The effect of electrical head-to-chest stunning on the EEG in sheep

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Abstract

Head-to-body stunning is regarded as ‘best practice’ stunning for sheep. The benefits are loss of consciousness followed by cardiac arrest, death, prevention of animal movements post stun/kill and improved meat quality. Commercial equipment places electrodes on the head and back, which is known to cause pelt burning, thus reducing the value of the skins. The aim was to demonstrate that passing current at 1.5 A and 50 Hz from the top of the head to the chest in lambs for 3.1 s would result in epilepsy. Electroencephalographic (EEG) and electrocardiographic (ECG) activity was recorded in sheep using non-invasive electrodes. Measurements in this trial were successfully performed on three lambs (live weight 25 to 39 kg) which were anaesthetised and given neuromuscular blockers to inhibit muscle activity. EEG information showed that the head-to-chest stunning produced an epileptic-like episode, which was followed by an isoelectric output. ECG recordings showed that ventricular fibrillation (VF) was induced and coincided with the epileptic brain activity observed. No animals regained brain activity or sinus heart rhythm after applying the stated stunning conditions. As a conclusion, it is postulated that modified stunning equipment passing an electrical current from the top of the head to the sternum in lambs (1.5 A, 50 Hz; 3.1 s) may induce an epileptic seizure and VF.

Keywords: animal welfare, EEG, electrical stunning, head-to-back, head-to-chest, sheep

Introduction

In the European Union sheep may only be slaughtered for human consumption after stunning in accordance with the methods and specific requirements set out in EC regulation 1099/2009. The loss of consciousness and sensibility shall be maintained until the death of the animal. With electrical head-to-body stunning, the risk that animals could regain consciousness during bleeding is almost eliminated, even by poor bleeding, due to induction of epilepsy and ventricular fibrillation (VF) (Blackmore & Petersen 1981; Gregory & Wotton 1984; Anil & McKinstry 1992), provided that VF leads to permanent cardiac arrest. An additional advantage is reduction of clonic activity, which facilitates handling of the carcase and, as the heart stops functioning during stunning, problems with blood spots around ruptured capillaries in the carcase are minimised (Gregory 1998). The method has been in use for years, using commercially available equipment where one electrode is placed on the sheep’s head, the other on the back, in line with the shoulder and above the heart. Such equipment may, however, cause pelt burning (Gilbert et al 1984; Haluk Anil 2012) and a substantial reduction in value of the skin.

The aim of this study is to demonstrate that passing 1.5 A at 50 Hz from the top of the head to the sternum may induce epilepsy and VF in sheep. The literature discusses various ways to achieve head-to-body stunning and inducing VF, without impairing the quality of the skins (Gregory 1998), including head-to-chest/brisket and head-to-leg. To the authors’ knowledge, there is no published work proving that placing electrodes over the head and sternum and applying alternating current (1.5 A at 50 Hz), will induce epilepsy.

Materials and methods

Approval

The experimental work reported in this paper was approved by the Norwegian Food Safety Authority (NFSA/Mattilsynet), application ID 12276.

Study animals

Lambs (n = 4) were transported to the Faculty of Veterinary Medicine, the Norwegian University of Life Sciences in Oslo, Norway. They were housed for four days in two pens with a concrete floor; bedding was provided and hay and water supplied ad libitum. One day, prior to the experimental work, the animals were weighed and shorn on the head and back. Live weights were between 25 and 39 kg. The number of animals used was based upon practical considerations, particularly availability of time and financial resources; four animals was considered sufficient to demonstrate the principle of head-to-chest stunning.