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SOME FACTORS AFFECTING TEST-DAY VISUAL MILK SOMATIC CELL CONCENTRATION AND MILK YIELD IN HOLSTEIN FRIESIAN COWS RAISED IN EGYPT

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SUMMARY

To assess the relationship between sample test-day milk yield (TDM) and milk somatic cell concentration of Holstein Friesian cows raised under Egyptian conditions, the effects of cow source, farm, season and year of calving, parity and age at calving were investigated. Data on a total number of 2811 cows were collected from four dairy farms located in different areas (Al-Salhia and Dunia in Ismailia region, and Delta Misr farm 1 and 2 in Monofia governorate). Milk somatic cell concentration was examined using visualized linear score (VLS_{SCC}) ranging from 0 to 3 digits. VLS_{SCC} was converted to expected somatic cell count (E_{SCC}), which in turn was expressed as expected somatic cell score (E_{SCS}) in statistical analysis.

The results showed that the direct animal random effect was responsible for a remarkable variability in TDM and partially for E_{SCS}. These findings refer to the presence of genetic variability of these traits and indicate the possibility of genetic improvement of general udder health and milk yield through appropriate genetic improvement strategies. Overall least square means (LSM) of TDM and E_{SCC} ranged from 10.1 to 27.9 Kg/day and from 575,000 to 1,404,000 cells per ml milk, respectively. The highest LSM_{TDM} was 21.7$\pm$4.47 Kg/day at the third parity. Estimates of LSM for E_{SCC} ranged from 575,000 to 957,000 and 851,000 to 1,404,000 cells per ml milk for the two groups representing low and high level of E_{SCC}, respectively. Age at calving and parity are generally the second most affecting factor on TDM and E_{SCS}. Changes in TDM and E_{SCC} were computed at different levels of VLS_{SCC}. In general, TDM decreased with advancing level of E_{SCC} indicating a negative relationship. The average overall reduction in TDM was 4.01 Kg/day and the corresponding increase of E_{SCC} was 418,670 cells per ml milk. Prediction of milk SCC was based on daily milk yield (DY_{Kg}), days in milk (DIM_{days}) and order of lactation (Pr).

*The general form is: milk SCC = 2119 -59.94*DY - 9.56*DIM - 19.43*Pr.*

The equation could be used for prediction under the prevailing conditions of local Holstein Friesian dairy farms. Accuracies of all suggested SCC prediction equations ranged from 57.4% to 84.8%.

Keywords: *Somatic cell count, test-day milk yield, Holstein Friesian, stage of lactation.*

INTRODUCTION

Mastitis is one of the most costly health problems of dairy cattle and is a major source of economic loss to dairy farmers. It results in a significant reduction in milk yield, due mainly to damage of milk-producing tissues in the udder. There is, also, a reduction in butterfat and casein levels, resulting in poorer cheese making properties. Mastitis is also the most frequent disease responsible for early culling of milking cows. The somatic cell count is the number of cells present in milk (body cells as distinguished from invading bacterial cells). It is used as an indicator of udder infection. Roger and Peter (1995) indicated that a herd with a somatic cell count (SCC) of about 200000/ml will have minimal losses in yield, but for every increase in cell count of 100000/ml, there will be a reduction of 2.5% in milk yield. Miller (1984) indicated that mastitis causes a yearly loss exceeding two billion Dollars to commercial dairy farmers in the USA, mainly due to reduced milk yield from infected cows. This high level of losses has raised interest in breeding as means of reducing the incidence of mastitis by supplementing management control programs. Mrode and Swanson (1996) showed a negative relationship between production and SCC in later parities due partly to culling in the first parity on the basis of mastitis and milk production. Culling practices would remove low milk producers and potentially high producers with mastitis infection and high SCC; thus high milk producers, with low SCC, would be favored to have a second parity. Seasonal effect on SCC was reported by many workers (Schutz *et al*., 1994 and Zhang *et al.,* 1994). They concluded that the highest SCC occurred during summer months. The objectives of the present study were: 1) to study the effect of farm, season and year of calving, parity, age at calving and stage of lactation, on test-day milk (TDM) and visualized linear score (VLS_{SCC}) and 2) to asses the relationship between the two variables.

