GENETIC FACTORS AFFECTING TOTAL MILK YIELD, LACTATION PERIOD AND CALVING INTERVAL OF CROSSBRED FRIESIAN COWS RAISED ON NILE DELTA

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Abstract

The main objective of the study is to estimate the various genetic parameters to determine the status of the productive herd, as well as the effect of non-genetic factors such as (parity, season and year of calving also interactions between these factors) for total milk yield (TMY kg), lactation period(LP, days) as milk production traits and calving interval (CI, days) as reproductive traits of Crossbred Friesian (local & Friesian) at generation F_8, cows raised on Nile Delta in Gamaza herd, Egypt. A total number of 1308 lactation records of 402 cows (daughters of 279 dams and 73 sires). The analysis was performed using SAS (2003). The model included the random effects of genetic factors (sire effect) and fixed effects (parity, season and year of calving). In addition the animal model MTDFREML was used to estimate heritability (h^2) and breeding value (BV).

- Actual means of TMY, LP and CI were 1918 kg; 231 day and 440 day respectively.
- (h^2) estimated of productive trait (TMY, LP) were high h^2 0.44±0.002 and 0.46±0.01 while CI was low h^2 (0.01±0.005).
- The correlation coefficients between TMY and LP were positive with 0.28 for the genetic correlation between the two traits while the phenotypic correlation was 0.79, which means that the genetic improvement of one of the two traits could be improved by the genetic improvement of other trait.
- The range of (BV) for cows was high for most of studied traits. The ranges of breeding values of cows for TMY, LP and CI were 2075.1kg, 307.2 day and 232.8 day, respectively.
- The genetic trend of all studied traits was the lowest for the genetic trend in 2003 and 2015 years while the highest values of the genetic trend of all traits in 2017.

In conclusion, the difficulty of genetic improvement of CI by selection due to the low heritability of this trait can be improved by increasing improving environmental conditions and good care together. Higher ranges of BV for cows for most of studied traits indicate higher genetic variation and higher opportunity for selection of top cows in breeding value, which would result in rapid genetic progress in the future generations. The study recommends that this can be confirmed by molecular genetics to detect the location of quantitative traits that affect milk production and selection of the cows carrying these genes.

Keywords: *productive and reproductive traits, genetics, heritability, Crossbred, Nile Delta.*

INTRODUCTION

Livestock production is one of the most important sectors that contribute directly to the total agricultural value, contributing about 30% of this value, but there is a gap between the national dairy production and amount of consumption. To fill this gap one long time way, is increase the productivity of local dairy cattle by selection and continuous genetic improvement using the recent computerized methods available used in the developed counties. The second way, is consider the Friesian crossbred cattle which play a great role in dairy industry because of its high productivity of milk compared with the local cattle. Livestock depends on the genetic potential of the animal as well as the environmental factors of nutrition and good care, integrated management of herd, health monitoring to control various diseases, allowing the possibility of genetic expression and improvement in the genetic capacity of the animal, so the provision of care and appropriate nutrition of the animal contributes to show good qualities and improved animal productivity to increase economic return (Bhuiyan,1999). Genetic improvement through selection depends on the identification of genetically superior animals by estimating the breeding values of these animals. Productivite and reproductive traits are among the most important traits that are directly affected by different environmental factors, which necessitate good management and genetic improvement programs based on genetic information and genetic estimates of the study population. Genetic evaluation to increase the productivity of dairy and achieve the highest economic return of animals by estimating the genetic parameters and identify the requirements for genetic improvement of these animals in the future. The genetic parameters are needed also to predict breeding values to be used in the ranking and selection of superior animals for breeding. Consequently, estimation of genetic parameters for productive and reproductive traits and breeding values for established Friesian herds in Egypt are required for the genetic improvement programs of these cattle (Oudah and Zainab,2010).

The objective of this study is to determine the status of the productive herd with the estimation of genetic and non-genetic factors that affect the productivity of the herd and determine the different genetic factors that effect on (TMY, kg), (LP, day) and (CI, day) of Friesian crossbred cattle raised in Egypt.

