Egyptian J. Anim. Prod.(1994) 31(1):65-84.

GENETIC ASPECTS AND ADJUSTMENT FACTORS FOR LACTATION TRAITS OF FRIESIAN CATTLE RAISED IN EGYPT

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SUMMARY

Genetic analysis of lactation traits in Friesian cattle was carried out on data of 4849 records of 1644 cows sired by 254 bulls. Yields of milk of 305-day (305 MY) and total lactation (TMY) and length of lactation (LP) and dry period (DP) were the traits examined. Two methods of gross comparison (GC) and polynomial regression analysis (PRA) were used to calculate different sets of multiplicative factors to standardize milk yield of Friesian cattle to mature equivalent basis and to minimize environmental variation due to days open.

Means of 305 MY, TMY, LP and DP were 2384 Kg, 2577 Kg, 322 days and 83 days, respectively. Effects of year and season of calving, age at calving and days open were generally significant source of variation for milk traits studied. A curvilinear relationships for age of cow could be fitted on the data of milk yield of Friesian cattle raised in Egypt. All lactation traits increased in a curvilinear manner (P<0.01) with the increase of days open. Age correction factors constructed by GC and PRA method had similar trend and they did not exhibit large differences between consecutive classes of calving at older ages, while they showed relatively large differences between consecutive classes at younger ages. Differences in age factors were consistent across 305 MY and TMY and consequently factors used for adjusting 305 MY could be applied to TMY without substantial loss in accuracy. For age factors of 305 MY and TMY, absolute difference of about 0.2 between GC and PRA methods was recorded and consequently PRA could be recommended. Consistent trends for days open correction factors were detected where they tend to decrease with the increase of days open.

Days open correction factors constructed by GC and PRA methods did not exhibit large differences and they reflected similar trend, i.e. either of the two methods can remove the effect of days open on milk yield. Heritability estimates (h^2) for yield traits (305 MY and TMY) were moderate, while estimates for lactation intervals (LP and DP) were low. Repeatabilities of consecutive and nonconsecutive lactations indicated that first parity was more effective in predicting performance of third parity relative to the third parity itself.

Keywords: Friesian cattle, milk traits, adjustment factors, genetic analysis

INTRODUCTION

In order to improve milk productivity of a herd of cattle through cow and sire evaluation, there is a need to compare the yields of different cows after standardizing their records to the same basis. Accordingly, investigation on methods of estimating the correction factors to adjust milk records for non-genetic factors (e.g. age of cow and days open) seemed to be important. In Egypt, Galal et al. (1974) using gross comparison, second degree polynomial regression analysis and paired comparison methods concluded that the three methods succeeded in removing the dependence of milk production on age and they were not significantly different from each other in that regard. Other Egyptian studies (Abdel-Aziz and Hamed, 1979; Khattab and Ashmawy, 1990; Khalil et al., 1992) estimated different sets of correction factors using different methods and they have recommended to correct lactation records for age at calving and concurrent days open. In this respect, Khalil et al. (1992) with two commercial Friesian herds raised in Egypt concluded that the correction factors of third degree polynomial regression analysis (PRA) were more effective in correcting lactation records for age compared to gross comparison (GC) method. They added also that PRA correction factors of days open based on modal class or maximal production were closely similar in their efficiency to correct milk yield for days open.

Estimating of repeatability, heritability and age and days open correction factors for milk traits of Friesian cattle raised in Egypt at Sakha station in the northern part of Nile Delta was the main objective of this study.

MATERIAL AND METHODS

Data

This work was carried out using the productive and reproductive records of a Friesian herd raised at Sakha Farm, Animal Production Research Institute, Ministry of Agriculture, Egypt. Animals were kept under a regular system of feeding and management adopted by the institute. During winter and spring months (from December to May), animals were fed ad libitum on Berseem (*Trifolium alexandrinum*). During summer and autumn months (from June to the end of November), animals were fed on dry concentrate mixture according to their weight and production in addition to Berseem hay and rice or wheat straw.

Heifers were inseminated when they reached about 300 kg live body weight and cows were inseminated during the 1st heat period after two months post-partum. Cows that failed to conceive were rebred in the next heat period. Breeding cows were artificially inseminated using semen of bulls chosen and evaluated according to semen characteristics. Data on 4849 lactation records of 1644 cows sired by 254 bulls were collected over a period of 27 years started by 1963. Traits included 305-day milk yield (305 MY), total milk yield (TMY), lactation period (LP) and dry period (DP).