MATERIALS AND METHODS

***Structure of the data*:**

Productive data of Holstein Friesian cows were collected from four farms. The total number of dairy cows used in the present study was 723, 737, 1061, and 290 in Al-Salhia, Dunia, and Delta Misr farm number 1 and number 2, respectively. The data were composed of 3909 test-day records of producing cows in the first four parities. The first measurement on the cow was obtained three weeks after parturition. Information on dates of first calving, parity, source of the cow (imported as pregnant heifer or locally born in Egypt), calving date, dates of all available test-day observations and date of drying off were recorded for all animals. Stage of lactation was divided into four groups (lactational quarter year: LQY) going from the first month of lactation up to the 12^{th} month with three months interval each (Table 1). Determination of milk somatic cell was performed after Gary (1985). The most important materials used in the test were smooth black bakelite sheets, NaOH 4%:, medicine droppers, mixer sticks ″15cm long″ and picture guide for scoring test reactions. All samples were stored at 0 to $4^{\circ}C$. Testing must be completed within 36 hr after collection. Levels of SCC in milk were presented as Visualize Linear Score of somatic cell count (VLS_{SCC}) using 0- 3digits (Table 2).VLS_{SCC} was converted to expected somatic cell count (E_{SCC}) according to Barillet *et al.* (1984). For statistical analysis E_{SCC} was further expressed as expected somatic cell score (E_{SCS}) using $\log_2 E_{SCC}$ (Rogers *et al*., 1991). Data were analyzed using Multitrait Derivative Free Restricted Maximum Likelihood (MTDFREML) animal model (Boldman *et al*., 1997). The general linear animal mixed model in matrix notation is given by

$$y = Xb + Z_1 a + Z_2 c + e .$$

Where: *y* is the vector of observations, *X* is the known matrix, *b* is the vector of fixed effects (four parities and/or age at calving (16 age groups, Table 1), cow source (imported and local), four dairy farms (Al-Salhia, Dunia, and Delta Misr farm number 1 and number 2,) , four season of calving and three year of calving from 1999 to 2001), Z_1, Z_2 are the known incidence matrices, *a,* and *c* are non-observable sire and cow random vectors, respectively. Expectation and variances are defined as:

$$E\begin{bmatrix} a \\ c \\ e \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \qquad \text{var}\begin{bmatrix} a \\ c \\ e \end{bmatrix} = \begin{bmatrix} A\sigma^2{}_a & \sigma_{au} \ldots\ldots\ldots\ldots 0.0 \\ \sigma_{au} & B\sigma^2{}_c \ldots\ldots I\sigma^2{}_{e_1} \\ 0 & I\sigma^2{}_{e_1} \ldots\ldots I\sigma^2{}_{e_2} \end{bmatrix}$$

Where: *A* and *B* are the numerator relationship matrix among animals of sire and cow within sire, I is the identity matrix, $\sigma^2{}_a$ and $\sigma^2{}_c$ are the direct random additive genetic effect of the sire and cow. $\sigma^2{}_{e_1}$ and $\sigma^2{}_{e_2}$ are the sire and cow population error variance.

Table 1. Number (Obs) and percentage (Obs%) of test-day observation according to calving age (CA,mo) within parity (Pr) and lactational quarter year (LQY, mo.)

	CA / parity					**LQY**		
Parity	CA	Obs	Obs%	Obs	Obs%	LQY	Obs	Obs%
	≤24	203	11.25					
1st	>24-	961	53.27	1804	46.15	1 - 3	915	23.41
	>28	640	35.48					
	≤36	211	21.44					
2nd	>36-	512	52.03	984	25.17	4 - 6	131 6	33.67
	>40	261	26.52					
	≤48	161	20.02					
3rd	>48-	531	66.04	804	20.57	7 - 9	110 6	28.29
	>52	112	13.93					
	≤60	103	32.49					
4th	>60-	131	41.32	317	8.11	10- 12	572	14.63
	>64	83	26.18					

Table 2. Visual linear score (VLS_{SCC})of milk somatic cell (10^3/ml milk) and mid-point (MP) values in milk samples (Gary, 1985)

Result test	VLS_{SCC}	Range*10^3	MP
Mixture is opaque and milky in appearance, and entirely free from precipitate.	0	$\leq$500	250
Background is less opaque but still somewhat milky	1	>500-$\leq$1000	750
Background is slightly watery in appearance.	2	>1000-$\leq$1500	1250
Background is definitely watery, with larger clumps of coagulated material.	3	>1500	1750

RESULTS AND DISCUSSION

Least-Square analysis of variance:

Results of analysis of variance for TDM and E_{SCS} are presented in Table 3. Among all investigated factors, animal random effect was the most affecting factor on TDM where it showed the highest mean square value (Table 3). Effect of animal on TDM across and within parities was proved to be significant (P$\leq$0.01). These results are in agreement with Mohamed (1998) and refer to the presence of genetic variability of this trait, indicating the possibility of genetic improvement of milk yield through proper genetic improvement strategy.

