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Estimation of Genetic and Phonotypic Trends for Age at First Calving, Calving Interval, Days Open and Number of Insemination to conception for Isfahan Holstein Cows

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ABSTRACT

For the current research the records of 62 farms in Isfahan province were available. To estimate genetic and phonotypic trends of reproductive traits such as age at first calving, calving interval, days open and number of insemination to conception rate the records of 63,866 cows including 167793 reproductive records were employed. Farms were covered by Vahdat industrial Agriculturists and Dairymen Cooperative of Isfahan during 1986 to 2012. Genetic parameters estimated by linear animal model using Restricted Maximum Likelihood Method (REML). Genetic and phonotype trends were estimated by using regression of average breeding values and phonotype values on calving year. Heritability of age at first calving (0.19±0.007), calving interval (0.06±0.005), days open (0.041±0.004) and number of insemination to conception (0.071±0.004) were estimated. Phonotypic trends of age at first calving, calving interval, days open, number of insemination to conception in first parity and number of insemination to conception in second parity onward were estimated to be -3.48± 1.08, -0.41±0.4, -0.42±0.2, 0.013±0.0025 and 0.031±0.01 respectively. Estimated genetic trends for age at first calving, calving interval, days open, for number of insemination to conception in first parity and number of insemination to conception in second parity onward were estimated to be 0.07±0.06, -0.56±0.5, -0.02±0.06, 0.0015±0.001 and 0.0005±0.005, respectively.

Key word: phenotype and genetic trends, age in first calving, days open, calving interval, number of insemination to conception

INTRODUCTION

Profitability of dairy herds strongly depends on reproductive performance. Reproductive efficiency of a cow is measure by factors such as age at first calving, calving interval, days open and number of services per conception (Nilforooshan et al 2004). Age at first calving includes the period that a cow needs to reach maturity and to reproduce for the first time, calving intervals reflect the periods that a cow

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reproduces again (Hare et al 2006). Days open is calving interval to pregnancy again. Most breeding programs give more weight to yield and type traits than the reproductive performance in selection idices. Use of these programs has cased genetic improvements in yield and depresses in reproductive traits (Faraji-Arough et al 2011). Estimating genetic and phonotypic trends in a population allow the assessment of the effectiveness of the selection procedure and gives the opportunity for monitoring management conditions. It also supplies the animal breeder with essential information to develop more successful programs in the future. Reproductive traits heritability range between 0.03 and 0.05. lower heritability is partly affected by the existence of a very important environmental influence on these triats (gawnwan et al 2011). Genetic analysis for age at first calving, calving interval, days open and number of insemination to conception is studied in different countries. Nilforooshan et al (2004) reported that mean age at first calving for Iranian Holstens was 26 months. Means days open for US Holsteion cow was 113 days. (Oseni et al 2004). Heritability estimates for days open in Ethiopian Boran cattle and their crosses with Holstein Friesian in central Ethiopia 0.047 and 0.1, respectively, by Hali et al. (2009). Deljoo Isaloo et al (2012) analysd over 10891 records collected from 23 years (1988 to 2010) by animal breeding center Iran. Hertability estimates for age at first calving, calving interval, open days and number of insemination to conception for Iranian Holstein cows were 0.016, 0.051, 0.023 and 0.01, genetic trends were -0.004, -0.04, -0.002 and 0.0001and phonotypic trends were -0.08, -0.04, 0.006 and 0.0001, respectively. The objectives of this study was to estimate the heritability, genetic and phonotypic trend for age at first calving, calving interval, days open and number of insemination to conception in Iranian Holsteins in the Isfahan province.

