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A STUDY ON PRODUCTION AND REPRODUCTION TRAITS OF FRIESIAN CATTLE IN EGYPT

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ABSTRACT

A total of 1834 lactation records of Holstein cows were used for studying the random effects of sire and cow within sire and the fixed effects of year of calving, month of calving and parity on 305 day milk yield (305-dMY), lactation period (LP), dry period (DP), days open (DO), number of service per conception (NSPC) and calving interval (CI).

Least squares analysis of variance showed significant effect of sire on 305-dMY only (P<0.01), while effect of cow within sire was significant (P<0.01) on all productive and reproductive traits studied. The effect of fixed factors were mostly significant (P<0.05) & (P<0.01).

The partial linear regression coefficients of DO and DP on 305-dMY were 11.31±0.5 kg/d (P<0.01) and -10.93±0.83 kg/d (P<0.01) respectively, which indicate that reduction in dry period is considered if it is a desirable goal for dairymen.

Heritability estimates were moderate for 305-dMY and LP (0.33 and 0.19 respectively) and extremelly low for DP, DO, CI and NSPC (0.02. 0.01. 0.02 and 0.01), respectively. Most estimates of genetic correlation were nearly similar to the corresponding estimates of phenotypic correlation in values having the same direction.

Keywords: Friesian cattle, Production and reproduction traits, genetic and non genetic factors.

INTRODUCTION

Milk yield and fertility traits are the principal factors affecting profitability of a dairy breeds. Early post partum breeding in dairy animals, high fertility, short dry period and early maturity resulted in more calves and high milk yield per unit of time throughout the herd life (Britt, 1975).

The genetic importance of fertility in dairy cattle should be evaluated for its direct effect on cows reproductive performance and its association with milk yield. Olds *et a1.* (1979), Janson (1985); Kafidi *et al.* (1992) and Bagnato and Oltenacu (1993) concluded that fertility traits have low heritabilities, generally between 0.01 and 0.10, indicating that little genetic improvement for reproductive performance can be expected.

Negative influence of level of milk production on fertility has been observed by many authors (Everett *et al.*, 1966 ; Olds *et al.*, 1979 ; Janson, 1985 ; Afifi *et al.*, 1992 ; Kafidi *et al.*, 1992). In addition, Hansen *et al.* (1983) found that selection for fertility is possible but it will generally be associated with a decline in production, so the conclution was not economically feasible. Seykora and Mcdanial (1983), on the other hand, concluded that selection for the improvement of productive performance could be economically justified.

The objectives of this work are to estimate genetic and non-genetic factors affecting productive and reproductive traits and phenotypic and genetic parameters for the same traits in on herd of Holstein-Friesian cattle in Egypt.

MATERIAL AND METHODS

Total of 1834 lactation records of Holstein cows belong to the herd of Dalla Farm located 130 km North West of Cairo were used for the present study. Records were taken during the period of 1987 to 1991. Abnormal records affected by diseases or by disorders such as abortion were excluded. Productive traits studied are 305 day milk yield (305 d MY), Lactation period (LP) and proceeding dry period (DP). Reproductive traits are days open (DO), calving interval (CI) and number of services per conception (NSPC). The number of sires and the average of daughters per sire were 305 and 6.01, respectively. The number of daughters per sire ranged from 5 to 26. The genetic analysis included the sire which had at least five daughters and each cow had more than one record.

Records included number of days open for all lactations followed by a normal calving. This was computed as the interval between parturitions and the date of successful mating. If the date of successful mating was not known (DO); so it was calculated using figure of 275 days as a mean of estimated gestation period. Length of dry period was computed by subtracting the date of last milking from the next calving date off. Records with missing drying off date were rejected.

Artificial insemination (AI) was used at random. Heifers were served for the first time when they reached 350 Kg. Cows were usually served two months post partum, and pregnancies were detected by rectal palpation 60 days after the last service. Animals were kept loose under semi open sheds all the year round. All cows were fed concentrates with Alfalfa and rice straw all the year.

Data were analyzed using Harvey's (1990) Mixed Model Computer Program. Productive traits i.e. 305 d MY and LP were analysis using a linear model which include the fixed effects of month and year of calving and parity, and each of days open, dry period as a covariates and sire and cow within sire as random effects. For DP, DO. CI and NSPC the previous model was used while the effect of DO and DP was omitted.

