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TEST-DAY AND WHOLE LACTATION REPEATABILITY FOR SOMATIC CELL COUNT AND SOME MILK PRODUCTION TRAITS OF HOLSTEIN FRIESIAN COWS IN HUNGARY

A.A. Amin[1], S. Mokhtar[1] and T. Gere[2]

1- Department of Animal Production, Faculty of Agriculture, Suez Canal University, Ismailia-41522, Egypt, and 2- Department of Animal Breeding and Genetics, Gyongyos College of Agriculture, Godollo University of Agricultural Sciences, 3200-Gyongyos, Hungary

SUMMARY

Somatic cell count (SCC) and milk production traits were studied to explain their variability attributed to differences in age at calving within primiparous or multiparous cows. The analyzed data involved 6 Hungarian Holstein-Friesian genotypes having total number 193467 lactation records representing 4 parities collected from 8 farms during three years (1991 to 1993). The statistical mixed model included cow as random effect nested within genetic group, parity, age of calving within parity, and herd-year month of calving as fixed effects. Age at calving was divided into 16 classes (4 classes per parity). The overall least squares means for examined traits were daily milk yield (DY): 21.4±2.2kg; fat (F%): 3.7±0.11; protein (P%): 3.2±0.09; lactose (Lac%): 4.8±0.11; SCC (thousand cells per ml): 299±86; and milk production in 305 days (305-MY): 5804±161kg. Differences, in most studied traits, due to fixed effects were significant ($P<0.05$ to $P<0.0001$). Lactational means of SCC tended to increase with advancing order of lactation and age of calving within parity in a linear fashion. Changes in SCC and in milk production traits occurred from parity to another except in F% which decreased with advancing order of lactation. Changes in SCC with advancing calving age within 1st parity were higher than the corresponding changes within higher parities. Repeatability estimates were computed for lactational and sample test day using complete lactations and sample test day data sets, respectively. Estimates of lactational repeatability were 0.41, 0.39, 0.38, 0.55, 0.50 and 0.47 for DY, F%, P%, Lac%, SCC and 305-MY, respectively. The highest rate of increase in repeatability of sample test day was found for SCC obtained within the 3rd parity with advancing age at calving. Estimates of repeatability indicate that sample test-day information may play an important role in improving dairy cattle profitability.

Keywords: Hungarian Holstein-Friesian, repeatability, somatic cell count, milk, fat, protein, lactose

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INTRODUCTION

Genetic improvement in milk yield has been accompanied by health problems. Thus, the health care cost accounts for 10-20% of milk yield value (Shook and Schutz, 1994). About half of this cost is due to mastitis treatment. Direct selection to reduce the incidence of mastitis is not easy. Somatic cell count (SCC) has for many years been used as an indirect means of identifying high levels of (sub)-clinical mastitis in dairy herds. Dairy control agencies, dairy herd international testing laboratories, and milk plants use electronic somatic cell count (SCC) instruments as a fast, economical and relatively accurate method to assess SCC concentrations in milk. As an indicator for mastitis, SCC of milk has several desirable attributes for selection. SCC information is used for control purposes, and in national scale genetic evaluations (Boettcher *et al.*, 1992 and Wiggans *et al.*, 1994), and decision-making on the farm level (Reneau, 1986). Faust and Timms (1995) reported that overall mean of SCC was 418,000 cells/ml with range from 9000 to 3,966,000 and the coefficients of variability ranged from 7.6% to 16.4% in Denmark. Boettcher *et al.* (1992) reported that the highest lactational means of somatic cell score tended to be in the short lactations of young cows than in the long lactations in older cows. Schutz *et al.* (1990a) found that, means of somatic cell score (SCS) tend to increase with age in each parity, while the heighest means of milk yield, fat and protein percentage were obtained at 25 to 27 mo. of calving within 1st parity and at 37 to 40 mo within the 2nd calving. Also, they found that, behavior of SCS was different in 1st than in subsequent parities suggesting that SCS may respond to different stimuli early versus late in life. Schutz *et al.* (1994) found that, the variance estimates of the permanent environmental effect for SCC in three different herds of HF ranged from 0.20 to 0.22 and the maximum cow repeatability was 0.324. The corresponding estimate by Da *et al.* (1992) was 0.35 and by Welper and Freeman (1992) was 0.27. Zhang *et al.* (1994) found that, repeatability estimates for lactational somatic cell score (LSCS) of bulls with at least 30 daughters were 0.64$\pm$.18 for 1st lactation, 0.76 $\pm$ 0.15 for 2nd to 5th lactation and 0.86 $\pm$ 0.14 for all lactations. Mrode and Swanson (1996) found that, phenotypic correlations between SCC values across lactations are generally lower than the genetic correlations, the phenotypic and genetic correlations between lactations one and two, one and three, and two and three averaged 0.26 and 0.21, 0.36 and 0.76, and 0.76 and 0.87, respectively. Rogers *et al.* (1995) reported that, phenotypic correlations for SCS were generally much smaller than the corresponding genetic correlations. They found that, phenotypic correlations, within lactation ranged from 0.40 to 0.59 and across lactations ranged from 0.15 to 0.35.

