Associations between open-field behaviour and stress-induced hyperthermia in two breeds of sheep

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Abstract

In sheep (Ovis aries) and other farm animals, routine husbandry procedures can cause negative emotions, such as fear, which are generally considered to reduce animal welfare. The open-field test (OFT) is the most widely used test to measure fearfulness in animals. The induction of psychological stress is often accompanied by an elevation of core body temperature, referred as stress-induced hyperthermia (SIH) and both OFT and SIH were used in this study to measure fearfulness in sheep: the aim being to examine associations between behaviour in the OFT and the SIH response, using data from two breeds of sheep tested repeatedly over time. Twenty-four ewes from two breeds, Lacaune and Ripollesa, were tested for 10 min with all behaviours recorded throughout. Rectal temperature was measured immediately prior to the start of the test (T1) and 10 min after its completion (T2). SIH was measured as the difference between T2 and T1. Sheep were tested over three periods of three experimental days each. Ewes of both breeds showed consistent changes in behaviour in the OFT and a clear SIH response. Bleats and visits to the water bucket showed a clear pattern between rounds. Differences between T1 and T2 were found, T2 was higher than T1 suggesting that exposure to a novel arena caused SIH. Breed differences were found whereby T2 was 0.12°C higher in Ripollesa than Lacaune. These findings have implications for selection programmes, creating the possibility of selecting less fearful animals that will cope better with handling procedures that may induce fear. Further, they also demonstrate the importance of using both behavioural and physiological variables to evaluate fear.

Keywords: animal welfare, fear, open-field test, sheep, stress, stress-induced hyperthermia

Introduction

Fear can be defined as a set of behavioural defence sequences protecting individuals from environmental dangers, social aggressions or abiotic aversive stimuli. (Misslin 2003). Fear can also be induced by social isolation, which is known to be one of the most important fear-eliciting situations in sheep (Ovis aries), inducing behavioural and physiological perturbations (Minton & Blecha 1990; Romeyer & Bouissou 1992; Vandenheede et al 1998). In order to cope with a challenging situation, the individual evaluates the psychophysical and environmental properties of the event (Desire et al 2002). In addition to these environmental influences, the expression of fear is the result of interactive processes related to past experiences and the animal’s genetic background (Boissy et al 2005). Fear reactions have an obvious adaptive value in the wild, for example detecting and escaping predators (Vierin & Bouissou 2002). Fear plays a crucial role in this process by motivating animals to avoid potentially harmful situations (Rushen et al 1999). Under farm conditions, however, acute or chronic fear reactions can lead to reduced productivity and welfare (for a review, see Dawkins 1990; Boissy 1998; Rushen et al 1999). The open-field test (OFT) or arena test is a behavioural test in which the animal is isolated from its conspecifics and introduced into an unfamiliar and barren environment. OFT is the most commonly used test to measure fearfulness in animals, and was developed for laboratory animals (Gray 1987). It has been widely used in farm animals (for a review, see Forkman et al 2007). Validation of the OFT, as a measure of fear in sheep, can be done by correlating behaviour in the OFT with physiological changes known to be associated with some forms of stress. Correlations between adrenocortical and behavioural responses to novelty have been found in calves (van Reenen et al 2005). Physiological responses associated with an emotional state of fear are generally believed to include increased activity of the sympathetic nervous system, eg increased heart rate and catecholamine secretion, and of the hypothalamo-pituitary-adrenal (HPA) axis, eg elevated plasma corticosteroids (Boissy 1995; Boissy & Le Neindre 1997; Ramos & Mormède 1997; Rushen et al 1999). When faced with the same challenge, fearful individuals show more pronounced behavioural (eg immobility or panic) and physiological (eg quicker, greater, longer) responses than...