Statistical models

Data were analysed using Harvey's (1990) mixed model computer program. Records of cows were grouped into age subclasses of 3-month interval (about 24 classes) while they were grouped into 11 days-open subclasses of 20-day interval starting from 30 days. Data of all lactations were analysed by fitting the effects of year and season of calving, age at calving and days open as fixed effects and sire and cow within sire as random effect. It was not possible to examine simultaneously year by season interaction, because the equations for estimation would have involved a matrix too large to invert. Also, the limited number of records or their absence in some subclasses, did not permit the inclusion of such interaction.

Age and days open correction factors for lactation traits were firstly constructed by smoothing the curve representing the relationship between least-squares means of milk yield (305 MY and TMY) and classes of age or days open using third degree polynomial regression analysis (PRA). The partial cubic regression coefficient of 305 MY and TMY on age or days open were not significant, therefore, both linear and quadratic relationships were only considered. The prediction equations of adjusted 305 MY or TMY were estimated as:

$$Y= \mu+ b_L(X-\mu_X)+ b_Q(X-\mu_X)^2+ b_C(X-\mu_X)^3 \quad \ldots\ldots\ldots (1)$$

Where Y= the predicted value of 305 MY or TMY; μ= overall least- square mean of a given lactation trait (adjusted for effects included in the model); b_L, b_Q and bC= estimates of partial linear, quadratic and cubic regression coefficients of 305 MY or TMY on age or days open; X= age or days open, and μ_X= usually equal to mean of age or days open. The multiplicative factor was calculated as: $C= \mu/\mu'$, where C= the multiplicative correction factor; μ= the least-square mean of 305 MY or TMY at modal class (the most frequent class) and μ'= the predicted average of milk at each class of age or days open.

Age and days open correction factors for 305 MY and TMY were secondly constructed using gross comparison method (GC), i.e. by fitting the second degree polynomial regression of age or days open into milk production as:

$$Y_i= \mu+ b_L(X_i-\mu_{Xi})+ b_Q(X_i-\mu_{Xi})^2+ e_i \quad \ldots\ldots \quad (2)$$

Where Y_i= milk production at ith age or days open interval, μ= overall mean adjusted for effects included in the model, b_L & b_Q= estimates of partial linear and quadratic regression coefficients of a given milk trait on age or days open, X_i= subclass of ith age (in months) or days open, μ_{Xi}= usually equal to mean of age or days open and e_i= an error term. Then the first derivatives

of $Y_i= \mu+b_L(X_i-X_\mu)+ b_Q(X_i-X_\mu)^2$ with respect to X was

obtained and the resulting equation set to zero to find X at which Y is maximum. Different sets of age and days open correction factors for 305 MY and TMY using gross comparison method were constructed as $C_i= Y_m/Y_i$, where Y_m= the predicted average of milk at maximum production and Y_i= the least-square mean of 305 MY and TMY at each class of age or days open.

Henderson method 3 was utilized to estimate the genetic and phenotypic variance and covariance components for the different traits, i.e. sire (σ^2_S), cow within sire ($\sigma^2_{C:S}$) and remainder (σ^2_e). Heritabilities were estimated by the paternal half-sib method as:

$$h^2 = 4\sigma^2_S/(\sigma^2_S+ \sigma^2_{C:S}+ \sigma^2_e).$$

Cows were not required to have three lactations to be evaluated (Hansen et al., 1983). For early selection or culling policies, data of the first three lactations were used, therefore, to estimate repeatabilities of milk traits in two consecutive parities (i.e. first and second parities or second and third parities) or not consecutive ones (i.e. first and third parities). Repeatability was estimated as:

$$t= (\sigma^2_S+\sigma^2_{C:S})/ (\sigma^2_S+\sigma^2_{C:S}+\sigma^2_e).$$

Approximate standard errors for heritability and repeatability were computed by the LSMLMW program of Harvey (1990).

RESULTS AND DISCUSSION

Means

Means of uncorrected records of different lactation traits are given in table 1. Means reported here for 305 MY (2384 kg) and TMY (2577 kg) were higher than those means reported for Friesian cattle raised in Egypt by Arafa (1987), while they are lower than those reported by Mohamed (1987) and Afifi et al. (1992a). For subtropical Arabian countries, El-Tawil et al. (1977) with Friesian in Iraq and Mansour (1992) with Holstein Friesian in the Kingdom of Saudi Arabia reported higher means than those obtained here. However, low milk yield of Friesian cows during the earlier period after importation may reflect the source of importation and may be due to the heat stress to which lactating cows were exposed since they need some time to adapt in subtropical and semi-arid areas.

Table 1. Means[+], standard deviation (SD) and coefficients of variations (CV) for milk traits in Friesian cattle

Trait	Mean	SD	CV%
305 MY (Kg)	2384	798	20.6
TMY (Kg)	2577	966	24.0
LP (days)	322	77	18.4
DP (days)	83	92	72.5

+ Number of records used was 4849.