Table 3. Mean-square values of test-day milk yield (TDM) and expected somatic cell score (E_{SCS}) within and across parities

Source	df	TDM					E_{SCS}			
		Overall	Parities				Overall	Parities		
			1st	2nd	3rd	4th		1st	2nd	3rd
Animal R.E.	1176	70.39***	49.70***	60.49**	46.84**	50.62***	0.18	0.11	0.37***	0.39
Cow source	1	33.08*	23.98*	21.15	11.31	22.07*	0.11	0.05	0.19*	0.22
Farm	3	50.17**	26.08*	24.74	40.91**	36.18**	0.18	0.07	0.30**	0.35
Season	3	37.92*	27.32*	36.61*	22.57	20.85	0.00	0.06	0.24*	0.33
Year	2	41.89**	18.86	33.67*	22.65	17.24	0.14	0.04	0.28**	0.26
Parity	3	66.33**					0.37***			
Calving Age			46.46***	32.54	39.72**	41.64***		0.15*	0.67***	0.70**
Cov: Stg_{linear}	1	41.04**	23.41*	25.52	27.71*	31.43**	0.28**	0.11	0.43**	1.01***
$Stg_{Quadratic}$	1	32.96*	19.63	25.70	30.68*	27.79*	0.19*	0.07	0.25*	0.43
Ran. Res.	2708	32.15	21.53	37.00	28.19	23.61	0.19	0.15	0.16	0.58
Res. df			849	616	417	84	2369	842	609	410
R^2 %		92.08	91.62	87.56	89.58	91.3	89.45	80.85	94.32	86.47

Animal R.E. : Animal Random Effect
Cov.: Covariate, Ran. Res.: Random Residual, *: P<0.05, ** : P<0.01, *** : P<0.001. Stg: stage of lactation

Analysis of variance for pooled data set (Table 3) showed that animal random effect was not significant on E_{SCS}. However, the magnitude of mean square of E_{SCS} due to animal effect within parity increased from the first to the third parity. It was proved to be significant only in the second parity. The present results agree with those reported by Emanuelson and Philipson (1984) and disagree with those reported by Mohamed (1998).

Results in Table 3 show that differences between farms in TDM were significant (P<0.01) either for the pooled data or the separate parities except the second parity. These results are in accordance with those of many investigators working on different breeds of dairy cattle (Afifi *et al*., 1992 and Amin, 1998). In general, variation in TDM among farms could be attributed to different feeding and managerial practices and due to the differences in genetic make-up of the stock. Differences among farms in E_{SCS} were significant (P<0.05) across parities and within the second parity (P<0.01) (Table 3). Significant differences among herds in milk somatic cell concentration could be attributed to application of different control programs tend to provide hygienic and management practices to control intra-mammary infection.

Season and year of calving affected significantly (P<0.05or P<0.01) TDM of the pooled data (Table 3). Similarly, the study of Afifi *et al*. (1992) revealed significant differences in milk yield due to season and year of calving. Season and year of calving generally had non-significant effect on E_{SCS} (Table 3). Liebe *et al*. (1996) reported non-significant effect of season and year of calving on milk somatic cell count. However, significant effect of season on milk somatic cell was reported by Rodriguez *et al*. (2000). The reasons for seasonal variations are unknown and only speculated to be the effects of housing and temperature changes on infection status.

Parity and age at calving are generally the second most affecting factors on TDM and E_{SCS} as shown in Table 3. Age could be expected to be very important source of variation if the heifers were inseminated for first time so early in their life that some of them had not yet reached physiological maturity and consequently body size and their body systems are still at lower levels.

