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Estimation of Genetic and Phenotypic Parameters for Some Milk Traits on Egyptian, Friesian and their Crosses Cows

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ABSTRACT

A total of 1561, 575 and 2337 normal lactation records of Baladi, Friesian and their crosses cows respectively were used in the present study. The three genetic groups belonged toELGemeza farme Animal Production Research, institute, Ministry of Agriculture, during the period from 1975 to 2011. Trait studied are 305 day milk yield (305 d MY) and lactation period (LP). Data were analyzed by using Multi Trait Animal model (MTAM). The model includes the fixed effects of month and year of calving and parity and the random effects of animal, permanent environmental and errors. Average 305 d MY was 1160, 2098 and 1695 kg, for Baladi, Friesian and crossing, respectively. Mean of LP was 210, 272 and 248 d, for the three groups, respectively. Month and year of calving and parity had highly significant effect on 305 d MY and LP. Heritability estimates for 305 d MY ranged from 0.06 to 0.39 for the three groups and LP ranged from 0.05 to 0.28. Genetic correlation among two traits ranged from 0.40 to 0.96**,** while phenotypic correlation ranged from 0.50 to 0.70.
Keywords: phenotypic and Genetic parameters, baladi, Friesian cows and their crosses, 305 day milk yield and lactation period.

INTRODUCTION

During recent years considerable emphasis has been placed upon the importance of raising Friesian cattle in Egypt especially in the government and privately owned large dairy herds which began to increase in number. The productive characteristics of the Friesian cattle in Egypt and their crosses with the local cattle have been intensively investigated, Tag El-Dien (1990). Several methods have been proposed for improving the genetic make up of the local cattle through crossing with imported genotypes Arafa (1987). The genetic parameters of the productive traits of the imported cattle and their crosses with the native cows were also estimated Mstageer et al., (1990).

In this study the genetic and phenotypic parameters of some productive traits of baladi, Friesian and their crosses cows were estimated

MATERIALS AND METHODS

Data were obtained from three genetic groups of cows 1561 lactation records for 127 baladi cows sired by 20 sires, 575 records for 178 Friesian cows sired by 47 sires and 2337 records of 747 crosses sired by 97 sirs in table 1. All cows are kept at ELGmeza farm, belonging to Animal Production Institute, Ministry of Agriculture, Cairo, Egypt, during the period from 1975 to 2011. Abnormal records of cows affected by diseases such as mastitis and udder troubles or reproductive disorders were excluded. Animals were kept under semi- open sheds. Amounts of rations given to cows were determined according to animal body weight and level of milk production. Milking was practiced twice a day. Cows were grazing on Egyptian clover (*Trifolium alexandrinum*), berseem during December to May, during the rest of the year they were given pelted concentrates and rice straw. The ration was offered twice daily and clean water was available all the time. Cows were artificially inseminated by using frozen semen. Assignment of sires to cows at random. Heifers were served for the first times when they reached 24 months or 350 kg. Cows were usually served two months postpartum. Pregnancy was detected by rectal palpation 60 days after the last service. Traits studied are 305 day milk yield (305 d MY) and lactation period (LP). Structure of data, mixed model equations and no. of iterations are presented in Table 1.

Data were analyzed by Multiple Trait Derivative Free Restricted Maximum Likelihood (MTDFREML) according to Boldman et al. (1995). The Multi Trait Animal Model (MTAM) included the effects of month and year of calving and parity as fixed effect and random effects of animal, permanent environmental and residual. The following multi trait animal model (MTAM) were.

$$Y_{ijklmn} = \mu+M_i+t_j+P_k+al+P_{em}+e_{ijklmn}$$

Where

Y_{ijklmn} are the observations:
μ= The overall means
M_i= The fixed effect of month of calves (i=1,2, …., 12),
t_j=the fixed effect of year of calves, j= 1975, 1976….2011),
P_k= the fixed effect of parity, (1,2,………., 8),
al= the an random effect of animals;
P_{em}= the random effect of permanent environment
e_{ijklmn}= the random of error.

