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GENETIC EVALUATION OF SOME PRODUCTIVE LIFETIME TRAITS OF LOCALLY BORN FRIESIAN COWS IN EGYPT

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SUMMARY

Data on 2186 lactation records of 541 pure Friesian cows presenting 43 sires and 372 dams born at the Dairy Unit of Milk and Meat Project of the Faculty of Agriculture, Alexandria University, between 1983-2006 were utilized to evaluate lifetime milk yield (LMY), days in lactation (LDL), daily milk yield (LDMY) and number of lactations (NL) of Friesian cows. Also, the effects of season and year of calving and age at first calving on the previous traits were studied.

The least square means of LMY, LDL, LDMY and NL were 18310 kg, 1318 day, 13.6 kg and 4.04 lactations, respectively. Season of calving had no significant effect on all studied traits. Year of calving had significant effect (P<0.01) on all studied traits. Age at first calving had significant effect (P<0.05) on LDMY, but had no significant effect on LMY, LDL and NL.

The heritability estimates from univariate animal models were 0.272, 0.137, 0.117, and 0.116 for LMY, LDL, LDMY and NL, respectively. The moderate heritability for LMY emphasized the possibility of realizing a considerable rate of genetic improvement in this trait through selection programme. The genetic corrletions estimated from bivariate animal models were positive ranging from 0.264 to 0.993, except that between LMY and LDMYwas negative (-0.163). All correlations among all traits were significant (P<0.01). The positive genetic correlations between LMY and each of LDL and NL indicate that selection for any traits associated with genetic improvement in other traits. Phenotypic correlations among all traits were positive ranging from 0.099 to 0.966 and significant (P<0.01 or P<0.05).

The breeding values for LMY, LDL, LDMY and NL of cows ranged between -759 and 1139 kg, -101 and 105 day, -1.77 and 1.82 kg and between -01.64 and 2.69 lactations, respectively, the corresponding values for dams were between -814 and 1107 kg, -122 and 100 day, -2.38 and 1.53 kg and between -1.74 and 3.24 lactations, respectively. The breeding values for sires were between -560 and 748 kg, -117 and 83 day, -1.79 and 1.26 kg and between -1.44 and 3.12 lactations for the respective traits. The genetic trends estimated by the regression of sires breeding values on time were positive and nonsignificant for LMY, LDL and NL and negative approached zero for LDMY. Generally, the results indicate that improvement of productive lifetime traits of Friesian cows could be obtained through both selection programme and improvement of management conditions.

Keywords: Heritability, genetic correlation, breeding values, genetic trend, productive lifetime traits, Friesian cows

INTRODUCTION

The ability of the cow to produce and reproduce for many years is a very important characteristic in dairy enterprises. Consequently, productive lifetime is generally considered as one of the most important economic traits in dairy cattle production (Tekerli and Kocak 2009, Singh *et al*. 2011, Jovanovac *et al*. 2013, Kefena *et al*. 2013, Martens and Bange 2013, Teke and Murat 2013, Novakovic *et al*. 2014, Jenko *et al*. 2015, Van Pelt *et al*. 2015, Horvath *et al*. 2017 and Mirhabibi *et al*. 2018). Increase productive lifetime affects profitability in a desired direction by reducing replacement costs and increasing the higher yielding cows in the herd (Brickell and Wathes 2011, Singh *et al*.2011, Jovanovac *et al*. 2013, Sasaki 2013, Van Pelt *et al*. 2015, Horvath *et al*. 2017 and Mirhabibi *et al*. 2018).

