Indian J. Anim. Res., 34(1): 24-28, 2000

VARIABILITY IN SEX RATIO IN KARAN SWISS CATTLE

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ABSTRACT

Based on 4440 calving records, the frequency of male births (sex-ratio) was observed to be 0.516 which was significantly higher than that of the female births. However, the frequency of male births did not differ significantly among different genetic groups, period, season and parity of calving. The frequency of male births among the progeny of different sires did not differ significantly. The heritability and repeatability estimates were found to be very low.

INTRODUCTION

The female sex is the most important determining factors of the birth rate of a population because the females become incapable of reproduction after a certain age particularly in humans and females also produce fewer off spring than males particularly in farm animals. In most of the species the number of births to a female of a given age is independent of the number and age structure of male population. It is the female which produces milk and lays eggs for human consumption and hence the birth of more females is more economical in dairy animals. A number of conflicting reports are available in literature regarding the variation in the frequency of male and female births in relation to different genetic and non-genetic factors. However, the informations are limited on crossbred cattle particularly on the aspect of the estimates of genetic parameters of sex ratio. Therefore, this study was planned to study the sex ratio in Karan Swiss strain of crossbred cattle in relation to non-genetic factors and to estimate the genetic parameters.

MATERIAL AND METHODS

A total of 4440 births of 1399 Karan Swiss cows born and maintained at N.D.R.I., Karnal were analysed. These cows were of 5 different genetic groups having Brown Swiss inheritance as 25, 50, 62.5, 75 per cent and the last group have 75% exotic inheritance of two exotic breeds, viz., Brown Swiss and Holstein-Friesian.The data on calving records were spread over a period of 26 years (1963-1988) which was divided into 5 periods. Each year was further divided into four seasons, viz., winter (December-March), summer (April-June), Rainy (July-September) and autumn (October-November).

The data were subjected to least squares analysis without interaction to study the effect of level of exotic inheritance, period, season and order of lactation on the frequency of male births. The sex-ratio was taken as the percentage of male calves born to the total normal calves born. The genetic analysis was conducted to estimate the heritability of sex ratio on 3881 normal calves sired by 58 sires. The heritability was estimated from paternal half-sib correlation method. The repeatability of sex-ratio was worked out by two methods viz. Regression of sex-ratio in second gestation on that of the sex-ratio in first lactation, and from intra-cow correlation method based on all normal births of a cow.

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RESULTS AND DISCUSSION

The overall sex ratio (frequency of male calves) among normal calves in this herd was 51.6 per cent (Table 1). The chi-square test indicated that the frequency of male births was significantly higher than that of the female births. Significantly higher frequency of male births have also been reported by Kaushik and Singhal (1982) among calves born to Jersey x Hariana F1 cows mated to Holstein sires and by Tomar and Verma (1988) for the calves born to Tharparkar cows mated to Holstein and Jersey sires. On the other hand, Tomar and Arora (1970), Tomar *et al.*, (1976), Sethi and Rao (1981), Singh and Parekh (1982), Patel *et al.*, (1988), Tomar and Verma (1988) and Arun *et al.*, (1992) could not observe any significant deviation in sex ratio from normal expectation.

The percentage of male births varied from 48.7 among the calves born to cows of 3 breed crosses having 75% exotic inheritance to 53.7 among those born to cows with less than 50% Brown Swiss inheritance (Table 1). The frequency of male births did not differ among the calves born to cows of different grades. However, the sex ratio was found to be significantly higher (52.2%) among the calves born to cows having 50% exotic inheritance. Tomar and Verma (1988a) and Arun *et al.* (1992) reported that sex ratio was not significantly different among the calves born to cows of different grades. The sex ratio in favour of male births was observed among the calves born during first (56.3%) and last period (53.4%) (Table 1). However, the differences were significant only for the sex ratio obtained in last period. The frequency of male births among different periods, however, did not differ significantly. These results are similar to those of Tomar and Verma (1998) who reported that sex ratio was significantly higher during certain years but the percentage of male births among years did not differ significantly. The year of calving was not a significant source of variation in sex ratio as reported by Singh and Parekh (1982), Patel *et al.*, (1988a), Tomar and Verma (1988) and Singh *et al.*, (1991) for the calves born to crossbred cows. On the other hand, significant effect of year of calving on sex ratio has been reported by Lathwal *et al.*, (1993) in Red Sindhi cows and Arun *et al.*, (1992) for Holstein x Sahiwal cows.

The sex ratio varied from 50.2% to 53.1% in different seasons (Table 1). However, the seasons of birth or calving had no effect on the sex ratio in this herd. This supported the findings of Tomar *et al.*, (1976), Lathwal *et al.*, (1993) for the calves born to Zebu breeds, Singh and Parekh (1982), Patel *et al.*, (1988), Tomar and Verma (1988a), Singh *et al.*, (1991) and Arun *et al.*, (1992) for the calves born to crossbred cows. On the other hand, significant effect of season of calving on the sex ratio have been reported by Tomar and Arora (1970), Sethi and Rao (1981) and Tomar and Verma (1988b).

