

The Welfare of Sheep: Review of Recent Literature

Harold W. Gonyou
Research Scientist - Ethology
Prairie Swine Centre

Introduction

Sheep production has generally been free from criticism on welfare issues as most sheep are extensively managed and lambs remain with their mothers from several weeks before weaning. Sheep production is a relatively minor portion of animal agriculture and has not attracted as much attention as other species in North America. In regions of the world in which sheep represent a major industry, several welfare issues have been the focus of recent research.

Castration and tail docking are procedures used in several species, but are of particular relevance to welfare studies of sheep as each may be performed using several procedures. Shearing, with its restraint and use of noisy, hot shears represents a common and repeated fear evoking procedure throughout the industry. The handling, transportation and slaughter of sheep is also a major welfare concern.

Recent Reviews

Gonyou (1997) reviewed animal welfare issues relevant to sheep, covering literature as late as 1991. The review emphasized the need for properly designed and maintained handling facilities and equipment, and the importance of training of personnel. Although sheep are not a major agricultural species in the current Canadian industry, they are frequently exhibited at fairs and exhibitions such as sheep dog trials and shearing displays. Organizations holding such events should establish policies protecting the welfare of the animals involved.

Several practices of the sheep industry impinge upon the welfare of the animals (Gonyou, 1997). Shearing is a necessary but stressful procedure due to the required restraint as well as the noise, heat and contact of the shears. It should be done quickly, but with care to avoid cuts resulting from careless shearing. Castration may be performed using rubber rings, the burdizzo clamp or bloodless castrator, or surgically. Of these, surgical castration is least stressful, but runs an increased risk of infection. Tail docking is performed to reduce the incidence of fly strike by keeping the tail area free of feces. As with castration, rubber rings, the burdizzo and surgical removal are all options. Again, surgical removal appears to be least stressful.

The welfare of sheep at the time of slaughter has been reviewed by Middleton (1995). The review identifies pre-slaughter handling as a source of stress that can result in carcass quality defects. It is suggested that provision of feed and the opportunity for rest during lairage will reduce this stress. In regards to stunning, it is recommended that wetting the skin and wool is critical for electrical stunning of sheep. If captive bolt stunning is used the size of bolt and speed should be appropriate for sheep. Additional areas of research are recommended for pre-slaughter handling and restraint systems.

A review by Macnab (1998) addressed the specific welfare concerns of hill sheep farming in Scotland. Although the paper addresses a unique husbandry system, its recommendations can be extrapolated to other extensive situations. In extensive systems it is important to identify the important diseases that can be controlled by vaccination. It is also essential to identify the important parasites in the region. Finally, the appropriate times to gather the flock for health treatments should be identified. In the case of hill sheep, it is recommended that gathering and treatments take place five times per year, at pre-lambing, shearing, weaning, pre-breeding and post-breeding.

Two reviews were published on transportation of sheep (Knowles, 1998; Hall and Bradshaw, 1998). These reviews cover much of the literature that is reviewed in the transportation section of this chapter. Therefore, readers are referred to that section, or to the papers themselves for additional information.

Castration

The rubber ring method of castration maintains popularity despite the fact that it is one of the more painful methods. Several studies were conducted to determine ways of reducing the pain accompanying this procedure. The use of an epidural anaesthetic was ineffective in reducing the pain induced by rubber ring castration (Scott et al., 1996). However, the use of a local anaesthetic in conjunction with the ring method was effective in reducing pain (Kent et al., 1998). These authors also found that combining the rubber ring and bloodless castrator (clamp or Burdizzo) methods resulted in a reduction in pain compared to the ring method alone. This was confirmed by Thornton and Waterman-Pearson (1999) who compared the ring and combined methods with surgical castration. In terms of overall pain and cortisol response, the combined ring and clamp method was the least harmful when no anaesthetic was used. A local anaesthetic was completely effective in eliminating the reactions to ring and combined castration, but not so for the surgical method. A general anaesthetic was effective for the surgical method. The conclusion to be drawn from these studies is that the combined method is the least stressful of those studied, and that it can be further improved with the use of a local anaesthetic.

