# GENETIC ANALYSIS OF FEMALE FERTILITY HEALTH TRAITS IN KARAN FRIES (HOLSTEIN CROSSBRED) COWS*

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## ABSTRACT

A total of 2972 parity records on 977 Karan Fries (Holstein crossbred) cows were analyzed to assess the influence of genetic and non-genetic factors on indicators for fertility health traits. The proportion of overall incidence was estimated as 0.05 for repeat breeding and 0.20 for anestrus. The period and parity of calving had significant effect (P<0.01) on health indicator traits, while season and genetic group showed non-significant effect. The heritability was estimated as 0.26 for repeat breeding and 0.53 for anestrus in primiparous; 0.07 for repeat breeding and 0.19 for anestrus in pluriparous cows. The values of rank correlations among ranks of sires based on breeding value for repeat breeding and anestrus were found to be negative and high (P<0.001) for production traits and positive and moderate (P<0.05) for reproduction traits except for first dry period (FDP).

**Key words:** Heritability, Anoestrous, Repeat breeding, Primiparous, Pluriparous

## INTRODUCTION

The ultimate aim of dairy farming is to maximize the profitability by increasing production and reducing the cost of production. Production and fertility traits are equally important. Impaired fertility reduces the economic efficiency and increases the cost of production in dairy farms. Infertility is the major cause of culling in crossbred herd, accounting for 37 % of all cows culled. If the involuntary culling is reduced, more cows would reach to their productive peak *i.e* fourth to fifth lactation. In Scandinavia, female fertility traits are included as breeding objectives in breeding programmes to counter the deterioration in fertility due to selection for high milk production. Inclusion of fertility traits in breeding programmes in India has been limited due to lack of sufficiently reliable data. The complexity of fertility leads to problems in defining suitable measures of female fertility. Fertility measures that are calculated from insemination data fall into two major categories : interval traits and fertility scores. The aims of this study were to estimate the genetic parameters and breeding value of sires for female fertility traits in primiparous and pluriparous cows.

## MATERIALS AND METHODS

Data on fertility problems were collected from 2972 parity of 977 Karan Fries cows during the period of 1996-2008 from treatment register maintained at National Dairy Research Institute, Karnal. Female fertility traits were scored as all-or-none traits (*i.e.* if a cow had the problem of repeat breeding or anestrus, it was given a score of 1; otherwise a score of 0). Incidences of repeat breeding and anestrus were used as indicator traits for fertility health. The disease records were analyzed lactation-wise. Incidence of indicator traits was measured in terms of proportion (Woodward, 1999). The influence of season, period, parity and genetic group of calving on indicator traits of fertility health were studied by Chi square analysis (Snedecor and Cochran, 1994). Data were analyzed to estimate the heritability of indicator traits, based on one-way classification model

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with two random sources of variability i.e., "among " and "within" families as suggested by Robertson and Lerner (1949) for binary traits and discussed by Gianola (1982).

$$h^2 = \frac{\frac{SSF}{\pi(1-\pi)} - (s-1)}{r(k-s+1)}$$

Where,

SSF = Corrected sum of square due to families

$\pi$ = Incidence of character in general population

s = No. of families (sires)

r = Additive relationship between family members

k = $\Sigma n_i - \Sigma n_i^2 / \Sigma n_i$

$n_i$ = No. of individual in the $i^{th}$ family

The standard error of heritability was estimated by the formula suggested by Gianola (1982).

$$SE\ of\ h^2 = \sqrt{\frac{2(s-1)}{r^2(k-s+1)^2}}$$

Where,

s = No. of families (sires)

r = Additive relationship between family members

k = $\Sigma n_i - \Sigma n_i^2 / \Sigma n_{i3}$

Breeding value of sires was estimated for indicator of fertility health traits as suggested by Gianola (1982)

$$a = \frac{h^2 e^{\frac{-t^2}{2}}}{\sqrt{2\pi}\sigma_y^2}(y - \bar{y})$$

Where,

y = A score of $i^{th}$ sire in the response

$\bar{y}$ = Mean of y

$\sigma^2_y$ = Variance of y

t = Threshold point of response

The sires were also evaluated for first lactation production (total milk yield, 305 days milk yield and lactation length) and reproduction efficiency traits (calving interval, service period and dry period) by estimating the breeding value from the regression of sire's breeding value on daughter's average (Pirchner,1969). The sires were ranked in desirable order on the basis of breeding value for milk production as well as for health traits. The correlation between rankings of sires based on various traits was calculated as Spearman's rank correlation coefficient (Steel and Torrie,1960).

