Additive genetic variance and covariance in some reproductive disorders in Hungarian Holstein Friesian using multi-trait animal model

Summary

Relationships between some reproductive disorders in the first 3 lactations of Holstein Friesian cows were investigated for 1886 lactation records. Multiple-trait maximum likelihood procedure which included sire, cow within sire as random effect and herd, parity, month and year of calving as fixed effects was used to estimate heritabilities and repeatabilities for the studied traits. Abortion within 60 days, retained placenta, ovarian cysts, calving difficulty, dystocia, mastitis, and calving type were coded as 0 and 1 for heritability and repeatability estimations. Pooled and separate analysis were applied on the first 3 lactations. Abortion within 60 days, retained placenta, ovarian cysts, calving difficulty, dystocia, mastitis, abortion no. and calving type had moderate heritability estimates which ranged from 0.15 to 0.24. Low heritability estimates and a weak sire variance component were obtained for milk fever. The most frequent disorder traits were mastitis, milk fever, abortion no. calving type and calving difficulty (0.37 to 0.72). Up word trend of heritability estimates with advancing order of lactation was observed for mastitis, abortion within 60 days, and abortion no. while heritability estimates for calving type, calving difficulty and dystocia had a back word trend. These results help in determining the suitable age of selection. Additive genetic variances and covariances among the studied traits have indicated reducing incidence rates if selection index procedure used in this field. Strong negative genetic correlation between milk fever and abortion no. (-0.429) while negative phenotypic correlations between all studied traits were not more than -0.120 which was estimated for calving difficulty and abortion no.

Key Words: dairy cattle, heritability, repeatability, correlation, reproductive disorders, Hungarian Holstein Friesian

Zusammenfassung

Titel der Arbeit: Genetische Parameter von Reproduktionsmerkmalen untersucht an Ungarischen Holstein Friesian Rindern


Schlüsselwörter: Milchrind, Heritabilität, Korrelationen, Reproduktionsmerkmale, Ungarische Holstein Friesian
Introduction
Reproductive performance of Holstein Friesian cattle under Hungarian conditions are below the acceptable level compared with other herds of this breed in original situation (GÁSPÁRDY et al., 1995). Low reproductive performance (such as conception and pregnancy rates) affects the profitability of dairy herds by decreasing milk produced per cow per day, the calf crop, and the magnitude of culling rate (BRITT, 1985). Minimization of the reproductive disorders occurrence such as retained placenta, metritis and ovarian cysts which cause from 2 to 5 weeks delay in calving interval was the one way to improve the reproductive efficiency (ERB et al., 1980). Disorders and milk production are interrelated in the dairy cow: the stress of milk production predisposes some disorders and may interfere with fertility; diseases can also interfere with concurrent yield; reproductive diseases have negative effects on breeding performance along in addition with pregnancy affects persistency of lactation (ERB et al., 1985). Moderate heritability (0.38) for retained placenta was reported by ERB et al. (1958). Heritability of dystocia was 0.17 in the first parity and decreased thereafter to .08 and .05 for second and third parity or greater parity cows was reported by POLLAK and FREEMAN (1976). On the other hand, pooled data set of different parities generated the lowest heritability estimate of 0.01 for dystocia as showed by MARTINEZ et al. (1983). Calving difficulty occurs more than 50% of all calves during calving time (PHILIPSSON, 1976a). PHILIPSSON (1976b) found that 45.5 and 49.7% of calf mortality were due to calf difficulty of heifers and cows respectively during parturition. Also he found that the genetic correlation between direct effects for stillbirth rate and calving difficulty was 0.6 and the genetic correlation between maternal effects for stillbirths rate and dystocia was 0.64.

The objective of this study was to examine the genetic and phenotypic variability through different interrelationships which may exist in some dairy cattle disorders at different parities. It is aimed to explain the relationship between reproductive disorders as an advanced step for selection against the high costly reproductive disorders which in turn may improve the performance of dairy cattle.

