Changes in Genetic and Phenotypic Parameters of Some Production and Reproduction Traits by Level of Milk Production of Friesian Cows in Egypt

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ABSTRACT

Data collected from 7748 records relevant to 1694 Friesian cows presenting 379 sires kept at Sakha research farm during the period from 1970 to 2007 were utilized to study the changes in genetic and phenotypic parameters of milk production and some reproduction traits by level of milk production. The least squares analysis with unequal subclass numbers indicated that the overall means of daily milk yield (DMY), total milk yield (TMY), 305-days milk yield (305-DMY), lactation period (LP), dry period (DP), days open (DO) and calving interval (CI) were 13, 3950 and 3697 kgs, and 310, 117, 139 and 427 days, respectively. The corresponding means were 8.83, 2826 and 2649 kgs and 320, 124, 156 and 444 days for low, 13.65, 4204 and 3931 kgs and 308, 116, 136 and 424 days for medium and 18.90, 5632 and 5292 kgs and 298, 107, 117 and 405 days for high levels of milk production, respectively.

Genetic and phenotypic parameters for studied traits were estimated by MTDFREML with multiple-trait Animal Model. Heritability estimates of DMY, TMY, 305-DMY, LP, DP, DO and CI for low level milk production were 0.28, 0.22, 0.26, 0.18, 0.13, 0.27 and 0.27, respectively. The corresponding values for medium level milk production were 0.32, 0.26, 0.34, 0.26, 0.24, 0.21 and 0.15, respectively, and those for high level milk production were 0.49, 0.46, 0.49, 0.37, 0.32, 0.15 and 0.13, respectively. Heritability estimates for production traits increased synergistically with level of milk production but those of reproduction traits decreased. Genetic correlations among most of the studied traits were positive for all levels of milk production ranging from 0.04 to 0.87, but that between 305-DMY and DP for the medium level was negative (-0.14). Trends in the genetic correlations by levels of milk production were similar to those of heritability estimates. Phenotypic correlations among the studied traits were positive ranging from 0.01 to 0.70 for all levels of milk production except those between 305-DMY and each of LP and CI for medium level (-0.10 and -0.06, respectively) and between TMY and each of 305-DMY, DP and DO for high level (-0.04, -0.01 and -0.05, respectively). However, trends in the phenotypic correlations by levels of milk production were reversal to those found for heritability and genetic correlations.

The results, in general, indicate that higher accuracy of selection and better genetic improvement would probably be achieved on cows characterized with high level of milk production regardless of their expected performance for reproduction traits. However, when considering reproduction traits, the medium level milk producing cows may document better indices for a total merit accounting for production and reproduction traits. Designing such indices may form an effective selection programme to improve production and reproduction performance of cows in this herd.

Key words: Heritability, genetic correlation, milk production, days open, calving interval, Friesian cows, Egypt.

INTRODUCTION

In Egypt, the dairy industry represents 35% of the total investments in animal production sector. Since the early seventies Friesian cattle from different countries have been widely imported to Egypt in order to be raised either as pure-bred or for crossing with local cows. Consequently, many governmentally owned and private sector commercial dairy farms were established and operated under semi intensive production systems in order to achieve reasonable profitability (Sadek *et al.*, 1994).

Profitability of dairy enterprises, however, is influenced by the levels of milk production of the lactating cows (Gaidarska, 2009 and Rehman and Khan, 2012). In turn, milk production characteristics which form the major part of the dairy project revenues is classified as complex production traits governed by both hereditary and environmental factors (Marti and Funk, 1994; Falconer and MacKay, 1997 and Sahoo *et al*., 2003).

Production of more annual milk yield per cow is a preliminary measure of the productive efficiency of the dairy enterprise since maximum production of milk occurs when optimal managemental conditions are employed (Kellogg *et al.*, 2001; Das *et al*., 2003; Oltenacu and Broom, 2010 and Khan *et al.*., 2012). The integration of dairy traits such as age at first calving, days open, dry period, calving interval and herd lifetime in addition to the performance of milk production along with the acquaintance of the relationships among them are important for the effective control of the dairy production system leading to maximum economic returns (Ajili *et al.,* 2007; Pozveh *et al*., 2009 and Behmaram and Aslaminejad, 2010).

