

Stallion-like Behavior in Mares: Review of Incidence, Characteristics, Ovarian Activity, and Role of Testosterone

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ABSTRACT

Stallion-like sexual behavior in mares is rare, except in association with ovarian tumors or hormonal treatments. The rarity of the phenomenon was confirmed in a recent 3-year study. The mean number of mares with detected stallion-like behavior, including mounting with thrusts, during an entire ovulatory season was 5.7 (17/3 years) in a herd averaging 105 mares (5% incidence/mare/season). From a total of 17 mountings of an estrous mare by another mare, 15 occurred when the mounting mare was in the follicular phase and two when in the early luteal phase. Plasma testosterone concentration on the day of mounting was higher ($P < 0.01$) in the mounting mares (17.7 ± 2.3 pg/ml) than in the standing mares (10.9 ± 0.5 pg/ml). No other deviation in the endocrine, behavioral, or morphologic aspects of the estrous cycle was observed. In another study, testosterone was assayed daily from 7 days before to 4 days after ovulation in seven mares during estrous cycles with no detected mare-on-mare mountings. Concentrations during the follicular phase were highest on the days corresponding to when mare-on-mare mounting was detected in the previous study. It is concluded that the rare occurrence of stallion behavior by untreated mares with no detected ovarian tumors is a consequence of an unusually high, apparently transient fluctuation in circulating testosterone at the time of mounting.

Keywords: Female–female mounting; Mares; Sexual behavior; Testosterone

INTRODUCTION

Stallion-like behavior can be induced in mares by large doses of estrogens,^{1,2} androgens,³⁻⁶ or anabolic steroids.⁷ In untreated mares, male-like behavior has been associated with ovarian tumors.⁸⁻¹¹ However, the earlier literature contains only a few reports of incidental and chance observation of a mare in estrus being mounted by a nonpregnant mare^{12,13} or a pregnant mare,¹⁴ apparently in the absence of an ovarian tumor. Despite its rarity in mares, based on the scarcity of reports, jennies frequently exhibit male-like sexual behaviors.^{15,16} Forty-two jennies observed for 376 hours exhibited 169 mounts, and the mounting and standing jennies were both in estrus in 88% of the mounts. Female–female mounting and male-like sexual behavior occurs commonly in some other large mammals (cows, Uganda kobs,¹⁷ goats¹⁸). The phenomenon also is common in some laboratory species (rats¹⁹) and in some species of subhuman primates.¹⁷ Mounting behavior by a female rat increases in the presence of a receptive female, regardless of the stage of the estrous cycle of the mounting female.¹⁹ Female Japanese macaques routinely mount other females; pelvic thrusts are involved, but the mounts differ in some respects from the mounts of males.²⁰

EQUINE COURTSHIP AND SEXUAL BEHAVIOR

Sheer dynamism characterizes equine courtship and display.¹³ Most often, the mare and stallion will enter into precopulatory interplay. This may consist of sniffing and nuzzling by the stallion of the head, lower flank and groin, and perineum of the mare, presumably in search of olfactory cues. Often the stallion will bite or nip the mare. Biting may be vigorous, consisting of prolonged grasping and tugging of skin folds or the vulva. Frequently, the stallion will nibble at the mare's rear leg, especially the hock area; this results in a lowering of the mare's pelvis apparently to facilitate intromission. Upcurling of the upper lip (flehmen) and herding the mares are other frequent behavioral manifestations by the stallion. An estrous mare may follow the stallion or, if the stallion approaches, may squeal and paw before turning her head to nuzzle and nibble the stallion. These preliminaries soon may be followed by frank signs of estrus, including posturing (positioning the body

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in a manner accommodating to copulation), raising the tail to expose the genitalia, urinating or passing fluids, and clitoral winking every few seconds (rhythmic eversion of the labia with projection of the clitoris). When not in estrus, the mare will respond to the stallion with vigorous kicking, biting, tail switching, squealing, and other nervous and repelling maneuvers.

