

## Estimate of Genetic and Phenotypic Trends for Some Productive and Reproductive Traits of Friesian Cows in Egypt

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### ABSTRACT

The purpose of this study was to estimate the genetic and phenotypic parameters in order to obtain the trends of 305-day milk yield (305-DMY) lactation period (LP), calving interval (CI) and days open (DO) of Friesian cows. Data consisted of 5728 lactation records for 2040 Friesian cows sired by 139 bulls during the years from 1979 to 2016 at Sakha and El-Karada Farms inherent in the Animal Production Research Institute (APRI), Kafr-Elsheikh Governorate, Egypt. Data were analyzed using Harvey program statistic (Harvey, 1990) to determine the fixed effects to be included in the analytical model. Covariance components were estimated for univariate and bivariate analysis for all traits with derivative-free restricted maximum likelihood (REML) procedures using the MTDFREML program of Boldman *et al.*, (1995). Means for 305-DMY, LP, CI and DO were 2632.09 kg, 300.02 d, 449.92 d and 173.95 d, respectively. Heritability estimates were 0.24, 0.22, 0.16 and 0.17 for the similar previous traits, subsequently. The genetic correlation between all traits studied were moderate and positive, ranging from 0.26 to 0.75. Corresponding phenotypic correlations between different traits under investigation were small and positive and ranged between 0.05 to 0.29. The annual genetic changes in the breeding values (BV's) were positive for 305-DMY (6.10 kg/yr.) while being negative for LP, CI and DO (-0.16, -0.05 and -0.06 d/yr, respectively), indicating that there is an achievement superior sires however more attention should be given to reproductive traits to avoid losses related to these traits in the future. The results indicated that the use of top ranking bulls on the basis of their (BV's) for milk yield traits in breeding program will lead to noticeable genetic improvement in productivity of Friesian cows in Egypt.

**Keywords:** genetic trends, phenotypic trends, genetic parameters, productive traits, reproductive traits, Friesian cows, Egypt.

### INTRODUCTION

The increase of production efficiency could be achieved either by improving the environmental conditions of the population, by improving the mean breeding values of members of the population, or by a combination of both (Katkasame *et al.*, 1996). It is important to appreciate genetic trends to observe and rate selection programs. Totally knowing all animals and grade them according to their genetic worth for the wanted characters to make the best use of them in breeding and this is the main goal of animal breeding, so genetic rating of animal is a key topic. (Ahmad *et al.*, 2008). In fact, Genetic trend is defined as a change in performance per unit of time due to changes in the mean of breeding value, while phenotypic trend is a change in production per unit of time (Hebert and Bhatnagar, 1988). Trends refer to increase or decrease that happened as a result of using breeding plans in the place (Ojango and Pollott, 2001). Normally, researchers should provide dairy producers with net information to help them take genetic decisions. Positive or negative genetic trends help animal breeders to judge the quality of breeding programs in the herd. Genetic trend and environmental trend are two components of phenotypic trend. In common, the correlation between fertility traits which give low heritability, and several production traits are negative (Jorjani 2006). Over the years, animal breeders have focused on productive traits in sire evaluation. Such selection criteria have resulted in a positive genetic trend in milk production associated with a decline in reproductive performance in dairy cow. The decline in female fertility has led to additional insemination cost and veterinary cost, culling and replacement rate. Broadly, controlling the environment and enhancing breeding methods, we could attain positive phenotypic and genotypic trends. (Amimo *et al.*, 2007).

The objectives of the present study were to estimate the necessary genetic and phenotypic parameters of productive and reproductive traits in the Friesian cows to calculate the phenotypic and genetic trends for 305-DMY,

kg, LP, d, CI, d and DO, d in order to achieve the genetic improvement possibilities of these traits together.