The genetic improvement of a given trait is a function of its heritability value and higher accuracy of heritability estimation occurs when the environmental variation are reduced. Thus adjusting the performance records for the known environmental effects should ameliorate heritability estimates and, consequently, make improvement by selection more effective (Kunaka and Makuza, 2005, Hammoud, *et al*., 2009; El-Awady and Oudah, 2012 and Usman, *et al*., 2012). Furthermore, adequate estimation of variance components for determination of genetic parameters of dairy cattle performance traits is necessary for the application of an optimal breeding strategy seeking the genetic improvement of the dairy cows performance traits (Rahman *et al*., 2007; Suhail, *et al..,* 2010; Pantelic *et al*.„ 2011; Zink, *et al*., 2012 and Goshu, *et al*., 2014).

The objectives of this study were to estimate heritability values and genetic and phenotypic correlations of some production and reproduction traits of Friesian cows grouped according to their levels of milk production to determine the impact of these levels on the response of dairy cows for improvement strategies and selection plans.

MATERIALS AND METHODS

Source of data:

Data used in this study were collected from 7748 records of pure Dutch Friesian cows raised at Sakha Experimental station, located in the northern part of the Nile Delta during the period from 1970 to 2007. The farm belongs to the Animal Production Research Institute, Ministry of Agriculture. The data were relevant to 1694 cows presenting 379 sires. The production traits under investigation were daily milk yield (DMY, kgs), total milk yield (TMY, kgs), 305-days milk yield (305-DMY, kgs), lactation period (LP, days) and dry period (DP, days). The reproduction traits were days open (DO, days), and calving interval (CI, days). DMY was calculated as the total unadjusted milk yield divided by days in milk.

Herd management:

The routine feeding system was to allow cows in milk to graze berseem (*Trifolium alexandrinum*) from November till mid-May, from 10:00 to 14:00 hrs daily, and then were offered rice straw at a rate of 4 kg/cow. Concentrate mixture was given to cover the rest of their standards nutritional requirements according to their milk production, body weight and pregnancy status. From May to November the cows were fed on concentrate mixture, rice straw and berseem hay if available. Cows were inseminated artificially using frozen semen locally prepared from sires produced on the farm.

Statistical analysis:

Only normal lactations with length ≥ 150 days from all available parities between 1 and 6 or more were included. Parity 6 class included lactations later than the sixth. Milk production was grouped into levels according to DMY; 1) low level: DMY ≤ 10 kg, 2) medium level DMY >10 and ≤ 15 kg and 3) high level: DMY >15 kg. Number of records for levels 1, 2 and 3 were 1987, 4867 and 894 presenting 25, 62 and 13 % of the total records available, respectively.

Least squares of GLM procedure (SAS 2008) were utilized to test the significance of the fixed effects of month of calving (12 months), year of calving (38 years), parity (6 parties) and level of milk production (3 levels) while age at first calving was considered as covariate. The statistical model was:

$$Y_{ijklm} = \mu + S_i + T_j + V_k + A_l + \beta\,(Age) + e_{ijklm}$$

where,

Y_{ijklm}: either DMY, 305-DMY, TMY, LP, DP, DO or CI; μ: an underlying constant specific to each trait; S_i: the fixed effect of i^{th} month of calving; T_j: the fixed effect of j^{th} year of calving; V_k: the fixed effect of k^{th} parity, A_l: the fixed effect of l^{th} level of milk production, β: the linear regression coefficient of each studied trait on age at first calving and e_{ijklm}: random residual assumed to be independent and normally distributed with mean zero and variance σ^2_e. All of above effects on studied traits were significant ($P < 0.05$), therefore, were included in the subsequent analyses.