During the last three decades, milk yield per lactation has greatly increased, whereas fertility, health and productive life have decreased (Kanus 2009, Oltenacu and Broom 2010, Zink *et al*. 2012, Pritchard *et al*. 2012, Martens and Bange 2013, Horvath *et al*. 2017 and Mirhabibi *et al*. 2018). Consequently, these traits have been considered in breeding programs in most countries all over the world (Oltenacu and Broom 2010, Zavadilová and Štípková 2012, Kargo *et al*. 2014, Olechnowicz *et al*. 2016, Mirhabibi *et al*. 2018 and Ward *et al*. 2018). Genetic improvement of lifetime productive traits by direct or indirect selection requires estimates of genetic parameters of these traits (Sadek *et al*.2009, Zavadilová and Štípková 2012, Zink *et al*. 2012, Al-Samarai *et al*. 2013, Goshu *et al*. 2014, Stanojevic *et al*.2016 and Ward *et al*. 2018). Evaluation of the dairy cows' lifetime productive traits is important for developing breeding and management programs for genetic improvement; it helps in selection sires and dams with superior genetic merits (Jovanovac *et al*. 2013, Kern *et al*. 2014, Radwan*et al*. 2015, Kern *et al*. 2016, Abfalter *et al*. 2016, Olechnowicz *et al*. 2016 and Ward *et al*. 2018).

The objective of this investigation was to evaluate lifetime milk yield, days in lactation and daily milk yield and number of lactations of Friesian cows raised in a governmental dairy herd in Egypt. Also, the effects of season and year of calving and age at first calving on the considered traits were studied.

MATERIALS AND METHODS

Source of data:

Data used in this investigation were collected from 2186 lactation records relevant to 541 locally born pure Friesian cows which belong to the Dairy Unit of Milk and Meat Project of the Faculty of Agriculture, Alexandria University. This project has been established in 1982 and the records representing cows born during the period from 1983 to 2006. The traits under investigation were lifetime total milk yield in kilograms (LMY), days in lactation in days (LDL), daily milk yield in kilograms (LDMY) and number of lactations (NL).

Herd management:

Animals were housed free in shaded open yards, grouped according to their average daily milk yield, and fed *ad libitum* on berseem (*Trifolium alexandrinum*) from November till May and on Sorghum (*Sorghum bicolor)*along with berseem hay from June till October. They were also fed all year around on concentrate supplementary ration containing at least 14 % crude protein and 65 % total digestible nutrient. Feeding allowances were offered according to milk production and physiological status as recommended by NRC (1982 and 1989). Water was also available ad libitum. Heifers were artificially inseminated for the first time when reaching 350 kgs of weight and pregnancy was detected by rectal palpation 60 days after service. The cows were machine milked twice a day at 06.00h and 18.00h.

Statistical analysis:

Least squares of GLM procedure (SAS 2008) were utilized to test the significance of the fixed effects of season of calving (4 seasons), year of calving (8 periods) and age at first calving as a covariate. Month of first calving were classified by season into autumn's between September and November, winter's between December and February, spring's between March and May and summer's between June and August. Year of first calving was classified into six groups (1= 1985-1988, 2= 1989 - 1992, 3=1993 - 1996, 4= 1997 – 2000, 5= 2001-2004 and 6= 2005-2008). The statistical model fitted was:

$$\mathbf{Y_{ijkl} = \mu + S_i + T_j + + \beta\ (Age_{ijk}) + e_{ijkl}}$$ where,

$\mathbf{Y_{ijkl}}$: either LMY, LDL, LDMY or NL; μ: an underlying constant specific to each trait; $\mathbf{S_i}$: the fixed effect of i^{th} season of calving (i=1,2,3 and 4); $\mathbf{T_j}$: the fixed effect of j^{th} year of calving (j=1,2,3……11); β: the linear regression coefficient of each studied trait on age at first calving, as a co-variable, Age_{ijk}: the deviation of age at first calving from its mean, as a co-variable, and $\mathbf{e_{ijkl}}$: random residual assumed to be independent normally distributed with mean zero and variance σ^2_e.