In terms of lactation intervals, mean of LP reported here (322 days) for Friesian falls within the range of Egyptian reports (Mohamed, 1987; Afifi et al., 1992a). While, mean of DP (83 days) is shorter than those of Friesian cattle reported by most of the Egyptian studies (e.g. Arafa, 1987; Mohamed, 1987; Khattab and Ashmawy, 1988).

Variation

Coefficients of variation (CV) for different milk traits are presented in Table 1. Lower phenotypic variation in days of milk (LP) comparable to variation in yield of milk is an indicative to the role of temporary environment influences LP. Regarding to the high estimate of CV for DP (72.5%), it could be stated that DP is mostly governed by environment and management of the herd which could bring down the DP in Friesian cattle in Egypt. There is apparently greater phenotypic variability in DP as compared to lactation yield and length; indicating that a little role of temporary environment influences lactation traits and length. This confirms the same trend obtained for Friesian cattle raised in Egypt (Mohamed, 1987; Khattab and Ashmawy, 1988; Afifi et al., 1992a).

Non-genetic aspects

All main fixed effects included in the model were significant sources of variation for different traits studied except the effect of season of calving on 305 MY and TMY (Table 2). F-ratios presented in table 2 indicate that DO and age are considered the major factors influencing (P<0.01 or P<0.05) 305 MY, TMY, LP and DP. Afifi et al. (1992a) came to the same conclusion using another data set from commercial Friesian herds. This leads to conclude that adjusting of lactation records for age and days open is very necessary for sire evaluation.

Table 2. F-ratios+ of least-squares analysis of variance for milk traits in Friesian cattle

Source	df	305 MY	TMY	LP	DP
Sire	253	2.0	1.9	1.6	1.5
Cow within sire	1390	3.0	3.0	1.7	1.3
Year of calving	27	12.9	4.4	4.7	4.7
Season of calving	3	0.2ns	1.1ns	4.0	2.3
Age at calving	23	6.7	4.0	1.8	7.1
Days open	10	3.4	16.0	59.2	73.8
Remainder df	3142				
Remainder mean squares	258351	393767	3449	569	

+ns=non-significant (P>0.05), other F-ratios are significant at P<0.05 or P<0.01 or P<0.001.

Least square means of each individual class of year or age or days open are too numerous to be reported here. During the later years of the study, cows give more milk than earlier years. The clear differences between least-square means obtained here for lactation traits in different age or days open classes indicate the need to adjust lactation yield for age and days open. In this respect, Abdel-Aziz and Hamed (1979) reported that adjustment of milk records for age is necessary to compare the genetic merits of cows in different ages.

The wide variation in least-square means for milk yield obtained in the present study for different days open classes lead also to state that it is necessary to adjust milk traits for days open. Schaeffer and Henderson (1972) concluded that adjustment of milk production records for days open would not involve genetic influences, since the heritability of days open is very low and essentially zero.

Results of third degree polynomial regression analysis of different traits on age at calving and days open are presented in table 3. These partial regression coefficients showed curvilinear relationships ($P<0.01$ or $P<0.001$) between milk yield and age at calving. Accordingly, curvilinear relationships for age of cow could be fitted on the data of milk yield of Friesian cattle raised in Egypt. Many investigators (e.g. Neimann-Sorensen et al., 1987; Soliman et al., 1989; Khalil et al., 1992) reported that the partial linear, quadratic and cubic regression coefficients of milk yield on age at calving were significant.

The partial linear, quadratic and cubic effects of age at calving on interval traits (i.e. LP and DP) were significant (Table 3). Similarly, Janson (1980) and Afifi et al. (1992a) reported that differences in ages at calving were significant for LP and DP.

Significant partial linear and quadratic or cubic regression coefficients given in table 3 showed that all milk (305 MY and TMY) and interval (LP and DP) traits increased in a curvilinear fashion ($P<0.01$) with the increase of days open. Smith and Legates (1962) attributed such curvilinear trend to the competition between milk production of the cow and the nutrition of her fetus especially at the 5th month of pregnancy. They also added that it might be due to the negative association between the milk secretion hormones and the stage of pregnancy. This trend of curvilinear relationship between milk traits and DO was also confirmed by other reviewed Egyptian reports (Mohamed, 1987; Khattab and Ashmawy, 1988; Afifi et al., 1992a). On the other hand, a simple linear relationship between days open and milk traits was observed by Camoens

Table 3. Estimates of third degree polynomial regression analysis of different milk traits on age and days open

