Does breed affect nursing and reproductive behaviour in beef cattle?

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Álvarez-Rodríguez, J., Palacio, J., Casasús, I. and Sanz, A. 2010. **Does breed affect nursing and reproductive behaviour in beef cattle?** Can. J. Anim. Sci. **90**: 137–143. This experiment was designed to assess the role of genetic differences in nursing behaviour and the resumption of post-partum ovarian cyclicity of beef cows with different types of calf management. Twenty-four multiparous winter-calving cows, 12 Parda de Montaña (PA) and 12 Pirenaica (PI), were randomly assigned to once-daily restricted nursing during 30 min (RESTR) or ad libitum nursing (ADLIB). Cow-calf behaviour was recorded at weeks 3, 8 and 13 of lactation. Results were compared within suckling system. Twice-weekly blood samples were drawn throughout lactation to analyse progesterone as an indicator of ovulation. Within each type of calf management, both breeds nursed their calves for a similar amount of time (23.0 and 57.2 min in PA vs. 25.9 and 59.0 min in PI, when nursing once daily or ad libitum, respectively; $P > 0.10$). Furthermore, ovarian cyclicity was initiated at a similar time after calving between breeds (70 vs. 73 d in PA and PI, respectively), although it was shorter in RESTR than in ADLIB (54 vs. 89 d; $P < 0.001$).

Key words: Beef cattle, calf management, restricted nursing, post-partum anoestrus

Álvarez-Rodríguez, J., Palacio, J., Casasús, I. et Sanz, A. 2010. **La race affecte-t-elle le comportement à la reproduction et le comportement maternel chez les bovins de boucherie?** Can. J. Anim. Sci. **90**: 137–143. L'expérience avait été conçue pour évaluer le rôle des variations génétiques dans le comportement maternel et dans le rétablissement du cycle ovarien après la mise bas chez les vaches de boucherie, selon les conditions d'élevage. Vingt-quatre vaches multipares ayant vêlé en hiver, soit 12 Parda de Montaña (PA) et 12 Pirenaica (PI), ont été réparties au hasard en deux groupes: allaitement restreint à 30 minutes une fois par jour (RESTR) ou allaitement ad libitum (ADLIB). Le comportement de la mère et du veau a été noté à 3, à 8 et à 13 semaines de lactation. Les résultats ont ensuite été comparés pour les deux régimes. Des échantillons de sang ont été prélevés deux fois par semaine durant la lactation afin de doser la progestérone et d'établir quand reprenait l'ovulation. Les vaches des deux races allaitent leur veau durant le même laps de temps, peu importe la méthode d'élevage (23,0 et 57,2 min. pour les PA c. 25,9 et 59,0 min. pour les PI, avec l'allaitement une fois par jour ou ad libitum, respectivement; $P > 0{,}10$). Par ailleurs, le cycle ovarien reprend à un moment similaire après le vêlage chez les deux races (70 c. 73 jours pour les PA et les PI, respectivement), bien qu'il soit plus court chez le groupe RESTR que chez le groupe ADLIB (54 c. 89 jours; $P < 0{,}001$).

Mots clés: Bovins de boucherie, élevage de veaux, allaitement restreint, anoestrus post-partum

Suckling has been shown to play a key inhibitory effect on cattle re-breeding, since cows recognize their own calf through visual and olfactory cues that establish a maternal bond with the young throughout lactation (Williams and Griffith 1995). Hoffman et al. (1996) demonstrated that cows whose calves remained in visual and physical contact but were restricted from suckling had shorter post-partum anestrous intervals than cows whose calves had visual and physical contact and were allowed to suckle ad libitum. This cow-calf bond along with mammary stimulation (Lamb et al. 1997) may cause the negative effect of suckling on the resumption of ovarian cyclicity.

Several nursing systems have been used to overcome the suckling effects on reproductive performance (Randel 1981; Galina et al. 2001; Krohn 2001). In the Spanish Pyrenees, the usual practice to shorten the calving interval is to restricted nursing for short periods once or twice a day in the morning and/or afternoon.