### MATERIALS AND METHODS

#### Source of the data

Data used in the study consists of 5728 complete lactation records for 2040 Friesian Cows sired by 139 bulls over the years from 1979 to 2016. In Fact, each sire had less than 5 daughters was ignored from the statistical record analyses. There were many reasons to ignore some incomplete records and traits limitations(i.e., cows were removed with (1) no measurements on milk traits or with records from 500, d lactation period; (2) duplicate records and (3) duplicate termination codes. Henceforth, Friesian cows that used in the analysis were native to Sakha and El-Karada Experimental Farms, Animal Production Research Institute (APRI), Ministry of Agriculture, Kafr-Elsheikh Governorate, Egypt.

Therefore, the cows loosely housed in open sheds system and kept under a comparable system of feeding and management. They fed on good quality concentrate ration and provided with their requirements to live according to their body weight, milk production, and pregnancy status, all of that practiced on the farm carried out by APRI. Animals were supplied with Egyptian clover (*Trifolium alexandrinum*) during winter and spring, but during summer and autumn they were fed on dry ration, mainly either Egyptian cover hay or green sweet sorghum, and rice straw was available around the year Portable water and mineral mixture was available freely. Cows were milked twice daily in a parallel by DeLaval Alpha milking machine. Milk yield was recorded daily to the nearest 100 g at each milking. Cows were usually at dry off about two months before the expected calving date. On the other hand, cows were artificially inseminated at random. Artificially inseminated at random used for cows and when Heifers reached 2 years of age or 350 kg live body weight, which comes first, in this case, be ready to service and cows were almost serviced two months postpartum.

Pregnancy was detected by rectal palpation sixty days after the last mating. Traits studied are productive traits as 305-day milk yield (305-DMY), kg, lactation period (LP), d. Besides, reproductive traits are calving interval (CI), d; and days open (DO), d.

**Data analysis**

Data were analyzed using Harvey program statistic (Harvey, 1990) to determine the fixed effects to be contained in the analytical model. The statistical model included season (1 to 4) and year (1979 to 2015) of birth, parity of cow (1 to 5) and farm (1 =Sakha and 2 =El-Karda). All effects are significant for all traits was contained in the analytical model.

Covariance components were estimated for univariate and bivariate analysis for all traits with derivative-free restricted maximum likelihood (REML) procedures using the MTDFREML program of Boldman et al, (1995). The basic multiple model was:

$$Y = XB + Zd + Wpe + e$$

**Where:**

Y is a vector of observations, B = is a vector of fixed effects with incidence matrix X.

d ~ NID (0, I<sub>c</sub> σ<sup>2</sup><sub>pe</sub>) is a vector of direct additive genetic effect with incidence matrix Z, Pe ~ NID (0, A σ<sup>2</sup><sub>d</sub>) is a vector of random maternal permanent environmental effects with incidence matrix W, and e ~ NID (0, I<sub>n</sub> σ<sup>2</sup><sub>e</sub>) is a vector of random residual effects. Also, σ<sup>2</sup><sub>d</sub> is the direct additive genetic variance; σ<sup>2</sup><sub>pe</sub> is the maternal permanent environmental variance, σ<sup>2</sup><sub>e</sub> is the residual variance (temporary environment), A is the additive relationship matrix, I<sub>c</sub> and I<sub>n</sub> are identity matrices of order equal to the number of maternal permanent environmental effects and the number of records, respectively.

Convergence reached when the simplex variance was less than 10<sup>-8</sup> and then several extra rounds of iterations were executed to ensure that a global maximum was reached. Best linear unbiased prediction (BLUP) of estimated breeding values (EBV's) was calculated by back-solution using the MTDFREML program for all animals in the pedigree file for multi-traits analysis. Selection index was used to compare the accuracy of selection for mastitis resistance when the selection is based on SCC, MAST or a combination of both along with MY. Accuracy was defined as the correlation between the true breeding value using genetic and phenotypic covariance estimated in the first lactation.

