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Genetic Improvement Using the Selection Indices for Some Productive and Reproductive Traits in Friesian Cattle Raised in Egypt

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ABSTRACT

A total of 1600 lactation record during the years 2000 to 2007 were collected to represent 554 cows were inseminated 84 sire in Alkarda station in Kafr El-Sheikh of the Institute of Animal Production Research, Agricultural Research Center, Egypt . The objective of this study was to estimate the genetic and non-genetic parameters, breeding value (BV) for some productive and reproductive traits, determine economic values for various production traits total milk yield (TMY), lactation period (LP),calving interval(CI) and dry period (DP) in dairy production, as well as to determine total economic selection index. The research is based on data which include 1600 lactations of 554 cows. Data were collected during the period 2000 – 2007. The derivative-free restricted maximum likelihood (REML) procedure was used to determine heritability, genetic correlation and breeding value of the studied traits. It was determined that within economic selection index the most important trait is milk yield, while values for other traits are almost negligible. Selection indices using one phenotypic standard deviation as REV_1 and limit method as REV_2. The results indicated that non genetic factors affecting (TMY), (LP), (CI),(DP) and interaction between (parity & season), (parity& year), (year & season) had highly significant ($p<0.001$) effect on those traits except the effect of CI and DP . The overall means (Mean) of TMY, LP, GI and DP were 3158.8 kg; 343.5, 453.9 and 78.5 day, respectively. Heritability estimate (h^2) for TMY, LP, GI and DP were 0.33, 0.08, 0.07 and 0.04, respectively. Phenotypic correlation between each two traits ranged from -0.11 to 0.29; and genetic correlation between each two traits ranged from -0.29 to +1 . Ranges estimates breeding values(BV) of cows estimated for TMY, LP,GI and DP were 1034.8, 522.5, 223.6 and 46.5, respectively in herd which was higher than those for sire 573.8, 152.4,127.9 and 19.6 and those fore dam 1034.8, 445.2, 154.3 and 29.8, respectively. general indices I_1 and I_{12} incorporating TMY, LP, GI and DP was the best (R_{IH} = 0.٦٣) and it is recommended if the selection was exercised; in addition there are high similarity of genetic gains under the two different groups of economic values REV_1 and REV_2.General guide was the most efficient use of my way to derive economic value I_1 = 0.36216 (TMY) -0.77931 (LP) + 0.83967 (CI) - 3.96728 (DP). I_{12} = 0.34412 (TMY) - 0.46265 (LP) + 0.34458 (CI) - 1.12974 (DP). This study will help the breeders to select the best dairy animals which will be used for production. The future generations based on genetics of milk production and reproduction traits in early lactation.

Keywords: Friesian cattle, Productive and reproductive traits, Genetic and non-genetic parameters, Breeding values, Selection Index .

INTRODUCTION

Knowledge of genetic parameters of some factors affecting milk yield is required for planning efficient breeding programs in animal production (Behzadi; *et al* 2013) . Friesian cows are the most exotic breed; the dairy sector in Egypt went to increase dairy production through genetic improvement. Although milk production is clearly a major component of profitability, the emphasis it has received is, also due to the ease of measurement compared to some other components of profitability. However, continued selection for higher milk production has been questioned on a number of accounts as it has been widely associated with deleterious effects on health, fertility and welfare of cows, as antagonist relationship (Pryce *et al*., 2002).

Berry *et al*., (2003) have noted, however, that there is a possibility to select increasing milk production without negatively impacting fertility. Within the selection index are combined the production levels of two or more characteristics, obtaining a score based on which is made the selection. Such an obtained score is in maximal correlation with the genetic contribution of certain individual. (Ivanović *et al*., 2014), since some authors have attempted to use milk yield and some reproductive traits in a combined index (El-Arian; 2005 and Atil, 2006). Estimation of genetic and phenotypic parameters for productive and reproductive traits is an important tool for the definition and evaluation of selection programs. Parameters can be estimated using several methods, such as Least Square Methods (LSM), Restricted Maximum Likelihood (REML) and Best Linear Unbiased Predictions (BLUP). In order to improve or at least stop the deterioration trend in fertility, more emphasis on fertility traits in selection is necessary.

Miglior *et al*., (2005) stated that the most selection indices were based on improving milk yield and outside North America toward increasing fat and protein content .The aims of this study were to estimate genetic parameters for some production and reproduction traits such as heritability, phenotypic and genetic correlation among between the studied traits and selection Index for total milk yield (TMY), lactation period (LP), calving interval (CI) and dairy period (DP) in Friesian cows in Egypt.

Estimation of genetic parameters is important for estimating breeding values and for designing selection indexes by using two methods of deriving relative economic values.

