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Characterisation of Shy-feeding and Feeding lambs in the first week in a feedlot

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ABSTRACT

Up to 20% of lambs introduced to feedlots are prone to 'Shy-feeding' or inappetence. Factors considered to contribute to the condition of Shy-feeding include: neophobia (environment and concentrated feeds), disease and competition around feeding. However, little is known about the individual characteristics of these animals. This study investigated some individual characteristics associated with shy-feeding, which may provide useful information to enable early identification of vulnerable animals. Forty lambs in a feedlot pen were studied in 3 cohorts (120 lambs total) over 16 months. This study focused on the behaviour of lambs in the first week in the feedlot. Lambs were provided with 2 m^2 floor space per animal and 4 cm trough length each. Temperament and weights were recorded before entry to the feedlot and weights were recorded again at the end of the first week. A blood sample was collected during the first week to measure plasma cortisol concentrations and 24 h feeding behaviour (time feeding) was also recorded in week 1. Based on total time spent feeding over a 24-h period in week 1, lambs were categorized into two distinct groups: "Shy-feeders" (<30 min feeding, n = 22) and "Feeders" (>1 h feeding, n = 98). No animal in the 3 cohorts spent between 30–60 min at the feed trough. Accumulated analysis of variance was used to compare entry weights, temperament, growth (live weight change), and feeding behaviour of each group. Most of the Shy-feeders lost weight in the first week whilst most of the Feeders gained weight, however within each grouping there was no relationship between growth and time at the feed trough despite time at the feed trough varying from 1 to 5 h for Feeders. Shy-feeders were displaced less from the feed trough by other lambs than Feeders ($P < 0.001$), but were twice as likely to visit the feed trough when there were no other lambs there ($P = 0.022$). There was no difference between Shy-feeders and Feeders in entry weight ($P = 0.64$) or in the recorded measurement of temperament ($P > 0.50$). These results indicate that a considerable proportion of lambs in the feedlot were vulnerable to inanition and consequently at risk of poor health and welfare. While these lambs could clearly be classified by the time spent feeding over a 24-h period in week 1, the measurement of temperament and entry live weight were not related to the condition of Shy-feeding.

1. Introduction

Inappetence or shy-feeding in sheep is a persistent problem in both the live export industry and intensive lamb finishing systems, and can affect up to 20% of sheep in feedlots (Jolly and Wallace, 2007; Barnes et al., 2008). Whilst most shy-feeding sheep will commence feeding within 2 weeks of feedlotting (Norris et al., 1990; Savage et al., 2008), prolonged inappetence in sheep results in reduced productivity (in terms of growth), higher susceptibility to disease (Higgs et al., 1993) and in some cases leads to a state of exhaustion resulting from a prolonged reduction or cessation of food intake otherwise known as inanition (Norris et al., 1990; Perkins et al., 2010). Thus early identification of Shy-feeders is important from both a welfare and a production perspective. The exact cause for this voluntary refusal to eat remains in question; however it is largely considered to be a result of failing to adapt to the feedlot environment. When lambs are first allocated to feedlots there is much that they have to contend with: transport, mixing with unfamiliar animals, novel feed, novel environment, competition for feed, increased exposure to disease and greater human

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contact all of which are known stressors (Arnold and Maller, 1974; Higgs et al., 1993; Hall et al., 1998; Waiblinger et al., 2006; Fraser, 2008; Mellor et al., 2009; Miranda-de la Lama et al., 2012; Villalba et al., 2012).

Social hierarchies in a gregarious species like sheep may aide in the moderation of intense intra-specific aggression (McBride et al., 1964). Farming and domestication of sheep can disrupt their natural social organisation (Ashton and Morbey, 1997; Miranda-de la Lama et al., 2012), and the allocation of lambs into groups by age or weight may hinder the ability of sheep to form stable social hierarchies and adapt to intensive farming environments.

The very definition of a feedlot inherently indicates that any resources provided will be finite; limited by quantity, location or space allowance. The resulting competition around feeding has been linked to inappetence by Arnold and Maller (1974) who reported a higher incidence of non-feeders with increased competition (from shorter trough lengths), although this has been contradicted by Norris et al. (1990). The link between the competitive ability of an animal and social hierarchy is not always clear (Dove et al., 1974; Sherwin, 1990) and the differences in social behaviour between shy-feeding animals and feeding animals have not yet been investigated.

There are mixed reports in the literature regarding weight as an attribute associated with dominance in sheep (Arnold and Maller, 1974; Lobato and Beilharz, 1979; Preston et al., 2003; Pelletier and Festa-Bianchet, 2006). While Arnold and Maller (1974) found no strong relationships between body weight and non-feeders, their results did indicate that heavier animals were less likely to become non-feeders, though the lighter animals were found in both categories. Being one of the characteristics by which lambs are assessed for sale or slaughter, live-weight remains the most routine, standard and easy measurement to obtain and thus a link between live-weight and susceptibility for persistent inappetence would be valuable.