Heritability (h<sup>2</sup>) was estimated by using the following equation (h<sup>2</sup> = σ<sup>2</sup><sub>a</sub> / σ<sup>2</sup><sub>a</sub> + σ<sup>2</sup><sub>pe</sub> + σ<sup>2</sup><sub>e</sub>), where, σ<sup>2</sup><sub>a</sub> = additive genetic variance, σ<sup>2</sup><sub>pe</sub>= permanent environmental variance and σ<sup>2</sup><sub>e</sub>= random residual effects. The more detail in the description of the mixed model equations was written by Mrode (1996).

Based on first lactation, the genetic trends for different traits studied were obtained by estimating coefficients of regression the estimate of breeding values on years of birth. For the p<sup>th</sup> year, the average of transmitting abilities was  $\sum_i n_{ip} \bar{a}_i / n \cdot p'$  where n<sub>ip</sub>

is the number of daughters of sire i born in the p<sup>th</sup> year, and  $\bar{a}_i$  is the predicted transmitting ability of the i<sup>th</sup> sire, (Canon and Munoz, 1991).

The accuracy of predicted breeding value for each individual was estimated according to Henderson

(1975) as  $r_{AA} \hat{a} = \sqrt{1 - d_j \alpha}$

Where r<sub>AA</sub> = the accuracy of prediction of the i<sup>th</sup> animals breeding value (animals with records) and animals transmitting ability (animals without records), d<sub>j</sub> = the j<sup>th</sup> diagonal element of inverse of the appropriate block coefficient matrix, and α = σ<sup>2</sup><sub>e</sub> / σ<sup>2</sup><sub>a</sub>.

**RESULTS AND DISCUSSION**

**Descriptive Statistics**

Means, standard deviation (±SD) and coefficients of variation (CV %) for studying traits are given in Table (1). In this study, means of 305-DMY, LP, CI, DO were 2632 kg, 300, d, 450, d and 174, d, respectively. The average of 305-DMY for Holstein cows were 9038 kg and 8455.4 kg, 6384.95 kg in Egypt as reported by Ashmawy and Khalil (1990), Salem et al., (2006), Hammoud (2013) and Faid Allah, (2015), respectively, and for Karen Fries (Holstein Friesian crossbred) was 3027.11 kg in India by Dash et al., (2016); all of those are higher than the ones in this study.

The length of the LP in the current study (300.02 d) was lower than the range of 332 to 470 d estimated by Faid Allah, (2015); Abou-Bakr et al., (2006); and Salem et al., (2006). The present mean of CI was 450, d is in line with Hammoud et al., (2014), Egypt, (427, d), but higher than Aghajari et al., (2015), on Iranian Holstein cows, (387, d). The mean of DO was 174; d was higher than obtained by Hammoud and El-Zarkony (2010) in Friesian cattle (130.7, d). Mean of DO for US Holstein cows was 113 days (Oseni et al., 2004 and Hultgren and Svensson 2010). Besides, Hare and Norman (2006) reported mean of first calving interval in Jerseys (390 day), Ayrshire (398 d), Holsteins (404 d), Guernsey (406, d) and Brown Swiss (407, d). Ansari-Lari et al., (2010) using 8204 calving records in five herds, reported that the men of DO and CI in Holstein cows in Fars province were 134 and 403 d, respectively.

**Table 1. Means, standard deviations (SD), coefficients of variation (CV %), Minimum, Maximum, SD for minimum and maximum for 305-DMY, kg, LP, days, CI, days and DO, days.**

Estimate	Traits			
	305-DMY, kg	LP, d	CI, d	DO, d
Mean	2632.09	300.02	449.92	173.95
SD	1089.80	989.54	102.90	103.86
C.V	41.40	32.98	22.87	59.71
Min	1000.0	150.00	329.00	45.00
Max	8159.0	886.00	750.00	493.00
Std Min	-150	-15.2	-11.8	-12.4
Std Max	507	59.2	29.2	30.7

**Genetic parameters**

Estimates of variance component for different traits are illustrated in table (2). Estimates of additive genetic variance for 305-DMY, LP, CI and DO were 2.94, 3.05, 2.44 and 3.21, respectively. Furthermore, the values of phenotypic variance for the same traits were 12.51, 13.93, 15.34 and 18.68, respectively.

