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GENETIC AND NON-GENETIC FACTORS AFFECTING TOTAL MILK YIELD, DAYS OPEN, NUMBER OF SERVICE PER CONCEPTION AND AGE At FIRST CALVING OF FRIESIAN COWS IN EGYPT.

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ABSTRACT

Total of 1394 normal records of Friesian cows in first lactation sired by 146 bulls collected from Sakha Farm, Ministry of Agriculture, Egypt during the period from 1970 to 1993 were used in this study. The data were used to estimate: the effects of non-genetic and genetic (sire) factors on total milk yield (TMY) and some reproductive traits namely days open (DO), number of service per conception (NSPC) and age at first calving (AFC), and to estimate genetic and phenotypic parameters for the previous traits. Data were analyzed using linear mixed model of Harvey's (1990). The results obtained could be summarized as follows:-

1. The actual means of TMY, DO, NSPC and AFC were 3391.9 kg, 190.7 days, 2.2 service and 31.8 month, respectively. Coefficients of variation of TMY and some reproductive traits (DO, NSPC and AFC) were 42.8% and (34.7%, 59.3% and 16.8%), respectively.
2. Month of calving had significant ($P< 0.05$) effect on days open, while, non significant effects on number of service per conception, age at first calving and total milk yield.
3. Year of calving had highly significant ($P< 0.01$) effect on total milk yield and of reproductive traits under the present investigation.
4. The sire had highly significant ($P< 0.01$) effects on total milk yield and days open and only significant ($P< 0.01$) effects on number of service per conception. While, non significant effect on age at first calving. The sire variance component (σ^2s) were 3.62%, 6.13%, 2.43% and 1.30% for TMY, DO, NSPC and AFC, respectively.
5. The estimates of heritability of total milk yield and reproductive traits of the cows at their first parity (based on parental half-sibs methods) were 0.15, 0.25, 0.10 and 0.05 for TMY, DO, NSPC and AFC, respectively.
6. Genetic correlations between reproductive traits studied were positive and significant ($P< 0.01$), except NSPC with AFC it was negative and significant ($P< 0.01$).
7. Phenotypic correlations between some reproductive studied traits were showed positive and significant ($P< 0.01$) values.
8. Environmental correlation between reproductive traits studied were positive and highly significant ($P< 0.01$).

Keywords: Friesian, cattle, total milk yield, reproductive traits, genetic parameters.

INTRODUCTION

High economic return is the main goal of dairy farm breeders. There is no dought in the roles of productive and reproductive performance of dairy cattle to attain this goal. Thus, knowledge of the relationships between the productive and reproductive traits as well as several environmental factors are represent one of the fundamental basis to reach this objective.

Milk yield in one hand and age at first calving, days open, number of services per conception and dry period in other hand are probably the most often used indices for evaluating productive and reproductive efficiency. Kubik (1992) stated that an average of 20 to 25 percent of good dairy producing cows are called every year due to poor reproductive performance.

The aim of this study were to estimate the effects of genetic and non genetic factors affecting total milk yield and reproductive traits of Friesian cows in the first lactation under Egyptian conditions.

MATERIALS AND METHODS

In this study a total of 1394 normal first lactation records for Friesian cows were used. The animals were raised in Sakha farm, located in the Northern Delta, Kafr El-Sheikh, Egypt. The productive and reproductive records were covered the period from 1970 to 1993. The cows were sired by 146 bulls. Cows were fed Egyptian clover (*Trifollum alexandrinum*) and graze *ad libitum* through the period from December to May. During these months, cows supplement with extra dry concentrates proportional to their weight and production. During the other months of the year, cows were fed on concentrate mixture along with rice straw and limited amount of clover hay when available. However, the feeding regime was carried according to Sakha Farm Animal Production research Institute.

Heifers were attempted for service for the first time when they reached 18 months or 350 kg live body weight. Cows in oestrus were usually serviced two months after calving. Rectal palpation for pregnancy diagnosis was per formed 60 days after the last service. Cows were machine milked twice daily.

Traits studied were total milk yield (kg), days open (day), number of service per conception (service) and age at first calving (month).

