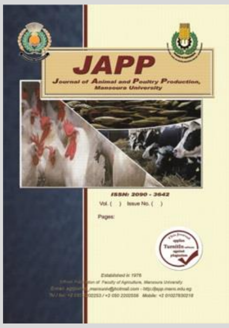
Journal of Animal and Poultry Production

Journal homepage: www.japp.mans.edu.eg
Available online at: www. jappmu.journals.ekb.eg

Genetic and Phenotypic Parameters and Trends for Milk Yield, Service Period and Calving Interval and The Economic Impact of Extending A Calving Interval on-Farm Profitability in Friesian Cows in Egypt

Zahed, S. M.*; S. Z. M. Ebrahim and Y. M. El-Diahy

Animal Production Research Institute, Ministry of Agriculture and Land Reclamation, Nadi El-Said Str., Dokki, Giza, Egypt



ABSTRACT

Genetic parameters for Friesian cows were estimated from 9155 lactation records for 3635 cows sired by 184 bulls. Multi-trait repeated animal models were employed using the REML procedure to estimate covariance components of total milk yield (TMY), service period (SP) and calving interval (CI). There is sufficient genetic variation (indicated by the coefficient of genetic variation) in total milk yield, service period and calving interval traits (15.6, 3.6 and 3.7%, respectively). Estimates of heritability for TMY, SP and CI traits were 0.170, 0.010 and 0.044, respectively. Permanent environmental variance ratios were 0.162, 0.017 and 0.048 for TMY, SP, and CI, respectively. Genetic correlations among SP and CI traits were high (0.998), however genetic correlations of reproductive with productive traits were unfavorable (0.512-0.661). The results indicated the possibility of continued selection for increased milk production which has deleterious effects on reproductive traits. The annual genetic changes were positive for TMY, SP, and CI (7.76 kg/yr, 0.076, and 0.24 d/yr, respectively). These positive trends indicate that there has been success in choosing better sires.The corresponding annual phenotypic changes for the same traits were positive (13.9 kg/yr, 0.029 and 0.82 d/yr, respectively). Positive annual genetic and phenotypic changes for SP and CI indicated that with improving milk yield the SP and CI will be increased. The financial situation of the farm is affected by the extension of the calving interval. The lower the calving interval, the more profitable the farm becomes, and prolonging this period for one day causes a financial loss for the farm.

Keywords: Genetic, phenotypic, genetic trends, profitability, extending a calving interval

INTRODUCTION

Antagonistic phenotypic and genetic correlations of fertility traits with milk yield would lead to a genetic decline in cow fertility if the selection is for milk production only. Thus, the incorporation of fertility in selection decisions seems desirable (Castillo-Juarez *et al*., 2000, Kadarmideen *et al*., 2000 and Zink *et al*., 2012). This situation has caused a decline in reproductive efficiency and has increased susceptibility to several diseases as well as the risk of culling due to reproductive or health disorders (Rogers *et al*., 1999 and Lassen *et al*., 2003).

Consequently, profitability in high-producing dairy herds has reduced (Zink, *et al*., 2012).Therefore, interest in including fertility and functional traits in the breeding goal for the dairy cattle population has increased. Many environmental factors (feeding, heat detection, the fertility of service sire, frozen semen characteristics, , artificial intelligence technician, etc.) have been found to have a very significant impact on fertility features.

Therefore, the heritability of most reproductive traits was generally less than 0.10 (Kadarmideen *et al*., 2003 and Wall *et al*., 2003). Fertility traits are genetically correlated with traits that are either well recorded or more heritable, such as milk yield (Pryce and Veerkamp, 2001).

As a result, direct measures of fertility and records on correlated traits, such as yield, can be used to supplement the predictions of genetic merit for fertility. The correlation between milk yield and fertility in not unity, therefore a favorable selection response infertility can be achieved while still achieving gains in milk production. Characteristics of milk production and physiological performance plays a major role in determining herd profitability and get hastily on an annual basis and determining the calving interval ranges from 12 to 13 mo, which is ideal (Arbel *et al*., 2001). Managing the calving interval is an important aspect of farm economic performance several studies have highlighted on economics of managing this aspect concerning produce milk, while others look at involve the general management of the farm in addition to milk production (Arbel *et al.*, 2001 , Hansson and Ohlmer, 2008 and Dono *et al*., 2013). The objectives of the present study were (1) estimate the necessary genetic parameters (2) estimate the genetic and phenotypic trends of total milk yield, service period and calving interval traits in the Friesian population to investigate genetic improvement possibilities for both. (3) evaluating the economic impact of extending a calving interval on-farm profitability.

MATERIALS AND METHODS

The present study carried out over 34 years (1982-2015) and obtained from the history of Friesian research herds maintained at Sakha and El-Karada . Experimental Farms belonging to the Animal Production Research

[*] Corresponding author.
E-mail address: smza56@hotmail.com
DOI: 10.21608/jappmu.2019.76532

Institute, Ministry of Agriculture and Land Reclamation, Egypt. A total of 9155 multiparous records were collected for 3625 cows with more than one lactation, sired by 184 bulls. Animals were grazed on Egyptian clover (*Trifolium alexandrinum)* berseem, from December to May. During the rest of the year, the animals were fed on concentrate mixture along with rice straw and a limited amount of hay when available. Cows producing more than 10 kg per day and those that were pregnant in the last two months of pregnancy were supplemented with extra concentrate ration. Cows were artificially inseminated by frozen semen. The sires having less than 5 daughters were excluded from the study. Cows were machine milked twice a day. Traits studied are total milk yield (TMY), first to last service period (SP) and calving to the next calving interval (CI). Where , TMY was defined as the amount of milk (kg) produced throughout the lactation length, while, SP it is the period between -date of calving and date of successful conception and CI is defined as the time period elapsed between two consecutive parturitions.