MATERIALS AND METHODS

Farm location

The records used for this study were collected from the history sheets of Friesian crossbred cows maintained at Gamaza farm, A government station located in the Nile Delta in Egypt. Herd size as shown in (Table1). were used for assessment of genetic parameters that affect milk traits of Friesian crossbred cattle in dairy herds.

Structure of data

Structure of the data analyzed for Friesian crossbred, a total of 1308 records were obtained from 402 cows (279 dams and 73 sires) in the Crossbred Friesian (local & Friesian) at generation F_8 at the Gamaiza farm.

Management and feeding :

Animal nutrition in the Gamaza farm depends on concentrate feed mixture along with wheat or rice straw in addition to Egyptian clover in winter or clover hay during summer (May to November). As a common practice, heifers in the farm were served when the cow reaches the age of sexual maturity (18 months) and proper weight (350 kg). Cows were mated via natural insemination; Pregnancy was diagnosed using rectal palpation after 2 months of insemination. The cow is machine milked twice daily in the morning and evening a day. The cows were dried off about two months before calving. Besides all herd had regular veterinary consultants for disease management control and vaccination.

Statistical analysis:

Data was analyzed using the (SAS 2003). Statistical mixed model was used:

$Y_{ijlkm} = \mu + S_i + P_j + SE_k + Y_l + (Y^* SE)_{lk} + (P^* SE)_{jk} + e_{ijlklnm}$. where,

Y_{ijljkm}: either TMY, LP and CI;

μ: an underlying constant specific to each trait; Si: a random effect of i^{th} sire;

Pj: the fixed effect of j^{th} parity of calving; SE_k: the fixed effect of k^{th} season of calving;

Y_l: the fixed effect of l^{th} year of calving, $(Y^* SE)_{lk}$:The interaction between l^{th} effect of year and k^{th} effect of season.

$(P^* SE)_{jk}$:The interaction between j^{th} effect of parity and k^{th} effect of season.

And $e_{ijlklnm}$ = normally distributed with mean zero and variance σ2e.

h^2 and BV of studied traits were estimated according to Boldman *et al.*, (1995) procedures using the MTDFREML program,: using the following model:

$$Y = Xb + Za + Zu + e,$$

The studied traits were (TMY), (LP) and (CI).

RESULTS AND DISCUSSION

The data in Table 1 shows means, standard deviation (±SD) at productive and reproductive traits. Coefficients of variability (CV%) for studying traits are given in table (2). In this study means of TMY, LP and CI were 1918 kg (46.6%), 231.2 days (35.2%) and 440 days (40.3%), respectively. Osman *et al.,* (2013) found that the average of TMY for first and second parities in cow herd in Egypt were 8954 kg and 8686 kg, respectively, while Shalaby *et al.*, (2013) gave 5387kg and Manal (2018) 10224 kg. The differences between results in TMY due to different genotype in one hand and management systems from herds to another were observed.

In the other side, in relation to CV% of TMY may be due to multi-factors of variations in number of lactation animal's method of statistical processing of data, climate nutrition and other management conditions as well as differences in genetic origin on the herd.

The LP in the current study (231days) table 1, was lower than Ayalew *et al*. (2017) was 315days and Manal (2018) was 413.1days.

On the other hand, the present mean of CI was 440days for crossbred Friesian. These mean was higher than that conducting by Hammoud *et al*., (2014), working on 7748 records of Friesian cows in Egypt, (427, days) but lower than El-Awady *et al*. (2017) how gave 449.9days.

Table 1. Actual means, (SD) and (CV %) for Productive and reproductive traits in Friesian crossbred cows.

Traits	No. of records	Means	SD	CV %
T MY (kg)	1308	1918	893.5	46.6
LP (days)	1308	231	81.3	35.2
CI (days)	936	440	177.5	40.3

SD= standard deviations and CV % = coefficients of variation

Genetic factors and non-genetic factors affecting milk production traits analysis of variance for factors affecting milk production traits under study are presented in table (2) Least square means (LSM) and standard errors (S.E) for factors affecting TMY, LP and CI are shown in table(3).The ANOVA results for the studied traits are given in table (2)

Genetic factors (Sire) had highly significant (p<0.01) effect on all traits study of Friesian crossbred cattle (Table 2). It can be concluded that herd had significant effect on most of milk production traits under study. Except the effect of the year on the LP, the effect was not significant. Results indicated the non-genetic factors affecting TMY, LP, CI and interaction between (parity* Season), (season* Year) had highly significant (P<0.001) effect on those traits except the effect of interaction between (Year*season) and (parity* Season) of trait CI; (Table 2).

