Abstract #167

Difference in meat quality depending on process time during slaughtering and chilling

M. Hviid[1], L. Kristensen[1]

[1] *Danish Meat Research Institute, Meat technology, Taastrup, Denmark*

Introduction

Tenderness and water holding capacity (WHC) are generally considered the two major meat quality traits, and – besides animal handling and genotypes – the chilling process is very important for the level of these two quality parameters.

The aim of this study was to investigate the variation in meat quality and process time at different European abattoirs.

Methods

Six different European abattoirs were investigated, all using group-based CO_2 stunning. Abattoir 5 used vertical condensation scalding and the others used scalding tanks. Abattoir 6 used spray chilling followed by a mild chilling tunnel process, the others used chilling tunnels with different air temperatures to ensure an equalization temperature of 7°C. The difference in process time during slaughter and chilling was recorded for 8 carcasses from sticking to entering and leaving the chilling tunnel. The temperature profile was measured in 4 carcasses with Testo 175T2 equipment including temperature loggers placed in the core of the loin. From carcasses going through the normal slaughter procedure without any stops due to extra veterinary inspection, 20-24 right loins were selected randomly for meat quality assessment. The samples were collected from the carcasses 22-24 hours after sticking. Samples from abattoir 2 and 3 included entire male pigs and castrates, while the others were a mix of female pigs and castrates.

EZ-DripLoss (EZ-drip) was determined as described by Rasmussen & Andersson, 1996, and tenderness was measured as Warner Bratzler shear-force (WBSF) at round cores with a V-shaped blade at a texture analyzer (Kragten & Gil, 2015). After aging for 72 hours, the sample was frozen until investigation. Only peak force (F1, Newton) is used in the following statistical analyses. Besides EZ-drip and WBSF, hot carcass weight and sex were recorded. The fixed effect of $abattoir_{(1-6)}$, $sex_{(1-3)}$ and the interaction were analysed with R.

Results

The process time (average of the recorded carcasses) and chilling process for the investigated abattoirs differ, Table 1.

Table 1. Process time (minutes) for the most important production steps in 6 European abattoirs.

Abattoir	Scalding time (min.)	Sticking to chilling (min.)	Min. in chilling tunnel	Min. to 7°C in the core in the loin
1	6.5	47	81	279
2	7.0	36	65	207
3	6.5	35	72	233
4	5.2	33	100	252
5	10.3	38	100	207
6	7.0	26	130	421

Due to different line speeds, the time from sticking to the start of chilling varies between the abattoirs. Time to 7°C will depend on both time and temperature in the tunnel. Abattoir 6 with the mild chilling took the longest time.

Table 2. WBSF (Peak Force, N) and EZ-drip (%) in loins – average values.

Abattoir	WBSF (N)*	EZ-DRIP (%)*
1	40.5^{a}	2.4^{ab}
2	50.0^{ab}	2.8^{a}
3	45.3^{a}	3.0^{a}
4	52.6^{b}	2.2^{ab}
5	46.8^{ab}	2.0^{ab}
6	67.5^{c}	1.8^{b}

* Columns with different letters mean P<=0.05

The statistical analysis showed that WBSF depended on abattoir and sex, where entire males had a significantly higher WBSF compared with castrates and female pigs. The variation in EZ-drip depended on abattoir, sex and the interaction between them. Entire males had a higher EZ-drip compared to female pigs and castrates. There was no influence of hot carcass weight on WBSF or EZ-drip.

The time from sticking to chilling is the most important single attribute to the difference in WBSF between the abattoirs, and Figure 1 shows the relation with WBSF (R^2=0.65).

Conclusion

Animal handling at the day of slaughter and the chilling rate are well known to influence tenderness and WHC due to the pH/temperature history of the muscle. The use of chilling tunnels in pig abattoirs delays the pH decrease and leads to a lower chill loss and drip loss as well, but accelerated chilling can also result in cold shortening (less tender meat), Rosenvold & Andersen, 2003.

In this investigation, a very fast slaughter process influenced the WBSF of the loin. The abattoir with the shortest time (26 min.) had nearly 40% tougher meat than the abattoir with the longest time (47 min.), and the “time from sticking to chilling start” gives a better correlation to WBSF than “time to 7°C in the core”. Former studies have focussed on the chilling process as such and not the time for the onset of the chilling. Rosenvold et al. (2010) showed that the stepwise chilling can lower WBSF by 25%.

The variation in EZ-drip could not be explained by differences in process parameters at the different abattoirs in this investigation. Time to onset of the chilling will be an important parameter in the future work with meat quality and processes.

Literature

Kragten S.A. & M. Gil, 2015. Instrumental tenderness – shear force. A handbook of reference methods for

meat quality assessment. 1st edition FAIM-COST, p45-54

Rasmussen A.J. and M. Andersson, 1996. New method for determination of drip loss in pork muscles. Proceedings 42nd ICoMST, Lillehammer, Norway (1996), p286-287

Rosenvold K. & H.J. Andersen, 2003. Factors of significance for pork quality – a review. Meat Science 64:219-237.

Rosenvold K. et al., 2010. Stepwise chilling: Tender pork without compromising water-holding capacity. J. Anim. Sci. 88:1830-1841.

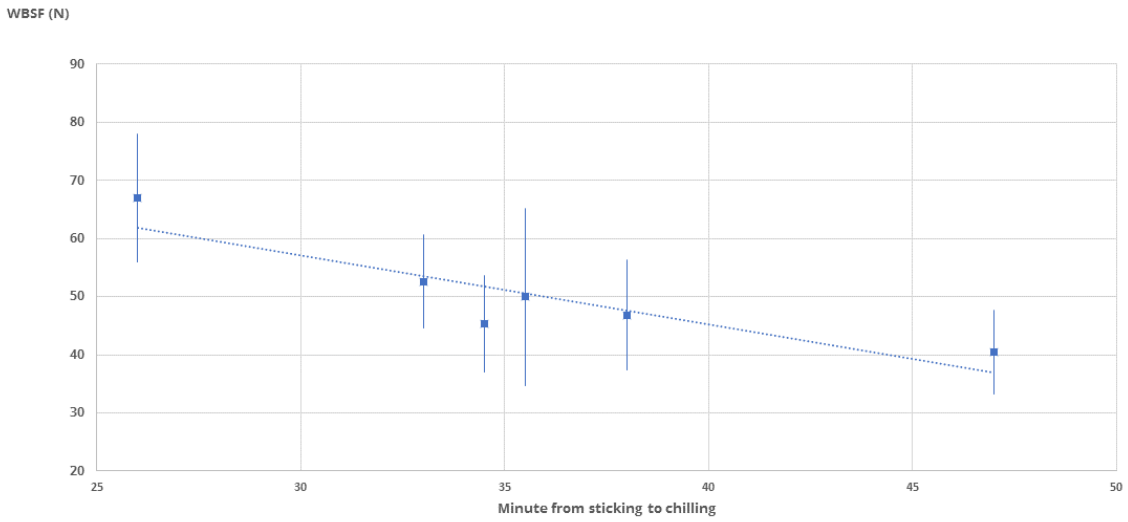

Figure 1.
Minutes from sticking to chilling and WBSF. LS Means with confidence interval for the 6 different times/abattoirs, adjusted for sex.