Calf's Suckling Ability in Italian Brown Swiss

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Abstract

Italian and European Brown Swiss breeders, in some cases, experience difficulties in feeding the calves because of their weak suckling ability in early days of life. For the calves' welfare it is very important to suckle immediately after birth because the composition of colostrum changes rapidly during the first days and the capacity of calves to absorb the immunoglobulin decreases quickly.

The study aims was to increase knowledge of environmental and genetic components affecting suckling ability , in order to evaluate the possibility of selecting for this trait.

The suckling ability recorded was classified in 3 categories (eat without help, eat with help, doesn't eat) at three postnatal meals, at 6, 12, 24 hours from birth. The data were normalized with Snell procedure.

The statistical model considered the management policies, the interval between birth and meal, parity and season of birth , weight at birth and gestation length as factors affecting trait variability. Variance components were estimated including the additive genetic and permanent environmental random effects in the model. The heritability estimate was 0.13 and repeatability 0.61 with a 0.04 standard error.

Even if the expected genetic gain would be smaller than for productive traits according to heritabilites, the genetic variance estimated show the possibility to select individuals for this trait. Undergoing collection of additional data, will be used in further researches to confirm findings of this study.

Keywords: Suckling ability, calf, functional trait, Brown Swiss

Introduction

Calves with non optimal feeding during the first days of life exhibit greater postnatal mortality, that affect profitability of dairy farms. In the American Brown Swiss cattle breed Erf *et al.* (1990) found that 6.4% of calves die within the first 2 days of life.

In the European Brown Swiss breed sometimes the newborn calves don't show sufficient suckling instinct which can be lethal in most cases. This aptitude can limit the diffusion of the breed in intensive farming practice (Santus, 2004; Zemp, 2004; Bulot 2004).

The stimuli influencing the suckling aptitude of calves are not exactly known.

Colostrum is the most important source of nutrition and passive immunisation for newborn calves (Gay, 1995; Newby *et al.,* 1982). Immunoglobulins are a very important component of colostrum and provide the calf with passive protection against infections and diseases until the calves own immune system becomes self-sufficient (Banks and McGuire, 1989). The colostrum compositions changes according to milk production after calving; each components concentration decrease, especially the immunoglobulin which is completely absent three days after calving. Also the energy and protein content decreases significantly (Blum and Hammon, 2000). Consequently, it is very important that the calves eat as soon as after the birth for their healthiness doesn't has welfare.

The study aims is to investigate the effect of environmental factors on trait variability and to estimate variance components of suckling behaviour in the Brown Swiss Breed in order to evaluate the possibility of genetic improvement for this trait.

Material and Methods

Since 1998 to March 2003 the ANARB (Italian Brown Swiss Breeders Association) organized a collection of data recording suckling ability in newborn calves. The breeders' participation to the project was free and voluntary. A total of 3699 observations were recorded on 1.339 calves in 263 herds. The suckling behaviour was collected by the farmer as categorical trait on the first three post natal meals. The categories were 1=calves eat without help, 2= calves eat with help and 3= calves did not eat at all.

Herds with less than three observations and the individuals with missing date of birth or mother identification were excluded from the analysis. After data editing, 2807 phenotypes on 973 calves in 126 herds located in 23 Italian provinces were utilised for the analysis.

Distribution of phenotypes is shown in Table 1: phenotypes were equally recorded during the cold season (October to March) and the warm one (April to September), the largest proportion of calves are progeny of pluriparous cows.

According to the weight at birth the calves were classified in 4 categories: light (less than 38 kg), normal (between 39kg and 42 kg), heavy (more than 43 kg) and missing information.

The gestation length was classified in 5 classes: very short (less than 283 days), short (between 284 and 288 days), normal (between 289 and 293 days), long (more than 294 days). and missing information.

The pedigree information were available from the ANARB data base and considered up to the fifth generation (a total of 8138 individuals), for the estimation of genetic variance components.

The procedure suggested by Snell (1960) was utilized to score categories so as to conform with intervals of the normal distribution.

Table 1. Frequencies of observation for the different classes of fixed effect.

	Suckle without help	Suckle with help	Don't suckle	N obs	N calves
Number of mother's parity					
Primiparus	354	325	122	801	283
Pluriparus	939	857	210	2006	690
Season of birth					
Warm	711	564	172	1447	501
Cold	582	618	160	1360	472
Gestation length					
Very short	226	175	58	459	158
Short	274	240	51	565	194
Normal	246	200	39	485	171
Long	179	179	33	391	138
Missing	368	388	151	907	312
Weight at birth					
Small	290	236	62	588	198
Normal	326	383	101	810	274
Big	103	243	49	395	133
Missing	574	320	120	1014	368

The model used was:

$y_{ijklmno}= \mu + H_i + NM_j + P_k + S_l + W_m + GL_n + a_o + pe_o + e_{ijklmnop}$

where: $y_{ijklmno}$= Observation for suckling behaviour, μ= factor common to all observations, H_i = fixed effect of the i_{th} herd (i=1, 126), NM_j = fixed effect of j_{th} meal number from birth (j=1,3), P_k = fixed effect of k_{th} parity (k=1,2), S_l = fixed effect of l_{th} season (l=1, 2), W_m = fixed effect of m_{th} weight at birth (m=1, 4) , GL_n = fixed effect of m_{th} gestation length (n=1, 5), a_o = additive genetic effect (N; 0, $G\sigma^2_a$), pe_o = permanent environmental effect (N ; 0, $I\sigma 2pe$), $e_{ijklmnop}$ = residual random error (N; 0, $I\sigma^2_e$).

