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The timing of oestrus, the preovulatory LH surge and ovulation in Blanca Andaluza goats synchronised by intravaginal progestagen sponge treatment is modified by season but not by body condition score

L.A. Zarazaga*, M.C. Gatica[1], L. Gallego-Calvo, I. Celi, J.L. Guzmán

Departamento de Ciencias Agroforestales, Universidad de Huelva, "Campus de Excelencia Internacional Agroalimentario, ceiA3", Carretera de Palos de la Frontera s/n, 21819 Palos de la Frontera, Huelva, Spain

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ABSTRACT

The aim of this study was to determine whether a seasonal pattern of reproductive events is followed after synchronisation by intravaginal progestagen sponge treatment in female Blanca Andaluza goats, and whether the timing of these events is affected by body condition score (BCS). During seasonal anoestrus (March), and again during the breeding season (November), the same 32 does were distributed into four subgroups according to their BCS: ≤2.25, =2.50, =2.75, and ≥3.00 ($n = 8$ in all cases). They were then synchronised using a commercial intravaginal sponge treatment. Every 4 h over the 72 h following sponge removal, oestrous activity, the LH concentration and each doe's number of follicles were followed by transrectal ultrasonography. The does synchronised during seasonal anoestrus produced more follicles than those synchronised during the breeding season ($P < 0.01$). The time elapsed between sponge removal and the onset of oestrus, the LH surge and time of ovulation, was also shorter in these does ($P < 0.001$). The BCS only modified the number of follicles present in the ovary just before ovulation; this number was significantly lower in the =2.50 BCS subgroup than in the other subgroups ($P < 0.05$). The present results show that the time to ovulation, and all events around it, are modified by the season in which Blanca Andaluza does are synchronised, but not by BCS.

1. Introduction

The Blanca Andaluza breed of goat, which is adapted to the environmental conditions of the Mediterranean, is endangered according to the Official Catalogue of Spanish Livestock Breeds (RD 2129/2008). The majority of goat farms that raise the breed are located in Andalusia's mountainous areas, where it is managed following a grazing-based system. The main aim of these farms is to produce meat, and kids must weigh 8–9 kg at slaughter (De la Vega et al., 2013). The breed shows very high phenotypic variability but is defined as convex, subelongate and sub-hypermetric, with an adult live weight of around 60 kg for the females (Fuentes García et al., 2000; Rodero et al., 2004). Its reproductive physiology and response to oestrus synchronisation have remained unstudied, but such knowledge is vital when trying to improve reproductive efficiency and ensure the breed's survival.

* Corresponding author at: Departamento de Ciencias Agroforestales, Universidad de Huelva, Carretera de Palos de la Frontera s/n, 21819 Palos de la Frontera, Huelva, Spain. Tel.: +34 959217523; fax: +34 959217304.
E-mail address: zarazaga@uhu.es (L.A. Zarazaga).
[1] Universidad Arturo Prat, Avenida Arturo Prat, 2120 Iquique, Chile.

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Table 1
Mean body condition score (BCS) and body weight of animals in each BCS subgroup at the time of sponge removal (means ± S.E.M. are for breeding season and seasonal anoestrus periods combined).

	BCS subgroup ≤2.25	BCS subgroup =2.50	BCS subgroup =2.75	BCS subgroup ≥3.00
N	16	16	16	16
BCS at sponge removal	2.25 ± 0.00b	2.50 ± 0.00c	2.75 ± 0.00d	3.23 ± 0.04a
Body weight at sponge removal	38.3 ± 1.1b	37.3 ± 1.0b	40.8 ± 1.3ab	43.8 ± 0.7a

Values with different letters in the same row are significantly different ($P < 0.05$).

Intravaginal devices that release progestagen are useful in optimising reproductive management in goats (Baril and Saumande, 2000) since they allow the scheduling of artificial insemination (AI); the diffusion of genes of interest and breed conservation is thus made easier. A routine synchronisation treatment involves the use of intravaginal sponges (inserted for 11 days) together with prostaglandin and eCG injections two days before sponge removal. This efficiently induces and synchronises oestrus and ovulation during the breeding season and even during seasonal anoestrus (Intervet, 2006).

