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Estimation of Milk Producing Ability of Holstein Friesian Cattle in a Commercial Herd in Egypt

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Abstract: A total of 3236 lactation records of 929 Holstein Friesian cattle sired by 290 bulls kept at a commercial herd in Egypt (Dalla Farm) were used. Cows transmitting abilities (CTA) were estimated by best linear unbiased prediction (BLUP). All cows whose at least two records up to six were used. Means of 90 day milk yield (90 dMY) and 305 day milk yield (305 dMY) are 1673 to 25 and 5076 ± 64 kg, respectively. Least squares analysis of variance showed a significant effect of month of calving, year of calving and parity as fixed effects and sire and cow within sire as random effects on 90 dMY and 305 dMY. Heritability, repeatability, genetic and phenotypic correlations were estimated by paternal half sibs correlations. Heritability estimates were 0.31 to 0.06 and 0.15 ± 0.05 for 90 dMY and 305 dMY, respectively. Repeatability estimates were 0.25 ti 0.02 and 0.34 ± 0.02 for 90 dMY and 305 dMY, respectively. Genetic and phenotypic correlations between the two traits studied were 0.47 ± 0.12 and 0.53, respectively. Estimates of CTA for 90 dMY ranged from -513 to 556 kg and from -989 to 1754 kg for 305 dMY with the range being 1069 and 2743 kg, respectively. Product moment correlation between 90 dMY and 305 dMY was 0.92. The present results indicated that CTA for 90 dMY was good predictor of CTA for 305 d MY.

Key words: Milk Producing Ability, Holstein Cattle

Introduction
Cow evaluation and selection are important in herd improvement scheme. The ultimate aim of an evaluation is to enable breeders to compare their animals by the estimated producing ability (Ashmawy, 1991). Schmidt and Van Vleck (1974) concluded that selection of cows could be for several purposes (1) to remain in the herd, (2) to obtain replacement heifers and (3) to obtain sons for herd use or use in artificial insemination. Henderson (1975) reported a scheme for cow evaluation within herd using best linear unbiased prediction (BLUP) methods that included additive genetic relationships among cows and information about sires of the cows. There are many different methods of cow transmitting ability has been estimated by different workers in different countries. Schmidt and Van Vleck (1974), Chyr *et al.* (1979) and Soliman *et al.* (1995) used most probable producing ability (MPPA). Henderson (1975), Hintz and Van Vleck (1978), Szkontnicki *et al.* (1978), Chyr *et al.* (1979), Schaeffer *et al.* (1982) and Soliman *et al.* (1995) used the best linear unbiased prediction. Estany *et al.* (1988), Van Der Werf *et al.* (1989) and Soliman *et al.* (1995) used selection index (SI).
Soliman *et al*. (1995) working on 16042 lactation records of Fleckiveh cows, used three methods for CTA, concluded that BLUP values is more accurate. In addition, Chyr *et al.* (1979) estimated milk-producing ability of Holstein Friesian cattle; found that a BLUP method is superior to herd mate comparison. Also, Schaeffer *et al.* (1982) found that using BLUP method is more accurate than traditional contemporary comparison method. Van Der Werf *et al.* (1989) reported that SI values are underestimated since young cows are compared with selection older cows.
The objectives of this study were to estimate genetic and phenotypic parameters for 90 dMY and 305 dMY and estimate cows transmitting abilities for milk traits by using the best linear unbiased prediction (BLUP) for Holstein Friesian cattle in a commercial herd in Egypt.

Materials and Methods
Data for this study were obtained from the Holstein Friesian cattle herd raised at Dalla farm in Egypt during the period from 1987 to 1994. The number of sires, cows and total number of lactations were 290, 929 and 3236, respectively. Sires with less than ten daughters were excluded. Artificial insemination using frozen semen was used. Traits studied are 90 day milk yield and 305 day milk yield. More information of that herd had described by Atil and Khattab (1999).

