The Genetic Evaluation of Some First Lactation Traits of Holstein Cows in Egypt

Hammoud, M.H. and Salem, M.M.I.
Department of Animal Production, Faculty of Agriculture, University of Alexandria, Alexandria, Egypt

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ABSTRACT

Data relevant to 696 Holstein cows raised at El-yoser private farm, 51 km south east Alexandria, between 1995-2005 were utilized to study the genetic behaviour of first lactation total milk yield (TMY), 305-days milk yield (305-DMY), peak yield (PY), lactation period (LP) and days open (DO). Also, the effects of season and year of calving and age at first calving were studied.

The least squares analysis with unequal subclass numbers indicated that the overall least square means of TMY, 305-DMY, PY, LP and DO were 10289.9 kg, 8417.1 kg, 36.9 kg, 392.7 day and 182.7 day, respectively. Season of calving had highly significant effect on PY, LP and DO, but had no significant effect on TMY and 305-DMY. Year of calving had highly significant influence on all studied traits. Age at first calving had highly significant effect on 305-DMY and PY, but had no significant effect on TMY, LP and DO.

The variance components estimated from sire-dam mixed models were utilized to calculate heritability estimates of 0.05, 0.11, 0.13, 0.05 and 0.18 for TMY, 305-DMY, PY, LP and DO, respectively. The genetic corrletions estimated from two traits sire mixed models were positive ranging from 0.12 to 0.96, except those between 305-DMY and PY with LP and DO were negative (-0.14 to -0.32). Correlations among all traits were highly significant. The positive genetic correlations between TMY and each of 305-DMY and PY indicate that selection for high TMY will produce associated genetic improvement in both 305-DMY and PY.

The breeding values for TMY, 305-DMY, PY, LP and DO of cows ranged between -8857.4 and 10253.0, between -5662.1 and 2817.0 and between -19.5 and 17.6 kg, -303.4 and 350.8, and between -278.8 and 495.0 day, respectively, the corresponding values for dams were between - 433.7 and 724.5, -895.8 and 604.2, -1.0 and 1.0 kg and -2.4 and 3.2 and between -10.2 and 16.5 day, respectively. The corresponding values for sires were between - 372.2 and 399.7, -455.9 and 337.7, -1.4 and 0.8 kg and -7.1 and 5.7 and between -16.4 and 29.7 day, respectively. The genetic trends estimated as the regression of sires breeding values on time were not significant for all traits and were negative except for PY and DO.

Generally, the results indicate that the managerial systems and environmental conditions were appropriate and have positive effects on performance traits of Holstein cows in this commercial herd. Also, the results indicate the need for designing an effective programme to increase the genetic variability in this herd in order to improve performance traits of cows through selection.

Key words: heritability, genetic correlation, breeding values, genetic trends, milk yields, lactation period, days open, Holstein cows.

INTRODUCTION

The population of cows in Egypt is continuously increasing and is estimated to be about 5.02 million heads. They produce about 3.21 million metric tons of milk and about 0.32 million metric tons of meat, representing about 53.88 % of the total milk production and 46.69 % of the total meat production, respectively (FAO, 2010).

In the last three decades, many private dairy farms were established in Egypt through introducing Holstein cows. These farms applied intensive production systems. However, the absence of high quality feeding, sound management and optimum veterinary services may permit the local environment to reject the high yielding dairy cows (Mostageer *et al*. (1987).

Many researchers have studied the genetic aspects of most of the productive and reproductive traits of Holstein cows in commercial herds under the semi-arid conditions in Egypt (Ahmed, 1996; Salem, 1998; Salem and Abdel-Raoof, 1999; Abdel-Salam, 2000; Abou-Baker *et al*., 2000; Abdel-Salam, *et al*., 2001; Abou Gamous, 2001; El-Arian *et al*., 2001; Afifi *et al*., 2002; Ahmed*, et al.* 2002; El-Arian *et al*., 2003; Nigm *et al*., 2003; Zahed *et al*., 2003; Alhammad, 2005; Abou-Baker *et al*., 2006; Salem *et. al*., 2006 and El-Attar, 2009).

The objectives of this investigation were to the study the genetic behaviour of some first lactation characters as associated with effects of season and year of calving and age at first calving. These characters were total milk yield, 305-days milk yield, peak yield, lactation period and days open in Holstein cows raised in a commercial dairy herd.

