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# Effect of Heifers Age at First Breeding and Calving on Some Performance Traits and Economic Returns in Friesian cows in Egypt

***Abu El-Naser[1], H G El-Awady[2], S Z M Ebrahim[3*]***
[1]*Doctor of Animal Breeding, Animal Production Department, Faculty of Agriculture, Damietta University, Egypt*
[2]*Professor of Animal Breeding, Animal Production Department, Faculty of Agriculture, Kafrelsheikh University, Kafrelsheikh, Egypt*
[3]*Researcher of Animal Breeding, Animal Production Research Institute, Dokki, Giza, Egypt*
***Email:*** **ymodmenna@gmail.com*
***DOI:***

***Abstract***

*The primary data used an actual study on 874 Friesian cows management from birth to end lifetime production was collected of El- Karada and Sakha Farms pertain to the Animal Production Research Institute (APRI), from 1990 to 2016. These data were analyzed to determine genetic parameters with REML using animal model and using a general linear model of SAS to determine the main effects. Means of MY, LTMY, LP NLC, AFB, AFC DO, CI, CFB, CFC, LTC, LPP and NP were 3571.63 kg, 17538.70 kg, 303.66 d, 3.48, 31.02month, 40.11month, 77. 54 d, 360.97 d, $961.63, $1259.73, $4638.59, $4858.78 and$1478.58, respectively. The highest rate of culling was in third parity 24.10% following by second parity of 23.59%. Direct heritability of MY, LTMY, LP NLC, AFB, AFC DO and CI was 0.57, 0.31, 0.35, 0.29, 0.38, 0.41, 0.13 and 0.09, respectively. Appraising genetic correlations between aforesaid feature were between (-0.54 to 0.53), the same features phenotypic correlations between same features were from (-0.46 to 0.22). That introduces the major possibility of improvement genetic and optimization management for MY, LTMY, LP, NLC, AFB and AFC. While possibility improvement DO and CI through optimization management. Therefore, management can play a major role in improving these traits. Reducing AFB and AFC bring about to decrease the direct rearing costs subsequently decrease total costs in lifetime vice versa increase LTMY, LPP, and NP. Therefore, it is the best to select replacement heifer for AFB or AFC so that maximum lifetime milk yield and net profit in Friesian farms.*

***Keywords:*** *Age at first calving, Friesian cows, lifetime milk yield, lifetime total cost, net profit*

## INTRODUCTION

Friesian cows in Egypt considered a source of milk and red meat. Improvement of milk production in dairy cattle, give rise to increase profitability in dairy increased milk production. Observed that the profitability finite was 5,760 L per dairy cow in the Czech Republic [1]. The increase of profitability occurs when AFC was (23 to 24 mo) [2]. The heifers early calved (less 26m) carried on do often 44% of their life up to five years producing milk. Milk yield is considered the most source of farm revenues [3, 4]. Some studies have reviewed the longevity was impressed with AFC [5, 6, 2]. The economic efficiency of dairy cattle is directly affected by the levels of age at first breeding, age at first calving and choosing the right time is worthy of increasing economic efficiency and improving the product performance [7]. Lifetime production of dairy cow influenced by AFC that milk production affected when calving earlier than 22 months of age [8]. The milk production be impressed with AFC in Holstein cows and genetic and phenotypic correlations between MY and AFC was negative [9]. The genetic correlation between lifetime milk production and milk yield was moderate (0.48) in Brown cattle [10]. An important factor for economically important traits of dairy cows is a genetic improvement, especially milk production [11]. The estimate of heritability for LP, DO and CI were stingy it follows, improvement management can play a major role in improving those traits in Friesian cattle [12]. Farm profit is dearly impacted by the changing prices of inputs and outputs on agricultural markets. Adequate investment can realize major production and total income [13].

The aim of this study is to: measure genetic parameters for milk yield (MY), lifetime milk yield (LTMY), lactation period (LP), age at first breeding (AFB), age at first calving (AFC), number of lactation completed (NLC)), days open (DO), and calving interval (CI) and measure the impact of age at first breeding and calving of heifers for MY, LTMY, LP, NLC, DO, and CI and economic achievement in Friesian cows.

