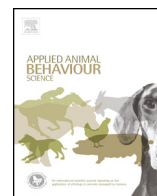




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Behavioural reactivity of ewes and lambs during partial and total social isolation



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ABSTRACT

This work investigated the differences in the reactivity of Sarda (primiparous $n = 18$, multiparous $n = 17$) and Dorset (multiparous $n = 8$) breeds of sheep and their singleton lambs to two challenging test situations involving a mother-lamb partial separation test and an isolation test. Non-parametric analysis used single behavioural variables and fear scores to evaluate the effect of parity, sex of lambs, and the association between mother-lamb behaviour. Amongst ewes, Dorset were characterised by a more calm temperament while Sarda (especially primiparous ewes) were more active in their response to challenge (i.e. more attempts to escape). As with their dams, lambs reflected to a certain extent this divergence and overall during isolation lamb fear score was on average significantly higher than dams. Correlations between measures of behavioural reactivity across tests were carried out to search for predictive measures of fear. A very strong correlation emerged linking vocalisation to locomotor activity. Vocalisation could be a good candidate as predictor factor of an active reaction of sheep to a fearful situation.

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1. Introduction

In sheep, isolation from conspecifics even for short periods of time is known to be one of the most stressful and fear eliciting situations, inducing significant behavioural and physiological perturbations (Boissy et al., 2005; Dodd et al., 2012; Vandenheede et al., 1998; Viérin and Bouissou, 2003). The link between the high reactivity of livestock and productive losses is well documented (Dodd et al., 2012). Genetic (e.g. breed) and developmental (e.g. maternal behaviour) factors contribute to individual variability in the level of reactivity to frightening situations. Breed differences in temperament and behaviour reaction were investigated during isolation tests in the presence or absence of frightening stimuli (Boissy et al., 2005; Hansen

et al., 2001; Jørgensen et al., 2011; Viérin and Bouissou, 2003). Boissy et al. (2005) found that Romanov lambs displayed more fear in the presence of humans than Berrichon-du-Cher crossbreeds, while the latter were the most active showing high activity levels and attempts to escape compared to Romanov in human absence. Adult Romanov sheep were found to have a more fearful disposition compared to both Ile-de-France and French Merino when exposed to a surprise effect or a human (Le Neindre et al., 1993; Viérin and Bouissou, 2003).

Maternal experience also influences fearful temperament, with decreasing reactivity as the animal experiences parturition (Murphy et al., 1994; Viérin and Bouissou, 2002). Reduced reactivity was associated with physiological changes (e.g. elevated plasma levels of progesterone) that prepare the ewe for birth (Viérin and Bouissou, 2001); pregnant ewes show lower fear reactions than dry ones (Poindron et al., 1997; Viérin and Bouissou, 2001). Viérin and Bouissou (2002) found that multiparous ewes were less

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fearful than primiparous ones in the presence of a human, and that the experience of one parturition reduced the reactivity of primiparous compared to nulliparous when faced with a surprise challenge.

Behavioural reactivity of sheep to challenges has been the focus of many researchers, in an attempt to find predictive indicators of fear and emotionality. In fact, there is evidence that behavioural measures of fear are consistent in time and across different tests (Murphy et al., 1994; Wolf et al., 2008). The correlation of variables scored during different tests may help identify measures that are predictive of behavioural activity, allowing to reduce the number of observed behaviours, selecting those that are more easily assessed (Dodd et al., 2012; Wolf et al., 2008). Moderate correlations, for example, were found comparing maternal behaviour to the agitation score of ewes when in a restraint test, or comparing vocalisation to locomotion during an isolation test (Murphy et al., 1994; Wolf et al., 2008).