Dairy cattle breeds (pure or crossbred) display less marked maternal behaviour than *Bos indicus* genotypes (Das et al. 2001) or even than *Bos taurus* breeds selected for beef (Le Neindre 1989), although others did not find a significant association (Paranhos da Costa et al. 2006). Parda de Montaña (PA) and Pirenaica (PI) are two suckler cattle breeds widely spread throughout northern Spain. Historically, cattle having PA genetics were selected for beef and mothering abilities from Brown Swiss, whose ancestors were introduced to Spain two

Abbreviations: **ADLIB**, ad libitum suckling; **BCS**, body condition score; **BW**, body weight; **PA**, Parda de Montaña cattle; **PI**, Pirenaica cattle; **RESTR**, restricted suckling once-daily

centuries ago as a dual-purpose breed (milk-beef). In contrast, PI is a traditional breed from the mountain areas of the Spanish Pyrenees. These cattle have been utilized in the past as a triple-purpose breed (work-milk-beef) but in the past century they have been selected for beef production. Permanently keeping calves with their dams has been more stressful for PA than for PI cows in terms of the duration of post-partum anoestrus (Sanz et al. 2003, 2005). Thus, we hypothesised that PA cows nurse their calves for a longer time each day than do PI cows, attaining a more intense relationship with their offspring, which may delay the resumption of ovarian cyclicity after calving.

MATERIAL AND METHODS

Animals and Experimental Design

Twenty-four multiparous winter-calving cows (8.8 ± 3.3 yr of age), 12 Parda de Montaña (PA) and 12 Pirenaica (PI), were randomly selected from the herd of La Garcipollera Research Station (Northeastern Spain, lat. 42°37′N, long. 0°30′W, 945 m a.s.l., average mean temperature 10.2 ± 0.2°C and annual rainfall 1059 ± 68 mm throughout the period 1999–2006). Both breeds had identical rearing management during their life. Prior to the beginning of the study, cows were allowed to graze during mid-pregnancy on mountain pastures (early autumn) and they were housed at the beginning of the last trimester of pregnancy and provided with supplementary feed (late autumn).

The day after parturition (mean 21 Feb. ± 16 d) cows were assigned, within breed, to one of two nursing regimens: once daily restricted nursing during a 30 min-period beginning at 0800 (RESTR) and ad libitum nursing (ADLIB). Cattle were allotted in four pens (two breeds under two different nursing systems). Treatments were balanced according to cow body weight (BW) and body condition score (BCS) (Lowman et al. 1976), calf birth BW and calf sex.

Cow-calf pairs remained indoors in a loose-housing system with straw-bedded pens throughout 4 mo of lactation. In the RESTR treatment, calves remained in groups in fenced cubicles (5 m × 5 m) adjacent to the dams' resting area with visual, tactile and auditory contact. In this treatment, cows and calves could not fit their heads through the fence but they could fit their noses through it. The fence (1.5 m high) was made on steel barriers placed horizontally with a gap of 15 cm between the rungs of the fence.

After parturition cows were group-fed, once-daily at 0900, a total mixed ration (13 kg for PA, 12 kg for PI, as-fed basis) composed of 58% forages and 42% grains, by-products and vitamin and mineral supplements (90.5% dry matter, 9.2% crude protein, 55.4% neutral detergent fibre, 31.2% acid detergent fibre, on a dry matter basis). The diet met maintenance requirements for energy and protein in a 550- or 590-kg beef cow producing approximately 9 kg or 7.5 kg of energy-corrected milk in PA and PI, respectively (National Research Council 2000). There were no feed refusals throughout the experiment. Water and mineral block supplements were provided ad libitum. Calves did not receive any forage or concentrate supplement throughout lactation and they had access to water during suckling periods (RESTR) or continuously (ADLIB).

The care and use of animals followed European guidelines (European Union Directive No. 86/609/CEE 1986). Animal care was approved by the *Centro de Investigación y Tecnología Agroalimentaria* (*CITA*) Research Council on Animal Care.

Recording of Behaviour Activities

Behaviour recordings were obtained in eight subgroups composed of three cow-calf pairs (a total of 24 pairs) balanced for calf sex, at weeks 3, 8 and 13 of lactation. There were a total of 24 recording days. Dams were allowed to nurse their calves in a barn (4.5 m × 7.5 m) that was located close to their resting area. Each subgroup of cows was brought into the recording barn (which was a part of the main barn) according to their calving date, followed immediately by their calves. The same recording barn was used with the different cow-calf pairs because cows were not oestrus synchronized (the calving period lasted 2 mo) and recordings were conducted at fixed weeks of lactation. The composition of sub-groups remained constant across observing days. Every cow-calf pair was randomly allocated each day to one trained observer. Every cow-calf pair had coloured neck collars to aid identification.