Estrous mares tend to form groups,²¹ and both estrous and diestrous mares may interfere with an active stallion/mare interaction.^{22,23} When interfering mares were in diestrus, their hostility was usually (92%) directed at the stallion, whereas when in estrus the interference was usually (73%) directed at the mare. Interference directed at the mare involved keeping the mare away from the stallion, whereas aggression toward a pair during mating was more frequently directed at the stallion. In conclusion, mare sexual behavior is complex and involves more than the routine signs of estrus and nonestrus.

INCIDENCE OF STALLION-LIKE BEHAVIOR IN MARES

Recently, a systematic documentation of the incidence of mare-on-mare mounting was made.²⁴ Observations were from a research herd of nonpregnant large ponies and pony-horse crosses during the ovulatory season (April–November) for 3 continuous years. All mares of the herd were exposed to stallions and mated by natural service during previous years. The herd varied in number from 75 to 135 mares (mean, 105). Other research projects were being done during this time and involved daily monitoring of the reproductive organs by transrectal ultrasonography. Hormone treatments were used in some of the experiments, but mounting mares were not in any of the treatment groups. The mares were housed in four groups in a shelter isolated from stallions, so that each sex seemed unaware of the other.

When anyone at or near the shelter noted by chance a mare with stallion-like behavior, heard stallion-like vocalizations from a group of mares, or saw a mare mounting a mare that stood for the mounting, the principal investigator was notified. Immediately after being notified, the investigator observed for approximately 20 minutes the group of mares that contained the mare with stallion-like behavior. Whether a mare mounted during the 20 minutes or showed other stallion-like sexual behaviors was recorded.

The rarity of the phenomenon was confirmed by a total of only 20 observed mounting interactions during the 3 years of the study. Although the mountings were chance observations, one to several workers were within the sheltered pens or in the lane adjacent to the sheltered area at least several hours/day every day. Three of the mounting interactions occurred during the same follicular phase and were excluded. The mean number of mares with detected mounting during an entire ovulatory season was 5.7 (17/3 years) in the herd of 105 mares (5% incidence/mare/season). The mean number of estrous

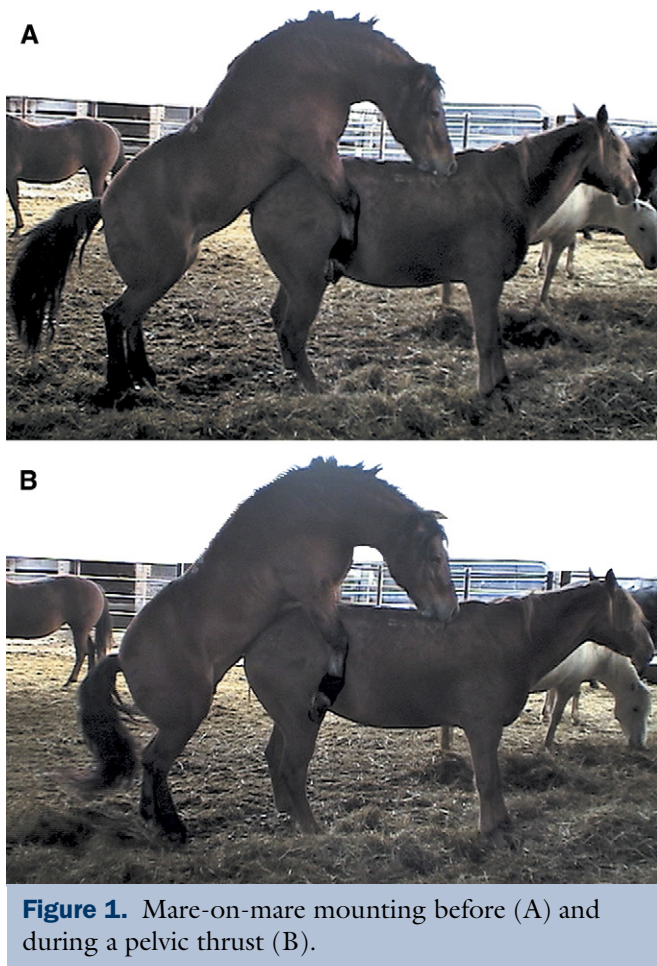
cycles/mare/year, in this herd, was 8.8 ± 0.4 . Thus, mounting was detected in 1 of 167 estrous cycles (0.6%). Although the incidence of the mounting behavior was rare, there was a measurable degree of repeatability within mares, as indicated by mounting by the same mare during consecutive years in 4 of 17 mounting interactions. Previously, at the same facility, mare-on-mare mounting was also observed by chance in horse mares (mostly Quarter Horses); stallion-like behavior during estrus was recorded in 3 of 112 mares being treated with a pituitary extract for stimulation of multiple preovulatory-sized follicles and in 0 of 47 control mares.²⁵