MATERIALS AND METHODS

A total number of 1600 lactation records of 554 cows sired by 84 bulls, during the period from 2000 to 2007 in dairy Friesian herd stated at farm Kafr El-sheikh (Karada research station) to Animal Production Research Institute (APRI) Ministry of Agriculture, Egypt . Animal feeding depends on concentrate feed mixture along with wheat or rice straw in addition to Egyptian clove in winter or clover hay during summer (May to November months). As common practice, milking cows were subjected to machine milking twice. As a common practice, milking cows were subjected to machine milking twice cows were artificially inseminated by reaching the 2nd month post partum. Heifers in both farms were served when reaching 18 month of age or 305 kg of live body weight. Structure of the data analyzed the shown in (Table, 1).

Table 1. Structure of the data analyzed for Egyptian Friesian cattle .

Observation	Herd
No of records	1600
No of sires	84
No of dams	344
No of cows	554

Statistical analysis:

Data was analyses using the general linear model (GLM) procedure *(*SAS, 2003).

The following statistical mixed model wasused:

$$Y_{ijkln} = \mu + S_i + P_j + SE_k + Y_l + e_{ijkln}$$

where,

Y_{ijkln}: either LP, TMY and 305d my; µ: an underlying constant specific to each trait; S_i: the random effect of i^{th} sire; P_j: the fixed effect of j^{th} parity of calving; SE_k:the fixed effect of k^{th} season of calving; Y_l: the fixed effect of l^{th} year of calving, e_{ijkln} = random residual assumed to be independent normally distributed with mean zero and variance σ^2_e.

Heritability and breeding values of studied traits were estimated with derivative-free restricted maximum likely hood (REML) procedures using the MTDFREML program according to Boldman *et al*., (1995), using the following model:

Y = Xb + Zu + 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, and e: a vector of random residual effects with mean equals zero and variance σ^2_e

Derivation of relative economic value:

Prior to computing the complete index, the economic values (v) were calculated by two methods, the economic value of milk yield were set to unity and the relative economic values of other traits were calculated relatively as shown in table (1).

One phenotypic standard deviation (REV_1): the economic value calculated depending on the phenotypic standard deviation where, REV_1=1/ σ_p where σ_p is the phenotypic standard deviation of trait According to *Sharma and Basu 1986 and Falconer and Mackay, 1996.*

Lamont method (REV_2) :according to *Lamont (1991)* the method depending on heritability estimates of the all traits, where, $REV_2 = T / h_i^2$,where ; $T = h^2_{TMYy} + h^2_{lp} + h^2_{CI} + h^2_{dp}$

The index value was calculated as $I= \sum_{i=1}^{n}(bipi)$, where :

I is selection index, b_i is a selection index weighing factor, p_i is a phenotypic measure and n is number of traits. Hazel (1943) proved that maximum r_{HI} is achieved when *Pb = Gv*, then The vector of optimal index weights (b) was calculated for each of the objectives as: $b=P^{-1}Ga$, where: P^{-1} is the inverse of the phenotypic (co)variance matrix of the traits in the selection index, G is the genetic covariance matrix between traits in the selection goal and the selection index, and a is the vector containing the economic values for the goal traits. Furthermore the other different properties of the selection index were calculated as following: Standard deviation of the index (σ_I)=$\sqrt{b'Pb}$, Standard deviation of the aggregate genotype (σ_H) = $\sqrt{a'Ga}$, Correlation between the index and the aggregate genotype (accuracy) $R_{IH} = \sigma_I / \sigma_H$.

RESULTS AND DISCUSSION

The overall means (Unadjusted means) and there, standard deviations (SD)and coefficient of variation (C.V) % of (TMY), (LP), (CI) and (DP) were showed in table (2).Unadjusted means and SD for (TMY), (LP), (CI) and (DP) were 3158.8±1153.3, 343.5±129.1,453.9±88.2 and 78.5±12.9, respectively. TMY in the present study was less than 5905 kg reported by Ajili *et al*., (2007) for Tunisian Holstein Friesian cows and 5533.1 by Ihlam *et al*, (2012) for Friesian cows under hot climates . Generally the present overall mean within the range of means reported in the other countries for the same trait as mentioned by Atil (2006).

Lactation period for Holstein cows in Egypt in the present study and their S.D was found to vary from 286 to 407 days and the coefficient of variability of lactation period ranged from 5 to 31.74% in agreement with those reported by Hammoud (2013) and Faid-allah, (2015) in Egypt.

The milk production reported in the present study were lower than The average calving interval 453.9 days was in agreement with that reported by (Ihlam *et al* 2012) (445.4) but was higher than that estimated by Afifi *et al*., (1992) as (390) days. Where the averages of TMY for Friesian cows in Egypt were recorded to be 5387.0, 4348.0, 7208.7 and 9710 kg as reported by El-Attar (2009), Allam (2011), Taha (2013) and Faid-alla (2015), respectively. Where the averages of LP for Friesian cows in Egypt were recorded to be 314, 327,332 and 357 days as reported by El-Attar (2009), Allam (2011), Taha (2013) and Faid (2015), respectively.