Materials and Methods
Animal conditions and structure of the data
Three herds from the Hungarian Holstein Friesian population were evaluated in this study. Data are from the first 3 lactations lasted from August 1983 until October 1993. Lactations could be completed at any stage by death, sale or drying-off. Complete lactation of 1886 records of 630 Hungarian Holstein Friesian cows were used in the analyses. All data which are concerned to hygiene were collected every month during the farm milk test day by a research technician. Emphasis was placed on accurate recording of calving, hygienic condition, breeding, culling, and management practices. All cows calved under observation for two days before and for 305 days after calving. The reproductive disorders included in this study were mastitis, milk fever, abortion within 60 days of pregnancy, abortion no., calving type, calving difficulty, dystocia, retained placenta and ovarian cysts. Positive observation responses were coded as 1 while negative results for studied problem in hygiene obtained the code 0 except the
trait of abortion no. A cow which was diagnosed and treated by a veterinarian during the farm visits as a clinical difficulty of productive disorder was considered as an incident of mastitis and milk fever. Incidence abortion within 60 days and abortion no. by examination of each concepted cow after 60 days from last insemination was recorded. Calving difficulty were assigned to be troublesome or ease let down of the calf during parturition. Normal delivery or caesarean (surgical delivery) was the base of recording calving type. Diagnosis of cystic ovary was based on rectal palpation of ovarian structures by the veterinary practitioner to determine the situation of ovaries. Each cow had assistance during parturition was recorded as a positive dystocia. After parturition of 24 hours each cow had not expelled all embryo members was recorded as a positive retained placenta.

**Statistical model**

The relationship coefficient matrix included 1886 lactation records of 630 cows, 57 sires and the half-sib sister groups involved 8-14 cows per sire. Paternal half-sib sister covariances were determined by animal mixed model (AMM) analysis of variance. The general mathematical model for these data was

\[
y_{ijk} = \mu + S_i + C_{ij} + H_k + e_{ijkl}
\]  

(1)

where

- \( y_{ijkl} \): is the measurement of the trait on the cow (transformed during analysis of variance),
- \( \mu \): is the population mean,
- \( S_i \): is a random effect of the ith sire,
- \( C_{ij} \): is a random effect of the jth cow nested within the ith sire,
- \( H_k \): is a herd effect (parity, month and year of calving), and
- \( e_{ijkl} \): is a random residual associated with each measurement.

The linear animal mixed model in matrix notation is given by

\[
y = Xb + Z_1 a + Z_2 c + e
\]  

(2)

where

- \( y \) is the vector of observations,
- \( X \) is the known matrix,
- \( b \) is the vector of fixed effects (parity, month and year of calving),
- \( Z_1 \), \( Z_2 \) are the known incidence matrices,
- \( a \), \( c \) are non-observable sire and cow random vectors.

Expectation and variances are defined as:

\[
\begin{bmatrix}
  a \\
  c \\
  e
\end{bmatrix}
= 
\begin{bmatrix}
  0 \\
  0 \\
  0
\end{bmatrix}
\quad \text{var}
\begin{bmatrix}
  a \\
  c \\
  e
\end{bmatrix}
= 
\begin{bmatrix}
  A\sigma^2_a & \sigma_{au} & \cdots & 0 \\
  \sigma_{au} & B\sigma^2_c & \cdots & I\sigma^2_e_1 \\
  \vdots & \vdots & \ddots & \vdots \\
  0 & I\sigma^2_e_1 & \cdots & I\sigma^2_e_2
\end{bmatrix}
\]

where

- \( A \) and \( B \) are the numerator relationship matrix among animals of sire and cow within sire, \( I \) is the identity matrix,
- \( \sigma^2_a \) and \( \sigma^2_c \) are the direct random additive genetic
effect of the sire and cow. $\sigma^2 e_1$ and $\sigma^2 e_2$ are the sire and cow population error variance.