## MATERIALS AND METHODS

### Data

Data used in the present investigation were collected from 2790 records relevant to 874 Friesian cows maintained at El-Karada and Sakha experimental stations pertain to the Animal Production Research Institute (APRI). These cows were daughters of 55 sires. The records used covered the period from 1990 to 2016. Studied traits productive traits such as milk yield (MY), lifetime milk yield (LTMY), lactation period (LP) and number of lactation completed (NLC), reproductive traits such as age at first breeding (AFB), age at first calving (AFC) days open (DO), calving interval (CI) besides economic traits such as costs of heifer until age at first breeding (CFB), costs of heifer until age at first calving (CFC), lifetime total costs (LTC), life production Profitably (LPP) and Net Profit (NP).

### Management

Animals in the farm were reserved under the same system of management and housing. The cows were feeding on Egyptian clover (Trifolium alexandrinum) during the period from (December to May) with concentrate mixture and rice straw, while the period from (June to November) was fed on concentrate mixture, rice straw and a limited amount of clover hay or silage were offered at 11.30. Animals were fed according to the recommended requirements of (APRI) depending on (NRC, 2001). Cows were artificially inseminated after 60 days postpartum, while heifers were artificially inseminated for the first insemination when attained more 350 kg of live body weight or 18-24 months using frozen semen from Dairy Services Unit belonging to the (APRI), Sakha, Kafrelsheikh, and Governmental. Pregnancy diagnoses were performing at 60 days after insemination by rectal palpation as routinely work. Cows milked twice daily through the lactation period by milking machine and milk yield was write down up to the nearest 0.1 kg on daily lactation.

### Economic Evaluation

These traits calculated based on prices of inputs and outputs and calculate nutrition decisions according to recommended requirements of (APRI) depending on (NRC, 2001). The prices were calculated based on the current market and farm gate prices as follows. Costs of heifer until the age at first breeding calculated at variable and fixed expenses from birth to first mating a per heifer, as well costs of heifer until the age at first calving calculated based on fixed and variable cost from birth to first calving a per heifer. Likewise, lifetime total cost calculated based on total cost included the variable and fixed cost from birth to culling of a cow. To assess the term of life production profitability calculated based on total revenues included (milk, calves, and manure) minus total cost from the first calving to end lifetime production. Net profit equals the total revenue minus the total cost in the period from birth until the end of lifetime production.

### Statistical Analysis

Firstly, data were analyzed via (SAS, 2004) to descriptive statistics and estimate the analysis of variance for some fixed effects included, month (1 to 12) and year (1990 to 2016) of calving, farm (El-Karada and Sakha), parity (1 to ≥10), levels of Age at first breeding and age at first calving. The following fixed model was:

$$Y_{ijklmno} = \mu + M_i + Y_j + F_k + P_l + AfB_m + Afc_n + e_{ijklmno}$$

Where: $Y_{ijklmno}$ = observation value; $\mu$ = overall mean; $M_i$ = fixed effect of i[th] month of calving; $Y_j$ = fixed effect of j[th] year of calving $F_k$ = fixed effect of a k[th] farm, $p_l$ = fixed effect of l[th] parity, $AFB_m$=fixed effect of m[th] age at first breeding, $AFC_n$= fixed effect of n[th] age at first calving and $e_{ijkl}$ = the random error term.

Then the program used for analysis of dat was the MTDFREML program to measure the variance and covariance component [14]. The multiple models the following:

$$Y = X\beta + Za + Wpe + e$$

Where:

Y= observations; β = fixed impacts (month, year of calving, farm and parity); a = additive genetic impacts, pe = permanent environmental, W = matrix linking records to permanent environmental impacts and e = residual effects. X and Z are incidence matrices linking records to fixed and genetic effects.

## RESULTS

### Statistical Descriptive

Means, standard deviation (SD) and Coefficients of variation for studied traits in the actual study in Table 1. Coefficients of variation for traits in current research work ranged from 17.90% to 68.87%, the highest CV% value for LTMY (68.87 %) that indicates a great variation between individual cows in these data. The actual mean for MY was 3571kg. This value paramount than those observed by Oudah et al., was 2655kg, in Friesian cows [15]. And close to noticed by El-Awady et al., being 3557.5 kg [11]. But lower than on Holstein Friesian cows found by Hammoud et al., was 8455kg [16]. The actual mean of LTMY was 17538.70kg. This estimate was lower than noticed in Holstein cows by Abu-Bakr and Sadek et al., were 26935kg and 42135kg, respectively in Egypt [17, 18]. Likewise, Jenko revealed that the mean of LTMY was (24376) higher the current estimates in Slovenian Brown [10].