Heritability estimates for 305-DMY, LP, CI and DO were 0.24, 0.22, 0.16 and 0.17, respectively. This estimate was higher than those reported by Abou-Bakr et al., (2006) who obtained heritability estimates of 0.13 for 305-DMY, however, values were close to the range 0.25 to

0.27 reported by Salem *et al.*, (2006) and Rashad (2013) for the same trait, when estimated on comparable Friesian or Holstein cows in Egypt.

**Table 2. Estimates of (Co) variance components and genetic parameters for 305-DMY, kg, LP, days, CI, days and DO, days.**

Traits	305-DMY, kg	LP, d	CI, d	DO, d
$\sigma_a^2$	2.94	3.05	2.44	3.21
$\sigma_{pe}^2$	2.37	2.95	2.60	11.71
$\sigma_e^2$	7.20	7.93	10.30	3.77
$\sigma_p^2$	12.51	13.93	15.34	18.68
$h^2$	0.24	0.22	0.16	0.17
$c^2$	0.19	0.21	0.17	0.63
$e^2$	0.57	0.57	0.67	0.20

$\sigma_a^2$  = direct additive genetic variance,  $\sigma_{pe}^2$  = maternal permanent environmental variance,  $\sigma_e^2$  = residual (temporary environmental variance),  $\sigma_p^2$  = phenotypic variance,  $h^2$  = direct heritability,  $c^2$  = fraction of phenotypic variance due to maternal permanent environmental effects and  $e^2$  = fraction of phenotypic variance due to residual effects.

Also, the current estimate of 305-DMY was higher than the value published by Faïd Allah (2015, 0.184), but it is totally agree with Endris *et al.*, (2013, 0.24). Heritability values for milk production traits of Friesian cows in subtropical, warm or hot climates of Sudan, tropical highlands of Ethiopia and China were also variable, ranging from 0.17 to 0.39 for 305-DMY (Effa *et al.*, 2011 and Usman *et al.*, 2012). The higher heritability estimates for 305-DMY for all levels of milk yield could be attributed to that truncation of the lactation records at 305 days in milk or considering the average daily production may reduce the temporary environmental variation associated with the day to day fluctuations in milk yield especially those occurring towards the end of lactation. This, consequently, inflates the genetic variation relative to the environmental (Hammoud *et al.*, 2014).

The present estimates of heritability of the LP were extremely superior to those obtained by Abou-baker *et al.*, (2006), Salem *et al.*, (2006) and Faïd Allah (2015) on Friesian or Holstein cows in Egypt and by (Effa *et al.*, 2011 and Usman *et al.*, 2012) under warm climate. Their ranges of heritability estimates were from 0.03 to 0.18. Heritability estimated in this research for CI and DO were 0.16 and 0.17. Hammoud *et al.*, (2014) indicated DO at low, medium and high level milk production was 0.27, 0.21 and 0.15 also, for CI were 0.27, 0.15 and 0.13, respectively. Osman *et al.*, (2013a) conducted heritability estimates of calving interval were 0.18 for second lactation at his studio on Holstein-Friesian dairy cattle. El-Shalamani (2011) reported heritability estimate of DO was 0.42 and Hammoud (2013) showed the values of DO was 0.48 for first lactation Holstein cows and Osman *et al.*, (2013b) conducted heritability estimates at first parity of DO was 0.313 for Holstein cows and at second parity was 0.117. The difference in heritability estimates among various studies for the same trait could be attributed to differences in the number of records used, the correction for different non-genetic factors, the model used and the methodology used for estimation (Abou-Bakr, 2009). Fraction of phenotypic variance due to maternal permanent environmental effects for different traits studied were ranged between (0.17 – 0.63). Vice-versa, fraction of phenotypic variance due to residual effects of all traits studied ranged between (0.20 – 0.67).

