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Assessment of luteal function by ultrasonographic appearance and measurement of corpora lutea in goats

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Abstract

In order to characterize the evolution pattern of the corpora lutea (CL) and to compare luteal function with their ultrasonographic appearance, 37 estrous cycles of Serrana goats ($n = 22$) were studied during breeding season. A daily transrectal ultrasound scanning was performed through two successive estrous cycles. Both solid and fluid-filled CL were observed and measured in both ovaries of each goat. Additionally, each CL was classified as CL_{ICHE} (CL with irregular contours and heterogeneous echotexture) or CL_{RCGE} (CL with regular contours and granular echotexture). Ovarian cyclic activity and luteal function were evaluated by biweekly plasma progesterone (P4) determination. The CL ($n = 60$) were first visualized on day 2.9 ± 1.0 after the day of ovulation (day 0), showing 7.1 ± 1.8 mm of diameter and reach their maximum size (12.5 ± 1.6 mm) on day 10.7 ± 3.2 ($P < 0.001$). Two days before the following ovulation (day −2), the CL regressed to 8.4 ± 1.3 mm ($P < 0.001$). The central cavity was found in 78.3% of CL, and had a persistence of over 50% until the last days of estrous cycle. The ratio CL length/cavity length was low during the first-third and high during the remaining two-thirds of estrous cycle. On day 2, the percentage of CL_{ICHE} was 33.3%, and began to decrease to 16.7% on day 6, reaching the minimum of 3.3% on day 10 ($P < 0.001$). This proportion increased on day −3 to 48.3% and reached 90% on day −1 ($P < 0.001$). The correlation between CL size and plasma P4 levels was $r = 0.63$ ($n = 87$; $P < 0.001$). A negative correlation between the daily proportion of CL_{ICHE} and plasma P4 levels was found ($r = -0.95$; $n = 18$; $P < 0.001$). These results suggest that the ultrasonographic appearance of CL is a reliable parameter for the assessment of luteal function in goats. Both the characterization of echotexture and size of central cavity could be valuable tools to differentiate between phases of normal estrous cycles.

Keywords: Corpora lutea; Progesterone; Estrous cycle; Goat; Ultrasonography

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1. Introduction

The ultrasonographic characterization of corpora lutea (CL) during the estrous cycle and early pregnancy of ruminants was performed for the first time in cows (Kito et al., 1986; Pierson and Ginther, 1987; Omran et al., 1988; Kastelic et al., 1990b). The comparison between real-time transrectal ultrasonography (RTU), rectal palpation and plasma progesterone (P4) concentration was used to assess the bovine luteal status (Sprecher et al., 1989; Ribadu et al., 1994). Significant correlations between size of CL and plasma P4 were observed during different phases of the estrous cycle in cattle (Kastelic et al., 1990a; Assey et al., 1993; Ribadu et al., 1994).

In goats, the variation of plasma P4 concentration during estrous cycle is well-known from more than 30 years (Heap and Linzell, 1966; Thorburn and Schneider, 1972). Recently, with the development of RTU, the detection and measurement of CL, in this species, were also studied (de Castro et al., 1999; Simões et al., 2005), including their relationship with the P4 levels (Orita et al., 2000; Medan et al., 2003). In ewes, a significant correlation between CL area and P4 concentration was found (Samartzi et al., 1995; Gonzalez de Bulnes et al., 2000). However, there is little information about the echo-characterization of CL with and without central cavities during the estrous cycle of goats.

Although the ultrasonographic appearance (morphology and echotexture) of the CL could be used to evaluate luteal activity in cattle, the functional classification of CL it was not easy when based in only one ultrasonographic examination (Battocchio et al., 1999) or only with the RTU method (Veronesi et al., 2002). However, the ultrasonographic appearance of CL seems to be a more reliable parameter than their size for the assessment of luteal function (Veronesi et al., 2002). To our knowledge, no data about the RTU reliability for this parameter was reported in goats.

The aims of the present study were (1) to describe the evolution of CL during the estrous cycle using RTU and (2) to determine the accuracy of the estimated size and ultrasonographic appearance of the CL in order to identify the different phases of the estrous cycle and to assess luteal activity in Serrana goats.

2. Materials and methods

2.1. Animals

Twenty-two Serrana goats, a local Portuguese breed, with 33.6 ± 8.0 kg live weight and aged 2–9 years were used during breeding season from September to November.

All procedures and experiments involving animals used in this research had the approval of the Animal Welfare Division/Veterinary General Directorate of the Ministry of Agriculture.

2.2. Evaluation of estrous and ovarian activity

Estrous synchronization was performed with two intramuscular injections of 50 μg of cloprostenol (Estrumate®, Schering-Plough II) given 10 days apart. Two vasectomised bucks were used for estrous detection. The observation of the flock was continuously performed between 36 and 72 h after the second prostaglandin application, and during the two subsequent natural estrous, in order to detect the onset of estrous in each animal. Out of these periods, and during the whole time of the experiment, at least one male with a marker harness was permanently