Analysis
Data were analyzed using the following mixed model:

$$Y_{ijklmn} = \mu + S_i + d_{ij} + M_k + Y_i + P_m + e_{ijklmn}$$

where, Y_{ijklmn}: 90 dMY or 305 dMY; μ: the overall mean ; S_i: the random effect of the l^{th} sire; d_{ij}: random effect of the j^{th} cow nested within the l^{th} sire; M_k: fixed effect of the k^{th} month of calving ($k = 1,...,12$); Y^i: fixed effect of the l^{th} year of calving ($l = 1987,...,1994$) ; P_m: fixed effect of the m^{th} parity ($m = 1 ..... 6$) and e_{ijklmn}: random error $N(0, \sigma^2)$.
Henderson Method III was utilized to estimate the genetic and phenotypic variance components for the different traits. e.g., sire (σ^2_s), cow within sire (σ^2_{cis}) and reminder (σ^2_{e},). Heritability (h^2) and repeatability (t) were estimated by the paternal half sibs methods as:

$$h^2 = 4\,\sigma^2_s/(\sigma^2_s + + \sigma^2_s) \text{ and}$$
$$t = (\sigma^2_s + \sigma^2_{o:s})/(\sigma^2_s + \sigma^2_{o:s} + \sigma^2_s)$$

Approximate standard errors for h^2 and t were computed by using LSMLMW program of Harvey (1990).

Best Linear Unbiased Prediction (BLUP): Data of all lactations were used for estimating BLUP values; one set of cross-classified non- interacting random effect (cow) is absorbed (Harvey, 1990). In this procedure, BLUP estimates for random cow effects absorbed by maximum likelihood were obtained. The following model (in matrix notation was used):

$$V = Xb + Tc + e$$

where, b is a column vector of the fixed effects (month of calving, year of calving and parity), T is nxp matrix, c is the vector of size p representing the unknown cow random effects. Representing this model by matrix notation could be as follows:

$$\begin{matrix} X'X & X'T \\ T'X & T'T + kc \end{matrix} \quad \begin{matrix} b = X'Y \\ = TY \end{matrix}$$

where, $k = 0^{25} / o^{2c}$ and solution to c is called BLUP of c.

Results and Discussion

Least squares means for 90 dMY and 305 dMY are 1673±25 and 5076±64 kg, respectively. The present means are higher than those reported by El-Din (1991) using another herd of Friesian cattle in Egypt, which are 921 and 2927 kg, respectively. While, the present mean of 305 dMY is lower than that reported by Bakir and Sogut (1999) in Turkey on Friesian cattle (6954 kg).

Least squares analysis of variance for 90 dMY and 305 dMY are presented in Table 1. Significant ($p<0.01$) effects of month and year of calving and parity on both traits studied are found. These results agree with the findings reported by Khattab *et al.* (1987), El-Din (1991), Khalil *et al.* (1994) and Atil and Khattab (1999) on Friesian cattle raised in Egypt. Similar findings are also, reported on Friesian cattle raised in other countries (Rege, 1991; Atay *et al.,* 1995; Kaya, 1996; Tawfik *et al.,* 2000). Differences in milk yield attributed to month and year of calving effects are interpreted to be due to climatic, nutritional and managerial conditions, which changed from one year or season to another and to phenotypic trend. Atay *et al.* (1995) working on Holstein Friesian cattle in Turkey found that the percentage of variance attributed to year and season of calving are 11.01 and 2.30%, respectively. The significant effect of parity or the increase of milk yield with increased lactation number could be due to with advanced age, the animals is mature, the body weight and size is fully developed, accompanied by the increase in size and function of the digestive and circulatory system, mammary glands and the other body systems. The amount of feed intake and feed utilization are generally increased and associated with increased efficiency of milk synthesis and secretion of the udder glandular tissues. Khattab *et al.* (1987), Ashmawy (1991), Atay *et al.* (1995), Kaya (1996) and Tawfik *et al.* (2000) came to the same results.