MATERIALS AND METHODS

Source of data:

Data used in this investigation were collected from first lactation records of 696 pure Holstein cows belong to El-yoser private farm, 51 km south east of Alexandria. The records presented 73 sires and 565 dams and covered the period from 1995 to 2005. The first lactation traits under investigation were total milk yield (TMY, kg), 305-days milk yield (305-DMY, kg), peak yield (PY, kg), lactation period (LP, days) and days open (DO, days).

Herd management:

Animals were housed free in shaded open yards, grouped according to average daily milk yield and fed ad libitum on corn silage mixed with concentrate ration (TMR) all year round and supplemented with *Alfa alfa* if available. Feeding allowances were offered according to milk production and physiological status as recommended by NRC (1989). Water was also available ad libitum. Heifers were artificially inseminated for the first time when reaching 360 kgs of weight and pregnancy was detected by rectal palpation 60 days after service. The cows were machine milked thrice a day at 06.00h, 13.00h and 18.00h.

Statistical procedures:

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 (11 years) and age at first calving (3 classes). Calvings 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. The statistical model fitted was:

$\mathbf{Y_{ijkl} = \mu + S_i + T_j + A_k + e_{ijkl}}$ where,

Y_{ijkl}: either TMY, 305-DMY, PY, LP or DO; μ: an underlying constant specific to each trait; S_i: the fixed effect of i^{th} season of calving; T_j: the fixed effect of j^{th} year of calving; A_k: the fixed effect of k^{th} age at first calving and e_{ijkl}: random residual assumed to be independent normally distributed with mean zero and variance σ^2_e.

REML estimates of variance and covariance components were provided and both fixed and random effects were fitted into the analyses (Littell *et al.* 1996).

The variance components were estimated from sire-dam mixed models:

$\mathbf{y = Xb + Zs + Wd + e}$ where,

y: a vector of observations, b: a vector of fixed effects with an incidence matrix X, s: a vector of random sire effects with incidence matrix Z, d: a vector of random dam effects with incidence matrix W and e: a vector of random residual effects with mean zero and variance σ^2_e. Heritability (h^2) was estimated as $4\sigma^2_s / \sigma^2_p$, where σ^2_s and σ^2_p were the estimated sire and phenotypic variances.

The genetic corrletions between traits were estimated from two traits sire mixed models:

$$\begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} X_1 & 0 \\ 0 & X_2 \end{bmatrix} \begin{bmatrix} b_1 \\ b_2 \end{bmatrix} + \begin{bmatrix} Z_1 & 0 \\ 0 & Z_2 \end{bmatrix} \begin{bmatrix} s_1 \\ s_2 \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \end{bmatrix}$$

Where yi = vector of observations, bi = vector of fixed effects, si = vector of random sire effects and ei = vector of random residual effects for the ith trait, and Xi and Zi are incidence matrices relating records of the ith trait to the fixed and the random sire effects, respectively.

It is assumed that

$$var \begin{bmatrix} s_1 \\ s_2 \\ e_1 \\ e_2 \end{bmatrix} = \begin{bmatrix} g_{11}A & g_{12}A & 0 & 0 \\ g_{21}A & g_{22}A & 0 & 0 \\ 0 & 0 & r_{11} & r_{12} \\ 0 & 0 & r_{21} & r_{22} \end{bmatrix}$$

Where g11 is the genetic variance for trait 1, g22 is the genetic variance for trait 2, g12 = g21 is the genetic covariance between both traits, r11 is the residual variance for trait 1, r22 is the residual variance for trait 2, r12 =r21 is the residual covariance between both traits and A is the numerator relationship matrix for sires.

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

I- Environmental effects:

Table (1) shows least square means and standard errors of the factors affecting the studied traits. The overall means of first lactation TMY, 305-DMY, PY, LP and DO being 10289.9, 8417.1and 36.9 kg and 392.7 and 182.7 days, respectively were lower than those of TMY and 305-DMY reported by Abou-Bakr *et al.*(2006) being 13172 and 10847 kg, respectively and those being 12054 and 9038 kg, respectively reported by Salem *et al.* (2006) on similar herds of Holstein cows in Egypt. The mean of LP (392.7 days) was longer than that of 370 days obtained by Abou-Bakr *et al.* (2006), but was shorter than that of 407 days obtained by Salem *et al.* (2006). DO of 182.7 days obtained in this study was shorter than that of 255 days found by Abou-Bakr *et al.* (2000), but was longer than that of 154 days obtained by Abou-Bakr *et al.* (2006).