The VCE package has been used for the estimation of variance components (Kovae'*et al.,* 2002).

To assess the significance of the environmental components, an analysis of variance has been performed, including only fixed factors in the models using the Proc GLM of SAS package (SAS user guide).

Results and Discussion

The histogram in Figure 1 shows the frequencies of suckling categories at different meals. The proportion of animals eating without help increase meal by meal and the number of individuals without a strong suckling ability decreases. The calves learn to suckle meal by meal but still a quite large proportion (10%) of the calves haven't eaten at third meal after the birth yet.

The herd is the factor with the strongest effect on suckling ability. The difference in the last square means between the best and the worst herd was 100 Snell score point.

The Figure 2 shows the last square means for the fixed. The distance of meal from the birth is an important factor: the difference between the first and the last (third) meal is about 15 Snell score.

The calves born during the warm season, shows greater suckling ability. This can be linked to the fact that during winter the calves exhibit more respiratory problems that might affect their general strength with possible consequences on willingness to eat.

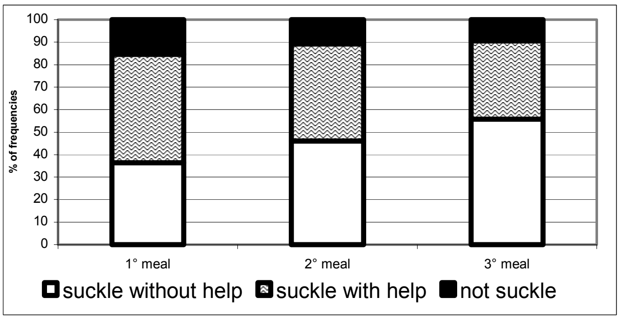

Figure 1. Frequencies of observation at different meals after birth.

This hypothesis is supported by findings of previous researches that show an increase in stillbirth rate of 2% during the winter season (Harbers *et al.,* 2000; Steinbock *et al.,* 2003).

The mother's lactation number, the weight at birth and the gestation length are three factors useful to indicate calves with possible lower vitality. All these factors are significant but they show a limited effect variation.

The results of estimation of variances components are shown in table 2. The additive genetic effect is 14% of the total variance. According to these findings the calves' suckling ability can be considerate a trait with moderate heritability.

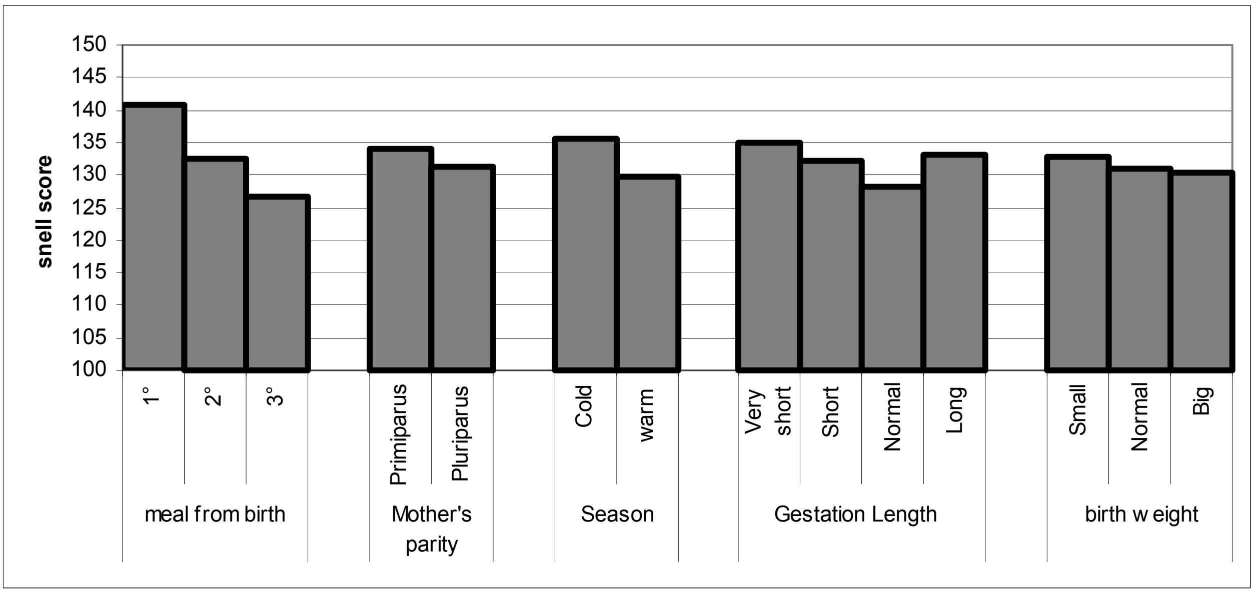

Figure 2. Least square means for some fixed effects.

Table 2. Estimates of variances components.

	variance components	Standard error
additive genetic	105	0.99
permanent environmental	364	0.99
residual error	292	0.18
phenotype	762	
heritability	0.137	0.04
repeatability	0.616	

The strong repeatability of the trait indicates that there are some other effect connected to the animal but not due to the genetic make up of the individual

Conclusion

Results of this study show that calves suckling ability have moderate heritability, (0.14) and can be identified as a trait to use in a selection scheme. According to these results selection to increase suckling ability is possible, but the genetic gain will require larger progeny groups in order to ensure sufficient accuracy in EBV testing.

In the Italian recording system it is easy to record the information on sucking behaviour when calves receive ear tags. For this reason a large data collection is affordable and applicable.

Additional studies are necessary to confirm these findings and collect additional information will permit to decide whether to incorporate suckling ability in the national selection programme.

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