Estimation remaining variance milk yield trait in periods of partial and full lactation based on the analysis of test day records in random regression model

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Abstract: Full lactation period has less remaining variance than the incomplete lactation period and maximum residual variance, all incomplete and complete lactations for milk yield was related to early lactation period. Then rapidly decreased until mid-lactation and finally, at the end of lactation will increase slightly, but its initial value is not in early lactation. In fact, the residual variance not only high, but also volatility in early lactation is also in this period. To obtain separate estimates of residual variance or any day at any stage of lactation leads to more accurate estimates of the components will be referred to during lactation. In the event that the assumption of constant residual variance in random regression models for residual variance will lead to a bias in the resulting estimates, especially in early lactation and also over-estimated the heritability will be roughly the mid-lactation.
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1. Introduction

Using random regression models because of advantages such as no need to correct the record than the animal models, ability to consider the environmental effects specific to each day Recording in statistical analysis to predict breeding values of the animals at an early age and timely decisions for elimination or selection of livestock, reducing the generation interval and increase the accuracy of genetic parameters due to an increase in the number of record of each animal is growing, the random regression model as a statistical model animal additive genetic effects with some random regression coefficient alternative that essentially means taking into account the different stages of lactation as different characters (1,4,5 and 9). Full use of partial breast-feeding rather than lactation period to reduce the generation interval and the faster bulls instead of using incomplete records and complete records are also reducing the cost of operation record (4 and 5). According Kettunen et al assuming constant residual variance during lactation, however, to reduce the number of parameters needed to estimate and as a result of the search process to find the maximum log-likelihood function. But if the covariance function fitted under the influence of assumptions made about the remaining variance the remaining variance estimation and analysis of covariance functions for other components likely to be affected combination of phenotypic variance (2,6 and 7).

The remaining variance is a multi-state models and order. In some models assumed to be constant residual variance during lactation. The remaining variance is assumed to be independent of days in milk. In some other models residual variance during lactation are assumed to be non-uniform and variable. The assumption in the model is considered in two ways. Once divided can be based on the K stages of lactation, the remaining variance attributed to each of these stages to be estimated. In the second case the residual variance through a variance function (VF) grade 2 or 3 so that by Albuquerque and Meyer (2001) is presented in computations (3).

Materials and methods

The data used in this study of 69 724 TD records in the database to flock to the country's Breeding Center records relating to 5 to 305 days in first lactation animals breeding age range from 18 to 36 months were extracted for analysis, after applying the above limitation. Finally, TD 13699 record milk production the first of the 2716 Holstein cows were daughters of 167 bulls and pedigree data files were obtained to form. In this study, age at calving by subtracting the date of birth and date of birth and the day of the test by subtracting the operating records date and date of birth was obtained. The study analyzed data file that is related to incomplete periods of 5 to 30 days, 5 to 60 days, 5 to 120 days, from 5 to 150 days, from 5 to 180 days, from 5 to 210 days, from 5 to 240 to 270 days and 5 days. In addition, the full course of 5 to 305 days of lactation was analyzed.

The statistical model used (animal model) to analyze the records were as follows:

$$Y_{ijklp} = M_i + TD_j + S_k + K_L + \sum_{n=1}^{2} b_n (\alpha ge_{ijklp})^n + \sum_{n=0}^{K} \beta_n \phi_n (\dim^*_{ijklp}) + \sum_{n=0}^{ka-1} a_{pn} \phi_n (\dim^*{}_{ijklp})$$
$$+ \sum_{n=0}^{kp-1} Y_{pn} \phi_n (\dim^*{}_{ijklp}) + \varepsilon_{ijklp}$$

Elements of the above statistics are as follows:

Y_{ijklp} : TD milk yield records

M_i : The effects of i-th subgroup of milking times a day i=1, 2

TD_j : Fixed effect of j-th recording j=1,…,54

S_k : Fixed effect of k-th season of calving k=1,..., 4

K_L : The effects of l-th year of calving l=1,…,6

b_n : n-th regression coefficient for age at calving.

