Genetic Assessment of Productive and Reproductive Traits in Friesian, Native, and Crossbred Cattle in Egypt

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Research Article

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Abstract

A total of 3023, 596, and 1189 lactation records for Friesian, Native, and their Crosses cows from 1994 to 2015 were utilized in this study to estimate and assess genetic and phenotypic parameters and breeding values for 305-day milk yield (305-DMY), lactation period (LP), calving interval (CI), and days open (DO) in these three genotype groups within the Egyptian context. Data were analyzed using the LSMLMW and MTDFREML programs. The analytical model included fixed effects such as season and year of calving, parity, and genotype groups, while random effects included animal and error. Unadjusted means for 305-DMY, LP, CI, and DO were as follows: 3597 kg, 362 days, 524 days, and 198 days for Friesian cows; 1399 kg, 199 days, 499 days, and 169 days for Native cows; and 2671 kg, 395 days, 556 days, and 215 days for Crosses cows. Genotype groups had a highly significant impact on all the studied traits. Heritability estimates were higher in both Crosses (0.32, 0.26, 0.25, 0.23) and Native cows (0.26, 0.28, 0.28) for productive and reproductive traits, respectively, compared to the Friesian cows (0.24, 0.22, 0.16, 0.17) for the same traits. Genetic correlations among productive and reproductive traits ranged from 0.10 to 0.86 for the three genotype groups, while corresponding phenotypic correlations were small to moderate and positive. The accuracy estimated for breeding values indicated that genetic improvement can be achieved through both sires and cows.

INTRODUCTION

In Egypt, the dairy industry represents 30–40% of total investments in the animal production sector, with a population of cows numbering less than 4.39 million (CAPMAS, 2017). Native Egyptian cows are a significant part of the dairy industry, known for their adaptation to local environmental conditions and resistance to common diseases. However, their numbers are dwindling, making them a valuable genetic resource (Abo-Elenin 2018, SANAD and Hassanane 2019).

According to CAPMAS (2017), a significant portion of Friesian cows in Egypt are crosses (more than 45%), with purebred Friesian cows comprising only a small fraction (4–5%). Most of the purebred Friesian cows are found in large private farms due to their specialized nutritional and management requirements. As a result of the increasing number of crossbred Friesian cows, the population of native cows has started to decline, with the Damietta cows being one of the most prominent native breeds.

In recent decades, farmers in Egypt have increasingly turned to agricultural mechanization and have replaced local livestock with mixed Friesian breeds. This mixed breeding is more productive in terms of milk production and resistant to common diseases due to the crossbreeding with local cows, in addition to lower costs compared to pure Friesian breeds.

The productive characteristics of Friesian cattle in Egypt, as well as native cows and their crosses, have been extensively studied, and genetic parameters for productive traits of imported cattle and their crosses with native cows have been estimated (Mostageer et al. 1990). Improving production efficiency can be achieved through better environmental conditions, improving the mean breeding values of the population's members, or a combination of both (Katkasame et al. 1996). Several researchers have investigated genetic and non-genetic factors affecting productive and reproductive traits in Friesian, Native, and their Crosses cows in Egypt e.g., (Abo-Elenin 2018, Awady et al. 2016, El-Awady 2013, Hussein et al. 2016, Sanad and Gharib 2021).

The objectives of this study are to estimate genetic and phenotypic parameters and breeding values for 305-day milk yield (305-DMY), lactation period (LP), calving interval (CI), and days open (DO) and assess these productive and reproductive traits for Friesian, Native, and Crosses cows under Egyptian conditions.

MATERIALS AND METHODS

Data

This study was granted approval by the Research Ethics Committee of the Faculty of Agriculture at Suez Canal University (reference number 42/2023). The data used in the analysis include 3023 normal lactation records of Friesian cows (703 cows and 74 bulls), 596 normal lactation records of Native cows (212 cows and 36 bulls), and 1189 normal lactation records of Crosses cows (316 cows and 51 bulls). These records cover the period from 1994 to 2015 and originate from Sakha and El-Karada farms in Kafr-El-Sheikh governorate (Friesian cows), El-Serow farm in Damietta governorate (Native cows), and El-Gemeza farm in EL-Gharbia governorate (Crosses cows). All three farms are affiliated with the Animal Production Research Institute (APRI), Agriculture Research Center, Ministry of Agriculture, Dokki, Giza, Egypt. The animals were loosely housed in open shed systems and were kept under similar systems of feeding and management in each farm, as described by (Abo-Elenin 2018). The traits investigated included 305-day milk yield (305-DMY, kg), lactation period (LP, days), calving interval (CI, days), and days open (DO, days).

