EFFECT OF BREEDING METHOD ON CALF SEX AND POSTPARTUM REPRODUCTIVE PERFORMANCE OF CATTLE AND BUFFALOES


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ABSTRACT

Successful farmers produce almost one calf per animal annually through natural and artificial mating in Pakistan. The Present study investigated the effect of mating method on calf sex and postpartum reproductive performance (PPRP) in crossbred cattle and buffalo. Data on 1591 animals including 795 crossbred cattle and 796 buffaloes were analyzed through SPSS 11. The results revealed overall 55 % male births in the cattle and buffalo population. Among the postpartum reproductive traits buffalo had significantly (P <0.01) higher incidence of assisted births (24 vs 14 %), service periods (40.89 vs 38.75 days) and number of services per conception (1.42 vs 1.21). Breeding method had significant effect on calf sex ratio. Male births were significantly (P <0.01) higher as a result of artificial insemination (59 vs 51 %) as compared to natural service (NS). Among PPRP indicators the incidence of assisted births was significantly (P <0.01) higher (23 vs 15 %) in AI as compared to NS. Similarly the incidence of retained fetal membrane was also higher (P <0.01) in births resulted from AI (10 vs 5 %). Service period (44.25 vs 35.40 days) and number of services per conception (1.43 vs 1.14) were also significantly higher in animals served through AI. Calf sex significantly affected service period and it was prolonged in the animals which gave birth to male calves. Number of services per conception had positive and significant (P <0.01) correlation with possibility of RFM (r = 0.094) and service period (r = 0.088). Present study suggested that buffaloes were more prone to postpartum reproductive problems and AI resulted to high frequency of male births ratio. Post partum reproductive problems were lower as a result of natural mating.

Key Words: Cross Bred Cattle, Buffalo, Calf Sex, Natural Service and AI


INTRODUCTION

In time breeding of animals for the production of milk and offspring is the major concern of dairy farmers. Successful farmers produce almost one calf per animal annually. This target could be achieved through improved breeding practices. Currently natural and artificial mating are the two major methods adopted for breeding of dairy animals in Pakistan. In natural mating simply bull is used for mounting on cow in estrus. This method is very old but still used in the country. In this method high cost of feed and labor are required. Some farmers keep bulls for natural mating to earn money. Artificial Insemination (AI) has been extensively used in the country since last six decades for breeding cattle and buffaloes. The AI network in the country has provided breeding coverage to almost all part of the country. A visible change in the comparative cross bred cattle population may be noted in the composition of national cattle herds, showing an ever increasing ratio of cross bred animals, possessing better productivity potential. However the practices have been associated with various health and productivity problems (Qureshi, 2004).

The ability to alter secondary sex ratio in cattle is financially attractive. In beef cattle, the increased growth rate and more efficient production of lean meat by males (Keane et al 1990) have financial advantages. In contrast, dairy farmers generally seek female dairy breed calves to perpetuate their herd while male beef crossbred animals are desired for the reasons cited above. Furthermore, the requirement for a lower male to female sex ratio (i.e., lower sex ratio) in dairy cattle is augmented when replacement rates are high. Hence, the financial attraction to manipulate sex ratio has lead to increased interest in techniques such as semen sexing and embryo sexing. There is evidence from Irish farmers that natural mating increases the probability of a female calf in dairy herds (Berry and Cromie, 2006). However, this has never been scientifically proven or refuted. Several factors may affect any potential association between mating type and sex ratio. One contributing factor may be the effect of timing of mating on the resultant sex ratio with a higher proportion of female offspring following early insemination (Rorie, 1999); this may result in a lower sex ratio from natural mating which has to
occur during estrus. Nonetheless, other studies in cattle have failed to identify a relationship between timing of service and sex ratio (Rorie, 1999). Another potential contributing factor to an association between mating type and sex ratio is the increased sex ratio from frozen semen compared to fresh semen (Johnson et al., 2000).

Numerous efforts have been made to alter the sex of calves by varying time of insemination (Pursley et al., 1998 and Martinez et al., 2004). It has been suggested that early inseminations (i.e. far before ovulation) would result in more female calves whereas late inseminations (i.e. close to ovulation) would result in more male calves, due to different timing of capacitation and survival time of the X- and Y-chromosome bearing spermatozoa in the female reproductive tract (Martinez et al., 2004). Dairy farmers of far-flung areas in Pakistan are still reluctant to use AI with their concern about the calf sex and problems in postpartum reproductive performance of animals after artificial insemination. Present study was therefore conducted to know the effect of natural and artificial breeding on calf sex birth ratio and to compare postpartum reproductive performance of cattle and buffaloes in births resulting from AI and natural service.