Table 2 . Overall Means standard deviations (S.D.), and coefficients of variations (C.V.) for the traits :for total milk yield (TMY), lactation period (LP), calving interval (CI) and dry period (DP) of Friesian cows in Karada herds.

Traits	No.	Means	SD	CV %
TMY (kg)	1600	3158.8	1153.3	36.5
LP (day)	1600	343.5	129.1	37.6
CI (day)	970	453.9	88.2	19.4
DP (day)	970	78.5	12.9	16.4

The mean (DP) (78.5 days). found in the present study indicated poor reproductive management . However, when lactation length decreased over the years and so did the calving interval, dry period was likely to increase, this value nearly similar to that estimated by Osmen *et al* (2013) 76.7 days in Friesian cows .

Estimates of CV% given in table 2 showed that variation in TMY was relatively high compared with other traits. Afifi *et al*., 1992 concluded that high variation in productive traits could be attributed to the variation in management decision the differences between our results and those of other workers could be due to differences in climatic and management conditions and genetic difference.

Non genetic factors affecting milk production traits analysis of variance for factors affecting milk production traits under study in presented in table (3) Least square means (LSM) and standard errors (S.E) for factors affecting TMY, LP, CI and DP are shown in table (4) .

The ANOVA results for the studied traits are given in table (3) it can be concluded that herd had significant effect on most of milk production traits under study .

Table 3. Analysis of variance for genetic and non-genetic factors affecting on TMY, LP, CI and DP in Friesian cows in Karada herds .

		Mean Squares			
Source of variation	df	TMY	LP	CI	DP
Parity	5	3447198.7**	60042.9***	9393.0 n.s	111.9 n.s
Season	3	3146349.2*	57649.2**	4260.2 n.s	154.7 n.s
Year	7	3422979.9***	215908.0***	15469.0*	106.6 n.s
Parity*season	15	638404.0 n.s	36240.7***	7019.2 n.s	78.6 n.s
parity * year	35	1137555.5 n.s	71633.0***	7082.0 n.s	90.6 n.s
Year * season	21	2302223.9***	67710.8**	7014.3 n.s	164.6 n.s
Sire		2932547.0***	18096.4****	6758.9	159.4
	df	83	83	71	71
Residual	df	1429	1429	812	812

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

The results indicated that non genetic factors affecting (TMY), (LP), (CI),(DP) and interaction between (parity&season), (parity&year), (year&season) had highly significant (p<0.001) effect on those traits except the effect of CI and DP . The least squares analysis of variance for data of all available lactations (Table3) TMY only gave evidence that sire was significant source of variation (p<0.0001) in the which indicating that sire selection may be used as useful tool for the genetic improvement of these milk production traits . This agrees well with findings of Nawaz *et al* (2013) and Al-Samaria *et al*. (2015) .

Ihlam *et al* ., 2012 reported significant effect of CI on the trait .Also for season of calving on CI Mohmed Khair *et al*., (2007) reported a high significant (P< 0.001) effect for parity on CI for Friesian and they reported also, that calving interval varied across different herd during different years. The difference in milk traits among different authors may be attributed to genetic potentiality of the different herds or referring to management practices and variability of climatic changes. However Gabr (2005) observed that the differences in TMY among 305days (MY) between parities were highly significant while no significant effect of parity on LP was found.El-Attar (2009) and Allam (2011) found that parity had a highly significant effect on LP. Lakshmi *et al*., (2009) explained that cows calved in fall and winter had comparatively low LP due to better feeding of cows that led to early conception and on time subsequent calving, whereas the probable reason for longer LP may be missing heats, improper timely insemination and repeat breeding which was in agreement with the present study, Usman *et al*., (2011) detected higher TMY in spring and lower in summer. Abdel-Gader *et al*., (2007) reported that milk production was higher in winter than the other seasons. While Javed *et al*., (2004) reported that milk production was higher in autumn and spring seasons and lower in hot summer. Similar results were obtained by Abdel-Gader *et al* (2007), El-Attar (2009) and Allam (2011) who found that year of calving had significant effect on TMY and 305d-MY. Also Mustafa and Sedar (2009) noticed that year of calving had significant effect on LP for Holstein cow. Also, safaa and Afify (2016) noticed that parity and year of calving had significant effect on TMY and LP for Holstein cow .

Table (4) display the effects of parity, season of calving and year of calving on TMY, LP, CI and DP the result clarified highly significant (P<0.01) effects of the aforementioned factors on all studied milk traits.

Table 4. Least square means (LSM) and standard error (SE) for factors affecting the studied traits in Friesian cows.