MATERIAL AND METHODS

Data, for this study, data were provided by the Animal Breeding Center of the Ministry of Agriculture in the Isfahan Province. The reproduction traits were age at first calving (AFC), calving interval (CI), days open (DO) and number of insemination to conception (INS). The original set had a total of 167793 record calved between 1986 and 2012 in 62 herds. Data editing was based on Deljoo Isaloo et al (2012) and shirmoradi et al (2010). AFC was required to be between 19 and 39 mo, and DO (data of pregnancy-data of calving) ranged from 30 to 200 d. If INS was greater than 10, then INS was assigned to 10, and CI(data of current calving-data of previous calving) was required to between 300 and 700 d. Descriptive statistics for the edited data set used for analysis are shown in Table 1. Calving difficulty (dystocia) was defined as 1 (no problem), 2 (slight problem), 3 (needed assistance), 4 (considerable force) and 5 (extreme difficulty).

Table 1. Descriptive statistics (number of records, mean, min, max and standard deviation(SD)) for the edited data set used for analysis.

trait	No of recored	Mean	Min	Max	SD
AFC	46768	763.53	572	1170	75.14
CI	65252	406.65	300	700	80.96
OD	69154	109.22	30	200	54.02
INS 1	66213	1.71	1	10	1.15
INS 2	101579	2.7	1	10	1.68

age at first calving (AFC), calving interval (CI), days open (DO), number of insemination in first parity (INS1) and number of insemination in second parity onward (INS 2).

Statistical analysis, The following statical model was applied to estimate genetic parameters:

$y_{ijk} = \mu + b(A_{ijk} - A) + B_i + a_j + e_{ijk}$ (for age at first calving)

$y_{ijklmn} = \mu + b(DFS_{ijklmn} - DFS) + P_i + CD_j + INS_k + a_l + pe_m + e_{ijklmn}$ (for calving interval)

$y_{ijklm} = \mu + P_i + CD_j + a_k + pe_l + e_{ijklm}$ (for days open)

$y_{ijklm} = \mu + HYS_i + p_i + M_j + a_k + pe_l + e_{ijklm}$ (for number of insemination)

Where

μ = overall population mean, A_{ijk} = pregnancy day,

B_i = Herd-year-season of birth, DFSijklmn = days from calving to first insemination,

Pi= Parity, CDj= calving difficulties,

INSk= number of insemination to conception, HYSi= Herd-year-season of calving,

Mj= season of insemination to pregnancy aj, al, ak= random additive genetic effects,

pem, pel= permanent environmental effect eijk, eijklmn, eijklm= random residual effects.

DMU software AIREML method (Jenson and Madsen 2005) was used to fit the linear mixed model based on Residual Maximum Likelihood (REML) and breeding values were estimated by best unbiased prediction (BLUP) procedure. Yearly genetic changes of cows EBVs for AFC. CI, DO and INS were computed to study genetic trend between 1986 and 2012 .Genetic and phonotypic trends were computed as a linear regression of yearly means on year birth the REG procedure of the Statistical Analysis System (SAS 9.1).

RESULTS AND DISCUSSION

Table 1 present the structure and descriptive statistics of traits used in the analyse. Mean of age at first calving was 763.53 days. This mean is less than the mean of AFC in Brown Swiss cow in the tropics of Mexico(937.6) (Estrada-Leon et al 2008) but these results agree with results of Iranian Holstein (Faraji-Arough et al 2011 and Deljoo Isaloo et al 2012). Mean of calving interval was 406.65 days. Estrada-Leon et al(2008), Hammoud et al (2010), Shirmoradi et al (2010), Ghiasi et al (2011) and Gunawan et al (2011) reported mean of calving interval in Brown Swiss(453.9), Friesian cow (403.1), Iranian Holstens(368.5), Iranian Holstens (393.8) Bali Cattle (360.9), respectively. Mean days open of this population 109.22 days. This mean is less than the mean of DO in Friesian cow(130.7) (Hammoud et al 2010) and agree with results of Iranian Holstein(Ghiasi et al 2011 and Deljoo Isaloo et al 2012). Number of insemination to conception is another widely used index of fertility. Mean of number of insemination to conception in first parity and number of insemination to conception in second parity onward were 1.7 and 2.7, respectively. This resulet similar with results of Japanese Black cows (Nishida et al 2006).

