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IMPROVING SOME PRODUCTION AND REPRODUCTION TRAITS USING DIFFERENT SELECTION INDICES IN EGYPTIAN NATIVE COWS

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ABSTRACT

This paper aims to develop an economic selection index (SI) for cattle production and reproduction traits in Egyptian Native cows. Dataset from 2000 records are used in pure native Egyptian herd, Animal Model (MTDFRAML) software was used, and selection indices were calculated with one phenotypic standard deviation as the relative economic value (REV). The study's features include total milk yield (TMY), lactation length (LP), calving interval (CI), and days open (DO). Cow selection based on SI relied nearly entirely on the direct consequences of genetic gain. As a result, utilizing SI may allow for increased cow production in the future generation. The general index (I_1) was competent as it included all the traits. I_1= 0.027(TMY) - 1.829 (LP) +1.510(CI)-8.39(DO); where (RIH=0.623), (RE =100%), genetic change (Δ G) for MY= 87.43 and h^2I = 0.45. Therefore, this study will help breeders to choose the best cows to produce milk for selection for it, as this it will lead to a genetic improvement in milk production and reproduction traits for future generations through the use of selection index numbers (1, 4, 5, and 2). The study recommends preserving the original Egyptian cows and works to develop them as a national treasure in light of the current climatic changes due to their resistance to the environmental conditions in addition to their high fertility.

INTRODUCTION

One of Egypt's milk- and meat-producing breeds of cows is the Egyptian cow. Despite having adjusted to their environment, they are in danger of going extinct. Dairy cattle native to Egypt are distinct from other cattle breeds in terms of physical characteristics and genetic breeding, and their genetic advantages are preserved. Native cows must be preserved as a national heritage. In Egypt, there are over 2.6 million (native dairy cows). It is essential to continue looking at how genetics affect the characteristics and trends in Egyptian cows, **Safaa and Gharib (2022)**. To calculate a cow's breeding value (BV), the selection index (SI) combines all the information about the cow and its related work, **Mohammed (2020).** The selected SI contains the production levels of two or more characteristics, producing a score that serves as the basis for the selection. Given that several authors have tried to include milk production and DO characteristics in a composite index **Ivanovic *et al.* (2014), Abosaq *et al.* (2017) and Safaa and Gharib (2022)**. Estimating the genetic and phenotypic characteristics for reproductive and productive features is a crucial tool for developing and evaluating programmers. In addition, an effort was made to create selection indices that integrated its heritability estimates with those economic attributes to choose the best selection index to increase the productivity of dairy herds.

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Based on the study's findings, appropriate decisions will be made to improve herd performance in the future, promoting the genetic development of these traits.

MATERIALS AND METHODS

Data Source

In the pure native Egyptian herd of El-Serw and Sids, two farms that belonged to are part of the Animal Production Research Institute (APRI), Egypt, are indicated in Table 1.

Herd Management

The feeding plan was chosen based on the body weight, production, and pregnancy of the animals. There is always a source of pure water. While certain concentrations with silage and flag leaves (Darawa), the mineral salt combination, and vitamins are available year-round. Egyptian clover is only offered in the summer. Twice every day, the cows are milked (morning and evening). Given the presence of a veterinarian who supervises the health of the herd to monitor the health condition, heifers were served at puberty at an appropriate weight of around 350 kg at an age of about 18 months.

Studied traits

Total milk yield (TMY/kg), lactation period (LP/day), calving interval (CI) and days open (DO) were recorded

Statistical Analysis

Estimates of (h^2) of examined attributes were performed using **Boldman *et al.* (1995)**. Multi-trait Animal Model (MTDFRAM) algorithms. The assumed model is as follows:

$$y = Xb + Z_1a + Z_2p + e$$

Where y = the vector of observations, b = vector of fixed effect (farm, year and season of calving and parity), a, p, and e are the vectors of direct additive (genetic influence), permanent environmental effect, and residual effect, respectively, and X, Z1, and Z2 are incidence matrices that relate individual records.

Estimation of relative economic value (REV)

Derivation.REV = 1/ σp, where σp is the phenotypic standard deviation for a trait.It is predicted using the same manner as in **Falconer and Mackay (1996), Abosaq *et al.* (2017) and Safaa (2022)**.