Data analysis

Data were analyzed using the LSMLMW computer program (Harvey 1990) for obtained the main effects. The mixed model used was:

$Y_{ijklmn} = \mu + S_i + SE_j + Y_k + P_l + GE_m + e_{ijklmn}$

Where: Y_{ijklmn} = individual observation; μ = overall means; Si = random effect of sire, SEj = fixed effect of season of calving (autom, spring, summer and winter) (j = 1 to 4); Y_k = fixed effect of year of calving (k = 1994 to 2015); P_l = fixed effect of parity (l = 1 to 6), GE_m = fixed effect of the genotype group (m = Friesian, Native and Crosses) and e_{ijklmn} = the residual effect.

Secondly, data analyzed to estimate the variance and covariance component with derivative-free restricted a maximum likelihood (REML) procedure using the MTDFREML program of (Boldman et al. 1995). The assumed model was:

$$Y = Xb + Zu + Wpe + e$$

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 an incidence matrix Z, p_e = a vector of permanent environmental effect with an incidence matrix W, e = a vector of residual effect. To estimate heritability (h^2_a) the following equation was used:

$h^2_a = \sigma^2_a / (\sigma^2_a + \sigma^2_{pe} + \sigma^2_e)$

Where: σ^2_a = additive genetic variance; σ^2_{pe} = permanent environmental variance and σ^2_e = the random residual effect associated with each observation.

Genetic correlations (rg) between any two traits were estimated according to Legates and (Legates and Warwick 1990), while phenotypic correlations (rp) were calculated according to (Turner and Young 1969).

Cow breeding values (CBV) were evaluated using their own records, while dam and sire breeding values were evaluated without their own records. The MTDFREML program was used to estimate the best linear unbiased predictions (BLUP) of calculated breeding values (BV's) for all animals' pedigree files for multi-traits analysis.

RESULTS AND DISCUSSION

Descriptive Statistics

Unadjusted means, standard deviations, and coefficients of variation (CV %) for the various traits are presented in Table 1. The coefficients of variation for these traits differ across the three genotype groups. In Friesian cows, these coefficients ranged from 22.92–59.43%. For Native cows, they ranged from 22.00–64.75%, and for Crosses cows, they ranged from 24.74–44.64%. These findings align with those of (Abo-Elenin 2018), who also observed similar results for Friesian, Baladi, and Crosses cows in a different dataset.

Furthermore, in a separate study conducted by (El–Awady and Abu El-Naser 2017) on Friesian cows, the overall means for LP (lactation period), DO (days open), and CI (calving interval) were estimated at 333 days, 119 days, and 405 days, respectively. In another study by (El–Awady et al. 2017), the mean values for 305-dMY (305-day milk yield), LP, CI, and DO were reported as 2632.09 kg, 300.02 days, 449.92 days, and 173.95 days, respectively. Conversely, (Sanad and Gharib 2021) found that Baladi cows exhibited means of 171.1 days for LP, 109 days for DO, and 402.7 days for CI.

The current study highlights the significant influence of the year of calving and genotype groups on 305-dMY, LP, CI, and DO ($P < 0.01$). Additionally, the season of calving was found to have a highly significant effect on 305-dMY ($P < 0.01$), while it had a significant effect on LP ($P < 0.05$) but no significant effect on CI and DO. Moreover, parity was highly significant for all studied traits, except for LP, where it exhibited a significant effect, as indicated in Table 1. These findings are consistent with prior research, including (El-Awady and Oudah 2012) study on Friesian cows, (Faid-Allah 2015) research on Holstein cows, (Abo-Elenin 2018) investigation of Friesian, Baladi, and Crosses cows, and (Sanad and Gharib 2021) study on Native cows in Egypt.

Table (1) Phenotypic means, standard deviations (SD), coefficient variability (C.V%), significance levels of independent variables and distributions of the data of 305-DMY, kg, LP, days, CI, days and DO, days in Friesian (F), Native (N) and Crosses (FxN) cows in Egypt.

