CO2-Stunning of pigs – an example of behaviour during induction and overview of gas concentration and other key parameters during routine slaughter of pigs in modern low stress group stunning devices

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Alternatives to CO_2- stunning of pigs should result in veritable improvements with regard to animal welfare. To date, studies from which many judgements with regard to animal welfare were developed, were not performed in modern low stress group stunning devices, where pre-slaughter stress can be significantly reduced and many technical features have improved. This brings into question the validity of the results in relation to modern practices. We therefore present a behavioural study of pigs during the induction to CO_2 stunning. To integrate these results and to give an idea of the conditions pigs encounter during modern CO_2 gas stunning we will show the results of gas measurements and other key parameters, gathered during inspection at site in 25 slaughter plants between 2010 and 2020.

A behavioural study was performed in 2016 under practical conditions (slaughter speed 290/h) on 110 pigs, stunned in a device type Backloader 5 (Butina®) in groups of (2 to) 4. For remote video observation we used GoPro® cameras in 30 gondolas. The space in the gondola was 2.45 m^2 = 0.61m^2/pig. Gas concentrations (CO_2- and O_2) were continuously measured using a PBI Dansensor A/S, Ringsted Denmark (CheckMate III O2 (ZrOx) / CO_2), in combination with a pump (Type PM13421-NMP30, Fa. Neuberger, Freiburg, Germany) connected to a hose (diameter 4 mm) let down at the side of gondola, at the same height of the pigs nose, entering into the gas atmosphere. Additionally we measured at the level of the monitoring sensors of the stunning device (>80% CO_2 was reached after 6 seconds at 30 cm below floor level; the pre-set concentration of 95% CO_2 at the first stop 249 cm below floor level was reached after 23 seconds, while the gondola stopped there for 27s). Video recordings were analysed for “start of deep breathing through open mouth”, “start of signs of agitation i.e. back or forward movements, quick lateral head movements”,“time of inability of the animal to remain in an initial standing position (e.g. stumbling, tumbling = LOP)” each sign if visible at the first pig of the group after start of gondola movement and “time of definitely lying (first / all pigs of the group)”. Agitation occurred in 10 of the 30 groups. In 20 groups the pigs showed deep breathing, then tumbled and fell. As an approach to calculate a critical time interval of potentially negative experience we calculated roughly the time interval between the first pig of the group showing tumbling or – if so - agitation to all pigs lying. This was on average 10s (range 6-18s; 50% interval 8-12s) and thus shorter than presumed to date.[1]

The data presented on modern CO_2 stunning were recorded in 25 plants using group stunning devices of different manufacturers (Butina, Marel, Banss, Banss Austria) mostly type Backloader or similar on behalf of retailers, authorities and slaughter industry. We will focus on conditions during induction, such as time to reach > 80% CO_2, time to reach the first stop and CO_2 concentration at the first stop. Additional information will comprise design, number and size of gondolas including space per pig, dwell time in > 80% CO_2, gas concentration at deeper stops, and stun to stick interval. Our measurements as well as volumetric calculation show that in most of the plants concentration of oxygen falls below 2% within 10 seconds or less, thus suggesting an anoxic besides the hypercapnic component during the induction phase.

We conclude that technological progress has modified conditions pigs experience during CO_2-stunning and refinement has the potential to improve animal welfare during stunning of millions of slaughter pigs until better alternatives are available. If studies on alternatives to CO_2-stunning include comparative studies the actual best practice and technological standards of CO_2 stunning should be represented.

[1] Video examples will be shown if possible