The percentage of male births varied from 48.9 to 57.3 among different parity of lactation (Table 1). However, neither the sex ratio within any parity nor the frequency of male births among the parities differ significantly. Similarly, no effect of parity of calving on sex-ratio have been observed by Tomar and Arora (1970), Tomar *et al.*, (1976), Sethi and Rao (1981), Singh *et al.*, (1991), Arun *et al.*, (1992) and Lathwal *et al.*, (1993). On the other hand, Tomar and Verma (1988a,b) reported that sex ratio differed significantly within certain parity but among parity the differences were non-significant.

Table 1. Average sex ratio among calves born to different genetic groups in relation to various non-genetic factors

fect	Normal births	Male births No.	%	Female births	X^2 (Sex ratio)	Effect	Normal births	Male births No.	%	Female births	X^2 (Sex ratio)
verall	4440	2292	51.6	2148	4.67*	**Seasons**					
enetic Groups						Winter	1902	955	50.2	947	0.03
						Summer	1006	525	52.2	481	1.92
) <50% B	95	51	53.7	44	0.52	Rainy	990	524	52.9	466	3.39
) 50% B	2982	1556	52.2	1426	5.66*	Autumn	542	288	53.1	254	2.13
) 62.5% B	532	278	52.2	254	1.08	**Parity**					
) 75% B	353	174	49.3	179	0.07	1	1439	721	50.1	718	0.006
) 75% H,B	478	233	48.7	249	3.01	2	979	493	50.3	486	0.05
						3	573	307	53.6	266	2.93
eriods						4	387	211	54.5	176	3.16
						5	266	148	55.6	118	3.38
	174	98	56.3	76	2.78	6	211	108	51.2	103	0.11
	915	452	49.4	453	0.13	7	161	80	49.7	81	0.006
	1470	754	51.3	716	0.98	8	137	75	54.7	62	1.23
	1024	530	51.7	494	1.26	9	103	59	57.3	44	2.18
	857	458	53.4	399	4.06*	10	184	90	48.9	94	0.08

= Brown Swiss, H = Holstein Friesian, *P<0.05

The results indicated that the sex-ratio varied from 36.8 to 70.3 per cent among the pregnancy of different sires. Among the progeny of 43 per cent of the total sires the sex ratio ranged within the normal range of 45 to 55 per cent whereas among the progeny of 10.3 per cent sires it was found to be less than 40 per cent and the sex ratio was more than 60 per cent among the progeny of 12 per cent sires. However, the statistical analysis of the date showed that the frequency of male births among the progeny of different sires did not differ significantly. The range in sex ratio among the progeny of different.sires have been reported as 42.2 to 52.2 per cent by Tomar and Arora (1970) in Hariana cows, 41.1 to 72.7 per cent by Tomar *et al.*, (1976), 33.3 to 63.4 per cent by Sethi and Rao (1981) in Sahiwal cows without any significant effect of sire of calf on sex ratio by any of these workers. Similarly no efffect of sire on sex ratio was reported by Tomar and Verma (1988 a,b), Lathwal and Arun (1994). On the other hand, significant effect of sire on sex ratio have been reported by Arun *et al.*, (1993) for crossbred cows bred to Sahiwal sires.

The heritability of sex ratio obtained by paternal half sib method was found to be almost zero (0.002). This low magnitude of heritability indicated that additive genetic variability was not present and hence the sex ratio cannot be changed by genetic manipulation.This supported the findings of Sethi and Rao (1981), Arun *et al.*, (1993) and Lathwal and Arun (1994) who reported that the heritability estimates of sex ratio were below 0.10.

The results of Table 2 showed that the percentage of male births was almost similar (51.11 and 51.13%) in the second parity among the two groups of cows which bore male births and female births in the first parity. The difference between the two percentage of male births in the second parity was almost zero and this difference indicated the repeatability estimate of zero order. The coefficient of association of male births in first two

Table 2. Repeatability estimate and coefficient of association of sex ratio in first two lactations.

Sex of calf in first gestation	Sex of calf in second gestation		Total No. of calves
	Male calves	Females	
Male calves	230 (51.11)	220	450 (48.2)
Females	248 (51.13)	237	485
Total No. of calves	493 (50.46)	484	977

Figures in parentheses are the percentage of male births.

Repeatability = 51.11-51.13 = -0.02 = -0.0002

$$\text{Coef. of association} = \frac{(230 \times 237) - (248 \times 220)}{(230 \times 237) + (248 \times 220)}$$

$$= -0.00045$$

parities was found to be zero (0.004). Further the repeatability of sex ratio based on the data of all parities was also found to be almost zero. Therefore, based on all these results, it was not possible to predict the sex of calf in subsequent parity based on the sex of calf in previous parity. Very low repeatability estimates of sex ratio have also been reported by Sethi and Rao (1981), Arun *et al.*, (1993) and Rawal and Tomar (1995).

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