Table 2. Degrees of freedom, mean squares, F values and significance of factors affecting productive and reproductive traits in Friesian crossbred cows.

Source of variation		Mean Squares		
	DF	TMY	LP	CI
Sire	72	1222952.9***	9362.5***	69077.1***
Parity	6	7297112.6***	33474.5***	272774.2***
Season	3	2258288.3***	11493.0**	200033.0***
Year	15	1702150.5*	5690.2 n.s	60013.03*
Year * Season	45	1030879.3***	9694.1***	30053.0 n.s
parity * season	18	76538472.0*	8621.9*	26301.6 n.s
Residual	776	538472.0	5172.4	241205.7

* = significant at P<0.05,
** = significant at P< 0.01,
*** = significant at P< 0.001, ns = non-significant

The overall means and standard error, of the studied traits of cross Friesian cattle in Gammaza Farm (2002–2017) were illustrated on table 2. The effects of parity order, season and year of calving on TMY, LP and CI were highly significant (P≤ 0.01) Table 3.

Total milk yield

The differences between averages of the milk yield traits studied reflected the changes from year to other in climatic, nutritional and managerial conditions. Similar observations were recorded by Safaa and Afify (2016). The effect of year were significant (P<0.05) on both traits TMY and CI. While it was non-significant for a trait LP. The Autumn and Winter seasons showed higher values (1818.2 and 1926.3kg) for TMY. In Fact the environment condition as a whole and specially the available good quality of green feed-stuff available from the starting of lactation and during the effective first part of LP.

The total milk yield was significantly affected by parity order (P≤ 0.01) result presented in Table 3. The total milk yield exhibited a decreasing trend as parity number increased. The highest total milk yield was recorded in the four parity (2043.6 kg), followed by five parity (2023.7 kg), and third (2023.3 kg) on the other hand, the highest LP was recorded in the four parity (338.2days); the first parity had significantly the lowest LP. Season of calving highly significantly (P≤0.01) affected TMY and LP. The cows which calved in winter had significantly highest total Milk yield (1926.3kg).

The year of calving had a significant effect (P≤0.01) on TMY. The highest milk yield was recorded in the year 2010 (2065.4 kg). Moreover; the results revealed that the TMY was high significantly (P≤0.001) affected by (season*year) of calving but the LP was significantly (P>0.05) influenced. While the effect of interaction (year * season) and (parity * season) were non-significant on CI trait.

Lactation period

The effects of parity, season and year of calving on lactation period were outlined in (Table.3) The effect of parity number on LP was significant (P>0.01), while season, year of calving and interactions between season of calving had a significant (P≤0.01) influence on LP. However; cows which calved in wet summer had significantly (P≤0.05) the shortest lactation length (216.1±8.2) On the other hand, the cows which calved in the year 2005 had significantly (P≤0.01) the longer lactation period (251.1±16.1 days) than those cows which calved in 2017 (245.9±17.1 days) and 2004 (245.9±17.1 days). While the cows that calved during year 2009 and 2008 had the shortest lactation period (199.0±14.1 and 192.2±13.6 days, respectively). However different was not significant. Also the results showed that the LP was significantly (P≤0.01) influenced by (season* year) of calving. While was significant (P≤0.05) influenced by interaction between parity and season of calving.

Calving interval

The results in Table 3 were highly significant (P<0.001) for year of birth in 2017 it was 269.3days ±36.6 While this was the longest in 2012 it was estimated 625.6 days ±27.8 This can be explained by the variability in the number of cows and the emergence of new generations during the year of calving, Ray *et al.*, (1992) indicates that the increase in length CI in the spring and summer compared to autumn and winter in Friesian cows due to the high temperatures that negatively affect the success rates of fertilization after birth and to prolong the duration of pregnancy, leading to an increase CI. While Hernandez-Reyes *et al.* (2001) they concluded that length CI was shorter in winter and spring due to the availability of green fodder.

Finally, El-Awady and Oudah (2012) found that parity had a highly significant effect on CI (P<0.01).