Trait	Age at calving						Days open					
	Linear		Quadratic		Cubic		Linear		Quadratic		Cubic	
	b	SE	b	SE	b	SE	b	SE	b	SE	b	SE
305 MY,Kg	12.4***	1.4	-0.18***	0.03	-0.0012	0.002	0.52***	0.15	-0.006*	0.003	-0.00005	0.00006
TMY, Kg	10.5***	1.7	-0.15***	0.04	0.0003	0.002	2.05***	0.19	-0.016***	0.004	-0.00001	0.00067
LP, days	-0.3*	0.2	0.01**	0.003	0.0003*	0.0002	0.40***	0.02	0.003***	0.0003	0.00004	0.000007
DP, days	1.2***	0.2	-0.04***	0.004	0.0009***	0.0002	0.54***	0.23	0.003***	0.0004	0.00001	0.00001

*= P<0.05, **=P<0.01, ***= P<0.001.

et al. (1976) for Holstein- Friesian and by Soliman et al. (1989) for Pinzgauer cattle. Such unfavourable associations between days open and milk traits may have causes other than purely genetic ones. Blau and Scholz (1982) reported that the delaying of days open may be caused by several factors, e.g. the farmer's decision and selection policy. Accordingly, the farmers were to inseminate high-yielding cows later than moderate or low-producing cows. This could produce an antagonistic relation between milk traits and days open (Distl et al., 1985). Moreover, it is possible that high producing cows will be afforded more chances of conceiving than low-producing cows (Soliman and Khalil, 1991).

Age correction factors

Age-correction factors are usually calculated to convert the production of the cow at a certain age to mature equivalent base. Second degree polynomial regression equations used in calculation of gross comparison method (GC) were:

$$Y= 1132+33.44X-0.18X^2 \text{ for 305 MY,}$$

$$Y= 1482+28.05X-0.15X^2 \text{ for TMY.}$$

Age at maximum production used in estimation of correction factors derived by GC method was calculated at X= 92.91 and 93.5 months for 305 MY and TMY, respectively. The predicted estimates of maximum production (after substituting for X) are 2685 and 2794 kg for 305 MY and TMY, respectively.

Age correction factors for 305 MY and TMY are presented in table 4. These estimates indicated that age-correction factors for milk yield of young cows (less than 30 months) were higher than older ones (more than 80 months). This trend was similar to that obtained by other investigators working on Friesian cattle in Egypt (Galal et al., 1974; Khattab and Ashmawy, 1990; Khalil et al., 1992). The mature equivalent factors from this study show also a rapid decline for ages of the young cows relative to the gradual decline for ages of the older cows, i.e. factors did not exhibit large differences between consecutive classes of calving at older ages while they show relatively large differences between consecutive classes at younger ages. This higher increments at younger ages may be due to that culling of cows at younger ages (in the first three lactations) was mainly performed on the basis of fertility and health. The rather high age correction factors for early calved heifers and cows for 305 MY and TMY traits were not expected especially for animals that calved at less than 24 months. The small number of animals that calved at early ages could be the main cause in this respect. Also, small number of records associated with age classes at older ages makes comparison between classes at older ages less reliable.

The differences in age correction factors were consistent across traits of the present study (Table 4). Therefore, factors used for adjusting 305 MY could be applied to TMY without substantial loss in accuracy. Similar trend was observed by Khalil et al. (1992).

Days-open correction factors

A modal value of 50 days open period is obtained in the present study, i.e. an open period of 50 days is effective for economic production (in terms of short calving interval and maximum lifetime) in Egypt. This figure indicates that Friesian cows raised in Egypt should be mated as early as possible for maximum production. Second degree polynomial regression equations used in calculation of GC method were:

$$Y= 2303+ 2.08X- 0.006X^2 \quad \text{for 305 MY,}$$

$$Y= 2073+ 6.25X+ 0.016X^2 \quad \text{for TMY.}$$

Days open at maximum production used in calculation of correction factors derived by GC method was estimated at X= 173 and 195 days for 305 MY and TMY, respectively. The predicted estimates of maximum production after substituting for X are 2483 and 2794 Kg for 305 MY and TMY, respectively.

Multiplicative days open correction factors of 305MY and TMY are presented in Table 5. As expected, these factors indicate that correction factors for milk yield decreased with the increase of days open. In Egypt and for Friesian cattle, Khattab and Ashmawy (1988) and Afifi et al. (1992a) reported the same trend.

