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Plasma progesterone in alpaca (*Lama pacos*) during pregnancy, parturition and early postpartum

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Abstract

Plasma progesterone concentration during pregnancy and the early postpartum period was measured by radioimmunoassay in five alpacas (*Lama pacos*), of the Huacaya breed, whose pregnancy length had a mean of 344.8 ± 4.4 days. Concentration of progesterone increased ($P < 0.001$) from low preparting values (0.11 ± 0.06 nmol/l) to greater values at 30 days of pregnancy (8.05 ± 1.13 nmol/l) and remained high up to 2 months of pregnancy. A slight transitory decline was observed between 3 to 7 months. Concentration of plasma progesterone dropped markedly during the 72 h before parturition especially, at the day of parturition. © 1999 Elsevier Science B.V. All rights reserved.

Keywords: Alpaca; Pregnancy; Progesterone; Parturition

1. Introduction

The importance of progesterone in the maintenance of mammalian pregnancies has been well accepted, with the pattern of secretion being variable among species (Stabenfeldt et al., 1972). Likewise, the importance of progesterone in termination of pregnancy is variable (Bedford et al., 1972).

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In South American camelids most of the information about progesterone regulation of pregnancy is for llamas (*Lama glama*) (León et al., 1990; Bravo, 1994), but this aspect is poorly defined in alpacas (*Lama pacos*) with most information being available for the first 30 days of pregnancy or after infertile matings (Sumar, 1991; Sumar et al., 1993). In llamas, it is accepted that plasma concentration of progesterone over 1 ng/ml (3.1 nmol/l) indicates pregnancy and this level is maintained throughout gestation, declining gradually 15 days before parturition (León et al., 1990).

Information concerning plasma progesterone profile during pregnancy, parturition and early postpartum in alpaca is presented here.

2. Material and methods

Five adult alpacas (4–5 years old) of Huacaya breeding were used. All females had at least one normal pregnancy and parturition prior to being included in this study. Controlled mating was conducted with males of proven fertility. The day of mating was considered as Day 1 of gestation. Pregnancy was confirmed by ultrasound at Day 21 after mating and reconfirmed by rectal palpation 100 days after mating. Animals had free access to pasture and water during the study.

Blood samples (2 ml) were collected by jugular venipuncture, using evacuated tubes containing EDTA, every 15 days from mating until the end of the 10th month of pregnancy and then twice a week until parturition. One sample was obtained at 24 h postpartum. Samples were centrifuged at $1200 \times g$ for 10 min at 4°C and plasma was stored at –20°C until analysed.

Progesterone analysis was conducted using a solid phase radioimmunoassay using DPC (Diagnostic Product, Los Angeles, CA, USA) reagents, provided and validated for use in alpacas by IAEA (International Atomic Energy Agency). Reported assay sensitivity was 0.09 nmol/l and antibody cross reactivity was 100% with progesterone, 2% with 20-alpha dihydroprogesterone, 1.7% with 11-deoxycorticosterone, 2.4% with 11-deoxycortisol and 1.3% with 5-pregnan-3,20-dione. All other steroids tested had less than 1% cross reactivity.

Samples were evaluated in a total of five assays with intra and interassay coefficients of variation of 10.3 to 7.8% and 1.4 to 4.1%, respectively.

Concentrations of hormone and variances are reported as the mean and the standard error of the mean (SEM). Analysis of the data was performed using the Statistical Applications System (SAS) program.

3. Results

The five animals in the study had an average length of pregnancy of 345 ± 4.4 days. All the alpacas had normal deliveries and live offspring. Changes in plasma concentration of progesterone between mating and 24 h postpartum are shown in Fig. 1. Plasma

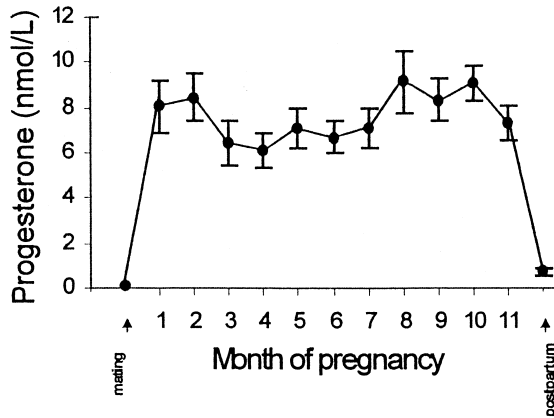


Fig. 1. Plasma concentration of progesterone in alpacas, during mating, pregnancy and early postpartum. The data depicted represents the mean values and vertical bars represent the SEM.

concentrations of progesterone increased from pre-mating values of 0.11 ± 0.05 to 8.05 ± 1.13 nmol/l at the first month of pregnancy ($P < 0.001$). A slight decline in plasma concentration of progesterone was observed from 3 to 7 months of pregnancy, although values remained over 6 nmol/l, with a subsequent increase between 8 and 10 months of pregnancy. Absolute sample values during gestation ranged from 1.6 to 17.0 nmol/l.