Statistical analysis;

The data were analyzed with the REML procedure to estimate (co)variance components by the VCE6 program (Groeneveld *et al*., 2010) using the repeatability animal model. The applied model was as follow:

$$\mathbf{Y_{ijklmn} = \mu + + F_i + Y_j + S_k + b1(AC_l) + a_m + pe_m + e_{ijklmn}}$$

Where Y_{ijklmn} = the individual observation of the trait, μ =the overall mean, F_i = fixed effect of farm (2), Y_j = fixed effect of year of calving (34), S_k= fixed effect of season of calving (4), AC_l = age at calving as a regression and lactation period as a regression (only for TMY trait), a_m = random additive genetic, pe_m= random permanent environmental effect of an animal and e_{ijlkmn}= error as random effect.

It was assumed that the covariance between additive, permanent environmental and residual effects was zero. Multivariate estimated breeding values (EBV) were estimated by the PEST program (Groeneveld *et al*., 2010) fitting an animal model and using genetic parameters obtained as described above. In matrix notation, the general model for genetic analysis can be expressed as below:

$$\mathbf{Y= Xb + Z_a a + Z_{pe} pe + e}$$

Where Y is vector of observations, b is vector of fixed effects, a is vector related to animal additive genetic effects, pe is vector of permanent environmental effects and e is a vector of residuals, X, Z_a and Z_{pe} are incidence matrices which related the fixed effects, animal additive genetic effects and permanent environmental effects to the vector of observations, respectively.

The genetic trend was estimated as the linear regression of means of EBV on a year of birth for all traits.

The phenotypic trend was estimated by regressing phenotypic values on a year of birth (SAS, 2011).

Economic Evaluation

The animals were divided according to the level of calving interval into three groups, which are of high (H1), medium (H2) and low (H3). The gross annual margins and the interest/cost ratio are calculated as economic parameters. The prices of inputs and outputs from the farm are calculated according to the current market price and the farm price at the farm

To calculate the Gross margin is the subtraction of total variable cost from the total gross output. The benefit/cost ratio is the total gross output divided by the total variable cost.

RESULTS AND DISCUSSION

Descriptive Statistics

Mean and standard deviations (SD), phenotypic coefficient of variability (CVp%), genetic standard deviation (SDg) and genetic coefficient of variability (CVg%) of productive and reproductive traits are presented in (Table 1). Mean estimate ± SD of TMY in the present study (2875±1085 Kg). However, higher estimates were registered by several authors ranged from 7209±1754 to 13172±4261 Kg for Friesian cattle in Egypt (Salem *et al*., 2006, Abou-Bakr *et al*., 2006 and Faid Allah, 2015). The mean estimate of SP was 82.8± 29.4 d (Table 1), indicating around 4 inseminations needed for the cow to be conceived, the current estimates were comparable with estimates of 87.1±29.4d reported by Jamrozik *et al*. (2005).

However, higher means were 16.7 and 34d as reported by Berry *et al*. (2003) and Kadarmideen *et al*. (2003).

The mean estimate of CI was 433.2±78.1 d (Table 1), indicating a relatively poor fertility condition in Egyptian Friesian cows. This is in close agreement with 430±92d reported in Egypt by Abou-Bakr *et al*. (2006). Higher mean estimates of 470±27 d and 484 d for Holstein commercial herd in Egypt by (Salem *et al*., 2006 and Ibrahim *et al*., 2009, respectively) .On the contrary, lower estimates were registered by several other authors ranged from 374±50.5 to 421.0±86.0d from different production (Wall *et al*., 2003, Dal Zotto *et al*., 2007, Toghiani , 2012 and Zambrano and Echeverri, 2014).

The coefficients of phenotypic variation CV_P (Table1), showed a considerable phenotypic variation (37.8%) for TMY, however, SP and CI traits showed CV_p of 35.4% and 18.0%. The current estimates of a considerable phenotypic variation for TMY were a close agreement with 32 reported by Abou-Bakr *et al*., (2006) and Effa *et al*., (2011) . However, smaller estimates to the same trait were 22.8, 14.5 and 24.3% reported by Wall *et al*., (2003) , Salem *et al*., (2006) and Faid Allah (2015), respectively . While the coefficients of phenotypic variation CV_p for CI is accords with 18.9% for Holstein cattle in Colombia by Zambrano and Echeverri (2014). But, higher than estimates of 13.01and 5.7% reported by Wall *et al*., (2003) and Salem *et al*., (2006) , respectively .On the other hand, smaller than estimates of 21, 27.06 and 31.8 % recorded by Abou-Bakr *et al*., (2006), Ibranim *et al*., (2009) and Effa *et al*., (2011). The coefficients of genetic variation CV_g (Table1), showed a considerable genetic variation existed (>15%) for TMY. However, reproductive traits (SP and CI) showed CV_g (<4%). These results indicate that there is sufficient genetic variation in reproductive traits that can be used for selecting superior animals for breeding. Similar findings have also been CV_g for SP was 16.2% reported by Kadarmideen *et al*., (2000) and Berry *et al*., (2003).