Table 1: Least squares analysis of variance for factors affecting 90 day milk yield (90 dMY) and 305 day milk yield (305 dMY)

		F-values	
S.O.V.	O.F.	90 dMY	305 dMY
Sire	289	1.58**	1.19**
Cow: Sire	839	1.84^{5}*	2.65**
Month of calving	11	3.79**	4.42**
year of calving	59.23**	51.00**	
parity	5	40.46**	26.02**
Reminder	2285		
Reminder M.S.		131552.00	946805.00

**p<0.01 *p<0.05

Sire of the cow and cow within sire had a significant effect on milk traits studies ($p<0.01$, Table 1). The large estimates of V% attributable to sire and cow (Table 2) indicate that genetic improvement of milk traits could be achieved through sire and cow selection. In particular, large magnitude of the cow estimates might indicate a sizable potential for cow in selection programmes and/or in change of the herd management to improve yield traits (Afifi *et al.*, 1995).

Table 2: Estimates of variance components (σ^2), proportions of variation (V%), heritability (h^2) and repeatability (t) for 90 day milk yield (90 dMY) and 305 day milk yield (305 dMY)

	Traits	
	305 dMY	90 dMY
Sire		
σ^2	13722	1441972
V%	18	4
Cow: Sire		
	31103	55627
V%	8	31
Reminder		
σ^2	131552	946804
V%	74	65
h^2±S.E	0.31±0.08	0.15±0.05
T±S.E.	0.25±0.02	0.34±0.02

Sire cow: sire and reminder degrees of freedom were 289,639 and 2285, respectively

Estimates of h^2 for 90 dMY and 305 dMY are 0.31±0.06 and 0.15±0.05, respectively (Table 3). The present estimates are moderate and similar to those estimates reported by (Khattab *et al.,* 1987; El-Din, 1991; Rege, 1991; Khalil *et al.,* 1994; Afifi *et al.,* 1995; Atay *et al.,* 1995; Kaya, 1996; Atil and Khattab, 1999; Tawfik *et al.,* 2000). Repeatability estimates for 90 dMY and 305 dMY are 0.25±0.02 and 0.43±0.02, respectively. These values are in the range reported by (Ashmway, 1991; Atay *et al.,* 1995; Soliman *et al.,* 1995) which ranged from 0.25 to 0.48. Accordingly, the first lactation of each cow would lead to an accurate prediction of future performance, promises efficient relation and also would afford an opportunity for a faster return of sires to service if their evaluation can made early.

The expected cow transmitting ability (CTA) showed large differences among cows for 90 dMY and 305 dMY (Table 3) and ranged from -513 to 556 kg for 90 dMY and from -989 to 1754 kg for 305 dMY with the range being 1069 and 2743 kg, respectively. The present results indicate the high potential for rapid genetic improvement in milk production of Holstein Friesian cattle raised in Egypt through selection. Estimates of CTA for 305 dMY are near similar to those obtained by Soliman *et al.* (1995) working on Fleckvieh cattle. Also, differences were obtained by Hintz and Van Vleck (1978) estimated CTA by using BLUP methods, found that CTA ranged from -229 to 239 kg for Ayrshire, from -120 to 224 kg for Gurensey, from -161 to 203 kg for Holstein, from -89 to 209 kg for Jersey and from -600 to 91 kg for Brown Swiss, with the range being 468, 344, 364, 298 and 691 kg, respectively. They also, concluded that genetic trends of cow populations were less than twice the contribution of sires to genetic trends, indicating that estimating genetic trends in cow populations by doubling the trend in transmitting ability of sire is biased upwards.

On the other hand Szkontnicki *et al.* (1978) found small amount of variation on CTA for milk yield and fat yield. The differences in estimated of CTA for milk yield were 116, 173 and 485 kg for Brown Swiss, Canadienne and milking Shorthorn cattle, respectively. The differences for fat yield were 5.0, 8.6 and 13.0 kg for the same breeds, respectively. Soliman *et al.* (1995) working on Fleckvieh cattle estimated CTA for milk traits by using three methods li) best linear unbiased prediction, (ii) selection index for milk yield (S11) and selection index for carrier (SI2) and (iii) most probable producing ability (MPPA). They found that CTA for milk yield, ranged from -992 to 1561 kg for BLUP values, from -793 to 867 kg for S11 and from -1584 to 2121 kg for MPPA. The same authors concluded that the lowest differences were presented in 811. The differences in CTA using SI1 and 812 were nearly the same. Therefore both indices have the same trend in the evaluation of cows. The differences in CTA for BLUP were often larger than those for SI, this may be due to that available records of the cow were used in BLUP, while, SI used only the first record of the cow.