Table 3. (LSM±SE) for factors affecting study traits in Friesian crossbred cows.

Independent variable	NO	TMY, kg	L P ,d	CI, d
		Mean ± SE	Mean ± SE	Mean ± SE
Parity				
1	97	1161.4±93.8	193.3±9.19	366.7±19.9
2	252	1671.2±67.7	223.8±6.6	489.9±14.3
3	182	2023.3±77.5	248.9±7.6	447.9±16.4
4	143	2043.6±86.3	338.2±8.5	448.2±18.3
5	108	2023.7±97.7	226.1±9.6	432.4±20.7
6	71	1883.9±114.9	222.8±11.3	386.2±24.3
7	83	1701.7±115.9	202.4±11.3	541.6±24.5
Significant		***	***	***
Season of calving				
Autumn	183	1818.2±79.2	216.5±7.8	448.9±16.8
Winter	266	1926.3 ±74.7	226.5±7.3	416.4±15.8
Spring	183	1745.8±92.2	229.7±9.0	470.2±19.5
Summer	230	1657.8±83.4	216.1±8.2	443.3±17.6
Significant		***	***	***
Year of calving				
2002	80	1487.3±261.7	210.7±25.6	434.5±55.4
2003	28	1346.3±228.2	236.4±22.4	315.0±48.3
2004	65	1730.7±174.4	245.9±17.1	404.1±36.9
2005	59	1984.6±163.9	251.1±16.1	380.8±34.7
2006	56	1235.6±156.9	199.4±15.4	354.7±33.2
2007	50	1291.5±189.1	205.6±18.5	416.1±40.0
2008	70	1437.1±138.4	192.2±13.6	402.8±29.3
2009	59	1734.2±144.2	199.0±14.1	285.3±30.5
2010	120	2065.4±107.6	233.4±10.5	404.9±22.8
2011	51	1889.9±147.3	213.5±14.4	478.5±31.2
2012	76	1895.1±131.5	224.2±12.9	625.6±27.8
2013	51	1938.3±158.2	221.4±15.5	566.4±33.4
2014	34	2003.4±203.4	224.6±19.9	561.2±43.1
2015	38	2044.3±193.9	235.9±19.0	607.5±41.1
2016	50	2056.7±172.3	216.1±16.9	508.6±36.5
2017	49	2456.7±174.0	245.9±17.1	269.3±36.6
Significant		***	***	***

LSM = Least square means, SE = standard Error

***highly significant (P< 0.001)

Estimates of variance component for TMY, LP and CI of cross bred Friesian cows were found in table (4). Estimates of additive genetic variance (**σ^2_a**) for TMY, LP and CI were 547.7, 61.7and 16.1 respectively, for Friesian crossbred cows. Table 4 shows variance estimates showed increasing in the TMY but decreased in LP and CI.

Furthermore, the values of phenotypic variance (σ^2_p) for the same traits were 1319.2, 135.2 and 1420.4 respectively, for Friesian crossbred cows.

In this respect, estimates of additive genetic variance (σ^2_a) in CI trait was less than the residual variance (σ^2_e). In reproductive traits the residual variance effects comprised of a large proportion of total variation, therefore heritability estimates for these traits were low. Most previous researched concluded that additive genetic variation for reproductive traits was very low in pro-portion to phenotypic variation, which lead to heritability's for those to be close to zero and selection for improving of these traits would not be worthwhile (Hansen *et al.*, 1983).

Heritability estimates (h^2)

h^2 estimates for TMY, LP and CI were 0.44±0.002, 0.46±0.01 and 0.01±0.005 respectively. Heritability estimates for TMY was 0.44 for Friesian crossbred cows. Similar results obtained by Abdel-Glil (1996, 0.41) Also, the current estimated of TMY was higher than the value by Faid Allah (2015, 0.18) This estimate was lower than those reported by Manal (2018, 0.48). Differences in h^2 estimates among the various studies for the TMY, LP and CI may be due to differences in the number of records used.

The difference in h^2 was estimated among traits studies for the same trait. This is due to the possibility of differences in the methods of analysis, the statistical mode, and the number of records used. So the good management will lead to decrease in length of CI.