Independent variable	NO	TMY± SE, kg	L P±SE, d	NO	CI±SE, d	DP±SE, kg
Parity						
1	335	2971.9±82.6	313.8±9.2	166	440.2.±11.6	80.3±1.7
2	339	3214.3±91.7	323.6±10.2	201	454.2±14.4	79.9±2.2
3	283	3233.7±83.5	340.3±9.3	200	462.2±8.8	80.3±1.3
4	235	3309.5±92.2	350.1±10.3	152	465.2±9.8	78.9±1.5
5	207	3396.4±108.9	334.6±12.0	110	461.3±11.8	77.5±1.8
6	200	3235.2±106.2	298.3±11.8	141	444.2±11.1	78.3±1.7
Significant		***	***		***	***
Season of calving						
Autumn	473	347.9±78.2	321.9±8.7	283	448.9±8.9	78.8±1.3
Winter	434	3332.5±77.4	336.9 ±8.6	260	461.0±8.9	78.8±1.3
Spring	325	3290.7±83.1	339.4±9.3	212	455.0±9.1	80.7±1.3
Summer	367	3136.4±82.0	308.9±9.1	215	453.3±9.4	78.6±1.4
Significant		***	***		***	***
Year of calving						
2000	200	2940.5±134.9	293.7±15.0	117	433.6±14.2	77.2±2.1
2001	206	3180.5±114.4	293.2±12.8	118	437.4±12.5	76.9±2.2
2002	219	3136.6±116.4	299.1±12.9	174	447.3±12.5	79.4±1.9
2003	204	3121.9±128.6	402.42±9.0	126	453.0±12.5	80.7±1.8
2004	179	3591.9±128.6	357.3±14.3	129	459.1±15.1	81.1±1.8
2005	224	3478.6±105.8	337.2±11.8	108	493.0±12.9	77.7±2.3
2006	193	3244.4±128.9	388.6±14.4	132	448.3±12.9	79.4±1.9
2007	174	3119.4±137.7	268.1 ±15.4	66	463.9±22.6	81.3±3.4
Significant		***	***		***	***

*****highly significant (p<0.01)**

Estimate heritability (h^2) for TMY, LP, CI and DP were 0.33, 0.08, 0.07 and 0.04, respectively (Table 5). Very low h^2 estimates were recorded for LP, CI and DP. Medium h^2estimates were recorded to TMY (0.33) . This estimates shows similarity to that reported by Abosaq *et al* (2016) and Al-Samaria *et al* (2015) for 305-dMY and LP which where 0.35 and 0.06 respectively, while Lakashmi *et al* (2009) the heritability estimates in the present study indicated low genetic to environmental variance ratio for LP and DP.

Table 5. Phenotypic correlation (above), genetic correlation (below), variance components (V_A,V_{PE},$V_{TE}$$V_P$, and V_E) and heritability (h^2) for TMY, LP, CI and DP traits on the Friesian cows in Karada farm .

Traits	TMY	LP	CI	DP	V_A	V_{PE}	V_{TE}	V_P	h^2
TMY		0.29	0.12	0.03	366030	12274	731040	1109344	0.33
L.P	0.22		0.08	-0.11	1071	944	11063	13078	0.08
CI	0.19	1.0		0.03	563	378	6581	7522	0.07
DP	-0.11	0.07	-0.29		6.8	6.3	174	187	0.04

Va = Additive genetic effect, Vpe = Permanent environmental effect, Vte = environmental effect,
Vp= Phenotypic variance .h^2=heritability .

The present estimates of $h^2$for TMY indicated that genetic change for this trait is possible by selecting the most productive animal. However, the h^2 estimates for LP and CI indicated that the genetic variation among individuals may be due to environmental condition. Individual differences with respect to these traits could be reduced by management and breeding practices. El-Arian *et al*., (2002) working on Holstein Friesian cattle in Egypt, found that h^2 estimates for MY, LP, were 0.32 and 0.07, respectively

The Low heritability estimates for LP and CI indicated that these traits are affected mainly environmental factors through improving feeding and managerial strategy procedures .Similar result were report by Mostafa *et al*.,(2013) and Hommoud (2013). Improvement of feeding, management, detection of animal in heat and their insemination at proper time by good quality semen would help in improving CI. Concluded that low h^2 for CI trait suggested that most of the observed variation in this trait was due to temporary environmental conditions and management.. The improvement, reduction heat stress, better control of diseases including vaccination programs and wide spread milk recording and testing systems. The differences in the estimated heritability in the present study due to herd and environmental conditions as well as the method of estimation. The low estimate indicated that the variation due to additive gene action was small and that the variation due to the environmental factor was important.

In respect of estimates of genetic and phenotypic correlation among the studied traits are present in (Table,5) Genetic correlation (r_g) between each two traits ranged from -0.29 to +1 for; and Phenotypic correlation(r_p) between each two traits ranged from -0.11 to 0.29 for Genetic correlation among productive and reproductive traits were represented in table (5) . Positive genetic associations were estimated between CI and LP(0.1), TMY and LP(0.22), TMY and CI (0.19), and negative (r_g) between TMY and DP (-0.11) and high negative values were estimated between DP and CI (-0.29), *El-Bayoumi et al*., (2015) reported high positive (r_g) between CI and DP(0.9), CI and TMY (-0.99) and high negative between DP and TMY(-0.65) .