This study was undertaken to investigate effects of age of cow within parity and month and year of calving on 305-day milk yield, milk composition and somatic cell count in the first four parities, and estimation of repeatability, as a guide for the prediction of milk production in the subsequent lactations and as an indicator of susceptibility to mastitis, was performed.

MATERIALS AND METHODS

Data

The collected data involved 54 grades/combinations of crossing between Holstein-Friesian (HF) and Native Hungarian Breed (NHB). NHB was constructed earlier form crossing between several European breeds. Genetic types in the present study were grouped mainly into 6 classes, HF purebred, NHB, <25%HF, ≥25-<50%HF, ≥50-<75%HF and ≥75%HF. These animals had been reared in 8 farms during the period from 1991 to 1993 in Hungary. The total number of lactation records was 193467 representing four parities. The data were classified into four classes of age within parity with 4 months interval as shown in Table 3. Milking frequency varied between farms and ranged from 2 to 3 times per day. All three milking records were adjusted before analysis to two times only using appropriate correction factors (DHIA 1979). Vacum pressure of the milking parlor machine ranged from 40 to 60 kilo paskal/min. Only one type of instruments was used in one laboratory for counting somatic cells and measuring different milk compositions. Studied traits were daily milk yield (DY), fat percentage (F%), protein percentage (P%), lactose percentage (Lac%), somatic cell count/ml of milk (SCC), and milk yield in 305 days (305-MY). Production tests were performed in the middle of each month throughout the complete lactation in the first four parities. Correlation coefficients between the same traits in different parities (lactational repeatability) and within parity (sample test-day repeatability) were calculated using two different types of data sets, the first composed of whole lactation of all parities for all traits, and the second sample test-day measures within parity.

Statistical Analysis

All percentage data (F%, P%, & Lac%) were transformed using arcsine scale while SCC observations into natural logarithms. The following mixed model was adopted using the general linear models procedure of SAS GLM (SAS package 1992):

$$Y_{ijklmnop} = \mu + G_i + C_{ij} + F_k + P_l + A_{ml} + R_n + M_o + \varepsilon_{ijklmnop} \quad ..(1)$$

$Y_{ijklmnop}$: the natural log transformed of SCC, or arcsine transformation of sample test-day fat, protein, or lactose percentage, or the original observed values for DY and 305d-MY.

μ: Population mean, G_i: fixed effect of i*th* genetic group, i= 1 to 6 (classified according to the percentage of American Holstein Friesian genes when crossed with the native Hungarian breed), C_{ij}: random effect of j*th* cow nested within i*th* genetic group, F_k: fixed effect of k*th* farm, P_l: fixed effect of l*th* order of lactation (l=1, 2,..4 parity), A_{ml}: fixed effect of m*th* classes of age at calving within l*th* parity, R_n: fixed effect of n*th* year of calving, M_o: fixed effect of o*th* month of calving, and $\varepsilon_{ijklmnop}$: random residual effect.

Residual standard deviation from model (1) and mean SCC for the fixed effects (farm, parity, age within parity, month and year of calving) were used to compute coefficients of variation for all individual fixed effects. Measures of SCC and milk production traits in every age at calving class within parity were regarded as different traits in a separate analysis of variance for computing sample test-day repeatability for each trait.

The effect of lactation stages (sample test-day analysis of variance) was considered as effect of stage nested within parity in special model derivative from model (1). Separate analyses of variances were applied per parity.

Intraclass correlation provides a direct estimate of repeatability and was computed for all studied traits across four parities (3-1) and within each parity (3-2) as

$$t=\hat{\sigma}^2c+\hat{\sigma}^2e_{PE}/(\hat{\sigma}^2c+\hat{\sigma}^2e_{PE}+\hat{\sigma}^2e) \quad \text{-1)}$$

$$t=\hat{\sigma}^2c+\hat{\sigma}^2e_{PE}+\hat{\sigma}^2e_{TE}/(\hat{\sigma}^2c+\hat{\sigma}^2e_{PE}+\hat{\sigma}^2e_{TE}+\hat{\sigma}^2e) \quad \text{-2)}$$

$$\hat{\sigma}^2s_1=\hat{\sigma}^2c+\hat{\sigma}^2e_{PE},\ \hat{\sigma}^2s_2=\hat{\sigma}^2c+\hat{\sigma}^2e_{PE}+\hat{\sigma}^2e_{TE}$$

where t is the intraclass correlation, $\hat{\sigma}^2c+\hat{\sigma}^2e_{PE}$ are estimates of genetic and permanent environmental variance components (in lactational repeatability), $\hat{\sigma}^2c+\hat{\sigma}^2e_{PE}+\hat{\sigma}^2e_{TE}$ are estimates of genetic, permanent and temporary environmental variance components (in sample test-day repeatability), and $\hat{\sigma}^2s_1, \hat{\sigma}^2s_2, \& \hat{\sigma}^2e$ are estimates of the lactational, sample and the remainder variance components, respectively. Estimates of all variance components were generated using Variance Component Estimation package (VCE-package, Groeneveld, 1996).