***Table 1:*** *Means, standard deviation (SD) and coefficient of variation (CV %) for milk yield (MY), lifetime milk yield (LTMY), lactation period (LP), number of lactation completed (NLC) age at first breeding (AFB), age at first calving (AFC), days open (DO), and calving interval (CI).*

| Variable | Mean | Std Dev | CV% |
|---|---|---|---|
| MY, kg | 3571.63 | 1876.53 | 52.54 |
| LTMY, kg | 17538.70 | 12079.05 | 68.87 |
| LP, d | 303.66 | 112.45 | 37.03 |
| NLC, L | 3.48 | 2.08 | 59.78 |
| AFB, mo | 31.02 | 7.15 | 23.05 |
| AFC, mo | 40.11 | 7.18 | 17.90 |
| DO, d | 77.54 | 23.00 | 29.66 |
| CI, d | 360.97 | 108.90 | 30.17 |

The current mean of LP was shorter (303.66) than those found by Usman et al., on Holstein cows being 366.5 [19]. Shalaby and El-Awady et al., was 327day for LP on Friesian cows [20, 11]. While higher than stated by Sattar the mean of LP being 291.86d [21]. The actual estimate of a mean for NLC was 3.48 and comparable reviewed by El-Awady et al., the overall mean of NLC was ranged from (3.01 to 4.51) on Holstein Friesian cows for the three herds [22]. The present results for AFB and AFC were 31.02 and 40.11 months, respectively. These results longer than estimated by El-Awady et al., on three herds of Holstein Friesian cows for AFC was ranged from 24.01 to 27.66 mo and found by Ali et al., for AFB was ranged from 21 to 24 mo. The present means of DO and CI were 77.54 and 360.97d, respectively [23, 24, 25, 21]. These values for DO and CI were shorter than reported by many authors working in Friesian and Holstein in Egypt was (141 and 422d) and (120 and 401.16d) for DO and CI, respectively [26, 27, 28]. For CI were 372, 430 and 470, respectively and being 181.4d for DO. The estimate of overall means for CFB, CFC, TCL, LPP and NP were 961.63, 1259.73, 4638.59, 4858.78 and $1478.58, respectively are present in Table 2 [16]. The estimates for observed in the actual study were comparable to reported by Keown and Usman the total cost of raising a heifer from birth until 24 mo was ranged from $1050 to $1200/heifer [29, 19]. As well Gabler et al., in the United States, have reflected the average total cost of rearing replacement heifer being $1124.06 and ranging from ($896.86-$1305.03) and Boulton et al., estimated the mean of cost rearing a heifer from birth to AFC using data 101 UK dairy farms being £1819 [30, 31].

***Table 2:*** *Overall means and standard error of costs of heifer until age at first breeding (CFB), costs of heifer until the age at first calving (CFC), lifetime total cost (LTC), life production profitability (LPP) and Net Profit (NP).*

| Variable | Mean | SE |
|---|---|---|
| CFB, $ | 961.63 | 4.19 |
| CFC, $ | 1259.73 | 5.46 |
| LTC, $ | 4638.59 | 39.87 |
| LPP, $ | 4858.78 | 70.08 |
| NP, $ | 1478.58 | 59.16 |

*Recording the everyday expense for raising heifers at pre-weaning were the more expensive. But after weaning to 10 months of age, daily cost rise from 21 months of age [32, 33, 34].*

***Table 3:*** *Analysis of variance for some environmental factors affecting studied traits.*

| Traits | F- Value and significance | | | |
|---|---|---|---|---|
| | **Month of Calving** | **Year of Calving** | **Farm** | **Parity** |
| MY | 2.04* | 6.86** | 1.72 ns | 4.36** |
| LTMY | 2.04* | 1.74* | 47.27** | 11.53** |
| LP | 1.57ns | 5.21** | 5.03ns | 3.05ns |
| NLC | 0.69ns | 0.42 ns | 0.55* | 1.11ns |
| DO | 1.63ns | 3.59** | 30.18** | 23.94** |
| CI | 1.22ns | 1.89 ** | 9.79** | 13.10** |

**= P<0.05; **=P<0.01and ns = non –significant, MY= milk yield, LTMY= lifetime milk yield, NLC = number of lactation completed, AFB= age at first breeding, AFC= age at first calving, DO= days open, and CI= calving interval.*

The current results stated that the effect month of calving on traits under investigation no significant expect MY and LTMY were significant (P<0.05).While the year of calving was high significant (P<0.01) effect on MY, LP, DO, CI and significant effect ((P<0.05) on LTMY, but the non-significant effect on NLC are presented in the Table 3.

