Applied Animal Behaviour Science 117 (2009) 190–196

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

Physiological and behavioural alterations in disbudded goat kids with and without local anaesthesia

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ARTICLE INFO

Article history:
Received 13 November 2008
Received in revised form 10 January 2009
Accepted 12 January 2009
Available online 7 February 2009

Keywords:
Dehorning
Lidocaine
Animal welfare
Stress
Cortisol

ABSTRACT

The physiological and behavioural responses were evaluated in goat kids that were disbudded either with or without local anaesthesia, in a study with 56 animals randomly allocated among five groups. The anaesthesia/disbudding group (AD, $n = 12$) was treated with 2 mL 2% lidocaine (L2%) around each horn bud, 20 min before disbudding by thermal cauterisation; kids in the anaesthesia group (A, $n = 11$) were treated as AD, without being disbudded; the saline/disbudding group (SD, $n = 11$) was treated with 2 mL saline and disbudded; the S group ($n = 11$) experienced only simulated disbudding; and control/disbudding kids (CD, $n = 11$) were disbudded without any treatment. Cortisol concentrations, heart rate (HR) and respiratory rate (RR) were determined from 20 min before to 4 h after disbudding. Struggles and vocalisations were also recorded during the procedure. Disbudding caused an acute and significant increase in cortisol concentrations and the values remained high for 2 h. Cortisol concentrations were higher in the disbudded groups ($P < 0.05$), even when local anaesthesia was used. HR and RR were not affected by treatment ($P > 0.05$). Frequency of struggles (10.5 ± 0.6, 10 ± 0.7, 12.8 ± 0.7 for AD, SD, and CD, respectively) and vocalisations (16.5 ± 1.2, 16.5 ± 1.3, and 19.3 ± 1.3 for AD, SD, and CD, respectively) were higher in disbudded kids than in the S group (5.6 ± 0.7 and 8.7 ± 1.3, for struggles and vocalisations respectively; $P < 0.05$). A greater percentage of kids showed high intensity behaviours in the disbudded groups (struggles: 83%, 72%, and 100% and vocalisations: 83%, 81%, and 100% for AD, SD, and CD, respectively) than in the S group (13% and 9%; $P < 0.05$). In conclusion, disbudding by thermal cauterisation induces an acute cortisol elevation and increases the expression of behaviours that indicate stress and pain. Infiltrating 2% lidocaine around each horn bud did not inhibit these responses.

1. Introduction

In almost all animal industries, there are routine management procedures that result in pain for the animals, and the associated stress may interfere with critical functions or even result in death (AVMA, 2006). Procedures such as castration, tail docking, branding, dehorning, and disbudding cause short-term pain and can severely affect animal welfare.

In the wild, horns serve as weapons for defence against predators and for offence in battles between males for breeding access to females. The same issues apply to domestic ruminants; under housed conditions, horned animals represent a threat to pen mates, are more likely to destroy facilities than animals without horns, and are more dangerous for the personnel who need to handle them (Al-Sobayil, 2007). In cattle, horns are the single major cause of carcass wastage due to bruising (AVMA, 2006) and, in goats, horned animals require more feeding trough space (Loretz et al., 2004). Dehorning or disbudding is therefore

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doi:10.1016/j.applanim.2009.01.001

commonly used to avoid those problems (Harjinder et al., 1980).

It is preferable to dehorn goats when they are young (disbudding) as the practice seems to be less traumatic and dangerous (Hull, 1995; Valdmanis et al., 2007). Disbudding is usually performed during the first month of life and consists of removing the horn buds using thermal cauterisation (Smith and Sherman, 1994; Al-Sobayil, 2007; Valdmanis et al., 2007) or other methods. During the disbudding/dehorning of bovines, animals are exposed to conditions that ignore their welfare and some behaviours have been clearly observed that indicate acute pain and distress (Graf and Senn, 1999; Stafford and Mellor, 2005; AVMA, 2006). Studies on yearling calves have shown that the practice produces physiological and behavioural changes indicative of acute stress and general malaise (Bristow and Holmes, 2007). Cortisol levels and behaviours indicative of pain increase abruptly from disbudding and remain high for 4–5 h (Morisse et al., 1995; McMeekan et al., 1998a, b; Sylvester et al., 2004); escape behaviours, vocalisations, and head jerks are also dramatically increased (Morisse et al., 1995). These alterations are significantly attenuated with the use of tranquilisers and local anaesthesia (McMeekan et al., 1998a; Grondahl-Nielsen et al., 1999; Stafford and Mellor, 2005).