The estimated genetic correlations represented (Table, 5) suggested that when milk production is the selected variable there could be an increase of LP and decrease of CI, the selection of animals with short C might also result in a decrease of LP, which in agreement with respect Hulya Atil and Kattab (2005) .Animals with low level of milk yield had low positive significant phenotypic correlation between milk yield and CI as reported by Djedovi *et al*., (2012) who conclude that cows with moderate and high level of production had positive significant phenotypic correlation with CI. Near to the current results Moawed (2013) estimated low negative phenotypic relationships between DP and TMY .

Estimates of breeding values of cows, dams and sires for TMY,LP, CI and DP are presented in (Tables 6, 7 and 8 . The breeding values for TMY,LP, CI and DP of cows ranged between 680.9 and -353.9 Kg,275.8 and -246.7,85.5 and 138.1,14.4 and -32.4 days, respectively in herd . The ranges of breeding values for cows were higher than those for dams or sires for all studied traits.

Table 6 . The predicted all Cows breeding values (CBV) for milk traits in Karada herds

	TMY (kg)	LP(day)	CI(day)	DP(day)
Maximum				
CBW	680.9	275.8	85.5	14.1
Standard error	6.6	4.5	1.9	1.5
Accuracy	73	74	60	47
Minimum				
CBW	-353.9	-246.7	-138.1	-32.4
Standard error	7.8	3.5	2.1	1.6
Accuracy	60	85	51	39
Range(CBW^{Max}-CBW^{Min})	1034.8	522.5	223.6	46.5

Table 7. The predicted all Sire breeding values (SBV) for milk traits in Karada herds .

	TMY (kg)	LP(day)	CI(day)	DP(day)
Maximum				
CBW	386.1	76.5	38.6	6.7
Standard error	6.7	5.6	2.1	1.6
Accuracy	72	53	53	36
Minimum				
CBW	-187.7	-75.9	-89.3	-12.9
Standard error	6.98	4.6	1.9	1.7
Accuracy	72	73	58	28
Range(SBW^{Max}- SBW^{Min})	573.8	152.4	127.9	19.6

Table 8 .The predicted all Dam breeding values (DBV) for milk traits in Karada herds.

	TMY (kg)	LP(day)	CI(day)	DP(day)
Maximum				
CBW	680.9	198.5	39.2	10.2
Standard error	6.6	4.6	2.2	1.5
Accuracy	73	73	49	46
Minimum				
CBW	-353.9	-246.7	-115.1	-19.4
Standard error	7.8	3.5	2.0	1.6
Accuracy	60	85	58	37
Range(DBW^{Max}- DBW^{Min})	1034.8	445.2	154.3	29.6

Rang BV estimated of cows for TMY, LP, GI and DP were 1034.8, 522.5, 223.6 and 46.5day, respectively and that of sire BV for the above mentioned traits were 573.8 kg, 152.4 day,127.9 day and 19.6 day respectively (Table 6 and 7) where the range of dam BV was 1034.8 kg, 445.2 day, 154.3 day and 29.6 days, respectively. The present results show large differences among breeding value of cows, sire and dams in different traits studied .In addition, the cows, sires and dams positive values for TMY and LP. These results indicate the selection for TMY for top cows, sires and dams will increase LP and decrease CI in next generation. El-Arian *et al*., (2002) arrived at the same conclusion on Holstein Friesian .The high range of breeding values of dams and cows compared to those of sires may be due to using few numbers of proven sires compared to using large number of dam and cows and thus makes a good media for selection in dams and cows selection of cows for the next generation would lead to higher genetic improvement in the herd . The same trends were obtained by Hammoud (2013), Safaa and Afify (2016)..

The range of the cow breeding values for a certain trait gives an idea about the genetic variation among these cows. However the wider range of genetic variation that gives the chance for improvement of the considered trait through selection of superior cows in breeding value. The ranges of estimates for TMY were narrower than those obtained in previous studies Salem *et al*., (2006). However, ranges of estimates for DP were longer than that recorded by (Salem *et al*., 2006). While ranges of estimates for calving interval were shorter than those cited by Salem *et al*.,(2006) recorded accuracy for the same traits which ranged from 0.43 to 0.80 Shorter ranges were cited for CI by (Salem *et al*., 2006). Wider ranges for CI and TMY were cited by Ayied *et al*., (2011) but reported narrower ranges for DP.