CHARACTERISTICS OF SEXUAL BEHAVIOR IN MOUNTING MARES

Nine mares in the follicular phase mounted during the 20-minute observational period of the principal investigator.²⁴ The following percentages of male-like behaviors were recorded for the nine mounting mares: pelvic thrusting during mounting (100%; Fig. 1), more than one mount (56%), biting (44%) and sniffing (11%) estrous mares, and flehmen (44%). Distinctive herding by a mounting mare was noted once. The standing mares exhibited estrous signs and were permissive to mounting. In addition, it was observed that other mares in estrus, as well as the standing mare, often approached the mounting mare and exhibited estrous signs, including presenting the hindquarters to the mare with the stallion-like behavior. The mounting mares did not show signs of estrus on the day of mounting while in the herd. However, when two of the nine mounting mares were removed from the group of mares and exposed to a stallion, both mares showed distinct signs of estrus and did not attempt to repel the stallion. That is, the mares showed distinct stallion-like behavior only when with other mares, but showed only estrous signs when with a stallion. Similarly, in another study,²⁵ three horse mares that mounted estrous mares showed estrous behavior when exposed to a stallion on the same day that they demonstrated stallion-like behavior when with mares.

FOLLICULAR ACTIVITY IN MOUNTING MARES

In the recent study,²⁴ follicular activity and phase of the estrous cycle was characterized in mounting, standing, and control mares. The control mares were selected by matching to the mounting mare, using the mare from the entire herd that was nearest in number of days postovulation. From a total of 17 mounting mares, 15 mounted during the follicular phase (largest follicle, ≥ 25 mm, within 4 days before the next ovulation; progesterone concentration, <1 ng/ml). Two mounted in the early luteal phase (2 and 4 days after ovulation; progesterone, 3.0 and 4.2 ng/ml). Data obtained from 13 mares that mounted during the follicular phase were used for statistical comparisons among the three groups (mounting, standing, control). Number of days from ovulation to mounting, day of the estrous cycle, number of days from mounting



to the next ovulation, diameters of the largest and second largest follicles, and the number of follicles larger and smaller than 20 mm were not significantly different among the mounting, standing, and control mares.

CAUSE AND FUNCTION

Many underlying mechanisms have been reported or proposed as the impetus for female to female mounting and sexual interplay within various animal species. Hypotheses¹⁹ concerning female mounting have been categorized as follows: (1) female mounting is a normal feature of sexual behavior (attraction and motivation of a male or proceptivity, type of mate competition) and (2) female mounting is a social behavior unrelated to reproduction (an expression of dominance, a component of social communication, or an aspect of play behavior). In mares, its occurrence apparently does not have survival value for the species, considering the rarity of the phenomenon.