The RESTR cow-calf pairs were kept in the recording barn for 30 min. The behaviour activities in this treatment were continuously live recorded and additional continuous video recordings were used as backup for occasional uncertain observations. Each observer (a total of three) was responsible for recording behaviour of one individual cow.

In the RESTR treatment, the following activities were recorded: (a) the latency to the first contact between the calf and the cow's udder (in minutes), (b) cow nursing its own calf (in minutes), (c) cow nursing alien calves (in minutes), (d) the number of times the calf butted the udder, (e) the number of cow sniffs and plays with own calf (non-aggressive head butting), (f), the number of cow licks to own calf, (g), the number of cow licks to own body (self-grooming), (h) the number of cow licks to alien calves or other cows, (i) the number of agonistic events of a cow towards its calf or alien animals (head butting and kicking), (j) the number of cow vocalizations and (k) the total time of close proximity (< 1 m) between mother and young within each suckling session (in minutes).

The ADLIB sub-group was brought into the barn 24 h prior to sampling to acclimate them for the following 24 h observation and recording of nursing behaviour. The observations were performed through

video recording using the instantaneous scan sampling technique (Martin and Bateson 1993) with a 10-min sampling interval per cow-calf pair. This method involves extrapolation for the 10 min separating two successive scans to calculate the duration of nursing bouts. This interval fits the mean nursing duration recorded during more frequent samplings (Alvarez-Rodríguez et al. 2009). A single observer, who was also involved in recording the restricted nursing treatment, viewed all the ad libitum nursing video recordings. This observer was responsible for recording the activities of three cows.

In the ADLIB treatment, the following activities were recorded: (a) cow nursing its own calf, (b) cow nursing alien calves, (c) cow sniffing and playing with its own calf (non-aggressive head butting), (d), cow licking its own calf, (e), cow licking its own body (self-grooming), (f) cow licking alien calves or other cows, (g) agonistic behaviour of a cow towards its calf or alien animals (head butting and kicking).

The ADLIB pen was artificially illuminated at night (200 lx at 5-m height) to allow monitoring of the 24 h-cycle.

In both treatments, cow sniffing and playing with its own calf was mutually exclusive of cow licking and agonistic behaviour of a cow towards its calf or alien animals. Furthermore, mutually exclusive behavioural events included a cow only licking its own calf, its own body or alien calves/other cows.

In both nursing regimes, the nursing duration per day was calculated as the sum of the time that a cow spent nursing its own calf and/or alien calves. A nursing bout started when the calf took a teat in its mouth and ended when the calf moved and stayed away from the udder (Das et al. 2001). In the RESTR treatment, the following nursing bout was considered after a period of other activities of at least 1 min from the previous bout. In the ADLIB treatment, the 24-h nursing pattern was analysed descriptively as the mean time that a calf devoted to suckle every hour divided by the total nursing duration per day.

Productive Measurements

Cows and calves were weighed before the morning feeding within 24 h after calving. Cow BW at calving was calculated as the mean BW between 24-h post-partum and 1 wk post-partum. This mean value was more accurate because the first BW post-partum was recorded prior to the expulsion of placenta in some dams. Body condition score (BCS) was assessed at calving and at the end of the first 3 mo post-partum (Lowman et al. 1976). Calves were weighed at weekly intervals during the first 3 mo post-partum. Calf BW gains throughout this period were calculated by linear regression of BW against time.

Blood Sampling and Assay

Blood samples (5 mL) were collected into heparinised tubes by tail vessel puncture twice weekly (Monday–Thursday) before the morning feeding throughout 4 mo of lactation. Cows were blood sampled in a longitudinal sweep and were accustomed to the handling procedure prior to the start of the experimental period. Samples were centrifuged at $3000 \times g$ for 15 min at 4°C. Plasma was harvested and stored at −20°C until analysis of progesterone.

