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Age Correction Factors for Some Productive Traits in a Commercial Herd of Holstein Friesian Cattle in Egypt

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Abstract: 673 records of Friesian heifers produced by 166 sires kept at a commercial farm were used and the traits yield 90 days milk yield, 305 days milk yield and annual milk yield were examined. Least squares analysis of variance showed that the effect o f sire as a random effect, year and season of calving subclasses as a fixed effects and age at first calving (AFC)as a covariate on most of different traits were significant. Curvilinear of yield traits on age at first calving were obtained. A set of multiplicative age correction factors of different traits were derived by fitting a polynomial of second degree of production on age. Age correction factors had similar trend and they did not exhibit large differences between consecutive ages at older ages but relatively large differences between consecutive ages at younger ages, differences in age correction factors were consistently present across 305 days milk yield and each of 90 days milk yield and annual milk yield and consequently factors used for adjusted 305 day milk yield could be applied to different yield traits without substantial loss in accuracy.

Key words: Holstein friesian, heifers, age correction factors, Egypt

Introduction

Increased milk production in the first lactation is part of the goal to improve total performance of the cow and economic performance of the herd (Moore *et al.*, 1992). Selection on milk yield occurs mainly during the first lactation (Khattab and Sultan, 1991). To increase the accuracy of selection, correction records for non- genetic factors must be practiced. Age at first calving (AFC) is an important factor affecting milk yield. Praksed *et al.* (1988) reported that age at first calving (AFC) and weight at calving had a significant effect on 305 day milk yield and total milk yield, respectively. Partial and standardized partial regression indicated that the effect of age at first calving (AFC)and weight at calving are independent of each other, from which age at first calving (AFC) is more important than weight at calving. Accordingly, investigation on methods of estimating the correction factors to adjust milk records for non-genetic factors (e.g. age of cow) seemed to be important. In Egypt, Galal *et al.* (1974) developed age correction factors for Friesian cattle, using three methods (gross comparison, fitting a second degree polynomial of production on age and paired comparison) to calculate three sets of age correction factors. They concluded that the second method seemed to be the most successful in removing the effect of age on production. In this respect, Khalil *et al.* (1992) concluded that the correction factors of the third degree polynomial regression analysis was more effective in correcting lactation records for age compared to gross comparison method. Khattab and Ashmawy (1990), Gad (1995) and Atil and Khattab (1999), estimate different sets of correction factors using different methods and recommended to correct lactation records for age at calving. The aims of experiment were: 1) to estimate non-genetic factors affecting 90 days milk yield, 305 days milk yield and annual milk yield for a commercial herd of Friesian cattle in Egypt and 2) construction of a separate age correction factors for milk traits in the first lactation.

Materials and Methods

Data were obtained from milk records of first lactation records of Holstein Heifers, kept at a commercial farm in Egypt. The available data covered a period of 4 years from 1993 to 1996. A total 673 lactation records were used. Abnormal records for animals affected by diseases were excluded. Heifers were grazed on Alfalfa (*Medicago sativa*) and concentrate mixture during all the year. Age at first calving (AFC) was computed from birth and first calving. Annualized milk yield (AMY) was computed by the following equation as described by Bar-Anan and Soller (1979):

AMY = (total lactation milk yield / calving interval) * 365.

Artificial insemination (AI) was used at random. Heifers were served for the first time when they reached 18 mo or 350 kg. The genetic analysis included the sires, which have at least five daughters.

Analysis: Data were analyzed using the mixed model least squares and maximum likelihood computer program of Harvey (1987). The model used for the analysis included the effects of season - year subclasses as fixed, age at first calving (AFC) as a covariate and sire as a random on 90 days milk yield (90 dMY), 305 days milk yield (305 dMY) and annual milk yield (AMY).

Method of age correction factors: The prediction equations of adjusted 90 dMY, 305 dMY and AMY were estimated as:

$$Y = \mu + b_1 (x - \bar{x}) + b_q (x - \bar{x})^2 \qquad (1)$$

where:
Y: the predicted value of lactation traits
μ: overall least squares mean of a given lactation traits (adjusted for effects included in the model),
b_l and b_q are estimated of partial linear and quadratic regression coefficients of 90 dMY, 305 dMY and AMY on age at first calving
x: age and $\bar{x}$ usually equal to mean of age at first calving.
Then setting the first derivative of with respect to Y equal zero and solving for x located the age at maximum production. The maximum production was obtained by substituting the value of x back into equation (1).

Age correction factors were estimated as follows:

$$F_o = Y_m / Y_n$$

where:

F_o : the multiplicative age correction factor for lactation traits, Y_m : the maximum milk traits, Y_n : the milk yield at the n^{th} age in months.