RESULTS AND DISCUSSION

Analysis of variance and least-squares means

The computed variance percentage in DY, F%, P%, Lac%, SCC, 305-MY are presented in Table 1. Variations in all studied traits due to the cow random effect ranged from 20.2% to 30.0 and were higher than the corresponding variances observed for any of the other fixed effects. However, cow variations in F%, 305-MY and DY were greater than for the other studied traits. The effect of month and year of calving on variation in SCC was lower than that computed for milk yield and composition except year of calving on lactose% . Variations in P%, SCC, and Lac% due to differences among genetic groups were higher than that computed for other traits. This indicates that SCC could play an important role in the indirect selection for their high genetically correlated economic traits (i.e. relationship between SCC and mastitis). The slightly significant differences in most studied traits due to variation among the eight farms indicate that management effect is nearly the same across the country and transportation of the animals from one region to another would not have a clear effect upon the performance of the cow. Variations in the studied traits due to the effect of farm ranged from 5.7% to 10.7% (Table 1). Milk yield and SCC were more affected than the other studied traits by differences in farm management level.

Table 1. Variance percentage and significance in daily milk (DY), fat% (F%), protein % (P%), lactose% (Lac%), somatic cell count (SCC), and 305-day milk yield (305-MY)

SOV	DY		F%		P%		Lac%		SCC		305-MY	
GnGp	8.1	**	6.0	**	16.7	*	10.3	**	10.9	**	9.4	**
Cow within genetic group	24.7	****	30.0	****	20.2	**	24.1	***	23.1	***	25.1	***
Farm	9.3	**	6.1	*	6.4	*	5.7	*	10.7	*	8.2	*
Parity	12.0	**	8.7	*	8.7	*	8.1	**	10.3	*	11.3	**
Age within parity	6.8	**	6.4	*	6.7	*	6.4	**	8.4	*	5.4	*
Year	6.9	*	8.4	**	6.4	*	5.0		6.3		10.1	**
Month	10.7	*	15.7	***	8.1	**	5.0		4.2		8.7	
Residual	21.5		18.7		26.8		35.4		26.1		21.8	

****: P<0.0001, ***: P<0.001, **: P<0.01, *: P<0.05, total records no. = 193467, df residual =134035

Least-squares means for studied traits in the first four parities and for the classes of age at calving within parity are presented in Table 2. Variance proportion of the studied traits due to the effect of parity ranged from 8.1 to 12% (Table 1). DY increased progressively with advancing order of age at calving within the 1st, 2nd, and 4th parities. Schutz *et al.* (1990 a) found that significant effect of calving ages on milk yield in the first three parities and in milk compositions in 2nd and 3rd parity only. Results in Table 2 were used to compute average increase in SCC per parity as $\{((X_{2ndP}-X_{1stParity})+(X_{3rdP}-X_{2ndP})+(X_{4thP}-X_{3rdP}))/3\}$ and per class of calving age within each parity as $\{((X_{2ndCA}-X_{1stClass\text{-}Age})+(X_{3rdCA}-X_{2ndCA})+(X_{4thCA}-X_{3rdCA}))/3\}$. The average increase SCC was 51700 cell/ml/parity and 39400 cell/class of calving in overall parities. The average increase in SCC per class of calving age within the 1st, 2nd, 3rd and 4th were 57700 cell, 28700 cell, 45700 cell and 25300 cell, respectively. The maximum change was 89000 cell/ml obtained in the 1st parity between the 1st and the 2nd class of age, while the minimum change was 9000 cell/ml obtained in the 2nd parity between the 3rd and the 4th class of age. Natzke *et al.* (1972) found that older cows had higher average cell counts than younger cows and that the average increase per parity was 100,000 cell/ml of milk, while 80,000 cell as average increasing rate was reported by Schutz *et al.* (1990b). SCC and DY increased as the order of lactation advanced and also as age of calving within parity increased (Table 2). This means that young cows (i.e. 1st and 2nd lactations) tend to have lower SCC than the multi lactating cows (i.e. 3rd and 4th calvers). Variation in SCC due to effect of calving age within first parity was higher than within other parities (Table 2 and Figure 1-a). In the current study, the proportionate increase of SCC with advancing age at calving within the 2nd parity was lower than for the DY, while the corresponding relationship was similar within the 3rd and the 4th parity (Fig. 1-a).

