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Comparison of the effect of natural mating, LH, and GnRH on interval to ovulation and luteal function in llamas

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Abstract

Gonadotropins and GnRH have been used to electively induce ovulation in llamas and alpacas, but critical evaluation of the natural interval to ovulation after mating has not been performed nor has a direct comparison of the effects of natural mating versus hormone treatments on this interval and subsequent luteal development. The objectives of this study were to compare the effects of hormonal treatments and natural mating on ovulation induction, interval to ovulation, and luteal development in llamas. The ovaries of llamas were examined by transrectal ultrasonography once daily. Llamas with a large follicle were assigned randomly to be: (1) mated with an intact male (mated; $n = 10$); (2) given 5 mg of LH im (LH; $n = 11$); or (3) 50 μg of GnRH im (GnRH; $n = 10$). Ultrasound examinations were performed every 4 h from treatment (day 0) to ovulation and thereafter once daily for 15 consecutive days to monitor CL growth and regression ($n = 5$ per group). Plasma progesterone concentrations were measured at days 0, 3, 6, 9, and 12 after treatment to evaluate CL function. The size of the largest preovulatory follicle at the time of treatment did not differ among groups (11 ± 0.6, 10.5 ± 0.8, 11.8 ± 0.9 mm, for mated, LH, and GnRH groups, respectively; $P = 0.6$). No differences were detected among groups (mated, LH, and GnRH) in ovulation rate (80%, 91%, 80%, respectively; $P = 0.6$), or interval from treatment to ovulation (30.0 ± 0.5, 29.3 ± 0.6, 29.3 ± 0.7 h, respectively; $P = 0.9$).

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Similarly, no differences were detected among groups (mated, LH, and GnRH) in maximum CL diameter (14.2 ± 0.3, 13.2 ± 0.5, and 13.0 ± 0.7 mm, respectively; $P = 0.5$), the day of maximum CL diameter (7.6 ± 0.2, 7.6 ± 0.2, and 7.4 ± 0.4 mm, respectively; $P = 0.6$), or the day on which the CL began to regress (12.3 ± 0.3 [non-pregnant, $n = 3$], 11.8 ± 0.6, 12.2 ± 0.4, respectively; $P = 0.4$). The diameter of the CL and plasma progesterone concentrations changed over days ($P < 0.0001$) but the profiles did not differ among groups. In summary, ovulation rate, interval to ovulation, and luteal development were similar among llamas that were mated naturally or treated with LH or GnRH. We conclude that both hormonal preparations are equally reliable for inducing ovulation and suitable for synchronization for artificial insemination or embryo transfer program.

Keywords: Camelids; Corpus luteum; Ovary; Ovulation; Progesterone

1. Introduction

Camelids are considered induced ovulators; a copulatory stimulus is necessary to elicit ovulation in females (England et al., 1969; Fernandez-Baca et al., 1970). In an early study designed to determine factors associated with eliciting ovulation in alpacas (Fernandez-Baca et al., 1970), ovulation rate was compared among females that (1) were unmated; (2) were mounted only followed with or without artificial insemination; (3) had interrupted mating; (4) had sterile mating (vasectomized male) followed with or without artificial insemination; (5) had single or multiple uninterrupted matings (intact male); or (6) were given hCG. It was concluded that mounting with penile intromission is necessary to induce ovulation regardless of whether the male is intact or vasectomized, and that ovulation rate can be increased with hCG treatment. Support for the hypothesis that South American camelids are induced ovulators was provided in a later study in which a rise in plasma LH concentration was detected 15 min after natural mating in llamas (Bravo et al., 1990).

In a study involving one-time examination of the ovaries during necropsy at 2–6 h intervals post-mating ($n = 1$–5 alpacas/time interval; San-Martin et al., 1968), ovulation was detected as early as 26 h after mating and 24 h after hCG treatment. However, the method of detection (necropsy) precluded characterization of the mean interval and distribution of ovulations. Based on daily ultrasonography of the ovaries in llamas (Adams et al., 1989, 1990), ovulation was detected 2.1 ± 0.1 days (mean ± S.E.M.) after copulation. In another study involving ultrasonographic examination of the ovaries of llamas at 2 h intervals (Adam et al., 1992), ovulation was detected at 27.2 ± 0.3 h (mean ± S.E.M.) after hCG treatment and 28.6 ± 0.4 h after GnRH treatment. Although the latter study was not designed to compare the effects of treatment with natural mating, the authors reported a mating to ovulation interval of 2 day, similar to that previously described but substantially longer than the response to hormone treatment (Adam et al., 1992).

The characteristics of the luteal phase after natural induction of ovulation have been well described in llamas and alpacas (Sumar et al., 1988; Adams et al., 1990, 1991; Aba et al., 1995). Based on daily ultrasonography of the ovaries and every-other-day blood sampling after natural mating in llamas (Adams et al., 1991), maximum CL diameter and plasma progesterone concentration were detected at day 8 after mating (day 0 = mating). The first