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Assessment of aversion and unconsciousness during exposure to carbon dioxide at high concentration in lambs

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Abstract

*The most widely used stunning method in sheep is electrical. However, in lambs, this method leads to rupture of the blood vessels, provoking ecchymoses. In pigs (*Sus scrofa*), the use of CO_2-stunning systems has increased in popularity due to positive effects on meat quality and animal welfare (movement of animals in groups). The aim here was to assess the effectiveness of a progressive exposure to 90% carbon dioxide (CO_2) in inducing unconsciousness in lambs (*Ovis aries*) through changes in the middle latency auditory-evoked potentials (MLAEP) of the central nervous system (CNS), blood parameters (pH, carbon dioxide partial pressure (pCO_2), oxygen partial pressure (pO_2), oxygen saturation ($SatO_2$) and bicarbonate (HCO_3-), behaviour (head-shaking, sneezing, gasping and gagging) and physiological reflexes (corneal reflex, breathing and sensitivity to pain). Fourteen male lambs of the Ripollesa breed, weighing between 19 and 25 kg, were progressively exposed to an atmosphere of 90% CO_2 over 66 s. All blood parameters changed between 23 and 43 s after the onset of the immersion. The MLAEP did not decrease significantly until after 48 s exposure to CO_2, suggesting an absence of auditory-evoked brain activity. Before that, lambs exhibited head-shaking and sneezing starting at 10.6 (± 0.77) s, and gasping starting at 20.6 (± 1.36) s. After exposure, all animals showed absence of breathing and sensibility to pain, and 36% of them absence of corneal reflex. The pH and pCO_2 recovered basal values at 90 and 120 s, respectively, after the end of the exposure. The burst suppression index (BS%) and the A-Line ARX index (AAI) recovered basal levels at 116 and 159 s, respectively. Exposure to CO_2 at high concentration induces effective stunning in sheep for a period of 124 s. However, during exposure, the animals exhibited signs of aversion and breathlessness.*

Keywords: *animal welfare, auditory-evoked potential, aversion, carbon dioxide, sheep, stunning*