

Quality of maternal care and its effects on pain responsiveness in lambs

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Introduction

Importance of a good mother-young bonding

Maternal behaviour plays a crucial role in preparing the newborn to future challenges of life. The early life period is one of the most sensitive one, with the central nervous system taking rapidly a nearly definite shape. In this programming period, maternal behaviour favours an “appropriate development of systems underlying perception and evaluation of environmental cues” (Plotsky et al. 2001). In other words, maternal behaviour supports the development of a well adapted being in a given environment.

Sheep produce a low number of offsprings, and reproduction bouts are limited. In addition, lambs are born relatively weak, and represent attractive preys for predators in natural conditions. In Norway, lamb mortality before first summer pasture accounts for 8.1% of newborn lambs (Østerås et al. 2007). Better vocal communication between the dam and her offspring is related with a better survival of the lamb at 7 days (Nowak 1996). Likewise, a proper selectivity of the ewe for her own offspring and a better grooming behaviour at birth diminishes lamb mortality (Dwyer & Lawrence 2005).

Maternal behaviour and the offsprings’ experience of pain and stress

When in pain and distress, the survival of newborn is possibly threatened. Pain is defined as an “unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage” (Merskey et al. 2008). Recognition of signs of pain and distress in the offspring should be beneficial to the mother, as she can try and counteract those negative states. Indeed, in some species, mothers have been shown to play a role in how the offspring react to pain and stress. For instance, maternal contact and care can attenuate the sensitivity of the newborn to painful stimulations. In humans, skin to skin contact has analgesic effects on newborns (Johnston et al. 2003). Suckling and skin contact with the rat mother reduced pain responsivity in pups (Blass et al. 1995). The mother can also potentially provide her offspring with comfort in order to buffer the pain experience, as shown in rats (Walker et al. 2003) or defend it in case of a predation threat, as the offspring becomes an easier target.

An individual sensitivity to pain can therefore have a strong impact on their survival chances. Sensitivity to pain is assessed clinically through the measurement of an individual's threshold for perception and reaction to increasing intensities of a stimulus. Pain threshold can be defined as the least stimulus intensity at which a subject perceives pain. The nature of the stimulus can be mechanical, thermal, chemical or electrical.

Nociceptive thresholds were used to evaluate the efficiency of various analgesics (Nolan et al. 1987) or investigate a peripheral nociceptors sensitisation following chronic pain in sheep. The devices used so far required close proximity with human handlers or restraint of the animal during testing. This may have impaired the level of attention of the animals and increased their level of stress. Attention-shift and stress are well-known to alter results in nociceptive tests (Bushnell et al. 1985).

The goal of our experiment was to assess the relationship between pain sensitivity in the lamb and mother-young bonding.

Material and methods

In a study conducted by us in 2007, lambs sensitivity to thermal pain threshold was assessed through a wireless device, in order to avoid such interferences. This wireless thermal threshold testing device was originally developed for evaluation of analgesics in free-ranging cats (Dixon et al. 2002) and was adapted for use in lambs.

Thermal pain thresholds were measured in 10 days old lambs. A small heating probe was fixed on the base of the underside of the lamb's tail. The temperature of the probe was increased and stopped when a behavioural response of the lamb was witnessed, e.g. tail flicking or tail lifting. Maternal behaviours were recorded at the same time, as well as the ewes' and lambs' synchrony, i.e. how often they were performing the same behaviour at the same time, and the relative distances between them.

Results

No measurable relationship between the lamb sensitivity and specific maternal behaviours was found, however there was a relation between indicators of mother-young bonding and pain threshold. Lambs were less sensitive to the thermal stimulation when they were more synchronised with their dam when resting. Lambs were also less sensitive to temperature increase (thermal threshold) when they were standing at close distance from the ewe. These data suggest that the interaction with the ewe modulated thermal pain threshold in lambs. This effect could likely be explained through an increased attentiveness of the lamb to its dam. In other words, the lamb may be paying more attention to the dam

behaviours. As a result, the lamb would be less attentive to stimulations to its own body. Whether the ewe is showing particular behaviours remains to be investigated, as we could not find any particular behavioural pattern in this study.

Future research and possible applications

Further studies will be undertaken to study the effect of milk ingestion and body contact with the dam on the way lambs cope with painful and/or stressful situations. Interactions between ewes and humans before and after parturition will also be investigated. This type of data could find realistic on-farm applications to control pain.

As mentioned above, a good mother-young bonding improves lamb survival. However, selection of ewes presenting good maternal behaviours presents conflicting results. The heritability index for good maternal behaviour traits was found low (Everett-Hincks et al. 2005) or higher in other studies (Lambe et al. 2001). Nevertheless, long-term survival rate of lambs has been improved in New Zealand farms which practiced a selection of ewes scoring high on a Maternal Behaviour Score. Further investigations need to be done in order to determine the influence of management and sheep breed.

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