Genetic and phenotypic correlations between production and reproduction traits are in the table (3). All correlations (genetic and phenotypic) were positive. The positive genetic correlation between 305-DMY in dairy cows and the LP were reported by Salem *et al.* (2006) and Hammoud (2013). The positive genetic correlations between traits, especially productive ones obtained these traits could be improved simultaneously via a multi-trait selective breeding program. Hammoud (2013) obtained positive genetic correlations in Holstein cows between DO and 305-DMY ( $r_g=0.32$ ), LP ( $r_g=0.34$ ); LP and 305-DMY ( $r_g=0.29$ ). In parallel, Hammoud *et al.*, (2014) reported the genetic and phenotypic correlation at low, medium and high level milk production between CI, 305-DMY was ( $r_g=0.48$ ,  $r_p=0.70$ ), ( $r_g=0.82$ ,  $r_p=0.06$ ) and ( $r_g=0.75$ ,  $r_p=0.20$ ), respectively. Additionally, Osman *et al.*, (2013b) clarified positive genetic and phenotypic correlations in Holstein cows at the first parity between DO and LP ( $r_g=0.990$ ,  $r_p=0.771$ ) and positive correlations at the second parity were observed between LP and DO ( $r_g=0.298$ ,  $r_p=0.544$ ). The genetic and phenotypic correlation between LP and DO were positive ( $r_g=0.037$ ,  $r_p=0.406$ ); 305-DMY and LP were positive ( $r_g=0.037$  and  $r_p=0.406$ ) and 305-DMY and DO ( $r_g=-0.005$  and  $r_p=0.413$ ) as mentioned by Faïd Allah (2015). In fact, Rushdi, (2015) worked on a commercial herd of Holstein Friesian cows raised in Egypt found that the correlations between 305-DMY and DO were ( $r_g=0.08$ ,  $r_p=0.01$ ). On the contrary, Atil and Khattab (2005) published in his study on Holstein Friesian cows that the genetic correlation between CI and LP was -0.700, between CI and 305-DMY was -0.68 and between 305-DMY and LP was 0.96.

**Table 3. Estimation of genetic correlation ( $r_g$ ) above the diagonal and phenotype correlation ( $r_p$ ) under diagonal for 305-DMY, LP, CI, and DO.**

Traits	305-DMY	LP	CI	DO
305-DMY		0.41	0.28	0.26
LP	0.16		0.53	0.75
CI	0.29	0.05		0.11
DO	0.17	0.20	0.16	

**Trends**

Additive genetic and permanent trends, of the studied traits are illustrated in Figures (1 to 4) and phenotypic trends showed in table (4) across the time period from 1979 to 2013. Comparison of genetic and phenotypic trends helps to assess genetic improvement which due to superior performance.

Additive genetic, phenotypic and permanent trends for 305-DMY with variant ascending and descending over the years, ranged between (-291.99 to 399.59), (-206.44 to 111.26) as shown in figure (1) and (-403.28 to 282.59) this illustrated in table (4), respectively. The highest values of phenotypic trends were in last two years (2012, 450.81 and 2013, 482.59).

It was noticeable that additive genetic and permanent trend increased to 100.88 and 303.07 in the year of 2013, this indicated the genetic strategies and good managements can raise the yield. The highest estimate of additive genetic trend was 399.59 in year 1999 and of phenotypic trend were 482.59, 450.84 in years 2013, 2012. However, some limitations which

may cause the decrease or slow improvement in genetic progress like lack of selection/breeding techniques for evaluating animals, smaller herd size, inbreeding and absence of accuracy in recording (Ahmad 2007).