Results and Discussion

Uncorrected means: Means, standard deviations (SD) and coefficients of variation (CV%) for initial milk yield (i.e., 90 dMY), 305 dMY and AMY are presented in Table 1. Means reported here for 90 dMY, 1435; 305 dMY and AMY, 4356 are much higher than those reported for Friesian cattle in the most of the Egyptian studies (Ragab *et al.*, 1973; Khattab and Ashmawy, 1988 & 1990; Gad, 1995). Mohamed (1991) with a commercial herd of Friesian cattle in Egypt, reported that mean of 90 dMY and 305 dMY are 1405 and 3838 kg., respectively. Also, the present mean of AMY is higher than that reported by Ashmawy and Khattab (1991) with Friesian cattle (2944). In addition, Rege (1991) working on Friesian cattle in Kenya, found that 305 dMY and AMY were 3577 and 2982 kg., respectively. On the other hand, Fesus *et al.* (1999) working on three strains of Holstein Friesian in Hungary found that 305 dMY were 9737, 9854 and 9720 kg, respectively. The differences between the present estimated and those reported by other workers could be attributed to one or more of the following reasons: (1) the herds were treated under different climatic managerial conditions, (2) different herds could possibly be genetically and phonetically different from each other and /or (3) different models were used.

Table 1: Means, standard deviation (S.D.) and coefficients of variability (C.V.%) for different traits studied

Traits	Means	S.D.	C.V.%
90 dMY	1439	413	28.70
305 dMY	4734	1202	25.40
AMY	4356	1112	25.53

Coefficients of variations in milk yield traits ranged between 25.40 and 28.70 (Table 1). The relatively lower coefficient of variability for lactation traits in this herd may lead to the fact that this herd is a commercial herd and good managerial procedures.

Analysis of fixed effects: Results of analysis of variance are presented in Table 2. Year - season subclasses had a significant ($P<0.01$) influence on all variables analyzed, similarly, year and season of calving effects contributed significantly to the total variance of part of lactation 90 dMY, 305 dMY and AMY of Friesian cattle raised in Egypt (Ragab *et al.*, 1973; Ashmawy *et al.*, 1986; Khattab and Ashmawy; 1988 & 1990; Khattab, 1992; Hussen, 1996). In addition, Rege (1991), Gaur and Loges (1996) and Souza *et al.* (1996) working on different breeds of dairy cattle in different countries arrived at the same results. Differences among year - season subclasses can be attributed to both annual flu ctuations in weather conditions and possibly phenotypic trend. Ashmawy *et al.* (1986) reported that nutritional causes might be responsible for such differences observed in 305 dMY since cows calving in autumn (September - November) get berseem (December - May) throughout their lactation period and they start and continue their lactation in milk climatic conditions. A decrease in milk production during Spring and Summer may be due to decreased feed intake.

Estimates of partial linear regression coefficients of 90 dMY and AMY on AFC were significant ($P<0.01$, Table 2) being 12.95 ± 5 kg/mo and 29.15 ± 14.15 kg/mo, respectively, while the quadratic terms were not significant. The partial linear and quadratic regression coefficient of 305 dMY on AFC were significant being 49.15 ± 16.10 kg/mo and -1.15 ± 0.54 kg/mo^2, respectively.

Table 2: F-Ratios of least squares analysis of variance for 90 dMY, 305 dMY and AMY in first Holstein Friesian Heifers

S.O.V.	d.f.	F-Values		
		90 dMY	305 dMY	AMY
Sire	165	0.845	1.000	0.956
Year-season	15	9.05**	6.22**	10.82**
Regression				
AFC, linear	1	6.012**	8.880**	4.200*
AFC, quadratic	1	0.001	4.430*	3.200
Remainder	490			
Remainder M.S		120375	1174557	274298

*$P<0.05$, **$P<0.01$

The present results revealed that the effect of AFC on 305 dMY was expressed in a curvilinear. The same pattern reported by Ashmawy and Mokter (1984), Sallam *et al.* (1990) and Khattab (1992). On the other hand, Ashmawy *et al.* (1986) found linear regression coefficients of 305 dMY on AFC using another herd of Friesian cattle in Egypt. They also found that the youngest first calves 26 months produced the lowest yield, while the oldest ones 42 months produced the highest yield. Increase in AFC from 30 to 42 months of age results in significant increase in milk yield 316 kg. However, it is not justified to bring heifers into calving at an unduly late age although their first milk yield will increase because this will result in decreasing the longevity and increasing the cost of rearing the heifer. Gill and Allaire (1976) showed that early first calves were more economical producers than late calves as they compensated low initial yield in their longer productive life. Improving managerial conditions for Friesian heifers in Egypt to accelerate growth rate with more careful heat detection and breeding at a convenient young age is advisable to decrease AFC.