The animal mixed model equation (AMME) are

\[
\begin{bmatrix}
X' R^{-1} X & \ldots \ & X' R^{-1} Z_1 \\
Z_1' R^{-1} X & \ldots \ & Z_1' R^{-1} Z_1 + G^{-1} & \ldots & Z_1' R^{-1} Z_2 \\
Z_2' R^{-1} X & \ldots \ & Z_2' R^{-1} Z_1 & \ldots & Z_2' R^{-1} Z_2 + k^{-1} A^{-1}
\end{bmatrix}
\begin{bmatrix}
B^\wedge \\
\alpha^\wedge \\
\epsilon^\wedge
\end{bmatrix}
= \begin{bmatrix}
X' R^{-1} Y \\
Z_1' R^{-1} Y \\
Z_2' R^{-1} Y
\end{bmatrix}
\]

where \( n \) denote the number of animals and \( t \) the number of traits. Data are ordered traits within animals and missing observation are accounted for by zero columns in \( X \) and \( Z \) (MEYER, 1983).

Multi-Traits Derivative Free Restricted Maximum Likelihood (MTDFREML) procedure developed by BOLDMAN et al. (1995) are used to estimate all genetic and phenotypic covariances and predicting the breeding value for all studied traits. The variance structure from the sire model, in general terms is:

\[
\sigma^2 p = \sigma^2 s + \sigma^2 c + \sigma^2 e
\]

(3)

where \( \sigma^2 p \) is the total phenotypic variance, \( \sigma^2 s \) is the sire component of variance between paternal half sib groups which involve quarter of the additive variance. The cow model was used in separate analysis of variances and structure of the variance component was:

\[
\begin{align*}
\sigma^2 p &= \sigma^2 c + \sigma^2 e \\
\sigma^2 c &= \sigma^2 a_d + \sigma^2 E_p
\end{align*}
\]

(4.1)

(4.2)

Where \( \sigma^2 p \) is the total phenotypic variance, \( \sigma^2 c \) is the cow component of variance, \( \sigma^2 a \) is the additive genetic variance, \( \sigma^2 E_p \) is the permanent environmental variance, \( \sigma^2 e \) and is the residual variance.

Estimation of heritability by using \((4\sigma^2 s / \sigma^2 p)\), repeatability by using \((\sigma^2 s + \sigma^2 c / \sigma^2 p)\), genetic correlation by using \((\sigma_{mn} / [\sigma^2_n, \sigma^2_m]^{1/2})\) and phenotypic correlation by using \((\sigma_{mn} / [\sigma^2_n, \sigma^2_m]^{1/2})\). Where \( \sigma_{s1p2} \) and \( \sigma_{mp2} \) are sire genetic and phenotypic covariance between trait 1 and trait 2 and are estimated from the analysis of measurements of the two diseases on the same animal (observed scale); \( \sigma^2 s_1 \), \( \sigma^2 s_2 \) and \( \sigma^2 p_1 \), \( \sigma^2 p_2 \) are the sire additive genetic and phenotypic variances for the same disorders.

Results and discussion

The incidence percentages for some reproductive disorders in Hungarian Holstein Friesian cows are presented in Table 1. The most frequent occurrence either in number
or percentages of milk fever, calving type, calving difficulty and dystocia were observed in the 2nd lactation. Among all disorders the most frequent mastitis occurrence was observed in the 1st lactation and followed by also high percentage in the 3rd calving. This is may be due to increasing sensitivity of the superior lactating cows to this disease with advancing order of lactation. ERB et al. (1985) found that, heifers that were older at first calving were more likely than younger heifers to have mastitis. The incidence rate of abortion within 60 days was very high in the first lactation. This may be due to lowering and the unsuitable age at first conception and calving. Therefore, this disorder was from an economic point of view should be considered in the future for production of first calf heifers. Another reason may be also the insufficient maturity specially for the hind quarters of the primiparous including the reproductive system (HAMMOND et al., 1983).