Table 1. Mean, phenotypic standard deviation (SD_p), phenotypic coefficient of variation (CV_p%), genetic standard deviation (SD_g) and coefficient of genetic variation (CV_g%) for productive and reproductive traits.

Trait[s]	Mean	SD_p	CV_p%	SD_g	CV_g%
TMY (Kg)	2875	1085	37.8	449	15.6
SP (days)	82.8	29.3	35.4	3.0	3.6
CI (days)	433.2	78.1	18.0	15.8	3.7

a: TMY = total milk yield, SP = first to last service period, and CI = calving interval.

Variance Components

Estimates of phenotypic variance, heritability and standard error (h^2±SE), permanent environmental variance-ratio and standard error (c^2±SE) and repeatability (t) for productive and reproductive traits are shown in (Table 2).

Estimates of h^2 for TMY traits were generally higher (0.17) than reproductive (SP and CI) traits (0.010 and 0.044, respectively). Heritability estimates for TMY were (0.170±0.006). However, higher estimates were reported by several other authors from different production environments by Salem *et al*., (2006), Yaeghoobi *et al*., (2011), Sahin *et al*., (2014), Faid Allah (2015) and Radwan *et al*., (2015). But, higher than the reported value of 0.059±0.030 for the same breed in Egypt by Abou-Bakr *et al*., (2006). The estimate of h^2 for SP (Table 2), 0.010±0.001 which is comparable with Zink *et al*. (2012) where it reached (0.01±0.003). However, higher estimates were registered by several other authors ranged from 0.02±0.008 to 0.048±0.01 from different production environments by (Berry *et al*., 2002, Kadarmideen *et al*., 2003, Wall *et al*., 2003, Ulutas *et al*., 2008 and Toghiani 2012).

Heritability estimates for the calving interval was 0.040±0.001 (Table 2). However, lower estimates were reported by several other authors for Holstein dairy cattle (Kadarmideen *et al*.,2003, Wall *et al*., 2003 , Ulutas *et al*., 2008 and Montaldo *et al*., 2017).On the other hand, higher estimates were reported for the same breed in different countries range of 0.05±0.004 to 0.088±0.037 recorded by Salem *et al*. (2006), Toghiani (2012), Ibrahim *et al*. (2009), Zambrano and Echeverri (2014) and Sahin *et al*. (2014). Low h^2 estimates for reproductive traits in the present study indicate that improving management practices (intensive feeding, heat detection, semen quality and insemination technique, time of insemination and health programs) would be efficient for improving all reproductive performance of the cow (Sahin *et al*., 2014).

This moderately low heritability estimates for CI could be clarified by large environmental variance.

Accordingly, upgrades in nutrition and reproductive management should prompt an extensive diminishing long of CI than making the hereditary choice alone (Ayalew *et al*., 2017). The differences in inheritance estimates are between various research for the same feature is believed to be due to the difference in the model used in the analysis and the methodology used to estimate the difference in the number of records used and the correction for various non-genetic factors (Abou-Bakr, 2009) .

Relative permanent environmental variance (c^2) was moderate (Table 2) for TMY (16.2%), however, it was low for SP and CI (1.7 and 4.8%, respectively). Berry *et al*.,(2003) reported that c^2 was 0.1% for SP. Kadarmideen *et al*. (2003) reported that estimates of c^2, for M305 was 11.5%, however, it was 3.2% and 2.6% for SP and CI, respectively. Ojango and Pollot (2001) reported that c^2 for TMY was 9%, however it was 1.3% for CI.

Repeatability estimate (t) of TMY (Table 2) was 0.332, which was nearly the same (0.34) In Kenya as reported by Ojango and Pollot (2001), however, it was lower than 0.398, 0.48 and 0.61 as reported by Kadarmideen *et al*. (2003) in UK, Abou-Bakr *et al*. (2006) and Salem *et al*. (2006), respectively in Egypt. Estimates of t in the present study for SP and CI (Table 2) were low (0.027and 0.088). The estimate of t for SP higher than the reported value of 0.04 for the same breed in the UK by Kadarmideen *et al*. (2003). This is comparable with the Holstein commercial herd in Egypt by Ibrahim *et al*. (2009). But, it was close to zero 0.09 in Iranian by Toghiani (2012). However, a slightly lower estimate of 0.050, 0.06 were reported for the same breed in the UK and Kenya by Kadarmideen *et al*. (2003) and Ojango and Pollot (2001), respectively. CI is strongly influenced by temporary environmental factors, due to the complex nature of reproductive traits, difficulties in detecting ovulation, and various other administrative and nutritional factors (Ayalew *et al*., 2017). This study indicates that low estimates of repeatability for reproductive traits indicate that reproductive performance on any occasion is of little use in predicting later performance, which is strongly influenced by temporary environmental factors and decision policies of dairy producer concerning when rebreed a cow, difficulties in detection of estrus and other nutritional factors in the dairy herds.

Table 2. Phenotypic variance, ratios concerning phenotypic variance for additive genetic (h^2±SE), permanent environmental effect (c^2 ± SE) and repeatability (t) estimates for productive and reproductive traits.