Table 4. Estimates of variance components and genetic parameters for TMY, LP, and CI for Friesian crossbred cows.

Parameter	Traits		
	TMY, kg	LP d	CI d
σ^2_a	547.7	61.7	16.1
$\sigma^2 p_e$	4.07	7.8	6.2
σ^2_e	740.4	65.7	1398.1
$\sigma^2 p$	1319.2	135.2	1420.4
h^2_a	0.44±0.002	0.46±0.01	0.01±0.005
C^2	0.003±0.002	0.057±0.01	0.0044±0.014
e^2	0.56±0.003	0.49±0.013	0.98±0.014

σ2a = direct additive genetic variance, σ2pe = permanent environmental variance, σ2e = residual (temporary environmental variance), σ2p = phenotypic variance, h2a = direct heritability, c^2 = fraction of phenotypic variance due to permanent environmental effects and e2 = fraction of phenotypic variance due to residual effects.

Genetic and phenotypic correlations between the TMY* LP, LP * CI and TMY*CI shown in table (5). The genetic correlation between TMY and each of LP and CI were 0.28, -0.06 respectively, for crossbred Friesian cows. Through the positive genetic correlation between studied traits, this can be exploited in genetic selection programs, since when improving the trait; this improves the other traits. Can build the strategy on selection criteria on these traits. On the other hand negative genetic correlation coefficients were found between CI and each LP and TMY being -0.94 and -0.06, respectively. The phenotypic correlations (r_p) were positive correlation estimate between all studied traits are showed in table (5) Safaa and Afify (2016) reported the genetic correlation between LP and TMY was positive 0.84.

Table 5. Correlation Coefficient between of traits study in Friesian crossbred cows.

Traits	r_a	r_p
TMY* LP	0.28	0.79
LP * CI	-0.94	0.02
TMY*CI	-0.06	0.022

El-Awady *et al.*, (2016) working on a commercial Friesian herd in Egypt reported that the estimates of genetic correlations between LP and CI were 0.95. The phenotypic correlations between LP and CI were 0.96.

Minimum, maximum, range, standard errors and accuracy of cow BV for milk production traits (TMY,LP) and CI traits in crossbred Friesian cows are given in table 6.

The BV for milk production traits (TMY,LP) and CI of cows ranged 2075.1kg 307.2days and 232.8days, respectively and that of sire BV for the range 1426.6kg, 170.8days and 135.6 day. The ranges of BV for dams were 1759.4kg, 192.6 day and 207.8 day respectively in farm. These results indicate the selection for TMY and LP top cows, the ranges of BV cows higher than those for sire and dams for TMY and LP.

The accuracy of minimum and maximum estimates of cow BV ranged from (73 to 88%), while for all traits of the study (ranged from 0.55 to 0.88).The range of BV for present study in cow, sire and dam was greater than reported by Safaa and Hassanane (2017) they showed that the accuracy of those traits ranged from cow BV (0.63 to 0.92).

Table 6. Minimum, maximum, Range and accuracy of breeding values of factors affecting TMY, LP and CI traits in crossbred Friesian cows.

Traits	Animal	Minimum	S.E	Accuracy	Maximu	S.E	Accuracy	Range
TMY	Cow	-979.86	3.16	92	1095.20	11.1	88	2075.
	Sire	-833.18	16.53	77	593.39	19.9	56	1426.6
	Dam	-816.29	14.34	80	943.18	16.5	72	1759.4
LP	Cow	-157.20	5.57	70	150.03	5.33	73	307.2
	Sire	-113.24	5.33	74	57.58	6.49	56	170.8
	Dam	-82.95	4.64	81	109.69	5.54	71	192.6
CI	Cow	-121.59	2.62	76	111.21	1.91	88	232.8
	Sire	-60.83	3.28	57	75.27	3.34	55	135.6
	Dam	-104.34	1.67	91	103.43	2.21	83	207.8

S.E = Standard error; Min. = minimum; Max. = maximum, Range = Maximum minus Minimum and Range (BW Max- BW Min)

The present results show large differences among BV of cows, sire and dams in different traits studied. In addition, the cows, sires and dams showed positive values for TMY and LP. These results indicate the selection for TMY for top cows, sires and dams will increase LP and decrease CI in next generation. Safaa and Afify., (2016) arrived at the same conclusion on Friesian .