Good nutrition is vital in the artificial control of reproductive efficiency, but the intensity of its influence is reported to vary with season (i.e., whether the doe is in its breeding season or in seasonal anoestrus) (White et al., 1983; Del Carmen Rodríguez-Castillo et al., 2004). Certainly, nutritional status can modify the rate of ovulation (Del Carmen Rodríguez-Castillo et al., 2004; Martin and Kadokawa, 2006; King et al., 2010; Viñoles et al., 2010); it can exert its influence via its effect on body weight and body condition (Downing and Scaramuzzi, 1991; for more information see the review by Scaramuzzi et al., 2006). Rhind and McNeilly (1986) showed that ewes with low body fat reserves during the breeding season produce fewer large ovarian follicles and therefore fewer follicles capable of undergoing the final stages of development and ovulation. In goats, the success of oestrus synchronisation treatments is reported to be affected by severe alimentary restriction for even a few days (Mani et al., 1992, 1996), and certainly when followed over a few weeks (Kusina et al., 2001). Under extensive conditions, the nutritional status of animals can vary due to fluctuations in the natural availability of food; this can affect body fat reverses, and therefore reproductive responses.

The aim of the present study was to assess the effect of season of synchronisation and body condition score (BCS) on the sequence of reproductive events (time to onset of oestrus, time of LH surge, and time of ovulation, as well as the number of growing follicles) in female Blanca Andaluza goats following their synchronisation with intravaginal progestagen sponges.

2. Methods and materials

2.1. Animals and management

The present study was performed in accordance with Spanish Animal Protection Policy RD32/2007, which conforms to the European Union Directive 2010/63 regarding the protection of animals used in scientific experiments. It was conducted at the experimental farm of the University of Huelva (latitude 37°15′), which meets the requirements of the European Community Commission for Scientific Procedure Establishments (1986).

The experimental animals were 32 adult, non-pregnant, Blanca Andaluza does (1.4 years old at the onset of the experiment). During the experimental period, all were maintained in communal yards with an uncovered area without supplementary lighting.

2.2. Experimental design and goat nutrition

The study was designed as a factorial 4 × 2 trial with four groups of females goats of different BCS (Hervieu et al., 1991), i.e., ≤2.25, =2.50, =2.75 and ≥3.00 (Table 1), and two periods of different reproductive status, i.e., seasonal anoestrus (March) and breeding season (November). The 50 initial animals used to prepare these groups were those employed in other, long duration experiments that started at least 4 months before the present work, the main objective of which was to induce and maintain different BCS (not yet published). The selected animals had all shown a maintained BCS over the three consecutive weeks before the start of the experimental periods in both November and March (the same animals were used in both periods) (Fig. 1). During these three-week periods, the different BCS groups were fed with concentrate and barley straw to maintain the desired BCS according to INRA standards (Morand-Fehr and Sauvant, 1988). Food was offered once a day; the concentrate was provided individually to each animal, and the barley straw distributed to each group. The concentrate was a commercial mixture of maize (26.3%), beans (20%), oats (14.1%), cotton-seed (13.7%), peas (13.4%), lupin (7.3%), barley (0.2%), wheat (0.2%), sunflower seeds (0.2%) and a mineral-vitamin complement (4.6%). The nutritional values for the concentrate were 0.93 milk fodder units (UFL) and 76 g of digestible protein per kilogram of dry matter; for the barley straw these figures were 0.37 UFL and 25 g of digestible protein per kilogram of dry matter. The animals in the ≤2.25 and =2.50 subgroups received 0.37 ± 0.01 kg of concentrate and 0.45 ± 0.01 kg of barley straw feed per animal per day, and those in the =2.75, and ≥3.00 subgroups 0.54 ± 0.01 kg of concentrate and 0.46 ± 0.01 kg of barley straw feed per animal per day. All animals had free access to barely straw, water and mineral blocks containing trace elements and vitamins.

2.3. Blood samples, and hormone assays for checking reproductive status

During the three weeks before the March and November experimental periods, the plasma progesterone