The index value was calculated as

$$I = \sum_{1=n}^{n} biPi$$

The index value was computed as follows:

I is the Selection Index (SI), bi is the (SI) weighing factor, Pi is the phenotypic measure, whereas n is the number of characteristics. In addition, it was calculated for each of the objectives as b=P−1Ga, where P−1 is the inverse of the phenotypic (co)and it is the variance matrix of the traits in the (SI), G is the genetic covariance matrix between characteristics in the selection target and the (SI), and an is the vector representing the economic values of the goal traits. Also, the following calculations were made: The standard deviation (SD) of the index (σI) is √b'Pb, the standard deviation (SD) of the genotype (σH) is √a'Ga, and the accuracy (correlation between the index and genotype) RIH is σI / σH **(Hazel and Lush, 1942).**

Expected genetic change

Hazel and Lush (1942) and Van der Werf and Goddard (2003) calculated the predicted genetic change (Gi) for each trait following one generation of selection on the index (i = 1). The equation is: Gi= (i b' Gi) / σ_I. Where: i is the selection difference in SD units, b' is the transpose of weighting factors as a column vector, Gi is the I th column of the G matrix, and I is the index's standard deviation.

Table 1. Data structure and data : Data available for analysis

Item	Number
Record,	2000
Cows,	338
Sires,	37
Dams,	132 D
Farm,	2 F
Parity,	8 P
Year,	26 (1996-2021)
Season.	4 S

RESULTS AND DISCUSSION

Many times a week, the exact values for the phenotypic coefficients of variations (CV) for Baladi cows for TMY/kg, LP/day, CI/day, and DO/day are shown in Table 2. The figures provided by **Safaa and Gharib (2021)** are equivalent to the current estimate of the mean of TMY (786.7 kg) but lower than those reported on the Baladi herd by **Abdel-Hamid (2018) and Khalifa (1994)**. Moreover, the results of **Safaa and Gharib (2021)** and the average LP (170.9, days) are comparable. Contrarily, addition is higher than those estimated by **El-Shabory (2009)**. Nonetheless, according to **Abdel-Hamid (2018)** and **Khalifa (1994)**, they are lower than those discovered in Baladi cows. While the resultsgiven by **Safaa and Gharib (2021)** are similar to the average CI (402.7, day). Although, the results obtained by **Safaa and Gharib (2021)** consistent with the average DO (106.6, day).

All traits included in this study have moderate to high CV values (22.6 to 43.6%, Table 2), which confirms that these traits are influenced by a variety of factors, cow genetics, non-genetic variables (year, season, and parity), and flock management are all factors to consider. Additionally, the CV% values show greater variation in cow traits, and these findings reflect wide variations in these economic traits. Therefore, we expect genetic improvement during the selection program. These results were comparable to the given by **Safaa and Hassanane (2019) and Safaa and Gharib (2021).**

Heritability (h^2_a)

The calculated heritability (h^2a) for TMY, LP, CI, and DO were 0.17±0.026, 0.19±0.026, 0.13±0.023 and 0.14±0.023, respectively are shown in Table 3. Estimates of h^2a, on the other hand are low to moderate and agree with the majority of earlier researchers. These statistics align with the data on Baladi cows provided by **Safaa and Gharib (2021)**, h^2a estimated of TMY, LP, CI, and DO were 0.18±0.01, 0.15 ±0.001, 0.09± 0.041, and 0.05 ± 0.001, respectively. **Safaa and Hassanane (2017)** on Friesian Cows, discovered that the h^2a estimated of TMY, LP, and CI were, respectively, 0.12 ± 0.001; 0.29 ± 0.007 and 0.01 ± 0.003. This estimate was less than that made by researchers in Egypt studying Friesian cattle, **Hommoud and Salem (2013)** on Friesian cattle. They discovered that the relative h2 estimates for TMY, LP, and CI in Egypt were 0.33, 0.08, and 0.07, respectively. Nonetheless, the high h2a estimates for CI and DO suggest that there may be scope for selection-based genetic

Table 2. Actual means, standard deviations (SD) and coefficients of variation (CV%) for the Baladi cow features under study

Traits.	Mean	SD	CV(%)
TMY(kg)	786.7	343.3	43.6
LP(Day)	170.9	53.7	31.4
CI, d	402.7	100.9	25.1
DO, d	106.6	24.1	22.6

TMY, total milk yield; LP, lactation period; CI, calving interval; DO, days open.