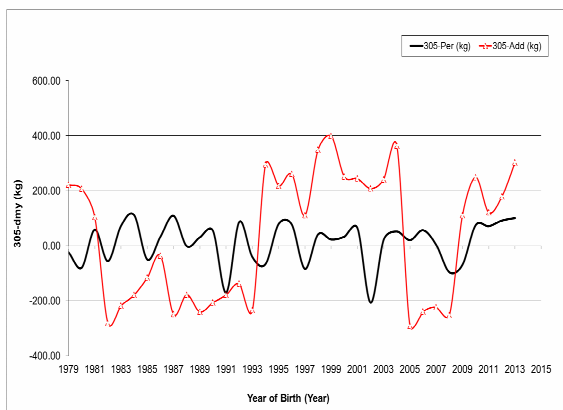


Figure 1. Additive genetic and permanent trends of 305-DMY (kg).

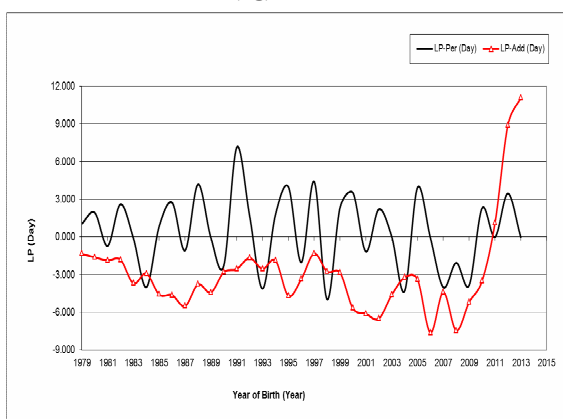


Figure 2. Additive genetic and permanent trends of LP (day).

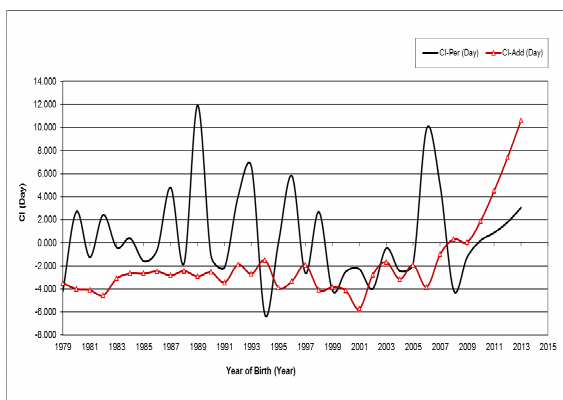


Figure 3. Additive genetic and permanent trends of CI (day).

On the other hand, additive genetic, phenotypic and permanent trends for LP, CI and DO behaved the same general direction and all of that described what happened in phenotypic trend in table (4). The values of additive genetic trends for LP ranged from (-7.62 to 11.08) and various ups and downs occurred until reached to the top value 11.08 in 2013.

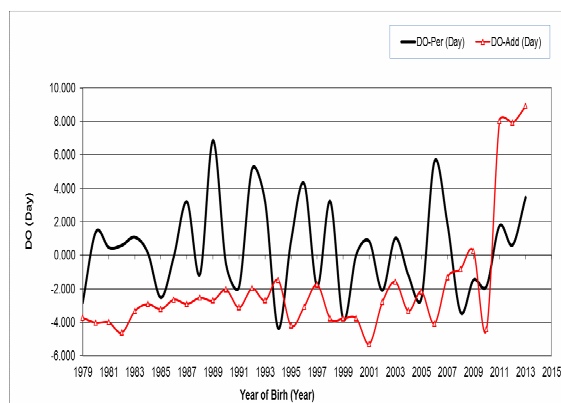


Figure 4. Additive genetic and permanent trends of DO (day).

Table 4. Estimates of annual phenotypic change/year for different studied traits.

