

# A multivariate measure of lactation persistency for dairy sheep

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**RIASSUNTO** – Una misura multivariata della persistenza di lattazione per gli ovini da latte – *Nel presente lavoro è stata verificata l'applicabilità di una nuova misura della persistenza della lattazione, basata sull'analisi multivariata dei fattori, negli ovini da latte. I risultati ottenuti sui dati relativi a 380 ovini di razza Sarda mostrano una buona capacità della variabile proposta a discriminare curve di lattazione con differente persistenza. L'ordine di parto e l'anno di parto hanno influenzato in maniera statisticamente significativa la persistenza di lattazione.*

**KEY WORDS:** dairy sheep, lactation persistency, factor analysis.

**INTRODUCTION** – The persistency of lactation, i.e. the ability of animals to maintain a constant level of production after the lactation peak, represents an interesting trait for animal breeding strategies, allowing for the increase of profitability of animal husbandry via the reduction of production costs. Dairy cattle with flatter curves show a higher reproductive efficiency, a better metabolic status and have their nutritional requirements more constantly spread throughout lactation, allowing for the use of cheaper feeds (Dekkers *et al.*, 1998; Solkner and Fucks, 1987). Also in dairy sheep the persistency could represent an interesting trait for breeding purposes. A main problem for the introduction of this trait in an aggregate genotype is represented by the difficulty in finding an objective measure: several measurements of lactation persistency have been proposed but none of them is widely accepted (Gengler, 1996). Recently a new index of the persistency based on multivariate Factor analysis, has been proposed for dairy cattle (Macciotta *et al.*, 2002). Aim of the present work is to check the suitability of this index to discriminate lactation curves with different persistency and to analyse the effect of some environmental factor on this trait.

**MATERIAL AND METHODS** – TD records of milk yield of 380 dairy ewes of first, second and third parity were analysed with the multivariate analysis of factors. Each ewe had 5 TD records that were considered as different traits. Two latent factors were extracted from original data. Factor scores, used as a new index of persistency, were calculated for each animal and analysed with the following mixed linear model in order to check the relationships between the proposed variable and factors known to affect this trait

$$PERS = PAR + H + LAMB + YEAR + ANIMAL + E \quad [1]$$

where PERS is the factor score corresponding to the persistency factor, PAR is fixed effect of the parity class (1, 2, 3), H is fixed the effect of the herd (1, 2), LAMB is the fixed effect of the number of lambs (1, 2), YEAR is the fixed effect of year of lambing (1=1995, 2=1996, 3=1997, 4=1998), ANIMAL is the random effect of the animal, E is the random residual.

**RESULT AND CONCLUSIONS** – The data set considered was suitable for the factor analysis, as evidenced by the Measure of Sampling adequacy (0.78).

Table 1. Common factor loadings.

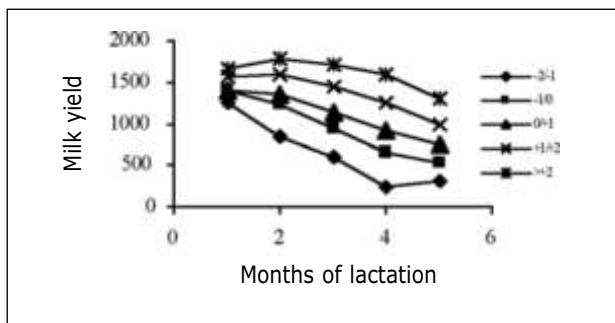
Variable	Milk	Yield
	Factor 1	Factor 2
TD1	0.20	0.85
TD2	0.44	0.82
TD3	0.65	0.53
TD4	0.84	0.30
TD5	0.70	0.19
Variance explained	0.37	0.36

Two common factors were able to explain about 73% of original variance. Correlations between the two factors and the original variables (Table 1) show a latent variable associated with the last part of the lactation and another associated with the first part, as already evidenced in cattle (Wilmink, 1987) and sheep (Macciotta *et al.*, 1999).

The factor correlated with the TD records of the last part of lactation can thus be proposed as a measure of lactation persistency. It is a standardised variable, quite mound-shaped distributed, with mean zero and standard deviation 0.89.

The capability of this new variable in discriminating lactation curves with different persistencies can be appreciated in Figure 1, where the average lactation patterns of five different classes of animals grouped according to factor 1 scores are represented. It can be clearly observed that as the value of factor 1 increases, the persistency of lactation tends to increase. Parity and year affected significantly persistency of lactation ( $P < 0.01$  and  $P < 0.05$  respectively), whereas the number of lambs did not affect significantly this trait (Table 2). The last result was quite expected because several studies reported an effect of the number of lambs on the shape of the lactation curve only for the first part of lactation.

Figure 1. Milk yield lactation curves of different classes of factor 1.



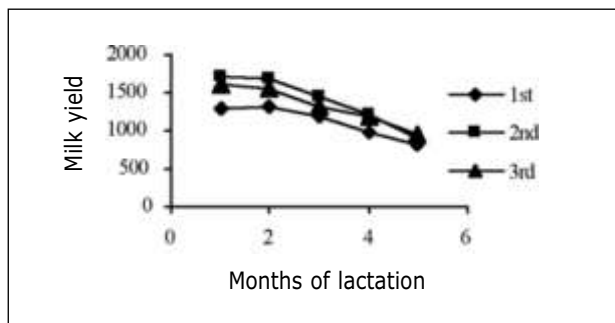
The unexpected lowest value of factor 1 for first parity ewes, being known that young animals have flatter curves (Stanton *et al.*, 1992), can be ascribed to seasonality of lambings in dairy sheep: autumn and spring for mature and primiparous ewes respectively. If lactations of lequal length are considered, first lambing ewes have the second part of lactation at the beginning of summer and therefore are subjected to negative environmental effects (high temperature, poor feed) that counterbalance their natural higher persistency. These results are confirmed by the raw lactation patterns of the three different parities (Figure 2).

Table 2. Least squares means of factor 1 estimated with model [1].

	Parity			N. of lambs			Year	
	Mean	SE		Mean	SE		Mean	SE
1	-0.20 <sup>A</sup>	0.31	1	-0.13	0.10	1995 <sup>Aa</sup>	0.51	0.30
2	0.27 <sup>B</sup>	0.30	2	-0.26	0.11	1996 <sup>Ab</sup>	0.33	0.29
3	0.44 <sup>B</sup>	0.30				1997 <sup>Ab</sup>	0.16	0.31
						1998 <sup>ABb</sup>	-0.30	0.39

<sup>A, B</sup> =  $P < 0.01$ ; <sup>a, b</sup> =  $P < 0.05$ ;

Figure 2. Milk yield lactation curves of different parity classes.



The multivariate Factor analysis of TD data within lactation allows for the calculation of a common factor that can be interpreted as an objective index of persistency. Results of phenotypic analysis should be further confirmed in larger data sets.

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