In the recent study,²⁴ blood samples were collected from the mounting, standing, and control mares immediately after the mounting. Testosterone concentrations were higher ($P < 0.01$) in the mounting group (17.7 ± 2.3 pg/ml) than in the standing group (10.9 ± 0.5 pg/ml), and the difference between the mounting and control

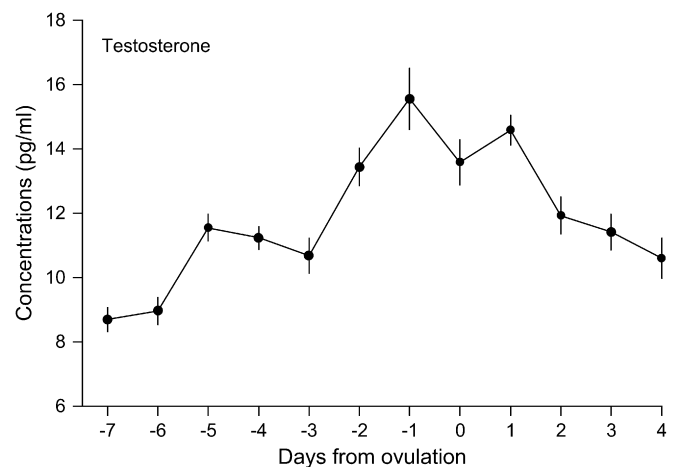


Figure 2. Means (\pm SEM) for testosterone concentrations for 7 mares. Day effect, $P < .04$.

groups (12.8 ± 0.6 pg/ml) approached significance ($P < 0.08$). Because of these findings, plasma testosterone was assayed with a commercial kit, as described,²⁶ in seven mares from 7 days before ovulation to 4 days after ovulation (unpublished). The objective was to determine whether testosterone concentrations during the follicular phase are highest on the days that mare-on-mare mounting was detected in the previous study. Concentrations were highest 2 days before to 1 day after ovulation (Fig. 2), and in the previous study, the follicular-phase mounting mares were an average of 1.8 days before ovulation. In the recent study,²⁴ mean testosterone levels in the two mares that mounted during the early luteal phase (18.1 pg/ml) were similar to the mean for mares that mounted during the follicular phase (17.7 pg/ml). Furthermore, the concentrations in these two mares were higher, with one exception, than for any of the 26 mares during the follicular phase in the standing and control groups. Concentrations of androstenedione, estradiol, estrone, and progesterone did not differ significantly among mounting, standing, and control mares.

No other deviation in the endocrine, behavioral, or morphologic aspects of the reproductive system was detected in mounting mares, except for the mounting response on the day of a high concentration of testosterone. Dominance behavior toward other mares, as manifested at the water and feeding stations, was not characteristic of any of the mares that mounted other mares, except for one mare. The mounting was not attributable to the causes reported for other species (abnormal fetal androgenization, ovarian tumor, a natural occurrence as in jennies and cows, an aspect of social behavior unrelated to reproduction). Although an early ovarian tumor cannot be eliminated, none were detected during intensive and extensive ultrasound examinations of the follicle population, even in mares that mounted 2 or 3 years earlier. It is concluded that the rare occurrence of mounting by

a mare is a consequence of an unusually high, apparently transient fluctuation in circulating testosterone at the time of mounting.