Peripheral progesterone was measured using a solid-phase radioimmunoassay commercial kit (Coat-A-Count P4 kit®, Diagnostic Products Corporation, Los Angeles, CA). The mean intra- and inter-assay coefficients of variation were $<8.0\%$ and $<10.4\%$, respectively. Mean sensitivity was 0.03 ng mL^{-1}. The onset of ovarian cyclicity was deemed to have occurred when progesterone levels were ≥ 1 ng m^{-1} in at least three or more consecutive samples. However, first short oestrus cycles (8 to 14 d) prior to the second ovulation were considered when plasma progesterone concentrations >0.5 ng mL^{-1} were detected in one or two consecutive samples. This peripheral progesterone concentration confirmed the disappearance of the dominant follicle when ovulation was also determined by ultrasonography (Sanz et al. 2003; Quintans et al. 2004). If cows had not ovulated prior to the end of fourth month post-partum, the interval to first ovulation after calving was regarded as this date and all experimental procedures were terminated.

Statistical Analysis

Data were analysed using SAS statistical software (SAS Institute, Inc. 2002). The different sampling methodologies for behavioural traits did not allow a valid statistical comparison of nursing activities between suckling systems. Only the breed effect was tested in behaviour analyses. Previously, normal distribution was tested with the Shapiro-Wilk test but it could not be verified. Therefore, means according to breed and week of lactation were compared with the Kruskal-Wallis non-parametric test (PROC NPAR1WAY).

Data from cow-calf productive performance and the interval to first post-partum ovulation were tested with analysis of variance (PROC GLM), by considering breed and nursing system as fixed effects in the model. The model concerning calf birth BW and ADG also contained the fixed effect of calf sex.

Differences between breeds concerning the proportion of cows nursing alien calves were analysed using the Fisher exact test of the FREQ procedure.

Data are reported as least square means (if normally distributed) or means and their associated standard errors. Differences with $P \leq 0.05$ were considered significant, and those where $P < 0.10$ were discussed as trends.

RESULTS AND DISCUSSION

Nursing Behaviour During Once-daily Restricted Nursing

Breed Effect

The time of latency to first contact of calf with the dam's udder was similar in both breeds (0.4 ± 0.1 and 0.3 ± 0.1 min, in PA and PI, respectively; $P > 0.10$). In addition, there were no statistical differences in the number of suckling bouts within each daily period (1.7 ± 0.2 and 1.8 ± 0.3, respectively; $P > 0.10$), the duration of the first suckling bout (20.7 ± 1.7 vs. 23.6 ± 1.5 min, respectively; $P > 0.10$) and the duration of the second bout within each session (2.0 ± 0.8 vs. 1.8 ± 0.9 min, respectively; $P > 0.10$). Likewise, the number of times the calf butted the udder within a suckling session did not differ between PA and PI breeds (77.5 ± 10.2 vs. 72.3 ± 8.8, respectively; $P > 0.10$).

Total nursing duration per daily period did not differ between breeds (Table 1, $P > 0.10$), and accounted for 77 and 86% of the total time spent together within the PA and PI breeds, respectively. This high proportion of time allocated to suckle might be explained by the lack of alternative feeding apart from the dam's milk. Pasture and concentrate supplementation for calves may reduce suckling duration per session up to 36% of the time in contact (Das et al. 2001).

The time for cows to allow alien calves to nurse was similar in both breeds ($P > 0.10$), although this was nearly threefold greater in PA compared with PI cattle. The non-filial nursing time accounted for 7 and 3% of the total nursing time in PA and PI, respectively. The proportion of cows that nursed alien calves did not differ across breeds (50.0 vs. 66.7% in PA and PI, respectively; $P > 0.10$). The calves that frequently sucked non-maternal dams are most likely attempting to compensate for some deficiency, such as low birth weight and/or insufficient supply of maternal milk (Víchová and Bartos 2005). However, the ocurrence of this behaviour was similar in both breeds.