Variance and covariance components and genetic parameters were estimated using the Wombat programme (Meyer, 2006) fitting univariate and bivariate animal models. The assumed model was:

$$y = Xb + Za + e$$ where,

y: a vector of observations, b: a vector of fixed effects with an incidence matrix X, a: a vector of random animal effects with incidence matrix Z, and e: a vector of random residual effects with mean equals zero and variance σ^2_e. The vector of additive (animal) effects (a) was assumed to be N~(0, Aσ^2_a), where ***A*** is the numerator relationship matrix among animals in the pedigree file and σ^2_e is direct genetic variance. The vector of residual effects (e) was assumed to be N~ (0, Iσ^2_e), where **I** being the identity matrix, and σ^2_e is the residual variance cov (a,e)=0.

The genetic correlations between traits were estimated from bivariate animal model. The assumed model was:

$$\begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} X_1 & 0 \\ 0 & X_2 \end{bmatrix} \begin{bmatrix} b_1 \\ b_2 \end{bmatrix} + \begin{bmatrix} z_1 & 0 \\ 0 & Z_2 \end{bmatrix} \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \end{bmatrix}$$

Where y_i = vector of observations, b_i = vector of fixed effects, a_i = vector of random animal effects for the i^{th} trait, e_i = vector of random residual effects for the i^{th} trait, and X_i and Z_i are incidence matrices relating records of the i^{th} trait to the fixed and the random animal effects, respectively.

It is assumed that:

$$\text{var}\begin{bmatrix} a_1 \\ a_2 \\ e_1 \\ e_2 \end{bmatrix} = \begin{bmatrix} g_{11}A & g_{12}A & 0 & 0 \\ g_{21}A & g_{22}A & 0 & 0 \\ 0 & 0 & r_{11} & r_{12} \\ 0 & 0 & r_{21} & r_{22} \end{bmatrix}$$

Where g_{11} is the genetic variance for trait 1, g_{22} is the genetic variance for trait 2, $g_{12} = g_{21}$ is the genetic covariance between both traits, r_{11} is the residual variance for trait 1, r_{22} is the residual variance for trait 2, $r_{12} = r_{21}$ is the residual covariance between both traits.

The genetic trends for the studied traits were computed as the regression coefficients of sires breeding values on their year of birth.

RESULTS AND DISCUSSION

The means, standard deviation (SD) and coefficient of variation (CV %) of the studied traits are shown in Table (1). The means of LMY, LDL, LDMY and NL were 18309 kg, 1318 day, 13.6 kg and 4.04 lactations, respectively. The means of LMY and NL were higher than those of being 9760 kg and 2.48 lactations, respectively documented by Khattab *et al.* (2009) on other herd of Friesian cows in Egypt. Moreover, the means of LMY, LDL and NL were higher than those being of 8831 kg, 35.8 month and 3.34 lactations for LMY, LDL and NL, respectively depicted by Sadek *et al.* (2009) on Friesian cows in Egypt. On the other hand, the means of LMY and LDMY were lower than those of being 217796 and 18.63 kg, respectively reported by Oudah *et al.* (2013) on a commercial herd of Friesian cows in

Egypt. Whereas, the current means of LDL and NL were higher than those of 1230 day and 3.73 lactations obtained by Oudah *et al*. (2013).

Table 1. Means, standard deviations (SD) and coefficient of variation (CV %) of the studied traits

Traits	Mean	SD	CV%
LMY (kg)	18309.02	11356	52.84
LDL (day)	1317.91	738.09	48.26
LDMY (kg)	13.58	2.90	14.48
NL (lactation)	4.04	2.27	49.02
No. of records	2186		

LMY: lifetime milk yield, LDL: lifetime days in lactation, LDMY: lifetime daily milk yield and NL: number of lactations.

Non-genetic effects:

Season of calving had no significant effect on all studied traits, but year of calving had significant effect (P<0.01) on all traits (Table 2). Similar effects on LMY of Holstein cows in Egypt were documented by Abou-Bakr (2009). In India, Singh *et al*. (2011) depicted that season and year of birth had no significant effects on LMY and LDL of Sahiwal cattle. Age at first calving as a co-variable had significant effect (P<0.05) on LDMY, but had non-significant effect on LMY, LDL and NL (Table 2). Contrary, Abou-Bakr (2009) reported that age at first calving had significant effect (P<0.01) on LMY. Moreover, Teke and Murat (2013) indicated that age at first calving had significant effects (P<0.05 or P<0.001) on LMY and lifetime of Holstein cows in Turkey. In general, these effects could be attributed to the changes in climatic conditions and feeding regimes and managerial systems during different seasons and years.