Table 3. Heritability (h^2_a) and permanent environmental (p^2_e) in herd study

Traits+	Parameter ± SE		
	h^2	p^2e	e^2
TMY	0.17±0.026	0.132±0.022	0.71±0.028
LP	0.19±0.026	0.008±0.004	0.80±0.026
CI	0.13±0.023	0.003±0.012	0.87±0.025
DO	0.14±0.023	0.003±0.004	0.86±0.024

TMY, total milk yield; LP, lactation period; CI, calving interval; DO, days open. σ^2 p = phenotypic variance, p^2_e = permanent environmental effects and $e^2$is residual effects. + Traits as defined in Table 2.

enhancement of these variables. Moreover, **Safaa and Hassanane (2017)** study on Friesian cows found that. TMY and LP had estimated h^2a values of 0.17 and 0.17, respectively. Although the estimations of h^2 for productive and reproductive qualities in this study were generally moderate and the efforts to improve these traits through herd selection would be successful. However, enhancing the management level would be the most practical approach to do so.

Genetic and Phenotypic Associations

Table 4 displays correlations between productive and reproductive qualities. Strong and favorable genetic connections between TMY and LP have been found (0.88). These outcomes correspond to those mentioned by **Hammoud and Salem (2013) and El-Awady *et al.* (2017)**, **Beneberu *et al.* (2021) and Safaa (2022)** of Friesian cows.

Moreover, TMY revealed strong genetic connections between CI and (0.99). These findings concur with those of further researchers. **Safaa and Hassanane (2019)** and **Beneberu *et al.* (2021)**. Whoever, **Hammoud and Salem (2013)** reported high and negative genetic correlations between TMY and DO (-0.99) and a negative genetic correlation between TMY and DO in Holstein cows (rg=-0.31). Estimated genetic connections between LP and CI were strong and favorable (0.94). These findings are comparable to those of Friesian cows found by **Beneberu *et al.* (2021)**, that estimated between LP and CI (0.32±0.44). **Safaa and Hassanane (2019)** also discovered a negative genetic association between LP and DO in Friesian cows, but their estimates of rG between LP and DO were high and negative (-0.87) and -0.45, respectively). Moreover, they revealed strong and adverse genetic connections between CI

Table 4. Genetic correlations (r_g) above diagonal and phenotypic correlations (rp) below diagonal in herd study

	TMY	LP	CI	DO
TMY		0.882±0.063	0.99±0.081	-0.999±0.058
LP	0.250±0.025		0.936±0.069	-0. 872±0.032
CI	0.128±0.027	0.28±0.024		-0.988±0.061
DO	-0.255±0.024	-0.853±0.007	-0.372±0.022	

TMY, total milk yield; LP, lactation period; CI, calving interval; DO, days open + Traits as defined in Table 2.

and DO (-0.99). These findings support those of other researchers. **Beneberu *et al.* (2021)** revealed that the rG estimate between CI and DO was (-0.372±0.022). According to **Hammoud (2013)**, the genetic connection between TMY and DO in Holstein cows is negative (rg=-0.83), while the genetic association between TMY and 305d-MY is positive (rg=0.35), between LP and TMY (rg=0.31) and 305d-MY (rg=0.29), and between DO and 305-dMY (rg=0.89) and LP (rg=0.52). By a multi-trait selective breeding approach, the positive genetic connection between traits, particularly the productive ones obtained by these traits, might be simultaneously improved. Calculated genetic correlations are crucial in the procedure to prevent issues with selection index sensitivity **Portes *et al.* (2021)**.

Although the phenotypic correlation (r_p) values between TMY and LP were favorable and moderate (0.250). These findings were equivalent to those reported by **Safaa and Hassanane (2019) and Safaa (2022)**. TMY and CI have a favorable and small phenotypic connection (rp) (0.128). These findings were in line with those made by **Safaa and Hassanane (2017)** who found that Friesian cows had a positive r_p estimate between TMY and LP (0.530).