Henderson method 3 was utilized to estimate the genetic and phenotypic variance and covariance components for the different traits, i. e. sir (δ^2s), cow within sir (δ^2c:s) and reminder (δ^2e). Heritabilities (h^2) were estimated by the paternal half-sib method as:

$$h^2s = 4\delta^2s / (\delta^2s + \delta^2c{:}s + \delta^2e)$$

Genetic and phenotypic correlations coefficients between any two traits were estimated by the formulae outline by Harvey (1990). Approximate standard errors for heritability and genetic correlation estimates were computed by the LSMLMW program of Harvey (1990).

RESULTS AND DISCUSSION

Least squares means of different traits are presented in Table 1. The mean reported here for 305 d MY (5194 kg) is higher than those reported by Ragab *et al.* (1973), Ashmawy *et al.* (1986) Khattab and Sultan (1990) and Abdel Glil (1991) working on Friesian cattle in Egypt. In addition, the present,

mean was higher than that reported by Hoque and Hodges (1980) on Holstein-Friesian in USA.

In terms of lactation intervals, mean of LP reported here (316 day) for Friesian falls within the range of Egyptian reports (Ragab *et al.*, 1973; EL Sedafy, 1989; Khattab and Sultan, 1990 and Afifi *et al.*, 1992), while, mean of DP (86 days) is shorter than those of Friesian cattle, reported by most of Egyptian studies (e.g., Ashmawy, 1975 ; khattab *et al.*, 1986 and Gad, 1995). Gili and Allarie (1976) found that maximum profit per day of herd life was expected for cows with 20 days dry period.

Table 1: Least squares mean and standard error (SE) of productive and reproductive traits as affected by various factors.

Factors	N	Productive traits				Reproductive traits	
		305 d MY, kg	LP, d	DP, d	DO, d	CI, d	NSPC
Overall means	1834	5194±96	316±11	86±11.	109±4.1	394±5.8	1.30±0.09
Months of calving							
1	135	5223±195	308±6	98±9	109±8	395±9	1.48±0.24
2	106	5336±174	305±7	95±9	107±9	399±8	156.±027
3	91	5384±166	320±6	64±11	95±10	382±10	1.49±0.19
4	82	5269±154	318±7	93±10	111±7	400±8	1.54±0.16
5	120	5148±135	310±6	109±12	108±8	402±8	1.33±0.14
6	153	5045±126	295±11	90±8	111±7	395±7	1.05±0.13
7	242	5132±117	310±4	102±8	112±9	390±7	1.02±0.13
8	268	5121±119	308±3	81±7	110±7	390±9	1.05±0.15
9	244	5195±130	311±4	82±7	100±9	379±9	1.05±0.20
10	116	5227±157	299±6	79±9	112±9	389±9	1.15±0.21
11	144	5232±166	308±6	88±7	111±9	395±7	1.38±0.23
12	133	5012±177	318±6	86±9	119±9	402±7	1.49±0.52
Year of calving							
1987	261	4398±582	319±22	100±10	120±9	400±6	1.13±0.10
1988	273	5398±308	311±11	82±8	110±8	393±6	1.68±0.42
1989	477	5869±105	306±13	81±6	98±6	386±10	1.49±0.82
1990	640	4989±303	298±11	90±6	100±6	388±11	1.29±0.31
1991	183	5314±584	302±22	87±10	86±10	389±5	1.30±0.40
Parity							
1	670	5121±254	281±10	96±10	100±11	380±11	1.60±0.12
2	606	5323±114	305±11	90±15	104±5	384±5	1.30±0.32
3	317	5224±140	329±14	85±18	110±9	390±8	1.28±0.03
4	241	5106±259	315±10	87±14	123±14	403±15	1.10±0.01
Regressions							
DO.							
Linear		11.31±0.5		0.82±0.02			
Quadratic		-0.003±0.003		- 0.0005±0.0001			
DP.							
Linear		-10.93±0.83		- 0.69±0.0315			
Quadratic		-0.001±0.004		- 0.00002±0.0003			

Average of DO and CI were 109 and 394 days, respectively. Afifi *et al.* (1992) reported that the average of DO and CI were 100 and 381 days, respectively, while an estimate of DO (171 days) was obtained by Khattab and Ashmawy (1988). Mean of NSPC was 1.30.

The differences between the present estimates and those reported by other workers could be attributed to one or more of the following reasons: (1) the herds were kept under different climatic and managerial conditions, (2) different herds could be possible genetically and phenotypically different from each other and or (3) different statistical models were used.

EL Keraby and Aboul-Ela (1982) reported that the longer DO and CI in dairy cows may be caused by several factors i.e., level of milk production, housing, silent heat missed oestrus due to weak symptoms, frequency and timing of oestrus detection and feeding season.