Table 9. Selection criteria, weighting factors (b-values), expected genetic gains (ΔG), relative efficiencies of selection (R_{IH}) and economic weight ($1/\sigma_p$ method) in general (I_1 to I_{11}) reduces indices used to improve TMY, LP, CI and DP in Friesian cows .Using one phenotypic standard deviation ($1/\sigma_p$) as economic relative efficiency (ERV_1)

Selection indices rank	TMY		LP		CI		DP		R_{IH}	RE%
	REV_1 (1/ σp method)									
	B	ΔG (kg)	B	ΔG (day)	B	ΔG (day)	B	ΔG (day)		
I_1	0.36216	345.7	-0.77931	3.9	0.83967	2.1	-3.96728	-0.3	0.634	100
I_2	0.34787	348.9	-0.59483	3.5	0.420118	1.7	-	-0.17	0.623	98.3
I_3	0.34294	345.2	-	4.1	-	2.5	-3.67462	-0.23	0.546	86.1
I_4	0.35927	340.0	0.42230	5.1	-	2.5	-	-0.17	0.521	82.2
I_5	0.30422	335.4	-	4.1	-0.98746	0.84	-	-0.17	0.515	81.2
I_6	0.37498	341.2	0.3166	4.7	-	2.5	- 3.06878	-0.21	0.510	80.4
I_7	0.31585	340.4	-	4.1	-0.7335	1.4	-1.14313	-0.15	0.508	80.1
I_8	-	42.6	-0.31848	4.7	0.70022	2.4	-2.89304	-0.54	0.293	46.2
I_9	-	42.6	0.77757	8.5	-	6.6	-2.23751	-0.11	0.246	38.8
I_{10}	-	34.4	-	8.7	-0.76877	-6.12	-0.55364	0.16	0.208	32.8
I_{11}	-	42.6	-0.18342	3.4	0.32281	0.31	-	0.05	0.147	23.2
Selection indices rank	REV_2 (lamont method)								R_{IH}	RE%
	B	ΔG (kg)	B	ΔG (day)	B	ΔG(day)	B	ΔG(day)		
I_{12}	0.34412	350.1	-0.46265	3.6	0.34458	2.01	-1.12974	-0.22	0.586	100
I_{13}	0..34284	349.9	-0.43062	3.5	0.27007	1.9	-	-0.17	0.584	99.7
I_{14}	0.33108	347.6	-	4.1	-	2.5	-0.81268	0.18	0.574	98.0
I_{15}	0.32226	346.3	-	4.1	-0.33573	2.0	0.20082	-0.14	0.567	96.8
I_{16}	0.321	346.2	-	4.1	-0.34706	2.0	-	-0.17	0.567	96.8
I_{17}	0.34877	348.4	-0.07103	3.9	-	2.5	-0.72429	-0.18	0.563	96.1
I_{18}	0.34725	348.2	-0.05594	3.9	-	2.5	-	-0.17	0.562	95.9
I_{19}	-	34.4	-	8.7	-0.36304	-7.2	0.76917	0.40	0.285	48.6
I_{20}	-	42.6	0.33536	9.4	-	6.6	0.09613	0.07	0.283	48.3
I_{21}	-	42.6	-0.03750	8.7	0.19525	4.6	-0.04537	-0.26	0.193	32.9
I_{22}	-	42.6	-0.02918	8.9	0.17012	4.8	-	0.05	0.190	32.4

b = index coefficient, ΔG= genetic change, R_{IH}= index accuracy, RE%= relative efficiency, RE% = evidence ordered by its efficiency relative $REV_1=1/\sigma_p$ where σ_p is the phenotypic standard deviation of trait according to (*Sharma and Basu 1986 and Falconer and Mackay1996*). Lamont method (REV_2): according to *Lamont (1991)* the method depending on heritability estimates of the all traits, where, $REV_2 = T / h_i^2$ where $T = h^2_{tmy} + h^2_{lp} + h^2_{ci} + h^2_{dp}$

Been estimating the value of ΔG for recipes that did not make it in the directory account (colored boxes) through what is known as the genetic improvement of the accompanying recipes are as follows $CR_y = i\, h_x h_y r_g \sigma_{Py}$ according to Falconer and Mackay (1996)

Comparison between all 22 selection indices when using one phenotypic standard deviation as REV_1 and lamont method as REV_2 in (Table 9) showed that the selection index I_1 and I_{12} which incorporated (TMY), Lactation period (LP), Calving interval(CI) and dry period (DP), the equation of the general indices I_1 and I_{12} were:

I_1 = 0.36216 (TMY) - 0.77931 (LP) + 0.83967 (CI) - 3.96728 (DP).

I_{12} = 0.34412 (TMY) - 0.46265 (LP) + 0.34458 (CI) - 1.12974 (DP).

their correlations with the aggregate genotype were (0.63). The expected genetic changes per generation in each variety assuming a selection intensity "one" which would be gained due to applying this index were +345.7 kg, +3.9, +2.1 and -0.3 days, +350.1 kg, +3.6, +2.01 and-0.22 days for TMY, LP,CI and DP, respectively. When using the economic value by REV_1 and REV_2 .

General indices I_1 and I_{12} which include all four traits ranked (RE=100%), there it recommended to apply selection based on these indices, negligible increase in RE values occurred when DP dropped from general indices. The highest increase in RE values to 98.3, 99.7 % when DP dropped from general indices which caused their rank 2nd, respectively in both REV_1 and REV_2. The dairy men are interested to minimize the deterioration of fertility through declining the DP period because this will increase life time productivity and increase directly the income from milk and calves sales.

