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Follicular dynamics in Serrana goats

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Abstract

Twenty-two Serrana goats were studied through two successive estrous cycles in order to characterize their follicular dynamics during the breeding season. The ovaries of the goats were scanned daily by real-time ultrasonography and all follicles ≥3 mm were measured and classified. The data were classified by the number of follicular waves per goat to test the hypothesis that temporal and morphological differences between the last follicular wave of an ovary, irrespective of ovulation, will affect the selection of the next ovulatory wave.

The mean interovulatory interval was 20.7 ± 1.0 days (mean ± S.D.). Three to five waves per estrous cycle were observed and 61.3% (19/31) of cycles had four waves. In estrous cycles with four waves, the day of onset of the first, second, third and fourth wave was 1.4 ± 1.0, 6.9 ± 1.4, 11.6 ± 1.8 and 16.8 ± 1.6, respectively. No differences ($P > 0.05$) were found between the day of onset of the first and second waves for estrous cycles with three, four or five waves. However, the day of onset of the third and fourth waves occurred later when the number of waves per estrous cycle increased ($P < 0.001$). The duration of the interwave interval (time between the day of onset of two consecutive waves) was longer when the second wave was ovulatory. The length of the growth phase (2.4 ± 0.9 days) and size (5.9 ± 0.7 mm) of the dominant follicle in the second wave were lower ($P < 0.01$) than for the first wave (3.3 ± 1.2 days and 6.6 ± 0.9 mm, respectively) and the fifth wave (4.1 ± 1.2 days and 7.5 ± 1.0 mm, respectively). Within pairs of ovaries, the onset of the last wave occurred later ($P < 0.05$) and was less variable in ovulatory ovaries (day 16.8 ± 1.4, $n = 20$) than in anovulatory ovaries (day 15.1 ± 3.7, $n = 20$). The length of the growing phase was longer ($P < 0.001$) in the last waves of ovulatory ovaries (3.1 ± 0.9 days) than in the last waves of anovulatory ovaries (1.7 ± 0.8 days). These results support the hypothesis that the day of onset of the ovulatory wave is related to or, at least, conditioned by the luteolysis and the decrease in plasma progesterone.

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In summary, the estrous cycle of Serrana goats is characterized by sequential follicular wave growth with a great variability in their onset and duration, with the exception of the ovulatory wave. The temporal and morphological differences observed in the last wave of estrous cycle provide strong evidence for the role of progesterone in their regulation.

Keywords: Estrous cycle; Follicular dynamics; Ovary; Goat; Ultrasonography

1. Introduction

Follicular dynamics during the estrous cycle of the goat were first reported by Ginther and Kot (1994) using real-time ultrasonography (UTR). These authors frequently found four follicular waves in the estrous cycle and suggested that follicular dominance occurred in first and last waves. These results have been confirmed by other reports (de Castro et al., 1998, 1999; González de Bulnes et al., 1999; Padilla and Holtz, 2000), and are similar to the follicular dynamics observed in other ruminant species (see reviews of Adams (1999), Ireland et al. (2000) and Mihm et al. (2002)).

The occurrence of reduced, or lack, of follicular dominance in some waves in the middle of the estrous cycle of polyovular species (sheep and goats) has been reported by some authors (Schrick et al., 1993; Orita et al., 2000), but there is no agreement on this point (Bartlewski et al., 1999; Gibbons et al., 1999; Evans et al., 2000). In cows, the pattern of hormonal and follicular dynamic of waves with co-dominant follicles or one dominant follicle has some differences (Kulick et al., 2001) to small ruminants.

Recent studies linking the morphological and functional characteristics of ovarian structures have provided an understanding of the relationships between progesterone (P4), estradiol, FSH or inhibin to goat ovarian dynamics (Gonzalez-Valle et al., 1998; de Castro et al., 1999; Schwarz and Wierzchos, 2000; Menchaca and Rubianes, 2002; Medan et al., 2003).

Rubianes and Menchaca (2003) suggested that when ovulation is induced by luteolysis the ovulatory follicle could be dominant follicle of an existing wave in either the growing or static phase. The ovulatory follicle was present at the time of the induced luteolysis in a significant proportion of the goats in the study of Gonzalez-Bulnes et al. (2005).

Studies of follicular dynamics in the natural estrous cycle of goats (Ginther and Kot, 1994; de Castro et al., 1999; Medan et al., 2003) show that there are no significant differences between the last two waves of the cycle or between these waves and the previous ones. However, these studies show a great variability in the number of follicular waves and it may be important to characterize them in relation to the number of waves present in the estrous cycle. The data of these studies were analyzed by combining the waves of each ovary, since both ovaries receive the same hypophyseal-pituitary signal, although the asymmetry of the follicular dynamics between right and left ovary has been recognized (see review of Driancourt (2001)).

This asymmetry between ovaries could be partially related to some local effects, which were recently reviewed by Rubianes and Menchaca (2003). Temporal analysis of the last follicular wave of each ovary within a goat could reveal some differences between these last two waves.

We hypothesised that there are some differences between the last two waves of the estrous cycle or between the beginning of the last wave of the ovulatory and anovulatory members of a pair of ovaries that reflect the selection mechanisms of the ovulatory wave.