The rate of change in SCC in the earlier ages at calving within the 1^{st} lactation was higher than the corresponding rate of DY. Rates of increase in daily milk yield with advancing age at calving within the 1^{st} and the 2^{nd} parity were higher than the corresponding rates within the 3^{rd} and the 4^{th} lactations (Figure 1-a). The highest difference in the rate of SCC obtained for age at calving groups within the 1^{st} parity (0.60: calculated from Figure 1-a) and the lowest estimate obtained within the 1^{st} and the 2^{nd} lactations (0.21: calculated from Figure 1-a). On the other hand, classes of age at calving within 2^{nd} and 1^{st} parity showed maximum differences in DY while minimum differences were among classes of calving age in the 4^{th} lactation. Differences in the estimates of change of P% and F% for age at calving classes within the first three parities were very high compared with other traits (Figure 1-b).

Table 2. Least squares means, standard errors (SE), for daily milk yield (DY), fat % (F%), protein % (P%), lactose % (Lac%), somatic cell count (SCC), and 305-day milk yield (305-MY) in four classes of calving age (month) within the first 4 parities

Calving age (mo.)	DY_{Kg}	F %	P%	Lac%	$SCC10^3$/ml	$305\text{-}MY_{kg}$
First parity	**16.2±.11**	**4.1±.09**	**2.2±.01**	**3.9±.11**	**230±24**	**4584±196**
≤20.0	15.1±.11	3.0±.11	1.1±.95	2.7±.18	123±15	2945±204
20.1-24.0	15.7±.20	3.6±.12	1.8±.09	3.1±.21	212±14	3412±124
24.1-28.0	18.3±.22	4.0±.01	2.3±.12	4.1±.04	290±21	4478±114
>28.0	20.2±.23	2.7±.12	2.4±.12	4.5±.01	296±18	5412±138
Second parity	**17.7±.15**	**3.6±.05**	**2.9±.05**	**4.3±.01**	**304±22**	**4987±211**
≤28.0	16.3±.14	3.1±.01	1.8±.12	3.1±.12	263±14	4478±179
28.1-32.0	17.0±.17	3.0±.05	1.9±.01	3.9±.01	281±15	4789±149
32.1-36.0	22.3±.24	3.7±.11	2.8±.05	4.8±.05	340±25	5034±109
>36.0	22.9±.42	2.8±.12	3.7±.05	4.9±.05	331±22	5347±212
Third parity	**19.4±.22**	**3.1±.10**	**3.2±.08**	**5.3±.01**	**352±85**	**5378±205**
≤36.0	17.8±.11	2.5±.11	2.4±.01	3.9±.11	304±11	5079±124
36.1-40.0	18.1±.22	2.6±.09	2.8±.12	4.5±.02	331±14	5224±221
40.1-44.0	20.1±.14	3.3±.12	3.9±.09	5.7±.17	375±19	5749±102
>44.0	23.1±.09	3.7±.17	4.2±.12	5.9±.01	397±15	6345±204
Fourth parity	**22.7±.24**	**2.8±.02**	**4.5±.11**	**5.5±.05**	**385±13**	**6011±175**
≤44.0	19.3±.07	2.2±.01	3.7±.01	4.2±.12	331±23	5324±124
44.1-48.0	21.1±.11	2.3±.05	3.8±.18	4.9±.01	386±14	5563±154
48.1-52.0	21.9±.13	2.9±.09	4.7±.08	5.6±.04	404±34	6241±130
≥52.0	24.3±.18	3.2±.10	4.9±.18	5.8±.01	417±17	6548±250

Repeatability

Estimates of lactational and sample test day repeatability for the studied traits are presented in Table 3. Estimates of lactational repeatability herein are lower than those reported in the study of Faust and Timms (1995). This may be due to differences existing in data sets used and to the statistical model. Lactational repeatabilities obtained here were comparable to estimates reported by Welper and Freeman (1992). The highest estimates of lactational repeatability were obtained for Lac%, SCC and

