

# Reproductive seasonality in female goats adapted to a subtropical environment persists independently of food availability

G. Duarte<sup>a</sup>, J.A. Flores<sup>a</sup>, B. Malpau<sup>b</sup>, J.A. Delgadillo<sup>a,\*</sup>

<sup>a</sup> *Centro de Investigación en Reproducción Caprina, Universidad Autónoma Agraria Antonio Narro, Periférico Raúl López Sánchez y Carretera a Santa Fe, C.P. 27054, Torreón, Coahuila, Mexico*

<sup>b</sup> *Physiologie de la Reproduction et des Comportements, UMR 6175 INRA-CNRS-Université de Tours-Haras Nationaux, IFR 135, 37380 Nouzilly, France*

Received 22 May 2008; received in revised form 25 July 2008; accepted 31 July 2008

## Abstract

The aim of this study was to determine whether the seasonal change in food availability provides a predictive cue that synchronizes the breeding season in goats adapted to the subtropical conditions of Northern Mexico. Groups of multiparous intact ( $n = 7$ ) and ovariectomized does bearing a subcutaneous implant constantly releasing estradiol-17 $\beta$  (OVX+E;  $n = 12$ ) were allocated in two pens and received a constant amount of feed. Another group of OVX+E does ( $n = 10$ ) was incorporated into a flock raised under natural grazing conditions with seasonal fluctuations in food availability. Blood samples were taken twice weekly. Ovulation of intact goats was inferred from plasma progesterone levels. In OVX+E does plasma levels of LH were measured. Intact does displayed seasonal variations in ovulation and the breeding season lasted from September to February. OVX+E goats displayed large seasonal variations in LH secretion regardless of whether they were fed constantly indoors or kept under natural grazing conditions ( $P < 0.0001$ ). The mean date of increase in LH secretion varied between years ( $P < 0.0001$ ) but did not differ between groups (naturally grazed: August  $13 \pm 10$  days; constantly fed: August  $26 \pm 10$  days). In contrast, the seasonal decline in LH secretion differed between groups: it was consistently delayed in constantly fed animals compared to those feeding naturally (naturally grazed: January  $28 \pm 4$  days; constantly fed: February  $24 \pm 6$  days, group effect,  $P < 0.01$ ). These results show that local female goats from subtropical Mexico display large reproductive seasonality independently of food availability.

© 2008 Published by Elsevier Inc.

**Keywords:** LH; Ovulation; Estrous behavior; Season; Management system

## 1. Introduction

Reproductive seasonality is a common feature in most habitats of the world, but little is known about the regulation of these seasonal cycles. The ultimate cause of seasonal reproduction is a seasonal change in climate and

food availability that exerts selective pressure restricting breeding activity to a particular time of the year when it is most likely to be successful. In some mammals, reproduction is opportunistic, depending upon immediate climatic and nutritional conditions [1]. This strategy is often observed in small-sized mammals that can complete gestation and lactation rapidly once a favorable period occurs. Alternatively, seasonal species with a long gestation use a predictive strategy to produce offspring at the optimal time of year on a regular basis [1]. In temperate areas, the annual photoperiod cycle is the major source of environmental information in the control

\* Corresponding author at: Universidad Autónoma Agraria Antonio Narro, Ciencias Médico Veterinarias, Periférico y Carretera a Santa Fe, 27000, Torreón, Coahuila, Mexico. Tel.: +52 871 729 7651; fax: +52 871 729 7676.

E-mail address: [joaldesa@yahoo.com](mailto:joaldesa@yahoo.com) (J.A. Delgadillo).

of seasonal functions. In subtropical and tropical areas where the amplitude of the annual change in day length decreases as a function of latitude, the role of photoperiod may be reduced and other environmental factors may act as time-of-year predictors.