Variance-covariance components among pairs of traits were obtained with derivative-free restricted maximum likelihood (REML) procedures using the MTDFREML program of Boldman *et al*., (1995). The assumed model was:

$$y = Xb + Zu + Wp + e$$ where,

y: a vector of observations, b: a vector of fixed effects with an incidence matrix X, u: a vector of random animal effects with incidence matrix Z, p: a vector of permanent environmental effects with incidence matrix W, and e: a vector of random residual effects with mean equals zero and variance σ^2_e.

RESULTS AND DISCUSSION

Means and standard deviations (SD) of all parities production and reproduction traits under different levels of milk production are in Table (1). The means of TMY, 305-DMY and DMY were lower than those found by Hammoud (2006) being 14, 4238 and 3948 kg ,respectively on an analogous herd of Friesian cattle in Egypt, but those of LP, DP, DO and CI were higher being 303, 75, 126 and 400 days, respectively.

Table 1: Mean ± SD of daily milk yield (DMY, kg), total milk yield (TMY, kg), 305- days milk yield (305-DMY, kg), lactation period (LP, day), dry period (DP days), days open (DO, days) and calving interval (CI, days) for low medium and high levels of milk production.

Traits	Overall	Low	Medium	High
DMY	13 ± 1.14	8.83 ± 0.87	13.65 ± 1.15	18.90 ± 1.66
TMY	3950 ± 1215	2826 ± 912	4204 ± 1247	5632 ± 1710
305-DMY	3697 ± 1190	2649 ± 851	3931 ± 1244	5292 ± 1649
LP	310 ± 15	320 ± 17	308 ± 12	298 ± 27
DP	117 ± 13	124 ± 26	116 ± 23	107 ± 36
DO	139 ±12	156 ± 14	136 ±10	117 ± 16
CI	427 ± 31	444 ± 34	424 ± 27	405±44
No. of records	7748	1987	4867	894

The means of DMY for categories of milk yield were 8.83, 13.65 and 18.90 kg for the consecutive levels with notably increasing variations by level of milk yield. The increments were 4.82 and 5.25 kg between levels I and 2 and 2 and 3 indicating an expected analogy. The corresponding changes by the level of milk yield were 1378 and 1428 kg forming 49 and 34 % for TMY and 1282 and 1361 kg forming comparable percents of 48 and 35 for 305-DMY. This indicated adjacent similarities of the distribution of DMY, TMY and 305-DMY records, resemblance in their variation from one level of yield to another and clarified the effectiveness of DMY to represent both adjusted and unadjusted seasonal milk yield. Adjusting milk yield records resulted in symmetric differences of 177, 273 and 340 kg of milk for low, medium and high levels of milk production with a similar percent's of around 6 for all levels and indicated that adjustment worked similarly for records of different levels. In general, the behaviour of records that belonged to the different levels of milk yield was similar and, therefore, should possess analogous relationships with other traits. LP and DP recorded decreases of about 11 and 9 days, respectively, for the increased levels of milk yield.

Variance components:

Permanent environmental effects on traits under study accounted for from 0.30 to 0.36, from 0.21 to 0.43 and from 0.15 to 0.38 of the total phenotypic variation for low, medium and high levels of milk production, respectively and the corresponding temporary environmental effects were from 0.39 to 0.52, from 0.43 to 0.55 and from 0.32 to 0.53.

Proportions of total variance due to temporary environmental effects were higher than those due to permanent for all categories of milk production with respect to all traits under study. However, proportions of permanent environmental effects decreased gradually from level 1 to level 2 to reach about 47 % in level 3 proportionate to level 1 for DMY, temporary environmental effects however, increased for level 2 then decreased for level 3 to be lower than that of level 1. Similar trends were observed for temporary environmental effects for TMY and 305-DMY.

Permanent environmental effects showed also similar trends except for level 2 of 305-DMY, but TMY showed gradual decrease in permanent environmental effects by level of milk yield which decreased gradually from level 1 to level 2.

For LP and DP temporary environmental effects had hardly changed and remained high for all categories. Permanent environmental effects for both traits had no apparent particular trends for different levels of milk yield. They commenced high for level 3. These results reflect differences in trends of reproduction traits for all levels of milk yield in comparison with milk production traits.