Genotype Group	Traits							
	305-dMY, kg		LP, d		CI, d		DO, d	
	Mean ± SD	CV%	Mean ± SD	CV%	Mean ± SD	CV%	Mean ± SD	CV%
Friesian (F)	3597 ± 1421.6	39.52	362.1 ± 117.5	32.45	524 ± 120.1	22.92	198.3 ± 117.8	59.43
Native (N)	1399 ± 906.0	64.75	199.0 ± 70.7	35.54	499 ± 109.7	22.00	168.8 ± 99.5	58.96
F x N (FN)	2672 ± 1178.6	44.12	394.6 ± 118.8	30.10	556 ± 137.6	24.74	215.3 ± 96.1	44.64

Variable	Levels of significance (F)			
	Traits			
	305-DMY	LP	CI	DO
Season of calving	5.94**	3.52*	1.35^{ns}	1.32^{ns}
Year of calving	40.38**	3.30**	3.59**	3.48**
Parity	91.30**	3.19*	15.49**	17.40**
Genotype group	272.78**	185.09**	14.52**	20.27**
ns = not significant, * significant at P < 0.05 and ** significant at P < 0.01				

Variances and heritabilities

Genetic parameter assessments play a crucial role in decision-making processes related to selection methods, the prediction of direct and correlated responses to selection, the choice of future breeding systems, and the evaluation of genetic gains. Table 2 presents estimates of (co)variance components for various traits in Friesian, Native, and Cross cows.

The current estimates of additive genetic variance (σ2a) for all traits were found to be lower than the residual variance (σ2e). Notably, in fertility-related traits, a substantial proportion of the total variation was attributed to residual variance effects. This observation underscores the potential for achieving reasonable rates of improvement in these traits through effective management and environmental conditions.

Direct heritability estimates for 305-DMY (305-day milk yield) and LP (lactation period) in Friesian cows were moderate, at 0.24 and 0.22, respectively. These values were lower than those observed in Native cows (0.26 for 305-DMY and 0.28 for LP) and Crosses cows (0.32 for 305-DMY and 0.26 for LP). Conversely, CI (calving interval) and DO (days open) in Friesian cows exhibited the lowest heritability values, measuring 0.16 for CI and 0.17 for DO, in comparison to Native cows (0.24 for CI and 0.27 for DO) and Crosses cows (0.25 for CI and 0.23 for DO), as detailed in Table 2. These findings closely align with the results reported by Awady, et al. (2016) and El–Awady, et al. (2017) in their studies on Friesian cows, as well as with those obtained by Abo-Elnin (2018) in research involving Friesian, Native, and their crossbred cows in Egypt. These insights into variances and heritabilities provide valuable guidance for future breeding strategies and the ongoing enhancement of cattle populations.

Table (2) Estimates of variance components and genetic parameters for studied traits through Animal Model for Friesian (F), Native (N) and Crosses (FxN) cows in Egypt.

Genotype Group	Friesian Cows				Native Cows				Crosses Cows			
Traits	305-DMY	LP	CI	DO	305-DMY	LP	CI	DO	305-DMY	LP	CI	DO
σ^2_a	3.23	3.36	2.68	3.53	2.54	3.10	3.22	3.50	4.50	3.30	3.88	3.17
σ^2_{pe}	2.61	3.25	2.86	12.88	2.60	3.21	3.36	3.95	4.03	3.55	4.06	4.50
σ^2_e	7.92	8.72	11.33	4.15	4.72	4.69	6.74	5.47	5.73	5.72	7.34	5.92
σ^2_p	13.76	15.32	16.87	20.55	9.86	11.00	13.32	12.91	14.26	12.57	15.28	13.59
h^2_a	0.24	0.22	0.16	0.17	0.26	0.28	0.24	0.27	0.32	0.26	0.25	0.23
c^2	0.19	0.21	0.17	0.63	0.26	0.29	0.25	0.31	0.28	0.28	0.27	0.33
e^2	0.57	0.57	0.67	0.20	0.48	0.43	0.51	0.42	0.40	0.46	0.48	0.44

σ^2_a = direct additive genetic variance, σ^2_{pe} = maternal permanent environmental variance, σ^2_e = residual (temporary environmental variance), σ^2_p = phenotypic variance, h^2_a = direct heritability, c^2 = fraction of phenotypic variance due to maternal permanent environmental effects and e^2 = fraction of phenotypic variance due to residual effects.