***Table 4:*** *Levels of significance for age at first breeding (AFB) and first calving (AFC) on different studied traits.*

| Traits | AFB | AFC |
|---|---|---|
| | F- Value and significance | |
| MY | 0.63** | 1.07** |
| LTMY | 1.33** | 1.88* |
| LP | 0.67ns | 0.79ns |
| NLC | 0.29ns | 0.31ns |
| DO | 1.74* | 1.70* |
| CI | 1.37ns | 1.37ns |
| CFB | 918.79** | 0 |
| CFC | 3.19* | 8.64** |
| LTC | 4.47** | 4.19** |
| LPP | 1.49* | 2.19* |
| NP | 1.50* | 1.08* |

**= P<0.05; **=P<0.01and ns = non –significant, MY= milk yield, LTMY= lifetime milk yield, NLC = number of lactation completed, AFB= age at first breeding, AFC= age at first calving, DO= days open, CI= calving interval. CFB= costs of heifer until the age at first breeding, CFC = costs of heifer until the age at first calving, LTC= lifetime total cost, LPP=life production profitability, and NP=net Profit*

Influence year of calving agrees with finding by Shalaby et al., for DO and CI on Friesian cattle and El-Awady et al., for MY, LP, DO and CI on Friesian cows [11, 35]. The actual study reflected that effect of the farm on MY and LP was no significant, contrariwise was high significant (P<0.01) effect on LTMY, DO and CI, but was significant (P<0.01) effect on NLC, and sequentially the parity was highly significant (P<0.01) on MY, LTMY, DO and CI and non-significant on LP and NLC, presented in Table 3. The current results were similar that reviewed by El-Awady et al., for effect parity on DO, CI, and LP on Friesian cows. This study reflected that the effect levels of age at first breeding and age first calving on LP, NLC and CI were no significant and had significantly on LTMY and NLC and DO, are presented in Table 4, and added that increasing MY with increase AFB and AFC as given in Table 5 [11].

***Table 5:** Effect of different levels of age at first breeding (AFB) and first calving (AFC) on productive and reproductive traits under investigation.*