Dropping TMY in I_8, I_9, I_{10} and I_{11} resulted decline in RE values down to 46.2, 38.8, 32.8, and 23.2%, respectively in the ERV_1 while dropping TMY in I_{22}, I_{21}, I_{20} and I_{19} resulted decline in RE values down to 32.4, 32.9, 48.3 and 48.6 %,respectively in the ERV2 which caused their rank to fell down, it illustrates the importance of including TMY in any selection index to improve the total income . The same trend was obtained by Abosaq *et al* ., (2016) and Set El-Habbaeib (2015) where the RE value decreased when dropped MY from general selection indices. Van Raden (2002) determined, during his research of selection indexes in use for breeding value assessment of dairy cattle that in six countries (Germany, France, England, Israel, Australia and New Zealand) in selection indexes are included just milk traits, in three countries (USA, Canada and Italy) around third part of the total value of selection index refers to the characteristics of the dairy cattle type and longevity, while in certain countries, like Denmark, beside mentioned traits are also introduced a reproductive traits, as well as characteristics related to animal health status.

The lowest index by REV_2 method was I_{22} which include LP and CI. The inclusion of TMY in this index resulted in considerable improvement in RE of this index from 32.4to 100% .

So the maximum return can be achieved by using the general index I_1 or I_{12}, It is recommended for improving milk production and improving or at least minimizes the deterioration trend in fertility under economic values derived by the both mentioned methods. The rank correlation among general and reduced indices when using two methods of relative economic value REV_1 and REV_2 was 0.99 ($P \leq 0.001$), which indicated quite high similarity of genetic gains under the two different groups of economic values. It might be reliable to REV_1 and REV_2 due to it is simplicity and high applicability. In addition relative efficiency, accuracy of index and correlated response indicated the same results.

CONCLUSION

The present results suggested that improvement of reproductive traits through selection is difficult, but required enhancement of managerial and environmental conditions. Higher range of the cow breeding values for total milk yield than sires and dams verified a wider genetic variation so there is a better opportunity to select superior cows which leads to rapid genetic progress in future generations. The result of selection according to selection indexes was almost exclusively genetic gain in direct effects regardless of the type of index and the amount of index information. Discounting had a minimum influence on selection indexes. Productive and reproductive traits in the next generation, which would lead to more genetic improvement. In conclusion, this study will help the breeders to select the best dairy animals which will be used for production. The future generations based on genetics of milk production and reproduction traits in early lactation, where Selection indices I_1 and I_{12} which incorporated Total milk yield (TMY), lactation period (LP), calving interval (CI) and dry period (DP) was recommended when selection was exercised. Inclusion of (TMY) in any selection index was recommended.

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التحسين الوراثي باستخدام الأدلة الانتخابية لبعض الصفات الإنتاجية والتناسلية في ماشية الفريزيان المرباه في مصر .