Table 1
Observation number and percentage for some reproductive disorder in Hungarian Holstein Friesian cows (Tierzahl, Merkmale und deren Auftretenshäufigkeit)

<table>
<thead>
<tr>
<th>Traits</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record numbers</td>
<td>630</td>
<td>628</td>
<td>628</td>
<td>1886</td>
</tr>
<tr>
<td>Traits</td>
<td>Observation</td>
<td>Number</td>
<td>Observation</td>
<td>Number</td>
</tr>
<tr>
<td>Mastitis</td>
<td>67</td>
<td>53</td>
<td>89</td>
<td>209</td>
</tr>
<tr>
<td>Milk fever</td>
<td>41</td>
<td>81</td>
<td>61</td>
<td>183</td>
</tr>
<tr>
<td>Abortion within 60 days</td>
<td>112</td>
<td>14</td>
<td>61</td>
<td>240</td>
</tr>
<tr>
<td>Abortion no.</td>
<td>28</td>
<td>16</td>
<td>8</td>
<td>50</td>
</tr>
<tr>
<td>Calving type</td>
<td>16</td>
<td>32</td>
<td>30</td>
<td>64</td>
</tr>
<tr>
<td>Calving difficulty</td>
<td>30</td>
<td>56</td>
<td>46</td>
<td>132</td>
</tr>
<tr>
<td>Dystocia</td>
<td>20</td>
<td>51</td>
<td>9</td>
<td>105</td>
</tr>
<tr>
<td>Retained placenta</td>
<td>96</td>
<td>58</td>
<td>46</td>
<td>200</td>
</tr>
<tr>
<td>Ovarian cysts</td>
<td>92</td>
<td>58</td>
<td>46</td>
<td>196</td>
</tr>
<tr>
<td>More than one disorder</td>
<td>128</td>
<td>161</td>
<td>218</td>
<td>507</td>
</tr>
</tbody>
</table>

The amount of cow variance components for all studied traits were greater than corresponding for sire variance components as resulted from the pooled analysis (Table 2). This may be due to including of permanent environmental variance along with dominant variance in the cow variance component (FALCONER, 1988). The contribution of sire and cow component variance were varied between different traits. The highest estimate of sire variance component was observed for calving difficulty while the highest estimate of cow variance component was observed for milk fever as shown in Table 2. Therefore, constructing selection index for reducing incidence of calving difficulty and milk fever must be based on the estimates of sire and cow
variance components.

Table 2
Estimates of sire $\sigma^2 s$, cow $\sigma^2 c$, residual $\sigma^2 e$ and phenotypic $\sigma^2 p$ estimates component of variance for some disorder traits in dairy cattle that generated from pooled analysis (Varianzkomponenten für Merkmale, ermittelt am Gesamtmaterial)

<table>
<thead>
<tr>
<th>Traits</th>
<th>$\sigma^2 s$</th>
<th>$\sigma^2 c$</th>
<th>$\sigma^2 e$</th>
<th>$\sigma^2 p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mastitis</td>
<td>0.008</td>
<td>0.091</td>
<td>0.094</td>
<td>0.193</td>
</tr>
<tr>
<td>Milk fever</td>
<td>0.001</td>
<td>0.098</td>
<td>0.085</td>
<td>0.184</td>
</tr>
<tr>
<td>Abortion within 60 days</td>
<td>0.007</td>
<td>0.010</td>
<td>0.100</td>
<td>0.117</td>
</tr>
<tr>
<td>Abortion No.</td>
<td>0.004</td>
<td>0.071</td>
<td>0.023</td>
<td>0.098</td>
</tr>
<tr>
<td>Calving type</td>
<td>0.002</td>
<td>0.022</td>
<td>0.030</td>
<td>0.054</td>
</tr>
<tr>
<td>Calving difficulty</td>
<td>0.002</td>
<td>0.011</td>
<td>0.021</td>
<td>0.034</td>
</tr>
<tr>
<td>Dystocia</td>
<td>0.003</td>
<td>0.013</td>
<td>0.048</td>
<td>0.064</td>
</tr>
<tr>
<td>Retained placenta</td>
<td>0.006</td>
<td>0.010</td>
<td>0.084</td>
<td>0.100</td>
</tr>
<tr>
<td>Ovarian cysts</td>
<td>0.006</td>
<td>0.010</td>
<td>0.083</td>
<td>0.098</td>
</tr>
</tbody>
</table>

