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Review

The importance of social behaviour for goat welfare in livestock farming

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ABSTRACT

The domestic goat is a sociable, inquisitive, and intelligent species, which has been used for its meat, milk, skin, and fur since it was first domesticated ca. 10,000 years ago. Although it exhibits a wide range of behaviours, the domesticated goat has been the subject of relatively few behavioural studies. In domestic goats, the opportunity to express certain social behaviours can be limited by captivity and management systems, especially in modern production systems, where goats are reared intensively under high stocking densities, sexual segregation, early separation of kids from their mothers, frequent regrouping, and manipulation during critical periods, including gestation and weaning. To better understand the requirements of this species and to identify possible tools for the detection of early modifications in natural behaviours that might indicate poor welfare and the establishment of positive human–animal interactions, this review provides a detailed description of goat social behaviour. Practical recommendations arising from observations of goat social behaviour are provided in the conclusions.

1. Introduction

Domesticated about 10,000 years ago (Mason, 1984; Zeder and Hesse, 2000), goats were probably the first ruminant livestock species (Hatziminaoglou and Boyazoglu, 2004). Changes in the availability or accessibility of space, food, water, and shelter, exposure to risk of predation, and changes in the social environment often accompany the transition from living free to captivity. Those changes set the stage for the development of the domestic phenotype (Price, 1999). During domestication, many of the behavioural traits of the wild types were replaced by those found in existing domesticated populations (Mignon-Grasteau et al., 2005) and goats evolved domestic traits that enabled them to live and reproduce in captivity (Gautier, 1990). Present-day domesticated goats are the product of those adaptations, the artificial selection by breeders for specific traits in meat, milk, and fur, and the effect of natural selection for fitness under variable conditions (Galal, 2005).

Small ruminant livestock occur widely, including many developing countries, which use traditional extensive production systems designed to meet the needs of the families. In the more developed countries, to be more efficient and to increase production, the systems are changing from traditional to semi-intensive or intensive conditions (Miranda-de la Lama et al., 2010). With the intensification of animal production systems, the animal's way of life has become progressively artificial. Animal nutrition, reproduction, and diseases have been the subject of considerable research; however, the development of efficient management techniques that optimize production and high standards of animal welfare requires a better understanding of the mechanisms of goat behaviour (Bouissou, 1980).

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Behaviour is one of the most important early indicators of the welfare of an individual and its adaptation to its environment and reflects the immediate response to the interaction between the animal and its environment (Metz and Wierenga, 1997). Social behaviour can vary considerably in response to different environmental factors because it evolved to allow adaptations to specific environments (Mattiello, 2001). The social behaviour of small ruminant species has been studied, but much of the research has focused on sheep because, of its ubiquity; however, goat behaviour is quite different from sheep behaviour. In general, goats are more reactive than are sheep, because they are more aggressive (i.e., when they are attacked, goats tend to face the attacker, but sheep usually flee) and they exhibit more exploratory behaviours, whereas sheep are more fearful and shy (Kilgur and Dalton, 1984; Houpt, 2005). To better understand the specific requirements for ensuring sufficiently good welfare for goats, especially for those in intensive production systems, this review provides a detailed description of the social behaviour of the caprines.

2. Principles of social behaviour

Social behaviour is all of the interactions between two or more individuals in a group that modify the activity of the group (Fraser and Broom, 1990) and that cover the function of intra-specific communication (Immelmann, 1988). The motivation to perform a behaviour depends on the interactions between internal and external factors that involve feedback control mechanisms (Galindo et al., 2000). Physiological, environmental, and behavioural mechanisms that serve to maintain the balance in the relationships within a group that otherwise would be transitory or null regulate social activity (Mendl and Held, 2001).

The social group is part of the complex and dynamic environment of the individual (Mendl and Deag, 1995), in which many strategies have evolved to enhance survival and maintain the viability of the group (Mendl and Held, 2001). Social behaviour serves many purposes, including group cohesion and ecological integration (Fraser and Broom, 1990), and provides a number of advantages (Immelmann, 1988), such as better protection from predators, more efficient foraging, easier potential access to sexual partners, and more successful defence of neonates (i.e., Jarman, 1974; Hunter and Skinner, 1998; Estevez et al., 2007), which is why most ungulate species exhibit a high level of social organization (Mattiello, 2001). However, living in a group can have costs, particularly, competition for food or access to other resources, which can lower the fitness of individuals (Estevez et al., 2007).

3. Communication

Social relationships among individuals in a group can be conveyed by a variety of communication signals (Immelmann, 1988). Communication plays a key role in the development and maintenance of social behaviours. For example, communication is essential for the recognition of individuals within the group, locating other group members, sending signals intended to establish or maintain an individual's social status, or informing other animals about one's temporary state (i.e., receptivity to males by fertile females) (Immelmann, 1988). The recognition of a familiar individual and the formation of a social memory are essential to the development of social bonds (Lim and Young, 2006).

In goats, more than in sheep, olfactory signals are important, especially in sexual and maternal behaviour (Levy et al., 2004). For example, the "buck effect" is stimulated mainly through olfactory cues (Gelez and Fabre-Nys, 2004). Urine is one of the main vectors for signals of individual identity and goats frequently urinate, especially when expressing their reproductive status. In addition, they secrete olfactory signals through pedal glands and a tail gland. Typically, volatile odorants are perceived by the olfactory epithelium and non-volatile substances (pheromones) can be perceived with the aid of the vomeronasal organ (or Jacobson's organ) by performing the flehmen behaviour, which is typical of the males of all ruminant species, including goats (Houpt, 2005; Wakabayashi et al., 2002).

An olfactory learning process is the primary basis for the development of the relationship between dam and their kids (Poindron et al., 2007a), although an additional role of visual and/or auditory stimuli during the sensitive period cannot be excluded (Poindron et al., 2007b). Romeyer et al. (1994) found that damage to the main olfactory system before parturition inhibited the formation of selective nursing bonds and Houpt (2005) reported that a week-old kid subjected to open castration was rejected by his mother, possibly because of the smell of the fresh wound. In livestock systems where kids are nursed by their dams, to limit odour contamination, manipulation of newborn or young kids should be performed with caution in order to minimize the risk that a kid will be rejected by its mother, taking into account that visual characteristics of the young are probably not able to compensate for the loss of olfactory cues (Romeyer et al., 1994).

Goats are a vociferous (Lenhardt, 1977) and exhibit a variety of vocalizations including snorts, bleats, and sneezes (Kilgur and Dalton, 1984). Vocal signals (i.e., distress calls and isolation bleats emitted by kids) are important in the establishment of the mother–infant relationship and are helpful to mothers in locating the lying-out site of their kid (Poindron et al., 2003). Vocalisations by goats are indicators of social isolation (Boivin and Braadstad, 1996). Alarm vocalizations consist of high-pitched sneezes, which are often accompanied by visual signals such as stamping, although the latter seem to be of lesser importance to goats (Houpt, 2005). During the season of sexual activity, bucks vocalize more frequently, but there is no evidence that these vocalizations stimulate sexual activity in anoestrous females (Vielma et al., 2008).

Olfactory, vocal, and visual signals from females are important to bucks in detecting oestrus females. Signs that indicate females are in heat are more pronounced in goats than they are in sheep (Sevi et al., 2009), possibly because: there is sexual segregation among goats and females might have to attract bucks from a distance, whereas in flocks of sheep signals from females can be less obvious.