Faid-Allah (2015)reported direct heritability values of 0.112 for LP (lactation period) and 0.105 for DO (days open). Similarly, Hussein, et al. (2016) conducted a study on Baladi cows and found heritability estimates of 0.06 for 305-dMY (305-day milk yield) and 0.05 for LP, suggesting relatively lower heritability for these traits in this particular breed.

Furthermore, El–Awady, et al. (2017) conducted research on Friesian cows and reported direct heritability values of 0.16 for CI (calving interval) and 0.17 for DO. These heritability estimates indicate a moderate genetic component influencing these reproductive traits in Friesian cows. In another study, El–Awady and Abu El-Naser (2017) estimated heritability (h^2) values for multiple traits, including MY (milk yield), LP, DO, and CI, in Friesian cows. Their findings revealed heritability values of 0.34 for MY, 0.17 for LP, 0.15 for DO, and 0.17 for CI, providing insights into the genetic influence on these traits in Friesian cows. Similarly, Sanad and Gharib (2021) focused on Native cows and reported heritability estimates of 0.18 for MY, 0.15 for LP, 0.05 for DO, and 0.09 for CI. These heritability values shed light on the degree to which genetics play a role in determining these traits in Native cows. Additionally, Abu El-Naser et al. (2020) conducted research that yielded heritability estimates of 0.32 for MY, 0.29 for LP, and 0.18 for CI, further contributing to our understanding of the genetic component of these traits.

These collective findings from various studies provide a broader perspective on the heritability of important traits in different cattle breeds, which can be valuable for breeding and selection programs aimed at improving these traits.

Genetic and phenotypic correlations

Understanding the genetic correlations and residual ratios among various traits in different cattle genotypes is crucial for making informed decisions related to breeding strategies and genetic improvement.

Genetic and phenotypic correlations, along with permanent and residual ratios among different studied traits for the three genotypes, are presented in Table 3. Genetic correlations between 305-DMY and LP, CI, and DO in Friesian cows were moderate and positive (0.45, 0.31, and 0.29), respectively, and were close to the corresponding correlations in Crosses cows (0.47, 0.32, and 0.30). In contrast, these correlations were lower in Native cows (0.35, 0.24, and 0.22), respectively. Additionally, genetic correlations among LP and CI, as well as LP and DO, were higher in Crosses cows (0.61 and 0.86) and Friesian cows (0.58 and 0.83) compared to Native cows (0.46 and 0.65). Genetic correlations between CI and DO were low for all three genotype groups (0.12, 0.10, and 0.12). The residual ratios among the studied traits ranged from 0.01 to 0.40 for Friesian cows, 0.009 to 0.31 for Native cows, and 0.01 to 0.41 for Crosses cows. In all three genotype groups, the highest ratio was observed between 305-DMY and DO, while the lowest ratio was between LP and DO. These results were somewhat higher than those obtained by (Abo-Elenin 2018).

Table (3) Estimation of genetic correlation (r_g), phenotypic correlation (r_p), permanent ratio (r_{pe}) and residual ratio (r_e) for 305-DMY, LP, CI, and DO of Friesian, Native and Crosses Cows.

	Trait 1	Trait 2	r_g	r_p	r_{pe}	r_e
Friesian Cows	305-DMY	LP	0.45	0.18	0.25	0.10
		CI	0.31	0.32	0.85	0.18
		DO	0.29	0.19	0.01	0.40
	LP	CI	0.58	0.06	0.13	0.17
		DO	0.83	0.22	0.01	0.01
	CI	DO	0.12	0.18	0.12	0.30
Native Cows	305-DMY	LP	0.35	0.14	0.20	0.08
		CI	0.24	0.25	0.67	0.14
		DO	0.22	0.14	0.01	0.31
	LP	CI	0.46	0.04	0.10	0.13
		DO	0.65	0.18	0.10	0.10
	CI	DO	0.10	0.14	0.095	0.23
Crosses Cows	305-DMY	LP	0.47	0.19	0.26	0.10
		CI	0.32	0.33	0.99	0.19
		DO	0.30	0.20	0.01	0.41
	LP	CI	0.61	0.06	0.13	0.18
		DO	0.86	0.23	0.01	0.01
	CI	DO	0.12	0.19	0.12	0.31