Trait[s]	TMY	SP	CI
σ2(p)	1178003.0	856.0	6101.4
h^2	0.170±0.006	0.010±0.001	0.040±0.001
c2	0.162±0.013	0.017±0.001	0.048±0.001
T	0.332	0.027	0.088

a: TMY= total milk yield, SP =first to last service interval and CI = calving interval.

Genetic correlations

Estimates of genetic (r_g±SE), and phenotypic (r_p) correlations are given in Table (3). Estimate of r_g between SP and CI traits was high (0.998), as would be expected, which is nearly the same (0.96) as reported by Ulutas *et al*., (2008). Strong and favorable genetic correlations of CI with SP was 0.61 (Wall *et al*., 2003). Strong genetic correlations among reproductive traits suggested that improving one fertility trait would result in a correlated improvement in other fertility traits (Wall *et al.*, 2003).

Also, Kadarmideen *et al*., (2003) reported that high and favorable genetic correlations (0.90) between SP and CI. The same authors added that high and favorable genetic correlations among many fertility traits indicated that animals ranked for one trait would rank similarly in the other correlated traits. This means that genetic improvement of one fertility trait could be expected to cause similar parallel improvement in the highly correlated trait.

Table 3. Genetic±SE (above diagonal) and phenotypic (below diagonal) correlations for productive and reproductive traits.

Trait[a]	TMY	SP	CI
TMY		0.512±0.061	0.661±0.040
SP	- 0.017		0.998±0.001
CI	- 0.037	0.331	

a: TMY= total milk yield, SP = first to last service interval and CI = calving interval.

Estimates of r_g between TMY and each of SP and CI were 0.512 and 0.661, respectively (Table 3), indicating a large deleterious impact of production on female fertility.

Ulutas *et al.* (2008) reported that r_g between TMY and SP was 0.63. Zink *et al.* (2012) reported that r_g between TMY and SP was 0.26. Genetic correlations of milk yield with CI was strongly unfavorable (0.27, 0.56, 0.59, 0.69, 0.70) as reported by Wall *et al.* (2003) Dal Zotto *et al.* (2007), Toghiani (2012), Sahin *et al*. (2014) and Ulutas *et al.* (2008), respectively, indicating that increasing milk yield is associated with longer CI.

Phenotypic correlations

Estimate of r_P between SP and CI was 0.331 (Table 3), which are smaller than 0.85 and 0.95 reported by Kadarmideen *et al.* (2003) and Ulutas *et al.* (2008). Estimates of r_P between TMY and each of SP and CI traits (Table 3) were low (-0.017 and -0.037, respectively).

Ulutas *et al*. (2008) reported that r_p between TMY and each of SP and CI were 0.01 and 0.096, respectively.

Sahin *et al*. (2014) reported that estimate of r_p was 0.14 between TMY and CI.

Genetic and Phenotypic trend

The genetic trend for TMY, SP and CI traits from 1982 to 2015 are shown in Figure 1(a, b, c). The mean breeding value for TMY significantly increased by 7.76±0.495 kg/yr, and fluctuated considerably from year to year. The estimated genetic trend for TMY was significant and increased by 6.26 kg/yr, and the mean breeding values fluctuated considerably from year to year (Ulutas *et al.*, 2008). The same authors added that these fluctuated breeding values might be considerably from largely qualitative basis upon which selection decisions were made and the use of bull with unknown breeding values. The estimated genetic trend for milk yield was significantly positive, 19.61 kg/yr (Yaeghoobi *et al., 2011*). The genetic trend for total milk yield was slightly upward with increasing trend and wide fluctuation observed in the recent years (Hussain *et al., 2014*). Sahin *et al.,* (2014) showed irregular fluctuation in breeding values of milk yield and genetic trend was estimated to be 6.88kg/yr, contributing these fluctuation to be a result of using of bulls with unknown breeding values. For the last 40 years, a positive genetic trend was observed (0.099±0.011) for first lactation milk yield (*Jenko et al*., 2015).

The genetic trend for SP and CI (Figure 1b, c) are significantly increased from year to year by 0.029±0.11 and 0.82±0.27 d/yr. Ibrahim *et al*., (2009) reported that genetic trend of CI was significantly positive 0.06±0.02 d/yr, indicating a genetic increase in calving interval over time. Abdelharith (2008) reported estimate of genetic trend (0.030±0.03d/yr) for CI. CI has increased over time, resulting in longer calving interval (Wall *et al*., 2003). The genetic trend in CI was increased by 1.34 d/yr (Ramatsoma *et al.,* 2014). In contrary, Atil and Khattab (2005) estimated genetic trend for CI to be -0.95 d/yr. Genetic trends for SP and CI were desired negative, -0.041 and -0.23, respectively which lead to favorable decreasing in SP and CI over time (Ghiasi and Honarvar, 2016).

The estimated phenotypic trends for TMY, SP and CI from 1982 to 2015 are shown in Figure 2(a, b, c). The phenotypic trend for TMY increased significantly by 12.41±7.06 kg/yr. Phenotypic change in milk yield was significant positive and increased by 69.5 kg/yr, and considerable fluctuation was observed between years, presumably reflecting management differences and feed availability (Ulutas *et al*., 2008).