Table 2. Effects of season and year of calving and age at first calving on the studied traits

Factors	Traits				
	df	LMY	LDL	LDMY	NL
Season of calving	3	NS	NS	NS	NS
Year of calving	**5**	**	**	**	**
Age at first calving	1	NS	NS	*	NS
Error	531				

LMY: lifetime milk yield, LDL: lifetime days in lactation, LDMY: lifetime daily milk yield and NL: number of lactations.
NS: Not significant (P>0.05); *: Significant (P<0.05); **: Highly significant (P<0.01).

Genetic and phenotypic parameters:

Heritability (h^2):

Estimates of variance components and heritability (h^2) for all lifetime studied traits are presented in Table (3). Heritability estimates obtained in this study were 0.272, 0.137, 0.117 and 0.116 for LMY, LDL, LDMY and NL. Moderate heritability estimates for LMY in this study indicate that improvement of this trait could be obtained through both selection program and improvement of management conditions. Whereas, low heritability estimates for LDL, LDMY and NL in this study indicated large environmental effects on these traits and reflected differences in their response to the existing environmental conditions. Similarly, moderate heritability estimate of 0.24 for LMY of Holstein cows was depicted by Abou-Bakr (2009). Khattab *et al*. (2009) reported moderate heritability estimate of 0.24 for LMY and low estimate of 0.12 for NL of Friesian cows. In Iraq, Sadek *et al*. (2009) depicted moderate heritability estimates of 0.29, 0.29 and 0.25 for LMY, LDL and NL, respectively. Al-Samari *et al*. (2013) reported low heritability estimates of 0.10 and 0.02 for LMY and NL of Holstein cows. Oudah *et al*. (2013) documented heritability estimates of 0.268, 0.365, 0.024 and 0.401 for LMY, LDL, LDMY and NL of Friesian cows. In Serbia, Stanojevic *et al*. (2016) indicated low heritability estimates of 0.067 and 0.0747 for LMY and NL of Holstein cows, respectively. In India, Vintohraj *et al*. (2016) indicated heritability estimates of 0.095, 0.044 and 0.073 for LMY, LDL and LDMY, respectively of Jersey x Red Sindhi crossbred cows. In Libya, Ward *et al*. (2018) reported heritability estimates of 0.18, 0.19 and 0.30 for LMY, LDL and LDMY, respectively. In view of the wide range of heritability estimates with other studies, there is good evidence that genetics plays a moderately large part, in determining variations in LMY and certain associated characters.

Table 3. Additive genetic (σ^2_a), environmental (σ^2_e) and phenotypic variances (σ^2_P), and heritability (h^2) for the studied traits.

Traits	σ^2_a	σ^2_e	σ^2_P	h^2 (SE)
LMY	0.243	0.650	0.893	0.272 (0.018)
LDL	6750.3	42476	49226.	0.137 (0. 091)
LDMY	2.505	18.830	21.335	0.117 (0.097)
NL	3.457	26.373	29.830	0.116 (0.090)

LMY: lifetime milk yield, LDL: lifetime days in lactation,
LADM: lifetime daily milk yield and NL: number of lactations.