Table 1. Behaviour activities of cows during once-daily restricted nursing (RESTR) for 30 min in Parda de Montaña (PA) and Pirenaica (PI) breeds (recordings at weeks 3, 8 and 13 of lactation)

	Breed			
Continuous sampling (0800–0830)	PA	PI	SE[z]	*P* value
Nursing duration (min)	23.0	25.9	0.8	0.16
Non-filial nursing duration (min)	1.7	0.7	0.5	0.75
Sniffs and plays with own calf (no.)[y]	4.8	4.4	0.9	0.78
Licks to own calf (no.)[y]	21.7	98.9	20.4	0.05
Licks to own body (self-grooming) (no.)[y]	0.8	1.1	0.5	0.29
Licks to alien calves/cows (no.)[y]	0.0	2.0	0.7	0.15
Agonistic encounters (no.)[y]	0.9	3.7	0.7	0.05

[z]SE, standard error.
[y]Cow sniffing-playing with its own calf, licking and agonistic behaviour were measured as a rate per 30 min period.

Overall, the lack of breed differences in nursing and allonursing behaviour is consistent with the results from the twice-daily restricted nursing system (Alvarez-Rodriguez and Sanz 2009).

In contrast, cow-calf pairs from the PA breed spent less time in close proximity (<1 m) throughout the 30-min nursing period than PI cows (24.6 ± 1.3 vs. 27.9 ± 0.8 min, respectively; $P < 0.05$). The PA cows tended to vocalize with a lower rate per 30-min period (0.4 ± 0.2 vs. 2.3 ± 1.2 times, respectively; $P = 0.06$) and showed less agonistic behaviours towards its calf or other animals than PI dams (Table 1; $P = 0.05$).

Stage of Lactation Effect

The number of suckling bouts per session was lower at week 3 than at weeks 8 and 13 of lactation (1.3 ± 0.1 vs. 2.3 ± 0.4 and 1.8 ± 0.3, respectively; $P = 0.05$). Total nursing time decreased as calves grew from week 3 to 8 and 13 of lactation (27.0 ± 1.0 vs. 23.9 ± 1.5 and 22.5 ± 1.5 min, respectively; $P < 0.05$). During this same interval, the number of times the calf butted the udder declined (96.4 ± 14.5, 72.8 ± 8.8 and 55.5 ± 7.5, respectively; $P = 0.10$). Butting activity might reflect a problem of milk availability (De Passillé 2001). However, in this study the rate of butting was parallel to the decreasing trend of milk production throughout lactation (Álvarez-Rodríguez et al. in press). The reduction of nursing bouts and nursing time might be explained by an increase in the milk intake by calves, since they were not supplemented with any other feed.

The number of times a cow was observed licking her own body was lower during weeks 3 and 8 than week 13 of lactation (0.3 ± 0.2 and 0.0 ± 0.0 vs. 2.6 ± 1.3, respectively; $P < 0.05$). The number of agonistic events of cows towards its calf or other animals increased concomitantly (0.3 ± 0.2 vs. 3.9 ± 1.9 and 2.8 ± 1.0, respectively; $P < 0.01$). The rest of the observed behaviours in RESTR treatment (latency to first contact with calf, number of sniffs-plays with own calf, number of licks to own calf or alien calves/cows, number of cow vocalizations, time of cow-calf in close proximity) were not affected by the stage of lactation ($P > 0.10$).

Nursing Behaviour During Continuous Cow-calf Access

Breed Effect

Under continuous association husbandry of calves with their dams, nursing duration per day was similar in both breeds (Table 2). Cow-calf pairs spent approximately 1 h per day suckling (4% of the 24 h-period). The total time spent nursing in this study is similar to other studies in which calves were raised exclusively on milk in confinement: 3 to 4% of the day (Lewandrowski and Hurnik 1983); 5% of the day (Williams et al. 1984); 4% of the day (Álvarez-Rodríguez et al. 2009).

Cows from the PA breed nursed alien calves for longer compared with the PI breed ($P < 0.05$). The

Table 2. Behaviour activities of cows during ad libitum nursing (ADLIB) in Parda de Montaña (PA) and Pirenaica (PI) breeds (recordings at weeks 3, 8 and 13 of lactation)

Instantaneous scan sampling (10-min sampling interval) (0000–2359)	Breed		SE[z]	*P* value
	PA	PI		
Nursing duration (min)	57.2	59.0	3.5	0.80
Non-filial nursing duration (min)	10.7	2.8	1.9	0.05
Sniffing-playing duration with own calf (min)[y]	1.3	0.0	0.4	0.11
Licking duration towards own calf (min)[y]	22.0	22.8	3.3	0.71
Self-grooming duration (min)[y]	6.0	5.0	1.2	0.90
Licking duration towards alien calves/cows (min)[y]	1.3	6.7	1.4	0.08
Agonistic behaviour duration (min)[y]	1.3	2.8	0.9	0.26

