Proceedings, 10th World Congress of Genetics Applied to Livestock Production

A comparison between different selection indexes for milk and udder health traits on Friesian cows in Egypt.

A. Khattab[1], A. Salem[2], M. Kassab[2] and A. Gabr[2]
[1]Animal Production Department, Faculty of Agriculture, Tanta University, Egypt
[2]Animal Production Department, Faculty of Agriculture, kafr El Sheikh University, Egypt.

ABSTRACT: A total of 937 normal lactation records of Friesian cows, kept at Sakha Farm, belonging to ministry of Agriculture, Dokki, Cairo Egypt during the period from 1999 to 2004 were used to estimate phenotypic and genetic parameters for 305 day milk yield (305 d MY), lactation period (LP), fat percent (F %) and somatic cell count (SCC). Data were analyzed using Multiple Trait Derivate Free Restricted Maximum Likelihood (MTDFREML). Means of 305 d MY, LP, F % and SCC were 3558 kg, 301 d, 3.7 % and 536 x 10^{-3}, respectively. Heritability estimates for 305 d MY, LP, F % and SCC were 0.61±0.14, 0.16±0.07, 0.40±0.07 and 0.03±0.07, respectively. Eleven selection indexes were constructed. Index I_1 incorporating the four traits was the best (R_{IH}= 0.97).
Key words: Friesian cows; Selection indexes; Udder health

Introduction

Genetic improvement of mastitis resistance can be based either on direct selection on clinical mastitis (CM) or indirect selection, using traits genetically correlated to mastitis such as somatic cell account (SCC) **(**Ødegård et al. (2003)**)**. Selection for lower somatic cell source (SCC) is currently used to genetically resistance **(**Ødegård et al.(2005.

The objectives of the present study were to estimate phenotypic and genetic parameters for 305 d MY, LP, F % and SCC and to construct a set of selection indices used for improvement of milk traits on Friesian cows under Egyptian condition.

Material and Methods

Data. Data on 937 normal lactation records of Friesian cows sired by 50 bulls kept at Sakha Farm from 1999 to 2004 were used. Abnormal records affected by diseases such as mastitis and udder troubles or by disorders such as abortion were excluded. Artificial insemination (AI) using frozen semen was used. Each sire represented at least 5 daughters. Traits studied are 305 day milk yield (305 d MY), lactation period (LP), fat percent (F %) and somatic cell count (SCC).

Statistical analyses. Multi trait animal model included the fixed effects of month of calving, year of calving (1999 to 2004) and parity (1 to 5) and random effects of individuals, permanent environmental and errors. The estimates of phenotypic and genetic variance and covariance for 305 d MY, LP, F % and SCC were used for the construction of selection indices.

The principle of selection by means of an index developed by Hazel (1943) was followed in deriving the different indices used in this study. The basic index including the four traits was calculated using the matrix technique as described by Cunningham (1970). In addition, to the complete index, ten reduced indices were computed using all combination of traits. These indices were computed via the correlation with the aggregate genotype (R_{IH}). Relative economic values were estimated according to El- Awady (2009) by using the actual relative economic values as 1:6:12:0.19 for 305 d MY, LP, F% and SCC, respectively. The expected genetic change in any one of the traits included in the aggregate genotype was calculated according to Tabler and Touchberry (1955).

Results and Discussion

Unadjusted means. Means of 305 d MY, LP, F % and SCC were 3558 kg, 301 d, 3.7 % and 536 x10^{-3}, respectively. Estimates of CV % were 46.12, 36.21, 10.81 and 74.63 % for the four traits respectively. The higher CV % for SCC (74.63) reflects a great variation between individuals in such an important trait.

Table 1. Estimates of genetic parameters * for 305 day milk yield (305 d MY), lactation period (LP), fat percent (F %) and somatic cell count (SCC)

Traits	305 d MY	LP	F %	SCC
305 d MY	**0.61 ± 0.14**	**0.81**	**0.03**	**- 0.02**
LP	**0.96 ± 0.07**	**0.16± 0.07**	**0.03**	**-0.03**
F %	**0.15 ± 0.31**	**0.53 ± 0.40**	**0.40 ± 0.07**	**-0.15**
SCC	**-0.45±0.70**	**-0.32±0.08**	**-0.18±0.04**	**0.03±0.07**

*Heritability on diagonal, genetic correlation below diagonal and phenotypic correlation above diagonal.