Estimates of variance components and heritability shown in table 2. Estimates of additive genetic variance were less than residual variance. The residual variance effects consist of a large proportion of the total variation in AFC, CI, DO and INS. Therefore estimates for heritability for these traits were low. Heritability estimated for AFC, CI, DO and INS were estimated to be 0.19±0.007, 0.06±0.005, 0.041±0.004 and 0.071±0.004, respectively. These estimates in agreement whith the results obtained by(Faraji-Arough et al 2011 for AFC), (Mostert et al 2010 for CI),(Nishida et al 2006 for INS) and (Haile et al 2009 for DO). Deljoo Isaloo et al. (2012) reported lower heritability for AFC, CI, DO and INS in Holstein cows. These estimates in lager whith the results obtained by Estrada-Leon et al(2008), Gunawan et al (2011) and Ghiasi et al (2011). Comparison two models(linear and poisson models) for estimates heritability of INS in Iranian Holstein cows, the linear model performed better than the poisson model according to goodness of fit statistics, but these two models showed the same predictive ability(Abdollahi-Arpanahi et al 2013). Different values for heritability in this study could be due to several factor such as: breed of animal, management system, environmental factors, size of structure of data, model of analyses and statistical methods employed. Low estimates of heritability for reproductive traits indicated that these traits might be geatly influenced by environmental conditions. Therefore, improvements in nutrition and reproductive management would likely have a larger impact on reducing AFC, CI, DO and INS than the genetic selection (Faraji-Arough et al 2011).

Table 2. Variance components and heritability estimates (SE) for reproduction traits

Trait	V_A (SE)	V_R (SE)	V_{Pe} (SE)	h^2(SE)
AFC	782.981 ± 33. 6	3256.77 ± 33.02	_	0.19 ± 0 .007
CI	144.575 ± 12. 3	1995.69 ± 16.37	84.817 ± 15.437	0.06 ± 0.005
DO	121.368 ± 12.24	2643 ± 19.49	140.753 ± 17.26	0.041 ± 0.004
INS	0.139 ± 0. 245	1.694 ± 0.226	0.1163 ± 0.24	0.071 ± 0.004

V_A= Additive genetic variance; V_R= Residual variance; V_{Pe}= Permanent environmental variance, h^2=Heritability

Table 3. Genetic trend and phonotype trend for reproduction traits

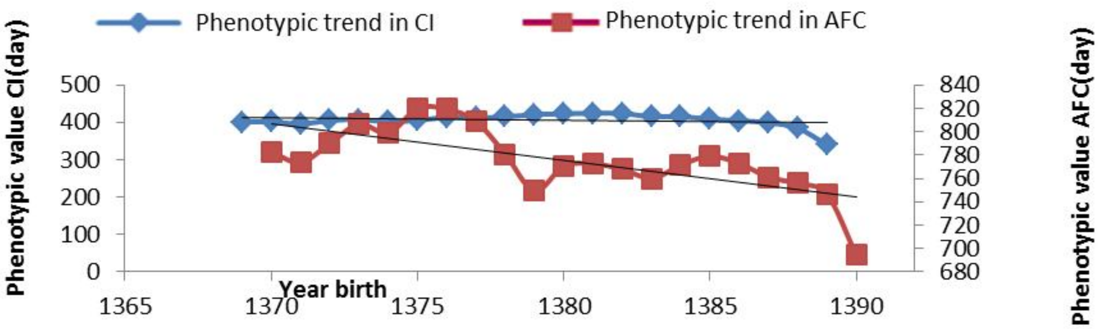
Traits	Genetic trend(SD)	phonotype trend(SD)
AFC	0.07 ± 0.06^{ns}	$-3.48 \pm 1.08^{**}$
CI	$-0.56 \pm 0.5^{**}$	-0.41 ± 0.5^{ns}
DO	-0.02 ± 0.06^{ns}	-0.42 ± 0.2^{ns}
INS 1	0.0015 ± 0.001^{ns}	$0.013 \pm 0.0025^{**}$
INS 2	0.0005 ± 0.005^{ns}	$0.031 \pm 0.01^{**}$