| V. | Levels | NO | Trait | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | MY | LTMY | NLC | LP | DO | CI |
| | | | Mean±SE | Mean±SE | Mean±SE | Mean±SE | Mean±SE | Mean±SE |
| AFB | ≤15 | 35 | 2893±271.6 | 20611±2386.6 | 4±0.3 | 303±19.9 | 64±8.9 | 347±8.8 |
| | 16-18 | 142 | 3115±131.7 | 18751±1213.9 | 3±0.1 | 320±10.4 | 59±3.7 | 342±3.7 |
| | 19-20 | 180 | 3163±102.9 | 18301±292.7 | 3±0.2 | 312±8.3 | 60±3.4 | 354±14.3 |
| | 21-22 | 203 | 3236±99.7 | 17854±1414.8 | 3±0.1 | 323±7.7 | 58±3.4 | 339±3.4 |
| | 23-25 | 229 | 3485±99.6 | 16882±960.6 | 3±0.1 | 325±7.4 | 62±3.4 | 343±3.5 |
| | 27-28 | 142 | 3374±152.8 | 16707±1105.8 | 2±0.1 | 322±11.3 | 63±4.7 | 345±4.7 |
| | 29-30 | 85 | 3486±189.7 | 16408±1353.9 | 2±02 | 315±11.1 | 49±4.7 | 331±4.7 |
| | 31-32 | 84 | 3271±161.7 | 16654±1027 | 2±0.2 | 296±10.8 | 62±6.5 | 343±6.5 |
| | 34-35 | 134 | 3577±126.2 | 16277±844.3 | 2±0.2 | 310±8.8 | 68±6.0 | 350±6.0 |
| | 37-38 | 149 | 3700±47.5 | 15403±1023.4 | 2 ±0.1 | 291±2.9 | 92±2.4 | 376±3.3 |
| | 39-40 | 137 | 3869±133.2 | 15138±838.9 | 2±0.1 | 312±9.7 | 77±6.1 | 359±6.0 |
| AFC | ≤25 | 60 | 2790±211.2 | 20965±1869.3 | 4±0.2 | 295±16.5 | 66±6.8 | 348±6.7 |
| | 26-28 | 185 | 3154±105.9 | 18426±1351.2 | 3±0.1 | 321±8.6 | 59±3.5 | 354±14.0 |
| | 29-30 | 211 | 3204±98.9 | 18359±292.2 | 3±0.1 | 319±7.5 | 60±3.4 | 342±3.5 |
| | 31-32 | 178 | 3289±103.8 | 16905±1002.8 | 3±0.1 | 324±8.7 | 60±3.4 | 341±3.4 |
| | 33-35 | 198 | 3525±112.7 | 16644±899.7 | 2.7±0.1 | 325±7.7 | 59±3.6 | 341±3.6 |
| | 36-38 | 135 | 3374±161.0 | 16612±1031.7 | 2±0.1 | 319±11.4 | 59±4.4 | 341±4.4 |
| | 37-40 | 126 | 3429±138.4 | 16207±892.7 | 2±0.7 | 306±8.7 | 55±4.7 | 336±4.7 |
| | 41-45 | 147 | 3712±47.0 | 15706±1079.4 | 2±02 | 291±2.9 | 92±2.4 | 375±3.3 |
| | 46-48 | 152 | 3476±125.2 | 15563±904.7 | 2±0.1 | 309±9.1 | 70±5.8 | 352±5.8 |
| | 49-50 | 108 | 3866±150.8 | 15269±956.1 | 2±0.2 | 314±11.2 | 82±6.9 | 363±6.9 |

*MY= milk yield, LTMY= lifetime milk yield, NLC = number of lactation completed, AFB= age at first breeding, AFC= age at first calving, DO= days open and CI= calving interval.*

The actual results indicated that effect AFB on CFB, CFC, and LTC LPP and NPC were significant, and shown that increased CFB, CFC and LTC with relation to increasing levels of AFB vice versa for LPP and NPC decreased with increasing levels of AFB and AFC. Also, AFC gets the same trend to effect on the above-mentioned traits are given in Tables (4, 6 and7). These results agree with Penev et al., working in Bulgarian dairy cattle, indicated that increasing cost per heifer until calving with increase age at first breeding and calving [36]. Boulton et al., observed that the mean cost of rearing heifer for all year-round calving was significantly higher than spring and autumn calving [30].

***Table 6:** Effect of age at first breeding levels on rearing and production expenses and revenues of farm Friesian cows in Egypt.*

| AFB Levels | NO | Trait | | | | |
|---|---|---|---|---|---|---|
| | | CFB$ | CFC$ | LTC$ | LPP$ | NP$ |
| | | Mean±SE | Mean±SE | Mean±SE | Mean±SE | Mean±SE |
| ≤15 | 35 | 437.02±11.83 | 7423.55±9.30 | 3022.48±304.92 | 5849.50±666.23 | 3569.35±720.84 |
| 16 - 18 | 142 | 537.42±2.19 | 827.85±4.26 | 3117.01±127.46 | 5247.15±350.71 | 2957.94±333.32 |
| 19- 20 | 180 | 609.79±2.01 | 915.10±11.52 | 3233.72±127.64 | 5151.01±93.45 | 2291.16±297.35 |
| 21-22 | 203 | 666.33±1.31 | 957.38±4.04 | 3637.42±136.06 | 4754.42±417.27 | 2049.44±256.01 |
| 23 - 25 | 229 | 742.90±1.73 | 1027.01±2.27 | 3640.77±115.48 | 4720.42±286.38 | 1927.40±387.38 |
| 26-28 | 142 | 835.23±2.14 | 1121.76±2.48 | 3500.06±123.05 | 4614.71±321.61 | 1854.14±222.25 |
| 29-30 | 85 | 916.28±1.99 | 11941 ±7.47 | 4022.15±186.21 | 4467.84±252.25 | 1669.18±291.16 |
| 31-32 | 84 | 978.47±2.00 | 1254.98±7.92 | 4081.99±201.77 | 4411.47±398.53 | 1583.33±366.40 |
| 33-35 | 134 | 1046.81±2.38 | 1344.46±4.11 | 4591.01±159.76 | 4475.99±318.19 | 1227.40±254.58 |
| 36-38 | 1419 | 1118.40±0.46 | 1423.32±6.48 | 4706.71±133.06 | 4047.43±292.82 | 1080.20±68.70 |
| 39-40 | 137 | 1241.95±2.25 | 1538.31±2.25 | 5492.17±53.80 | 3829.36±258.20 | 661.02±210.91 |