Overall mean square of TDM due to stage of lactation was higher than that within parity (Table 3). Mean square of TDM caused by the linear covariate term of stage of lactation increased markedly with advancing parity. Across parities, and within the 2nd and 3rd parity stage of lactation affected significantly E_{SCS} mainly through its linear covariate term. The effect of stage of lactation on somatic cell score has been proved to be significant in the study of Rupp *et al*. (2000). Farghaly (2002) showed that stage of lactation affected significantly milk somatic cell, since both the original and logarithm milk somatic cell were the highest shortly after calving, dropped to a minimum between 40 and 80 days postpartum and then steadily increased until the end of lactation.

Least-squares means:

Estimates of least-squares means (LSM) of TDM with their standard errors in the first four parities, calving seasons and farms are presented in Table 4. Overall mean of test-day milk yield was 17.5$\pm$5.2 kg. Results in Table 4 show that TDM increased gradually from the first lactation till the third one and decreased thereafter. The present results agree with those reported by Soliman and Khalil (1993), and Afifi *et al*. (1992) who found that means and standard deviations of milk yield increased with the advance of parity. They also reported much greater rise in yield from first to second parity than with any other two parities. Mohamed (1998) showed that milk yield increased with advancing age and reached its peak at the fourth parity.

Table 4. Least-squares means (LSM $_{Kg}$ ±SE) for test-day milk yield (TDM) in the first four parities, calving season and farms

		Range		Observation			
		Min	Max	No	%	LSM ± SE	CV%
Overall		10.1	27.9	2958	100	17.5±5.2	46.1
Parity	1	11.9	22.9	1237	41.8	14.5±5.0	21.8
	2	14.9	24.3	749	25.3	18.0±9.4	44.9
	3	10.1	27.9	534	18.0	21.7±4.4	37.9
	4	11.3	21.6	438	14.8	19.2±6.3	67.4
Season of Calving							
	Winter	14.9	27.9	1508	50.9	22.1±8.2	61.4
	Spring	11.9	24.3	544	18.3	18.3±6.1	54.1
	Summer	10.1	21.6	318	10.7	14.3±7.2	31.7
	Autumn	11.3	22.9	588	19.8	16.6±6.8	47.2
Farms	Al-Salhia	10.1	21.6	871	29.4	14.6±6.2	67.4
	Dunia	11.9	24.3	738	24.5	17.8±6.9	46.9
	Delta Misr1	14.9	27.9	1061	35.8	23.5±7.3	19.7
	Delta Misr2	11.3	22.9	288	9.7	18.4±3.6	29.8

CV: Coefficient of variability

Winter calvers produced the highest TDM followed by spring calvers (Table 4). Cows calved in summer produced the lowest TDM as expected due to the unfavorable surrounding high environmental temperature along with the low quality of feed and the low feed intake. Similar results were obtained by Soliman and Khalil, (1993), who showed that milk yield and constituents, in general, were highest in autumn and winter calvings, while heifers and cows calving in summer months gave the lowest milk yield.

Results in Table 4 indicate that cows of Delta Misr farm1 produced the highest TDM followed by those of Delta Misr farm 2 while the lowest TDM was recorded by cows of Al-Salhia farm. Differences in performance among herds may reflect genetic back-ground and managerial practices be adopted in these herds. Moreover, in Al-Salhia farm, no selection for milk yield has been exercised in the last 15 years. Cows of this herd had been frequently subjected to a substantial fluctuation in concentrates available. These unfavorable conditions along with the possible inevitable inbreeding might result in such low level of production.

Changes of SCC and TDM across stage of lactation within parity:

Two groups were formed according to level of SCC in milk i.e. LE_{SCC} ($\leq 750*10^3$ cell / ml) and HE_{SCC} ($>750*10^3$ cell/ml). This analysis was performed for the whole data as well as within parity. Least-squares means (LSM) of somatic cell count ($E_{SCC}*10^3$)/ml of milk and TDM classified into lactational quarter year (LQY) classes within parity for low and high E_{SCC} are given in Table 5. The results indicated clearly that E_{SCC} increased progressively with advancing month of lactation up to the fourth quarter of year (10-12 mo) after calving. This trend is observable for all parities whether within the group with low E_{SCC} or the other group with high E_{SCC}. Similar results were given by Schutz *et al*. (1994) who observed that the curves of somatic cell count (first and later lactation) in Holstein cattle were decreased to the nadir during the first 90 days postpartum and increased steadily during the remainder course of lactation. Mohamed (1998) reported that the peak of SCC in milk was attained at the second month of lactation, decreased to its lowest level at the third month and increased through the fourth month of lactation. He attributed the high SCC at the beginning of lactation to excessive shedding of epithelial cells in a small amount of milk produced as the mammary gland resumes her function after a dormant period, and at the end of lactation due to the high concentration of cells in a small amount of milk yield as milk production decline (dilution effect).