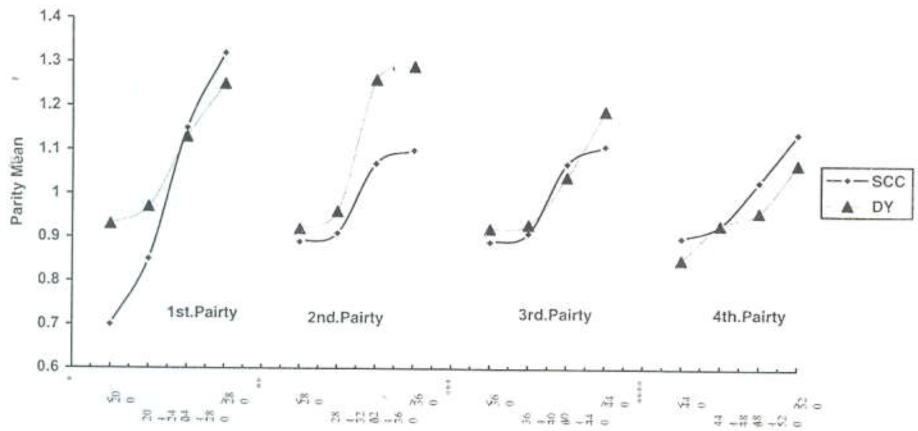

Figure 1-a. Change in somatic cell count (SCC) and daily milk yield (DY) with advancing age at calving within parity relative to the corresponding mean of each parity.

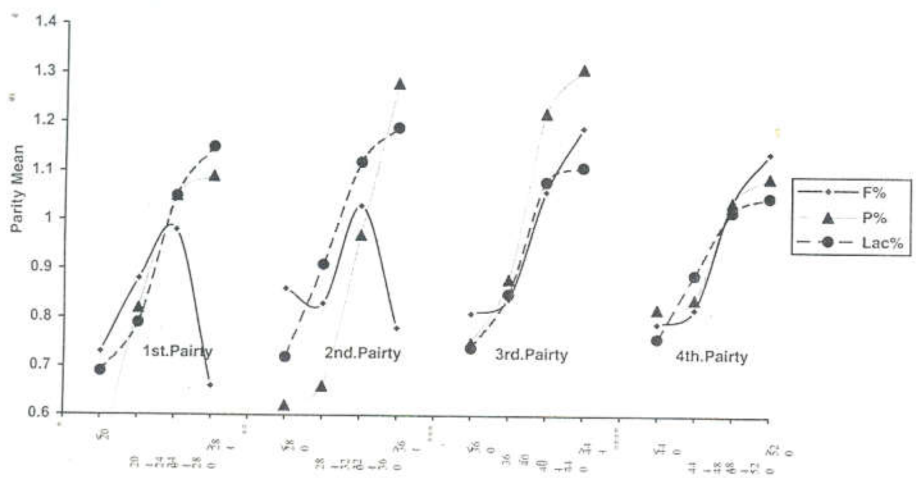

Figure 1-b. Change in fat % (F%), protein % (P%), and lactose % (P%) with advancing age at calving within parity relative to the corresponding mean of each parity.

305-MY (0.55, 0.50, and 0.47, respectively). This means that the prediction of SCC values in subsequent lactations from earlier ones can be made with a higher degree of accuracy. Estimate of SCC repeatability obtained by Schutz *et al.* (1994) was around 0.32. The current lactational estimates are in close agreement with results reported by Syrstad and Ron (1979). The lowest lactational repeatability estimates found in the present study was 0.38 for P% (Table 3) which is much lower than the corresponding estimate given by Welper and Freeman (1992). Low repeatability estimates for F% and P% as shown in (Table 3) reflect their limited use in prediction purposes.

Table 3. Lactational and sample test day repeatability estimates and standard errors for the all studied traits

Trait	Lactational	Sample test day			
		Within Parities			
		1st	*2nd*	*3rd*	*4th*
DY	0.41±.21	0.68±0.24	0.68±.19	0.70±.23	0.50±.13
F %	0.39±.18	0.22±0.13	0.25±.11	0.31±.11	0.35±.15
P %	0.38±.19	0.39±0.24	0.44±.18	0.54±.17	0.50±.20
Lac %	0.55±.11	0.50±0.14	0.62±.24	0.64±.18	0.71±.17
SCC	0.50±.24	0.18±0.23	0.46±.13	0.31±.21	0.45±.20
MY-305	0.47±.28				