Social learning, or the acquisition of new information through the observation of others, plays a significant role in the acceptance of novel feeds by many different species of animals using different modalities (Nicol, 1995). The acceptance of novel feeds by sheep is substantially improved when exposed to novel foods in a social setting (Chapple et al., 1987a; Thorhallsdottir et al., 1990). Social learning can lead to allelomimetic feeding patterns which may ultimately increase the level of activity and competition around areas where feeding space is limited. While high levels of competition may increase the incidence of shy-feeding, low levels of competition have also been shown to increase the variation of supplementary feed consumed, indicating that social facilitation of feed acceptance may be an important factor (Bowman and Sowell, 1997). Social interactions have also been found to influence the choice of feeding location in lambs (Scott et al., 1995) and have more influence on foraging location and dietary selection than feed preference when in an unfamiliar environment (Scott et al., 1996).

Temperament is a relatively stable and innate set of characteristics that make up an animal's disposition (Majolo and Ventura, 2010). It is commonly measured by an animal's response to stressors such as isolation, novelty, and humans (Romeyer and Bouissou, 1992; Murphy et al., 1994). Traits of temperament have been linked to productivity in terms of growth (Pajor et al., 2008), spacial distribution or social cohesiveness (Sibbald et al., 2009) and reduced stress (Beausoleil et al., 2012) and previous research has found merit in selectively breeding sheep based on temperament (Beausoleil et al., 2008). Thus, temperament may be a useful predictor of coping ability within a feedlot environment.

Since Shy-feeders will often appear healthy until 1–2 days before they die (Lightfoot, 2008), a greater knowledge about the individual characteristics and behaviour of these animals is clearly required in order to identify them early and manage them appropriately within feedlots. Thus this experiment aimed to identify shy-feeding based on observed feeding behaviour and investigate the differences in live weight, growth, social behaviour, feeding behaviour and stress between shy-feeding and feeding lambs in intensive finishing systems.

2. Materials and methods

2.1. Facilities

The experiment was conducted at a government owned agricultural research facility in Werribee, VIC (Longitude 144.7°E, Latitude −37.9°S,). One 40-lamb feedlot pen measuring 8 m × 10 m (2 m^2 per lamb) was constructed on compacted gravel using pine posts and ring lock fencing. Lambs were provided with 2 m^2 floor space per animal and 4 cm trough length (Model Code of Practice for the Welfare of Animals: Sheep, 2006; National Procedures and Guidelines for Intensive Sheep and Lamb Feeding Systems, 2009). Green shade cloth with a UV protection of 90% provided a shaded area of 3 m × 10 m away from the feeder. Water was provided *ad libitum via* a trough that spanned two feedlots on the dividing fence-line. Infrared CCTV cameras (RY-7033, Shenzhen Rui Ye Electronic Co., Ltd., Guangdong, China) were installed over the pen to observe behaviour at the feeder. GeoVision (GeoVision Australia Pty., Ltd.) and i-Watch digital video surveillance systems (International Security Control Solutions Pty., Ltd.) were used to record the behaviour.

2.2. Animals

All animal procedures were conducted with prior institutional ethical approval under the requirements of the Victorian Prevention of Cruelty to Animals Act 1986 in accordance with the National Health and Medical Research Council/Commonwealth Scientific and Industrial Research Organization/Australian Animal Commission Code of Practice for the Care and Use of Animals for Scientific Purposes.

One hundred and twenty merino wether lambs with an average initial live weight of 28.55 kg (standard deviation, 2.38 kg) were studied in this system (40 lambs per cohort) in 3 time replicates (120 lambs total) over 16 months. Each cohort was sourced from a single flock in a Victorian sale yard.

Two weeks prior to the study the lambs were transported to the study location and weighed. At this time, in addition to pasture they were also given some exposure (approximately 200 g per lamb per day) to the commercial diet (Easyone, Milne Feeds, 11.0 MJ/Kg, 14.5% crude protein) that was fed in the feedlots. This diet has been specifically designed to meet the protein, energy and mineral requirements of growing lambs in feedlots and prevent the occurrence of acidosis without the need to provide roughage such as hay. Once in the feedlot, this commercial diet was provided *ad libitum* in a self-feeder (Paton stock lick feeders, 2.4 m and 1.8 m long, plastic inserts removed) modified to provide lambs with 4 cm of trough length each.

2.3. Measurements

2.3.1. Temperament test

Lamb temperament was assessed using a modified Isolation Box Test (Murphy et al., 1994). This test is designed to measure the reactivity of sheep in response to isolation and restraint. This modified version of the test was conducted in an enclosed crate (1.25 m (L) × 0.55 m (W) × 1 m (H)) for 2 min.

Animals were drafted from their home paddock to a holding area next to the test crate and left to settle for 1 h. Animals were then moved in small groups to the entrance of the test crate *via* a single file race, an operator would then open the gate and encourage the