Two other studies examined management factors associated with either ring or bloodless castrator methods. In one, Kent et al. (1999) concluded that the ring should be used for small lambs. When used for lambs at 28 or 42 days of age there were more severe and larger lesions than when used on 2-day-old lambs. A survey of problems encountered with the use of the bloodless castrator indicated that haemorrhage and infection were common (Hosie et al., 1996). It was recommended that only castrators designed for use on lambs should be used, that the instrument should be properly maintained and stored, and that stockpersons should be trained in its use.

Tail-docking

Although the use of a heated cautery iron produces the least changes in behaviour and cortisol levels (Graham et al., 1997), it is not the preferred method of tail-docking due to the incidence of chronic infections. As with castration, studies have examined means of reducing the pain associated with the rubber ring method. Combining the ring and Burdizzo crush reduces the pain compared with the ring method alone. An injection of a local anaesthetic at the ring site is

also effective (Graham et al., 1997). Following an additional study, these same researchers conclude that the use of a local anaesthetic, either injected or needleless, was more effective in reducing pain than the application of the Burdizzo clamp following the application of the rubber ring.

Electro-ejaculation

Semen is routinely collected through electro-ejaculation for diagnostic purposes. Stafford et al. (1996) compared the aversion and cortisol response induced by electro-ejaculation with that of shearing and restraint. Sheep demonstrated the greatest degree of aversion to shearing, followed by electro-ejaculation. Cortisol levels following all three procedures were similar. In a review of the welfare issues associated with electro-ejaculation, Stafford (1995) recommended that ventrally positioned probes be used, that mild sedation be employed, and that a rest period should be given between collections.

Transportation

A considerable amount of research has recently been conducted on the stressfulness of transportation. During journeys of up to 24 hours, it was observed that heart rate and cortisol levels were highest at the beginning of the trip but decreased over time to minimum levels at 9 hours. At that point, the effects of feed withdrawal became evident in blood metabolites (Knowles et al., 1995). It would appear that transportation up to 24 hours would be acceptable under good conditions.

The elevation in heart rate and cortisol at the beginning of transportation is partly the result of loading. However, both ramp and automatic lift loading cause equal stress (Parrott et al., 1998). The motion of the journey affects the stress response of the animals if they are packed too loosely (Hall et al., 1998b). Somewhat crowded conditions reduce the incidence of slipping and loss of balance (Cockram et al., 1996). Slipping and loss of balance may be the reason that stress responses increase with the frequency of rapid acceleration and braking (Hall et al., 1998b). It is recommended that sheep be able to lie down on long journeys (Knowles et al., 1998). The reaction to transportation is affected by breed type, with upland breeds, traditionally raised under less intensive conditions, reacting more than lowland breeds (Hall et al., 1998a).

The previously cited work by Knowles et al. (1995) indicated that the effects of feed and water deprivation are noticeable on long journeys. Their observations on transported sheep were similar to the findings of Jackson et al. (1999) who worked with feed deprived, but not transported, sheep. Water deprivation did not result in dehydration until the animals were allowed to eat. Therefore, both feed and water are important at the end of a long journey or during a period of lairage between transport segments. Knowles et al. (1996) reported that an 8 hour lairage period with feed and water after 24 hours of transportation was sufficient for complete realimentation. Parrott et al. (1998) reported that a 1 hour lairage period was not sufficient during long journeys. Cockram et al. (1997) reported that a 12 hour period of lairage was better than only three, and that providing feed and water on the vehicle as an alternative to lairage was unadvisable. In general, after transportation of 15-24 hours, an extended lairage break with feed and water is important.

Lairage also occurs at the end of transport, prior to slaughter at the packing plant. If the animals are to be held for an extended period of time it is important that they be allowed to eat and drink (Cockram et al., 1999). It is also important that they be able to lie down and rest. Sheep prefer to lie on a strawed floor as opposed to wooden slats, but either seems adequate to allow for resting (Gordon and Cockram, 1995). Resting is facilitated if animals are not crowded and are kept in their original social groups (Jarvis and Cockram, 1995). Occasional disturbance by stockpersons during lairage does not appear to interfere with the sheep being able to rest (Jarvis and Cockram, 1995).