*CFB= costs of heifer until the age at first breeding, CFC = costs of heifer until the age at first calving, LTC= lifetime total cost, LPP=life production profitability, and NP=net Profit*

The present results compare to notate by Tozer et al. [37], AFC had a significant effect on the total cost of upbringing dairy heifer replacements with regard to older calving heifers were more costly to bring up than young cows. Pirlo et al., have reflected that AFC influence on rearing heifer costs and milk yield returns [38].

***Table 7:*** *Effect of age first calving levels on rearing and production expenses and revenues of farm Friesian cows in Egypt.*

| AFC Levels | No | Traits | | | |
|---|---|---|---|---|---|
| | | CFC$ | LTC$ | LPP$ | NP$ |
| | | Mean±SE | Mean±SE | Mean±SE | Mean±SE |
| ≤25 | 60 | 757.72±5.07 | 2915.04±197.02 | 5890.77±516.76 | 3733.39±558.67 |
| 26-28 | 185 | 857.16±11.06 | 3170.97±121.05 | 5174.89±93.20 | 2407.33±271.22 |
| 29-30 | 211 | 919.69±1.76 | 3419.69±121.40 | 4977.18±405.04 | 2138.59±252.67 |
| 31-32 | 178 | 981.99±1.27 | 3620.53±110.62 | 4725.95±293.59 | 1987.98±349.55 |
| 34-35 | 198 | 1054.75±.179 | 3655.65±147.83 | 4638.53±260.78 | 1953.69±268.04 |
| 36-38 | 135 | 1150.17±2.34 | 3711.88±128.34 | 4627.40±311.14 | 1838.14±238.35 |
| 39-40 | 126 | 1248.10±2.42 | 4237.36±175.32 | 4403.97±263.69 | 1725.01±309.50 |
| 41-45 | 1437 | 1413.26±6.41 | 4619.24±139.92 | 4104.03±307.32 | 1111.02±68.66 |
| 46-48 | 152 | 1462.64±2.13 | 4693.23±145.88 | 4019.80±278.61 | 863.20±225.98 |
| 49- 50 | 108 | 1548.27±1.95 | 5475.11±53.70 | 3847.99±289.45 | 703.02±249.17 |

*CFB= costs of heifer until the age at first breeding, CFC = costs of heifer until the age at first calving, LTC= lifetime total cost, LPP=life production profitability, and NP=net Profit*

It was revealed that AFC no effect on first lactation milk yield, while some pool of recent literature have reversed a negative effect [39, 40]. To decrease AFC had no impact on milk yield via larger lactations [16, 41, 40] mirrored diverse of total milk production in first 310 days in three groups of AFC were 22779, 23461 and 23666lbs, one by one in Holstein heifers. The connection between early calving and milk yield was a positive [42].

The present investigation cleared that the height rate of culling was in third parity 24.10%, following by second parity 23.59% and first parity 14.46%, while the lowest rate observed in 10$^{th}$ parity represent in the Table 8. Subsequently, it was a must to decrease the culling rate in the first three lactations to rise lifetime production and net profit for dairy cows via enhancement of genetics and management. Cows leaving the farm because of fertility problems, for example; mastitis, death, low production, chronic diseases and infections.

***Table 8:*** *The rate of culling during different lactations.*

| Parity | Ratio% | Parity | Ratio% |
|---|---|---|---|
| 1 | 14.46 | 6 | 6.05 |
| 2 | 23.59 | 7 | 4.51 |
| 3 | 24.10 | 8 | 4.51 |
| 4 | 13.50 | 9 | 1.40 |
| 5 | 7.23 | 10 | 0.64 |

Horváth et al., shown that the high ratio of culling in cows was during first lactation 26%, and then the rate gradually decreases [43]. Those cows which are in 6$^{th}$ lactation portray approximately 7% of the total culling number. Boldman et al., observed that the rate of culling was high at early and late lactations [44].