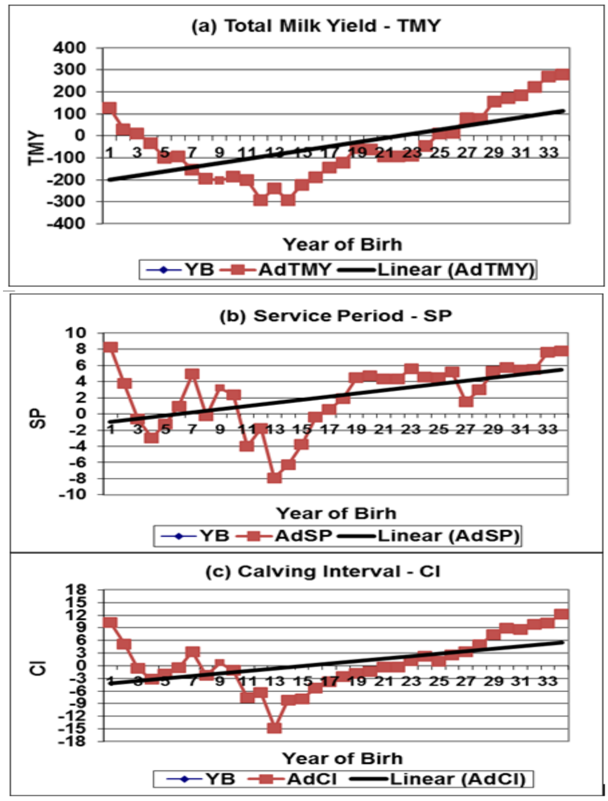


Figure 1. Genetic Trends for (a) TMY, (b) SP, (c) CI

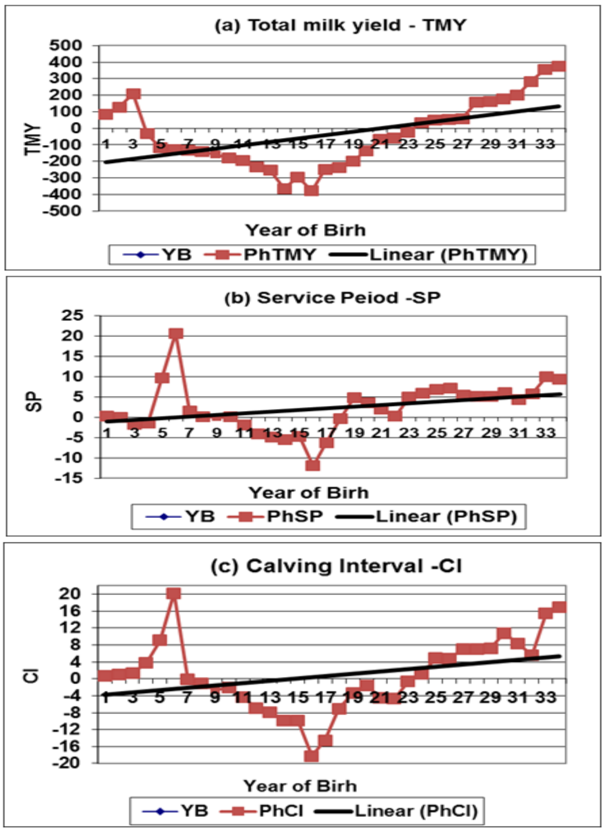


Figure 2. Phenotypic Trends for (a) TMY, (b) SP, (c) CI

Phenotypic trend for SP was unfavorable positive and increased by 0.029±0.117 d/yr. over time. Phenotypic trends of SP has increased by 1.6 d/yr from 1981 to 2007 (Ghiasi and Honarvar, 2016). The undesirable phenotypic trends might be attributed to the adverse environmental factors (Ghiasi and Honarvar, 2016). Phenotypic trend was slightly upward and with increasing trend and wide fluctuation observed in the recent years (Hussain, *et al*., 2014). As the trait is mainly governed by non-genetic factors, manage mental practices should be improved for lowering the CI (Singh *et al*., 2002). Phenotypic trend for CI in the present study was in unfavorable positive (0.82±0.27), indicating a phenotypic increase in calving interval over time. Singh *et al*., (2002) reported that phenotypic trend for CI was in positive direction (3.93d/yr). In contrary, phenotypic trend of CI was negative (-0.48±0.96 d/yr and -0.09±0.17 d/yr) as reported by Abdelharith (2008) and Ibrahim *et al*., (2009), respectively.

Financial evaluation for the impact of calving interval on farm

The approved assumptions used to calculate the farm budget and total gross output for herds according to the level of calving interval in(tables 4,5). In this study, the total gross output was 27981.61, 22665.95 and 19080.93 for the three groups, high, medium and low respectively, H1 was the highest group representing a 23.5% and 46.6% increase over H2 and H3, respectively this may be due to the increase in milk income. Milk production is a major source of income for the farm. Total variable cost for high calving interval (H1) is higher ($p<0.01$) than that of H2 by about 18.7 %, higher than H3 by about 61.1% . This difference between the three levels of calving interval is mainly due to its cost of feed and feed is the main component of the variable cost and the cost of semen as well as the cost of veterinary care and labor as the first level of high calving interval and high milk production, and therefore more expensive than other levels. The extract from this economic evaluation is that the gross profit margin for the third level is less than the calving interval.

Table 4. Approved assumptions used to calculate the farm budget.