Heritabilities:

Heritability estimates of production and reproduction traits for cows producing different levels of milk yield are shown in Table (3). Heritability estimates for DMY, TMY and 305-DMY were relatively alike within each category of yield levels. They ranged from 0.22 to 0.28, from 0.26 to 0.34 and from 0.46 to 0.49 exhibiting increase in values by consecutive categories of milk yield with quite similar trends for all production traits. However, TMY recorded the lowest heritability estimates for all levels of milk yield. The present estimates were higher than those reported by Abou-bakr *et al*., (2006) who obtained heritability estimates of 0.06 and 0.13 for TMY and 305-DMYbut were close to those reported by Salem *et al*., (2006) and Rashed (2103) whose estimates were in the range of 0.22 to 0.32 and 0.25 to 0.27 for the same traits, respectively, when estimated on comparable Friesian or Holstein cows in Egypt. Heritability estimates 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 0.10 to 0.44 and from 0.17 to 0.39 for TMY and 305-DMY and was 0.18 for DMY (Abdel Gader *et al*., 2007; Effa *et al*., 2011; Eid *et al*., 2012 and Usman *et al*., 2012).

Table 2: Proportions of permanent and temporary (residual) environmental variances and ± SE for daily milk yield (DMY, kg), total milk yield (TMY, kg), 305-days milk yield (305-DMY, kg), lactation period (LP, day), dry period (DP, days), days open (DO, days) and calving interval (CI, days) for low, medium and high levels of milk production.

Trait	permanent			temporary		
	Low	Medium	High	Low	Medium	High
DMY	0.34±0.12	0.29±0.11	0.16±0.17	0.39±0.13	0.49±0.15	0.35±0.06
TMY	0.34±0.11	0.28±0.05	0.21±0.13	0.44±0.09	0.46±0.11	0.33±0.01
305-DMY	0.32±0.17	0.43±0.05	0.19±0.12	0.42±0.08	0.43±0.11	0.32±0.05
LP	0.30±0.15	0.22±0.09	0.17±0.13	0.52±0.19	0.52±0.18	0.46±0.14
DP	0.36±0.17	0.21±0.17	0.15±0.14	0.51±0.21	0.55±0.24	0.53±0.17
DO	0.30±0.22	0.25±0.17	0.34±0.22	0.43±0.14	0.54±0.18	0.51±0.14
CI	0.32±0.21	0.30±0.17	0.38±0.26	0.41±0.19	0.46±0.22	0.49±0.11

Table 3: Heritability estimates ± SE of daily milk yield (DMY, kg), for total milk yield (TMY, kg), 305-days milk yield (305- DMY, kg), lactation period (LP, day), dry period (DP, days), days open (DO, days) and calving interval (CI, days) for low, medium and high levels of milk production.

Trait	Low	Medium	High
DMY	0.28±0.13	0.32±0.10	0.49±0.19
TMY	0.22±0.12	0.26±.06	0.46±0.08
305-DMY	0.26±0.15	0.34±0.06	0.49±0.23
LP	0.18±0.07	0.26±0.17	0.37±0.26
DP	0.13±0.05	0.24±0.16	0.32±0.24
DO	0.27±0.14	0.21±0.17	0.15±0.07
CI	0.27±0.16	0.15±0.14	0.13±0.07

The higher heritability estimates for 305-DMY and 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. Therefore, daily milk yield or adjusted milk yield could serve as better choices for appraising milk yield. Marti and Funk (1994), El-Arian *et al*., (2003), Abou-bakr *et al*., (2006) and Salem *et al*., (2006) obtained similar results but Effa *et al*., (2011) reported lower heritability estimate for 305-DMY (0.39) than for TMY (0.44) of dairy cattle in Ethiopia.