Season of calving had highly significant influence on PY, LP and DO, but had nonsignificant influence on TMY and 305-DMY. Spring calvers had the highest milk yields, winter and autumn calvers were intermediate and summers's produced the lowest yield of milk. The high yields in spring could be attributed to better climatic conditions enhancing the increase in feed intake. However, the decreased milk yields in summer may be attributed to the high increase in temperature and the associated decrease in feed intake. Cows calved in spring had longer LP and DO than those calved in other seasons. Similarly, El-shalmani (2011) found that season of calving had no significant infulence one on first lactation TMY, but had a significant one on LP and highly significant effect on DO of Friesian cows in Egypt. Contradictory to this, Nigm *et al.* (1994) indicated that season of calving had significant effect on first lactation TMY of Friesian cows in United Arab Emirates, but had nonsignificant effect on LP. Also, Sadek *et al.* (1994) reported that season of calving had highly significant effect on TMY, 305-DMY, but had no significant effect on LP of Friesian cows in commercial farms in Egypt. Moreover, Hammoud (1997) reported highly significant effect of season of calving on TMY and 305-DMY, but no significant effect on LP and DO of Friesian cows in Egypt. In addition, highly significant effect of season of calving on first lactation TMY and significant effect on LP of Holstein cows in Turkey were reported by Tekerli and Kocak (2009). In general, the effects of season of calving could be attributed to the changes in climatic conditions and feeding regimes during different seasons.

The effects of year of calving on all studied traits were highly significant, but no specific trends for these effects were apparent. The trends depended mainly on the endogenic conditions of individual animals, feeding and management practices and year to year climatic changes. The highest milk yields were attained in the years 1998, 2001 and 2005. However, the longest LP and DO were recorded on cows calved during the years 1995, 1996 and 2003. Khattab and Sultan (1990) and Sadek *et al.* (1994) found that year of calving had highly significant effect on first lactation TMY, 305-DMY, but had no significant effect on LP of Friesian cows in Egypt. Highly significant effects of year of calving on first lactation TMY and LP of Friesian cows were obtiand by Nigm *et al.* (1994). Hammoud (1997) reported that year of calving had highly significant effect on TMY and 305-DMY, but had no significant effect on LP and DO. Tekerli and Kocak (2009) and El-shalmani (2011) indicated that year of calving had highly significant influence on TMY, but had no significant influence on LP. No significant effect of year of calving on DO was depicted by El-shalmani (2011).

The effects of age at first calving on all studied traits were not significant except on 305-DMY and PY which were highly significant. Cows first calved between 26-30 months of age had the highest TMY, 305-DMY and PY and also had the longest LP and DO. Khattab and Sultan (1990) found that age at first calving had highly significant effect on TMY and 305-DMY, but had no significant effect on LP of Friesian cows. Highly significant effects of age at first calving on first lactation TMY, 305-DMY, LP and DO of Friesian cows were reported by Abdel-Glil (1996). Hammoud (1997) reported that age at first calving had highly significant effect on TMY and 305-DMY, but had no significant effect on LP and DO. However, Nigm *et al.* (1994), Tekerli and Kocak (2009) and El-shalmani (2011) found that age at first calving had nonsignificant effect on TMY and LP. Also, El-shalmani (2011) indicated that age at first calving had no significant effect on DO.

Table 1: Least square means and standard errors (LSM ± SE) of factors affecting total milk yield (TMY, kg), 305-days milk yield (305-DMY, kg), peak yield (PY, kg), lactation period (LP, days) and days open (DO, days).