In general, the heritability estimates of these disorders (Table 3) in the studied population were relatively higher compared with other reports (LIN et al., 1989; POLLAK and FREEMAN, 1976; MARTINEZ et al., 1983). Therefore design and application of accurate selection programs along with more genetic evaluation of Hungarian Holstein Friesian population will play an important role in decreasing incidence rates of different problems in hygiene, improving the general level of dairy cattle performance and reducing involuntary culling. Large variability among heritability estimates for disorder traits is to be expected because of differences in the clinical definition of diseases, in the accuracy of data recording, and in sample sizes. Also, one of the biological feature is that the natural immunity of the lactating cows which greatly differs from one herd to another may have a great impact on the general management practices and hygiene.

Table 3
Estimates of repeatability and heritability for some reproductive disorder traits in Hungarian Holstein Friesian cows (Wiederholbarkeits- und Heritabilitäts-Schätzwerte)

<table>
<thead>
<tr>
<th>Traits</th>
<th>Repeatability</th>
<th>Heritability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pooled</td>
<td>Pooled</td>
</tr>
<tr>
<td>Mastitis</td>
<td>0.47±.11</td>
<td>0.17±.05</td>
</tr>
<tr>
<td>Milk fever</td>
<td>0.53±.07</td>
<td>0.03±.03</td>
</tr>
<tr>
<td>Abortion within 60 days</td>
<td>0.09±.01</td>
<td>0.24±.08</td>
</tr>
<tr>
<td>Abortion No.</td>
<td>0.72±.22</td>
<td>0.17±.07</td>
</tr>
<tr>
<td>Calving type</td>
<td>0.41±.13</td>
<td>0.15±.08</td>
</tr>
<tr>
<td>Calving difficulty</td>
<td>0.37±.09</td>
<td>0.21±.08</td>
</tr>
<tr>
<td>Dystocia</td>
<td>0.20±.04</td>
<td>0.18±.07</td>
</tr>
<tr>
<td>Retained placenta</td>
<td>0.10±.02</td>
<td>0.24±.08</td>
</tr>
<tr>
<td>Ovarian cysts</td>
<td>0.10±.02</td>
<td>0.24±.08</td>
</tr>
</tbody>
</table>

Heritability estimates of 0.24 for calving difficulty in the 1st lactation and 0.28 and 0.26 for retained placenta and ovarian cysts respectively in the 2nd parity are higher than the corresponding values which reported by BRINKS et al. (1973) and POLLAK
and FREEMAN (1976). Trend for heritability estimates with advanced order of lactation was ascending for mastitis, abortion within 60 days, and abortion no. and descending for calving type, calving difficulty and dystocia. High estimates of repeatability of both mastitis and abortion incidence within 60 days were associated with increase and wide genetic variation with advancing order of lactation. This may be indicate that early selection against these traits within the first lactation will be very effective to improve the reproductive economic gain of the dairy herds. Curve linear trends of heritability estimates were observed for milk fever, retained placenta and ovarian cysts as shown in Table 3. These trends are in disagreement with the reported results of THOMPSON's (1984) except for retained placenta which was nearly in agreement. Estimates of heritability that generated from pooled analysis were in moderate level compared with those obtained from separate analysis of the 3 first lactation.