**Genetic Parameters**

Variance components and heritability for MY, LTMY, LP, NLC, AFB, AFC, DO

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and CI of Friesian cows in Egypt are given in Table 9. Direct heritability was lofty for MY and were moderate for LP, LTMY, NLC, AFB and AFC being 0.57, 0.35, 0.31, 0.29, 0.38 and 0.41, respectively. While estimates for DO and CI were stingy being 0.13 and 0.09 Table 9. The actual estimation of $h^2$ for MY, LP, DO and CI were higher than those estimated by the pool of recent literature [17]. In Holstein cows the $h^2$ for LTMY was 0.24 [45]. In Friesian the direct heritability was 0.17, 0.15, 0.02 and 0.03, for MY, LP, DO and CI respectively, Zadeh et al., in Iranian Holsteins estimate $h^2$ for MY and AFC were 0.24 and 0.34, respectively and in Friesian cows the direct heritability for MY and LP were 0.34 and 0.17 [9]. Likewise, [7, 46, 47] find out $h^2$ for AFC was lower than actual estimation under investigation and ranged from (0.16 to 0.38) [18]. in Holstein cattle shown the $h^2$ for LTMY and NLC were 0.29 and 0.25, respectively. Contrary, the present results lower than those reviewed by Hammoud et al., the heritability were 0.48 and 0.54 for LP and DO, respectively and El-Awady et al., the direct heritability for DO and CI were 0.15 and 0.17, respectively [48, 16].

***Table 9:*** *Estimate of variance components and heritability for MY, LTMY, LP, NLC, AFB, AFC, DO and CI of Friesian cows in Egypt.*

| Estimate | Traits | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **MY** | **LTMY** | **LP** | **NLC** | **AFB** | **AFC** | **DO** | **CI** |
| $\sigma^2a$ | 10630 | 49500 | 457 | 15.6 | 666 | 703 | 196.43 | 215 |
| $\sigma^2pe$ | 3500 | 38592 | 340 | 13.85 | 468 | 765 | 438.19 | 1947 |
| $\sigma^2e$ | 4370 | 72708 | 509 | 24.33 | 636 | 231 | 876.38 | 259 |
| $\sigma^2p$ | 18500 | 160800 | 1306 | 53.78 | 1770 | 1699 | 1511 | 2421 |
| $h^2a$ | 0.57 | 0.31 | 0.35 | 0.29 | 0.38 | 0.41 | 0.13 | 0.09 |
| $C^2$ | 0.19 | 0.24 | 0.26 | 0.26 | 0.26 | 0.45 | 0.29 | 0.80 |
| $e^2$ | 0.24 | 0.45 | 0.39 | 0.45 | 0.36 | 0.14 | 0.58 | 0.11 |

*$\sigma^2a$ = direct additive genetic variance, $\sigma^2pe$ = permanent environmental, $\sigma^2e$ = residual (temporary environmental variance) $\sigma^2p$ = phenotypic variance, $h^2a$ = direct heritability, $c^2$ = fraction phenotypic variance to permanent environmental, $e^2$ = fraction phenotypic variance due to residual effects, MY= milk yield, LTMY= lifetime milk yield, NLC = number of lactation completed, AFB= age at first breeding, AFC= age at first calving, DO= days open and CI= calving interval.*

The results of genetic correlations through productive traits (MY, LMY, LP and NLC) were ranged from (-0.32 to 0.37), and through reproductive traits (AFB, AFC, DO and CI) were from (-0.45 to 0.31). Continuously, the genetic correlations between AFB and other studied traits (MY, LMY, LP, NLC, AFC, DO and CI) were 0.21, 0.52, 0.26, 0.53, 0.31, -0.11 and -0.18, respectively.

While genetic correlations between AFC each of MY, LMY, LP, NLC, DO and CI were 0.34,-0.09, -0.31, -0.04, -0.45 and 0.11, respectively are given in Table 10.