Items	Calving interval		
	(H1) High CI	(H2) Medium CI	(H3) Low CI
* Number of records	1815	4300	2040
* Means of total milk yield, kg	6040	3935	2991
* Means of calving interval, d	440	372	350
* Average of age at first calving(mo.)	31	30	28
* No of service per conception	3.6	2.5	1.9
* Cow body weight is mature (kg)	500	450	400
* The calf sale price at birth (LE.)	3000	3000	3000
* The cost of Semen dose (LE.)	10	10	10
* The cost of annual veterinary care (LE.)	270	250	250
* Annual manure production per head (m3)	15	14	12
* Manure Price of m3 (LE.)	30	30	30
* Price of rectal palpation/time (LE.)	25	25	25
* Price of labor (Worker wages) (LE.)	2000	2000	2000
* Sale price of 1 kg milk in a farm (LE.)	5	5	5

The Egyptian Pound is genuine and utilized cash in Egypt and equivalent L.E = 0.17 USD.

Table 5. Detailed annual gross output and the variable costs for each level of calving interval.

Item	High (H1)	Medium (H2)	Low (H3)
Gross output			
The price of Milk	25052.27	19304.77	15595.93
The price of Calves	2479.34	2941.18	3125
The price of Manure	450	420	360
Total gross output	27981.61	22665.95	19080.93
Variable cost			
The price of Feeding	23940	19980	14333.4
The price of Labor	1200	1200	1200
The price of Insemination	36	25	19
The price of Palpation	90	62.5	47.5
The price of Veterinary care	270	250	250
Total variable cost	25536	21517.5	15849.9
Gross margin	2445.61	1148.45	3231.03
Benefit / cost ratio	1.10	1.05	1.20

More profitable as it reached 3231.03 EGP, while H1 was 2445.61 and H2 was 1148.45 EGP annually.

Wherefore, extending the calving interval is not economically feasible and that extending the calving interval for one day, a farm loss is estimated at 8.85 pounds per day. This is compatible with a reduced calving interval between 7d and 23d increased the annual gross margin per cow by between €8 and €92 (Bekara *et al*., 2017). The best profitability groups are the shortest CI model that reflects the best performance model and economic feeding efficiency (Dono *et al*., 2013). In contrast, the extension of CI was more profitable than shortening this period (Shalloo *et al*., 2014).

CONCLUSIONS

Total milk yield, service period and calving interval traits in all lactations were analyzed in the Friesian cows on Egyptian research dairy farms.

Due to low heritability and late availability of information, relying exclusively on direct selection to reduce calving interval is not advisable. Indirect selection for improved fertility might rely on early available traits like service period. Calving interval is a composite trait and cannot distinguish between infertility due to a delay in reproductive performance or due to the low success rate of AI events. Indeed, those traits like service period allow earlier prediction of bulls' breeding values and provide information for cows that could be culled early which increased the profitability of the dairy farm. Although the heritability of service period and calving interval traits is low, genetic variation between animals in reproductive traits do exist (indicated by the coefficient of genetic variation). So, selection for production traits seems to have merit for genetically improving reproductive performance.

High and favorable genetic correlations among reproductive traits indicated that animals ranked for one trait would rank similarly in other correlated traits. This means that genetic improvement of one reproduction trait could be expected to cause similar parallel improvement in the highly correlated trait. Based on the estimated genetic parameters, the use of fertility traits for indirect selection to enhance fertility in dairy cows is expected to be more effective than direct selection for fertility based on measurement of calving interval. Estimates of genetic trends for total milk yield over the 34 years indicated the importance of selection and mating based on reliable measures of breeding values. The selection for milk traits has an undesirable increase in fertility traits. Therefore, the deteriorating genetic trend of fertility traits showed the importance of including fertility in a total merit index so the genetic trend of these traits can be at least hold constant. Extending the calving interval of the heifer is not economically feasible, and extending this period for one day, farm losses are estimated at 8.85 pounds per day and animals are low, the period of CI is more profitable than others.

REFERENCES

Abdelharith, Hanaa (2008). Genetic and phenotypic trends of milk yield and reproductive traits for Friesian herd raised in Mid-Delta. Egyp. J. Appl. Sci., 23: 1-14.

Abou-Bakr, S., Alhammad, H.O.A.., Sadek, R.R. and A.A. Nigm (2006). Productive and Reproductive characteristics of Holstein cows under intensive farming system in Egypt. Egypt. J. Anim. Prod., 43: 91-98.

Abou-Bakr, S. (2009). Genetic and phenotypic trend of 305-day milk yield of Holstein cows raised at commercial farm in Egypt. Egypt. J. Anim. Prod., 46(2), 85-92.

Arbel, R., Bigun, Y., Ezra, E., Sturman, H., and D. Hojman (2001). The effect of extended calving intervals in high lactating cows on milk production and profitability. J Dairy Sci 84(3): 600-608

Atil, H. and A.S. Khattab (2005). Estimation of genetic trends for productive and reproductive traits of Holstein-Friesian cows in Turkey. Pakistan. J. Biol. Sci., 8: 202-205.

Ayalew, W., Aliy, M., and E. Negussie (2017). Estimation of genetic parameters of the productive and reproductive traits in Ethiopian Holstein using multi-trait models. Asian-Australas J Anim Sci.Vol. 30, No. 11:1550-1556 .

Bekara, M. A, Bareille, N., Bidan, F., Allain, C., and C. Disenhaus (2017).An ex ante analysis of the economic profitability of automatic oestrus detection devices in different dairy farming systems in France. https://hal.archives-ouvertes.fr/hal-01591150. Submitted on 20 Sep 2017.