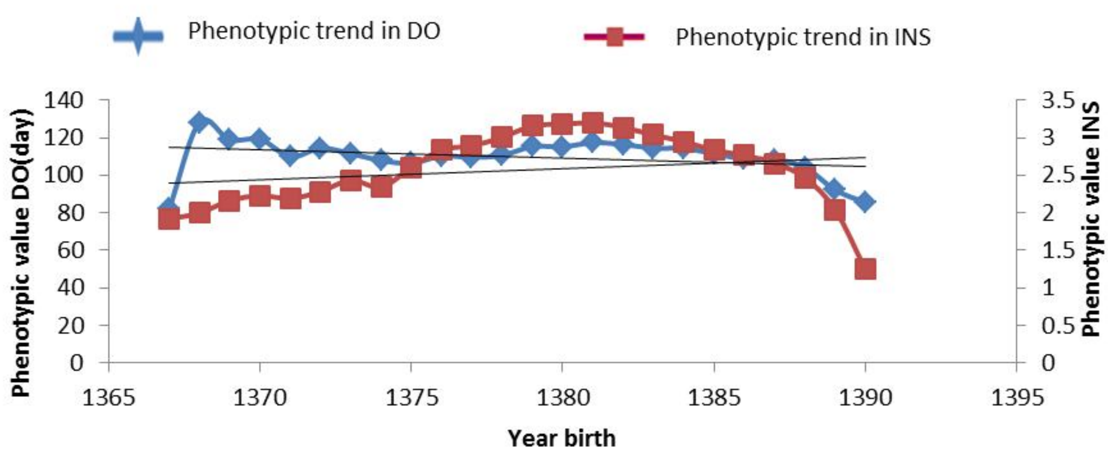
ns= No significantly different from zero. ** Significant(p<0.01), SD: Standard Deviation