The heritability estimates of LP and DP were generally lower than those for milk traits. This is expected and could be attributed to the larger environmental influences on these traits regardless of their relationships with milk yield. Heritability estimates of LP were slightly higher than those of DP. However, both traits had low heritability estimates for low yield category which increased for medium and high categories to be about twice as much of that of low category with equal increments between levels for both traits. The present estimates of heritability of LP and DP were higher than those obtained by Abou-bakr *et al*., (2006), Salem *et al*., (2006) and Rashad (2013) on Friesian or Holstein cows in Egypt and by Effa *et al*., 2011; Eid *et al*., 2012 and Usman *et al*., 2012 under warm climate. Their ranges for heritability estimates were from 0.03 to 0.18 and from 0.0 to 0.17 for LP and DP, respectively.

Reproductive performance measured as DO and CI exhibited reversed trend to milk production traits. High heritability estimates were observed for DO and CI of low level milk producer while the lowest were for the high level milk producers. Medium yield recorded medium heritability for DO but that for CI was closer to the heritability estimates of the low producing cows. Reformation of management practices in terms of adequate heat detection, utilization of reliable semen and insemination techniques, adoption of efficient health programmes and providing sufficient nutrition may play an important role to reduce the environmental variation and consequently improve heritability of reproductive traits of medium and high milk producers (Shitta *et al*., 2002).

Correlations:

Genetic and phenotypic correlations between traits of milk yield in different categories are in Table (4). The genetic correlations were high positive between DMY and TMY in all yield categories. However, these correlations between TMY and 305-DMY were smaller ranging between 0.68 and 0.74 for different yield levels. For each of the milk yield traits the genetic correlations were closely similar in categories of yield.

Table 4: Genetic (upper) and phenotypic (lower) correlations among daily milk yield (DMY, kg), total milk yield (TMY, kg), 305-days milk yield (305- DMY, kg), lactation period (LP, day), period (LP, day), dry period (DP, days), days open (DO, days) and calving interval (CI, days) for low (L), medium (M) and high (H) levels of milk production.

	DMY			TMY			305-DMY		
Traits	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**
				0.86**	0.85**	0.87**	0.77**	0.85**	0.85**
DMY				0.30**	0.23**	0.05NS	0.33**	0.13**	0.30**
							0.68**	0.73**	0.74**
TMY							0.37**	0.24**	- 0.04NS
	0.26**	0.28**	0.29**	0.56**	0.55**	0. 60**	0.54**	0.64**	0.61**
LP	0.26**	0.30**	0.06**	0.29**	0.17**	0.12**	0.26**	-0.10**	0.05NS
	0.71**	0.61**	0.84**	0.18**	0.04**	0.23**	0.30**	-0.14**	0.24**
DP	0.52**	0.06**	0.12**	0.21**	0.04**	-0.01NS	0.36**	0.04**	0.02NS
	0.19**	0.44**	0.31**	0.55**	0.57**	0.69**	0.79**	0.79**	0.72**
DO	0.41**	0.23**	0.37**	0.20**	0.12**	-0.05NS	0.24**	0.01NS	0.30**
	0.83**	0. 66**	0.73**	0.63**	0.74**	0.79**	0.48**	0.82**	0.75**
CI	0.51**	0.29**	0.40**	0.30**	0.20**	0.05NS	0.70**	-0.06**	0.20**

Standard errors for genetic correlations ranged from 0.04 to 053, 0.04 to 0.76 and 0.30 to 0.91 for low, medium and high levels of milk production, respectively.
**: Highly significant (P< 0.01), NS: Nonsignificant.

The corresponding phenotypic correlations were small positive except those between DMY and TMY of the high producing group which was positive approaching zero and between TMY and 305-DMY of the same group which was negative approaching zero. Salem *et al*., (2006) obtained similarly high genetic correlation of 0.88 but Abou-bakr *et al*., (2006) obtained small positive correlation of 0.20 between TMY and 305-DMY. Their phenotypic correlations between DMY and TMY and between TMY and 305-DMY were 0.85 and 0.08, respectively, and Eid *et al*., (2012) obtained phenotypic correlations of 0.03 between DMY and TMY.