Concentration of progesterone declined from 8.33 ± 2.02 nmol/l, 72 h prior parturition, to 1.48 ± 0.49 nmol/l ($P < 0.001$) at the day of delivery (Fig. 2). During the first week postpartum concentrations of progesterone remained low 0.24 ± 0.22 nmol/l (Fig. 2), and similar to pre-mating values.

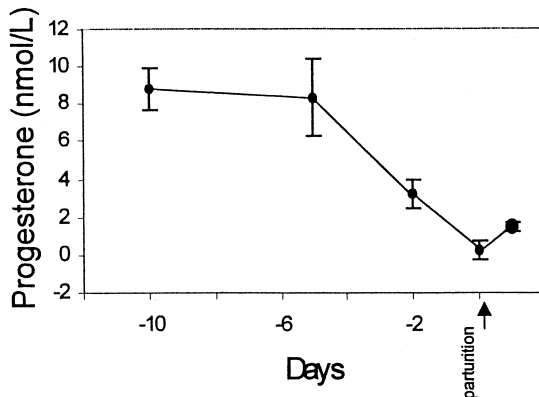


Fig. 2. Plasma concentration of progesterone in alpacas before parturition, at parturition and early postpartum. The data depicted represents the mean values and vertical bars represent the SEM.

4. Discussion

It is well accepted in alpacas, llamas and vicuñas, induced ovulating species, that the formation of a corpus luteum after a fertile or infertile mating, induces an increase in plasma progesterone of similar magnitude but different length (Sumar et al., 1988; León et al., 1990; Urquieta and Rojas, 1990; Bravo, 1994). As early as 3 to 5 days after sterile mating in alpacas, concentration of progesterone increased reaching a maximum of 10 to 20 nmol/l at Day 7 to 8 (Sumar et al., 1988). Regression of the corpus luteum by Day 10 to 11, possibly by the action of prostaglandin F₂ alpha action, functioned to decrease the concentration of progesterone to less than 1 nmol/l (Sumar et al., 1988).

With fertile matings, concentrations of progesterone in plasma follow a similar pattern in the first 8 days, but by Day 10 to 14 of pregnancy there is an increase in progesterone until 30 days of pregnancy (Sumar, 1991; Sumar et al., 1993). Similarly, our results showed a significant increase in plasma concentration of progesterone ($P < 0.001$) from pre-mating values to 30 days of pregnancy. Moreover, values at 30 days of pregnancy in this study were less than those found in alpacas by Sumar (1991) and Sumar et al. (1993).

Values for progesterone remained high during the first 2 months of pregnancy (average 8.05 ± 1.13 nmol/l). There was a slight decline in progesterone between 3 to 7 months of pregnancy (average 6.69 ± 0.72 nmol/l), returning to initial values between 9 and 10 months of pregnancy. Because there are no previous studies in the literature evaluating progesterone beyond 50 days of pregnancy in alpacas, comparisons are made with other species. Similar changes in progesterone during pregnancies have been observed in llamas between 18 and 27 weeks of pregnancy (León et al., 1990), at 21 weeks in dromedary camel (Elias et al., 1984), and between days 30 to 50 in the Barbary sheep (Hamon and Heap, 1990). The physiological explanation for this transitory decline is unknown and complex, because the corpora lutea can be removed after mid-pregnancy and the pregnancy will be maintained.

A significant decline in plasma concentration of progesterone began 72 h prepartum and in the last 24 h, concentration was even less ($P < 0.001$). These temporal changes prepartum are similar to those reported by León et al. (1990) in llamas, and by Urquieta and Rojas (1990) in vicuñas. However, the gradual decline beginning at 15 days before parturition as described in llamas (León et al., 1990), ewes (Stabenfeldt et al., 1972), Saanen goats (Thorburn and Schneider, 1972) or Chilean Creole goats (Parraguez et al., 1995), seems to be absent in alpacas. The meaning of this difference among species of ruminants, in which pregnancy depends mainly on progesterone secreted by the corpus luteum, is difficult to explain. A similar abrupt decline as detected in the present study occurred, 48 h prior to parturition in the Barbary sheep (Hamon and Heap, 1990) in which corpora lutea is not needed after mid-pregnancy.

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