Table 4. Age correction factors for 305-day (305 MY) and total (TMY) lactation of Friesian cattle derived by methods of Gross comparison (GC) and Polynomial regression analysis (PRA)

Age class (months)	N	305 MY GC	305 MY PRA	305 MY Difference	TMY GC	TMY PRA	TMY Difference
<24	43	1.466	1.357	0.109	1.350	1.267	0.083
25-27	177	1.411	1.313	0.098	1.311	2.235	0.076
28-30	1049	1.361	1.273	0.088	1.276	1.207	0.069
31-33	450	1.317	1.238	0.079	1.245	1.182	0.063
34-36	265	1.277	1.206	0.071	1.216	1.159	0.057
37-39	299	1.242	1.178	0.064	1.190	1.137	0.053
40-42	343	1.210	1.152	0.058	1.166	1.118	0.048
43-45	303	1.182	1.129	0.053	1.145	1.101	0.044
46-48	248	1.156	1.109	0.047	1.125	1.086	0.039
49-51	246	1.133	1.091	0.042	1.107	1.072	0.035
52-54	246	1.133	1.091	0.042	1.107	1.072	0.032
55-57	192	1.095	1.060	0.035	1.083	1.048	0.035
58-60	187	1.078	1.048	0.030	1.064	1.038	0.026
61-63	152	1.063	1.037	0.036	1.053	1.030	0.023
64-66	131	1.051	1.028	0.023	1.042	1.022	0.020
67-69	87	1.040	1.020	0.020	1.033	1.015	0.018
70-72	65	1.030	1.013	0.017	1.025	1.011	0.014
73-75	52	1.022	1.008	0.014	1.018	1.004	0.014
76-78	47	1.015	1.004	0.011	1.013	1.003	0.010
79-81	27	1.009	1.002	0.007	1.008	1.001	0.007
82-84	39	1.005	1.000	0.005	1.005	1.000	0.005
85-87	24	1.002	1.000	0.002	1.002	1.000	0.002
88-90	37	1.001	1.000	0.001	1.001	1.000	0.001
>91	149	1.000	1.003	0.003	1.000	1.003	0.003

Table 5. Days open correction factors for 305-day (305 MY) and total lactation (TMY) of Friesian cattle derived by methods of Gross comparison (GC) and Polynomial regression analysis (PRA)

Open-period class (days)	N	305 MY GC	305 MY PRA	305 MY Difference	TMY GC	TMY PRA	TMY Difference
<24	345	1.052	1.055	0.003	0.982	0.979	0.003
31-50	1100	1.038	1.040	0.002	0.990	0.992	0.002
51-70	858	1.026	1.028	0.002	0.999	0.993	0.006
71-90	520	1.017	1.019	0.002	0.999	0.999	0.000
91-110	267	1.010	1.011	0.001	0.991	0.994	0.003
111-130	250	1.004	1.005	0.001	0.979	0.983	0.004
131-150	204	1.001	1.002	0.001	0.960	0.966	0.006
151-170	224	1.000	1.000	0.000	0.937	0.944	0.007
171-190	166	1.001	1.000	0.001	0.909	0.917	0.008
191-210	261	1.003	1.003	0.000	0.879	0.888	0.009
>211	648	1.008	1.007	0.001	0.846	0.855	0.009

Evaluation of the two methods of correction-factors estimation

Age correction factors obtained by gross comparison method (GC) and those obtained by polynomial regression analysis (PRA) exhibited large differences and they reflected a similar trend (Table 4). However, magnitude of age correction factors constructed by GC method is relatively higher than those computed by the PRA method at all ages studied. For the same two methods and for another set of Friesian cattle raised in Egypt, Khalil et al. (1992) observed that these two methods were successful in removing the effect of age on milk production. In this reviewed study, estimates of R^2 obtained from using GC and PRA procedures show that $1-R^2$ of PRA were lower than those estimates of R^2 of GC method ($1-R^2$ of 305 MY and TMY were 0.33 and 0.35 for PRA vs 0.44 and 0.43 for GC). Such evaluation of the two methods leads to conclude that PRA is more efficient in correcting lactation records for age than GC method. Cooper and Hargrove (1982) stated that absolute difference of at least 0.05 was considered large enough to warrant separate sets of correction factors at any stage of milk production curve. In the present study and for both 305 MY and TMY, about 0.2 absolute difference between the two methods were recorded and consequently PRA method could be recommended. Comparison of the present GC and/or PRA age correction factors with those factors of other Egyptian studies on Freisian (Galal et al., 1974; Khattab and Ashmawy, 1990; Khalil et al., 1992) show that an agreement between present and reviewed factors at all ages was observed except at younger ages (<35 months) where they widely differed.

The multiplicative DO correction factors obtained by the two methods of estimation (GC and PRA) are nearly similar in magnitude and trend, i.e. either of the two methods can remove the effect of days open. With another set of Friesian records (Khalil et al., 1992), DO correction factors obtained here by PRA method comparable with those estimates of such data indicate that an average deviation of 0.04 was observed and consequently the two sets of DO correction factors of the present study could be effective in removing the effect of DO on milk production.