MATERIALS AND METHODS

Study regarding the effect of natural service (NS) and artificial insemination (AI) on calf sex birth ratio and postpartum reproductive performance of dairy cattle and buffaloes was based on the data collected from various state dairy farms of Pakistan. Management practices at these farms were controlled by a central command. All the animals were stall fed and were offered green fodder ad lib while concentrates was provided only to lactating animals @ one kg per three liters of milk irrespective to their production, lactation stage and body weight. Most of these farms had practiced natural mating; however artificial insemination was also initiated in some farms.

Data Collection

Total 1591 history sheets of 795 crossbred cattle and 796 buffaloes were utilized to collect the following information:

i. Animal Number
ii. Date of estrus
iii. Insemination date
iv. Method of mating: AI was coded as “1” while NS as “2”
v. Gestation length (days)
vi. Calf sex birth ratio: Male was coded as “1” while female as “2”
vii. Birth Assistance: zero , assistance or normal birth was coded “1” , Dystochia “2” , still birth “3” and abortion “4”
viii. Fetal membrane (FM) : FM expelled with in 8hrs and 9-16hrs was coded as “1” and “2” respectively
ix. Service period (days) : service period was divided in 4 categories as following , < 60 =1 ; 61- 90=2 ; 91- 120=3 and >120= 4
x. Number of services per conception

The data collected was stored in the MS Excel Programme and was analyzed for the results.

Statistical Analysis

The effect of species and breeding method on calf sex ratio and post partum reproductive performance was worked out through ANOVA procedure of Steel and Torrie (1982). Means were compared through Dunken multiple range test. Correlation among various parameters was determined through Pearson correlation. Computer software SPSS II was used to perform the above analysis.

RESULTS AND DISCUSSION

Effect of Species on Calf Sex and PPRP

Present study reports overall 55% male births in the cattle and buffalo population. Both the species had statistically similar male calf ratios. Among the postpartum reproductive traits buffalo had significantly higher incidence of assisted births (24 vs 14 %), service periods (40.89 vs 38.75 days) and number of services per conception (1.42 vs 1.21). Incidence of retained fetal membrane though numerically remained higher in buffaloes however, statistically there was no significant difference between the two species (Table I). This indicated that comparative to the cross bred cattle buffaloes are facing more postpartum reproductive problems. Physiological differences between the two species and better selection of cattle for reproductive traits could be the responsible factors.
Effect of Breeding Method on Calf Sex and PPRP

Breeding method had significant effect on calf sex. Male births were significantly higher as a result of AI (59 vs 51 %) as compared to natural service. Present results support the concern of local farmers about the high incidence of male births with artificial insemination. Among PPRP indicators the incidence of assisted births was significantly higher (23 vs 15 %) in AI as compared to NS. Similarly the incidence of RFM was also higher in births due to AI (10 vs 5 %). Service period (44.25 vs 35.40 days) and number of services per conception (1.43 vs 1.14) were also significantly higher in AI as compared to NS (Table II). This indicated that the post partum reproductive problems were maximum in AI. Problems in heat detection, wrong time of insemination, poor semen quality and lack of technical skill in performing of AI could be the possible causes.

Table I  Mean Comparison showing the effect of species on calf sex ratio and postpartum reproductive performance

<table>
<thead>
<tr>
<th>Species</th>
<th>Assisted birth (%)</th>
<th>Male birth ratio (%)</th>
<th>Retained placenta (%)</th>
<th>Service period (Days)</th>
<th>No of services per conception</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffalo</td>
<td>24</td>
<td>57</td>
<td>8</td>
<td>40.89</td>
<td>1.42</td>
</tr>
<tr>
<td>Cattle</td>
<td>14</td>
<td>54</td>
<td>6</td>
<td>38.75</td>
<td>1.21</td>
</tr>
<tr>
<td>Overall</td>
<td>19</td>
<td>55</td>
<td>7</td>
<td>39.82</td>
<td>1.31</td>
</tr>
<tr>
<td>Sig.</td>
<td>P &lt;0.05</td>
<td>NS</td>
<td>NS</td>
<td>P &lt;0.05</td>
<td>P &lt;0.01</td>
</tr>
</tbody>
</table>

Table II  Mean Comparison showing the effect of breeding method on calf sex ratio and postpartum reproductive performance

<table>
<thead>
<tr>
<th>Breeding method</th>
<th>Assisted births (%)</th>
<th>Male births(%)</th>
<th>Retained placenta (%)</th>
<th>Service period (days)</th>
<th>No of services per conception</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI</td>
<td>23</td>
<td>59</td>
<td>10</td>
<td>44.25</td>
<td>1.49</td>
</tr>
<tr>
<td>Natural</td>
<td>15</td>
<td>51</td>
<td>5</td>
<td>35.40</td>
<td>1.14</td>
</tr>
<tr>
<td>Overall</td>
<td>19</td>
<td>55</td>
<td>7.5</td>
<td>39.82</td>
<td>1.31</td>
</tr>
<tr>
<td>Sig.</td>
<td>NS</td>
<td>P &lt;0.05</td>
<td>P &lt;0.01</td>
<td>P &lt;0.01</td>
<td>P &lt;0.01</td>
</tr>
</tbody>
</table>

Correlation Analysis

Calf sex had significant but negative correlation (-.055) with service period. This indicated that animal giving birth to a male fetus will have more service period than that of female birth. Number of services per conception had positive and significant correlation with RFM and service period (Table III).