Statistical analysis:

Data were analyzed using linear mixed least square maximum likelihood (LSMLMW) computer program of Harvey (1990). The following mixed model was used to analyze total milk yield (TMY), days open (DO), number of service per conception (NSPC) and age at first calving (AFC):

$$Y_{ijkm} = \mu + S_i + M_j + Y_k + bL\,(x - \bar{x}) + e_{ijkm}$$

Where:

Y_{ijkm} = The individual observation,

μ = The overall mean,

S_i = The random effect of the ith sire,

M_j = The fixed effect of the jth month of calving j = 1, 2, 3, ...12 (from Jan. to December).

Y_k = The fixed effect of the kth year of calving k = 1, 2, 3, ...24 (from 1970 to 1993).

bL = Partial linear regression coefficient for the studied traits on cows weight at calving (WC).

x = Kg of weight at calving (WC), $\bar{x}$ average WC and,
eijkm = Residual term assumed to be randomly as a normally with mean zero and variance σ^2.

Heritability estimates (h^2) were computed by the paternal half-sibs methods according to the formula, $h^2 = 4\ \sigma^2_s / (\sigma^2_s + \sigma^2_e)$. Estimates of heritability (h^2) and genetic, phenotypic and environmental correlation coefficient among different traits were computed by LSMLMW program of Harvey (1990). All estimates were based on 1394 first lactation records.

RESULTS AND DISCUSSION

Means, standard deviation and coefficient of variation for total milk yield (TMY), days open (DO), number service per conception (NPSC) and age at first calving are presented in Table 1. The means of TMY, DO, NSPC and AFC were 3391.9 kg, 190.7 day, 2.14 service and 31.75 month, respectively.

Table 1. Means, standard deviation (SD) and coefficient of variation (CV%) for total milk yield and some reproductive traits.

Traits	Mean	SD	CV %
Total milk yield (kg)	3391.9	1451.9	42.8
Days open (day)	190.7	66.1	34.7
Number service per conception	2.14	1.27	59.3
Age at first calving	31.75	5.27	16.6

The value of total milk yield (3391.9 kg) was higher than that (2461 kg) reported by Abdel-Glil (1996), (2828 kg) by Badawy and Oudah (1999) and (3103 kg) by Alemam (2002), but it was lower than those reported by Shalaby (1996) being 3490 kg, El-Awady (1998) being 5032 kg, Marzouk (1998) being 3698 kg, and Hussein (2000) being 4765 kg.

The overall means of days open (DO) (190.7 days) (Table 1) was close to that obtained by Afifi *et al.* (1992) being 190 days. On the other hand, it was lower than that reported by Khattab and Ashmawy (1988) being 171 days, Marzouk (1998) being 152 days and Alemam (2002) being 151.7 days, in this respect, Khattab and Ashmawy (1988) pointed out that the DO length between 60-90 days will be desirable for reducing calving interval to be in the range of 12-13 months. El-Keraby and Aboul-Ela (1982) reported also that the longer DO in dairy cows may be caused by several factors (e.g. silent estrus, missed estrus due to weak symptoms, frequency and timing of estrus detection feeding season and level of milk production.

The overall mean of number of service per conception (NSPC) was 2.14 services (Table, 1). Nearly similar results were obtained by different authors working on dairy cattle in different countries, Mantysaari and Van Vleck (1989) 1.9, Abdel-Bary *et al.* (1992) 2.0, Oudah *et al.* (2001) 1.95 and Alemam (2002) 2.05 services. On the other hand, lower NSPC were found by Raheja *et al.* (1989) being 1.55, and Moore *et al.* (1990) being 1.58 services.

Higher NSPC were recorded by Kumar (1982) 2.36, Juma *et al.* (1988) 2.27, Mokhtar (1993) 3.3 and Ganah (2000) 2.5 services.

The overall means of age at first calving (AFC) was 31.75 months (Table 1). It is close to that obtained by different authors working on dairy cattle in different countries, Rade *et al.* (1986) 953 days, and Abdel-Glil (1996) 30.9 months. On the other hand, lower AFC reported by Mokhtar (1993) 28.7 months and Oudah *et al.* (2001) 27.0 months. Higher AFC were recorded by Mostagger *et al.* (1987) 34.4 months and Khattab and Sultan (1990) 34.0 months.

