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Social feeding decisions in horses (*Equus caballus*)

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Abstract

Like many other herbivores, in a natural environment equids feed on rather evenly distributed resources. However, the vegetation in their vast habitats constantly changes. If food is plentiful only little competition occurs over food, and in non-competitive situations domestic horses tend to return to the same feeding site until it is overgrazed. In contrast, they compete over limited food for which the social status of the individuals appears to be important. Especially in ruminants several studies have proved an influence of social organisations, rank, sex and the depletion of feeding sites on the feeding behaviour of individuals. However, it is not yet understood whether and how social aspects affect horses' feeding decisions. Curiosity about the influence of social rank on the horses' feeding decisions between two, equally with high-quality surplus food-filled buckets placed in different social feeding conditions, led us to create the test below. The observer horses were alternately tested with a dominant and a subordinate demonstrator placed in one of the three different positions. We conclude that domestic horses use social cognition and strategic decision making in order to decide where to feed in a social feeding situation. When possible they tend to return to the same, continuously supplied feeding site and switch to an "avoidance tendency" in the presence of dominant horses or when another horse is already feeding there. Thus, the social rank and the position of conspecifics affect the feeding strategy of horses.

Keywords: Feeding decision; Horse; Rank; Social behaviour

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1. Introduction

This study arose from the urgent need to gain more knowledge about the horses' social feeding decisions. In many tests horses discriminate between different food sources, or the horses' learning behaviour is positively reinforced by food rewards. Especially in the case of social learning tasks, in which animals are tested for their ability to learn specific feeding tasks from their conspecifics (see, for instance, Heyes and Galef, 1996; Nicol, 2006), feeding decisions are influenced by feeding choices of conspecifics. Several studies (Baer et al., 1983; Clarke et al., 1996; Baker and Crawford, 1986; Lindberg et al., 1999; Nicol, 2002) have been designed to prove social learning in feeding situations in horses. But, even though equids are highly social animals, none of the previous tests were able to demonstrate social learning in horses (Nicol, 2002; Krueger and Flauger, 2007). Baker and Crawford (1986), as well as Clarke et al. (1996), concluded from the results of their tests that horses learned something, because of the decrease in latency in approaching the test area after observing a demonstrator feeding. However, they may have "avoided" the feeding territory of the unfamiliar demonstrator (i.e. termed as "avoidance hypothesis").

Although, the avoidance hypothesis already suggests that social cognitive abilities, i.e., the processing, encoding, storage, retrieval, and application of social information, is decisive for the outcome of social feeding tests in horses, knowledge on the topic is very limited (Nicol, 2002). However, in previous studies we showed that horses are capable of social cognition. They memorise and generalize social experiences (Krueger, 2007), and distinguish the social affiliation and the social rank of other horses (Krueger and Heinze, in press).

For a better understanding of the present study we will proceed with outlining the current state of knowledge on social feeding competitions in grazers and other mammals, as well as on sociality in equids, and finally draw the main aspects for this study.

In general group life in social animals is determined by complex long-term social relationships (Hinde, 1983). The "shareholders" of social interaction may benefit from reduced predation risks, improved defence of resources and communal rearing. On the other hand each of them suffers from an increased

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competition for critical resources to a differential degree (Pusey and Packer, 2003).

In grazers, behaviours which are shown while animals compete over more homogeneously distributed and plentiful resources, the so-called feeding interactions, occur very rarely (Geist, 1974; Wittenberger, 1981; Wittemyer and Getz, 2007; Fischhoff et al., 2007). However, depletion of food sources causes higher competition (Jarman, 1974; Illius and Gordon, 1987). Analogous, to these findings most competition over food in red deer (*Cervus elaphus*), Roosevelt elk (*C. elaphus roosevelti*), and caribou (*Rangifer tarandus*) has been observed in winter when food is scarce (Appleby, 1980; Thouless, 1990; Weckerly, 1999; Barette and Vandal, 1986). Feeding competition in goats (*Capra hircus*) is influenced by the amount of available food and by the goat's sex, age and rank (Shi and Dunbar, 2006). However, feeding conspecifics can also serve as a reference point where to find preferred food items (Valone, 1989; Valone and Templeton, 2002). In this case, the presence of a foraging animal increases the interest of others in a specific feeding area, which has been termed social or local enhancement (Giraldeau, 1997; Poysa, 1992). It has been shown, that goats (*C. hircus*) use social information for locating high-quality feeding areas after observing others foraging (Shrader et al., 2007). They also raise their intake rate, in terms of feeding bouts per feeding time, in direct relation to the number of increasing competitors (Shrader et al., 2007).