Table 3: Minimum and maximum values for cow transmitting abilities (CTA) estimated by best linear unbiased prediction IBLUP)

Traits	Minimum	Maximum	Differences
90 dMY kg	-513	556	1069
306 dMY kg	-989	1754	2743

Number of cows evaluated were 929

Table 4: Percentage of negative estimates of cow transmitting ability 1CTA) for 90 day milk yield (90 dMY) and 305 day milk yield (305 dMY)

Traits	Negative values
90 dMY	36
305 dMY	30

Table 5: Frequency of thirty cow transmitting abilities for 90 day milk yield (90 dMY) and 305 day milk yield (305 dMY)

No. of cow	No. of	BLUP values (kg)	
		90 dMY	305 dMY
13	5	138	311
21	6	-68	-672
37	5	402	1309
45	5	-28	-40
53	5	-262	-649
58	6	171	751
73	6	-56	-526
95	5	271	502
120	5	154	407
143	6	-72	-518
158	5	102	418
172	5	-88	-377
221	5	556	860
228	5	-110	-413
290	5	149	373
302	6	240	387
309	5	245	715
376	5	231	684
384	5	124	641
393	5	-15	-539
407	5	-61	-546
436	5	-41	-702
441	5	-51	-221
513	5	144	530
540	5	486	372
558	5	-51	-387
571	5	129	350
587	5	396	483
740	5	-81	-558
979	5	-49	-338

The percentage of cow having negative estimate of CTA were 36 and 30% for 90 dMY and 305 dMY, respectively (Table 4). Soliman *et al.* (1995) found that the percentage of cows having negative estimates of CTA for milk yield were 52.0, 52.70 and 53.50% for BLUP, 811 and MPPA, respectively. One method of improving the production of a dairy herd is to cull the low producers of the 25-30% of the cow (Carter *et al.,* 1963). Therefore, using CTA estimates of 90 dMY and 305 dMY a criteria for culling decision the appropriate culling percent 30-36% will include those cows having CTA negative values.

Table 5 presents proof for 90 dMY and 305 dMY of thirty cows with the largest number of Isolations in all data. Fourteen cows had a negative proof. The present results indicate that cows had positive BLUP values for 90 dMY had also positive BLUP values for 305 d MY. Product moment correlation between CTA for 90 dMY and 305 dMY is 0.92. Therefore, CTA could be possible using initial milk yield 190 dMY) in order to minimize the time required for progeny test, this could decrease the generation interval and increase the annual genetic gain. In addition, Powell *et al.* (1978) concluded that selection, culling and mating decisions based on cow's part records can materially affect herd and population genetic progress. Cows with poor production potential can be identified earlier in lactation and removed to production more profitable operations in individual herd.

References

Afifi, E.A., M.H. Khalil, S.M. Zahed, A.M. Soliman, F.E. El-Keraby and A.A. Ashmawy, 1995. Estimation of genetic parameters for milk traits of Fleckvieh records not subjected to culling. Egypt. J. Anim. Prod., 32: 195-218.

Ashmawy, A.A., 1991. Reapeatability of productive traits in Egyptian buffaloes. J. Anim. Breed. Genet., 108: 182-186.

Atay, O., S.M. Yener, G. Bakir and A. Kaygisiz, 1995. Estimates of genetic and phenotypic parameters of milk production characteristics of Holstein cows raised at the Ankara Ataturk foresty farm in Ankara. Turk. J. Vet. Anim. Sci., 19: 441-447.

Atil, H. and A.S. Khattab, 1999. A comparison of different methods of estimating sire transmitting ability of some milk traits in a herd of Holstein Friesian. Pak. J. Biol. Sci., 2: 21-24.