REFERENCES

1. Azzie MAJ. Some clinical observations on the effect of implant of oestradiol benzoate in brood mare. *J Reprod Fertil* 1975; 23(Suppl):303–306.
2. Nishikawa Y. Studies on reproduction in horses. Tokyo: Japan Racing Assoc; 1959:98–99.
3. Cougouille-Gauffreteau B. Effects of androgen treatment on social and sexual behaviour in mares. *Appl Anim Behav Sci* 1984;13:175 (abstr).
4. McDonnell SM, Garcia MC, Blanchard TL, Kenney RM. Evaluation of androgenized mares as an estrus detection aid. *Theriogenology* 1986;26:261–266.
5. McDonnell SM, Hinrichs K, Cooper WL, Kenney RM. Use of androgenized mare as an aid in detection of estrus in mares. *Theriogenology* 1988;4:547–553.
6. Withrow JM, Sargent GF, Scheffrahn NS, Kesler DJ. Induction of male sex behavior in pony mares with testosterone propionate. *Theriogenology* 1983;20:485–490.
7. Squires EL, Voss JL, Maher JM, Shideler RK. Fertility of young mares after long-term anabolic steroid treatment. *J Am Vet Med Assoc* 1985;186:583–586.
8. Fretz PB. Behavioral virilization in a brood mare. *Appl Anim Ethol* 1977;3:277–280.
9. McCue PM, Roser JF, Munro CJ, Liu IKM, Lasley BL. Granulosa cell tumors of the equine ovary. *Vet Clin North Am Equine Pract* 2006;22:799–817.
10. Meinecke B, Gips H, Meinecke-Tillmann S. Progestagen, androgen and oestrogen levels in plasma and ovarian follicular fluid during the oestrous cycle of the mare. *Anim Reprod Sci* 1987;12:255–265.
11. Stabenfeldt GH, Hughes JP, Kennedy PC, Meagher DM, Neely DP. Clinical findings, pathological changes and endocrinological secretory patterns in mares with ovarian tumours. *J Reprod Fertil* 1979; 27(Suppl):277–285.
12. Fraser AF. Species-specific parturient behaviour. In: *Farm animal behaviour*. Baltimore, MD: Williams and Wilkins Co.; 1974:139–146.
13. Ginther OJ. Reproductive biology of the mare: basic and applied aspects. Cross Plains, WI: Equiservices Publishing; 1992:77–83, 173–181.
14. Rossdale PD, Ricketts SW. The practice of equine stud medicine. Baltimore, MD: Williams and Wilkins Co.; 1974:23–24.
15. Henry M, McDonnell SM, Lodi LD, Gastal EL. Pasture mating behaviour of donkeys (*Equus asinus*) at natural and induced oestrous. *J Reprod Fertil* 1991;44(Suppl):77–86.
16. Henry M, Lodi LD, Gastal MO. Sexual behaviour of domesticated donkeys (*Equus asinus*) breeding under controlled or free range management systems. *Appl Anim Behav Sci* 1998;60:263–276.
17. Vasey PL. Same-sex sexual partner preference in hormonally and neurologically unmanipulated animals. *Annu Rev Sex Res* 2002;13:141–179.
18. Shearer MK, Katz LS. Female-female mounting among goats stimulates sexual performance in males. *Horm Behav* 2006;50:33–37.
19. Fang J, Clemens LG. Contextual determinants of female-female mounting in laboratory rats. *Anim Behav* 1999;57:545–555.
20. Vasey PL, Foroud A, Duckworth N, Kovacovsky SD. Male-female and female-female mounting in Japanese macaques: a comparative study of posture and movement. *Arch Sex Behav* 2006;35:116–128.
21. Bristol F. Breeding behaviour of a stallion at pasture with 20 mares in synchronized oestrus. *J Reprod Fertil* 1982;32(Suppl): 71–77.
22. Ginther OJ. Sexual behavior following introduction of a stallion into a group of mares. *Theriogenology* 1983;19:877–886.
23. Ginther OJ, Scraba ST, Nuti LC. Pregnancy rates and sexual behavior under pasture breeding conditions in mares. *Theriogenology* 1983; 20:333–345.
24. Gastal MO, Gastal EL, Beg MA, Ginther OJ. Elevated plasma testosterone concentrations during stallion-like sexual behavior in mares (*Equus caballus*). *Horm Behav* 2007;doi:10.1016/j.yhbeh.2007.04.005.
25. Woods GL, Ginther OJ. Recent studies relating to the collection of multiple embryos in mares. *Theriogenology* 1983;19:101–108.
26. Ginther OJ, Utt MD, Beg MA. Follicle deviation and diurnal variation in circulating hormone concentrations in mares. *Anim Reprod Sci* 2007;100:197–203.