

Pre-mortal stress in slaughter cattle is known for causing both a negative impact on animal welfare as well as on meat quality. Animals less accustomed to human-animal contact may be especially difficult to handle on the day of slaughter. A shift of the stunning- and exsanguination processes from the abattoir to the animals' familiar environment improves animal welfare at slaughter. Consequently, dead, opposed to live animals, are transported to the abattoir, where evisceration and further processing can take place. In terms of commercial sale of the meat, the case for on-farm slaughter is complex within Europe. In Germany, however, on-farm stunning and killing of free-range cattle has become legal in November 2011, even by means of a gunshot.

The aims of this thesis were to assess possibilities of guaranteeing a proper stun by a gunshot at cattle, and to investigate the effect of the gunshot method on meat quality traits and exsanguinated blood characteristics. Isolated heads of post-mortem cattle and, in a follow-up study, live cattle were shot by employing various projectiles and calibres. Sections of the skulls revealed the penetration depth of the projectile, brain tissue damage and brain haemorrhages, respectively. Additionally, the stun quality was assessed by analyzing vital signs displayed by the animal directly after the shot. To investigate possible effects on meat quality, a comparison was conducted between cattle slaughtered on-farm via gunshot method and cattle originating from the same herd but slaughtered ordinarily at the abattoir. Furthermore, recommendations for a practical implementation of the gunshot method were derived, for example, that the shooting ought to take place in a special paddock that is familiar to the cattle, instead of open pastureland. The whole project was implemented on two farms in Northern Germany, keeping free-range cattle of the breeds Galloway and German Angus.

It was found that an accurate frontal gunshot at cattle using a suitable projectile and calibre reliably caused haemorrhagic bleedings sufficient for a deep stun or instantaneous death. In terms of optimized energy transmission and even safety concerns, the projectile employed should remain within the cranium instead of passing through the skull. Cattle slaughtered via gunshot method revealed improved meat quality compared to cattle slaughtered ordinarily at the abattoir. Significant differences were found in terms of tenderness (lower Warner-Bratzler shear force), water holding ability (lower drip loss), and meat colour (higher L\* -values). No cattle slaughtered via gunshot method showed final pH -values characteristic for DFD (dark, firm, dry) -meat. The minimization of pre-mortal stress was even more distinctly revealed by significantly different blood lactate -values of both groups. This refers not

only to the animal shot but also to the herd members witnessing the shot and breakdown. Furthermore, transport-related bruises and lacerations can be excluded as a matter of principle when the gunshot method is employed.

Key words: Abattoir, animal welfare, blood lactate, brain haemorrhages, cattle, free-range husbandry, Germany, gun, gunshot, meat quality, on-farm, shot accuracy, slaughter, slaughterhouse, stress, stun quality