The genetic correlations between LP and milk yield traits were mild positive between LP with DMY and moderately positive with TMY and 305-DMY. These correlations were closely similar for yield categories of each of milk production traits. However, phenotypic correlations were mild positive between LP with DMY and TMY and tended to decrease in value with the increase of milk yield of category but were close to zero between LP and medium and high levels of 305-DMY. Hermiz *et al*., (2005) obtained genetic correlations of 0.12 between TMY and LP but Abou-bakr *et al*., (2006) obtained genetic correlations of 0.24 between 305-DMY and LP and of 0.50 between TMY and LP, whereas Salem *et al*., (2006) reported genetic correlations of 0.43 and 0.62 between LP with TMY and 305-DMY. With respect to phenotypic correlation Atil *et al*., (2001) found a correlation of 0.43 between 305-DMY and LP while Hermiz *et al*., (2005) found phenotypic correlation of 0.64 between TMY and LP, but Abou-bakr *et al*., (2006) obtained a correlation of 0.29 between TMY and LP and of 0.01 between 305-DMY and LP and Salem *et al*., (2006) obtained a correlation of 0.31 between TMY and LP and of - 0.21 between 305-DMY and LP. Eid *et al*., (2012) reported a phenotypic correlation of 0.36 between DMY and LP and of 0.48 between DMY and LP.

The genetic correlations between DP and milk production traits were variable between traits and between yield levels. DMY with DP showed strong positive genetic correlation for levels 1 and 3 but that was moderate for level 2. TMY with DP had mild positive genetic correlation for levels 1 and 3 but that correlation approached zero for level 2. These correlations were even more variable between 305-DMY and DP. They were mild positive for levels 1 and 3 and mild negative for level 2. Hermiz *et al*., (2005) obtained no correlation between TMY and DP, Abou-bakr *et al*., (2006) obtained genetic correlation of 0.32 between TMY and DP and of 0.48 between LP and DP and Salem *et al*., (2006) obtained no correlation between DMY and DP. With respect to phenotypic correlations in the present study, DMY with DP had hardly mild and variable correlations among levels of milk yield, but these correlations were higher for level 1, low for levels 2 and 3. TMY with DP had mild phenotypic correlation for level 1 and no correlations for levels 2 and 3. Similarly were the correlations between 305-DMY and DP. Hermiz *et al*., (2005) obtained negative phenotypic correlation of 0.31 between TMY and DP and Abou-bakr *et al*., (2006) obtained phenotypic correlation of 0.32 between TMY and DP and of 0.25 between 305-DMY and DP. Salem *et al*., (2006) reported that the phenotypic correlations of - 0.12 and of 0.11 between TMY with DP and 305-D MY with DP.

Genetic and phenotypic correlations between reproduction traits measured as DO and CI with each of milk yield traits were also variable among levels of milk yield. These correlations were the highest between DO with 305- DMY followed by these with TMY but DMY had the lowest correlations with DO with no particular trend by level of milk yield. However, variations between the genetic correlations of different yield levels were less for TMY and 305- DMY as compared with those of DMY which had relatively high correlations with DO for level 2. Atil *et al*., (2001) found a genetic correlation of -0.05 between 305-DMY and DO. The present phenotypic correlations for the same levels and traits were considerably low relative to the respective genetic correlations and with no particular trend. Atil *et al*., (2001) obtained a phenotypic correlation of 0.18 between 305-DMY and DO.

Genetic correlations between CI and milk yield traits were positive for all levels of milk yield except between CI and 305- DMY of level 1 which was moderately positive. Also the genetic correlations accounted for less variation between levels of milk yield in all milk production traits. Hermiz *et al*., (2005) obtained genetic correlation of 0.05 between TMY and CI. No apparent trend was observed for the phenotypic correlations between CI and milk production traits of different levels of yield. However, level 1 for all milk production traits had the highest correlation with CI as compared with levels 2 and 3. The lack of trends between milk production and reproduction traits with respect to phenotypic and genetic correlations for different categories of milk yield may reflect a tendency of the high milk producing cows to be below the average for reproduction which necessitates exploring ways to deliberate these traits. Hermiz *et al*., (2005) obtained phenotypic correlation of 0.13 between TMY.

