The effect of age and method of gas delivery on carbon dioxide euthanasia of pigs

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Abstract

The objectives of this research were to evaluate the effect of age and delivering method during carbon dioxide (CO₂) euthanasia on the welfare of pigs (Sus scrofa). In Experiment 1, pigs aged 1, 2, 3, 4, 5 and 6 weeks (GRAD; n = 5 pigs per age) were placed in a chamber gradually filled with CO₂ released at a flow rate of 20% chamber volume per min. In Experiment 2, three week old pigs were placed in a chamber pre-filled with 100% CO₂ (PRE; n = 5). In both experiments, plasma cortisol concentrations were measured before and after exposure to CO₂. Behaviours indicative of stress and insensibility were recorded continuously during gas exposure; panting, open-mouth breathing, righting response, escape attempts, loss of posture, muscular excitation and respiratory arrest. Cortisol concentrations were elevated in pigs after CO₂ euthanasia, regardless of age or gas delivery method. The behavioural response to CO₂ was not affected by pig age. Latency to display panting, righting response, escape attempts, loss of posture, muscular excitation and respiratory arrest were shorter for PRE than GRAD pigs, but, duration of escape attempts and the cortisol response to euthanasia were similar between PRE and GRAD pigs. However, pigs placed in a chamber pre-filled with CO₂ spent a greater proportion of time prior to loss of posture displaying escape attempts. Regardless of age or induction method, exposure to CO₂ causes behavioural changes indicative of stress prior to loss of consciousness, therefore there is a need to continue to evaluate alternative methods of euthanasia.

Keywords: age, animal welfare, behaviour, carbon dioxide, euthanasia, pigs

Introduction

There are times on a swine farm when pigs (Sus scrofa) become ill or injured, and the animal care person must decide if euthanasia is necessary and, if so, what method of euthanasia is most humane for the pig, while also considering worker stress. The American Veterinary Medical Association guidelines for the euthanasia of animals (AVMA 2013) suggests several methods of euthanasia that are acceptable for pigs less than 32 kg (nursery and suckling pigs). These include carbon dioxide gas (CO₂), intravenous administration of barbiturates and blunt-force trauma performed using a non-penetrating captive bolt or manually (manual blunt-force trauma is only acceptable for suckling pigs). Euthanasia of pigs using an injectable agent is not practical on-farm as barbiturates require special handling and licensing. Manually applied blunt-force trauma can be difficult to apply consistently and may be aesthetically unpleasant for operators to perform. In contrast, mechanically applied blunt-force trauma performed using a purpose-built, non-penetrating captive bolt can deliver an appropriate and uniform amount of force resulting in more consistent structural damage to the brain (Casey-Trott et al 2013, 2014), however, not all farms have access to these tools. In recent years, the US swine industry has encouraged the evaluation of alternative methods of euthanasia for pigs and particularly inhalant agents (Sadler et al 2014a).

Carbon dioxide causes death in animals by inducing acidosis and inhibition of neurons that leads to loss of consciousness, insensibility and finally death (European Food Safety Authority [EFSA] 2004). The advantages of CO₂ gas as a method of euthanasia are that it is relatively inexpensive, non-flammable and non-explosive. In addition, it is commonly used to stun pigs at slaughter in several countries. However, exposure to CO₂ can cause the formation of carbonic acid on respiratory and ocular membranes and the sensation of breathlessness and fear in animals (AVMA 2013). Due to the potential negative welfare implications of CO₂ there is a need to further evaluate this method of euthanasia.

There are two common methods of delivery when administering CO₂ to euthanase animals; pre-fill and gradual fill. The pre-fill procedure involves placing an animal in a closed