Sire and cow effects

Sire was found to have significant ($P<0.05$ or $P<0.01$) effects on all milk traits (Table 2). These results are in agreement with those reported in the literature (Singh et al., 1987; Soliman and Khalil, 1989; Soliman et al., 1990). As expected, all lactation traits were affected ($P<0.001$) by cow-within-sire (Table 2). However, variances among cows in different traits may be due to sizable differences in genetic potentiality of lactating cows along with some changes in the herd management (Camoens et al., 1976). Similar to the present results, Soliman and Khalil (1989) and Khalil et al., (1992) reported that cow effects on milk yield and/or LP were significant ($P<0.01$ or $P<0.001$). In practice, the present and reviewed studies indicate that through sire and cow selection for milk traits, a genetic improvement of such traits is possible.

Variance components and heritability estimates

Estimates of variance component, percentages of variance attributable to the sire and cow-within-sire components (V%) and heritabilities (h^2) for different traits are presented in table 6. Slight differences in sire component of variance were observed between 305 MY and TMY in one hand and between LP and DP in the other hand. However, the sire contribution ranged from 3.0 to 8.9 % for such traits. The sire component of variance (σ^2_S) for 305MY and TMY were 8.9 and 7.9 %, respectively. These estimates fall within the range reported by Soliman and Khalil (1989), Soliman et al. (1990) and Afifi et al. (1992a) who obtained an estimate of 12.5%, 10.1% and 5.8 to 10.4%, respectively. The sire components of variance for lactation interval traits were 4.2% for LP and 3.0% for DP. Estimate of LP was higher than 1.2% obtained by Soliman and Khalil (1989) for Braunvieh cattle.

Heritability estimates (h^2) based on paternal half-sib for yield traits were moderate, while they were low for lactation intervals (Table 6). These estimates are in full agreement with those estimates reviewed for Friesian cattle raised in Egypt (e.g. Ragab et al., 1973; Afifi et al., 1992b). Heritabilities of DP and LP were 0.12 and 0.17 and therefore variation other than additive genetic accounted for 83 % to 88 % of variance in these lactation intervals. Because of low heritabilities for lactation intervals relative to yield traits, selection index based on paternal half-sister groups did not allow lactation intervals to play a major role in selection programmes. Opportunities probably exist to improve lactation intervals when poor herd fertility is prevalent. However, most variations in yield traits are dependent on herd management. If satisfactory environments can be provided for dairy cows to express genetic potential for yield traits, then it also could be possible to provide adequate environments for acceptable lactation intervals and fertility. In practice, lactation intervals could be monitored as selection criteria for yield progress to detect possible changes in phenotypic and genetic associations between milk yield and lactation intervals (Soliman and Khalil, 1991).

Table 6. Estimates of variance component $(\sigma^2)^+$, proportions of variation (V%) and heritabilities (h^2) and repeatabilities (t) for milk traits of Friesian cattle

Trait	Sire		Cow within sire		Remainder		h^2±SE	t±SE
	σ^2	V%	σ^2	V%	σ^2	V%		
305MY	42719	8.9	178527	37.2	258351	53.9	0.361±0.055	0.46±0.012
TMY	56838	7.9	266842	37.2	393767	54.9	0.320±0.051	0.45±0.018
LP	184	4.2	800	18.0	3449	77.8	0.170±0.039	0.22±0.017
DP	194	3.0	494	7.7	5696	89.2	0.120±0.035	0.11±0.015

+Sire, cow and remainder degrees of freedom were 253, 1390 and 3142, respectively.
*= P<0.05, **= P<0.01, and ***= P<0.001.

Repeatability estimates

Table 7 shows repeatabilities of milk traits. Estimates for first and second parities were higher than for second and third parities for milk yields and LP; possibly effects of permanent environment decreases slightly with advance of age. This means that records of the first parity was superior in predicting lactation performance of third parity relative to records of the third parity itself. In this respect, Hansen et al.

(1983) reported that repeatabilities for first and third parities were higher than for second and third parities for milk yield at 120, 180 and 305 days of lactation, i.e. first parity is more effective than second parity in predicting milk yield in third parity.

The lactation interval of DP had low repeatabilities (Table 7), which is an indicative of little additive genetic variance. The estimates ranged from 0.02 to 0.17. Such low estimates suggesting that shorter DP in one lactation may not be repeatable in subsequent lactations. However, these small repeatabilities could represent only effects of permanent environment.

Table 7. Repeatabilities (t) and their standard errors (SE) for milk traits in two consecutive parities (parity 1 & parity 2 and parity 2 & parity 3) and not consecutive parities (parity 1 & parity 3)

Trait	Parity 1,2	Parity 1,3	Parity 2,3
	t±SE	t±SE	t±SE
305MY	0.45±0.018	0.50±0.021	0.48±0.026
TMY	0.57±0.017	0.54±0.020	0.48±0.027
LP	0.48±0.019	0.53±0.020	0.34±0.029
DP	0.04±0.018	0.02±0.021	0.17±0.029

REFERENCES

Abdel-Aziz, A.S. and M.K. Hamed, 1979. The effect of region, season and year of calving on complete milk record of Egyptian buffaloes. Egyptian J. Anim. Prod., 19 (2): 227.