The coefficient of variation for TMY was 42.8% as shown in Table 1. This value is close to that of Badawy and Oudah (1999) 44.0%. On the other hand, lower coefficient of variation was reported by Abdel-Glil (1991) 33.7%.

The coefficient of variations of reproductive traits (DO, NSPC and AFC) were 34.7%, 59.3% and 16.6%, respectively, the wide variations reflected cow individual effect in these traits, due to poor management leading to such higher variation in NSPC and DO compared with AFC (Table 1). In this respect, Oudah *et al.* (2001) found that coefficient of variations of DO, NSPC and AFC were 56.9%, 61.0% and 12.7%, respectively.

The differences between the present estimates of TMY, DO, NSPC and AFC and these reported by different authors may be attributed to different climate, breeds, management, conditions, number of used animals, different methods of model analysis and also the accuracy of estrous detection and the time of insemination.

Table 2. Least squares analysis of variance of total milk yield and reproductive traits.

SOV	d.f.	TMY F	DO F	NSPC F	AFC F
Sire	145	1.32**	1.55**	1.21*	1.11^{NS}
Month of calving	11	1.39^{NS}	2.25^{NS}	1.20^{NS}	1.17^{NS}
Year of calving	23	12.99**	5.14**	3.44**	2.80**
Reg.					
WC linear	1	44.20**	34.93**	80.72**	308.97**
Remainder	1213	1644552.55	3880.53	1.44	21.74

* at 0.05 ** at 0.01

Table 2 showed that month of calving had non significant effect on TMY, these results are in agreement with those obtained by Shalaby (1996).

Also, the effects of month of calving was non-significant on DO, NSPC and AFC. Similar results were found by Kumar (1982), Khattab and Atil (1999) and Oudah *et al.* (2001). They found that month of calving had non significant effect on DO and NSPC, while it showed highly significant ($P< 0.01$) effect on AFC. Also, Alemam (2002) reported non significant effect of month of calving on DO and NSPC.

Year of calving had highly significant ($P< 0.01$) effect on TMY (Table 2). These results are in agreement with those obtained by Hussein (2000) and Farrag *et al.* (2000). Also, year of calving had highly significant ($P< 0.01$) effect on DO, NSPC and AFC (Table, 2). These results are in agreement with the finding of Khattab and Atil (1999), Oudah *et al.* (2001) and Alemam

(2002). The changes in atmospher conditions, quantity and quality of available feeds and the different management practices introduced from year to another may be the basis of this results.

Estimates of partial linear regression coefficients of TMY and reproductive traits (DO, NSPC and AFC) on cows weight at calving were highly significant (P< 0.01) (Table 2). The results indicated to increase in cows weight at calving associated with improving productive and reproductive traits.

The effects of sire on TMY was highly significant (P< 0.01) as shown in Table 2, these results are in agreement with those obtained by Hussein (2000), Aly *et al.* (2001) and Alemam (2002). Also, sire had highly significant (P< 0.01) effect on DO and only significant (P< 0.05) effect on NSPC. These results are in agreement with Abdel-Glil (1996), Oudah *et al.* (2001) and Alemam (2002). While sire effect on AFC was non significant (Table, 2). These results are non-agreement with those obtained by Oudah *et al.* (2001), who found that sire effect had highly significant (P< 0.01) effects on AFC.

Table 3.Estimates of sire variance components σ^2_s, error variance components $\sigma^2_e$and proportion of variance V% due to random effects and heritability $h^2 \pm$ SE for different studied traits.

