post-mortem*) has to be expected.

The superficial temperature evolution was systematically in conformity with a recommendation from the Canadian Agency for Food Inspection (2002) suggesting that the temperature has to be lower than 7°C after 24h. This threshold has been reached after 12h, 9h and 11h on average in slaughterhouses A, B and C respectively. It is difficult to conclude about another recommendation from Rosset and Roussel-Ciquard (1984) who suggested that a temperature of 5°C is reached "as soon as possible".

Concerning the weight loss, it ranged from 2.3 to 2.7% from one slaughterhouse to another (thus, a substantial difference of 0.4%), the lowest weight loss being observed in slaughterhouses (A and C) using a shock chilling, which is in agreement with Ortner (1989) for whom weight loss can be reduced by using shock chilling tunnels.

From this study, it can be concluded that the speed at which the surface of carcasses is chilled seems sufficient to limit microbial growth. The maximal internal temperature of + 7°C required by the European Regulation (EC) No 853/2004 was reached in 48 hours in the three slaughterhouses. However, taking into account some recommendations from the literature, the risk of putrefaction in deep leg has not to be excluded even if no putrefaction was reported by the slaughterhouses. Therefore, it is important to control the temperature in deep leg, particularly in very heavy carcasses (weight higher than 500 kg)

References

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