According to our knowledge, there is no significant information regarding the physiological and behavioural response in disbudded goat kids apart from one report from our group in which we reported that disbudding causes an acute increment in blood cortisol concentrations that lasts for 1.5–2.5 h (Alvarez et al., 2008). For kids, a disbudding technique has been described and the use of local anaesthesia is suggested to lessen the negative effects associated with this practice (McKeating and Pilsworth, 1984; Williams, 1985; Smith and Sherman, 1994; Al-Sobayil, 2007). However, from these reports, it is not clear on what type of evidence this is based.

In the absence of solid data regarding the possible beneficial effect of using local anaesthesia when disbudding kids, we evaluated the physiological and behavioural responses to disbudding and tested whether treatment with local anaesthetic (2% lidocaine (L2%)) around each horn bud would improve the outcomes.

2. Materials and methods

2.1. Location and animals

The study was conducted at an experimental farm located 30 km south of Mexico City. The experimental protocol was approved by the Internal Animal Ethics Committee of the Faculty of Veterinary Medicine and Zootechnie. All kids were <20 days of age, of French Alpine and Saanen genotypes, and were accustomed to human handling. At birth, they were separated from their mothers and managed in full confinement, during which they were handled twice daily for bottle-feeding of milk using in an artificial nursing system. During the study, the kids were fed according to the standard farm management (milk *ad libitum* at 09:00 and 16:00 h), and kept in groups of five in 0.5 m^2 pens with clean, dry bedding.

2.2. Experimental groups

A total of 56 kids were randomly allocated among the following groups: in group AD (n = 12, 11–19 days of age), 2 mL L2% was subcutaneously infiltrated around the base of each horn bud, 20 min before disbudding (Al-Sobayil, 2007); in group A (n = 11, 11–18 days of age), kids were treated as for AD, without being subjected to disbudding or simulated disbudding; in group SD (n = 11, 14–18 days of age), kids were subcutaneously infiltrated with 2 mL saline around each horn bud, 20 min before disbudding; in the group S (n = 11, 14–19 days of age), the disbudding procedure was only simulated without infiltrating or disbudding; group CD (n = 11, 11–19 days of age) was a positive control and kids were disbudded without any previous treatment. Disbudding was made by thermal cauterisation using an electric device (220 V) heated at 600 °C (Buttle et al., 1986) and without a pin prick test.

2.3. Treatment, sampling and recording

All treatments in the study were performed during a period of 2 weeks. Each day, five kids were chosen to receive a treatment selected at random. Disbudding/simulation were always performed at about 11:00–12:00 h. An expert assistant held each kid in a gentle and safe way, immobilizing the head and leaving the legs free to move. The hair around each horn bud was shaved. Disbudding was by a modification of the technique described by Al-Sobayil (2007): the electrically heated dehorner was applied three or four times per horn (3–4 s each time); the head was allowed to cool for about 10 s before re-application. The disbudding was considered sufficient when the corium of the horn was completely cauterised (Al-Sobayil, 2007). Simulation of disbudding was done subjecting the kid to all procedures indicated above, but using a cold dehorner. After disbudding, each button was sprayed with a local disinfectant (Furazolidone, Topazone®, Laboratorios PiSA® SA de CV, Mexico).

Blood (1 mL) was sampled at −20, −10, 0 (immediately before treatment), 0 (immediately after treatment), 10, 20, and 30 min, and also at 1, 2, 3, and 4 h after treatment. All samples were taken from both jugular veins (alternating sides) using needles (PrecisionGlide®, 22G1$^1/_2$, Becton Dickinson Vacutainer Systems, Franklin Lakes, USA) and heparinised tubes while the kid was gently, but safely restrained by an assistant. Samples were centrifuged at 2500 rpm for 15 min and plasma was frozen until assayed for cortisol using a commercial RIA kit (Diagnostics Products Corporation, Los Angeles, CA., USA). Sensitivity of the assay was 5.5 nmol/L, and intra- and inter-assay variations were 2.3% and 5.4%, respectively.

Before every blood sampling, heart rate (HR) and respiratory rate (RR) were recorded using a stethoscope.

During the disbudding, the behaviour of the kids was recorded by video camera. The behaviours that were quantified included struggles (slight or vigorous movements of legs, and attempts to escape) and vocalisations (emission of bleats with open or closed mouth), as has been described in bovine calves (Graf and Senn, 1999; Grondahl-Nielsen et al., 1999). The camera was always at the same