Correlation between subsequent lactation for the same disorder traits (repeatability) were presented in Table 3. The major repeated disorder traits were mastitis, milk fever, abortion no., calving type, and calving difficulty. Trait with the highest repeatability (0.72) was the abortion no. This can be due to the high magnitude the amount of the cow component of variance (Table 2). On the other hand the low magnitude of cow component of variance in abortion within 60 days is might be the reason of low repeatability compared with other estimates. This also may be due to low the contribution of permanent environmental effect because heritability estimates of abortion within 60 days were in general not low as shown in Table 3 of pooled and separate analysis of variance. Among the current studied disorders it appears that mastitis, milk fever, abortion no. and calving type are considered as high repeated observations that may play important role in voluntary direct and significant indirect culling of the high lactating cows from the most dairy cattle herds.

Table 4
Genetic and phenotypic correlations between some reproductive disorders in Hungarian Holstein Friesian cows as generated from pooled analysis (Genetische und phänotypische Korrelationen zwischen Merkmalen, ermittelt am Gesamtmaterial)

<table>
<thead>
<tr>
<th>Traits</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mastitis</td>
<td>1.000</td>
<td>0.984</td>
<td>0.959</td>
<td>0.808</td>
<td>0.852</td>
<td>0.808</td>
<td>0.864</td>
<td>0.869</td>
<td>0.886</td>
</tr>
<tr>
<td>Milk fever</td>
<td>0.984</td>
<td>1.000</td>
<td>0.993</td>
<td>0.690</td>
<td>0.758</td>
<td>0.716</td>
<td>0.750</td>
<td>0.756</td>
<td>0.767</td>
</tr>
<tr>
<td>Abortion within 60 days</td>
<td>0.959</td>
<td>0.993</td>
<td>1.000</td>
<td>0.660</td>
<td>0.697</td>
<td>0.716</td>
<td>0.742</td>
<td>0.745</td>
<td>0.751</td>
</tr>
<tr>
<td>Abortion No.</td>
<td>0.808</td>
<td>0.690</td>
<td>0.660</td>
<td>1.000</td>
<td>0.923</td>
<td>0.868</td>
<td>0.896</td>
<td>0.896</td>
<td>0.898</td>
</tr>
<tr>
<td>Calving type</td>
<td>0.852</td>
<td>0.758</td>
<td>0.697</td>
<td>0.923</td>
<td>1.000</td>
<td>0.917</td>
<td>0.936</td>
<td>0.941</td>
<td>0.945</td>
</tr>
<tr>
<td>Calving difficulty</td>
<td>0.808</td>
<td>0.697</td>
<td>0.716</td>
<td>0.868</td>
<td>0.917</td>
<td>1.000</td>
<td>0.908</td>
<td>0.914</td>
<td>0.918</td>
</tr>
<tr>
<td>Dystocia</td>
<td>0.984</td>
<td>0.758</td>
<td>0.742</td>
<td>0.896</td>
<td>0.936</td>
<td>0.908</td>
<td>1.000</td>
<td>0.995</td>
<td>0.999</td>
</tr>
<tr>
<td>Retained placenta</td>
<td>0.959</td>
<td>0.758</td>
<td>0.745</td>
<td>0.896</td>
<td>0.941</td>
<td>0.914</td>
<td>0.995</td>
<td>1.000</td>
<td>0.999</td>
</tr>
<tr>
<td>Ovarian cysts</td>
<td>0.808</td>
<td>0.716</td>
<td>0.751</td>
<td>0.898</td>
<td>0.945</td>
<td>0.918</td>
<td>0.999</td>
<td>0.999</td>
<td>1.000</td>
</tr>
</tbody>
</table>

1: estimates below diagonal, 2: estimates above diagonal

All genetic and phenotypic correlations between disorder traits using sire variance and covariance components which generated from pooled analysis were presented in Table 4. Non additive covariance component between abortion within 60 days and calving
type is very low, therefore the phenotypic correlation between these two traits was close to zero. The genetic correlations of milk fever with each of mastitis, abortion no., abortion within 60 days, retained placenta and ovarian cysts were positive and ranged from 0.63 to 0.99 (Table 4). On the other hand there are some genetic relationships are less than or equal to 0.10 which might indicate weak genetic association between these traits (Table 4). Retained placenta and ovarian cysts showed strong phenotypic correlation with abortion within 60 days. This indicates that most of the cows that had either retained placenta or ovarian cysts probably would abort their foetus in early months of pregnancy. Other phenotypic relationships were moderate or low indicating weak association between these traits.