Effect of Species on Postpartum Reproductive Performance

Present study reported that postpartum reproductive problems were higher in buffaloes than crossbred cattle. Present results are in line with the findings of El-wishy (2007).The high intensity of reproductive problems reported in present study and other related studies may be due to the reason that buffalo mostly belong to the resource constrained poor farmers and are mostly under feed (Qureshi et al., 1999) or over fed in peri-urban farming system (Qureshi, 1995);Nutritional standards for the animal have not been fixed. Khan et al. (2008) reported that milk production in dairy buffaloes was increased almost up to the level of their non pregnant counter part when they were provided supplemented ration. They have also reported that progesterone level in feed supplemented buffaloes was significantly increased (Khan et al., 2008).

Calf Sex and Breeding Method

The incidence of male calves as a result of AI has proved speculations of our group and the local farmers. Present study indicated that breeding method contributes significantly to the sex of new born calves in cattle as well as buffalos. Natural mating was found favorable for female births while artificial mating resulted in to more male births. Rorie (1999) found that there is anecdotal evidence from Irish farmers that natural mating increases the probability of a female calf in dairy herds. Several factors may affect any potential association between mating type and sex ratio. One contributing factor may be the effect of timing of mating on the resultant sex ratio. Nonetheless, other studies in cattle have failed to identify a relationship between time of service and sex ratio.
Another potential contributing factor to an association between mating type and sex ratio is the increased sex ratio from frozen semen compared to fresh semen (Johnson et al., 2000). Looper et al. (1998) found that in cattle, the percentage of females in the offspring can be increased by performing the AI within the first 18 h from the onset of the estrus, whereas delaying the AI significantly increases the percentage of males. When insemination is carried out beyond 30 h from the onset of the estrus, the percentage of males increases significantly. According to the regression analysis, the percentage of males increases 1.85% per hour from the onset of estrus. Martinez et al. (2004) carried out a field trial in cattle to study the effect of the interval between the onset of estrus and AI on sex ratio and fertility. They reported that the percentage of calved females (73.05%) was significantly superior for early inseminations (8–18 h), and it decreases 1.85% per hour from the onset of estrus. Delayed AIs (≥30 h) produce a significant deviation of the sex ratio towards the males (72.06%); nevertheless, fertility (percentage of successful pregnancies) diminishes significantly, from 66.19% (8–18 h) to 45.35% (≥30 h). They concluded variations in the interval between the onset of estrus and AI modify sex ratio.

The increased male ratio as a result of AI as reported in present study may be attributed to delay breeding as compared to natural breeding because for natural breeding locally available bulls are used, while AI arrangements take more than 10 to 15 hrs. This delayed breeding coupled by poor semen quality increases the probability of male births. The base for modern techniques of semen sexing support the high ratio of male births with delayed breeding. Hollinshead et al. (2002) found that Sexing technology takes advantage of the physiological differences between X and Y spermatozoa, favoring the presence of the desired kind of spermatozoa in the moment of fertilization and deviating the physiological sex ratio. The most accurate techniques include the use of flow cytometry to separate the X and Y sperm populations, and using the corresponding type to perform artificial insemination. Sperm with Y chromosomes are heavy and are lagged behind while X chromosomes being light get more chances to fertilize ova.

The larger number of males produced as result of AI as reported in present study may be associated with the old age of the cattle and buffalo. Bery et al. (2006) reported that the probability of a male calf being born was significantly higher in older cows compared to younger cows. No significant difference existed in the likelihood of a male calf being born from first parity (i.e., served as heifers) and second parity cows, the exception being 2002 when second parity animals had a greater (P < 0.05) likelihood of a male calf compared to first parity animals. Older parity animals, however, had significantly greater odds of a male calf than first parity cows. In the years 2003 and 2005, second parity cows had significantly lower odds of a male calf than older cows.