Table 1. Structure of data, mixed model equations (MME) and no. of iterations for the three genetic group.

observations	Breeds Baladi	Friesian	Crosses
No. of records	1561	575	2337
No. of sires	20	47	97
No. of dams	127	178	747
Animal in Relationships (A^{-1})	170	260	909
Mixed model equations	426	978	3340
No. of iterations	166	310	859

RESULTS AND DISCUSSION

Unadjusted means, standard deviation (SD) and coefficient of variability (CV %) for the three genetic groups are presented in Table 2. Means of 305 d MY are 1160 kg, 2099 kg and 1696 kg for Baladi, Friesian and their crosses cows, respectively. The present mean of 305 d MY for Baladi cows are lower than those found by Mostageer et al. (1987), Arafa (1987), Khalifa (1994) and EL- Shabory (2009) ranged from 1175 to 1450 kg. Means of 305 d MY for Friesian cows are lower than those reported by Khattab and Sultan, 2254 kg (1991), Khattab and Atil,3252kg (1999), Hussein, 2570 kg (2004), El- Awady, et al. 3050 kg (2014) working on another sets of Friesian cows in Egypt. Overall mean of 305 d MY for grading up Baladi with Friesian bulls were similar to those reported by Mostageer et al. (1987), Khalifa (1994) and El- Shabory (2009) ranged from 1620 to 1700 kg.

Means of LP for Baladi , Friesian and their crosses cows were 210 d, 271 and 247 d, respectively. Means of LP for Baladi cows was lower than those reported by Arafa 280 d (1987), Khalifa 268 d (1994). Also, the present mean of LP for Friesian cows was lower than those reported by Khattab and Sultan 338 d (1991), Khattab and Atil 367 d (1999), Yener et al. 293 d (2006). Also, the present mean of LP for grading up Baladi cows with Friesian bulls were lower than those found by Arafa 341 d (1987) and khalifa 313 d (1994). In this respect, El- Shabory (2009) with another set of data, reported that means of LP for baladi, Friesian and their crosses were 164, 261 and 233 d, respectively. Values of CV % for 305 d MY and LP ranged from 30.38 to 60.40 %. In this respect, El- Shabory (2009) found that CV % values for 305 d MY and LP for Baladi cows were 90 and 59 %, respectively. The large CV % values for 305 d MY and LP for there groups of cows, reflects a great variation between cows in productive traits.

The differences between the present estimates and those of other workers could be due to differences in climatic and management conditions and /or genetic differences in herds.

Table 2. unadjusted means, standard deviation (SD) and coefficient of variability (CV%) for 305 day milk yield (305 d MY) and lactation period (LP) for the three genetic groups.

Group	305 d MY			LP		
	Mean, kg	Sd, kg	CV %	Mean,	Sd, day	CV%
Baladi (Bal)	1160	700	60.4	210	75.3	35.8
Friesian (F)	2099	920	43.8	271	82.6	30.4
Crosses (BalX F)	1696	866	51.1	247	86.2	34.8

Non genetic factors

Least squares analysis of variance for factors affecting 305 d MY and LP for the three genetic groups are presented in Table 3. Month of calving had no significant effect on all traits except for the effect of month of calving on LP for Baladi cows. Year of calving had a significant effect on 305 d MY and LP for all three genetic group ($P < 0.01$, Table 3). Similar results are reported by Khattab and Sultan (1991), Khattab and Atil (1999), Yener et al. (2006), EL-Shabory (2009) and El- Awady et al. (2014). Change in milk yield and lactation period from year to another can be attributed to change in herd size, age of animals and improved management practiced introduced from year to another and phenotypic trends.

Table 3.Least squares analysis of variance for factors affecting 305 day milk yield (305 d MY) and lactation period (LP) for Baladi, Friesian and their crosses cows.