[z]SE, standard error.
[y]Cow sniffing-playing with its own calf, licking and agonistic behaviour were measured in minutes during 24 h.

non-filial nursing accounted for 19 and 5% of the total nursing time in PA and PI, respectively. The cattle breed producing more milk (PA) allowed more allosuckling to calves (Table 2). However, the proportion of cows which nursed alien calves did not differ across breeds (50.0 vs. 33.3% in PA and PI, respectively; $P > 0.10$). The breed effect on allosuckling behaviour was not consistent in both nursing systems. In addition, some authors have found that crossbred milk calves (zebu × dairy breed) allosuckle more than zebu (Das et al. 2000), whereas others observed that crossbred milk calves allosuckle less than beef calves (Víchová and Bartos 2005). It is possible that this behaviour arises as a result of nutritional deficiencies in the calves, regardless of genotype. However, the lack of time spent in non-filial nursing may indicate that the suckling was merely for non-nutritive purposes.

The PI breed doubled the time devoted to agonistic encounters against its calf or other animals compared with the PA breed, although this difference was not statistically significant ($P > 0.10$). The PI cows showed a tendency for greater social interaction with other cows and calves (allogrooming duration) than PA cows (Table 2; $P = 0.08$).

Daily nursing patterns of PA and PI cows are illustrated in Fig. 1. The percentage of time spent nursing was very similar in both breeds: between 0600 and 0800 (21 and 13% of the total nursing time in PA and PI, respectively), between 1400 and 1500 (6% of the total nursing time in both breeds), between 1700 and 1900 (13 and 12% of the total nursing time, respectively), between 2300 and 0000 (6% of the total nursing time in both breeds) with an earlier night-time peak in PA (between 0100 and 0200, 9% of the total nursing time) than in PI (between 0400 and 0500, 9% of the total nursing time). These results might reflect a metabolic need of the calves to obtain milk at intervals not longer than 7 to 8 h. Thus, the restricted nursing regimen clearly altered the calf's feed requirements, but allowed the dam to be re-bred while the ad libitum nursing regime did not promote re-breeding in cows.

Approximately 50 and 58% of the total nursing time occurred between 0600 and 1800, in PA and PI, respectively. The observed high incidence of nocturnal suckling is in agreement with previous studies in free-ranging (nearly 50%) (Somerville and Lowman 1979) and confined beef cows (39%) (Lewandrowski and Hurnik 1983). The occurrence of a nursing peak

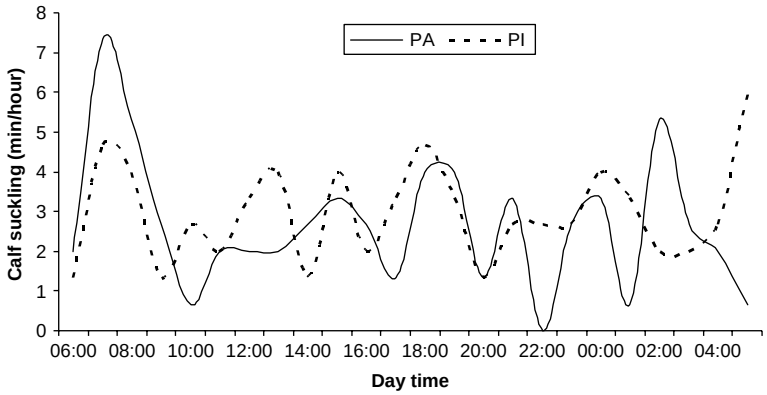

Fig. 1. Mean daily nursing pattern in Parda de Montaña (PA) and Pirenaica (PI) cows having continuous access with their offspring during lactation (each breed was kept in a separate pen indoors).

at sunrise (between 0600 and 0800) seems to be consistent in all the aforementioned studies, regardless of husbandry practices.