Genetic and phenotypic correlations between LP and DO were (0.88 and 0.89), while between 305-DMY and LP were (0.41 and 0.04). And among 305-DMY and DO were (0.41 and − 0.05), observed by (Faid-Allah 2015). Furthermore, Hussein, et al. (2016) estimated that the genetic and phenotypic correlations between 305-DMY and LP, being 0.96 and 0.70 for Friesian cows, while being 0.40 and 0.50 for Baladi cows and being 0.60 and 0.50 for Crosses cows, respectively. In addition, Awady, et al. (2016) on Friesian cows in Egypt, estimated that the positive and high values of genetic and phenotypic correlations between 305-DMY and each of LP, CI and DO, ranging from 0.79 to 0.99. Also, they estimated the genetic and phenotypic correlations between LP and each of CI and DO, ranging from 0.69 to 0.95.

Breeding values

The range of expected breeding values (EBVs) for cows (EBV'c) and sires (EBV's) for Friesian, Native, and Crosses cows are presented in Table 4. The EBV'c range for Friesian cows was 1397 kg for 305-DMY, 31.93 days for LP, 13.84 days for CI, and 16.57 days for DO. For Native cows, the range was 641.3 kg for 305-DMY, 28.05 days for LP, 117.7 days for CI, and 101.86 days for DO. Crosses cows showed a range of 1258.4 kg for 305-DMY, 220.55 days for LP, 89.65 days for CI, and 84.37 days for DO. The EBV's range for Friesian cows was 881 kg for 305-DMY, 16.17 days for LP, 7.84 days for CI, and 10.87 days for DO. For Native cows, the range was 345.4 kg for 305-DMY, 119.9 days for LP, 139.81 days for CI, and 99.88 days for DO. Crosses cows showed a range of 465.3 kg for 305-DMY, 121 days for LP, 155.98 days for CI, and 121.77 days for DO. The range of expected breeding values for dams (EBV'd) was 1002.1 kg for 305-DMY, 25.14 days for LP, 11.83 days for CI, and 13.66 days for DO in Friesian cows; 283.8 kg, 99.00 days, 86.57 days, and 81.62 days for Native cows; and 347.6 kg, 25.30 days, 43.01 days, and 64.24 days for Crosses cows. These results are consistent with previous studies (Abo-Elenin 2018, Awady, et al. 2016, Sanad and Gharib 2021).

For instance, Awady, et al. (2016) estimated that the range of breeding values (BV’s) for 305-DMY, LP, CI, and DO was 462 kg, 1.05 days, 2.26 days, and 5.93 days, respectively.

Additionally, El–Awady and Abu El-Naser (2017) provided insights into the range and accuracy of BV’c for LP, DO, and CI, with values of (2.926 and 0.72 to 0.78%), (7.41 and 79 to 82%), and (3.09 and 87 to 89%), respectively. The BV’s for these traits were estimated to be (104 and 35–51%), (5.95; 79 to 82%), and (2.28; 82 to 88%), respectively. Furthermore, the BV’d for the current traits ranged from (1.6; 37 to 40%), (6.14; 78 to 81%), to (2.98; 83 to 87%), emphasizing the genetic potential and reliability of these breeding values for selection and improvement programs.

Table (4): Range of expected breeding values (EBV"s) through cows, sires, dams and it’s percentage of accuracy’s (%) for 305-DMY, LP, CI and DO in Friesian, Native and Crosses Cows.