### Table III

**Correlation among various parameters**

<table>
<thead>
<tr>
<th></th>
<th>CORR</th>
<th>CALFSEX</th>
<th>BIRST</th>
<th>NSP</th>
<th>RFM</th>
<th>SP</th>
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</thead>
<tbody>
<tr>
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<td><strong>Pearson</strong></td>
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<td>.019</td>
<td>.037</td>
<td>.015</td>
<td>-.055(*)</td>
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<td></td>
<td><strong>Correlation</strong></td>
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<td>.019</td>
<td>.455</td>
<td>.141</td>
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<td>1591</td>
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<tr>
<td><strong>BIRST</strong></td>
<td><strong>Pearson</strong></td>
<td>.019</td>
<td>1.000</td>
<td>-.019</td>
<td>.016</td>
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<td></td>
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<td>.445</td>
<td>.516</td>
<td>.971</td>
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<tr>
<td><strong>SPC</strong></td>
<td><strong>Pearson</strong></td>
<td>.037</td>
<td>-.019</td>
<td>1.000</td>
<td>.088(**)</td>
<td>.372(**)</td>
</tr>
<tr>
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<td><strong>Correlation</strong></td>
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<td>.141</td>
<td>.445</td>
<td>.000</td>
<td>.000</td>
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<tr>
<td><strong>RFM</strong></td>
<td><strong>Pearson</strong></td>
<td>.015</td>
<td>.016</td>
<td>.088(**)</td>
<td>1.000</td>
<td>.094(**)</td>
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<td>.516</td>
<td>.000</td>
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<tr>
<td><strong>SP</strong></td>
<td><strong>Pearson</strong></td>
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<td>-.001</td>
<td>.372(**)</td>
<td>.094(**)</td>
<td>1.000</td>
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* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

CALFSEX = calf sex ratio, Birthst=Assisted births, SPC = services per conception, RFM = Retained fetal membrane and sp = service period.
The higher probability of a male calf being born when the immediately previous calf born within dam is male suggests some degree of repeatability of calf sex lays within cows. However, the proportion of this repeatability attributable to genetics is likely to be low (Ferguson et al., 2000).

Breeding Method and Postpartum Reproductive Performance

This study indicated that natural mating resulted to more normal births as compared to AI. In artificial insemination semen from good characters having bulls are collected and they have usually larger body size as compared of our local cattle and buffaloes. Being of larger body size the calf produced is also larger in size and lead to complications in birth. On the other hand in Natural mating mostly locally available bulls are used that are not much massive and lead to the birth of cooperatively smaller sized calves. Echternkamp and Gregory (1999) also reported that chances of abnormal births were increased with the twins births. Results of present study show that natural mating minimizes the chances of fetal membrane retention. AI requires more human involvement and error in any step could affect the results. Unhygienic glassware and contaminated AI tools expose the reproductive tract of animal to the invading bacteria which may lead to infection in reproductive tract as a result the chances of fetal membrane retention are increased. On the other hand for natural mating in stat farms mostly proven bulls are used which manimize the chances of infection and fetal membrane retention.

This study shows that the service period was longer in animals inseminated artificially as compared to those mated naturally. In support of present study, Overton and Sischo, 2005 in a California study compared calving to conception intervals for cows in AI pens with cows exposed to NS sires and found that cows with AI had a higher risk for pregnancy across all days in milk (DIM). The lengthened service period is mainly associated with poor heat detection in case of AI. Valergakis et al. (2000) reported that one of the main arguments for using of NS is the higher pregnancies per serviced. AI costs compared with those of keeping herd bulls and additional costs resulting from extended calving intervals (ECI) because of poor heat detection and conception rates when using AI (Valergakis et al., 2000; Overton and Sischo, 2005).

Breeding method was also found to have a significant effect on number of services required for conception. More services were required per conception in cows inseminated artificially. Overton et al. (2005) reported that Dairymen move cows from AI to bullpens for a variety of reasons including a common belief that these cows are less fertile and may have improved odds of becoming pregnant in bullpens, a decision to stop investing more capital in the form of semen, hormones, or labor into these lower fertility cows, or due to a lack of labor or housing capacity in AI pens. Conception rates in California herds have been shown to decrease as the number of services increases. However, the results of the their study suggest that keeping cows in the AI pen longer may improve the probability of becoming pregnant, despite the potential drop in expected conception rate.

Correlation of Calf Sex and Postpartum Reproductive Performance

Present study investigated that a cow/buffalo giving birth to male calf had prolonged service period than the cows pregnant with female calf. We presume that the factors leading to this phenomenon may be the larger body size of male calf, presence of the Y antigens in the male fetus and a local immune reaction towards the fetal testosterone.
CONCLUSION

Present study suggested that Buffaloes were more prone to postpartum reproductive problems as compared to the cross bred cattle. AI was associated to high frequency of male births while natural service favored female births. Animals served through AI exhibited more post partum reproductive problems than natural service. Cows giving birth to male calf had significantly longer service period.

REFERENCES