Bakir, G. and B. Sogut, 1999. Effect of dry period on the milk production traits of Holstein. Proceedings of the Uluslararasi Hayvancilik Kongresi, Eylul 21-24, 1999, Izmir, Turkey, pp: 792.

Carter, H.W., R.W. Spalding, R. Alberctsen and A.M. Meek, 1963. Herdmate comparisons and their use in evaluating dairy cows. New York State College of Agriculture-Cornell Extenstion Bulletin 1115.

Chyr, S.C., A.E. Freeman and J. Berger, 1979. Estimation of milk producing ability of Holstein cows. J. Dairy Sci., 62: 1774-1783.

El-Din, S.E., 1991. Studies on milk production on Firesian cows. M.Sc. Thesis, Faculty of Agriculture, Tanta University, Egypt.

Estany, J., M. Baelga, A. Blasco and J. Camacho, 1988. A comparison between BLUP and index for selection on litter size. Proceedings of the 4th World Rabbit Congress, Volume 2, October 10-14, 1988, Budapest, Hungary.

Harvey, W.R., 1990. Users Guide for LSMLMW, Mixed Model Least Squares and Maximum Likelihood Computer Program. PC-2 Version. Ohio State University, Columbus, USA.

Henderson, C.R., 1975. Use of all relatives in intraherd prediction of breeding values and producing abilities. J. Dairy Sci., 58: 1910-1916.

Hintz, R.L. and L.D. van Vleck, 1978. Estimation of genetic trends from cow and sire evaluations. J. Dairy Sci., 61: 607-613.

Kaya, I., 1996. Parameter estimates for persistency of lactations and relationship of persistency with milk yield in holstein cattle. Ph.D. Thesis, Ege University, Izmir, Turkey.

Khalil, M.H., M.F.A. Glil and M.K. Hamed, 1994. Genetic aspects and adjustment factors for lactation traits of Friesian cattle raised in Egypt. Egypt. J. Anim. Prod., 31: 65-65.

Khattab, A.S., M.A. Ibrahim and M.M. Mabrouk, 1987. Studies on part lactation milk production in Friesian cattle. J. Agric. Res. Tanta Univ., 13: 621-623.

Powell, R.L., B.G. Cassell, H.D. Norman and G.W. Bodoh, 1978. Variation in cow evaluation from records in progress. J. Dairy Sci., 61: 788-793.

Rege, J.E.O., 1991. Genetic analysis of reproductive and productive performance of Friesian cattle in Kenya I Genetic and phenotypic parameters. J. Anim. Breed. Genet., 108: 412-423.

Schaeffer, L.R., A. Kerr and E.B. Burnside, 1982. Dairy herd genetic differences for lactation production. Can. J. Anim. Sci., 62: 323-331.

Schmidt, G.H. and L.D. Van Vleck, 1974. Principles of Dairy Science. W.H. Freeman Publishers, New York, Pages: 558.

Soliman, A.M., M.N. Khalil, S.M. Zahed and E.A. Afifi, 1995. Effectiveness and comparison of the three methods of cow evaluation to improve milk traits of Fleckvieh cattle. Egypt. J. Anim. Prod., 32: 151-169.

Szkontnicki, W.J., A.K.W. Tong, M.A. Sharabay, K.M. Krotch, L.P. Johnson and L.R. Schaeffer, 1978. Sire and cow evaluation brown Swiss, Canadienne and milking shorthorn. J. Dairy Sci., 61: 497-505.

Tawfik, E.S., M.K. Mohsen, A.Y. Salem and H.G. El-Awady, 2000. Study on Friesian herds raised in Egypt and Germany. I. Estimate of non-genetic effects and genetic parameters. Arc. Fur Tierzucht, 43: 101-114.

Van Der Werf, J.H.J., J. Kamphof and H. Van den Broek, 1989. A simulation study comparing methods of within-herd estimation of breeding values for dairy cows. Livest. Prod. Sci., 23: 239-251.