Factor	No	TMY	305-DMY	PY	LP	DO
Overall mean	696	10289.9±110.1	8417.1±55.5	36.9±0.2	392.7±4.3	182.7±4.4
Season of calving		**NS**	**NS**	**	**	**
Winter	215	10261.0±249.5	8435.7±125.1	38.1±0.4	389.5±9.7	179.1±9.8
Spring	103	10945.3±337.7	8356.8±169.4	37.5±0.6	431.8±13.1	220.1±13.3
Summer	157	9896.7±288.7	8268.3±144.8	34.9±0.5	382.6±11.2	169.0±11.4
Autumn	221	10053.1±242.1	8607.8±121.4	37.2±0.4	366.9±9.4	162.3±9.5
Year of calving		**	**	**	**	**
1995	67	10085.2±396.4	8143.0±198.8	35.7±0.7	409.9±15.3	212.7±15.6
1996	101	9792.7±348.4	7973.3±174.8	34.5±0.6	394.5±13.5	186.1±13.7
1997	15	9166.3±773.2	8477.5±387.8	37.0±1.4	339.0±29.9	131.2±30.4
1998	89	11415.1±340.5	9442.4±170.8	40.5±0.6	389.7±13.2	174.2±13.4
1999	68	10302.7±374.5	8868.0±187.8	39.2±0.7	364.6±14.5	152.2±14.7
2000	64	9661.0±387.6	7830.0±194.4	34.4±0.7	392.6±15.0	184.5±15.3
2001	71	11172.8±374.5	8516.2±187.8	36.3±0.7	423.4±14.5	199.0±14.7
2002	107	10079.0±312.3	8453.6±156.6	38.9±0.6	366.6±12.1	167.8±12.3
2003	30	10398.9±558.0	8076.8±279.8	36.5±1.0	425.2±21.6	190.2±22.0
2004	62	10455.2±387.5	8219.3±194.4	36.1±0.7	410.2±15.0	193.8±15.3
2005	22	10650.3±650.9	8588.2±326.4	37.4±1.2	404.2±25.2	217.3±15.3
Age at first calving		NS	**	**	NS	NS
AFC≤26	295	10066.2±202.6	8181.8±101.6	36.0±0.36	395.0±7.8	185.0±8.0
26<AFC≤30	343	10638.3±183.3	8598.2±91.9	37.4±0.33	401.0±7.1	189.7±7.2
AFC>30	58	10162.6±403.7	8471.4±202.5	37.4±0.72	382.2±15.6	173.2±15.9

NS: Not significant (P>0.05); **: Highly significant (P< 0.01)

Π- Genetic parameters:

Estimates of variance components and heritability (h^2) for first lactation TMY, 305-DMY, PY, LP and DO are presented in table (2).

A- Variance components and heritability:

Estimates of maternal variances were higher than those of additive variances for all studied traits except DO. Thus, ignoring them may lead to an overestimation of heritability values. Consequently, maternal effects should be taken into consideration when planning strategies for long term selection programmes in dairy cattle.

Heritability estimates of 0.05, 0.11, 0.13, 0.05 and 0.18 were obtained for TMY, 305-DMY, PY, LP and DO, respectively. These estimates indicated low genetic to environmental variance ratios for lactation traits and reflected differences in their response to the existing environmental conditions. In general, the present estimates of heritabilty for TMY, 305-DMY and PY were lower than those depicted by Khattab and Sultan (1990) which were 0.31, 0.43 and 0.08 for TMY, 305-DMY and LP. Abdel-Glil (1996) reported heritability estimates of 0.41, 0.41, 0.27 and 0.12 for TMY, 305-DMY, LP and DO. Hammoud (1997) found heritability estimates of 0.33, 0.38, 0.33 and 0.21 for TMY, 305-DMY, LP and DO. Rehman *et al.* (2008) obtained heritability estimates of 0.11, 0.11and 0.09 for first lactation TMY, 305-DMYand LP of Sahiwal cattle. Tekerli and Kocak (2009) found heritability estimates of 0.27 and 0.02 for first lactation TMY and LP of Holstein cows in Turkey. El-shalmani (2011) obtained heritability estimates of 0.37, 0.38 and 0.42 for first lactation TMY, LP and DO. Pantelic *et al.* (2011) depicted heritability estimates of 0.49 and 0.08 for first lactation TMY and LP of Simmetal cows in Serbia. Heritability estimates of 0.20 and 0.03 for first lactation TMY and DO were reported by Zink *et al.* (2012) for Czech Holstein cows.