αge_{ijklp} : Age at calving (variable)

$\dim^*{}_{ijklp}$: Day standardized milk (in the range of -1 to +1)

$\phi_n(\dim^*{}_{ijklp})$: n-th Legendre polynomial of days in milk

B_n : n-th fixed regression coefficient

a_{pn} : n-th additive genetic random regression coefficients of p-th cow

y_{pn} : n-th permanent environmental random regression coefficients related to p-th cow

K: The constant regression analysis

k_g and k_p : Degrees respectively fitted genetic and permanent environmental variance function

The remaining variance through a variance function (V F) grade 2 so that by Albuquerque and Meyer (2001) is provided in the computations was:

$$\sigma_j^2 = \sigma_0^2 \exp\{1 + \sum_{r=1}^{V-1} br(\dim j^*)^r\} \quad (1)$$

Which σ_j^2 the remaining variance in the j-th days of lactation

σ_0^2 Intercept

br and V arfe respectively coefficients and parameters are subject to variance.

To perform analysis based on random regression model DXMRR program was used in the software DFREML and all analyzes were estimated based on average algorithm AI-REML information.

Results and Discussion

The model used in data analysis, random regression model (RR / CF) was used for analysis of milk yield with a minimum number of parameters and different degrees of fit for regression constant, random, additive genetic and permanent environmental was used. Random regression models with random effects were the same summary of the structure of the log with maximum likelihood function of the convergence time to reach the full course of lactation milk records in table (1) is provided. These models DXMRR software program DFREML been analyzed.

Table 1. The structure and details of the models studied

Log-likelihood function	The number of parameters	The remaining variance	The random regression analysis		The constant regression analysis	Record
		$V-1^3$	$K_p^{\ 2}$	$K_a^{\ 1}$		
2108-	*16*	*2*	*3*	*3*	*5*	Milk production

1. The additive genetic random regression analysis;
2. The degree of permanent environmental random regression analysis;
3. The variance function is considered fit for residual effect;

The number of parameters can be obtained from the following formula:

[K_a (K_a + 1) / 2 + K_P (K_P + 1) / 2 + V] = 16

In order to obtain the residual variance during lactation Albuquerque and Meyer method (2001) for a variance function (VF) grade 2 was used in (3).

$$\delta_j^2 = 3/47\exp(1-0/421\dim_j^* + 0/423\dim_j^*)^2$$

exp any number equal to the number in the log-on number is Nehprii. δ_j^2 Represents the estimated residual variance in the j-th days of lactation and $\dim_j^*$, j-th days in milk is standardized.

It is obvious that the above factors will be modified by changing the model.

In the range of -1 to +1 standard age and have obtained the following formula:

$$\dim_m = -1 + 2(\frac{L_i - L_{\min}}{l_{\max} - L_{\min}})$$

Figures 1 and 2 the variance in the remaining days of lactation milk yield during periods of partial and full lactation, according to equation (1) shows:

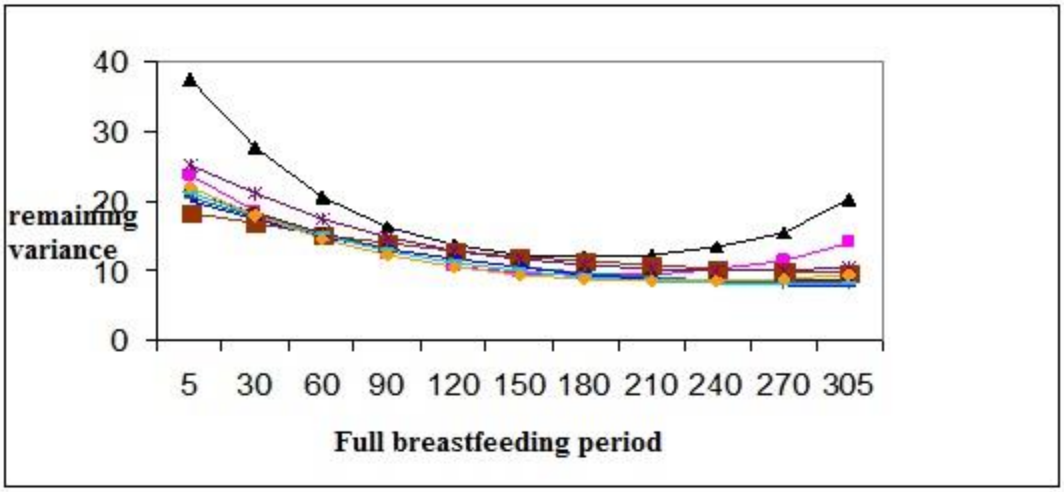

Figure 1 - The remaining variance complete lactations milk yield using random regression model

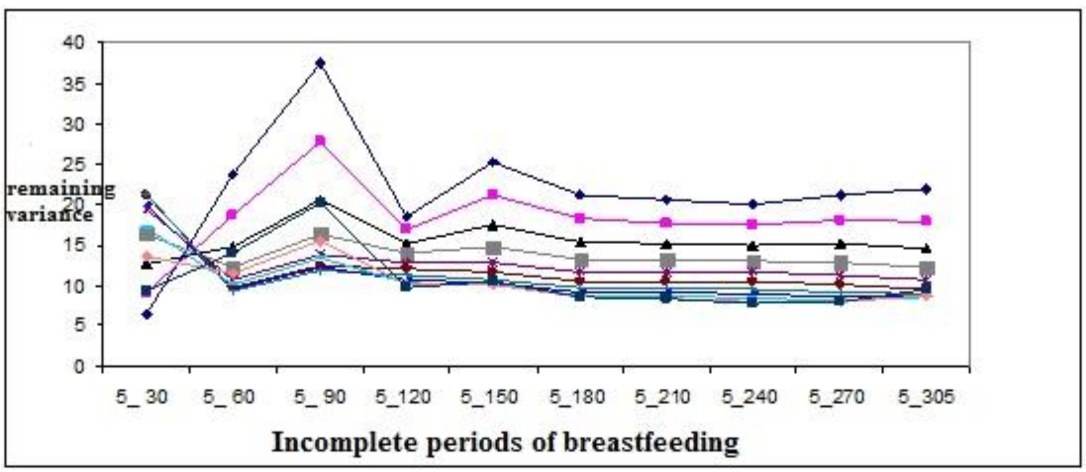

Figure 2- variance remaining days of lactation milk yield in lactations incomplete and complete with random regression model

According to the figures above, it follows the entire course of the remaining variance is less than the period of lactation, lactation is incomplete and maximum residual variance, all incomplete and complete lactations for milk yield is related to early lactation. In fact, the residual variance not only high, but also volatility in early lactation is also in this period. The process for the remaining variance by other researchers, including Jamrozik and Schaeffer (1997), Kettunen et al. (2000) and Olori et al. (1999) have also been reported (5,6 and 8). The remaining variance of nearly eight months of lactation to speed decreases and then increases again towards the end of lactation, but its initial value is not in early lactation.

Production in early and late lactation with temporary environmental variance is greater than production in mid-lactation by permanent environmental variances and genetic differences between most of the affected cows. Finally, the assumption of constant residual variance in random regression models leads to bias in the resulting estimates for residual variance, especially in early lactation and the resulting estimate for the total variance and thus affects the heritability (8). Based on the results of this study analyzed the records of unlimited size traits such as milk production by random regression model seems The residual variance model is the best way to do this is using a function because by using this method to estimate the residual variance milk every day without a dramatic increase in the number of parameters that must be estimated.

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