Selection criteria based on studied milk traits (MT): According to **El-Fiky *et al.* (2001) and Safaa (2022)**, the actual index weights (bs) show that each trait's relative concentration is maximizing the response to selection. Table 5 shows that the values of b for the traits varied depending on the index, being low in some, medium in others, and high in others, in addition to the presence of some negative indices and some that were positive.

As indicated in Table 5. comparison of all (11) selection indices (SI) using one phenotypic standard deviation as REV. Based on the indices' relative effectiveness, the following four indices were chosen to optimize the predicted gain across characteristics.

I_1= 0.027(TMY) - 1.829(LP) +1.510 (CI) - 8.39 (DO); (RIH=0.623)

I_4 = 0.301 (TMY) + 1.425(CI) - 5.798(DO); (RIH = 0.610)

I_5= 4.380(LP) +2.566(CI) - 15.752(DO); (RIH =0.581)

I_2= 0.3455(TMY) + 2.061(LP) +0.935(CI); (RIH =0.561)

Economy relative (RIH)

According to prior studies, the index's economic effectiveness is crucial when applying accurate economic weights only **Falconer and Mackay (1996)**. The relative economic weight in Table. 5 shows how to calculate the economic weights by using the primary cost that influences the relative economic value. The general index (I_1), which includes all analyzed features, had the highest RE: 100%.

Thus 0.027TMY - 1.829LP+1.510CI-8.39DO.

Table 5. Selection criteria, weighing factors (b-values) and relative efficiencies of selection (R_{IH}) and relative efficiency (RE%)

Index no	b- Values	RE(%)	RIH
1	**0.027TMY- 1.829LP+1.510CI- 8.39DO**	100	0.623
2	**0.3455TMY+ 2.061LP+0.935CI**	0.90	0.561
3	**0.3726TMY+2.413LP-0.236DO**	0.82	0.512
4	**0.301 TMY+1.425GI- 5.798DO**	0.98	0.610
5	**4.380LP+2.566CI- 15.752DO**	0.93	0.581
6	**0.259TMY- 3.196 DO**	0.79	0.492
7	**0.277 TMY + 0.786 CI**	0.81	0.505
8	**0.302 CI - 1.318 DO**	0.89	0.555
9	**0.326 LP - 0.006 DO**	0.67	0.421
10	**0.232 LP + 0.082 DO**	0.49	0.488
11	**0.874TMY+ 5.117LP**	0..81	0.505

Economic weight method (1/σp) (I_1:I_{11}) to improve TMY, LP, CI and DO in cows.Using one (1/σp) as economic relative efficiency (ERV).+ Traits as defined in Table 2.

Comparison between all (1_1) SI presented in Table 5. The selection index I_1 incorporated TMY, LP, CI and DO; General indices I_1 and I_{11} which include all four traits ranked (RE) =100%. I_1= 0.027(TMY) - 1.829(LP) + 1.510 (CI)- 8.39(DO); RIH=0.623 was clearly the best for genetic progress. These indicators may help cow breeders with their selection decisions (SI), enhanced production. (Production and reproductive) traits, genetic improvement and profitability of cattle herds.

The values (h^2I) of the four top indices mentioned above were both high, as shown in Table 6. Indicators I_1, I_4, I_5, and I_2 had heritability values of 0.45, 0.41, 0.27, and 0.48, respectively.

The current findings demonstrated that the best four indices (I_1, I_4, I_5, and I_2) can be used by animal breeders to quickly improve the genetic makeup of cows. The similar tendency was seen by **Abosaq *et al.* (2017)** and **Safaa (2022)**, who discovered that when total milk yield from general selection indices (SI) was removed, the RE value declined. Thus, the maximum return may be determined using the general index I1. Where to propose for enhancing milk production and avoiding the deteriorating trend infertility under economic values generated Table 6: expected genetic change in each feature.

Conclusion

Cow selection based on selection indices relied nearly entirely on the direct consequences of genetic gain. As a result, utilizing selection indices may allow for increased cow production in the next generation. The general index (I_1) was competent as it included all the traits.

I_1= 0.027(TMY) - 1.829(LP) +1.510(CI) - 8.39 (DO); where (RIH=0.623), relative efficiency (RE %) =100%, genetic change (Δ G) for MY= 87.43, kg and h^2I = 0.45.

