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Research

Lack of straw during finishing affects individual and social lamb behavior

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ABSTRACT

The aim of this study was to analyze the effect of straw bedding on individual and social behavior in lambs. Four groups of 6 lambs of the *Rasa Aragonesa* breed (n = 24; 17.2 ± 0.2 kg live weight and approximately 60 days old) were formed and fattened for 28 days, in an experimental design that included 2 treatments and 2 replicates. One treatment was given cereal straw either to eat or to lie on, whereas the other treatment had no straw. All groups were housed in 5.6 m^2 feedlot pens (*ad libitum* commercial concentrate and water). The lambs in each pen were recorded using a digital video camera (08:00-20:00 hours) for 28 days to measure lying, standing, walking, feeding, and drinking behavior as well as the use of space (scan sampling every 10 minutes). Stereotypies, social interactions, and productive performance parameters were observed by continuous sampling on days 1, 7, 14, 21, and 28 of fattening. There were no significant differences in terms of productive performance. In general, the frequency of standing, walking, and eating concentrate was higher in lambs without straw ($P \leq 0.001$). As expected, lambs spent more time standing in the straw box when this substrate was available ($P \leq 0.001$). Aggressive interactions decreased after 2 weeks in both treatments, but just lambs without straw kept low levels until the end of the trial ($P \leq 0.05$). Affiliative interactions increased in both groups throughout the experiment, indicating greater group cohesion. Stereotypic behaviors were more frequent in lambs with no straw on all observation days ($P \leq 0.05$). The absence of cereal straw was a source of stress for the lambs, which affected their behavior during fattening. Providing straw can be a practical way to increase environmental enrichment aimed at improving welfare.

Introduction

Welfare can be defined as the state of animals regarding their attempts to cope with their environment (Broom, 1986). The welfare of farm animals is a growing public concern and considered a priority for an increasing number of Europeans (European Commission, 2006; Vanhonacker et al., 2008). New regulations have been developed to control the quality of housing, and management procedures have been used throughout the production chain to satisfy consumer demands regarding welfare quality (Winter et al., 1998; María, 2006), but production systems change with time, requiring up-to-date analyses of how animals are coping under new conditions.

With respect to sheep production, traditional pastoral systems are now giving way to more intensive schemes with large flocks with increased productivity. In Spain, the second largest lamb producer in Europe, there are now 2 specialized subsystems; breeding the flock (under the farmer's responsibility) and fattening on large feedlots called classification centers (CCs). The main output is the highly appreciated meat from light lambs (slaughtered at 100 days old and 8.5-13 kg carcass weight; Sañudo et al., 1996) that are fed indoors with ewe milk and a concentrate (CO)-based diet until weaning (45-50 days old). After this period, they receive CO and straw at the CCs until slaughter. Although the new scheme simplifies the process and reduces farm labor, the social mixing,

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changing environments, increased handling, and need for double haulage may be stressful, affecting lamb welfare (Miranda-de la Lama et al., 2012). Although litter (usually chopped straw) may be provided at the CC, there is generally little else to stimulate activity. In addition, many CCs are now trying to reduce production costs and eliminate straw provision altogether, either as bedding or forage, which makes conditions quite barren. Feedlot managers argue that lambs at this age could be considered preruminants and so do not require straw, but the effect of lack of straw on lamb welfare is unclear.

Barren environments may cause chronic stress in lambs (Teixeira et al., 2012). Poor housing conditions also bring about behavioral changes, which may indicate reduced welfare and affect the normal ontogeny of relevant behaviors in this species (Pearce and Paterson, 1993; Newberry, 1995; Tuyttens, 2005). Providing environments with some kind of bedding substrate may increase the amount of exploratory behavior and reduce the animals' responsiveness to novel stimuli at the end of the rearing period (Courboulay and Meunier-Salaün, 2002). As well as interacting with the substrate, animals walk and run more, reducing the incidence of lameness, skin problems, and fear reactions (Faull et al., 1996). In addition to stimulation, straw can provide comfort and safety to confined animals, improving their welfare (Le Neindre et al., 2004). This need of the animals is particularly important in the context of intensive environments where they must occupy long periods with a limited range of behavior patterns (Hughes and Duncan, 1988). The manager's decision to provide some type of bedding material during the finishing phase for fattening lambs is a practical way to enrich the environment in intensive systems, and the cereal straw is the main option presently available on the market (Fraser et al., 1991).