Afifi, E.A., M.H. Khalil and M.A. Salem, 1992a. Evaluation of imported and locally-born Friesian cows raised in commercial farms in Egypt. I. Models and Non-genetic effects. Egyptian J. of Anim. Prod., 29 (1): (In press).

Afifi, E.A., M.H. Khalil, M.F. Abd El-Glil and Z.A. Sultan, 1992b. Estimation of genetic parameters and sire values for milk production of Friesian cattle raised in Egypt. Egyptian Journal of Animal Production, 29(2): (In press).

Arafa, Samira, A., 1987. The effect of crossing Egyptian cattle with exotic breeds on some production traits. M.SC. Thesis, Fac. Agric., Moshtohor, Zagazig Univ., Egypt.

Blau, G. and H. Scholz, 1982. Zu Beurteilung von Kurzlaktationen bei der Zuchtwertschätzung. Züchtungskunde 54: 173.

Camoens, J.K., R.E. McDowell, L.D. Van Vleck and J.D. Rivera Anaya, 1976. Holstein in Puerto Rico: I. Influence of herd, year, age and season on performance. J. Agric. of the Univ. of Puerto Rico., 4: 526.

Cooper, J.B. and G.L. Hargrove, 1982. Age and month of calving adjustments of Holstein protein, milk and fat lactation yields. J. Dairy Sci., 65: 1673.

Distl, O., H. Rosch and Krausslich 1985. Beziehungen zwischen Milchleistungs- und FruchtbarKeits-Parametern beim Deutschen Fleckvieh in Gebiet der Besamungsstation MEGGLE unter Berucksichtigung der Abgangsrate. Züchtungskunde 57: 309.

El-Tawil, E.A., K.H. Juma and M.H. Ali, 1977. Evaluation of the factors affecting milk production from purebred and crossbred Friesian cattle in Iraq. J. Agric. Sci.,12: 175.

Galal, E.S.E., F.D. Quawasmi and S.S.Khishin, 1974. Age correction factors for Friesian cattle in Egypt.Z. Tierzüchtg. Züchtgsbiol., 91: 25.

Hansen, L.B., A.E. Freeman and P.J. Berger, 1983. Variance, repeatabilities and age adjustments of yield and fertility in dairy cattle.J. Dairy Sci.,66: 281.

Harvey, W.R., 1990. User's Guide for LSMLMW. Mixed model least squares and maximum likelihood computer program. PC-2 version. Ohio State Univ., Columbus, USA (Mimeograph).

Janson, L., 1980. Studies of fertility traits in Swedish dairy cattle. I. Effects of non-genetic factors. Acta Agric. Scand, 30: 109.

Khalil, M.H., E.A. Afifi and M.A. Salem, 1992. Evaluation of Imported and Locally-born Friesian cows raised in commercial farms in Egypt. 2. Evaluation of correction factors and of some genetic effects. Egyptian J. of Anim. Prod., 29 (2): (In press).

Khattab, A.S. and A.A. Ashmawy, 1988. Relationships of days open and days dry with milk production in Friesian cattle in Egypt. J. Anim. Breed. Genet., 105: 300.

Khattab, A.S. and A.A. Ashmawy, 1990. Factors for standardizing 305-day lactation records of Friesian cows for age at calving. Egypt. J. Anim. Prod., 27 (2): 161.

Mansour, H., 1992. Age and month of calving adjustment factors of 305 day milk yield for Holstein Friesian in the Kingdom of Saudi Arabia. Annals Agric. Sci., Ain Shams Univ., Cairo, 37 (1): 95.

Mohamed, S.S., 1987. Milk production as affected by calving interval and service period in purebred and crossbred Friesian cows in Egypt. M.Sc. Thesis., Fac. Agric., Ain Shams Univ., Cairo, Egypt.

Neimann-Sorensen, A., J. Pedersen and G. Christensen, 1987. Milk protein as breeding objective in Danish cattle breeding. J. Anim. Breed. Genet. 104:74.

Ragab, M.T., A.S. Abdel-Aziz and H.M. Morad, 1973. Phenotypic and genetic parameters of some productive traits in a herd of Friesian cattle at the Tahreer Province. Egyptian J. Animal Production, 13(1): 1.

Schaeffer, L.R. and C.R. Henderson, 1972. Effect of days dry and days open on Holstein milk production. J. Dairy Sci., 55: 107.