Finally, this study will assist breeders identify the best cows to supply milk for selection., as this will lead to a genetic improvement in milk production and reproduction traits for future generations by using selection index numbers (1.4.5 and 2). The study recommends preserving the original Egyptian cows and working to develop them as a national treasure in light of the current climatic changes due to their resistance to environmental conditions in addition to their high fertility.

Table 6. Expected genetic change in each trait (Δ G) and aggregate genetic worth (ΔH) along with the heritability (h^2_I) for indices in general (I_1 toI_{11})

Index no	TMY	LP	CI	DO	h^2I	σ^2H
1	87.43	11.850	21.789	-5.699	0.45	245.7
2	76.924	12.670	20.114		0.48	404.3
3	69.880	11.706		- 4.748	0.45	409.1
4	85.429		21.831	-5.542	0.41	392.4
5		11.187	21.732	-5.787	0.27	61.3
6	69.039			-4.479	0.61	270.3
7	70.715		18.100		0.53	262.5
8			19.899	-5.040	0.49	74.0
9		10.142		- 3.443	0.51	42.4
10		11.303	17.077		0.09	34.8
11	69.866	11.66			0.005	918.9

+ TMY, total milk yield; LP, lactation period; CI, calving interval; DO, days open.+ Traits as defined in Table 2.

REFERENCES

Abdel-Hamid, T.M. (2018). Evaluation of reproductive and productive performance for Friesian, crosses and local cows under Egyptian conditions.'Ph.D. Thesis, Dept. Anim. Prod., Kafrelsheikh Univ.

Abosaq, F.M.; Zahran, S.M.; Khattab, A. S.; Zeweil, H.S. and Sallam, S.M. (2017). Improving reproductively and productivity traits using selection indices in Friesian cows .J. Alex. Univ. Fac. Agric. (Saba Basha), Alex. Univ., 22: 110 -120.

Beneberu, N.; Alemayehu, K.; Mebratie, W.; Getahun, K.; Wodajo, F. and Tesema, Z. (2021). Genetic and phenotypic correlations for reproductive and milk production traits of pure Jersey dairy cows at Adea-Berga, central highland of Ethiopia. Livestock Res. for Rural Dev., 33, Article 46., Retrieved Dec., 31: 2022, frohttp://www.lrrd.org/ lrrd33/3/bnibo3346.html.

Boldman, K.G.; Kriese, L.A.; Van Vleck, L.D. and Kachman, S.D. (1995). A manual for use of MTDFREML.A set of programs to obtain estimates of variances and covariances (DRAFT). ARS, USDA, Washington, D. C.

El-Awady, H.G.; Salem, A.Y.; Abdel-Glil M.F.; Zahed, S.M. and A.S. (2017). Estimate of genetic and phenotypic trends for some productive and reproductive Traits of Friesian cows in Egypt. J. Anim. and Poult. Prod.., Mansoura Univ., 8 (8): 329 – 334.

El-Fiky, F.A.; Aboul-Hassan, M.A.; Attalah, G.E.Y. and Bata, S.S. (2001). Selection indices for improving body weight in Baladi rabbit. Egypt. Poult. Sci., 21 (II): 305-318.

El-Shabory, L.S. (2009). A study of productive traits on Egyptian cattle and it is crosses with Friesian cattle. M.Sc., Thesis, Fac. Agric. Tanta Univ., Egypt.

Falconer, D. and Mackay, T. (1996). Introduction quantitative genetics. To quantitative Genetics. 4th Ed., Long man, London and NY.

Hazel, L.N. and Lush (1942). The efficiency of three methods of selection. J. Heredity, 393.

Hammoud, M.H. (2013). Genetic aspects of some first lactation traits of Holstein cows in Egypt. Alex. J. Agric. Res., 58 (3): 295–300.

Hammoud, M.H. and Salem, M.M.I. (2013). The genetic evaluation of some first lactation traits of Holstein cows in Egypt. Alex. J. Agric. Res., 58 (1): 1-8

Ivanović, S.; Stanojević, D.; Nastić, L. and Jeločnik, M. (2014). Determination of economic selection index coefficient for dairy cows. Econ. Agric., (61) 4: 861-875.