Genetic correlations:

Table (4) shows that genetic correlations among the studied traits were positive ranging from 0.264 to 0.993, except thatbetween LMY and LDMY was negative (-0.163). All correlations among all traits were significant (P<0.01). The positive genetic correlations among LMY, LDL and NL would result in a correlated response when selecting for LMY and consequently could produce genetic improvement in these correlated traits. However, the low negative genetic correlation between LMY and LDMY could result in negligible deleterious in the former when selection is applied on the latter. Therefore, high milk producers may not be the first choice for total merit amelioration. Khattab *et al*. (2009) obtained genetic correlations of 0.50 between LMY and NL of Friesian cows. Sadek *et al*. (2009) documented extremely high positive genetic correlations of 0.99, 0.96 and 0.98 between LMY and LDL, LMY and NL and between LDL and NL of Friesian cows, respectively. Oudah *et al*. (2013) depicted significant (P<0.01) positive genetic correlations ranged from 0.261 to 0.998 among LMY, LDL, LDMY and NL of Friesian cows. The genetic correlation between two traits is mainly due to genes that have effects on both traits. Genetic correlations have always been important part of carefully constructed breeding programs.

Table 4. Genetic (below diagonal) and phenotypic correlations (above diagonal) and standard errors (SE) among the studied traits

Traits	LMY	LDL	LDMY	NL
LMY		0.966** (0.002)	0.247** (0.049)	0.597** (0.028)
LDL	0.993** (0.008)		0.198** (0.051)	0.625** (0.026)
LDMY	-0.163** (0.404)	0.928** (0.588)		0.099* (0.580)
NL	0.264** (0.901)	0.561** (0.679)	0.615** (0.679)	

LMY: lifetime milk yield, LDL: lifetime days in lactation, LDMY: lifetime daily milk yield and NL: number of lactations.
* Significant (P<0.05) **: Highly significant (P<0.01).

Phenotypic correlations:

Phenotypic correlations among the studied traits were significant (P<0.05 or P< 0.01) positive ranging from 0.099 to 0.966 (Table 4). Oudah *et al*. (2013) documented positive phenotypic correlations ranged from 0.050 to 0.900 among LMY, LDL, LDMY and NL of Friesian cattle. Khattab *et al*. (2009) reported positive phenotypic correlations of 0.30 between LMY and NL of Friesian cows. Sadek *et al*. (2009) reported extremely high positive phenotypic correlations of 0.97, 0.91 and 0.95 between LMY and LDL, LMY and NL and between LDL and NL of Friesian cows, respectively. Oudah *et al*. (2013) indicated significant (P<0.01) positive phenotypic correlations ranged from 0.519 to 0.900 among LMY, LDL, LDMY and NL of Friesian cows except that between LDLand LDMY was being of 0.050. Also, Ward *et al*. (2018) depicted high positive phenotypic correlation of 0.78 between LMY and LDMY. The phenotypic correlation is due to genetic effects that are in common for the two traits, as well as environmental effects that affect both traits.

Breeding values:

Estimates of breeding values (BV) for cow, dams and sires for all studied traits are presented in Table (5). Breeding value defined as the total genetic ability of an animal for a given trait. Therefore, breeding value refers to the value of an animal in a breeding program for a particular trait. In practice, breeders want to know the level of performance that can be expected from progeny of certain individuals. The present breeding values for cows ranged between -759 and 1139 kg, -101 and 105 day, -1.77 and 1.82 kg and between -1.64 and 2.69 lactations for LMY, LDL, LDMY and NL, respectively, the corresponding values for dams were between -814 and 1107 kg, -123 and 100 day, -2.38 and 1.53 kg and between -1.74 and 3.24 lactations, respectively. The breeding values for sires were between -560 and 748 kg, -117 and 83 day, -1.79 and 1.26 kg and between -1.44 and 3.12 lactations for the respective traits. Khattab *et al*. (2009) documented breeding values for Friesian cows, dams and sires varied between -2141and 4379, -12721 and 2241and between -2525 and 4021 kg and between -0.7and 1.3, -0.5 and 0.4 and between -0.7 and 0.5 lactation for LMY and NL, respectively. Oudah *et al*. (2013) reported breeding values for Friesian sires ranged between -931 and 3692 kg, -224 and 164 day, between -0.128 and 0.144 kg and between -0.718 and 0.607 lactation for LMY, LDL, LDMY and NL, respectively. In general, estimation of the breeding values is necessary for the application of an optimal breeding strategy seeking the genetic improvement of the dairy cows' performance traits.