Traits	Sire		Error		Heritability
	σ^2_s	V%	σ^2_e	V%	$h^2 \pm$ SE
TMY	61804.4	3.62	1644552.6	96.38	0.15 ± 0.07
DO	253.2	6.13	3880.5	93.87	0.25 ± 0.08
NSPC	0.036	2.43	1.445	97.57	0.10 ± 0.06
AFC	0.087	1.30	21.740	98.70	0.05 ± 0.06

The sire components (σ^2_s) adjusted for fixed effects of environmental factors ranged between (1.30 to 6.13%) of the total variance for total milk yield and reproductive traits studied as shown in Table 3. The present estimate of sire component concerning TMY (3.62%) is lower than that obtained by Khattab (1992) being 10.6%. Also, the present estimates of sire components for DO (6.13) is higher than that reported by Abdel-Glil (1991) being 2.5%, Salem and Abdel-Raouf (1999) being 2.5 and Oudah *et al.* (2001) being 4.20%. While, sire component for NSPC (2.43%) is close to that obtained by Oudah *et al.* (2001) being 4.08%. In spite of the significant effect of sire on the studied productive and reproductive traits; the magnitude of this significant effect, proportional to the total variance were corresponded with low heritability estimates of these traits (Table 3).

The estimates of heritability for TMY, DO, NSPC and AFC in the present study were ranged between 0.05 to 0.25. These values are in accordance with the estimates of different authors for the same traits on different dairy cattle breeds in various countries. El-Awady (1998) showed that h^2 for TMY was 0.43 and, Alemam (2002) was 0.184. Kumar (1982) observed that h^2 for DO, NSPC and AFC were 0.04, 0.07 and 0.38, respectively. Smith *et al.* (1989) found that h^2 of AFC was 0.01. Abdel-Glil (1996) found that h^2 of DO and AFC were 0.12 and 0.78, respectively. Salem and Abel-Raouf (1999) found that h^2 of DO and NSPC were 0.01 and 0.10,

respectively. Oudah *et al.* (2001) found that h^2 of DO, NSPC and AFC were 0.168, 0.105 and 0.163, respectively, and Alemam (2002) found that h^2 for DO and NSPC were 0.176 and 0.036, respectively.

The low estimates of heritabilities for the productive and reproductive traits studied indicated that the major part of the variation in these traits was environmentally, so selection may not prove effective in bringing about genetic improvement in these traits. Therefore, better management can play a major role in improving these traits. Mokhtar (1993) came to the same conclusion.

Table 4. Genetic correlation ± SE (above diagonal) and phenotypic correlation (blew diagonal) and environmental correlation (between parentheses).

Traits	DO	NSPC	AFC
DO	--	0.17 ± 0.33**	0.25 ± 0.43**
NSPC	0.54** (0.62)**	--	-0.37 ± 0.57**
AFC	0.23** (0.24)**	0.35** (0.40)++	--

The genetic correlations between reproductive traits as shown in Table 4 were positive and highly significant (P< 0.01), except for between NSPC and AFC was negative and highly significant (P< 0.01). These results are in accordance with Abdel-Glil (1996), he found that genetic correlation between DO and AFC was -0.21, Oudah *et al.* (2001) and Alemam (2002) were found that genetic correlation between Do and NSPC were 0.099 and 0.650, respectively.

The phenotypic and environmental correlations between reproductive traits shown in Table 4 were positive and highly significant (P< 0.01). Similarly, Abdel-Glil (1996) found that phenotypic correlation between DO and AFC was -0.04, Oudah *et al.* (2001) found that phenotypic and environmental correlations between DO and NSPC were 0.50 and 0.564, respectively and Alemam (2002) found that phenotypic correlation between DO and AFC was 0.553.

The value of environmental correlation between DO and NSPC (0.62) was nearly similar to that of phenotypic correlation (0.54). Also, the phenotypic correlation between DO and NSPC was higher than the genetic correlation (0.17) (Table 4). This emphasize the large environmental influence on these traits.

From the previous results, it could be noticed the low estimates of heritability for the studied productive and reproductive traits. This indicated to the major part of the variation in these traits were environmentally and by the way selection may not prove effective in brining about genetic important in these traits. Therefore, better management (environmental influence) can play a major role in improving these traits.