Thus, foraging in groups comprises benefits and costs. Social animals benefit from collective predator protection and social information processing, such as using conspecifics as a reference point as described above, but competition over the preferred food items may be costly and even result in serious injuries. Subordinate animals usually pay the highest costs while trying to obtain scarce resources such as food, water, rest places and shelter in the presence of dominant animals (Barton, 1993a,b). In chimpanzees (Hare et al., 2000), for instance, subordinate animals only choose food that is hidden behind a small barrier in such a way that the dominant animal cannot see it. Hare et al. (2001) even highlighted that chimpanzees seem to know which particular animal has watched the crucial event, since subordinates go for food when the observing dominant animal is exchanged for a non-observing dominant animal.

However, it is not yet understood whether and how social aspects affect horses' feeding decisions. Equids live in fission–fusion social systems (Fischhoff et al., 2007) in which the members of social groups frequently disperse and reunite again. Though, social live takes different shapes in equids, for species, which live in wide grasslands, such as the Serengeti Plain of Tanzania (Moehlman, 2002), the valleys of Hustai National Park in Mongolia (King and Gurnell, 2005) and the "Great Basin" in northern America (Berger, 1986), food and water resources are sufficient enough to allow females to feed together and thus to form stable groups, which consist of one or more mares, their offspring and usually one, but occasionally up to five males (i.e. referred to as "harem" or "family, Tyler, 1972; Berger, 1977; Moehlman, 2002). Surplus stallions gather in separate bachelor bands that differ in size from 2 to approximately 17 horses (Berger, 1977). Many subgroups form a structured social unit, called "herd," which shows the same migration patterns within a common home range (Miller, 1979; Berger, 1986). Horses roam in vast habitats and spend an average of 60% of their time feeding on constantly changing vegetation (Salter and Hudson, 1979; Waring, 2003). They prefer to feed on grasses in areas where preferred food is more plentiful (Duncan, 1983; Salter and Hudson, 1979). In non-competitive situations, while horses feed all by themselves with no other horses near by, domestic horses tend to return to the same feeding site until it is overgrazed (Devenport et al., 2005).

When food sources are limited the social status of the individuals appears to be important. In the context of determining dominance relationships among domestic horses, paired feeding tests, an interaction contest over the limited resource "food", have often been applied (Houpt et al., 1978; Ellard and Crowell-Davis, 1989). This technique is still in use for several species, like monkeys and apes, today (Li et al., 2007), although doubts arose concerning the reliability of dominance hierarchies investigated in the contest over point resources for species, that generally feed on rather homogeneously distributed resources. Ellard and Crowell-Davis (1989) were the first to mention that the results of such a test with draft-horse mares did not match their observations of the dominance hierarchy of the same horses in the field. Accordingly, in recent studies (Heitor et al., 2006a,b; Ellard and Crowell-Davis, 1989; Linklater and Cameron, 2000; Berger, 1977; Houpt et al., 1978; Houpt and Wolski, 1980; Goldschmidt-Rothschild and Tschanz, 1978), dominance relationships in horses have been assessed by using approach–retreat interaction and the direction of threats and submissive gestures (McDonnell, 2003; McDonnell and Haviland, 1995; Feist and McCullough, 1976).

Curiosity about the influence of social rank on the horses' feeding decisions between two, equally with high-quality surplus food-filled buckets placed in different social feeding conditions, led us to create the test below. Both feed-buckets were black in color and marked with olfactory cues from prior feeding of the test horses. The observer horses were alternately tested with a dominant and a subordinate demonstrator, which were determined from dominance relationship data observed in the field. The demonstrator was placed in one of three different positions either defined as (i) demonstrator feeding, (ii) demonstrator tied up or (iii) demonstrator absent. We hypothesised that the decisions of the observer horses would be strongly influenced by the demonstrators' rank in all the three feeding situations.

2. Materials and methods

2.1. Animals

We investigated the behaviour of 14 horses: 11 standard bred horses and 3 ponies (composed of 12 mares and 2 geldings), all aged between 6 and 30 years. The horses were individually identified by their brands and coloration. For testing social behaviours the social background and the housing conditions of the animals are of importance. Socially kept animals might behave differently from those that are kept individually. The horses that took part in the tests were members of