Exsanguination of slaughter pigs – influence on meat quality

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Introduction

Stunning methods induce temporary loss of consciousness and rely solely on prompt and accurate sticking procedures to facilitate bleeding and to cause death. Sticking involves the serving of major blood vessels e.g. neck cutting or chest sticking. The stun-stick interval should be sufficiently short to induce death through blood loss before the animal recovers from the stun. Sticking procedures vary; however, the supply of oxygenated blood to the brain should be stopped as rapidly as possible.
If exsanguination fails or is incomplete, even the adequately stunned animal has a potential to regain brain and body functions (TROEGER et al., 2005). Besides the animal welfare issue, effects on meat quality and residual blood content are probable. Therefore, the following questions should be answered. Is there an effect of bleeding success on meat quality and residual muscle blood content? Is there an effect of a prolonged stun-to-stick interval (eg. CO_2-Backloader) on amount of obtainable blood, meat quality and/or residual muscle blood content?

Materials and Methods

The amount of blood loss (in % of body weight) from 1825 genetically well defined slaughter pigs was measured and put in relation to parameters of meat quality and degree of bleeding out.
The pigs were stunned electrically with a cardiac arrest method (head-only current: 1,3 amps, 2 sec, 500 hz; head-to-body current: 1,1 amps, 5 sec, 100 hz). Sticking was carried out by two different trained workers: Worker A (skilled) and worker B (less skilled). Two different stun-to-stick intervals were used: 15 sec and 180 sec. The resulting test groups are shown in Tab. 1.

Table 1: Test Groups

	1A	**1 B**	**2 A**
n pigs	1165	542	118
stun-to-stick interval (sec)	15	15	180
sticker	A (skilled)	B (less skilled)	A

The sticking blood amount was calculated by weighing the stunned pig on a horizontal scale (before sticking) and for a second time after bleeding on the rail (about 10 minutes after sticking). From the difference of the two weights resulted the blood amount of each single pig.
As meat quality parameters, pH-values in M. longissimus dorsi and M. semimembranosus (Portamess, Fa. Knick, Berlin) 1 and 24 hours p.m., conductivity in M. longissimus dorsi and M. semimembranosus 24 hours p.m. (LF-Star, Fa. Matthäus, Pöttmes) and meat colour of M. longissimus dorsi 24 hours p.m. (Minolta-Chromameter, Japan) were measured. Hemoglobine amounts of diaphragma muscles were analysed by HPLC (WOLTERSDORF et al., 2000). Differences between the test groups were tested for significance (Scheffé-test, $P < 0,05$).

Results and Discussion

The amount of blood (bleed-out) over all pigs was 4.25 % (Median) of live body weight. The bleed-out was with 4.29 % higher ($P < 0.05$) for the skilled worker (A) than for the less skilled one (B) with 4,13 %. After delayed bleeding (180 sec) the bleed-out was 4.07 %.
The residual muscle blood content was influenced by stun-to-stick interval. After delayed sticking the hemoglobine content in diaphragma muscle was 2.47 mg/g, versus 2,30 mg/g after immediate sticking. The difference was significant ($P < 0.05$). There was a significant correlation between bleed-out and residual muscle blood content ($r = -0,26$; $P < 0,001$).
Meat quality was influenced in a positive direction by higher amounts of bleed-out. Meat quality was better for carcasses of pigs stuck by the skilled worker (A). PH-values of loin and ham 24 hours p.m. were a little but significant ($P < 0,05$) higher, conductivity-values of ham were lower ($P < 0,05$). The colour of loin was more red (higher a*-values) and less pale (lower L*-values) (Tab. 2).

Table 2: Results of meat quality measurements for different workers (1A, 1B) and after delayed sticking (2A) [mean values]

	Worker A (skilled) Stun-to-stick 15 sec	Worker B (less skilled) Stun-to-stick 15 sec	Worker A (skilled) Stun-to-stick 180 sec
pH_1 ham	6.54	6.51	6.50
pH_1 loin	6.45 [a]	6.43 [a]	6.35 [b]
pH_{24} ham	5,64 [a]	5.61 [b]	5.71 [c]
pH_{24} loin	5.50 [a]	5.47 [b]	5.52 [c]
LF_{24} ham	3.85 [a]	4.69 [b]	3.44 [a]
L* loin	52.61[a]	53.15 [b]	52.85 [ab]
a* loin	4.13 [a]	3.84 [b]	4.98 [c]

pH_1 = pH-value 45 min p.m.; pH_{24} = pH-value 24 hours p.m.; LF_{24} = conductivity 24 hours p.m.; L* = brightness; a* = red value;
a, b, c) values with different indices in the same line differ significantly ($P \leq 0,05$)

The carcasses of delayed stuck pigs showed lower pH_1 - values in M. longissimus dorsi but higher pH_{24} - values in loin and ham (Tab. 2). These results could be induced by a prolonged motoric activity of the electrical stunned pigs because of delayed sticking with an accelerated depletion of muscle glycogen as a consequence.

Conclusions

The performance of sticking and the stun-to-stick interval influence the efficiency of bleed-out. Efficiency of bleed-out influences meat quality and residual blood content of the carcass (and so carcass weight). Therefore, a quality assurance of sticking and bleed-out by systematic control is necessary and economical significant.

References

1. Troeger, K., Moje, M., and Schurr, B. (2005). Kontrolle der Entblutung. Voraussetzung für eine tierschutzkonforme Schweineschlachtung. *Fleischwirtsch. 85 (2),* 107-110.
2. Woltersdorf, W., Arneth, W., and Mintzlaff, H.-J. (2000). Ausblutungsgrad beim Rind nach unterschiedlicher Rückenmarkzerstörung. *Fleischwirtsch. 80 (9),* 135-139