Source of variation	F – values								
	Baladi			Friesian			Crosses		
	d. f	305 d MY	LP	d.f	305 d MY	LP	d.f	305 d MY	LP
Between Sires	19	6.53**	7.72**	46	3.53**	2.70**	96	5.64**	2.79**
Between cows: Sires	107	4.08**	3.4 **	131	1.47**	1.93**	650	2.13**	2.08**
Between month of calving	11	1.52 ns	2.39*	11	1.11 ns	0.95 ns	11	2.11 ns	1.07 ns
Between year of calving	22	3.90**	3.75**	29	5.96**	4.62**	36	14.08**	9.27 **
Between Parity	7	4.91**	2.10*	8	7.52**	1.76 ns	9	18.04 **	3.10 **
Residual, M.S.,	395	195804	3075	573	364375	3763	1534	319712	4158

- *P > 0.05
- ** P < 0.01
- ns = Nonsignificant

Parity had a significant effect on 305 d MY and LP for the three genetic groups ($P < 0.01$, Table 3), expect the effect of parity on LP for Friesian cows. Similar results are reported by Khattab and Ashmawy (1988), Hussein (2004), Yener et al. (2006), El- Shabory (2009) and El- Awady et al. (2014). The significant effect of parity on milk traits could due to the increase in body weight combined with advancing of age and to the full development of the secretary tissue of the udder.

Random effects

Sire of the cow and cow within sire had a significant effect on 305 d MY and LP for the three genetic group studied ($P < 0.01$, Table 3). The present results are in agreement with those obtained by Khattab and Sultan (1991), Khattab and Atil (1999), Yener et al.

(2006) and El- Awady et al. (2014), working on different breeds of dairy cattle. The present results indicated that the possibility of genetic improvement of milk traits through sire and dam selection. In addition, selection is important in herd improvement scheme. The ultimate aim of an evaluation is to enable breeders to compare their animals by estimating producing ability.

Genetic parameters

The average number of Mixed Model Equations (MME) and number of iterations recorded were 426 and 166, respectively for Baladi cows, 978 and 310, respectively for Friesian cows and 3340 and 859 for their crosses cows, respectively (Table 1). Results in the present study are higher than those estimated from single trait animal model found by Salem (1998) The author reported that the number of iterations for milk yield and lactation period were 153 and 127, respectively of Hostein Friesian cows in Egypt. The higher number of iterations in the present study may be due to using two traits in the same analysis and taking into considerations the genetic, permanent and errors covariances among these traits. In this respect, Swalve and Van Vleck (1987) used records of 4000 cows to estimate genetic parameters for milk yields of first, second and third lactations with an animal model, only 18 rounds of iteration were realized, while, Albuquerque et al. (1995) found that some runs stopped after 300 rounds of iteration. El- Arian et al. (2003) concluded that the number of iterations required to reach convergence could be affected by the number of animals, the number of random effects in the models and traits studied.

The heritability estimates for 305 d MY, LP were, 0.06 and 0.05 for baladi cows, respectively, while 0.39 and 0.28 for Friesian cows, respectively and 0.38 and 0.21 for their crosses cows, respectively (table 4). In this respect, El- Arian et al. (2003) working on 2096 normal lactation records of Holstein cows raised in a commercial herd, found that heritability for 305 d MY was 0.32. Hussein (2004) using another set of that herd, using sire model, reported that heritability estimates for 305 d MY was 0.25. In addition, El-Shalmani (2011) with British Friesian in Egypt, found that heritability for total milk yield was 0.37. Abdel – Salam et al. (2001) analyses 2245 lactation records of Holstein herd of the International Company for Animal Wealth, reported that heritability for 305 d MY was 0.05 and concluded that the low heritability estimates for 305 d MY , may be due to size of the data set and nature or editing of the data. The moderate heritability estimates for 305 d MY and LP for Friesian and crosses groups, suggests that the genetic improvement in milk yield and lactation period can be achieved through selection breeding program. The present estimates of LP for Friesian cows and their crosses are similar to that reported by Khattab and Sultan (1991) being 0.27.

Table 4. Estimates of heritability (h^2) on diagonal , genetic correlation (r_g) below diagonal and phenotypic correlation (r_p) above diagonal among 305 day milk yield (305 d MY) and lactation period (LP) for the three genetic group.