Berry, D.P., Buckley, F., Dillon, P., Evans, R.D., Rath, M. and R.F. Veerkamp (2003). Genetic relationships among body condition score, body weight, milk yield and fertility in dairy cows. J. Dairy Sci., 86: 2193-2204.

Castillo-Juarez, H.P.A., Oltenacu, R.W., Blake, C.E., McCullock and E.G., Cienfuegos-Rivas (2000). Effect of herd environment on genetic and phenotypic relationships among milk yield, conception rate and somatic cell score in Holstein cattle. J. Dairy Sci., 83: 807-814.

Dal Zotto, R., De Marchi, M., Dalvit, C., Cassandro, M. Gallo, L. Carnier, P. and G. Bittante (2007). Heritabilities and genetic correlations of body condition score and calving interval with yield, somatic cell score, and linear type traits in Brow Swiss cattle. J. Dairy Sci., 90: 5737-5743.

Dono, G., Giraldo, L. and E. Nazzaro (2013). Contribution of the calving interval to dairy farm profitability: results of a cluster analysis of FADN data for a major milk production area in southern Italy. Spanish Journal of Agricultural Research 11(4): 857-868

El–Awady, H. G., Salem, A. Y, Abdel-Glil, M. F., Zahed S. M and A. S. Abo El-Enin (2017). Estimate of Genetic and Phenotypic Trends for Some Productive and Reproductive traits of Friesian Cows in Egypt. J. Animal and Poultry Prod.., Mansoura Univ., Vol. 8 (8): 329 - 334, 2017.

Effa, K., Wondatir, Z., Dessie, T. and A. Haile (2011). Genetic and environmental trends in the long-term dairy cattle genetic improvement programmes I the central tropical highlands of Ethiopia. J. Cell Anim. Biol., 5:96-104.

Faid Allah, E. (2015). Genetic and non-genetic analysis for milk production and reproductive traits in Holstein cattle in Egypt. JITV 20: 10-17.

Ghiasi, H. and M. Honarvar (2016). Genetic and phenotypic trends of fertility traits in Iranian Holstein cows. Iranian J. Appl. Anim. Sci., 6:53-58.

Groeneveld, E., Kovac, M. and T. Wang (2001). PEST User's Guide and Reference Manual, Version 4.2.3.

Groeneveld, E., Kovac, M. and N. Mielenz (2010). VCE6, User's Guide and Reference Manual, Version 6.0.2

Hansson, H. and B. Ohlmer (2008). The effect of operational managerial practices on economic, technical and AL locative efficiency at Swedish dairy farms. Livest Sci 118(1): 34-43.

Hussain, A., Iqbal, J., Shafiq M., Akhtar, P. Abdul Shakoor , U. Waheed and S. Campus-jhang (2014). Genetic and phenotypic trends for milk yield per lactation in Sahiwal Cattle under arid and condition of Pakistan. Pak. J. Life Soc. Sci., 12: 170-173.

Ibrahim, M.A.M., Rushdi, H.E., Abdel-Salam, S.A.M. and S. Abou-Bakr (2009). Genetic and phenotypic trends of calving interval and age at first calving in a commercial Holstein herd. Egypt. J. Anim. Prod., 46:103-112.

Jamrozik, J., Fatehi, J., Kistemaker, G.J. and L.R. Schaeffer (2005). Estimates of genetic parameters for Canadian Holstein female reproduction traits. J. Dairy Sci., 88: 2199-2208.

Jenko, J., Perpar, T. and Kovac, M. (2015). Genetic relationship between lifetime milk production, longevity and first lactation milk yield in Solvenian Brown cattle breed. Mljekarstvo, 65: 111-120.

Kadarmideen, H.N., Thompson, R. and Simm, G. (2000). Linear and threshold model genetic parameter estimates for disease, fertility and production traits in UK dairy cattle. J. Anim. Sci., 71: 411-419.

Kadarmideen, H.N., Thompson, R., Coffey, M.P. and M.A. Kossibati (2003). Genetic parameters and evaluations from single-and multiple-trait analysis of dairy cow fertility and milk production. Livest. Prod. Sci., 81: 183-195.

Lassen, J.M., Hansen, M.K., Sorensen, G.P., Aamand, G.P., Christensen, L.G. and P. Madsen (2003). Genetic relationship between body condition score, dairy character, mastitis, and diseases other than mastitis in first-parity Danish Holstein cows. J. Dairy Sci., 86: 3730-3735.

Montaldo, H.H., Carlos Trejo, C. and C. Lizana (2017). Genetic parameters for milk yield and reproduction traits in the Chilean Dairy Overo Colorado cattle breed. Cien. Inv. Agr. 44(1):24-34.

Ojango, J.M.K. and G.E. Pollott (2001). Genetics of milk yield and fertility traits in Holstein-Friesian cattle on large-scale Kenya farms. J. Anim. Sci., 79: 1742-1750.

Pryce, J.E., and R.F. Veerkamp (2001). The incorporation of fertility indices in genetic improvement programs. Fertility in the high producing dairy cow. BSAS Occ. Publ. 26: 237-250.

Radwan, H.A.A., Abo Elfadl, E.A. and A.M. Fardos (2015). Estimates of population parameters of some economic traits in Holstein Friesian cows by using statistical program. Global Vet. 14: 129-135.