Genotype	Traits	Cows (EBV'c)				
		Min.	Max.	Range	SEP	Accuracy%
Friesian	305-DMY	-591.8	805.2	1397	71.5-112.2	00-84.7
	LP	-10.571	21.362	31.93	12.1–25.3	00-95.7
	CI	-5.148	8.69	13.84	19.8–20.9	00-89.1
	DO	-6.831	9.735	16.57	0.95–1.65	00-90.2
Native	305-DMY	-243.1	398.2	641.3	69.3–75.9	69.3–75.9
	LP	-20.35	7.7	28.05	67.1–75.9	70.4–75.9
	CI	-32.67	85.03	117.7	23.1–53.9	75.9–86.9
	DO	-41.36	60.5	101.86	31.9–33	64.9–71.5
Crosses	305-DMY	-232.1	1026.3	1258.4	62.7–92.4	22-31.9
	LP	-153.45	67.1	220.55	34.1–89.1	53.9–75.9
	CI	-27.28	62.37	89.65	23.1–30.8	74.8–89.1
	DO	-22.55	61.82	84.37	29.7–51.7	85.8–86.9
Sires (EBV's)						
Friesian	305-DMY	-414.7	466.4	881.1	35.2-112.2	00-104.5
	LP	-7.7	8.47	16.17	9.9–25.3	00-106.7
	CI	-4.334	3.509	7.843	5.5–20.9	00-105.6
	DO	-4.433	6.435	10.87	0.45–1.65	00-105.6
Native	305-DMY	-135.3	210.1	345.4	17.6–26.4	52.8–75.9
	LP	-72.6	47.3	119.9	17.6–52.8	67.1–92.4
	CI	-65.34	74.47	139.81	45.1–50.6	39.6–94.6
	DO	-42.13	57.75	99.88	31.9–33	63.8–91.3
Crosses	305-DMY	-184.8	280.5	465.3	51.7–89.1	67.1–95.7
	LP	-72.6	48.4	121	17.6–34.1	30.8–95.7
	CI	-85.14	70.84	155.98	42.9–50.6	61.6–70.4
	DO	-74.14	47.63	121.77	40.7–48.4	40.7–63.8
Dams (EBV'd)						
Friesian	305-DMY	-457.60	544.50	1002.10	81.4-112.2	00-105.6
	LP	-11.61	13.53	25.14	15.4–25.3	00-86.9
	CI	-5.47	6.36	11.83	15.3–20.9	00-79.2
	DO	-6.95	6.71	13.66	1.11–1.65	00-81.4
Native	305-DMY	-165.00	118.80	283.80	118.8-133.1	34.1–40.7

Genotype	Traits	Cows (EBV’c)				
		Min.	Max.	Range	SEP	Accuracy%
	LP	-41.80	57.20	99.00	27.5–52.8	34.1–38.5
	CI	-39.38	47.19	86.57	22-42.9	90.2–91.3
	DO	-29.81	51.81	81.62	18.7–29.7	63.8–69.3
Crosses	305-DMY	-122.10	225.50	347.60	135.3-138.6	30.8–31.9
	LP	-12.10	13.20	25.30	73.7–75.9	24.2–69.3
	CI	-15.29	27.72	43.01	11-18.7	46.2–52.8
	DO	-29.59	34.65	64.24	16.5–27.5	57.2–62.7

(Sanad and Gharib 2021) study on Native cows reported the range and accuracy of BV’c for LP, DO, and CI as (26.65 and 55%), (13.37 and 60%), and (77.12 and 57%), respectively. The estimates of BV’s for these traits were (20.51 and 66%), (8.7 and 52%), and (41.49 and 60%), respectively. Furthermore, the predicted estimates of BV’d for the corresponding traits were (16.32 and 50%), (10.96 and 50%), and (61.78 and 59%), respectively. These results provide valuable insights into the genetic potential and reliability of breeding values in Native cows, highlighting their utility in selection and breeding programs for improved performance and productivity.

Conclusion

The findings of this study highlight the robust genetic potential of Native Egyptian cows, coupled with Crosses cows' ability to deliver commendable milk production, despite slightly extended calving intervals. These attributes align well with the Egyptian environmental conditions, making them suitable choices for local cattle farming.

Moreover, Egyptian Native cows exhibit unique characteristics, including heightened disease resistance and a remarkable adaptability to the local environment. These traits underscore the importance of preserving this indigenous breed for maintaining genetic diversity in the region's cattle population.

Considering these insights, we recommend a concerted effort to conserve and safeguard Egyptian Native cows. Furthermore, it is advisable to explore their potential in enhancing the genetic traits of high-economic-value breeds, such as pure Friesian cows.

Declarations

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Author's Contributions

Abdullah Ali Ghazy and Ibrahim Atta Mohammed Abu El-Naser conceived and designed the study, formulated the research question, conducted rigorous data analysis, played a key role in interpreting the results, actively participated in drafting, and revising the manuscript, and contributed to the overall conceptualization of the project. Abdelhamid Saeed Abo El-Enin, and Anas Abd El-Salam Abou El-Anine Badr collected and compiled the lactation records, contributed substantially to the development of the research idea, provided critical insights during the study design, actively participated in the data interpretation process, and actively participated in drafting the manuscript. Hassan Ghazy El-Awady took the lead in writing the initial draft of the manuscript, integrating the results, revising the manuscript, and ensuring the coherence of the narrative.