Table 5. Least-squares means of expected somatic cell count (E_{SCC}*10^3/ml milk) and test-day milk yield (TDM) classified into lactational quarter year across parity for low and high E_{SCC} group

Traits/ Parity	Low somatic cell concentration (LE_{SCC})				High somatic cell concentration (HE_{SCC})			
	Lactational Quarter Year (months)							
	1-3	**4-6**	**7-9**	**10-12**	**1-3**	**4-6**	**7-9**	**10-12**
E_{SCC} *all*	575+13	535+24	861+52	957+73	851+102	986+129	1127+142	1404+261
1st	297+8	491+14	715+19	823+24	833+94	712+88	964+57	1115+120
2nd	328+11	497+13	849+21	925+42	842+101	873+91	1023+98	1326+131
3rd	364+14	541+25	867+37	963+58	859+97	994+109	1167+132	1451+124
4th	385+11	564+17	841+39	991+121	860+106	985+110	1181+84	1449+111
TDM *all*	12.2+2.1	18.7+3.5	27.4+4.2	19.15+4.6	9.7+3.8	13.3+5.7	19.6+6.3	11.6+6.4
1st	10.3+1.5	17.3+4.3	22.9+5.2	18.15+4.1	4.2+2.3	10.6+7.9	17.5+8.3	8.1+3.6
2nd	10.9+2.0	18.0+5.0	26.4+5.3	18.73+5.4	7.7+2.6	12.8+4.7	20.6+5.6	12.4+6.3
3rd	13.8+2.5	21.6+5.1	36.3+6.1	23.61+5.3	11.7+1.5	15.7+5.7	18.4+5.4	12.1+5.1
4th	15.4+3.5	25.9+5.4	29.5+6.5	21.15+4.0	8.7+2.6	10.8+4.9	12.3+7.1	7.1+4.2

LE_{SCC}: ≤750*10^3 cell / ml milk, HE_{SCC}: >750*10^3 cell / ml milk

Another clear trend could be detected from results in Table 5. Least-squares means for E_{SCC} within each class of stage of lactation tend to increase with progressing parity. As expected, older cows show usually higher E_{SCC}, as they become more and more susceptible to mastitis infection with advancing age. This result agrees with those reported by other workers concerning parity effect such as Schutz *et al*. (1995). Within the low somatic cell count group, the difference in E_{SCC} between the last lactational quarter of year (10-12 mo) and the first lactational quarter of year (1-3 mo) was not affected markedly by parity, where only small differences could be detected. However, the corresponding differences in the high somatic cell count group reflect obviously parity effect, where the differences between the two classes increased markedly with advancing parity from the first to the fourth parity. This result may suggest the existence of parity-stage of lactation interaction on E_{SCC}, especially when dealing with cows suffering from high incidence of mastitis measured on high level of E_{SCC} in milk. Within parity, TDM increased with progressing lactation from the first lactational quarter of year (1-3 mo) till the third lactational quarter of year (7-9 mo) and decreased thereafter showing a curve-linear fashion. This trend was true for all parities within both groups of milk somatic cell level in milk. Within all classes of stage of lactation, cows of the LE_{SCC} group produced markedly more TDM than the comparable cows of the HE_{SCC}. This reflects the depressive effect of the HE_{SCC} on the milk produced through the probable infection with mastitis in herds characterized by a HE_{SCC}. These results are in close agreement with those reported by Rupp and Boichard (2000).

Changes of E_{SCC} and TDM across different levels of SCC:

Changes in E_{SCC} and TDM among different levels of SCC and relative changes to overall mean are presented in Table 6. In general, TDM decreased with advancing

Table 6. Changes of expected somatic cell count (E_{SCC}) and test-day milk yield (TDM) among different levels of somatic cell count relative to overall mean within different farms