Sample test-day repeatability of Lac% and DY were rather high either as overall estimate or when calculated within parity (Table 3). Sample test-day repeatability estimates are subjected to differences in the permanent and temporary environmental effects. When temporary environmental effects represent a considerable proportion of environmental variance then it is expected that this will lead to higher sample test-day estimates than lactational repeatability estimates. This may raise the question about the reliability of information based on sample test-day data for different traits in expecting performance rather than those obtained from the whole lactation. Sample test-day repeatability estimates for DY, P% and Lactose were higher than that calculated for SCC by 72%, 25% and 75%, respectively (Table 3). Sample test-day F% repeatability was lower than the corresponding estimates for SCC as well as lactational estimates with 36% reduction in sample test day comparison. Therefore, expected results to improve the previous traits (i.e. lactose and DY) or very related traits based on sample test-day data set seem to be attainable. In general, estimates of sample test day repeatability (Table 4) for all traits were higher than the corresponding lactational repeatabilities except for F% and SCC. Therefore, prediction of production based on lactational repeatability estimates will be less effective than that based on sample test-day repeatability estimates except for F% and SCC. However, the lactational repeatability of SCC was higher than its sample test-day repeatability. The extremely low repeatability estimates of SCC in the 1st lactation may have resulted in lower estimate for sample test-day compared with lactational repeatability. Repeatability of monthly cell count reported by Monardes and Hayes (1985b) agreed with the current repeatability of sample test day for SCC within the 2nd and the 3rd parity. Sample test-day repeatability for DY, and P%, shows a curve-linear fashion that increased slowly from the 1st to the 3rd parity and reduced slightly thereafter in the 4th parity with a remarkable reduction in the case of DY (Table 4). The corresponding repeatability estimates of F%, and Lac% increased in a moderate progress of a linear relationship with advancing order of lactation from the 1st to the 4th parity. Sample test-day repeatability results for all studied traits (Table 4) increased considerably from the 1st to the 2nd lactation. This indicates that the prediction of the future production will be extremely reliable from the early stage of the 2nd lactation. Sample test-day repeatability curve of SCC increased with advancing order of lactation in two stages, where it declined at the third parity and then went up once again at the 4th lactation. Monardes and Hayes (1985a) found that estimates of repeatabilities of SCC in different lactations were similar to those from test days.

Sample test-day repeatability estimates of the different classes of age at calving groups within parity are presented in Figures 2-a & 2-b for all traits. In general, sample test-day repeatability of SCC increased with advancing age at calving within the first three parities. Estimates of sample test day repeatability of SCC ranged from 0.22 to 0.60 the widest observed range was for age at calving group within the3rd parity (Figure 2-a). On the other hand, the narrowest differences of these estimates were found within the 4th parity. These results may suggest that more variability either of genetic or permanent environmental origin occurs between age at calving classes within the 3rd parity. In the 4th parity only, repeatability estimates of SCC declined after increasing with advancing of calving age to create a repeatability curve-linearship. Figure 2-a showed that estimates of repeatability of sample test-day of DY consisted a moderate and strong curve-ship for calving age within 2nd and 3rd parity, respectively, while a progressed linear-ship of these estimates were observed within 1st and 4th parity. Identical relationship was observed between sample test day repeatability of P% (Figure 2-b) and DY (Figure 2-a) across all parities, while only within 1st and 2nd parity changes of sample test-day repeatability of SCC and F% were approximately similar (Fig. 2-a, 2-b). Figures of sample test-day repeatability of Lac% had a curve-relationship with advancing calving age within all parities. Variations between estimates of sample test-day repeatability for milk composition within the 2nd and the 3rd parity are extremely small (Fig. 2-b). This may indicate that the 2nd and 3rd classes of calving age groups within each parity are more efficient to repeat them self production picture across their life time production. Mrode and Swanson (1996) concluded that, the repeatability between consecutive lactations increased with age, showing that permanent environmental effects and cow genetic effects become more important with increasing parity. Estimation of the changing rates of SCC production along with milk production traits across and within lactations, as the best prediction indicator for the future production, are needed to develop accurate conclusion about the current lactations and the expected production of the total life, also to determine what is the best time to consider SCC in selection program and take a suitable management decision.

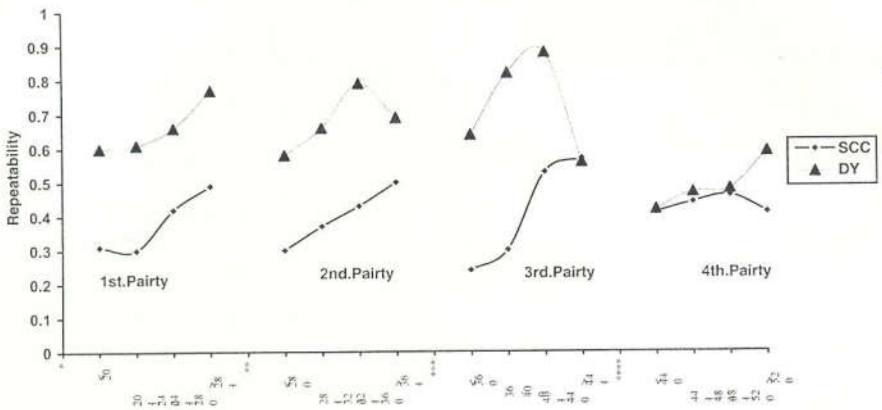

Figure 2-a Sample test day repeatability estimates of somatic cell count (SCC) and daily milk yield (DY) in relation to age at calving within parities.