The ranges of BV cow in all traits of study were always higher than their corresponding of either sire or dam BV. There for, it could be stated that selecting cows for TMY, LP and CI traits of the study according to cow BV would be more reasonable and efficient than selecting them according to their sires or dams BV.

Regression coefficients (b ± S.E)) of cows BV on year for TMY, LP and CI traits in crossbred Friesian cows(Table7).Milk production was found to increase by 3.40±2.82kg/year and LP trait increased by 1.25±0.34day/year. While CI decreases by -0.74±0.31day per year. The genetic trends estimated as the regression coefficients of estimated breeding values of cow on time were positive and non-significant for TMY trait. This might be to use of cows with variable genetic background from different sources. Safaa and Hassanein (2017) obtained regression coefficients of estimated breeding values of n Friesian cows on TMY(-2.65 ± 5.27 kg/year) and LP(-0.38 ± 0.38 year).

Table 7. Regression coefficients (b ± S.E)) of cows BV on year for TMY, LP and CI traits in crossbred Friesian cows.

Traits	b ±SE
TMY	3.40±2.82^{ns}
LP	1.25±0.34***
CI	−0.74±0.31*

ns = non-significant, *** = significant at P<0.001 and * significant at P< 0.05.

Figures (1- 3) show that environmental, genetic and phenotypic trend for TMY, LP and CI affected by years how that the milk production traits of the herd the studied have a clear trend for changes in the year of calving .

TMY trait was found to be affected by year this is due to environmental differences of the years; there was a positive trend during the 2002, 2004 and 2006. While, 2003, 2005, 2015 and 2016 gave negative environmental trend at all year's figure (1).This indicates an increase in the TMY with the advancement of years where it was initially 80.30 and became the last year 2017 was 181.4kg.For LP trait the values were positive except for 2002, 2003 and 2015, where they were negative, indicated an increase in LP over the years, with the years progressing to -4.2 and finally 25.4 in 2017 year .CI trait was found to be affected by year this is due to environmental differences of the years, there was a positive trend during the 2002, 2005 and 2017years for CI. While the rest of the years were negative for the CI trait. From Figures (1-3), it is noted that there is no clear environmental or phenotypic trend for all the traits of the study.