Table 5. Breeding values of cows, dams and sires for the studied traits

Trait	Cow breeding values			Dam breeding values			Sire breeding values		
	Min.	Max.	Range	Min.	Max.	Range	Min.	Max.	Range
LMY (kg)	-759	1139	1898	-814	1107	1921	-560	748	1300
LDL (day)	-101	105	206	-122	100	222	-117	83	200
LDMY (kg)	-1.77	1.82	3.59	-2.38	1.53	3.91	-1.79	1.26	3.05
NL (lactation)	-1.64	2.69	4.33	-1.74	3.24	4.90	-1.44	3.12	4.52

LMY: lifetime milk yield, LDL: lifetime days in lactation, LDMY: lifetime daily milk yield and NL: number of lactations.

Genetic trends:

The genetic trends estimated as the regression coefficients of estimated breeding values of sires on time were positive and non-significant for LMY, LDL and NL, but negative and non-significant for LDMY (Table 6). This might be attributed to the use semen of sires usually with variable genetic background from different sources. No apparent specific genetic trend which reflected the lack genetic progress achieved overtime, indicated the need for designing an effective long-term breeding program to improve productive lifetime traits of Friesian cows in this herd through selection and planned mating with semen of sires which possess high ETA for milk production and fertility obtained from trustable genetic source.

Table 6. Regression coefficients (b±SE) of estimated breeding values of sires on their birth year for the studied traits

Traits	Sire breeding values
	b ± SE
LMY (kg)	2.738^{NS} ± 6.303
LDL (day	0..154^{NS} ± 0.823
LDMY (kg)	-0.004^{NS} ± 0.014
NL (lactation)	0.003^{NS} ± 0.018

LMY: lifetime milk yield, LDL: lifetime days in lactation, LDMY: lifetime daily milk yield and NL: number of lactations.
NS: Not significant (P>0.05).

CONCLUSIONS

The moderate heritability for LMY emphasized the possibility of realizing a considerable rate of genetic improvement in this trait through selection program. Selection with high emphasis on LMY will likely affect LDL and NL since its genetic correlations with these traits were highly and mildly positive. Low heritability estimates for LDL, LDMY and NL indicated that the differences in these traits of Friesian cows in this herd were mainly due to different nutritional, climatic conditions and management practices prevalent over different times. The low genetic trends of sires for all studied traits reflected the lack genetic progress achieved overtime. In general, the results indicate that improvement of productive lifetime traits of Friesian cows could be obtained through both selection program and improvement of management conditions.

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التقييم الوراثي لبعض صفات طول الحياة الإنتاجية لأبقار الفريزيان المولوده محلياً في مصر

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استخدم في هذا البحث بيانات عدد ٢١٨٦ سجل حليب خاصه بعدد ٥٤١ بقرة فريزيان مولوده خلال الفترة من ١٩٨٣ وحتى ٢٠٠٦م بوحدة إنتاج الألبان واللحوم- كلية الزراعة- جامعة الإسكندرية لإجراء التقييم الوراثي لبعض صفات طول الحياة الإنتاجية لأبقار الفريزيان في هذا القطيع الإنتاجي. وأيضاً دراسة تأثير كل من موسم الولادة، سنة الولادة والعمر عند أول ولادة علي الصفات موضع البحث.

تم تحليل البيانات إحصائياً بطريقة الحدالأدنى للمربعات باستخدام برنامج SAS. وأوضحت النتائج أن المتوسط العام بلغ ١٨٣٠٩ كجم لإنتاج اللبن طول الحياة، ١٣١٨ يوم لأيام الحلب طول الحياة، ١٣.٥٨ كجم لمتوسط اللبن اليومي طول الحياة و ٤.٠٤ لعدد مواسم الحليب. موسم الولادة لم يكن له تأثيراً معنوياً علي كل الصفات موضع البحث بينما سنة الولادة كان لها تأثيراً معنوياً جداً (P<0.01) علي كل الصفات. العمر عند أول ولادة لم يكن له تأثيراً معنوياً علي كل الصفات فيما عدا لمتوسط اللبن اليومي طول الحياة حيث كان التأثير معنوي (P<0.05).