Fixed effects

Month of calving had significant effect ($P<0.01$) on DP and reproductive traits (Table 2). The present results indicate that cows calving in autumn and winter showed shorter DO than those calving during spring and summer. Cows calving in summer and autumn show short CI and NSPC but increased in winter and spring. Poor results in breeding efficiency in summer are attributed to the high incidence of silent ovulation making detection of oestrus more difficult and may be also to deficiency in green fodder.

Year of calving had a significant effect ($P<0.05$ or $P<0.01$) on all traits studied (Table2). These results agree with the findings on Friesian cattle raised in Egypt as reported by Ashmawy *et al.* (1986), Khattab *et al.* (1986), Khattab and Ashmawy (1990), Afifi *et al.* (1992) and Gad (1995). The same findings were also reported on Friesian cattle raised in other countries by Sharma *et al.* (1982) and Kafidi *et al.* (1992). Change in production from year to another can be attributed to changes in herd size; age of animals and improved management practiced introduced from year to another.

Lactation number (parity) had a significant effect ($P<0.01$) on all different traits studied except for 305 d MY ($P<0.01$, Table 2). The present results are agree with those of Everett *et al.* (1966), Ragab *et al.* (1973), Khattab and Ashmawy (1988 & 1990), Abdel Gli (1991) and Rege (1991). Also, the present results indicated that the 1st calving was associated with the shortest DO, CI (100 and 380 d, respectively) and tended to increase gradually till the 4th lactation (123 and 403 d, respectively), while, NSPC was higher for first lactation (1.60) and lower for the fourth parity) (1.10, Table 1). At such time animal is mature in body weight and size fully developed accompanied by increase in the size and function of digestive and circulatory system, mammary gland and the other body systems which followed by increasing efficiency of milk synthesis and secretion of the udder glandular tissue.

Including DO as a polynomial regression of the first and the second degree in the model yielded significant ($P<0.01$, Table 2) partial linear regression coefficient of 305 d MY or LP on DO, while the quadratic terms were significant only for LP.

The curvilinear relationships of 305-dMY and/or LP on DO were similar to the results obtained by Khattab and Ashmawy (1988); Sallam *et al.* (1990) and Gad (1995). Estimates of regressions given in Table (1) indicate that 305 dMY increased linearly with the increase of days open. From the economic point of view, however it would not be desirable to prolong the days

open. In addition, Scheaffer and Henderson (1972) found that as the length of days open period increased milk yield also increased at each successive stage of lactation. Also, Laben *et al.* (1982) found that effective estrus detection was probably a major factor affecting reproductive performance in dairy cattle. So, initiation of breeding as early as possible with an intensive program of heat detection could shorten DO. In addition, El-Fouly *et al.* (1976) reported that preparing the animals to have the full chance for conception during the season of full ovarian activity (October - March) could reduce DO considerably.

Table 2: F-rations for factors affecting productive and reproductive traits.

S.O.V.	d.f.	Productive traits			Reproductive traits		
		305 d MY	LP	DP	DO	CI	NSPC
Sire	304	1.34**	0.64	0.64	0.01	0.58	0.96
Cow:Sire	383	1.95**	1.24**	2.09**	2.50**	2.43**	1.45**
Month of calving	11	0.99	1.32	5.04**	9.47**	7.74**	7.99**
Year of calving	4	109.54**	2.75*	11.92**	3.12*	18.30**	22.08**
Parity	3	1.98	5.24**	45.04**	50.26**	98.15**	75.34**
Regressions							
DO, linear	1	48.77**	766.68**				
DO, quadratic	1	0.36	26.39**				
DP, linear	1	173.63**	83.43**				
DP, quadratic	1	0.17	0.025	1128			
Remainder (d.f)	1124	569991	822	2525	1128	1128	1128
Remainder, MS					5507	4026	1.25

* P<0.05 ** P<0.01

Estimates of partial linear regression coefficients of 305-dMY and LP on DP were negative and highly significant (P<0.01, Table 1), being -10.93±0.83 kg/d and –0.69±0.31d/d respectively, while, the quadratic terms were not significant (Table 2). The present results indicate that each of 305-d MY and LP increased as the length of DP decreased. From the economic point of view, it is important to reduce the preceding dry period. This trend could be attributed to that the quite DP enables the cow to her body and to restore the minerals which may have been depleted through the period other lactation. Also, this period helps the cow to build up a reserve other body flesh before calving and to give enough rest to organs of milk secretion. Similarly, results are obtained by Scheaffer and Henderson (1972), Khattab and Ashmawy (1988) and Gad (1995). Khattab and Ashmawy (1988) with Friesian cows, found that the preceding dry period of approximately 60 days gave the highest average milk production in the following lactation (3236 kg) while the lowest milk yield was found at 180-239 days (2891 kg).