Goats and sheep are found from high latitudes to the equator. In temperate areas, they are seasonal breeders and photoperiod is the main environmental factor responsible for these seasonal changes in reproductive activity [1–4]. Estradiol negative feedback on gonadotrophin secretion varies dramatically between the breeding and anestrus seasons, and this constitutes the main neuroendocrine mechanism by which season regulates gonadotrophin secretion and consequently ovulatory activity [2]. These seasonal changes in estradiol negative feedback are well illustrated in ovariectomized ewes treated with subcutaneous implants constantly releasing estradiol-17 $\beta$  (OVX+E). In these animals, high and low-plasma luteinizing hormone (LH) concentrations coincide with ovulatory and anovulatory periods, respectively [5,6]. In subtropical and some tropical latitudes, seasonal variations in reproductive activity are also observed in most breeds of sheep and goats adapted to these environmental conditions [7–9]. For instance, Australian female cashmere goats are sexually active during autumn and winter, and high-plasma LH concentrations in OVX+E females are observed at the same time [6,8]. In these areas, most animals are maintained in natural conditions with marked seasonal variations in food availability, and it is often hypothesized that food availability is the main factor controlling the annual sexual activity [10,11]. In support of this possibility, the seasonal cycle of Merino rams can be modified by changing the annual cycle of food availability [12]. When these rams are subjected to a Mediterranean photoperiodic cycle and received a maintenance constant diet, testicular growth is influenced by photoperiodic changes. However, when they received a simulated Mediterranean diet, with a reduction of food availability during the decreasing days, nutrition dramatically modified the testicular response to photoperiod, and the seasonal changes of testes were associated mainly with changes in body mass. In addition, in does, the breeding season is shortened by about 1 month when they received a maintenance diet compared with those that received 1.5 times maintenance requirements [13].

In subtropical Northern Mexico, female goats are usually kept with males in natural grazing conditions, eating only spontaneously available natural vegetation. In these conditions, most births occur from November to February, suggesting a seasonal pattern of reproduc-

tive activity with an anestrus period lasting until June [14].

Interestingly, this onset of breeding activity is 3 months in advance of temperate areas where photoperiod is the main environmental factor controlling seasonal reproduction, suggesting a different regulation of when breeding occurs [15]. More importantly, this period (June) coincides with the end of the dry season and an increase in plant growth on grazing land [14]. This coincidence between increase in food availability and onset of breeding activity led us to hypothesize that, in this environment characterized by contrasting food availability throughout the year, the seasonal change in food availability provides a predictive cue which synchronizes the onset of the breeding season in goats adapted to subtropical conditions of Northern Mexico. To confirm this hypothesis, we first determined whether in the absence of this cue, i.e. with constant feeding throughout the year, animals expressed seasonal changes in ovulatory activity over a 2-year period. Secondly, we compared the seasonal changes in LH secretion in ovariectomized and estradiol-treated goats in natural grazing or fed constantly over the same period. This experimental model was used to avoid pregnancy in females kept outdoors. A preliminary study was performed to test sensitivity to estradiol changes between anestrus and breeding season in these animals as it has been demonstrated in ewes and goats from temperate and subtropical areas [5,6].

## 2. Materials and methods

### 2.1. General

The study was performed in Torreón (latitude 26° 23'N, longitude 104° 47'W), State of Coahuila, Mexico for 27 months from 1 January. The photoperiod in this region varies from 13 h 41 min of light at the summer solstice to 10 h 19 min of light at the winter solstice. The area is characterized by a dry climate with an average annual rainfall of 266 mm (range: 163–504 mm) generally occurring between June and September with a wide inter-year variability. Mean annual maximum and minimum temperatures was 36.6 °C between May and August, and 5.7 °C between December and January, respectively. The maximum and minimum temperatures and rainfall recorded during the experiment are shown in Fig. 1.

Three-year-old multiparous female goats were used. The local population of animals, called Criollo, originating from the Spanish Granadina, Murciana and Malagueña breeds, were imported into Mexico during

Download English Version:

<https://daneshyari.com/en/article/2394105>

Download Persian Version:

<https://daneshyari.com/article/2394105>

[Daneshyari.com](https://daneshyari.com)