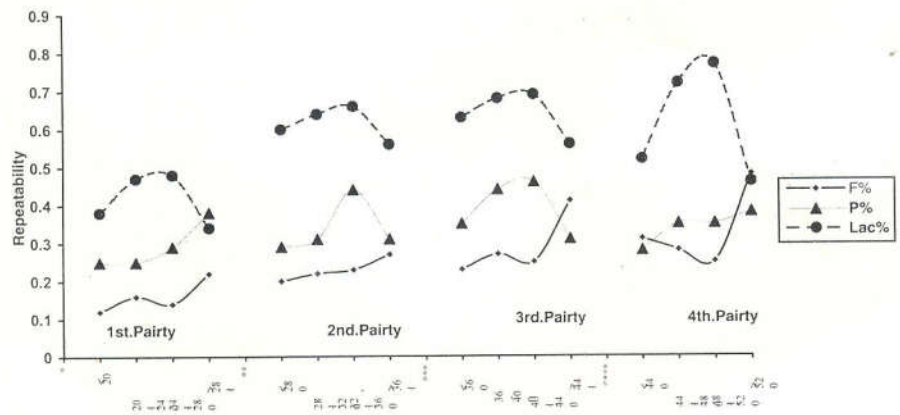

Figure 2-b Sample test day repeatability estimates of fat (F%), protein (P%) and lactose (Lac%) percentage in relation to age at calving within parities.

REFERENCES

Boettcher, P.J., L.B. Hansen, P.M. VanRaden, and C.A. Ernst, 1992. Genetic evaluation of Holstein bulls for somatic cells in milk of daughters. J. Dairy Sci., 75:1127-1137.

Da, Y., M. Grossman, I. Misztal, and G.R. Wiggans, 1992. Estimation of genetic parameters for somatic cell score in Holsteins J. Dairy Sci., 75: 2265-2271.

DHIA: Dairy Herd Improvement Associations, 1970. Annual Reports of Dairy Cattle Improvement. pp: 16.

Faust, M.A. and L.L., Timms, 1995. Estimates of variability for somatic cell count measurements in the Iowa dairy industry. J. Dairy Sci., 78: 546-551.

Groeneveld, E., 1996. A Multivariate Multi Model Restricted Maximum Likelihood (Co)variance Component Estimation Package, REML VEC Version 3.2, (FAL) Mariensee-Germany.

Miller, P. 1973. A recent study of age adjustment. J. Dairy Sci., 56:952-961

Monardes, H.G. and J. F. Hayes, 1985a. Genetic and phenotypic statistics of lactation cell counts in different lactations of Holstein cows. J. Dairy Sci., 68: 1449-1455.

Monardes, H.G., and Hayes, J.F. 1985b. Genetic and phenotypic relationships between lactation cell counts and milk yield and composition of Holstein cows. J. Dairy Sci., 68:1250-1257.

Mrode, R.A. and Swanson, G.J.T. 1996. Genetic and statistical properties of somatic cell count and its suitability as an indirect means of reduction the incidence of mastitis in dairy cattle. Animal Breeding Abst., 64 :847-857.

Natzke, R.P., R.W. Everett, and D.S. Postle, 1972. Normal milk somatic cell counts. J. Milk Food Technol., 35: 261-273.

Reneau, J.K. 1986. Effective use of Dairy Herd Improvement somatic cell counts in mastitis control. J. Dairy Sci., 69: 1708-1719.

Rogers, G.W., G.L Hargrove, and J.B. Cooper, 1995. Correlations among somatic cell scores of milk within and across lactation and linear type traits of Jerseys. J. Dairy Sci., 78: 914-920.

SAS Institute, Inc. 1987. Page 549 in SAS/STAT™ Guide for Personal Computers. SAS Inst., Cary , NC.

Schutz, M.M., L.B. Hansen, G. R. Steuernagel and A. L. Kuck, 1990a. Variation of milk fat, protein, and somatic cells for dairy cattle. J. Dairy Sci., 73:484-493.

Schutz, M.M., L.B. Hansen, G. R. Steuernagel, J.K. Reneau, and A. L. Kuck, 1990b. Genetic parameters for somatic cells, protein and fat of Holsteins. J. Dairy Sci., 73:494-502.

Schutz, M.M., P.M. Vanraden, and G.R. Wiggans, 1994. Genetic variation in lactation means of somatic cells scores for six breeds of dairy cattle. J. Dairy Sci., 77: 284-293.

Shook, G.E., and M.M., Schutz, 1994. Selection on somatic cell score to improve resistance to mastitis in the United States. J. Dairy Sci., 77: 648-658.

Syrstad, O. and I. Ron, 1979. Variation in somatic cell counts of milk samples from individual cows. Act. Vet. Scand., 20: 555-566.

Welper, R.D. and A.E. Freeman, 1992. Genetic parameters for yield traits of Holstein, including lactose and somatic cell score. J. Dairy Sci., 75: 1342-1348.