Year of Calving	305-DMY, kg	LP, d	CI, d	DO, d
1979	-112.73	3.88	-22.47	-21.31
1980	71.87	10.24	-11.30	-11.72
1981	-154.28	8.46	-16.24	-15.17
1982	-317.52	13.71	-21.32	-20.48
1983	-392.60	-6.72	-11.23	-11.24
1984	-403.28	9.46	0.99	0.81
1985	-384.16	5.46	3.28	3.11
1986	-342.88	17.96	14.76	16.98
1987	-309.98	16.71	20.17	20.81
1988	-84.34	22.81	12.34	13.76
1989	-183.01	13.63	9.95	11.86
1990	-138.30	10.25	10.01	11.96
1991	65.09	3.76	-0.58	0.87
1992	-5.29	6.46	5.17	7.02
1993	28.21	2.47	-2.04	-2.00
1994	411.54	20.43	16.68	17.06
1995	272.95	-10.82	-12.98	-12.56
1996	375.22	8.43	1.27	3.52
1997	227.67	31.99	17.64	18.64
1998	370.12	20.74	4.73	5.54
1999	410.55	15.30	-0.94	-0.70
2000	317.10	-2.48	-5.70	-5.42
2001	132.47	-4.94	-19.41	-20.04
2002	291.65	-4.22	11.06	10.53
2003	330.29	14.63	27.16	26.09
2004	328.47	3.66	-0.59	-0.11
2005	292.84	19.15	23.87	25.30
2006	100.12	-26.43	-4.13	-3.64
2007	84.56	1.57	27.33	22.15
2008	-295.36	-28.76	38.05	32.55
2009	-171.39	-12.60	43.44	41.75
2010	-225.74	-0.55	-3.11	-4.81
2011	206.46	37.42	12.92	32.51
2012	450.84	61.69	28.11	29.58
2013	482.59	84.59	37.86	49.06
Annual phenotypic change (Mean±SE)	15.14 ± 3.92	0.33 ± 0.35	1.02 ± 0.23	1.07 ± 0.24

Similarly, the values of permanent and phenotypic trends for LP ranged from (-4.969 to 0.7127) and from (-28.76 to 84.59), respectively. The top values of permanent and phenotypic trends were (7.127 in 1991) and (84.5 in 2013, 61.69 in 2012). It is important to notice that the permanent had a slowly decrease at middle of years (Figure 2).

In addition, values of additive genetic trends for CI and DO ranged from (-5.72 to 10.60) and (-5.29 to 8.90), respectively, and estimated phenotypic trends for CI and DO ranged between (-22.47 to 43.44) and (-21.31 to

49.06), respectively. It is so clear reproductive traits had the same genetic and phenotypic trends and both achieved an equal decrease, but a large progress achieved in final years.

Conversely, permanent trend for CI and DO are shown (Figure 3, 4)

And ranged between (-6.23 to 11.925) and (-4.346 to 6.845), where the highest estimate was in 1985 (11.925) and in 1985 (6.845), respectively Permanent trend indicated management practices had improved over time.

Better feeding and advancement in total management and breeding programs, etc. are very important to improve animals' milk production. Besides, Selection in a proper direction, by selected young bulls and considerate the breeding values of these animals, can attain a further improvement in the power of the population. It is important to avoid selection on the basis of milk yield of their dams only as a single criterion. (Ahmad *et al.*, 2009). Moreover, the genetic progress could only be possible in a vast genetic base and a larger cow herd. In addition, the progress through powerful selection could occur by the absence of inbreeding and ensuring accuracy in performance recording in the future.

### CONCLUSION

Some of the productive and reproductive traits of Friesian cows of some government research dairy farms in Egypt were analyzed. Because of low heritability, lack of records for culling cows, and late availability of information, relying exclusively on direct selection to reduce CI is not advisable. Indirect selection for improved fertility might rely on early available traits like DO. In addition, DO and CI are composite traits and cannot identify if infertility by reason of a decrease in reproductive efficiency or due to the low success rate. Really, those traits allow earlier prediction of bulls' breeding values and provide information for cows that could be culled early which increased the profitability of the dairy farm.