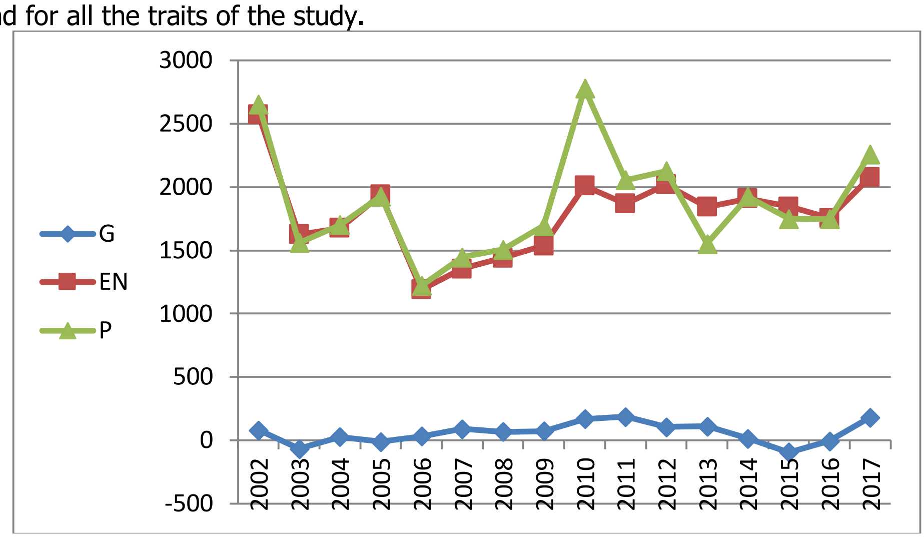

Fig. 1. Environmental, Genetic and phenotypic trend for TMY

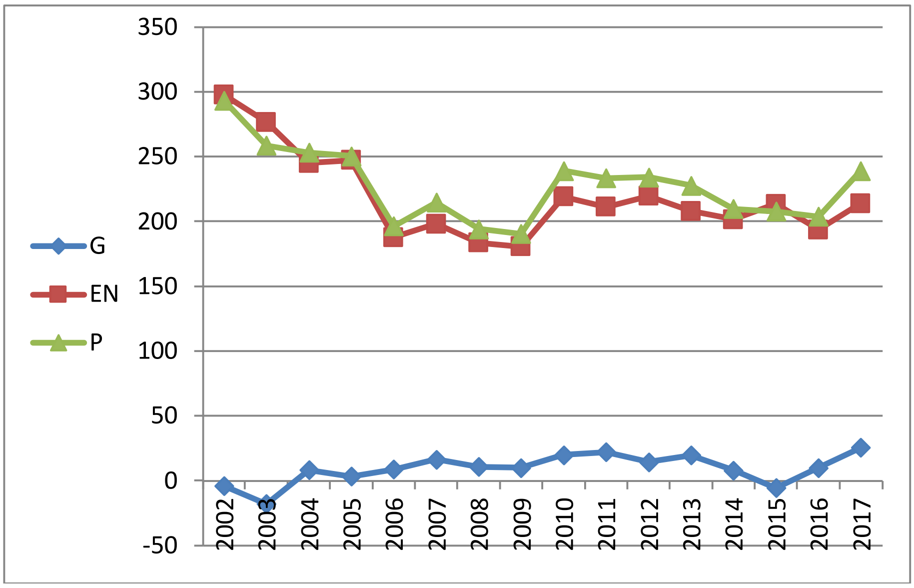

Fig. 2. Environmental, Genetic and phenotypic trend for LP

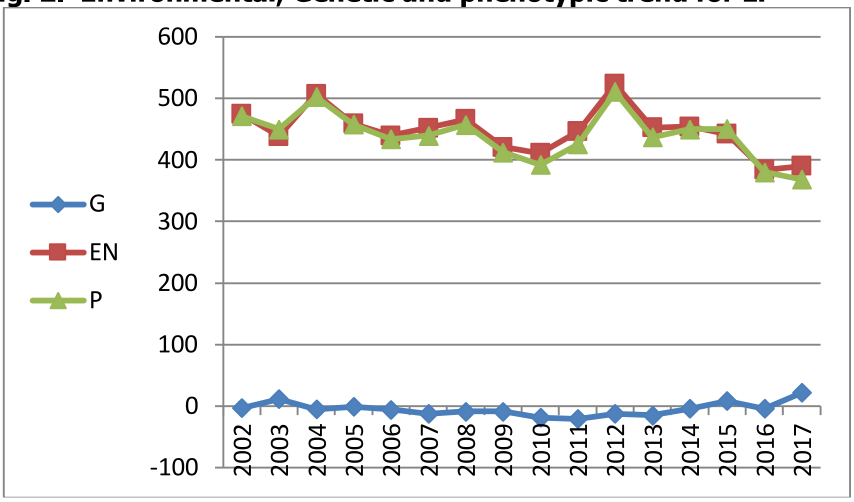

Fig. 3. Environmental, Genetic and phenotypic trend for CI

In general, year of calving is considered the most important source of variation in different TMY, LP and CI may be attributed to changes in weather, management and feeding systems.

The effect of year of birth is related to the diversity of nutritional provided to the animal for the different type of nutrients during the seasons. This indicates that attention needs to be given to environmental factors such as nutrition, health and management. The genetic value of all studied traits was the lowest for the genetic trend in 2003 and 2015 years while the highest values of the genetic trend of all traits in 2017.The same trend agreement Dina (2014).This decline may be attributed to the use of natural insemination in some years and the lack of clear plans for breeding and improvement.

CONCLUSION

- It is possible to conclude that the crossbred Friesian cows in Egypt has shown high productivity under environmental conditions because of the highly (h^2 and BV) estimates of most of the traits under study, noting that through good care and genetic improvement of these traits can increase the productivity of these animals in the next generation
- The low estimates of h^2 for CI indicate that non-additive genetic variance and environmental variance play vital role in the expression of phenotypic characters. Therefore, the improvement may be brought about by maximizing the control over the controllable environmental factors.
- The study also identified the possibility of selecting superior cows based on the BV of genetic improvement for the following generations.
- The genetic value of all studied traits was the lowest for the genetic trend in 2003 and 2015 years while the highest values of the genetic trend of all traits in 2017. This decline may be attributed to the use of natural insemination in some years and the lack of clear plans for breeding and improvement.
- The study recommends that these superior cows should be selected on the basis of BV by detecting the location of the traits that affect the milk production of these cows through molecular genetics.