CONCLUSION

According to the present results, 62 % of the Friesian cattle imported to Egypt and kept, without crossing with other breeds or strains, for milk production under semi intensive conditions produced relatively moderate amounts of milk with a range of 10 to 15 kg / day, while only 13 % of these cows produced above 15 kg of milk / day. Utilization of high producing cows as nucleus for formation of outstanding herds of elite cows for milk production seems to be logic. But unfortunately, this approach may face the barrier of the tendency of the high producing cows to be less sound for fertility as expressed in this work by DO and CI, which were found to possess low heritability and genetic correlation with milk yield though the corresponding parameters for high milk producers were high. Practically, this could be interpreted as an antagonizing association between milk production and reproduction characteristics. So if these cows are subjected to selection for total merit improvement for the traits of concern in the present study, some technical problems such as low genetic gain or negative correlated response may arise. Therefore, high milk producers may not be the first choice for total merit amelioration. Whereas, the moderate level milk producing cows though produce a bit lower milk production, they possess the advantages of the high frequency of occurrence and the large magnitude of heritability and genetic correlations for production and reproduction traits. Besides, they are more tolerant to the sustainable harsh seasonal environment. Therefore, it could be advisable to set a breeding plan comprising an index to incorporate both milk production and reproduction traits for the medium level milk producing cows as well as the high producers. Such an index is anticipated to succeed in changing the natural physical antagonism between milk production and fertility. This along with the proper evaluation of the economic aspects of reproduction traits under semi intensive dairy farming in Egypt may promote the revenues of the dairy enterprises.

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الملخص العربى

التغيرات في المعاييرالوراثية والمظهرية لبعض الصفات الإنتاجية والتناسلية تبعاً لمستوي إنتاج اللبن لأبقار الفريزيان في مصر

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أجري هذا البحث على بيانات قطيع أبقارالفريزيان بمزرعة محطة بحوث سخا- معهد بحوث الإنتاج الحيواني- وزارة الزراعة. وقد شمل البحث بيانات ٧٧٤٨ سجلات الحليب الخاصه بعدد ١٦٩٤ بقرة تمثل بنات ٣٧٩ طلوقة خلال الفترة من ١٩٧٠ وحتى ٢٠٠٧. استهدف البحث دراسة التغيرات في قيم المعايير الوراثية لبعض الصفات الإنتاجية والتناسلية تبعاً لمستوي إنتاج اللبن لأبقار هذا القطيع التجريبي.

تم تحليل البيانات إحصائياً بطريقة الحد الأدنى للمربعات باستخدام برنامج الـ SAS. وأوضحت النتائج أن قيمة المتوسط العام لإنتاج اللبن اليومي ١٣ كجم، لإنتاج اللبن الكلي ٣٩٥٠ كجم، لإنتاج اللبن في ٣٠٥ يوم ٣٦٩٧ كجم، لطول موسم الحليب ٣١٠ يوم، لفترة الجفاف ١١٧ يوم، للفترة من الولادة حتي الاخصاب ١٣٩ يوم وللفترة بين الولادتين٤٢٧ يوم. بينما كانت المتوسطات ٨.٨٣ كجم، ٢٨٢٦ كجم، ٢٦٤٩ كجم، ٣٢٠ يوم، ١٢٤ يوم، ١٥٦ يوم و٤٤٤ يوم لنفس الصفات بالنسبة لمستوي إنتاج اللبن المنخفض. وكانت هذه المتوسطات ١٣.٦٥ كجم، ٤٢٠٤ كجم، ٣٩٣١ كجم، ٣٠٨ يوم، ١١٦ يوم، ١٣٦ يوم و٤٢٤ يوم لنفس الصفات لمستوي إنتاج اللبن المتوسط. كما بلغت ١٨.٩٠ كجم، ٥٦٣٢ كجم، ٥٢٩٢ كجم، ٢٩٨ يوم، ١٠٧ يوم، ١١٧ يوم و ٤٠٥ يوم لنفس الصفات لمستوي إنتاج اللبن المرتفع.