The influence of bedding materials on the health, welfare, and behavior of housed livestock has been extensively researched (Tuyttens, 2005), but relatively few studies focus on lamb production (Teixeira et al., 2012). Behavioral comparisons between straw and slat systems for ewes were performed by Cooper and Jackson (1996) and Gordon and Cockram (1995). The sheep with access to straw demonstrate a more natural and richer behavioral maintenance pattern (Cooper and Jackson, 1996; Day et al., 2006; Wolf et al., 2010). Choice studies that test bedding substrate preferences have been carried out by Gordon and Cockram (1995), Wolf et al. (2010), and Teixeira et al. (2013). The lambs clearly prefer soft and dry bedding materials such as straw or sawdust. Similar studies have been performed by Færevik et al. (2005) for adult ewes after shearing. The aim of this study was to analyze the effect of the presence of straw as bedding material on individual and social behavior in lambs during the finishing phase of fattening. The hypothesis was that not providing straw to lambs can make their adaptation to their new challenging environment at the CC more difficult, decreasing their welfare.

Materials and methods

The study was carried out at the experimental farm of the University of Zaragoza, Spain (latitude 41°41' N). The area is located in the Ebro River depression, characterized by a dry Mediterranean climate with an average annual temperature of 15°C and an average 317 mm annual rainfall. All protocols were approved by the animal experimentation ethics committee (Comisión Etica Asesora) of the University of Zaragoza.

Subjects and study description

Twenty-four entire male lambs of the *Rasa Aragonesa* breed, clinically healthy, were used. Average live weight on arrival to the experimental farm was 17.20 (±0.2) at approximately 60 days old. Following the traditional management protocols for this breed, lambs had been weaned at 45 days of age. All animals were kept in a holding pen during 24 hours and, after sorting by weight, were individually identified by numbers marked on their sides and back with livestock paint spray for easy identification. Four groups of 6 lambs were formed and fattened for 28 days, in an experimental design that included 2 treatments and 2 replicates (n = 24). The animals were housed randomly in 1 of four 1.7 × 3.3 m pens, with a stocking density of 0.93 m^2 per lamb. One treatment was given cereal straw either to eat or to lie on, whereas the other treatment had no straw. All groups were fed ad libitum with pellet CO in a feeder as well as fresh water. The commercial CO used (Ovirum High Energy®) contained barley, corn, wheat, vegetable fat, soya tort, sugarcane molasses, calcium carbonate, sodium chloride, and a vitamin mineral corrector (18% crude protein and 3.5 Mcal/kg dry matter/day of metabolizable energy).

Productive performance parameters

Animals were weighed individually at the beginning of experimental period (W1) and just before transport (W2). Average slaughter live weight was 27.32 (±0.61) and 26.59 (±0.61) kg, for lambs with straw and without straw, respectively. The addition of CO in the feeder and feeder rejection (at the end of experiment) were both recorded. The total consumption of CO was estimated as the difference between the CO added and the CO and forage refused. Average daily gain was estimated by the difference between W2 and W1 (weight gain) divided by the total fattening days (28). The conversion index was estimated as CO/weight gain. The animals were slaughtered within the weight range of the Ternasco-type category at a European Commission-approved abattoir after overnight lairage following standard commercial procedures.

Behavioral profile

A video-recording device (model VDVR-9; Circontrol S.A., Terrassa, Spain) was set up in a room close to the pens to record lamb behaviors. One camera was placed in front of 2 pens, 220 cm above the ground. Two kinds of recording were carried out for 12 hours per day (08:00-20:00 hours): scan sampling every 10 minutes throughout the experiment; and continuous sampling on days 1, 7, 14, 21, and 28 (a total of 60 hours per pen). Each video was observed twice by the same trained observer to record the behaviors in each group.

The use of space in each pen was recorded by instantaneous sampling. Four areas were defined in each pen (Figure 1): (1) straw box, (2) feeder hopper, (3) drinker, and (4) resting area. Every 10 minutes, the position of each lamb and maintenance behavior were noted. The behaviors recorded as instantaneous samples included lying (lamb resting with eyes open or closed), standing (lamb standing on all 4 legs), walking (lamb on all 4 legs and in motion), feeding (lamb searching for feed CO in the trough and eating it), and drinking (lamb drinking water from the drinker).

The continuous behavior sampling (Martin and Bateson, 1993) was used to record social interactions and stereotypic behaviors. As all animals were individually identified, the total number of affiliations and aggressions initiated by each individual per day were considered for statistical analyses. Aggressive interactions included butts (when the lamb used its forehead to hit another lamb on any part of its body), pushing (when a lamb used its body to push another lamb to access the feeder or water thought), mounting (when a lamb mounted another lamb from behind to move the latter, without an apparent sexual function), kicking (when a lamb hit another lamb on any part of its body, with its forelegs), threats