



The behaviour of gestating dairy ewes under different space allowances



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ABSTRACT

Provision of adequate housing is essential to assure the welfare of farm animals. One relevant aspect is space allowance, due to potential consequences on the behaviour and welfare of animals. The objective of this study was to determine the effect of space allowance on the behaviour and potential welfare implications of dairy ewes during gestation. With this purpose, 54 pregnant ewes were randomly allocated to groups of 6 ewes with space allowances of 1, 2, or 3 m²/ewe (three replicates per treatment). Behaviour was observed between gestation weeks 9 and 19. Data collection included focal observations (4 gestation periods of 2 consecutive weeks, 3 days/week) and scan samplings (twice/week during 11 gestation weeks). The effects of space allowance, point of gestation, and their interaction on the percentage of time, frequency (focal observations) and percentage of occurrence (scan samplings) of behaviours were determined with a mixed model ANOVA, with point of gestation as repeated measure. In general, less activity as indicated by reduced movement ($P < 0.05$) and higher percentages of time at the feeder ($P < 0.05$) were observed at 1 m²/ewe as compared to 2 and 3 m²/ewe. Occurrences of negative, and especially positive social interactions, were also higher at 1 m²/ewe ($P < 0.05$), perhaps as result of the higher chances to find another individual in the path of movement rather than of increased social conflict. The initial period of study was characterized by a higher frequency of positive social interactions ($P < 0.001$) and explorative behaviours ($P < 0.005$), likely due to the novelty effect. On the contrary, the decline in activity, as indicated by a reduction in the percentage of time standing ($P < 0.05$) and increased resting ($P < 0.05$), was evident as gestation progressed. A clear effect of space allowance was detected, although it was mostly restricted to moving and eating behaviours.

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1. Introduction

Provision of adequate housing is essential to assure the welfare of production animals, but also to maintain the

efficiency and assure the sustainability of any production system. Although many factors must be considered when evaluating the adequacy of housing conditions, one that is of primary relevance is the availability of space, as space limitations can have major impact in terms of welfare and performance of the animals.

Space allowance is generally defined as the average area offered per animal (Petherick, 2007; Petherick and Phillips, 2009), and it is considered a defining feature of all animal production systems due to its economic

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implications. Provision of large enclosures for animal housing implies larger land requirements, higher construction and maintenance costs, and possibly manpower requirements. Therefore, commercial animal production systems usually limit, to some degree, space allowance.

However, it is well known that space limitations can have negative consequences for the welfare of production animals (Fraser and Broom, 1997; Estevez et al., 2007) as well as on performance. For example, space limitations have been associated with increased behavioural problems and aggression, and a reduction of the performance in pigs (Averós et al., 2010a,b, 2012; Gonyou et al., 2006; Turner et al., 2000), cattle (Ingvarsen and Andersen, 1993; Krawczel et al., 2012; Wechsler, 2011), and poultry (Bessei, 2006; Cornetto et al., 2002; Estevez, 2007; Lay Jr. et al., 2011).

Dairy sheep production systems have traditionally been characterized by the utilization of extensive grazing areas (Boyazoglu and Morand-Fehr, 2001), where spatial restriction may be considered small, or virtually non-existent. Nonetheless, the progressive transition from traditional to modern production systems, due in part to an attempt to protect animals from adverse weather, has led to the use of more intensive husbandry procedures and higher productive efficiency in sheep (Shrestha, 2011).

The transition to more intensive systems can impose strong limitations on the space available to dairy sheep. Previous studies have already shown that a reduction in lying area altered the resting patterns of pregnant ewes (Bøe et al., 2006). Reduced available space also impaired the performance of lambs (Gonyou et al., 1985; Horton et al., 1991) and altered ewes' spatial distribution and behaviour despite the higher space allowances as compared to more intensive housing conditions (Sibbald et al., 2000). On the other hand, increasing space allowance from 1.5 to 3 m²/ewe has been associated with an increased proportion of animals walking and a reduced incidence of aggressions (Caroprese et al., 2009). In addition an improvement in health condition, including enhanced immune response, and a quantitative and qualitative improvement in milk production in dairy ewes has been observed when space allowance increased from 1 to 2 m²/ewe (Sevi et al., 1999).

The effects of spatial restriction for dairy sheep may also have consequences for their reproductive efficiency, and the quality of their offspring. This is suggested by the finding that management-related stressors (such as thermal, nutritional, hormonal and other) may compromise ewes' reproductive efficiency (Dobson et al., 2012), and ultimately, the survival and performance of their offspring (Shelton, 1964; Brown et al., 1977). It is therefore clear that a successful pregnancy in sheep will be, at least partially, determined by the ability of ewes to cope with any potential stress source affecting them throughout gestation, possibly including space limitation. Literature regarding changes in the behaviour of ewes across gestation is scarce, but Caroprese et al. (2009) found that the behaviour of ewes changed during a 1-year experiment. It may, therefore, be expected that space allowance would alter the behavioural patterns of pregnant ewes across gestation. However, the impact of space allowance provided under intensive

housing on the activity and social behaviour of gestating ewes and potential impacts on welfare are still unknown. Investigation of the effects of space allowance would, therefore, provide information that would contribute to the optimization of dairy sheep production systems in terms of animal welfare.

This work is framed within a larger study designed to determine the effects of space allowance over the behaviour, welfare and reproductive performance of gestating dairy ewes, and the potential impact that such space limitation may have over the quality of their offspring. This study aimed to determine the effects of space allowance, while maintaining constant group size, on the activity and the social behaviour of dairy ewes between weeks 9 and 19 of gestation. We hypothesized that low space allowance (high densities) will constrain the activity and behavioural repertoire in pregnant dairy ewes, and would potentially increase the occurrence of negative social interactions as result of increased competition for space. These effects might, consequently, have a negative impact on their welfare than could be exacerbated through gestation.

2. Materials and methods

The experiment was approved by the NEIKER-Tecnalia Animal Experimentation Committee (Reference AFA.2011.02), and was carried out according to the European Directive 86/609/ECC regarding the protection of animals used for experimental and other scientific purposes.

2.1. Animals and pre-treatment facilities

The present study was carried out at the experimental dairy sheep farm of Neiker-Tecnalia (Vitoria-Gasteiz, Spain) between August 2011 and January 2012. One hundred and thirty five primiparous and multiparous Latxa ewes (*Ovis aries*), one to eight years old, were artificially inseminated (AI) at the end of August. Latxa breed is traditionally used for dairy purposes, and is generally managed under semi-extensive conditions. Ewes were initially housed as a single flock in a barn (14 m × 32 m) with solid walls and windows allowing natural lighting. Artificial lighting was available for necessary management duties at any hour. Straw bedding was provided, and fresh straw was added periodically as required to maintain adequate bedding conditions. Ewes had daily access (about 20 h/day) to an adjacent outdoor pasture (5 ha) until housed in the experimental pens. Pasture was complemented with ad libitum access to vetch and oats and water through automatic nipple drinkers inside the barn.

Forty-six days after AI, pregnancy and number of foetuses per ewe were confirmed by ultra-sound (Ovi-scan 6, BCF, Australia). Simultaneously, ewes' body condition was determined using a 5-point scale (Russel et al., 1969). Among the ewes with confirmed pregnancy, fifty-four were randomly selected for the experiment; they remained in the flock until the start of the experimental period.

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