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Research Article

Effect of Artificial Insemination and Natural Service on Calf Sex Ratio in Dairy Cattle

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Abstract: The objective of this study was to determine the effect of artificial insemination and natural mating on secondary sex ratio. Data consisting of 259 birth records were provided in the analysis. In artificially inseminated cows, 123 births were recorded, of which 56 were females and 67 were males. In cows through natural service, there were 136 calves, in total with 62 females and 74 males. With respect to breed group there were 27 calves (12 females, 15 males) from indigenous, 123 (56 females, 67 males) from Indigenous × Jersey (F_1), 54 (26 females, 28 males) from $F_1 \times F_1$ (F_2) and 55 (24 females, 31 males) from F_1 × Friesian cows. Factors affecting the logic of the probability of a male calf being born were determined using chi square analysis. Type of mating (i.e., natural or artificial insemination) and, breed of service sire did not significantly ($P>0.05$) affected the likelihood of a male calf being born.

Keywords: AI, natural service, calf xex ratio

1. INTRODUCTION

The concern about the determination of secondary sex ratio (SSR) of calves born in dairy cattle is of great concern now a day [1]. The identification of sex ratio with some biotechnological applications; namely, super ovulation, in vitro fertilization, in vitro embryo production, embryo division, and embryo transfer has been of great significance in dairy production [2]. The profitability of milk production may be dependent on increasing female calving ratio [1]. Probability theory indicates that the SSR, the ratio of male to female offspring at birth, should be 50:50 in respect of evolutionary equilibrium [3]. In mammals, SSR of newborn offspring was affected by many factors viz., litter size, maternal age, maternal parity, mother's milk yield, maternal stress, birth type, birth season and time of insemination, inbreeding levels, managerial conditions, and population demography [4]. Besides, body condition scores significantly influenced positively secondary sex ratio [3]. In similar studies, significant effects of breed, sire, season, parity, and year on sex ratio were reported [5, 6]. Additionally, it was stated that a substantial influence of sex hormone levels of dam on sex ratio was determined in the previous study [7] and sex ratio was positively associated with herd size [8]. In Azad Jammu and Kashmir, the rapid genetic improvement of indigenous low productive and non-descript cows is in progress through artificial insemination (AI) but, in recent years, there is concern from local farmers that artificial insemination increases the probability of a male calf in dairy production. The idea that the probability of male calves is being increased by AI in dairy production, has never been scientifically proven or refuted [9]. This is a limiting factor in the application of artificial insemination. Therefore, the objective of the present study was to determine whether artificial insemination or natural mating in dairy cattle affects the sex of the resultant calf.

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2. MATERIALS AND METHODS

The data regarding calf sex ratio of 123 calves obtained as a result of artificial insemination and 136 calves obtained as a result of natural breeding were utilized in the present study.

2.1 Crossbreeding

The different types of crosses and the genotype are in Table 1. In first cross F_1 offspring from crosses between indigenous and Jersey were produced by artificial insemination. In second type of cross F_1 female were crossed with F_1 male by natural breeding, as a result of which $F_1 \times F_1$ (F_2) offspring were produced. In third type of cross the F_1 female were crossed with pure Friesian bull by natural breeding to produce 25 % indigenous + 25 % Jersey + 50 % Friesian offspring. All the cows were maintained at Livestock Development Research Centre (LDRC) Muzaffarabad, Azad Jammu and Kashmir.

2.2 Sex Ratio

The records of normal calving were studied. Sex

Table 1. Type of crosses among different breed group and the genotype of the offspring**.**

Type Of Cross	Genotype of Offspring
Indigenous × Jersey	F_1 (50 % Indigenous + 50 % Jersey)
$F_1 \times F_1$	F_2 (50 % Indigenous + 50 % Jersey)
F_1 × Friesian	25 % Indigenous + 25 % Jersey+ 50 % Friesian

Table 2. Number of female, male calves and their sex ratio in crossbred cows both, inseminated artificially and with natural service**.**

Breeding Method	No. of births	Female	Male	Sex Ratio	$X^2_{(1)}$	P
Artificial Insemination	123	56	67	100♀♀:119.64♂♂	1.019	> 0.2
Natural Service	136	62	74	100♀♀:119.35♂♂	0.743	> 0.2
Total	259	118	141			

Table 3. Number of female, male calves and their sex ratio in indigenous and crossbred dairy cows.

Breed Groups	Number of Births	Female	Male	Sex Ratio	$X^2_{(1)}$	P
Indigenous	27	12	15	100♀♀:125.00♂♂	0.340	> 0.5
Indigenous × Jersey (F_1)	123	56	67	100♀♀:119.64♂♂	1.019	> 0.2
$F_1 \times F_1$ (F_2)	54	26	28	100♀♀:107.69♂♂	0.074	> 0.5
F_1 × Friesian	55	24	31	100♀♀:129.17♂♂	0.445	> 0.5
Total	259	118	141			

ratio was calculated as proportion of males against 100 female (100♀♀: □♂♂).

2.3 Statistical Analysis

The probability of a male calf being born was analysed by chi square test. A threshold significance level was $P < 0.05$.

3. RESULTS

3.1 Effect of Artificial Insemination and Natural Service on Calf Sex Ratio

Sex ratio of calves from artificially inseminated cows and calves obtained as a result of natural service (NS) from crossbred cows is given in Table 2. In artificially inseminated cows, 123 births were recorded, with 56 females and 67 males (100♀♀:125♂♂). Crossbred cows through natural service gave birth to 109 calves, of these 50 were females 59 were males (100♀♀:118♂♂). However, the difference between male and female births did not differ significantly ($P > 0.050$) between two methods of breeding (AI and natural service).