Farm	Range SCC*10^3	E_{SCC}*10^3			TDM		
		Average	Chg[1]	%Chg[2]	Average	Chg[1]	%Chg[2]
		1006			17.53		
	<500	342		34.00	18.25		104.11
Overall	>500-<1000	709	367.00	70.48	17.33	-0.92	98.86
	>1000-<1500	1131	422.00	112.43	12.61	-4.72	71.93
	>1500	1598	467.00	158.85	6.23	-6.38	35.54
Av Chg			418.67			-4.01	77.61
		1001			21.94		
Dunia	<500	351		35.06	32.61		148.63
	>500-<1000	709	358.00	70.83	28.64	-3.97	130.54
	>1000-<1500	1216	507.00	121.48	21.34	-7.30	97.27
	>1500	1713	497.00	171.13	12.34	-9.00	56.24
Av Chg			454.00			-6.76	
		1194			17.91		
Delta	<500	405		33.91	22.15		123.67
	>500-<1000	851	446.00	71.26	17.15	-5.00	95.76
	>1000-<1500	1398	547.00	117.06	18.24	1.09	101.84
	>1500	1961	563.00	164.20	15.33	-2.91	85.59
Av Chg			518.67			-2.27	
		942			17.51		
Delta Misr2	<500	215		22.82	24.16		137.98
	>500-<1000	697	482.00	73.99	18.26	-5.90	104.28
	>1000-<1500	1109	412.00	117.73	19.42	1.16	110.91
	>1500	1701	592.00	180.57	12.09	-7.33	69.05
Av Chg			495.33			-4.02	

Av Chg : Average change
Chg[1] = differences among sequence classes within group. ie. 709 - 342 = 367
Chg[2] = overall mean : classes ratio

level of milk somatic cell concentration. The amount of overall expected phenotypic reduction in TDM ranged from 0.92 to 6.38 kg/day. While the average reduction in TDM among different farms ranged from 2.27 to 6.76 kg/day. The average corresponding overall increase in E_{SCC} was 418,670 cells/ml milk. E_{SCC} among farms ranged from 351,000 to 1,713,000, 405,000 to 1,961,000 and 215,000 to 1,701,000 cells /ml milk for Dunia farm, Delta Misr farm number 1, and Delta Misr farm number 2, respectively. The highest reduction in TDM was in Dunia farm that showed the highest mean of TDM (21.94 kg/day). Average increases in E_{SCC} among different farms ranged from 454,000 to 518,670 cells/ml milk. Although Delta Misr farm number 1 and Delta Misr farm number 2 showed approximately the same TDM mean (17.9 vs. 17.5 kg/day), the reduction in this trait was halved in Delta Misr farm number 1 compared with Delta Misr farm number 2. This may reflect some differences in udder health management among both farms. In general, the highest increase in E_{SCC} was corresponded to the lowest TDM reduction (Delta Misr farm number 1). Therefore, the increase of E_{SCC} within Delta Misr farm number 1 could be mainly attributed to non-medical factors (non-mastitic cows).

Prediction equations for somatic cell count:

To predict SCC in milk three models were generated (Table 7). PE_{SCC}^{0} is the general model based on data of daily milk yield (DY), stage of lactation (Stg) and parity (Pr). PE_{SCC}^{Pr1} to PE_{SCC}^{Pr4} are models to predict SCC for each of the first four parities, based on daily milk yield and stage of lactation. PE_{SCC}^{Mo1} to PE_{SCC}^{Mo10} represented models to predict SCC across the first 10 months of lactation using daily milk yield only. Estimates of partial regression coefficients in different models have negative values. DY showed the highest partial regression coefficients in different equations. Expected reductions in SCC ranged from -52,550 to -66,660 cells /ml milk for each one kg increase in daily milk yield. Accuracy of SCC prediction using PE_{SCC}^{Pr1} was above 80% (the highest estimate) and ranged from 74.3% to 82.3% across the first four parities. Contributions of stage of lactation in expected SCC were very low in comparison with the effect of DY in different models. Therefore, using suitable PE_{SCC} depending on the available data, SCC could be predicted every day or at each milking without applying SCC test. This tool could also be used for monitoring the general udder health in very short time without additional effort and costs.