B- Genetic correlation:

Genetic correlations among studied traits are presented in table (3). Positive correlations between TMY and other traits varied between 0.12 and 0.89, between 305-DMY and PY was 0.76 and between LP and DO was 0.96; however those between 305-DMY and PY with LP and DO were mild negative ranging from -0.14 to -0.32. All positive and negative genetic correlations were highly significant. The high positive genetic correlations between TMY and each of 305-DMY, PY, LP and DO would result in a correlated response when selecting for TMY and consequently could produce genetic improvement in these correlated traits. However, the negative genetic correlations between 305-DMY and PY with LP and DO could result in deleterious in the former when selection is applied on the latter. Khattab and Sultan (1990) obtained genetic correlations of 0.94, 0.68 and 0.44 between TMY and 305-DMY, between TMY and LP and between 305-DMY and LP, respectively. Abdel-Glil (1996) found high positive genetic correlations of 0.34 to 0.92 among TMY, 305-DMY, LP and DO of Friesian cattle. Hammoud (1997) obtained extremely high positive genetic correlations of 0.93 to 0.98 among TMY, 305DMY, LP and DO of Friesian cattle. Also, El-shalmani (2011) depicted high positive genetic correlations of 0.23 to 0.98 among TMY, LP and DO of Friesian cattle. Zink *et al.* (2012) reported genetic correlation of 0.39 between TMY and DO.

ΠΠ- Breeding values:

Estimates of breeding values of cows, dams and sires for first lactation TMY, 305-DMY, PY, LP and DO are found in table (4). The breeding values for TMY, 305-DMY, PY, LP and DO of cows ranged between -8857.4 and 10253.0, -5662.1 and 2817.0 and -19.5 and 17.6 kg, -303.4 and 350.8 and between -278.8 and 495.0 day, respectively, the corresponding values for dams were between -433.7 and 724.5, -895.8 and 604.2, -1.0 and 1.0 kg , -2.4 and 3.2 day and between -10.2 and 16.5 day, respectively. Moreover, the corresponding values for sires were between -372.2 and 399.7, -455.9 and 337.7, -1.4 and 0.8 kg, -7.1 and 5.7 and between -16.4 and 29.7 day, respectively.

Table 2: Variance components and heritability estimates (h^2) for TMY (Kg), 305-DMY (kg), PY (kg), LP (day) and DO (day).

Trait	σ^2_s	σ^2_d	σ^2_e	σ^2_A	σ^2_m	σ^2_E	σ^2_P	h^2
TMY	105830	2790314	5298628	423320	2684484	5086968	8194772	0.05
305-DMY	55727	1685700	290188	222908	1629973	178734	2031615	0.11
PY	0.849	19.1406	5.3649	3.396	18.2916	3.6669	25.3545	0.13
LP	177.66	4426.75	8838.86	710.64	4249.09	8483.54	13443.27	0.05
DO	621.09	905.51	12254	2484.36	284.42	11011.82	13780.6	0.18

Table 3: Genetic correlations among TMY (Kg), 305-DMY (kg), PY (kg), LP (day), and DO (day).

Traits	305-DMY	PY	LP	DO
TMY	0.89**	0.70**	0.12**	0.15**
305-DMY		0.76**	-0.28**	-0.14**
PY			-0.32**	-0.15**
LP				0.96**

**: Highly significant (P< 0.01)

Table 4: Breeding values for TMY (Kg), 305-DMY (kg), PY (kg), LP (day) and DO (day).

Trait	Cow breeding values		Dam breeding values		Sire breeding values	
	Min. ± S.E	Max. ± SE	Min. ± S.E	Max. ± SE	Min. ± SE	Max. ± SE
TMY	-8857.4 ± 763.4	10253.0 ± 758.3	-433.7 ± 610.1	724.5 ± 596.7	-372.2 ± 290.7	399.7 ± 349.3
305-DMY	-5662.1 ± 543.3	2817.0 ± 549.6	-895.8 ± 492.4	604.2 ± 463.7	-455.9 ± 245.9	337.7 ± 231.6
PY	-19.5 ± 1.6	17.6 ± 1.7	-1.0 ± 0.9	1.0 ± 1.0	-1.4 ± 0.6	0.8 ± 0.8
LP	-303.4 ± 24.6	350.8 ± 18.7	-2.4 ± 8.3	3.2 ± 8.3	-7.1 ± 8.9	5.7 ± 9.8
DO	-278.8 ± 36.4	495.0 ± 28.5	-10.2 ± 19.2	16.5 ± 19.0	-16.4± 19.3	29.7 ± 19.3

The ranges of breeding values for cows for all traits were higher than those for dams or sires. El-shalmani (2011) estimated breeding values of Friesian sires ranged between -806.2 and 776.4 kg, -14.2 and 14.4 and between -23.7 ± 38.9 day for TMY, LP and DO, respectively.