Khalifa, Z.A. (1994). Effect of crossing Native cattle with Friesian on milk production traits in Egypt. Ph.D. thesis, Fac. Agric., Alex. Univ., Egypt.

Mohammed, E. (2020). Review on selection index in animal breeding Ph.D. thesis. Haramaya Univ.

Portes, J.V.; Gilberto, R.O.M.; Luiz, O.C.; Silva, M.D.; Mac Neil, U.; Gomes, P.; Viviane, V.L. and José Braccini, N. (2021). Selection indexes for Nellore production system in the Brazilian Pant anal. Brazilian J. Anim. Sci., 50: e20200264.

Safaa, S.S. and Hassanane, M.S. (2017). Genetic evaluation for some productive and reproductive traits in Friesian Cows Raised in Egypt J. Anim. and Poult. Prod., Mansoura Univ., Vol. 8 (8): 227-232.

Safaa, S.S. and Hassanane, M.S. (2019). Genetic factors affecting total milk yield, lactation period and calving interval of Crossbred Friesian cows raised on Nile Delta. Egypt. J. Agric. Res., 97 (2): 771-784.

Safaa, S.S. and Gharib, G.M. (2021). Genetic evaluation and principal components analysis for milk traits in Holstein Friesian cattle. Egyptian J. Anim. Prod., 58 (3): 99-107:113-121.

Safaa, S.S. (2022). Comparison between different selection indices for some productive traits in Friesian cows. Indian J. Anim. Sci., 92 (3): 370–373.

Safaa, S.S. and Gharib, M.G. (2022). Genetic and non-genetic estimates of lactation curve in Friesian cows. Egyptian J. Anim. Prod., 59:81-87

Van der Werf, J. and Goddard, M. (2003). Models and Methods for Genetic Analysis. Amidala Anim. Breeding, Summer course, New England Univ.

الملخص العربي

التحسين لبعض الصفات الإنتاجية والتناسلية باستخدام أدلة انتخابية مختلفة في الأبقار المصرية المحلية

صفاء صلاح سند ، المعتز بالله محفوظ شعراوي ، محمود غريب غريب

معهد بحوث الإنتاج الحيواني (APRI) ، مركز البحوث الزراعية (ARC) ، مصر.

يهدف هذا البحث إلى الحصول علحى دليل انتخابي اقتصادي (SI) لبعض الصفات الانتاجية والتناسلية في الأبقار المحلية المصرية. تم استخدام بيانات 2000 سجل انتاجي في قطيع أبقار محلية اصيلة ، تم التحليل بواسطة برنامج النموذج الحيواني (MTDFRAML) ، بينما تم أستخدم دلائل أنتخابية(SI) طريقة وحدة واحدة من الانحراف المعياري المظهري (REV). واشتملت صفات الدراسة على إجمالي إنتاج اللبن(TMY) ، وطول فترة الحليب (LP) ، والفترة بين ولادتين (CI)، وطول فترة الأيام المفتوحة(DO) . كان اختيار البقرة على أساس SI يعتمد بشكل شبه حصري على التأثيرات المباشرة للمكافئ الوراثي. لذلك يمكن تحسين إنتاجية الأبقار في الجيل التالي باستخدام SI وكان الدليل العام (I_1) الأكفأ لأنه تتضمن جميع الصفات المدروسة. I_1= 0.027 (TMY) - 1.829(LP) + 1.510 (CI) - 8.39 (DO)؛ حيث كانت الكفاءة النسبية 100% = (RE %) ، والتغير الجيني(Δ G) ل MY= kg 87.43, و h^2_I =0.45 هذه الدراسة ستساعد المربين على اختيار أفضل الأبقار لإنتاج اللبن ليتم الانتخاب لها، حيث سيؤدي ذلك إلى تحسين وراثي في إنتاج اللبن وصفات التناسل للأجيال التالية من خلال استخدام أرقام الدليل الانتخابي (1 ، 4 ، 5 و 2). وتوصي الدراسة بالحفاظ على الأبقار المصرية الأصيلة والعمل على تنميتها باعتبارها ثروة قومية في ظل التغيرات المناخية الحالية نظرا لمقاومتها للظروف البيئية بالإضافة إلى خصوبتها العالية.

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