Conclusions

Increasing incidence rates of any reproductive disorders such as dystocia, retained placenta, cystic ovary ... etc. play important role in indirect significant culling of the genetically superior milk production lactating cows. Reproductive disorder considered herein are defined broadly. In general genetic and phenotypic variances and covariances obtained indicate that improving these disorders through selection seems possible. The strong and positive genetic relationships between milk fever and mastitis, abortion within 60 days and abortion no., retained placenta and ovarian cystic, distocya and calving type, retained placenta and ovarian cysts indicate that may be selection against any one of these dairy cattle disorders would result in a positive correlated effect with respect to the other traits. If selection index is desired procedure in future to reduced incidence rates of mastitis and milk fever, that need to make a restriction on increasing abortion no., because there are negative relationship between these traits. Retained placenta was very correlated genetically with abortion no. within 60 days and abortion no. This indicate that high possibility of aborting light or heavy pregnant cows which obtained in the previous lactation a positive retained placenta. Abortion no. had direct impact on general breeding performance of dairy cattle and yearly economic calf crop by high repeated aborted heavy pregnant cows. Cows with high repeated milk fever had moderate phenotypic correlation with abortion no. within 60 days, retained placenta and ovarian cysts compared with other disorders. On the other hand moderate negative genetic correlation were reported between milk fever and both of retained placenta and ovarian cysts resulting in an indicate that association of milk fever with poorer breeding performance and increase risk of being culled. Estimates of repeatability for mastitis and abortion no. within 60 days were very high and associated with the magnitude of genetic variance and covariance components from the first to the third calving. This may indicate that the importance of early selection against these traits within the first lactation which would be effective in improving the economic gain of the dairy farms.

References

A Manual for Use of MTDFREML. A set of programs to obtain estimates of variances and covariances.
BRINKS, J. S.; OLSON, J.E.; CARROLL, E.J.:

BRITT, J.H.:

ERB, R. E.; HINZE, P.M.; GILDOW, E.M.; MORRISON, R.A.:

ERB, H. N.; MARTIN, S.W.; ISON, N.; SWAMINATHAN, S.:
Interrelationships between production and reproductive diseases in Holstein cows. J. Dairy Sci. 63 (1980), 1911-1917

Path model of reproductive disorders and performance, milk fever, mastitis, milk yield, and culling in Holstein cows. J. Dairy Sci. 68 (1985), 3337-3347

GÅSPÅRDY, A.; BOZ, S.; DOHY, J.:

HAMMOND, J.; BOWMAN, J.C.; ROBINSON, T.R.:

Heritabilities of and genetic correlations among six health problems in Holstein cows. J. Dairy Sci. 72 (1989), 180-186

MARTINEZ, M.L.; FREEMAN, A.E.; BERGER, P.J.:
Genetic relationship between calf liveability and calving difficulty of Holsteins. J. Dairy Sci. 66 (1983), 1494

MEYER, K.:

PHILIPSSON, J.:

PHILIPSSON, J.:

POLLAK, E. J.; FREEMAN, A.E.:
Parameter estimation and sire evaluation for dystocia and calf size in Holsteins. J. Dairy Sci., 58 (1976), 1817-1827

THOMPSON, J.R.:

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Authors' addresses
Dr. ASHRAF A. AMIN, Dr. WAILT H. KISHK
Department of Animal Production, Faculty of Agriculture, Suez Canal University,
41522-Ismailia
Egypt
samin@nt.suez.eun.eg.

Prof. Dr. TIBOR GERE
University of Agricultural Sciences, Gödöllö, Gyöngyös College of Agriculture,
Department of Animal Breeding
3200 – Gyöngyös
Hungary


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E.-C.-Baumann-Straße 20
95326 Kulmbach