Handling

A number of studies could be classified as having to do with handling of sheep. Markowitz et al. (1998) reported that human feeding and handling of lambs within the first 10 days of their lives resulted in increased affinity for humans later in life. Sheep are also able to differentiate between their handler and a stranger, to the point that the presence of their handler has a calming effect in stressful conditions (Boivin et al., 1997). Jarvis and Cockram (1995) reported that there are numerous potential bruising events that occur at livestock markets, but that actual levels of bruising did not differ between those transported directly from the farm and those that passed through a market. However, a later study indicated that market lambs did have more bruising, as did those transported long distances (Jarvis et al., 1996). Their conclusions are that care should be taken to reduce the incidence of bruising in markets and during road travel. The handling of animals within the slaughter line, specifically whether or not animals should be prevented from witnessing other animals being killed, was addressed by Anil et al. (1996). Being able to see other sheep being killed did not affect the stress responses of sheep prior to slaughter.

Weaning

Early weaning of lambs, at ages up to 28 days, affects immune responses and performance (Napolitano et al., 1995). Orgeur et al. (1998, 1999) examined the stressfulness of three methods of weaning on lambs at 3 months of age. They either weaned the lambs conventionally (complete separation), or separated the lambs and ewes by a short distance (1999) or for increasing amounts of time beginning at 4 weeks of age (1998). Their conclusions were that weaning at 3 months of age is not very stressful, and any of these methods would be appropriate to use.

Ear Tags

Ear tags can be the source of injuries and infections in sheep. Edwards and Johnston (1999) reported on the incidence of injuries associated with six types of ear tags. The shape of the tag was more important than the material in causing injuries. Loop tags resulted in more injuries. The least injuries were caused by plastic two-piece tags made of flexible polyurethane.

Transgenics

Hughes et al. (1996) compared the behaviour of transgenic and control sheep during handling, on pasture, and in pens. The transgenic sheep carried the human alpha-1 antitrypsin factor. Transgenesis barely altered the behaviour of the animals and had no detectable deleterious effects in the animals. However, any deleterious effects of transgenesis will likely be related to the effects of the specific gene transferred. Therefore, each new transgenic should be evaluated for welfare status.

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Abstract or Summary of Interesting Publications

Boivin,X., Nowak,R., Le Neindre,P., Tournadre,H. , Le Neindre,P. 1997. Discrimination between shepherds by lambs reared under artificial conditions. *Journal of Animal Science* 75:2892-2898.

Few experiments have demonstrated that the identity of a stockman can play a role in the reaction of farm ungulates toward a human. In this study, the researchers looked at the ability of 32 lambs reared artificially in groups of four to discriminate between their shepherd and an unknown shepherd. Half of the lambs were bottle fed in isolation by one shepherd during the first 3 weeks while the other half was fed alternately by three shepherds. The lambs were then tested at 3, 6 and 14 weeks of age to find out the effect of rearing conditions on the response to isolation and to reunion with the known or an unknown shepherd. Some of the behaviours measured were the number of vocalizations, number of squares crossed, latency to interact with the shepherd, and time spent interacting with the shepherd. During the test performed at 3 weeks, lambs interacted more quickly, interacted longer and vocalized less with the known shepherd than with the unknown shepherd. These behaviours were noted more at 3 and 6 weeks than at 14 weeks. These results showed that lambs can distinguish among different people and that fear responses to isolation are reduced more when a known shepherd is present. Also, this ability to discriminate among handlers was most apparent at week 3 and 6 and by week 14 had disappeared. Therefore, knowledge of the shepherd in early age can greatly affect a lamb's reactions to that shepherd and this could help the usual shepherd handle the lambs and ease the fear and stress in the lambs.

Graham,M.J., Kent,J.E., Molony,V. 1997. Effects of four analgesic treatments on the behavioural and cortisol responses of 3-week-old lambs to tail docking. *The Veterinary Journal* 153:87-97.