The genetic trends estimated as the regression coefficients of estimated breeding values of sires on time were generally low and nonsignificant for all traits (Table 5). These estimated trends were negative for TMY, 305-DMY, LP, but were positive for PY and DO without any specific genetic trends observed for all traits. This might be attributed to lack of sires selection or to use of sires from different sources and with variable genetic background. The changes in the feeding and management regimes across the years may also contribute to inflating the phenotypic variation in the traits under investigation. Abdel-Gilil (1996) obtained regression coefficients of estimated breeding values of Holstein sires on time of -12.20 ± 8.4 kg/year, -4.5 ± 3.8 kg/year and 1.89 ± 0.94 day/year for TMY, 305-DMY and LP, respectively. Also, El-shalmani (2011) reported regression coefficients of estimated breeding values of Friesian sires on time of -7.030 ± 1.830 kg/year, 0.001 ± 0.041 day/year and -0.096 ± 0.078 day/year for TMY, LP and DO, respectively with no apparent specific genetic trend which reflected no genetic progress achieved overtime.

Table 5: Regression coefficients (b ± S.E)) of estimated breeding values of sires on their birth year forTMY (Kg), 305-DMY (kg), PY (kg), LP (day), and DO (day).

Traits	Sire breeding values
	b ± S.E
TMY	-0.123 ± 5.142
305-DMY	-0.187 ± 5.207
PY	0.002 ± 0.017
LP	-0.010 ± 0.101
DO	0.073 ± 0.346

CONCLUSIONS

The present results showed that the differences in the performance traits of cows were mainly due to different nutritional, climatic conditions and management practices prevalent over different times. Heritability estimates for TMY, 305-DMY, PY, LP and DO being 0.05, 0.11, 0.13, 0.05 and 0.18, respectively indicated the need for a plan to increase the genetic variability for these traits with special emphasis on milk production traits. The genetic correlation of 0.89 and 0.70 between TMY with 305-DMY and PY indicated that selection for high TMY will result in correlated response to genetic improvement in both 305-DMY and PY. The low ranges of sires breeding values for all studied traits were probably due to the absence of genetic variability and selection of sires.

In general, these results show that the managerial systems and the environmental conditions were appropriate and have positive effects on performance traits of Holstein cows in this herd. In addition, the results also indicate the need for designing an effective programme to increase genetic variability in order to improve the performance traits of cows in this commercial herd through selection.

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الملخص العربى

التقييم الوراثي لبعض صفات موسم الحليب الأول لأبقار الهولشتين في مصر

محمد حسن حمود، محمد محمود سالم

قسم الإنتاج الحيواني- كلية الزراعة- جامعة الإسكندرية

أجريت هذه الدراسة على بيانات قطيع أبقارالهولشتين فريزيان بمزرعة اليسر الخاصة الموجوده بالكيلو٥١ طريق إسكندرية- القاهرة الصحراوي. وقد شملت الدراسة بيانات سجلات موسم الحليب الأول لعدد ٦٩٦ بقرة خلال الفترة من ١٩٩٥ وحتى ٢٠٠٥. واستهدفت الدراسة التقييم الوراثي لبعض صفات موسم الحليب الأول لأبقار الهولشتين فريزيان في قطيع تجاري. وأيضاً دراسة تأثير كل من موسم الولادة، سنة الولادة والعمر عند الولادة علي الصفات موضع الدراسة.

تم تحليل البيانات إحصائياً بطريقة الحد الأدنى للمربعات، وأوضحت النتائج أن المتوسط العام بلغ ١٠٢٨٩,٩ كجم لإنتاج اللبن الكلي، ٨٤١٧,١ كجم لإنتاج اللبن في ٣٠٥ يوم، ٣٦,٩ كجم لأقصي إنتاج لبن يومي، ٣٩٢,٧ يوم لطول موسم الحليب و١٨٢,٧ يوم لطول فترة الأيام المفتوحة. موسم الولادة كان له تأثير عالي المعنوية علي كل من أقصي إنتاج لبن يومي، طول موسم الحليب وطول فترة الأيام المفتوحة بينما لم يكن له تأثيراً معنوياً علي كل من إنتاج اللبن الكلي وإنتاج اللبن في ٣٠٥ يوم. سنة الولادة كان لها تأثيراً معنوياً جداً علي كل الصفات موضع الدراسة. العمر عند أول ولادة لم يكن له تأثيراً معنوياً علي كل الصفات فيما عدا إنتاج اللبن في ٣٠٥ يوم وأقصي إنتاج لبن يومي حيث كان التأثير عالي المعنويه.