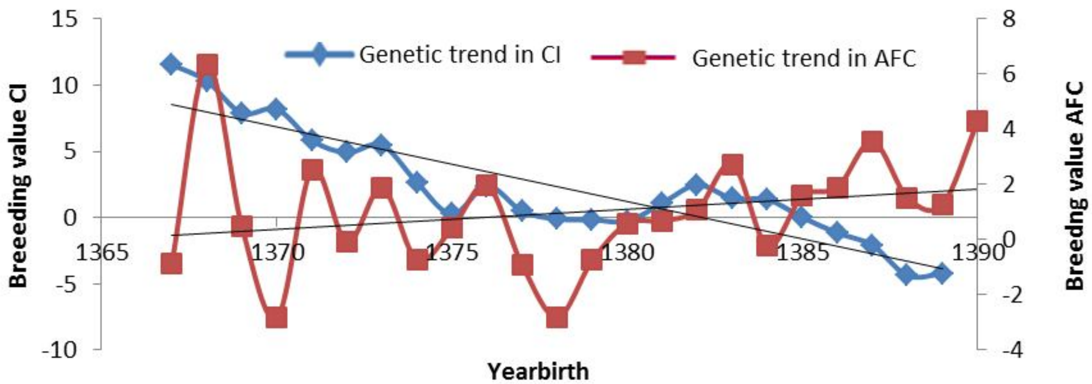
The phenotypic and genetic trend for reproductive traits included AFC, CI, DO and INS between 1986 and 2012 are shown in figure 1, 2, 3 and 4, respectively. The AFC, phonotypic levels were increased from 1996 to 1999 and decreasing phonotypic levels from 1999 to 2012.Decreasing the levels could be due to the selection for low age at first calving. Faraji-Arough et al (2011) reported that age at first calving decreased from 877 days in 1985 to 800 days in 1987for Iranian Holsteins. Reductions in age at first calving were also found in Bali cattle (Gunawan et al 2011) and Iranian Holsteins (Deljoo Isaloo et al. 2012). The phonotypic trend of CI and DO, increased from 1996 to 2003(for CI) and 1986 to 1989, 1997 to 2006 (for DO) and decreasing phonotypic trend from 2003 to 2012(for CI) and 2006 to 2012 (for DO), These trends show that CI and DO in Iranian Holstein is improving. Ansari-Lari et al., (2009) reported in Iranian Holstein in Fars provice decreased from 435 days in 2000 to 389 days in 2005 and decreasing trend for days open in Iranian Holstein was reported by Deljoo Isaloo et al (2012). Genetic trend for AFC, CI, DO and INS have irregular trends some years positive and some years negative.Linear regression coefficient of yearly means of breeding value and phonotypic value for AFC, CI, DO and INS are showed in table 3.Regression coefficient for EBV and phonotypic trend was negative for all trait (excpt for phonotypic and genetic trendof INS1 and INS2 and genetic trend of AFC). Genetic trend for CI and phonotypic trend for AFC, INS1 and INS2 were significant (p<0.01). However, they were not significant for other traits (p<0.05).A possible cause of this undesirable trend is intense selection to increase daily gain giving much attention on fertility. The low degree of genetic progress for the reproductive traits can be explained mainly by two factors. First, in this selectin program, the greater emphasis was on the performance traits rather than on the reproductive traits. Second, these traits generally have a low heritability and this may slow down genetic progress.

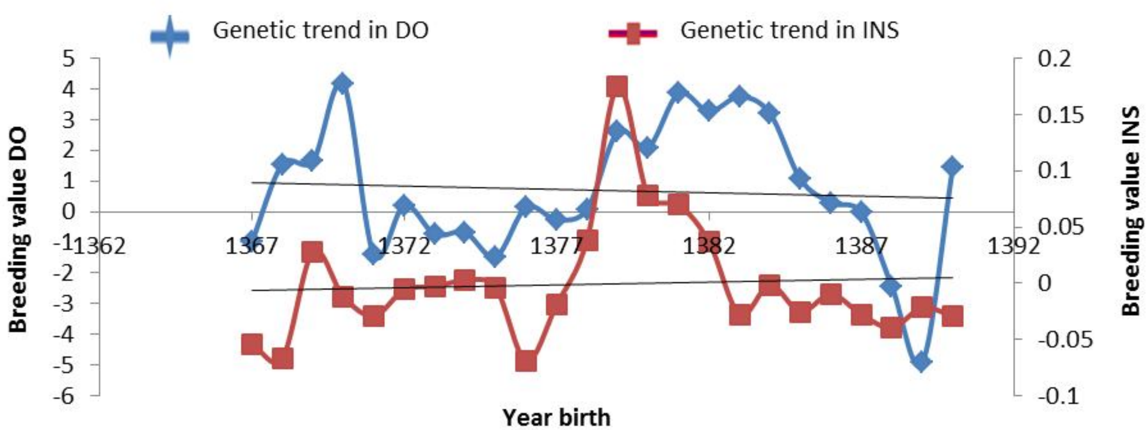
CONCLUSION

Estimated heritability of reproductive traits included AFC, CI, DO and INS were very low. The low heritability for these traits suggested that their genetic improvement would be slow. For improving these traits, improvements in nutrition and reproductive management could be useful. The trend for these traits (excpt for phonotypic and genetic trend of INS1 and INS2 and genetic trend of AFC) were negative .This could be attributed, partly to better management and improvement in nutrition during this period and also to the fact that large genetic trend for milk which has been observed in countries with decreasing reproductive performance has not occurred in Isfahan Holstein Cows.