Tail docking is regularly practiced to reduce the risk of blowfly strike. However, there is concern over the welfare of the animals undergoing this procedure as many studies have indicated that all commonly used methods result in signs of acute distress. In this study, the behavioural and

cortisol responses of lambs were used to determine which of three methods of tail docking (rubber ring, Burdizzo and rubber ring combined, or heated docking iron) produced the least signs of pain in the first 3 hours after use and which of four anaesthetics (1.0 ml bupivacaine subcutaneously, 0.5 ml bupivacaine epidurally, a topical cold analgesic spray or diclofenac 1.5 mg kg⁻¹) was most effective in reducing these signs. It was found that compared with the rubber ring alone, the application of the Burdizzo crush as well as the ring reduced the incidence of active behaviours, the cortisol response and the time spent in abnormal positions. Docking with a heated cautery iron produced the least changes in behaviour and cortisol levels, but that does not mean that this method is the best as it can produce lesions that can lead to chronic infections. Subcutaneous injection of the local anaesthetic at the ring site just before application of the ring was the most effective means of reducing the pain from this method. From these findings, it was concluded that if a practical means can be found to produce a local anaesthetic quickly and without the use of needles, then the method of ring tail docking could be more humane.

Kent, J.E., Molony, V., Graham, M.J. 1998. Comparison of methods for the reduction of acute pain produced by rubber ring castration or tail docking of week-old lambs. *The Veterinary Journal* 155:39-51.

The rubber ring method for castration and tail docking of lambs is widely used, but has been shown to produce considerable acute pain in all ages of lambs up to six weeks. In this study, a bloodless castrator was compared with an injection of local anaesthetic in their ability to reduce pain for rubber ring castration. As well, the effectiveness of a needleless injection technique was compared with a conventional injection. The results showed that for castration, the most effective method in reducing pain was the application of the ring, followed by an injection of local anaesthetic and then by the application of the bloodless castrator. For rubber ring tail docking, the most effective method was a needleless injection of local anaesthetic without the use of the bloodless castrator. Injections of local anaesthetic by either the needle or the needleless injector were effective, but the needleless injection was safer, quicker and easier to apply. From the results, it was concluded that the injection of a local anaesthetic immediately after the application of the rubber ring effectively reduced, but did not completely eliminate, the acute pain produced by this method of castration and tail docking.

Knowles, T.G. 1998. A review of the road transport of slaughter sheep. *Veterinary Record* 143:212-219.

This paper reviews the past and recent scientific literature relevant to the road transport of slaughter sheep. Recommendations for the best practices are given and areas that require further work are also identified. When conditions are difficult, individual animals use various methods to try to counteract any adverse effects of those conditions. This may involve changes in behaviour and shifts in physiological variables away from values that are typically considered to be "normal". There are many types of measurements that can be used to assess the effects of transport. They are mortality, injury and disease, immune function, meat quality, weight loss, the levels of muscle and liver glycogen, plasma free fatty acids, urea, and B-hydroxybutyrate, and blood measurements of total protein, albumin, packed cell volume and osmolality. The death or injury of an animal is an extreme but useful measurement of welfare. However, mortality rates and levels of injuries among lambs are low when compared with those of other farmed species and considering the numbers of animals transported. Before being loaded onto a truck, sheep can show signs of stress due to previous handling. Loading and the initial few hours of transport cause a sharp increase in heart rate, muscle activity and plasma hormone concentrations, but

these factors decrease after 9 hours. Transport can involve long periods without food or water. One result is a loss of liveweight and a reduced carcass weight. During long journeys, a mid-transport lairage stop for food, water and rest should provide a chance for recovery from the effects of the journey before it is resumed. However, short rest periods do not seem to be of real benefit and could even be detrimental. There is little experimental work on which to base stocking densities, but evidence does suggest that animals require space in which to make positional adjustments in order to maintain their balance. The author concluded that much work still needs to be done in the area of sheep transport. Some of the topics that need to be looked at are appropriate resting periods and feed requirements, the effects of stocking density on injury and loss of balance and the circumstances under which high mortality occurs within individual loads.