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العوامل الوراثية التي تؤثر على إنتاج اللبن الكلي وطول فترة الحليب والفترة بين الولادتين في أبقار الفريزيان الخليطة المرباة في دلتا النيل

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الهدف من هذه الدراسة هو تقدير المعلمات الوراثية (المكافئ الوراثي ، والقيم التربوية) وكذلك تأثير العوامل غير الوراثية مثل (ترتيب موسم الولادة ، السنه ،الموسم أيضا التفاعلات بين هذه العوامل) لبعض الصفات الإنتاجية والتناسليةوكانت الصفات المدروسة: إجمالي إنتاج اللبن (TMY، kg) ، طول فترة الحليب (LP ، اليوم) كصفات إنتاجية ، الفترة بين الولادتين (CI ، الشهر) كصفة تناسلية. بلغ إجمالي عدد سجلات 1308 سجل تم الحصول عليه من 402 بقرة أبناء (279 أم و 73 أبً) في قطيع خليط فريزيان بمحطة الجميزه ، في مصر. تم إجراء التحليل باستخدام (SAS 2003). اشتمل النموذج على التأثيرات العشوائية للعوامل الوراثية (تأثير الاب) والتأثيرات الثابتة (ترتيب موسم الولادة ،السنه ،الموسم). بالإضافة إلى ذلك ، تم استخدام نموذج الحيوان لتقدير المعالم الوراثية.

حيث كان لسنة الولادة تأثيرعاليا لمعنوية على جميع صفات الدراسة (انتاج اللبن الكلى ، طول فترة الحليب ،الفترة بين ولادتين) كما كان تأثيرموسم الولادة معنوي لجميع صفات الدراسة

• كان متوسط الصفات لـ TMY و LP و CI 1918كجم ؛ 231 يومًا و 440 يومًا على التوالي.

المكافئ الوراثي المقدر (h^2) لجميع الصفات المدروسة (TMY و LP و CI) كان 0.44 ± 0.002 و 0.46 ± 0.01 و 0.01 ± 0.005 على التوالي

• كانت قيم معاملات الارتباط المقدرة بين TMY و LP موجبة مع 0.28 للعلاقة الوراثية بين الصفتين بينما كان الارتباط المظهري 0.79 ، مما يعني أن التحسن الوراثي لأحد الصفات يمكن تحسينه عن طريق التحسين الوراثي للصفة الأخرى.

• كان مدي القيم التربوية (BV) للأبقار مرتفعاً لمعظم الصفات المدروسة. حيث بلغت القيم التربوية للأبقار للصفات المدروسة(TMY و LP و CI) 2075.1 كجم و 307.2 يوم و 232.8 يوم على التوالي.

• قدر الاتجاه الوراثي لجميع الصفات المدروسة وكانت أقل القيم للاتجاه الوراثي في عام 2003 و 2015بينما كانت أعلى قيم الاتجاه الوراثي لجميع الصفات في عام 2017.

نستنتج من الدراسة ، صعوبة التحسين الوراثي للفترة بين الولادتين عن طريق الانتخاب لهذه الصفة بسبب انخفاض المكافئ الوراثي لهذه الصفة حيث يمكن تحسينها بزيادة تحسين الظروف البيئية والرعاية الجيدة معا. كما تشير القيم التربوية المقدرة من الأبقار في معظم الصفات المدروسة إلى وجود اختلافات وراثية عالية وفرصة أكبر لاختيار الأبقار الأعلى في القيم التربوية ، مما يؤدي إلى تحسين وراثي سريع في الأجيال القادمة. لذا توصي الدراسة بتأكيد ذلك بواسطة علم الوراثة الجزيئية للكشف عن موقع الصفات الكمية التي تؤثر على إنتاج محصول اللبن واختيار الأبقار التي تحمل هذه الجينات.