REFERENCES

- Abdollahi-Arpanahi, F., H. Aliloo, H. Ghiasi and J. I. Urioste. 2013. Comparison of poisson ,probit and linear models for genetic analysis of number of inseminations to conception and success at first insemination in Iranian Holstein cows. J. Anim. Sci.153: 20-26.
- Ansari- Lari, M., M. Rezagholi and M. Reiszadeh. 2009. Trends in calving age and calving intervals for Iranian Holstain in Fars province, Southern Iran. Trop. Anim. Health.Prod. 41: 1283-1288.
- Deljoo-Isaloo, H. A and M. Pasha-Eskandari-Nasab. 2012. The estimationngenetic and environmental parameters and genetic and phenotype and genetic trend strad for reproduction traits of Holstein cows was Khoramdare Culture Technology. J. Anim. Sci. 92: 52-58.

- Estrada- Leon, R. J., J. G. Magana and J. C. Segura Correa. 2008. Genetic parameter for reproductive trait of Brown Swiss cow in the tropice of Mexico. J. Anim. Vet. Adv. 7:124-129.
- Faraji-Arough, H., A. A. Aslaminjad and H. Farhangfar. 2011. Estimation of genetic parameter and trends for age at first calving and calving interval in Iranian Holstein cows. J. Agri. Sci. 7: 79-87
- Ghavi Hossein-Zade, N. 2011. Estimation of genetic and phenotypic relationships between age at first calving and productive performance in Irainan Holstens. Trop. Anim.Health. Prod. 43:1-7.
- Gunawan, A., R. Sari, Y. Parwoto and M. J. Uddin. 2011. Non genetic factors effect on reproductive performance and preweaningmortality from artificially and naturally breed of Bali cattle J. Indonesian. Trop. Anim. Agric. 36:1-8.
- Hammoud, M. A., S. Z. EI-Zarkouny and E. Z. M. Oudah. 2010. Effect of sire, age at first calving, season and year of calving and parity on reproductive performance of Friesian cows under semiarid conditions in Egypt. Anim.Proc. 60-82.
- Haile, A., B. K. Joshi, W. Ayalew, A. Tegegne and A. Singh. 2009. Genetic evaluation of Ethiopian Boran cattle and theircrosses with Holstein Friesian in central Ethiopia: reproductive traits. J. Agric. Scie. 147: 81–89.
- Hare, E., H. D. Norman and J. R. Wright. 2006. Trend in calving ages and calving intervals for dairy cattel breed in the United States. J. Dairy. Sci. 89:365-370.
- Jensen, J. and P. Madsen. 2005. Calculation of standard errors of estimates ofgenetic parameters in DMU. Danish Institute of Agricultural Sciences, Tjele, Denmark.
- Mostert, R. B., R. R. Van der Westhuizen and H. E. Theron. 2010. Calving interval genetic parameters and trends for dairy breeds in South Africa.J. Anim. Sci. 40:156-162.
- Nilforooshan, M. A and M. A. Edriss. 2004. Effect of age at first calving on some productive and longevity traitsnin Iranian Holsteins of the Isfahan Province. Anim. Dariy. Sci. 87: 2130-2135.
- Nishida, A., M. A. Aziz, S. Nishida and K. Suzuki. 2006. Modelling number of services Per conception of Japanese Black cattle by random regression. J. Anim. Breed. Genet. 123: 56-63.
- Oseni, S., S. Tsuruta, I. Misztal and R. Rekaya. 2004. Genetic parameters for days open and pregnancy rates in US Holsteins using different editing criteria. J. Dairy. Sci. 87: 4327-4333.
- Shirmoradi, Z., A. R. Salehi, R. Pahlavan and M. R. Mollasalehi. 2010. Genetic parameters and Trend of production and reproduction traits in Iranian Holstein cattle. J. Anim.Procd. 12: 21-28.