3.2 Effect of Breed Group on Calf Sex Ratio

The numbers of male, female calves and their sex ratio in indigenous and crossbred dairy cows are presented in Table 3. A total of 259 (118 females, 141 males) births were studied, of which 27 (12 females, 15 males) were from indigenous, 123 (56 females, 67 males) from Indigenous × Jersey (F_1), 54 (26 females, 28 males) from $F_1 \times F_1$ (F_2) and 55 (24 females, 31 males) from F_1 × Friesian cows. Sex ratio of calves from indigenous, F_1, F_2 and F_1 × Friesian cows was 100♀♀:125♂♂, 100♀♀:120♂♂, 100♀♀:108♂♂ and 100♀♀:129♂♂ respectively. Chi-square test showed that male and female births were not significantly ($P > 0.050$) different from each other in all the breeds groups.

4. DISCUSSION

In dairy generally, a farmer desires to have more female born in order to increase the profitability of milk production with increasing female calving ratio

There is evidence from Irish farmers that natural breeding increases the probability of a female calf in dairy [9]. Khan et al [10] reported that male births were significantly higher as a result of artificial insemination compared to natural service but in present study no significant gender difference was observed from Indigenous × Jersey (F_1) calves because of artificial insemination. Similarly calves outcome of natural service, between F_2 and F_1 × Friesian crosses, male and female calf's ratio was not significantly different from zero.

The result of the present study are not in agreement with the view of Berry and Cromie [9] who for the very first time quantify the effect of AI versus natural mating on secondary sex ratio in dairy and beef cattle.This may be due to the difference of breed that have been used as foundation breed for crossbreeding and some other factor such as time of insemination.

In this study, there was no significant increase in female calves both in indigenous cows and in crossbred cows. Sex ratio reflected to be a higher proportion of male calves for all types of crosses, but this was not significantly different from zero. Some investigators have also shown that male calves were born in higher number than female calves. Rahman et al [11] found to be insignificant difference of sex ratio of local and crossbred cows calved in different season in Dhaka, Bangladesh. Mukherjee et al [12] observed significantly higher frequency of male births in comparison with that of female births from Karan Swiss cows in India. Significantly higher frequency of male births have also been found by Kaushik and Singhal [14] among calves from Jersey x Hariana (F_l) × Holstein and Thanparker × Jersey (F_1) × Friesian [13].

5. CONCLUSION

In present the study, no association was evident among natural mating, artificial insemination and different breed groups.

6. REFERENCES

1. Yilmaz, E., A. Eyduran & A. Kaygisiz. Determination of some environmental factors related to sex ratio of brown Swiss calves. *Journal of Animal and Plant Science* 20: 164-169 (2010).
2. Kaygisiz, A. & Y. Vanli. Factors influencing sex ratio in Brown Swiss Cattle. *Indian Journal of Animal Science* 78: 656-657(2008).
3. Roche, J.R., J.M. Lee & D.P. Berry. Climatic factors and secondary sex ratio in dairy cows. *Journal of Dairy Science* 89: 3221-3227 (2006).
4. Demiral, O., M. Ün, M. Abay & T. Bekyürek. The effect of artificial insemination timing on the sex ratio of offspring and fertility in dairy cows. *Turkish Journal of Veterinary & Animal Sciences* 31: 21-24 (2007).
5. Singh, B., D. Kumar, H. Singh, R.B. Prasad & J.B. Singh. Genetic studies on sex ratio in dairy cattle. *Indian Journal of Animal Science* 74: 986-988 (2004).
6. Kaygisiz, A.Y., L.Vanli & Cakmak. Estimates of genetic and phenotypic parameters of sex ratio in Holsytein Cattle. GAP III.Agricultural Congress, Şanliurfa, Türkiye (2003).
7. Lari, M.A. Sex ratio at birth in dairy herds in Fars province, southern Iran. *Tropical Animal Health and Production* 38: 593-595 (2006).
8. Farahvash, T.S., G. Adabi, A. Ahmadzadeh & J. Davoodi. Some factors affecting sex ratio of dairy herds in East Azarbijan, Iran. *Asian Journal of Animal and Veterinary Advances* 3: 357-362 (2008).
9. Berry, D.P. & A.R. Cromie. Artificial insemination increases the probability of a male calf in dairy and beef cattle. *Theriogenology* 67:346–352 (2007).
10. Khan, S., M.S. Qureshi, N. Chand, A. Sultan, R.I. Khan, Ihsanullah, A.J. Tanweer, S.M. Sohail, M. Hussain, A. Akhtar & D. Khan. Effect of breeding method on calf sex and postpartum reproductive performance of cattle and buffaloes. *Sarhad Journal of Agriculture* 28: 479-476 (2012).
11. Rahman, M.M., M.N. Islam, S. Faruque & B.K. Roy. Effect of season on the sex ratio and calving frequency of cattle under farm conditions. *Journal of Biological Science* 2: 160-161 (2002).
12. Mukherjee, K., S.S Tomar & R.B. Singh. Variability in sex ratio in Karan Swiss cattle. *Indian Journal of Animal Research*34, 24-28 (2000).
13. Tomar, S.S. & G.S. Verma. Genetic variability in components of replacement in Karan Fries cattle.*Indian Journal of Animal Science*, 58, 1204-1208 (1988).
14. Kaushik, S.N. & R.A. Singhal. Sex ratio in Hariana × exotic cross-breds dairy cattle. *Indian Journal of Animal Science*52: 433-435(1982).