

Note

Variation in gestation length as breeding season advances in *Bruna dels Pirineus* beef cattle breed

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Abstract — The variation in gestation length according to the time lapse from the onset of the breeding season until the day of mating was investigated in the *Bruna dels Pirineus* beef cattle breed. A total of 359 gestations belonging to five breeding seasons were analysed. Average gestation length under natural service was 288.6. Gestation length tended to increase significantly ($p < 0.05$) to about 1.5 days in cows that were mounted in the two last thirds of the breeding season. The effects of domestication on birth synchrony are discussed.

birth synchrony / gestation length / beef cattle / *Bruna dels Pirineus*

Résumé — Variation de la durée de gestation selon l'avance de la saison de reproduction chez la race bovine à viande *Bruna dels Pirineus*. Nous avons étudié chez la race *Bruna dels Pirineus* l'effet sur la durée de gestation du temps écoulé entre la mise à reproduction et la saillie. Un total de 359 gestations de cinq saisons de reproduction a été analysé. La moyenne de la durée de gestation après la monte naturelle a été de 288,6 jours. La durée de la gestation a été accrue de 1,5 jours ($p < 0,05$) dans le groupe de vaches fécondées dans les deux derniers tiers de la saison de reproduction. Dans ce travail, sont discutés les effets de la domestication sur la synchronisation des mises bas.

synchronisation des mises bas / durée de la gestation / vaches de races à viande / *Bruna dels Pirineus*

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1. INTRODUCTION

Gestation length in the domestic cattle is known to be affected by several factors including breed [6], sex and weight of the calf [3], parity and calving season [9]. Furthermore, data gathered on the wild plains bison (*Bison bison*) show that in this species the time lapse between the onset of the breeding season and the day of mating modifies gestation length and that females in good body condition who are mated after the seasonal peak of mating have shorter gestations [1]. Whether this time lap factor modifies gestation length in the domestic cattle is as yet unknown. We explored this possibility in this paper.

2. MATERIALS AND METHODS

2.1. Data

Data from 359 gestations belonging to 179 beef cows were recorded in a herd of the *Bruna dels Pirineus* breed. This breed has a typical production system characterised by grazing forages in the Pyrenean mountains of Catalonia in the summer, and by staying during the rest of the year around the farm consuming a variety of feeds (forage, hay and silage). Gestation length was calculated as the difference between calving date and the date in which the mount was registered, following visual daily inspection. In a previous analysis (data not published), gestation length was estimated to be 287 days. Since the oestrus interval is approximately 21 days, gestation lengths above 302 days and below 272 days were considered erroneous and deleted from the database. Data were recorded in five campaigns (1992–1993 to 1994–1995, 1996–1997 and 1997–1998). All cows were bred by natural service. The breeding season started usually in January and extended until the end of March, being divided arbitrarily into three periods: 1, from the beginning of matings to the day 30; 2, between 31 and

60 days; and 3, for matings after day 61. Age at breeding was assigned to six age categories as follows: 2 years for cows being served before 1003 days of age, and 3, 4, 5, 6, and 6+ years for the intervals 1 004–1 338, 1 339–1 703, 1 704–2 070, 2 071–2 436, and more than 2 436 days, respectively.

2.2. Statistical model

Data were analysed by assuming a linear model as follows:

$$y_{ijklmn} = \mu + bp_i + year_j + ca_k + cs_l + cow_m + e_{ijklmn}$$

where

y_{ijklmn} : data recorded (gestation length),

μ : general mean,

bp_i : breeding period (1 to 3),

$year_j$: effect of the campaign of breeding (1 to 5),

ca_k : age of cow at breeding (2 to 7),

cs_l : calf sex (male or female),

cow_m : cow effect, and

e_{ijklmn} : error.

All the effects were assumed fixed except the cow and error that were assumed to be random effects. The calculations were performed by means of the Mixed Procedure in the SAS statistical package [7].

3. RESULTS

Results are given in Table I. Average gestation length in this herd of the *Bruna dels Pirineus* breed was 288.6 days. After fitting the model, gestation length showed a very small residual variability, since its coefficient of variation was below 2%.

Gestation length tended to increase significantly ($p < 0.05$) about one day and a half in cows that were mounted in the two last thirds of the breeding season. Gestation length was also influenced by the age of the cow, since the animals 6 years old and older

Table I. Descriptive statistics, significance levels and least squares means for gestation length (d).

	Gestation length (<i>N</i> = 359)	
Mean	288.6	
Residual variance	20.1	
C.V. (%)	1.6	
<i>Level of significance</i>		
Breeding period	0.03	
Campaign	0.45	
Cow age (years)	0.01	
Sex of calf	0.11	
<i>N for each level and Least Squares Means (LSM)</i>		
Breeding period	N	LSM
1	226	288.0 ^a
2	98	289.4 ^b
3	35	289.4 ^{ab}
Cow age, years		
2	76	289.1 ^a
3	57	287.5 ^b
4	53	288.2 ^{abc}
5	42	288.3 ^{abc}
6	43	290.5 ^{ad}
6+	88	290.1 ^{ad}
Sex of calf		
Female	158	288.5 ^a
Male	201	289.3 ^a

LS-means with the same superscript in the same column for the same effect did not differ significantly ($p < 0.05$).

tended to have longer gestations for one additional day. The campaign of breeding did not significantly influence gestation length.

4. DISCUSSION

Our results showed that gestation length is affected not only by the age of the cow but also by the day of mating with respect to the beginning of the breeding season. Some authors have shown that calving season

affects gestation length [9], but these studies refer to differences between cows mated in two different seasons of the year, whereas our study showed differences between cows mated on different days within the same season. Although the effect was relatively small, it was of a similar magnitude to that previously reported for other factors [5, 8]. The fact that we did not find any effect of the sex of the calf is not particularly surprising, since other studies have also failed to show such an effect [4].

A striking difference between domestic cattle and the wild plains bison is that in bison females mated at the end of the breeding season gestation is shorter [1], whereas from our data, the effect was the opposite in domestic cattle. We do not have any satisfactory explanation for this difference. However, it is important to recall that in the wild plains bison there is a marked reproductive synchrony, and although this is mainly the result of seasonal breeding, it has been suggested that the changes in gestation length related to the time of mating may have been selected in order to increase such synchrony [1]. It is likely that the domestication process has eliminated the reproductive advantages of reproductive synchrony; if this is the case, there is no reason to expect domestic cattle to have a mechanism such as the gestation adjustment described in the bison.

Another question is related to the proximate mechanism underlying the effect of day of breeding on gestation length. The statistical model used eliminates the possibility that this effect can be explained by age differences between the cows that were mated near the onset of the breeding season and those mated near the end. It is interesting to recall that in the wild plains bison, females in poor body condition have a gestation length greater than those in good body condition that were mated on a similar day [1]. A similar effect of nutrition on gestation length has been documented in the red deer [2]. The possibility exists, therefore,

that cows mated near the onset of the breeding season have a better body condition than cows mated near the end of the breeding season and we believe that this point deserves further research.

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