Technical contribution: evaluation of the efficacy of a non-penetrating captive bolt to euthanase dairy goat kids up to 30 days of age

MA Sutherland*†, TJ Watson† and ST Millman‡

1 AgResearch, Ruakura Research Centre, Hamilton 3214, New Zealand
2 Department of Veterinary Diagnostic & Production Animal Medicine, Iowa State University, IA 50111, USA
* Contact for correspondence and requests for reprints: mhairi.sutherland@agresearch.co.nz

Abstract

The objective of this study was to evaluate the effectiveness of a non-penetrating captive bolt (NPCB) to euthanase previously disbudded Saanen dairy goat kids (Capra hircus) up to 30 days of age and 9 kg bodyweight. Goats were euthanised by placing the muzzle of the NPCB behind the poll between the ears with the goat's head bent so its chin was touching its chest. The NPCB was either fired once (Experiment 1; n = 30) or twice in quick succession (Experiment 2; n = 103). Immediately after application of the NPCB and every 30 s thereafter, signs of sensibility (presence of brainstem reflexes) were assessed together with the presence of cardiac activity, convulsions and rhythmic respiration, until cardiac activity ceased. In Experiment 1, 27 of the 30 goat kids were rendered immediately insensible and remained insensible until cardiac activity ceased; brainstem reflexes (the blink reflex) and rhythmic respiration remained present in three of the animals after application of the NPCB. In Experiment 2, all goat kids were rendered immediately insensible without return to sensibility prior to cessation of cardiac activity and death. In conclusion, applying the NPCB twice in close succession, behind the poll between the ears with the goat's head bent so its chin was touching its chest, reliably caused immediate and sustained insensitivity followed by death in Saanen goat kids up to 30 days of age and 9 kg bodyweight.

Keywords: animal welfare, behaviour, euthanasia, goats, insensibility, non-penetrating captive bolt

Introduction

In livestock production systems, occasions arise where individual animals are killed to reduce suffering (euthanasia) or because they have little or no economic value (culling); for simplicity, the term euthanasia will be used throughout this manuscript. Whether for culling or euthanasia, farmers need to identify and euthanise animals as soon as possible to prevent any potential suffering. Manual blunt force trauma (BFT) is the method most commonly used for euthanasia of neonatal goats (Capra hircus) (kids). If performed correctly, BFT causes severe damage to the central nervous system resulting in immediate and sustained insensibility and death. However, limitations of manual BFT are that it can be difficult to apply consistently, its effectiveness is reliant upon the strength of the operator performing the procedure, and it is unpleasant for operators to carry out. In contrast, methods of mechanically controlled BFT, such as a penetrating (PCB) or non-penetrating captive bolt (NPCB), can consistently deliver an appropriate and uniform amount of force resulting in more consistent structural damage to the brain (American Veterinary Medical Association [AVMA] 2013).

The NPCBs are aesthetically advantageous over PCBs because they cause less external damage. Efficacy of purpose-built NPCBs has been demonstrated for euthanasing 4 to 5 week old lambs (Finnie et al 2000), pigs less than three days of age (Casey-Trott et al 2013), pigs weighing 3–9 kg (Casey-Trott et al 2014) and turkeys (Erasmus et al 2010a,b). Recently, our research team has shown that the NPCB is an effective method of euthanasia for kids up to 48 h of age (3.9 ± 0.60 kg) (Sutherland et al 2016). Effectiveness of NPCB for euthanasia of older kids is unknown. However, bodyweight of 30 day old dairy kids is similar to the 9 kg pigs examined by Casey-Trott et al (2014) and corresponds with live weight at slaughter for milk-fed meat goat kids (Arguello et al 2005). Therefore, the objective of this study was to evaluate the effectiveness of an NPCB to euthanise dairy kids up to 30 days of age (or approximately 9 kg).

Materials and methods

The study was conducted between July and August (southern hemisphere winter) 2015 at the AgResearch Ruakura research facility in New Zealand. All procedures involving animals were approved by the AgResearch Ruakura Animal Ethics Committee (#13588) under the New Zealand Animal Welfare Act of 1999. The study animals were sourced from two commercial farms and identified for euthanasia.

At approximately 48 h of age, goats were transported from two commercial farms to the AgResearch Ruakura research facility in New Zealand. Goats were transported in accordance with the requirements of the New Zealand Animal Welfare Act 1999. The goats were kept in an enclosed area with feed and water provided ad libitum until the time of their scheduled appointment. The procedure was conducted in a manner that caused the least possible suffering to the animals. The study involved the collection of blood samples for analysis of blood gases and biochemical parameters to determine the effectiveness of the procedure. The samples were collected aseptically using a 22-gauge needle into 4 ml vacutainer tubes containing lithium heparin. The samples were centrifuged at 2,000 x g for 15 minutes to separate the plasma. The plasma was frozen at -20°C until analysis. The samples were analysed for pH, pCO2, pO2, lactate, potassium, sodium, chloride, creatinine, glucose, albumin, urea, creatinine and electrolytes using an ABL 800 radiometer. The samples were analysed using standard methods.