Genetic parameters. Heritability estimates (h^2) for 305 d MY, LP, F % and SCC were 0.61± 0.14, 016±0.07, 0.40±0.07 and 0.0.3±0.07, respectively (Table 1). The present estimates of h^2 for 305 d MY, LP and F % are higher

Table 2. Selection indices (I's), expected genetic change per generation (EG), correlation of index with aggregate genotype (R_{IH}) and the efficiency (RE) of different indices relative to the original index (I_1)

Index	Variables *								R_{IH}	RE
	305 d MY, kg		LP, d		F %		SCC x10-3			
	b	EG	b	EG	b	EG	b	EG		
I_1	0.78	639	-5.43	40.40	14.56	0.10	-3.35	-427	0.97	100
I_2	1.01	520	-7.53	35.01	96.67	0.01			0.87	90
I_3	0.18	450	6.33	32.80			-2.85	-105.3	0.94	97
I_4	0.47	400			15.93	-0.90	-3.56	26.3	0.80	82
I_5			0.45	21.54	-11.50	-0.67	0.60	-379	0.67	69
I_6	1.01	500	-7.52	35.05					0.87	90
I_7	0.60	560			82.01	0.014			0.78	80
I_8	0.52	385					-2.69	-174	0.96	98
I_9			5.72	19.63	17.91	0.04			0.44	99
I_{10}			0.20	20.99			-0.01	-82.6	0.93	96
I_{11}					11.49	0.66	0.59	-400	0.95	98

*305 day milk yield (305 d MY), lactation period (LP), fat percent (F %) and somatic cell count (SCC), b = weighting factors of the index.

than those found by El- Awady and Oudah (2011) being 0.31 and 0.11, respectively. Similar estimates of h^2 for F % are reported by Nilforooshan and Edriss (2007)(0.41). The present estimates of h^2 for SCC are lower than those reported by Rogers (1993)(0.12) and El- Awady (2009)(0.24). According to higher estimates of h^2 for 305 d MY and F %, it could be concluded that the genetic improvement in milk yield and milk composition can be achieved through selective breeding program. Low h^2 estimates for LP and SCC indicated that these traits are affected by mainly by environmental factors such as improvement of feeding, management and milking cows three or four times per day. Genetic correlations among 305 d MY, LP and F % were positive and ranged from 0.15±0.31 to 0.96±0.07, while the genetic correlations among SCC and all traits are negative and ranged from -0.18 ±0.40 to -0.45± 0.70 (Table 1). The present results suggested that selection for milk production would lead to slight increase of F% and high lactating cows are also having the longer LP , while, SCC decreased and this the goal of dairymen. Phenotypic correlations among all traits are similar to genetic correlations. Similar results are reported by (Ødegård et al., 2003 &2005, El-Awady, 2009 and Missanjo et al., 2013) Working on different breeds of dairy cattle on different countries.

Selection indices. Eleven selection indices were constructed (Table 2). The original index (I_1) included at the four variables (i.e, 305 d MY, LP, F % and SCC) to be used for improving the aggregate genotype of the four traits, while the reduced indices (I_2, I_3,……,and I_{11}) included only two or three variables to select aggregate genotype. The expected genetic change per generation ranged from 385 to 639 kg for 305 d MY, from 19.63 to 40.40 d for LP, from -0.90 to 0.66 % for F % and from -427 to 26.3 x 10^{-3} for SCC. The maximum genetic improvement for 305 d MY, LP and SCC were achieved by the original index (I_1). The expected genetic gain in 305 d MY increased by 639 kg/generation, LP increased by 40.40 d/generation and SCC decreased by 427 X 10^{-3} cell/generation and F % increased by 0.10 %. The maximum genetic improvement for F % was achieved by I_{11} which includes F % and SCC. Expected genetic gain in F % increased by 0.66 %/generation and SCC decreased by 400 x 10^{-3} cell/ml.

Indices not including SCC (I_2, I_6, I_7 and I_9) showed a reduced accuracy (R_{IH})(0.87, 0.87,0.78 and 0.44, Table 2, respectively). Hence it would be desirable to include SCC in an index incorporating 305 d MY, LP and F % . In this respect**,** El-Awady (2009) and Missanjo et al. (2013) reported that the importance of including SCC in any selection index to improve the total merit of dairy cows and reduce clinical mastitis. In addition, Rogers (1993) concluded that selection for lower somatic cell scores, higher udders and closer teat placement would help to reduce or to eliminate undesirable correlated responses in milking labor and mastitis associated with selection for increased milk yield.

Conclusion

Results suggest that selection index I_1, which incorporated 305 day milk yield, lactation period, fat % and somatic cell count was the best (R_{IH}= 0.97). This index is recommended for Friesian cows kept at Sakha Farm, belonging to Animal Production Research Institute, Dokki, Cairo, Egypt.

Literature Cited

Cunningham, E.P.(1970) XIV. British Poultry breeders round Table, Birmingham, Nov. 14-16,1972.

El- Awady, H.G. (2009) Livestock Research for Rural Development .vol 9:21.

El- Awady, H. G., Oudah , E.Z.(2011) Asian –Aust. J. Anim. Sci., 24:1514.

Hazel, L.N. (1943) Genetics, 28:476

Missanjo, E., Chikosi, V., Halimani, T.(2013) ISRN Veterinary Sci., http://dx.doi.org/10.1155/2013/148030.
Nilforooshan, M. A., Edriss, M. A. (2007) Arch. Tierz., 50:71.
Odegard, J., Klemetsdal, G., Heringstad (2003) J.Dairy Sci., 86:4129
Odegard, J., Klemetsdal, G., Heringstad (2005). J. Dairy Sci., 85:2384.
Rogers, G.W. (1993) J. Dairy Sci., 76:664.
Tabler, K.A., Touchberry, R.W. (1955) J. Dairy Sci., 38:1155.