Availability of data and material

The study data can be obtained from the corresponding author upon making a reasonable request.

Ethics Approval

All experimental procedures and the study protocol have received approval from the Research Ethics Committee of the Faculty of Agriculture at Suez Canal University (reference number 42/2023). The experiments were conducted in compliance with internationally accepted standard ethical guidelines for the use and care of animals.

Conflict of interest and funding

The authors declare that there are no conflicts of interest associated with this research paper. This study was entirely self-funded, and no external financial support, affiliations, or competing interests that could influence the research, analysis, or interpretation of the findings existed.

We affirm that the absence of conflicts of interest upholds the integrity, objectivity, and impartiality of this research. No external funding, grants, or sponsorships were received in connection with this work.

References

1. Abo-Elenin, A., 2018. Evaluation of reproductive and productive performance for Friesian, crosses and local cows under Egyptian conditions, (Ph. D. Thesis, Fac. Agric., Kafr El-Sheikh Univ, Egypt)
2. Abu El-Naser, I., Abd-Elatief, A., and Ghazy, A.A., 2020. Maternal Genetic Effect on Expected Genetic Response of Selection Indices for Milk Production of Friesian Cows in Egypt, Journal of Animal and Poultry Production, 11, 469-474
3. Awady, H., El-Khalek, A., and Abo Elreesh, M., 2016. Genetic evaluation for some productive and reproductive traits by using animal model in a commercial Friesian herd in Egypt, Journal of Animal and Poultry Production, 7, 279-285
4. Boldman, K. et al., 1995. A manual for use of MTDFREML. A set of programs to obtain estimates of variances and covariances, US Department of Agriculture, Agricultural Research Service, 114,
5. El-Awady, H., 2013. Effect of milk yield on economic profitability of Holstein Friesian cows under intensive production system in Egypt, Pakistan Veterinary Journal, 33, 239-226
6. El-Awady, H., and Oudah, E., 2012. Effect of some non-genetic factors on milk yield and calving interval of Friesian cows. Minia International Conference for Agriculture and Irrigation in the Nile Basin Countries, El-Minia, Egypt, 2012,
7. El–Awady, H., and Abu El-Naser, I., 2017. Estimate of direct and maternal genetic parameters for some production and reproduction traits in Friesian cows through sire and animal models, Journal of Animal and Poultry Production, 8, 477-482
8. El–Awady, H. et al., 2017. Estimate of genetic and phenotypic trends for some productive and reproductive traits of Friesian cows in Egypt, Journal of Animal and Poultry Production, 8, 329-334
9. Faid-Allah, E., 2015. Genetic and non-genetic analysis for milk production and reproductive traits in Holstein cattle in Egypt, JITV, 20, 10-17
10. Harvey, W., 1990. User's Guide for LSMLMW and MIXMDL PC-2 Version, Mixed model least-squares and maximum likelihood computer program. Ohio State University, Columbus, Ohio, USA,

11. Hussein, K., Badr, A.A., and El-Komey, S.M., 2016. Estimation of Genetic and Phenotypic Parameters for Some Milk Traits on Egyptian, Friesian and their Crosses Cows, Journal of Animal and Poultry Production, 7, 181-184
12. Katkasame, S. et al., 1996. Trend analysis on milk production traits in the dairy farming promotion organization of Thailand, Agriculture and Natural Resources, 30, 211-219
13. Legates, J.E., and Warwick, E.J., 1990. Breeding and improvement of farm animals, (McGraw Hill Inc.)
14. Mostageer, A. et al., 1990. Milk production characteristics of Baladi cattle and their F1 crossbreds with some European breeds, Journal of Animal Breeding and Genetics, 107, 301-310
15. Sanad, S., and Gharib, M.G., 2021. Genetic Parameters for Milk Traits in Egyptian Native Cows, 46-23 ,4 ,
16. SANAD, S.S., and Hassanane, M., 2019. Genetic factors affecting total milk yield, lactation period and calving interval of Crossbred Friesian cows raised on Nile Delta, Egyptian Journal of Agricultural Research, 97, 771-784
17. Turner, H.N., and Young, S.S., 1969. Quantitative genetics in sheep breeding, Quantitative genetics in sheep breeding.,