Stage of Lactation Effect

The recorded behavioural activities were not affected by the stage of lactation in the ad libitum suckled cows ($P > 0.10$). The steady nursing pattern throughout lactation was not observed in the restricted nursing system. It is likely that calves allowed free access to their dams spent more time engaged in non-nutritive suckling than calves that were restricted to nursing for only 30 min daily.

Animal Performance

The BW and BCS of PA dams at calving were lower than for PI cows (Table 3), but similar across the two nursing systems ($P > 0.10$). In contrast, cow body condition at the end of the first 3 mo post-partum was similar between breeds ($P > 0.10$), but greater in the RESTR treatment compared with the ADLIB treatment ($P < 0.001$). The onset of ovarian cyclicity was similar between breeds ($P > 0.10$), but it occurred 5 wk earlier in the RESTR treatment compared with the ADLIB treatment ($P < 0.001$).

Calf BW at birth tended to be greater in PA than in PI cows (Table 3, $P = 0.06$), but this parameter was similar in both nursing systems ($P > 0.10$). There was a tendency for greater calf daily gains in PA than in PI breed ($P = 0.08$), although suckling duration was similar between breeds ($P > 0.10$).

Pre-weaning growth differences may be due to genetic differences between these two genotypes (Villalba et al. 2000; Casasús et al. 2002; Sanz et al. 2003). The design of this experiment did not allow us to test whether breed differences in rate of growth were due to a limitation in milk supply or in the growth potential in early life. The mean energy-corrected milk yield in the present experiment tended to be greater for the PA than for the PI cows (8.4 vs. 7.2 ± 0.5 kg, $P = 0.08$, reported in Álvarez-Rodríguez et al. in press), but mean feed intake and average daily gain of calves were similar when they were offered the same diet ad libitum after weaning (Blanco et al. 2009). As suckling duration was similar in both breeds within each nursing system, we theorized that the rate of milk intake might have been greater in PA than PI calves to support a higher rate of growth prior to weaning. In fact, Le Neindre (1989) suggested that the total suckling time should result from the need for mother-young physical contact instead of from milk production. Accordingly, suckling bout duration is taken rather as an indication of calf's needs than of milk intake, as recently discussed in terms of suckling and allosuckling behaviour (Drabkova et al. 2008).

The similar nursing duration in both breeds may explain the lack of differences between genotypes in the interval to first ovulation after calving. However, the initial hypothesis concerning breed differences in nursing duration did not hold true.

Calves from the ADLIB group grew faster than those from RESTR ($P < 0.05$). The greater rate of growth in calves continuously maintained with their dams was attained by increasing their suckling time more than twofold compared with the once-daily suckling group. However, milk production of dams was only 1 L greater in the ADLIB treatment than in RESTR treatment (8.3 vs. 7.3 ± 0.5 kg $L^{-1} d^{-1}$, $P > 0.10$, reported in Álvarez-Rodríguez et al. in press). This free-suckling behaviour impaired the onset of ovarian cyclicity in their dams, regardless of breed.

Within each type of calf management, cows from Parda de Montaña and Pirenaica breeds nursed their calves for a similar amount of time. Furthermore, ovarian cyclicity was initiated at a similar time after calving between breeds, although it was shorter in cows nursing once daily than ad libitum.

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Table 3. Animal performance in Parda de Montaña (PA) and Pirenaica (PI) breeds nursing once-daily (RESTR) for 30 min or ad libitum (ADLIB)

	Breed (B)		Suckling (S)			*P* value	
	PA	PI	RESTR	ADLIB	SE[z]	B	S
Cows							
Calving body weight (BW) (kg)	544	588	565	567	16	0.07	0.91
Body condition score (BCS) at calving	2.51	2.62	2.58	2.55	0.03	0.04	0.55
BCS end of third month post-partum	2.58	2.59	2.66	2.51	0.04	0.97	0.03
Interval to first post-partum ovulation (d)	70	73	54	89	6	0.66	<0.001
Calves							
Birth BW (kg)[y]	44.7	40.8	41.5	44.0	1.4	0.06	0.21
BW gain during first 3 mo of lactation (kg d^{-1})	0.80	0.71	0.69	0.82	0.03	0.08	0.02

[z]SE, standard error.
[y]Calf sex only affected calf birth BW, being greater in males than in females (45.0 vs. 40.5 kg; $P < 0.05$).

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