تم استخدام برنامج الـ MTDFREML لتقدير المعايير الوراثية للصفات موضع الدراسة. كانت تقديرات المكافئ الوراثي لصفة إنتاج اللبن اليومي ٠.٢٨، لإنتاج اللبن الكلي ٠.٢٢، لإنتاج اللبن في ٣٠٥ يوم ٠.٢٦، لطول موسم الحليب ٠.١٨، لفترة الجفاف ٠.١٣، للفترة من الولادة حتي الاخصاب ٠.٢٧ وللفترة بين الولادتين ٠.٢٧ لمستوي إنتاج اللبن المنخفض كانت ٠.٣٢، ٠.٢٦، ٠.٣٤، ٠.٢٦، ٠.٢٤، ٠.٢١ و ٠.١٥ لمستوي إنتاج اللبن المتوسط

وكانت ٠.٤٩، ٠.٤٦، ٠.٤٩، ٠.٣٧، ٠.٣٢، ٠.١٥ و٠.١٣ لمستوي إنتاج اللبن المرتفع. واتضح أن تقديرات المكافئ الوراثي للصفات الإنتاجية زادت مع زيادة مستوي إنتاج اللبن بينما تلك الخاصه بالفترة من الولادة حتي الاخصاب والفترة بين الولادتين فقد تناقصت.

كانت تقديرات الارتباط الوراثي موجبة وتراوحت بين ٠.٠٤ إلي ٠.٨٧ بين الصفات موضع الدراسة فيما عدا تلك التي بين إنتاج اللبن في ٣٠٥ يوم وفترة الجفاف للمستوي المنخفض من إنتاج اللبن كانت سالبة (-٠.١٤). كما كانت التغيرات في تقديرات الارتباط الوراثي تبعاً لمستوي إنتاج اللبن متشابه مع تلك الخاصه بتقديرات المكافئ الوراثي. وكانت كل تقديرات الارتباط الوراثي سواء الموجبة أو السالبة معنوية جداً فيما عدا تلك التي بين إنتاج اللبن الكلي وفترة الجفاف للمستوي المتوسط.

كانت تقديرات الارتباط المظهري موجبة وتراوحت بين ٠.٠١ إلي ٠.٧٠ بين الصفات موضع الدراسة فيما عدا تلك التي بين إنتاج اللبن في ٣٠٥ يوم وكل من طول موسم الحليب والفترة بين الولادتين للمستوي المتوسط كانت سالبة (-٠.١٠ و -٠.٠٦ علي الترتيب) وتلك التي بين إنتاج اللبن الكلي وكل من إنتاج اللبن في ٣٠٥ يوم، فترة الجفاف والفترة من الولادة حتي الاخصاب للمستوي المرتفع (-٠.٠٤، -٠.٠١ و-٠.٠٥ علي الترتيب). كانت التغيرات في تقديرات الارتباط المظهري حسب مستوي إنتاج اللبن عكس تلك الخاصه بتقديرات المكافئ الوراثي والتلازم الوراثي. وكانت تقديرات الارتباط المظهري سواء الموجبة أو السالبة كلها معنوية جداً لمستوي الإنتاج المنخفض، معظمها لمستوي الإنتاج المتوسط وبعضها لمستوي الإنتاج المرتفع.

بصفة عامة توضح نتائج هذا البحث أن لمستوي إنتاج اللبن أثراً كبيراً علي تقديرات المكافيء الوراثي والارتباط الوراثي والمظهري للصفات الإنتاجية والتناسلية لأبقار الفريزيان في هذا القطيع. وأيضاً توضح النتائج أنه يمكن تحقيق دقة انتخاب أعلي ومعدل تحسين وراثي أفضل في حالة الأبقار مرتفعة الإنتاج. وبالتالي هناك ضرورة حتمية لتصميم برنامج انتخاب فعال لتحسين الصفات موضع البحث لأبقار هذا القطيع.