Table 7. Estimates of partial regression coefficients (b), (and their standard error), intercept for somatic cell count prediction

	General and parity coefficients of prediction equations				
	All data PE^0	**PE^{Pr1}**	**PE^{Pr2}**	**PE^{Pr3}**	**PE^{Pr4}**
Intercept	2119±1.48	2185±1.09	2102±2.70	2037±5.82	2132±2.72
b_{DY}	-59.94±0.09	-64.49±2.17	-59.71±6.12	-56.05±2.22	-61.55±0.13
b_{Stg}	-9.56±0.40	-7.51±0.18	-4.91±1.09	-5.07±1.08	-7.12±0.91
b_{Pr}	-19.43+2.07				
Accuracy	84.8	81.4	78.4	74.3	82.3
	Monthly (Mo) Coefficient prediction equations				
	PE^{Mo1}	**PE^{Mo2}**	**PE^{Mo3}**	**PE^{Mo4}**	**PE^{Mo5}**
intercept	2216±1.39	2130±1.23	2091±2.63	2021±4.12	1960±3.22
b_{DY}	-66.66±0.11	-60.75±0.74	-58.97±2.07	-55.11±1.14	-52.55±0.19
Accuracy	61.3	63.3	67.4	64.9	64.6
	PE^{Mo6}	**PE^{Mo7}**	**PE^{Mo8}**	**PE^{Mo9}**	**PE^{Mo10}**
intercept	998±1.62	998±2.04	1149±4.32	1201±3.63	2166±4.11
b_{DY}	-62.30±2.12	-59.40±1.17	-54.30±4.19	-55.60±2.21	-63.62±3.21
Accuracy	57.4	57.9	67.4	64.3	67.6

PE: prediction equation, DY: Daily milk yield, Stg: stage of lactation, Pr: parity

REFERENCES

Afifi, E. A., M. H. Khalil, and M. A. Salem, 1992. Evaluation of imported and locally-born Friesian cows raised in commercial farms in Egypt. I-Models and non-genetic effects. Egypt J. Anim. Prod., 29 :17-41.

Amin, A. A., 1998. Selection indexes for improving some productive and reproductive traits in dairy cattle. Ph. D. Thesis, Fac. Agric. Hungary. Godollo Uni.

Boldman, K. G., L. A. Kriese, L. D.Van Vleck, C.P. Van Tassell, and S.D. Kachman, 1997. A Manual for Use of MTDFREML. A set of programs to obtain estimates of variances and co-variances. U.S. Department of Agric., Agric. Res. Service.

Barillet, F.; R. Rupp, S. M. Grasteav, J. M. Astruc, and M. Jacquin, 1984. Genetic analysis for mastitis resistance and milk SCS in French dairy cattle. Genet. Sel. Evol., 28: 169-181.

Emanuelson, U. and J. Philipsson,1984. Studies on somatic cell counts in milk of Swedish dairy cows. II. Estimation of genetic parameters for monthly test-day results. Acta Agri. Scand., 34:45-53.

Farghaly, H. M., 2002. Comparison among different mathematical models of lactation curves to describe the somatic cell counts in Fleckvieh milk. Zagazig J. Agric. Res., 29: 211-228.

Gary, H., 1985. Standard methods for the examination of dairy products. 15th Edition. American Public Health Association. Washington, D. C. pp 246-248.

Liebe, A.; H. Worstorff, and D. Schams, 1996. Changes in somatic cell count and plasma cortisol concentration during three relocation trials in German Brown cows. Milchwissenschaft 51:423-426.

Miller, R. H., 1984. Traits for Sire Selection Related to Udder Health and Management. J. Dairy Sci., 67:459-471.

Mohamed, S. E., 1998. Inheritance of somatic cell count and its genetic relationship with productive traits in dairy cattle. M. Sc. Thesis, Fac. Agric. Zagazig Univ. Zagazig, Egypt.

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

Rodriguez, S Zas; D. Gianola, and GE. Shook, 2000. Evaluation of models for somatic cell score lactation patterns in Holsteins. J. Livestock Prod. Sci., 67:19-30.

Roger, B. and Peter, E., 1995. Mastitis control in dairy herds an illustrated and practical guide. 1st Edition. Farming Press Publications, United Kingdom.

Rogers, G. W.; G.L. Hargrove, T.J. JR Lawlor, and J.L. Ebersole, 1991. Correlations among linear type traits and somatic cell counts. J. Dairy Sci., 74: 1087-1091.

Rupp, R. and D. Boichard, 2000. Relationship of early first lactation somatic cell count with risk of subsequent first clinical mastitis. J. Livestock Prod. Sci., 62:169-180.

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

Schutz, M. M.; P.M. Van Radein, G.R. Wiggans, and H.D. Norman, 1995. Standardization of lactation means of somatic cell scores for lactation of genetic evaluations. J. Dairy Sci.,78: 1843-1854.