Singh, A., G.M. Taylor and B.N. Singh, 1987. Factors affecting some reproductive and productive traits in Malvi cattle. Dairy Sci. Abstr., 49(1): 33.

Soliman, A.M. and M.H. Khalil, 1989. Milk protein as a breeding objective in Braunvieh cattle breeding. Third Egyptian-British conference on Animal, Fish and Poultry Production, Alexandria, 7-10 October, 1989., pp. 301-316, Egypt.

Soliman, A.M. and M.H. Khalil, 1991. Genetic and phenotypic associations of milk traits with age at calving and with length of open period, dry period and lactation. Egyptian Journal of Animal Production, 28(2): 19.

Soliman, A.M., A.A. Ashmawy, M.H. Khalil and A. Essl, 1989. Analysis of milk production traits of Pinzgauer cattle in Austria. I. Non-genetic factors. J. Anim. Breed. Genet.,106: 423.

Soliman, A.M., A.A. Ashmawy, M.H. Khalil and A. Essl, 1990. Analysis of milk production traits of Pinzgauer cattle in Austria. II. Genetic parameters. J. Anim. Breed. Genet., 107: 43.

Smith, J.W. and J.E. Legates, 1962. Relation of days open and days dry to lactation milk and fat yields. J. Dairy Sci., 45: 1192.

السمات الوراثيه ومعاملات التعديل لصفات انتاج اللبن فى ابقار الفريزيان المرباه فى مصر

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استخدمت الدراسه بيانات ٤٨٤٩ سجل إدرار لعدد ١٦٤٤ بقره فريزيان باستعمال ٢٥٤ طلوقة من نفس النوع. وأشتملت الدراسه على تحليل البيانات الخاصه بإنتاج اللبن فى ٣٠٥ يوم والإنتاج الكلى وطول أيام الحليب وفترة الجفاف. وأستخدمت كل من طريقة المقارنه الكليه وطريقة تحليل الإنحدار المتعدد لحساب عدة مجموعات لمعاملات التصحيح للعمر، ومعاملات التصحيح لفترة الأيام المفتوحه. وحسبت قيم المعامل الوراثى والمعامل التكرارى للصفات المدروسة. وتتلخص النتائج المتحصل عليها فيما يلى :

- متوسط إنتاج اللبن الكلى والـ ٣٠٥ وفتره الحليب وفتره الجفاف ٢٥٧٧ كجم، ٢٣٨٤ كجم لبن ، ٣٢٢ يوم ، ٨٣ يوم على الترتيب. كان تأثير كل من سنة وفصل الوضع وعمر الولادة والأيام المفتوحة معنويا على الصفات المدروسه، وذلك بإستخدام طريقة الحد الأدنى المربعات المعنوية لتحليل التباين.

- تأثر محصول اللبن معنويا بعمر البقرة عند الولادة وكانت العلاقة فى شكل خط منحنى وأوضحت قيم معاملات التصحيح للعمر والمتحصل عليها بطريقة المقارنه الكلية أو الإنحدار المتعدد بأن الإختلافات كانت ثابته بين هذه المعاملات خلال ٣٠٥ يوم وخلال موسم الإدرار الكلى. ولاتوجد فروق كبيره بين المعاملات عند الأعمار الكبيره للأبقار بينما كانت الفروق كبيره نسبيا عند الأعمار الصغيرة . كما أوضحت الدراسه أنه يمكن استخدام معاملات التصحيح للـ ٣٠٥ يوم لتعديل سجلات اللبن الكلية بدون أى تقليل لدرجة الدقه .

- أدت زيادة فترة الأيام المفتوحه إلى زيادة كل من الصفات المدروسه ، وكان التأثير معنوى على مستوى ١٪. وكانت العلاقة على شكل خط منحنى ، وكانت العلاقة ثابته بين معاملات التصحيح للأيام المفتوحة فى كل من إنتاج الـ ٣٠٥ يوم والإنتاج الكلى ، وإن كانت تميل إلى الإنخفاض مع زيادة عدد الأيام المفتوحه . وأوضحت الدراسه أنه لاتوجد فروق كبيرة فى قيم معاملات التصحيح للأيام المفتوحه والمحسوبه باحد الطريقتين.

- كانت قيم المعامل الوراثى لصفة إنتاج اللبن للـ ٣٠٥ والإنتاج الكلى هى ٠,٣٦ ، ٠,٣٢ على الترتيب . وكانت قيم المعامل التكرارى لهاتين الصفتين هى ٠,٤٦ ، ٠,٤٥ على الترتيب بينما كانت قيمه كل من المعمل الوراثى والتكرارى لكل من فتره الحليب و فتره الجفاف منخفضه .