Though the inheritance of reproductive traits is low, there are high differences among animals in reproductive traits (indicated by coefficients of variation). Therefore, selection for milk yield traits appears to have a quality to improve reproductive efficiency genetically. Positive favorable genetic correlations among all traits under investigation illustrated animals with a high rate for one trait would have high rate similar in other correlated traits. Also, these traits probably controlled by the same genes, so breeders could improve them with each other by selection. Moreover, positive genetic trends for most of the studied traits are an index for the possibility of improvement of the current herd genetically.

Based on the present estimated genetic parameters, the use of indirect selection will improve fertility in dairy cows is expected to be more effective than direct selection for fertility traits. The results indicated that the use of top-ranking bulls on the basis of their reliable measures of breeding values will lead to noticeable genetic improvement in productivity of Friesian cows in government research dairy farms in Egypt.

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## تقدير الاتجاهات الوراثية والمظهرية لبعض الصفات الإنتاجية والتناسلية في أبقار الفريزيان في مصر

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الغرض من الدراسة هو تقدير الاتجاهات الوراثية والمظهرية لصفة إنتاج اللبن في ٣٠٥ يوم، طول مدة الحليب، الفترة بين ولادتين وفترة الأيام المفتوحة لأبقار الفريزيان بمزرعتي سخا والقريضا التابعتين لمعهد بحوث الإنتاج الحيواني بمحافظة كفر الشيخ-مصر. و شملت الدراسة ٥٧٢٨ سجل لعدد ٢٠٤٠ بقرة فريزيان و ١٣٩ طلوقة، خلال الفترة من ١٩٧٩ إلى ٢٠١٦. وتم تحليل البيانات باستخدام برنامج التحليل الإحصائي (Harvey (1990) لتحديد العوامل الثابتة كى توضع فى المودل الاحصائى. كما استخدم برنامج (MTDFREML program of Boldman *et al.*, (1995) لتقدير المعايير الوراثية ومكونات التباين المختلفة. وكانت قيم متوسط إنتاج اللبن في ٣٠٥ يوم ٢٦٣٢,٠٩ كجم، ومتوسط طول موسم الحليب ٣٠٠,٠٢ يوم، ومتوسط الفترة بين ولادتين ٤٤٩,٩٢ يوم، متوسط الفترة من الولادة وحتى الإخصاب ١٧٣,٩٥ يوم. بينما تقديرات المكافء الوراثى لصفة إنتاج اللبن في ٣٠٥ يوم هي ٠,٢٤، لطول موسم الحليب هي ٠,٢٢، للفترة بين ولادتين هي ٠,١٦، وللفترة من الولادة حتى الإخصاب هي ٠,١٧. وكانت قيم الارتباط الورثى بين كل الصفات متوسطة وموجبة وتتراوح بين ٠,٢٦ إلى ٠,٧٥. فى حين أن القيم المناظرة للارتباط المظهرى بين الصفات موضع الدراسة كانت صغيرة وموجبة وتتراوح بين ٠,٠٥ إلى ٠,٢٩. وقد وجد أن التعيير الوراثى السنوى لقيم التربية موجبة لصفة إنتاج اللبن في ٣٠٥ يوم وكانت ٦,١٠ كجم/سنة بينما كانت سالبة لكل من طول موسم الحليب والفترة بين ولادتين والفترة من الولادة وحتى الإخصاب (- ٠,١٦ و - ٠,٠٥ و - ٠,٦٠ يوم/سنة على الترتيب) وهذا يشير الى وجود آباء متفوقة ولكن يجب منح مزيد من الاهتمام للصفات التناسلية لتجنب الفقد فيها فى المستقبل. كما تشير النتائج إلى أن استخدام الثيران الأعلى تصنيف فى القيم الوراثية لصفات اللبن فى برامج التربية سوف يؤدي إلى تحسين وراثى ملحوظ فى إنتاجية أبقار الفريزيان فى مصر.