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العوامل الوراثية والغير وراثية المؤثرة على إنتاج اللبن الكلى والأيام المفتوحة (فترة التلقيح) وعدد التلقيحات اللازمة للإخصاب والعمر عند أول ولادة فى أبقار الفريزيان فى مصر

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تم تحليل بيانات ١٣٩٤ سجل لأبقار الفريزيان فى الموسم الأول والملقحة بعدد ١٤٦ طلوقة وذلك بمزرعة سخا التابعة لوزارة الزراعة بمصر خلال الفترة من ١٩٧٠ إلى ١٩٩٣ . وإستخدمت البيانات لتقدير التأثيرات الغير وراثية والوراثية والعوامل المؤثرة على إنتاج اللبن الكلى وبعض صفات التناسل مثل الفترة من الولادة حتى التلقيح المخصب وعدد التلقيحات اللازمة للإخصاب والعمر عند أول ولادة وكذلك تقدير الإرتباطات المظهرية والوراثية لهذه الصفات وتم تحليل البيانات إحصائيا بإستخدام (Harvey, 1990). وكانت النتائج المتحصل عليها كالتالى:-

١- بلغ متوسط إنتاج كل من اللبن الكلى والفترة من الولادة حتى التلقيح المخصب وعدد التلقيحات اللازمة للإخصاب والعمر عند أول ولادة ٣٣٩١,٩ كجم ، ١٩٠,٧ يوم ، ٢,١٤ تلقيحة و ٣١,٧٥ شهر على التوالى. معامل الإختلاف لكل من إنتاج اللبن الكلى وبعض الصفات التناسلية (الفترة من الولادة حتى التلقيح المخصب وعدد التلقيحات اللازمة للإخصاب والعمر عند أول ولادة) كانت ٤٢,٨% و (٣٤,٧% ، ٥٩,٣ %، ١٦,٦%) على التوالى.

٢- تبين أن لشهر الولادة تأثير معنوى عند ($P< 0.01$) على الفترة من الولادة حتى التلقيح المخصب وغير معنوى على عدد التلقيحات اللازمة للإخصاب والعمر عند الولادة وإنتاج اللبن الكلى.

٣- كان لسنة الولادة تأثير عالى المعنوية ($P< 0.01$) على صفة إنتاج اللبن الكلى وكل صفات التناسل موضع الدراسة.

٤- تأثير الطلائق كان عالى المعنوية ($P< 0.01$) على كل من إنتاج اللبن الكلى والفترة من الولادة حتى التلقيح المخصب ومعنوى ($P< 0.01$) على عدد مرات التلقيح اللازمة للإخصاب ، بينما تأثيره غير معنوى على العمر عند أول ولادة. مكونات التباين (σ^2_s) كانت ٣,٦٢ و ٦,١٣ و ٢,٤٣ و ١,٣٠ لكل من إنتاج اللبن الكلى والفترة من الولادة حتى التلقيح المخصب وعدد مرات التلقيح اللازمة للإخصاب. والعمر عند أول ولادة على التوالى.

٥- تقديرات قيم المكافىء الوراثى لإنتاج اللبن الكلى وصفات التناسل فى الموسم الأول والمعتمدة على طريقة تزاوج أنصاف أشقة لكل من إنتاج اللبن الكلى والفترة من الولادة حتى التلقيح المخصب وعدد التلقيحات اللازمة للإخصاب والعمر عند أول ولادة بلغت ٠,١٥ ، ٠,٢٥ ، ٠,١٠ ، ٠,٠٥ ، ٠,٠٥ على التوالى.

٦- الإرتباط الوراثى بين صفات التناسل تحت الدراسة كانت موجبة ومعنوية ($P< 0.01$) فيما عدا بين كل من عدد التلقيحات اللازمة للإخصاب والعمر عند الولادة كانت سالبة ومعنوية ($P< 0.01$).

٧- الإرتباط المظهرى بين صفات التناسل تحت الدراسة كانت موجبة ومعنوية ($P< 0.01$).

٨- الإرتباط البيئى بين صفات التناسل تحت الدراسة كانت عالية ومعنوية ($P< 0.01$).

ويستدل من هذا البحث أنه من خلال الرعاية الجيدة لماشية الفريزيان يمكن تحسين الصفات التناسلية والإنتاجية لتلك الماشية مما يؤدى إلى رفع كفاءتها الإنتاجية تحت الظروف البيئية فى مصر.