## RESULTS AND DISCUSSION

The results showed the overall proportion of incidence as 0.05 for repeat breeding and 0.20 for anestrus. The incidence of repeat breeding and anestrus was lowest in the winter season calvers as compared to others. It was 0.04 for repeat breeding and 0.18 for anestrus in winter of season. Incidence of repeat breeding increased over the periods. The incidence of anestrus was found to be highest (0.29) during the period of 2000-03 and lowest (0.13) during the 1996-99. The period of calving had highly significant ($P<0.01$) effect on repeat breeding and anoestrous. Repeat breeding showed an increasing trend whereas anestrus showed decreasing trend over the parities. Lower estimates of incidence were observed in primiparous cows for anestrus (0.13) and in pluriparous cows for repeat breeding (0.02-0.05). Subjecting the data to statistical analysis, the results revealed that season and genetic group had no significant effect on incidence of fertility disorders. However, significant effect of parity and period was observed on incidence of fertility disorders.

Perusal of literature revealed that incidence of repeat breeding ranged from 0.07 to 0.28 in crossbreds (Kulkarni *et al.*, 2002 ;Selvaraj *et al.*, 2003 and

Balasundaram, 2008 ). Similar to significant influence of parity and period of calving in the present findings, significant difference and increasing trend over the parities were observed for anestrus in Friesian × Hariana cows by Sharma and Luktuke (1983). The reason of higher incidence of anestrus in later parities in comparison to first parity might be negative energy balance due to increase of milk yield with the increase in parity order. The variations in incidence of fertility disorders over the period may not only be caused by inter annual random changes of the climatic factors but may also include management changes. The nutrition not commensurate with the higher nutrients requirement of high milk producing cows suppresses fertility. Hence, providing the balanced nutrition could facilitate in further enhancing the fertility of cows.

The heritability for fertility health traits have been estimated in the herd of Karan Fries Cows. The estimates were 0.26 ± 0.09 for repeat breeding and 0.53 ±0.47 for anoestrous in primiparous; and 0.07±0.04 for repeat breeding and 0.19±0.03 for anestrus in pluriparous cows. Similarly, estimate of heritability of fertility measures was found to be low usually below 0.05 in Holstein Friesian breed (Philipsson and Lindhe, 2003). Kadermideen *et al*. (2000) estimated the heritability for fertility trait (conception to first service) in Holstein cows. The estimate of heritability was 0.010 ±0.004 by linear model and 0.012±0.005 by threshold model.

Breeding values of sires were estimated for health, reproduction and production traits of Karan Fries. The rank correlations of breeding values of sires for repeat breeding and first lactation production and reproduction traits were estimated as -0.53, -0.46, -0.48, 0.29, 0.23 and 0.30 in primiparous cows and -0.63, -0.58, -0.54, 0.31, 0.31, and 0.04 in pluriparous cows with first lactation length (FLL) , first lactation milk yield FLMY, first lactation 305 days milk yield (F305DMY), first calving interval (FCI), first service period (FSP) and first dry period (FDP), respectively. The values of rank correlations were found to be high and negative ($P<0.001$) for production traits and moderate and positive for reproduction traits except for FDP. High and negative estimates of rank correlation were observed among the breeding value of sires for fertility health traits against anestrus and first parity production traits. The estimates of fertility health against anestrus were -0.37,-0.50.-0.48, 0.30, 0.20, and 0.13 in primiparous and -0.73,-0.82.-0.85, 0.08, 0.08, and -0.06 in pluriparous for FLL, FLMY, F305DMY, FCI, FSP and FDP, respectively.

It could be inferred from the result that sires breeding value for fertility health traits showed unfavorable association with FLL, FLMY and F305DMY and positive association with FCI and FSP in primiparous cows. The heritability for fertility disorders was low to medium in primiparous and pluriparous cows. However, a high estimate of heritability was observed for anoestrous in primiparous cows but it did not differ significantly from zero because the estimate was associated with high sampling error. The low heritability of repeat breeding may partly be due to the large influence of management practices and also that some traits may be a combinations of sub-traits with different physiological expressions. Fertility health traits showed unfavorable association with production traits and favorable association with reproductive efficiency traits in primiparous cows.

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