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RESEARCH

Sexual behavior of medium-ranked rams toward non-estrual ewes is stimulated by the presence of low-ranked rams

Rodolfo Ungerfeld

Departamento de Fisiología, Facultad de Veterinaria, Montevideo, Uruguay.

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Abstract In sheep, access to receptive females is affected by dominance relationships. The aim of the first experiment was to determine how the presence of high- or low-ranking rams affects sexual behavior of medium-ranked rams toward non-estrual ewes in pen tests. A complementary objective was to determine whether the presence of 1 or 2 rams has stronger effects. Social rank of 13 rams was determined using the food competition test. The number of courtship behaviors, mounts, and ejaculations was recorded in pen tests with non-estrual restrained ewes. In the first experiment, medium-ranked rams were subjected to 5 tests with: (1) the ewe alone, (2) the ewe and 1 restrained tied high-ranked ram, (3) the ewe and 2 restrained tied high-ranked rams, (4) the ewe and 1 restrained tied low-ranked ram, and (5) the ewe and 2 restrained tied low-ranked rams. The number of high- or low-ranked rams (1 or 2) present in the tests did not affect the results. There were no differences on courtship behaviors, but the number of mounts and mounts with ejaculation was greater when low-ranked rams were present. In a second experiment, it was determined whether the presence of medium- or low-ranked rams stimulates sexual behavior of high-ranked rams. The high-ranked rams were tested with: (1) the ewe alone, (2) the ewe and 1 restrained tied medium-ranked ram, and (3) the ewe and 1 restrained tied low-ranked ram. No differences were recorded in relation to presence of other rams during the tests. It was concluded that the presence of low-ranked rams stimulates sexual behavior of medium-ranked rams toward non-estrual ewes in pen tests. This effect was not related with the number of rams included in the test. The presence of medium- or low-ranked rams did not alter the sexual behavior of high-ranked rams toward non-estrual ewes.

Introduction

In ruminants, dominance relationships determine unequal access to resources, such as food (Loretz et al., 2004; Jørgensen et al., 2007), water (Andersson et al., 1984), lying space (Andersen and Bøe, 2007), shade (Sherwin and Johnson, 1987), or individuals from the other gender. Low-ranking rams have limited access to receptive females, affecting mating performance in groups of rams (Preston et al., 2003). In feral sheep, competition among rams may prevent subordinate males from participating in reproductive activity (Signoret and Balthazart, 1993), the young males being inhibited commonly (Geist, 1971; Hass and Jenni, 1991). However, in domestic rams, the suppressive effect of dominant

Address for reprint requests and correspondence: Rodolfo Ungerfeld, PhD, Departamento de Fisiología, Facultad de Veterinaria, Universidad de la República, Lasplaces 1550, Montevideo 11600, Uruguay; Tel: +598-2-628-6955; Fax: +598-2-6280130.
E-mail: rungerfeld@gmail.com

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rams on subordinate rams may be even more intensive. In this sense, Lindsay et al. (1976) showed that the mating activity of subordinate rams is low when dominant rams are located in an adjacent pen (the so-called audience effect).

Dominant rams limit access to females using different strategies. Lovari and Ale (2001) observed that rams may defend estrual ewes without restricting their movements: "tending" (tactic), "block" (sequester of estrual ewes), and "course" (quick mates without previous courtship). In pen tests, it has been reported that the presence of dominant rams inhibits the sexual behavior of subordinate rams (Synnott and Fulkerson, 1984; Tilbrook et al., 1987; Ungerfeld and González-Pensado, 2008). However, most studies have focused on how high- and low-ranked rams interact, but little has been studied on the strategies developed by medium-ranked rams. It is interesting to study medium-ranked rams, as they are probably the least stable group, competing to achieve high-rank positions, but also avoiding low-ranked rams to reach their position. In this sense, Aguirre et al. (2007) reported that although high-ranked rams produce better semen than low-ranked rams, the semen values of medium-ranked rams had great variability ranging between the high- and low-ranked rams. Therefore, it would be interesting to determine whether medium-ranked rams develop specific strategies to maintain or increase their social position.

It should also be considered that rams compete differently according to the motivation in specific contexts rather than in relation only to general hierarchies. In effect, Erhard et al. (1998) reported that rams that differ markedly in their competition ability to access estrual ewes were similar in their competitiveness and success when competing for food. Considering that it is known that sexual behavior is related to social ranks in groups of rams, it would be interesting to determine whether sexual behavior in nonsexual contexts is also a social signal related to social relationships.

Two experiments were designed to determine the influence of the presence of rams of higher or lower social ranks on sexual behavior of other rams toward non-estrual restrained ewes in pen tests. The aim of the first experiment was to determine whether the presence of low- or high-ranked rams affect sexual behavior of medium-ranked rams. A complementary objective of this experiment was to determine whether the presence of 1 or 2 rams has stronger effects on medium-ranked rams. The second experiment was designed to determine how the presence of low- or medium-ranked rams affect sexual behavior of high-ranked rams.

Materials and methods

Animals, management, and determination of social rank success index

The experiment was performed in the Campo Experimental N°1 (Migues, Canelones, Uruguay) during the late breeding season (May-June). Thirteen Corriedale × Milchschaf male rams (1-year-old; 49.7 ± 1.0 kg; mean ± SEM) were used for the study. All the rams were maintained as a single group since weaning (1 month). The rams had past sexual experience with restrained tied non-estrual ewes in pen tests in conditions similar to those performed in these experiments.

Hierarchy was determined using the food competition test (Synnott and Fulkerson, 1984) on 2 occasions before the experiments were performed. After fasting the rams for 12 hours, each dyad of rams was allowed to compete for feed in a bucket which was only large enough for one of them. Paired encounters were performed each day, with each ram tested once. Only 1 test was performed with each ram each day. When a ram was able to eat from the bucket for >1 minute, it was considered to be the dominant individual of the pair of rams (Lindsay et al., 1976). After testing every possible pair of rams, a success index based on the proportion of tests in which each ram was considered as dominant was calculated. Rams were classified into 3 categories according to their success index as high (>0.66; n = 4), medium (0.33-0.66; n = 6), and low (<0.33; n = 3) social rank individuals.

Sexual behavior

The sexual behavior of the rams was evaluated in a pen test with non-estrual restrained ewes. Different ewes were used in each test. Ewes were tied from the neck in 5 m × 5 m pens, thereby preventing the possibility of them avoiding the mounts. The number of events of anogenital sniffing, lateral approaches, flehmen, mounts attempts, mounts, and mounts with ejaculation was recorded for a 30-minute period. Each ram was used in only 1 test per day.

Experiment 1

The 6 medium-ranked rams were subjected to 5 tests each, in a random order, in which the ram was located with: (1) the ewe alone, (2) the ewe and 1 restrained tied high-ranked ram, (3) the ewe and 2 restrained tied high-ranked rams, (4) the ewe and 1 restrained tied low-ranked ram, and (5) the ewe and 2 restrained tied low-ranked rams. High- or low-ranked rams were randomly selected for each test. The interaction of the other ram was prevented by tying it at a distance that avoided a direct physical interaction with the tested ram and with the ewe, but allowing it to be close enough to be permanently seen by the experimental ram.

Experiment 2

Similar tests were performed, also in random order, with the 4 high-ranked rams. Rams were tested in the same pen test and with the same conditions, with (1) the ewe alone, (2) the ewe and 1 restrained tied medium-ranked ram, and (3) the ewe and 1 restrained tied low-ranked ram.