***Table 10:** Estimation of different correlations and ratios among AFB, AFC, LP, DO, CI, MY, LTMY and NLC of Friesian cows in Egypt.*

| Trait1 | Trait2 | $r_{a1a2}$ | $r_{p1p2}$ | $r_{e1e2}$ | $r_{pe1pe2}$ |
|---|---|---|---|---|---|
| MY | LTMY | -0.06 | 0.09 | 0.51 | -0.25 |
| | LP | 0.37 | 0.22 | -0.02 | -0.39 |
| | NLC | -0.32 | -0.04 | 0.02 | 0.37 |
| | AFB | 0.21 | -0.14 | 0.76 | -0.10 |
| | AFC | 0.34 | 0.01 | -0.16 | -0.46 |
| | DO | 0.25 | -0.07 | -0.41 | 0.48 |
| | CI | -0.47 | -0.36 | -0.59 | -0.42 |
| LTMY | LP | -0.19 | -0.16 | -0.26 | 0.12 |
| | NLC | 0.03 | 0.04 | 0.03 | -0.18 |
| | AFB | 0.52 | 0.09 | -0.39 | 0.29 |
| | AFC | -0.09 | 0.06 | -0.37 | 0.56 |
| | DO | 0.16 | -0.13 | 0.00 | -0.63 |
| | CI | -0.54 | -0.46 | -0.37 | -0.65 |
| LP | NLC | 0.02 | 0.04 | 0.04 | 0.14 |
| | AFB | 0.26 | 0.10 | 0.15 | -0.49 |
| | AFC | -0.31 | -0.14 | -0.49 | 0.59 |
| | DO | 0.30 | 0.09 | -0.02 | 0.69 |
| | CI | -0.35 | -0.08 | 0.16 | -0.77 |
| NLC | AFB | 0.53 | 0.01 | 0.03 | -0.29 |
| | AFC | -0.04 | 0.04 | -0.05 | 0.20 |
| | DO | 0.25 | 0.11 | 0.10 | 0.35 |
| | CI | 0.18 | -0.03 | -0.14 | -0.58 |
| AFB | AFC | 0.31 | -0.05 | -0.27 | -0.34 |
| | DO | -0.11 | 0.04 | 0.32 | -0.29 |
| | CI | -0.18 | -0.21 | 0.17 | -0.47 |
| AFC | DO | -0.45 | -0.38 | -0.36 | -0.49 |
| | CI | 0.11 | 0.09 | 0.41 | 0.30 |
| DO | CI | -0.31 | 0.04 | -0.26 | 0.29 |

*$r_{a1a2}$ = genetic correlation between trait1, 2 and so on, $r_{p1p2}$ = phenotypic correlation between traits 1, 2 and so on, $r_{e1e2}$ = residual environmental ratio between traits 1, 2 and so on and $r_{pe1pe2}$ = ratio of permanent environmental between traits 1, 2. MY= milk yield, LTMY= lifetime milk yield, NLC = number of lactation completed, AFB= age at first breeding, AFC= age at first calving, DO= days open and CI= calving interval.*

These results lower than those estimated by Safaa et al., working in Holsteins cow between MY and each of (LP and CI) were 0.34 and 0.36, as well the relation between LP and CI was positive (0.69) [49]. Computation of phenotypic correlations among studied traits (productive and reproductive) were ranged from (-0.46 to 0.22), which the lowest relation between CI and LTMY while the highest relation between MY and LP are given in Table 10 [50, 51]. The actual results incongruity with Zadeh et al., in Iranian Holsteins stated that the genetic and phenotypic correlations between (AFC and MY) were negative -0.36 and -0.11, respectively [52, 53]. Likewise, Sadek et al., have revealed that the genetic and phenotypic correlations between LTMY and NLC were high and positive 0.91 and 0.96, respectively in Holstein cattle [18, 9].

## CONCLUSION

The present results offer that the advantages of reducing AFB and AFC decrease rearing costs, whereas the proportion of rearing costs of heifers until calving as overall means were about 26% of total cost within a lifetime of an animal. Likewise reducing AFB and AFC lead to increase lifetime milk production and lactation number complete in dairy cows under investigation. The estimates of direct heritability for MY, LTM, AFC, AFB and NLC venerated the possibility of realizing admirably of genetic improvement in these traits under investigation. Therefore, there is no choice but application the genetic improvement and optimization management can bring about the greatest role in reducing both AFB and AFC and betterment net profit in dairy farms under actual study.

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