The aim of this study was to compare the reactivity of sheep (*Ovis aries*) to two established fear tests: a mother-lamb partial separation test and an isolation test. Previous researchers have developed a scoring system assigning a level of fear to each animal to obtain an integrated view of the reaction to a test (Romeyer and Bouissou, 1992; Vandenheede and Bouissou, 1993; Vandenheede et al., 1998; Viérin and Bouissou, 2003). As fear may be considered as a unitary phenomenon across tests, Vandenheede et al. (1998) developed a new scoring method that would allow direct comparison between different groups of animals and different tests by positioning an animal on a continuous fear scale. Due to the ease of the methodology, a similar scoring method was chosen for our study to have a synthetic view of sheep reactions to the tests, and to compare different groups of animals, or the same animal across tests. Correlations between measures of behavioural reactivity across test were carried out to search for predictive measures of fear. The effect of breed, parity, sex of lambs, and the association between mother-lamb behaviour was also investigated.

2. Materials and methods

2.1. Subjects

Primiparous and multiparous ewes (*O. aries*) of Sarda, a light Italian dairy breed accounting for 43% of total national production, and Dorset Horn, a heavy British meat breed, and their singleton lambs were randomly selected from three different flocks kept on an experimental farm, and which characteristics are described below:

1. Sarda breed primiparous (SP): 18 Sarda ewes, in a flock of 34 animals (age approx. 2.5 years, weight kg 36.7 ± 7.9), all primiparous (first gestation), were used. They were kept in a shaded outdoor pen of 110 m². All animals were born and bred in the experimental farm. Lambs were 6 males and 12 females.
2. Sarda breed multiparous (SM): 17 Sarda ewes, in a flock of 38 animals (age 4–5 years old, kg 41.1 ± 7.5), all multiparous (2nd or 3rd gestation), were used. They were kept in an indoor pen with access to an outside paddock

of 250 m² total. These animals were born and bred in the experimental farm. Lambs were 9 males and 8 females.

3. Dorset breed multiparous (DM): 8 Dorset ewes in a flock of 19 animals (age 5.5–6.5 years, kg 58.1 ± 3.1) were used. All ewes were multiparous (2nd or 3rd gestation). They were kept in a shaded outdoor pen of 300 m². These animals were imported from UK at 2–3 years of age, and were then bred and managed in the same way as the Sarda sheep on the experimental farm. Lambs were 3 male and 5 females.

All animals were kept with their flocks and only removed individually for testing.

2.2. Management

During gestation and lactation, ewes were fed to meet their nutritional requirements. All sheep were fed hay once a day (at 07:00 a.m.) and their diet was supplemented with a commercial concentrate (250–300 g/ewe) and with 50 g/ewe of shelled corn. All animals had free access to water. All ewes underwent oestrus synchronisation with intravaginal progestogen sponges (Crono-Gest sponges and Crono-Gest PMSG, Intervet Italia S.r.l.) and lambs were delivered naturally. After delivery, each ewe and her lamb were kept together in a pen (2 m² per pair), which allowed visual and acoustic communication with the rest of the flock. When the ewe and lamb had established a good bond (between 12 and 72 h after birth), they were reintroduced to their respective flocks. Lambs were not artificially weaned and remained in the flock for all the duration of the study. Further, no stressful procedure as castration or tail docking was performed to any of the tested animals.

2.3. Procedure

2.3.1. Test 1 – mother-lamb partial separation test

Lambs and ewes were subjected to this first test when lambs were 60–70 days old. A test arena (7 m × 3 m) was divided by a wire mesh fence to create a smaller area (6 sqm) and a larger one (15 sqm). A reference line was drawn, with powder chalk, on both sides, 80 cm from the fence (Fig. 1a). All lambs included in the study from each treatment group (groups were tested separately) were separated from the flock and housed together 30 min before commencing the test. Each lamb was isolated in the testing arena (smaller area) for 5 min prior to test. Its dam was then introduced in the larger area and behaviour was observed for 5 min. Two observers positioned along the reference lines, visible to the sheep, carried out live recording of the reactions. Each observer scored the behaviour of one of the pair. Recorded behaviours were: number of times a subject crossed the line near the fence with both front feet and number of vocalisations. The behaviour along the fenceline was recorded to later analyse from the videos the time each animal spent within 80 cm from the fence and the number of head bumps (i.e. attempts to reunite by jumping against the fence or, more often, by hitting the fence with the head).

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