صفاء صلاح سند

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تم استخدام عدد 1600 سجل إنتاجي من ٥٥٤ بقرة تم تلقيحها بـ ٨٤ طلوقة أثناء الفترة من ٢٠٠٠ إلى ٢٠٠٧ في قطيع إنتاج اللبن محطة القرضا بكفر الشيخ التابع لمعهد بحوث الانتاج الحيواني ، مركز البحوث الزراعية ، مصر وتهدف هذه الدراسة إلى دراسة تأثير العوامل الوراثية وغير الوراثية على الصفات المدروسة ، تقدير المعايير المظهرية والوراثية لبعض صفات (الصفات الانتاجية والتناسلية) و تقدير القيم التربوية للبقرة و الاب والام وكذلك عمل مجموعة من الأدلة الانتخابية تتضمن توليفات من الصفات الإنتاجية والتناسلية ، لبعض صفات انتاج (أنتاج اللبن الكلي ، طول فترة الحليب) وبعض الصفات التناسلية (الفترة بين ولادتين و فترة الجفاف) لدراسة اهم العوامل الوراثية والغير وراثية، و كذلك تقييم القيم التربوية للصفات المدروسة . تم حساب المعايير الإحصائية وتحليل التباين باستخدام برنامج SAS (SAS 2003) وتضمن النموذج التأثيرات العشوائية للعوامل الوراثية(تأثير الاب) والتأثيرات الثابتة (ترتيب موسم الولادة - الموسم - السنه) بغرض دراسة تأثير العوامل الثابتة بينما تم تقدير المعايير الوراثية والمظهرية بواسطة برنامج نموذج الحيوان (*Boldman et al., 1995*) لحساب المكافئات الوراثية وكذلك الارتباط الوراثي والمظهري بين الصفات المختلفة والقيم المتوقعة للقيم التربوية للأبقار وأمهاتها وآبائها بغرض الانتخاب علي أساس هذه القيم لكل صفة. أتضح من نتائج تحليل التباين أن كل العوامل المدروسة الثابتة والمتغيرة لها تأثير معنوي على معظم الصفات باستثناء صفة الفترة بين ولادتين وفترة الجفاف لم تتأثر معنويا . وجد ان التداخل بين ترتيب موسم الولادة & موسم الحليب وموسم الولادة & السنة والتداخل بين السنه & الموسم كان عالي المعنوية في كل الصفات المدروسة بينما كان غير معنوي لصفة الفترة بين ولادتين وفترة الجفاف. وكانت متوسطات قيم صفات محصول اللبن الكلي ، طول موسم الحليب ، طول الفترة بين الولادتين و فترة الجفاف ٣١٥٨.٨كجم و ٣٤٣.٥، ٤٥٣.٩، ٧٨.٥ يوم على التوالي . كانت قيم المكافئ الوراثي للصفات ٠.٣٣، ٠.٠٨، ٠.٠٧، ٠.٠٤ على التوالي لمحصول اللبن الكلي و طول موسم الحليب ، طول الفترة بين الولادتين و فترة الجفاف. وتراوح معامل الارتباط المظهري بين الصفات من - ٠.١١ الي +٠.٢٩والارتباط الوراثي من-٠.٢٩ الي +١. كانت القيم التربوية للصفات المدروسة للبقرة ١٠٣٤.٨ ، ٥٢٢.٥ ، ٢٢٣.٦ و ٤٦.٥ علي التوالي وهي أعلي من نظائرها للأب ٥٧٣.٨ ، ١٥٢.٤ ، ١٢٧.٩ و ١٩.٦ وللأم ١٠٣٤.٨ ، ٤٤٥.٢ ، ١٥٤.٣و٢٩.٦ علي التوالي لذلك يمكن الانتخاب للأبقار لصفات أنتاج اللبن علي أساس القيم التربوية للبقرة حيث يكون أكثر كفاءة لتحقيق تحسينا وراثيا ملموسا لصفات أنتاج اللبن في الابقار عن طريق الانتخاب بالإضافة للرعاية الجيدة لتحسين الصفات التناسلية . استخدمت الصفات المدروسة لعمل٢٢ دليل انتخابي حيث استخدمت طريقة وحدة واحدة من الانحراف المعياري المظهري كقيمة اقتصادية لعدد ١١أدلة انتخابية (دليل عام – مختزل) وباستخدام طريقة لامونت لتقدير القيمة الاقتصادية تم عمل ١١أدلة انتخابية (دليل عام –مختزل) الدليل العام كان الأكفأ باستخدام طريقتي اشتقاق القيمة الاقتصادية = I_1 = 0.34412(TMY) – 0.46265 (LP) + ٢ I_1..77931(LP) + 0.83967(CI) – 3.96728 (DP)٠-(TMY) ٠.٣٦٢١٦ 0.34458(CI) – 1.12974 (DP). تطبيق الدليل العام I_1 أدى إلى تغير وراثي متوقع لصفات الصفات أنتاج اللبن الكلي و طول موسم الحليب و الفترة بين ولادتين وفترة الجفاف قدرة ٣٤٥.٧كجم و ٣.٩ و ٢.١ و -٣.٠ يوم وكان معامل الارتباط بين الدليل والقيمة الوراثية الكلية (0.36).تطبيق الدليل العام I_{12} أدى إلى تغير وراثي متوقع لصفات محصول أنتاج اللبن الكلي و طول موسم الحليب و الفترة بين ولادتين وفترة الجفاف قدرة ٣٥٠.١ كجم ، ٣,٦ و٢.٠١ و-٢٢.٠ يوم علي التوالي وكان معامل الارتباط بين الدليل والقيمة الوراثية الكلية (٠.٥٨). الكفاءة النسبية للأدلة المختزلة بالنسبة إلى الدليل العام عند استخدام وحدة واحدة من الانحراف المعياري المظهري تراوحت من ٢٣.٢ % إلى ٩٨.٠ % تراوح معامل الارتباط بين الدليل والقيمة الوراثية الكلية تراوح من ٠.١٤ إلى ٠.٦٢ ؛ وتراوحت باستخدام طريقة لامونت من ٣٢.٤ % إلى٩٩.٧ % ومعامل الارتباط بين الدليل والقيمة الوراثية الكلية تراوح من ٠.١٩ إلى ٠.٥٨. نستخلص من هذه الدراسة أن الأدلة العامة التي تشتمل عل صفات أنتاج اللبن الكلي و طول موسم الحليب و الفترة بين ولادتين وفترة الجفاف هي الأفضل وينصح باستخدامها في حالة تطبيق دليل الانتخاب لغرض التحسين الوراثي وأن إسقاط صفة أنتاج اللبن الكلي من الدليل أدت إلى انخفاض شديد في كفاءة الدليل.