كانت تقديرات المكافئ الوراثي لصفة إنتاج اللبن الكلي ٠,٠٥، لإنتاج اللبن في ٣٠٥ يوم ٠,١١، لأقصي إنتاج لبن يومي ٠,١٣، لطول موسم الحليب ٠,٠٥ ولطول فترة الأيام المفتوحة ٠,١٨.

وكانت تقديرات الارتباط الوراثي موجبة وتراوحت بين ٠,١٢ إلي ٠,٩٦ بين الصفات موضع الدراسة فيما عدا تلك التي بين كل من إنتاج اللبن في ٣٠٥ يوم وأقصي إنتاج لبن يومي مع كل من طول موسم الحليب وطول فترة الأيام المفتوحة كانت سالبة وتراوحت بين -٠,١٤ إلي -٠,٣٢. وكانت كل تقديرات الارتباط الوراثي سواء الموجبة أو السالبة معنوية جداً. كما يتضح من التلازم الوراثي الموجب بين إنتاج اللبن الكلي وكل من إنتاج اللبن في ٣٠٥ يوم وأقصي إنتاج لبن يومي أن الانتخاب لصفة واحدة سيحدث استجابة غير مباشرة في باقي الصفات. بينما يتضح من التلازم الوراثي السالب بين كل من إنتاج اللبن في ٣٠٥ يوم وأقصي إنتاج لبن يومي مع كل من طول موسم الحليب وطول فترة الأيام المفتوحة أن الأنتخاب لأي من هذة الصفات سوف يؤدي إلي تدهور الصفات الأخري.

تراوحت تقديرات القيم التربوية للأبقار بين -٨٨٥٧,٤ و ١٠٢٥٣,٠ كجم ، بين -٥٦٦٢,١ و ٢٨١٧,٠ كجم، بين -١٩,٥ و ١٧,٦ كجم، بين -٣٠٣,٤ و ٣٥٠,٨ يوم وبين -٢٧٨,٨ و ٤٩٥,٠ يوم بالنسبة لإنتاج اللبن الكلي، لإنتاج اللبن في ٣٠٥ يوم، لأقصي إنتاج لبن يومي، لطول موسم الحليب ولطول فترة الأيام المفتوحة علي التوالي. أما تقديرات القيم التربوية للأمهات فتراوحت بين -٤٣٣,٧ و٧٢٤,٥ كجم ، بين -٨٩٥,٨ و٦٠٤,٢ كجم ،

بين -١,٠٠ و ١,٠ كجم، بين -٢,٤ و٣,٢ يوم وبين -١٠,٢ و١٦,٥ يوم بالنسبة للصفات السابقة علي التوالي. أما تقديرات القيم التربوية للطلائق فتراوحت بين -٣٧٢,٢ و ٣٩٩,٧ كجم ، بين -٤٥٥,٩ و٣٣٧,٧ كجم ، بين -١,٤ و٠,٨ كجم، بين -١.٧ و٥,٧ يوم وبين -١٦,٤ و ٢٩,٧ يوم بالنسبة للصفات السابقة علي التوالي. ويلاحظ أن هناك مدي واسع للقيم التربوية للأبقار بالنسبة لكل الصفات وبالتالي انتخاب الأبقارعلي اساس القيم التربوية سوف يكون فعالاً في احداث التحسين الوراثي، بينما كان المدي متوسط للقيم التربوية للأمهات مقارنة بالأبقار وأما القيم التربوية للأباء فكان لها مدي منخفض مقارنة بالأبقار أو الأمهات.

وقد حسبت معاملات اعتماد القيم التربوية للأباء علي السنوات وكانت سالبة لكل الصفات فيما عدا لأقصي إنتاج لبن يومي وطول فترة الأيام المفتوحة في حين كانت هذه المعاملات غير معنوية لكل الصفات. ولـم يوجـد اتجـاة وراثي محدد بالنسبة لكل الصفات وذلك لغياب الانتخاب الفعال للأباء.

بصفة عامة توضح نتائج هذه الدراسة أن لنظم الرعاية المناسبة والظروف البيئية الملائمة أثراً كبيـراً علـي الأداء الإنتاجي والتناسلي لأبقار الهولشتين في مصر. وأيضاً توضح النتائج أن هناك ضرورة حتمية لتصميم برنامج انتخاب فعال لتحسين الصفات موضع الدراسة في هذا القطيع التجاري.