تم تحليل البيانات أيضاً بواسطة نموذج الحيوان Animal Model بإستخدام برنامج Wombat. وتضمن النموذج التأثيراث الثابتة للعوامل غير الوراثية بالإضافة إلي تأثير الحيوان كمتغير عشوائي. كانت تقديرات المكافئ الوراثي لصفة إنتاج اللبن طول الحياة ٠.٢٧٢، لأيام الحلب طول الحياة ٠.١٣٧، لمتوسط إنتاج اللبن طول الحياة ٠.١١٧ ولعدد مواسم الحليب ٠.١١٦ وبالتالي يمكن تحسين إنتاج اللبن طول الحياة بالانتخاب حيث أن قيمة المكافيء الوراثي لهذه الصفة متوسطة.وكانت تقديرات معاملات الارتباط الوراثي موجبة وتراوحت بين ٠.٢٦٤ إلي ٠.٩٩٣ فيما بين الصفات موضع الدراسة فيما عدا تلك التي بين كل من إنتاج اللبن طول الحياة ومتوسط إنتاج اللبن اليومي طول الحياة كانت سالبة (-٠.١٦٣). وكانت كل تقديرات الارتباط الوراثي معنوية جداً (P < 0.01). ويتضح من التلازم الوراثي الموجب أن الانتخاب لصفة ما سيحدث استجابة غير مباشرة في باقي الصفات. وكانت تقديرات معاملات الارتباط المظهري موجبة وتراوحت بين ٠.٠٩٩ إلي ٠.٩٦٦ ومعنوية جداً (P<0.01) أو معنوية (P<0.05) .

تراوحت تقديرات القيم التربوية للأبقار بين -٧٥٩ و ١١٣٩ كجم ، بين -١٠١ و١٠٥ يوم وبين -١.٧٧ و ١.٨٢ كجم وبين -١.٦٤ و٢.٦٩ موسم لإنتاج اللبن طول الحياة، لأيام الحلب طول الحياة، لمتوسط إنتاج اللبن اليومي طول الحياة ولعدد مواسم الحليب علي التوالي. أما تقديرات القيم التربوية للأمهات فتراوحت بين -٨١٤ و ١١٠٧ كجم ، بين -١٢٢ و١٠٠ يوم وبين -٢.٣٨ و ١.٥٣ كجم وبين -١.٧٤ و ٣.٢٤ موسم بالنسبة للصفات السابقة علي التوالي. أما تقديرات القيم التربوية للطلائق فتراوحت بين -٥٦٠ و ٧٤٨ كجم ، بين -١١٧ و٨٣ يوم وبين -١.٧٩ و ١.٢٦ كجم وبين -١.٤٤ و ٣.١٢ موسم بالنسبة للصفات السابقة علي التوالي. ويلاحظ أن هناك مدي واسع للقيم التربوية للأمهات بالنسبة لكل الصفات مقارنة بالقيم التربوية لكل من الأبقار والأباء.

حسبت قيم معاملات اعتماد القيم التربوية للأباء علي السنوات وكانت غير معنوية موجبة لإنتاج اللبن طول الحياة، لأيام الحلب طول الحياة ولعدد مواسم الحليب في حين كانت سالبة تقترب من الصفر لمتوسط إنتاج اللبن اليومي طول الحياة. ولم يوجد اتجاة وراثي محدد بالنسبة لكل الصفات وذلك لغياب الانتخاب الفعال للأباء.

توضح نتائج هذا البحث بصفة عامة أنه يمكن تحسين صفات طول الحياة الإنتاجية لقطيع أبقار الفريزيان موضع البحث من خلال الانتخاب وتوفير نظم الرعاية المناسبة والظروف البيئية الملائمة.