	Baladi		Friesian		Crosses	
	305 d MY	LP	305 d MY	LP	305 d MY	LP
305 d MY	0.06±0.01	0.50±0.20	0.39±0.05	0.70±0.09	0.38±0.10	0.50±0.10
LP	0.40±0.05	0.05±0.02	0.96±0.09	0.28±0.06	0.60±0.10	0.21±0.09

Estimates of heritability for 305 d MY and LP for Baladi cows were 0.06 and 0.05, respectively (Table 4). El- Shabory (2009) with another sets of data , found that heritability for LP for Baladi cows was 0.16.Low heritability estimates for milk traits on Baladi cows may be due to different strains of Balaid cows, little additive genetic effects for milk traits and insufficient pedigree information of cow with records. Therefore, improvement milk traits for Baladi cows may be by improvement feeding and management practical and crossing with European bulls. Khattab (2009) as a review article concluded that increasing milk traits from Baladi cows can be by using grading up Baladi cows with European bulls, breeding European cows under intensive farming and using proven sire (progeny test) of Friesian and Brown Swiss bulls.

Genetic correlation between 305 d MY and LP were positive being 0.40, 0.96 and 0.60, for Baladi, Friesian and their crosses, respectively (Table 4). Similar results were reported by Khattab and Sultan (1991), Khattab and Atil (1999), El- Arian et al. (2003), Hussein (2004), yener et al. (2006),El- Shabory (2009) , El- Shalmani (2011) and El- Awady et al. (2014) and ranged from 0.36 to 0.98. The present results indicated that selection for high milk yield will be cause a correlated increase in LP.

Phenotypic correlation among 305 d MY and LP for Baladi, Friesian and their crosses were 0.50, 0.70 and 0.50, respectively (Table 4). The present results indicated that cows had high milk yield also longer lactation period. Similar results are reported by Khattab and Sultan (1991), Khattab and Atil (1999), Hussein (2004), El- Shabory (2009) and El-Awady et al. (2014).

CONCLUSION

The present results indicated that lower milk yield and shorter lactation period for Baladi cows and low heritability estimates for milk yield and lactation period, therefore, improvement milk traits for Baladi cows may be by improvement feeding management practical and grading up Baladi cows with Friesian bull.

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تقدير المعالم الوراثية والمظهرية لبعض صفات انتاج اللبن في الابقار المصرية والفرزيان وخليطهما

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استخدم في هذا الدراسة ١٥٦١ ، ٥٧٥ ؛ ٢٣٣٧ سجل انتاجي للابقار المصرية والفرزيان وخليطهما علي التوالي. وهذه المجموعات الوراثية الثلاثة بمزرعة الجميزة التابعة لمعهد بحوث الانتاج الحيواني التابع لوزارة الزراعة خلال الفترة من ١٩٧٥ حتي ٢٠١١ م. والصفات المدروسه هي انتاج اللبن فى ٣٠٥ يوم وطول موسم الحليب وتم تحليل البيانات باستخدام نموذج الحيوان متعدد الصفات (MTAM) واشتمل نموذج التحليل على عوامل ثابته هي شهر وسنة الولادة وترتيب موسم الولادة كان محصول اللبن فى ٣٠٥ يوم ١١٦٠ , ٢٠٩٨ , ١٦٩٥ كجم لكل من الابقار البلدية والفرزيان والخليط بينهما علي التوالي. وكان متوسط طول موسم الحليب ٢١٠ , ٢٧٢ , ٢٤٨ يوم وذلك للمجموعات الوراثية الثلاثة علي التوالي. كان لشهر وسنة الولادة وترتيب موسم الولادة تأثيرعالي المعنوية علي انتاج اللبن في ٣٠٥ يوم وطول موسم الحليب. وتراوحت قيم المكافئ الوراثي لانتاج اللبن في ٣٠٥ يوم من ٠.٠٦ الى ٠.٣٩ وطول فترة الحليب من ٠.٠٥ الى ٠.٢٨ للمجموعات الوراثية الثلاثة. تراوحت قيم الارتباط الوراثي بين صفتى انتاج اللبن فى ٣٠٥ يوم وطول موسم الحليب ما بين ٠.٤٠ الى ٠.٩٦ بينما كانت قيم الارتباط المظهرى من ٠.٥٠ الى ٠.٧٠ للمجموعات الوراثية الثلاثة .