Wiggans, G. R., P.M. VanRaden, and M.M. Schutz, 1994. Changes in USDA-DHIA genetic evaluations (January 1994). Anim. Improve. Programs Lab., Betsville, MD.

Zhang, W.C., J.C.M. Dekkers, G. Banos, and E.B. Burnside, 1994. Adjustment factors and genetic evaluation for somatic cell score and relationships with other traits of Canadian Holsteins. J. Dairy Sci., 77: 659-665.

المعاملات التكرارية لموسم الحليب ولعينة يوم الاختبار لبعض صفات إنتاج اللبن وعدد الخلايا الجسمية فى أبقار الهولستين فريزيان المجرية

أشرف أمين[1] ، سمير مختار[1] ، تيبورجر[2]

١ - قسم الإنتاج الحيوانى كلية الزراعة جامعة قناة السويس ٤١٥٢٢ الإسماعيلية مصر ، ٢-قسم تربية ووراثة الحيوان كلية الزراعة بمدينة جونجوش جامعة جدولوا للعلوم الزراعية ٣٢٠٠ جونجوش المجر

تمت دراسة صفات إنتاج اللبن وعدد الخلايا الجسمية لتفسير الاختلافات فيهما التى تعزى الى الاختلافات فى العمر عند الولادة لعجلات الموسم الأول أو الأبقار ذات المواسم المتعددة. أشتملت البيانات التى تم تحليلها إحصائيا على ٥٤ مجموعة وراثية من أبقار الهولستين فريزيان المجرية تكونت من ١٩٣٤٦٧ سجل لبن لأربعة مواسم إنتاجية تم تجميعها من ثمان مزارع إنتاجية خلال ثلاث سنوات (١٩٩١ الى ١٩٩٣). اشتمل نموذج التحليل الإحصائي المختلط على التأثير العشوائي للبقرة المتفرع من التأثير الثابت للمجموعة الوراثية، بالإضافة الى التأثيرات الثابتة الأخرى كموسم الحليب، العمر عند الولادة داخل موسم الحليب، تأثير موسم وسنة الولادة. تم تقسيم العمر عند الولادة الى ١٦ قسما (أربعة داخل كل موسم). كان المتوسط العام للصفات المدروسة كان ٢١,٤+٢,٢كجم لانتاج اللبن اليومى، ٣,٧+٠,١١ لنسبة الدهن، ٣,٢+٠,٠٩ لنسبة البروتين، ٤,٨+٠,١١ لنسبة اللاكتوز، ٢٩٩+٨٦ ألف خلية جسمية لكل ملليلتر لبن بالإضافة الى ٥٨٠٤+١٦١كجم لبن فى ٣٠٥ يوم. كانت الاختلافات فى أغلب الصفات المدروسة والتى تعزى الى التأثيرات الثابتة معنوية عند احتمال خطأ تزواح بين (٠,٠٥ الى ٠,٠٠٠١). تزايد المتوسط الموسمى لعدد الخلايا الجسمية مع تقدم ترتيب موسم الحليب وكذلك العمر عند الولادة داخل الموسم فى شكل شبة خطى. كانت التغيرات من موسم الى أخر فى صفات إنتاج اللبن وعدد الخلايا الجسمية متلازمة وذلك باستثناء نسبة الدهن. كانت التغيرات فى عدد الخلايا الجسمية مع تقدم العمر عند الولادة داخل موسم الحليب الأول أعلى من التغيرات المقابلة لها فى مواسم الحليب الأخرى. تم تقدير نوعين من المعامل التكرارى لجميع الصفات المدروسة، الأول: المعامل التكرارى الموسمى وذلك باستخدام البيانات الإنتاجية الكلية لكل موسم حليب، النوع الثانى: المعامل التكرارى لعينة يوم الاختبار (الاختبارات الشهرية خلال موسم الحليب) وذلك باستخدام المشاهدات أو القياسات الفردية للصفات المدروسة. كانت تقديرات المعامل التكرارى ٠,٤١ ، ٠,٣٩، ٠,٣٨ ، ٠,٥٥ ، ٠,٥٠ ، ٠,٤٧ لكل من إنتاج اللبن اليومى ، نسبة الدهن، نسبة البروتين ، نسبة اللاكتوز ، عدد الخلايا الجسمية ، إنتاج اللبن فى ٣٠٥ يوم على التوالى. أعلى معدل لتزايد المعامل التكرارى لعينة يوم الاختبار قدر لعدد الخلايا الجسمية داخل موسم الحليب الثالث مع تقدم العمر عند الولادة. تشير تقديرات المعامل التكرارى الى ان المعلومات الإنتاجية المستمدة من قياسات عينة يوم الاختبار من الممكن ان تلعب دوراً مهماً فى عملية الانتخاب المصحوبة بدقة تنبؤ عالية وذلك لتحسين الكفاءة الإنتاجية لماشية اللبن على المدى القصير.