Ramatsoma, N.I., Banga, C.B., MacNeil, M.D. and A. Maiwashe, (2014). Evaluation of genetic trends for traits of economic importance in South African Holstein cattle. South Afri. J. Anim. Sci., 44: 85-89.

Rogers, G.W., Banos, G. and U. Sander-Nielsen (1999). Genetic correlations among protein yield, productive life and type traits from the United States and diseases other than mastitis from Denmark and Sweden. J. Dairy Sci., 82: 1331-1338.

Sahin, A., Ulutas, Z., Adkinson, A.Y., and Adkinson, R.W. (2014). Genetic parameters of first lactation milk yield and fertility traits in Brow Swiss cattle. Ann. Anim. Sci., 14:545-557.

Salem, M.A., Esmail, H.M.., Sadek, R.R. and A.A. Nigm (2006). Phenotypic and genetic parameters of milk productive and reproductive performance of Holstein cattle under the intensive production system in Egypt. Egypt. J. Anim. Prod., 43: 1-10.

SAS (2011). SAS/STAT User's guide, Release 9.3. SAS Institute Inc, Cary, North Carolina, USA.

Shalloo, L., Cromie, A. and N. McHugh(2014).Effect of fertility on the economics of pasture-based dairy systems. Animal , 8:s1, pp 222–231. doi: 10.1017 /S1751731114000615.

Toghiani, S. (2012). Genetic relationships between productive traits and reproductive performance in Holstein dairy cows. Archiv Tierzucht, 55:58-468.

Ulutas, Z., Sahin, A. and M. Saatci (2008). Genetic parameters of milk yield in Jersey cows. J. Appl. Anim. Res., 34:29-32.

Wall, E., Brotherstone, S., Wooliams, J.A., Banos, G., and M.P. Coffey (2003). Genetic evaluation of fertility using direct and correlated traits. J. Dairy Sci., 86: 4093-4102.

Yaeghoobi, R., Doosti, A. Noorian, A.M. and A.M. Bahrami (2011). Genetic parameters and trends of milk and fat yield in Holstein's dairy cattle of West provinces of Iran. Inter. J. Dairy Sci., 6: 142-149.

Zambrano, J.C. and J. Echeverri (2014). Genetic and environmental variance and covariance parameters for some reproductive traits of Holstein and Jersey cattle in Antioquia (Colombia). Revista Brasileira de Zootecnia, 43: 132-139.

Zink, V., Lassen, J. and M. Stipkov (2012). Genetic parameters for female fertility and milk production traits in first-parity Czech Holstein cows. Czech J. Anim. Sci., 57(3): 108-114.

المعايير والاتجاهات الوراثيه والمظهريه لانتاج الحليب و فتره التلقيح والفتره بين ولادتين والتأثير الاقتصادى لتمديد الفتره بين ولادتين على ربحيه المزرعه لابقار الفريزيان فى مصر.

سميح محمد زاهد ، سماح زغلول محمود إبراهيم و ياسر مبروك مندور الديهى
معهد بحوث الإنتاج الحيواني ، وزارة الزراعة واستصلاح الأراضي ، شارع نادي الصيد ، الدقي ، الجيزة ، مصر.

تم تقدير المعايير الوراثية للأبقار الفريزيان من 9155 سجلًا للحليب لـ 3635 بقرة و184 ثور مغطاة 34 عامًا من (1982-2015) في قطيعين (سخا والقرضا) بمعهد بحوث الإنتاج الحيواني ، وزارة الزراعة واستصلاح الأراضي ، بمصر. تم استخدام نموذج REML لتقدير (التباين) مكونات التباين لكلا من انتاج اللبن الكلى ، وفترة التلقيح والفتره بين ولادتين. هناك تباين وراثي كاف (يشار إليه بمعامل التباين الوراثي) في إجمالي إنتاج الحليب وفترة التلقيح الفتره بين ولادتين (15.6 و 3.6 و 3.7٪ على التوالي). كانت تقديرات الوراثة لسمات TMY و SP و CI هي 0.170 و 0.010 و 0.044 على التوالي. وكانت نسب التباين البيئي الدائم 0.162 ، 0.017 و 0.048 ل TMY، SP ، و CI ، على التوالي. كانت الارتباطات الوراثية بين سمات SP و CI مرتفعة (0.998) ، لكن الارتباطات الوراثية للتكاثر مع الصفات الإنتاجية كانت غير مواتية (0.512-0.661). أشارت النتائج إلى إمكانية الاختيار المستمر لزيادة إنتاج الحليب الذي له آثار ضارة على الصفات التناسلية. كانت التغيرات الوراثية السنوية إيجابية بالنسبة لـ TMY و SP و CI (7.76 كجم / سنة و 0.076 و 0.24 يومًا على التوالي). تشير هذه الاتجاهات الإيجابية إلى أن هناك نجاحًا في اختيار مواليد أفضل. كانت التغييرات المظهرية السنوية المقابلة لنفس الصفات إيجابية (13.9 كجم / سنة ، 0.029 و 0.82 يومًا / عام ، وأشارت التغييرات الوراثية والإيجابية السنوية الإيجابية لـ SP و CI إلى أنه مع تحسين إنتاج الحليب ، سيتم زيادة SP و CI. يتأثر وضع المزرعة بتمديد الفتره بين ولادتين ، فكلما انخفض الفاصل الزمني لهذه الفتره ، زادت ربحية المزرعة و إطالة هذه الفترة تؤدى إلى خسارة مالية للمزرعة.