Soliman, A. M. and M.A. Khalil, 1993. Estimation of genetic parameters for single and composite milk trait in Fleckvieh cattle and their uses in programmers of early selection. Egypt. J. Anim. Prod., 30: 21-37.

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.

بعض العوامل المؤثرة على التركيز المرئى للخلايا الجسدية فى اللبن وإنتاج اللبن لعينة يوم الإختبار فى الهولستين فريزيان المربى فى مصر

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درس تأثير بعض العوامل لتقدير العلاقة بين إنتاج لبن (عينة يوم الإختبار) وتركيز الخلايا الجسدية فى أبقار الهولستين فريزيان المرباة تحت الظروف المصرية فى أربع مزارع هى الصالحية ودنيا بمحافظة الإسماعيلية ودلتا مصر رقم 1 ودلتا مصر رقم 2 فى محافظة المنوفية. اشتملت الدراسة على بيانات جمعت على 2811 بقرة لها مواسم إنتاجبة من الموسم الأول وحتى الرابع. تم تقدير تركيز الخلايا الجسدية فى اللبن من خلال التقديرات الخطية المرئية والتى تراوحت من صفر إلى 3. تم تحوير تركيزات الخلايا الجسدية الخطية إلى ما يقابلها من أعداد الخلايا الجسدية المتوقعة والتى تم استخدامها فى التحليل الإحصائى فى صورة تقدير الخلايا الجسدية.

وقد أظهرت النتائج أن التأثير العشوائى المباشر للحيوان كان له تأثيراً واضحاً على تباين صفة الإنتاج اليومى للبن ومسئولا جزئيا عن تباين مستوى الخلايا الجسدية فيه. وتشير هذه النتائج إلى وجود تباين وراثى لهذه الصفات مما يدل على إمكانية التحسين الوراثى للصحة العامة للضرع وإنتاج اللبن من خلال إستراتيجية التحسين الوراثى المناسبة .

تراوحت المتوسطات العامة لإنتاج اللبن وعدد الخلايا الجسدية المتوقعة فى يوم الاختبار بين 10.1 إلى 27.9 كجم /يوم و 575 ألف إلى مليون و 404 ألف خلية جسدية / ملى لبن على التوالى . أعلى إنتاج للبن اليومى كان 21.7 كجم /يوم وذلك فى الموسم الثالث. تراوحت أعداد الخلايا الجسدية المتوقعة بين 575 إلى 957 ألف خلية/ ملى لبن و 851 الى 1404 الف خلية / ملى لبن وذلك فى مجموعتى الخلايا الجسدية المنخفضة والمرتفعة على التوالى.

وقد أوضحت النتائج أن العمر عند الولادة وترتيب موسم الحليب إحتلا من حيث الأهمية المرتبة الثانية فى التأثير على تباين إنتاج اللبن اليومى وتقديرات الخلايا الجسدية المتوقعة. قدر التغير فى إنتاج اللبن وعدد الخلايا الجسدية عند مستويات مختلفة من العدد المرئى للخلايا الجسدية. كان هناك بصفة عامة تناقص فى إنتاج اللبن اليومى مع زيادة مستوى أعداد الخلايا الجسدية المتوقعة فى اللبن مما يشير إلى علاقة سالبة بينهما. كان المتوسط العام لانخفاض إنتاج اللبن اليومى 4.01 كجم / يوم وفى المقابل كان متوسط الزيادة فى أعداد الخلايا الجسدية هو 418670 خلية لكل ملى لبن.

تم إستخراج بعض المعادلات الخطية للمساعدة على التنبؤ بمستوى أعداد الخلايا الجسدية فى اللبن باستخدام بعض المعلومات مثل إنتاج اللبن اليومى، عدد أيام الحليب ، ترتيب موسم الحليب. والمعادلة العامة للتنبؤ كانت:
أعداد الخلايا الجسدية فى اللبن = 2119 -59.49* إنتاج اللبن اليومى – 9.56*عدد أيام الحليب – 19.43*ترتيب موسم الحليب. ومن الممكن استخدام هذه المعادلات للتنبؤ تحت الظروف السائدة فى المزارع المحلية لأبقار الهولستين فريزيان وفد تراوحت دقة التنبؤ باستخدام هذه المعادلة بين 57.4 إلى 84.8%.