Random effects

Sire of the cow had a significant effect on 305 d MY only (Table 2), These results are in agreement with those reported by Basu and Ghai 1980; Khattab and Sultan, 1990; Abdel Glil, 1991 and Gad, 1995. Present results indicate the possibility of genetic improvement of 305d milk through selection.

Cow within sire had a significant effects on all different traits studied (P<0.01, Table 2). Ruvuna *et al.* (1984), El Sedafy (1989) and Gad (1995) came to the same results. Variances among cows in their production and

reproduction may be due to sizable differences in genetic potentiality of cows along with same changes in the herd management (Camoes, *et al.*, 1976). In addition, 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 (ETA).

Heritability estimate for 305 dMY was 0.33± 0.09 (Table 3). Similarly, Swalve and Van Vleck (1986) and Hudson and Van Vleck (1972) reported corresponding estimates of 0.32 and 0.31 on Holstein-Friesian cattle. According to the moderate h^2 estimate reported herein, it can be concluded that the genetic improvement in milk production can be achieved through selection breeding program. The estimate of h^2 for LP was 0.19±0.05 (Table 3). The present estimate is in agreement with those of Ragab *et al.* (1973); Basu and Ghai (1980); Desphond and Ponde (1988) and Afifi *et al.* (1992) which ranged between 0.05 and 0.20 for different breeds of dairy cattle in different countries. The present results indicate that the major part of variation in this character is due to non-genetic factors, and great improvement in LP could be possible by improving feeding and management systems. For DP, h2 estimate was 0.02±0.06 (Table 3). Low heritability estimates for LP and DP suggest that management can play a grater role than selection for improving these traits.

Heritability estimates for DO, CI and NSPC were 0.01, 0.02 and 0.10, respectively (Table 3). The low h^2 estimates for reproductive traits indicate that a major part of variation in these characters were environmental and selection would not be effective in bringing out genetic improvement. Better management can therefore play an important role in improving such traits. Therefore, improving the managerial technique should lead to a considerable improvement in reproductive traits. The present results are within the range obtained by Smith and Legates (1962), Everett *et al.* (1966), Berger *et al.* (1981), Bagnato and Oltenacu (1993) and Kafidi *et al.* (1992). Scheaffer and Henderson (1972) reported that effect of days open on milk yield was almost all-environmental. Khattab and Ashmawy (1988) concluded that selection for improving fertility defined as days open had little to offer breeds.

Table 3: Estimates of Heritability (in diagonal), genetic correlations (below diagonal) and phenotypic correlations (above diagonal) for productive and reproductive traits.

Traits	305 d MY	LP	DP	DO	CI	NSPC
305 d MY	0.33±0.09	0.66	-0.12	0.37.	0.04	0.04
LP	0.76±0.04	0.19±0.05	-0.06	0.55	0.57	-0.12
DP	0.07±0.08	0.13±0.09	0.02±0.06	0.58	0.59	-0.01
DO	0.40±0.07	0.63±0.06	0.45±0.07	0.01±0.06	0.82	-0.003
CI	0.38±0.07	0.61±0.06	0.48±0.06	0.64±0.04	0.02±0.06	-0.02
NSPC	0.31±0.09	0.38±0.09	-0.04±0.09	0.91±0.09	0.14±0.09	0.10±0.07

Low h^2 estimate of DO were also estimated by Everett *et al.*, (1966) 0.07, Scheaffer and Henderson (1972) 0.02 - 0.03; Khatteb *et al.* (1987) 0.10 and Afifi *et al.* (1992) 0.08-0.16.

In conclusion, values of h^2 estimates for productive and reproductive traits in Friesian herd under study (Table 3) indicate that improvement in milk

traits could be achieved through selection, while improvement of DP, DO, CI and NSPC could be attained through efficient management.

Genetic correlation's (rg) and phenotypic correlation's (rp) between different studied traits are given in Table 3. Most estimates of rg were nearly similar to the corresponding estimates of phenotypic correlation in values having the same direction, except the coefficients between 305-dMY and each of DP, CI. and NSPC. Also between LP and each of DP and NSPC and between DO and NSPC as the coefficients of each of rg and rp differed in values and some of them differed in direction.

It could be concluded from the present study that the managerial level as well as the appropriate environmental conditions have great impacts on milk production and fertility traits of the imported Friesian cattle raised under the examined private farms in Egypt.

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