F- ratios presented in Table 2 indicate that year - season subclasses and age at first calving (AFC) are considered the major factors influencing milk traits. This leads to conclude that adjustment of lactation records for year, season and age at first calving (AFC) are very necessary for sire evaluation.

Age correction factors: Second-degree polynomial regression equations used in calculated of gross comparison were:

$$Y = 1417 + 12.94\,(x - \bar{x}) + 0.0067\,(x - \bar{x})^2$$
for 90 dMY,

$$Y = 4728 + 49.15\,(x - \bar{x}) - 1.1500\,(x - \bar{x})^2$$
for 305 dMY and

$$Y = 4340 + 29.15\,(x - \bar{x}) - 0.8414\,(x - \bar{x})^2$$
for AMY

Age at maximum production used in estimation of correction factors was calculated at (x) 40, 48 and 44 months for 90 dMY, 305 dMY and AMY, respectively. Khattab and Sultan (1990) working on 767 lactation records of Friesian cattle in Egypt found that maximum 70 dMY and 305 dMY were attained when heifers calved at 39 and 42 mo, respectively. They also, found that including the linear and quadratic regression coefficients of AFC in the model resulted in a reduction of 2.9 and 1.9 % in the residual mean squares for 70 dMY and 305 dMY, respectively. In addition, Sallam *et al.* (1990) using another herd of Friesian cattle in Egypt reported that partial linear regression of 305 dMY on AFC was 19.46 ± 9.12 kg/mo while the quadratic term was not significant. They also found that 305 dMY increased with increase of AFC

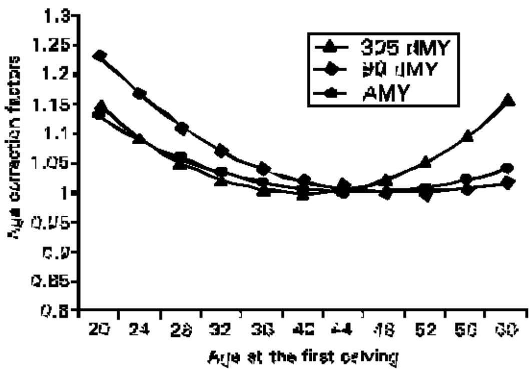

Fig. 1: Age correction factors for 90 days milk yield, 305 days milk yield and annual milk yield

Table 3: Multiplicative age correction factors for 90 dMY, 305 dMY and AMY for Friesian cattle in Egypt

Mo	90 dMY	305 dMY	AMY
20	1.1526	1.2323	1.1325
24	1.0925	1.1635	1.0909
28	1.0491	1.1106	1.0601
32	1.0209	1.0703	1.0308
36	1.0049	1.0402	1.0157
40	1.0000	1.0192	1.0048
44	1.0055	1.0059	1.0000
48	1.0227	1.0000	1.0010
52	1.0519	1.0010	1.0085
56	1.0964	1.0094	1.0211
60	1.1590	1.0190	1.0412

until 31 mo and then decline.

A set of multiplicative age correction factors for 90 dMY, 305 dMY and AMY are presented in Table 3. These estimates indicated that age correction factors for milk yield traits of young heifers less than 28 months were higher than older ones (more than 50 months). Khalil *et al.* (1994) suggested that the high age correction factors for early-calved heifers and cows for 305 dMY and AMY traits are not expected especially for animals that calved at least than 24 mo. The small number of animals that calved at early age could be the main cause in this respect.

Fig. 1 shows that the change of age correction factors for different traits and the factors of different sets are more similar at middle ages (40-48) than at extreme ones. Khattab and Ashmawy (1988) came to the same results. For the comparison between the separate factors of different traits studied the absolute differences between age correction factors for 305 dMY and each of 90 dMY and AMY were small in most ages and ranged between 0.00 and 0.11. Then, differences in age correction factors were consistent across traits of the present study (Table 3). Therefore, factors used for adjusting 305 dMY could be applied to each of 90 dMY and AMY without substantial loss in accuracy. In this respect, Hamed (1994) with Egyptian buffaloes, reported that the numerical values of age correction factors for AMY were smaller to the factors for 305 dMY before the age of maximum production. After the mature age was reached the factors became larger .They concluded that the differences between these factors were very small. Therefore, more research work in this respect is needed with large size data.

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