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# A Comparative Analysis of Reproductive and Productive Performance of Jharkhand State Cooperative Milk Producers' Federation

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## ABSTRACT

**Background:** The reproductive and productive performance play significant role in judging the qualitative and quantitative traits in a dairy animal and has direct effect on the milk production and profitability in any dairy enterprise.

**Methods:** The present study was conducted in Jharkhand State, wherein 180 members of Jharkhand State Cooperative Milk Producers' Federation and 180 non-member dairy farmers were randomly selected from three districts of Jharkhand. The data was collected from a total of 360 respondents using structured interview schedule. For present study, 135 crossbred, 58 indigenous cattle and 82 buffaloes were selected from the members; whereas 102 crossbred cattle, 36 indigenous cattle and 79 buffaloes were selected from non-members.

**Result:** The findings revealed that dairy animals reared by cooperative members showed better reproductive and productive performance that their non-member counterparts. This is attributed to reason that JMF members adopted better dairy management practices due to availability of timely veterinary services, quality feed and training on improved dairy practices. Therefore, through increased participation in JMF; creating awareness and training regarding improved dairy management, adequate extension, breeding policy and financial support would further enhance the productivity among the dairy animals in the state.

**Key words:** Cattle, Dairy, Productive, Reproductive.

## INTRODUCTION

India possesses a wealth of huge bovine population (299.6 million) which is the main source of milk production (Livestock Census, 2012). Even though India is global leader in dairy sector with milk production of 198.4 million tonnes and per capita milk availability of 406 grams/day and accounting for 22.00 per cent of the global share (NDDB, 2020), however, the average milk productivity of the dairy animals in India is very low as compared to other developed countries. There is large disparity in state-wise as well as regional milk production in India (Kale *et al.,* 2016). Among several states in India, Jharkhand is one of the most backward states in the country in terms of dairy development. At present, the Jharkhand State is ranked 17th in the position both in terms of milk production as well as milk productivity (GoI, 2019). To give impetus to dairy development in Jharkhand, the State Government formed the Jharkhand State Cooperative Milk Producers' Federation (JMF) with the collaboration of National Dairy Development Board (NDDB) which is credited with bringing about white revolution in the State and making the State self-sufficient in milk production (Mandi and Chakravarty, 2020).

Productive and reproductive efficiency are critical factors that have a significant impact on the economics of milk production. In the field, there are a variety of productive and reproductive issues that cause the animal to lose its reproductive function. Any disturbance in the animal's normal reproductive function leads to infertility or sterility, resulting in financial losses owing to the lengthening of the dry period and inter-calving gap, as well as a reduction in calving and lactation during the animal's lifetime (Agarwal *et al*., 2005). Therefore, milk production needs to be tracked frequently by measuring the productive and reproductive performance

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under the existing management system for improvement (Lobago *et al.*, 2007). The previous studies on the productive, reproductive and health performance of dairy animals were customarily studied in a localized manner and for a specific species for instance, a comparative analysis of the members of dairy cooperatives and private dairies in Rajasthan revealed that average milk yield of crossbred, local cows and buffaloes of the member of private dairy were 5.64, 3.39 and 4.37 litres; respectively while in case of member of dairy co-operative, average milk yield of crossbred, local cows and buffaloes were 5.64, 3.39 and 4.37 litres respectively. Therefore, average milk yield was found to be significantly higher in case of animals of dairy cooperative respondents than the private dairies at 5 per cent level of probability (Kumar, 2012). Another study on productive and reproductive performance of cattle and buffaloes reared under farmers' management in differential dairy progressive states in India (*viz*. Haryana, Maharashtra and Odisha) revealed that the productive and reproductive performances of buffalos in Haryana were better than Maharashtra and Odisha whereas, the productive and reproductive performances of crossbred were found better in Haryana as well as Maharashtra than Odisha. The reproductive performance of buffalo, indigenous and crossbred cow was assessed on the parameters such as age at first calving, services per conception, service period and calving interval while, productive performance was assessed based on the parameters such as average daily milk yield, lactation length, dry period, average lactation milk yield, peak yield (Kale *et al.*, 2018). Similarly, the reproductive and productive performance of dairy animals in Karnal district of Haryana State revealed that average daily milk yield, lactation length, lactation yield and peak yield was higher in crossbred cows as compared to buffalo and indigenous cows (Manjusha *et al.,* 2016). The evidences from field level study on productive and reproductive parameters of dairy animals in Uttar Pradesh, India revealed that average daily milk production of buffalo, CB cow, Indigenous cow, were as 5.75±0.65, 7.55±0.74 and 3.27±0.3 litre/day/animal respectively. The data pertaining to lactation length was (276±14, 274±16 and 294±18) days/animal. The lactation milk yield was (1587.60±113, 2091.35±145 and 964.65±98) litre/animal. The average peak milk yield was (8.56±0.85, 10.42±1.42 and 5.51±0.53) litre/animals. The dry period was (226±13, 211±15 and 264±19) days/animal. The age at first calving was (1288±122, 1170±88 and 1517±131) days/animals. The service period was (189±16, 197±12 and 268±18) days/animal respectively and lastly, calving interval of Buffalo, Crossbred cow, Indigenous cow, were 505±39, 485±32 and 558±55 days/ animal respectively (Meena *et al*., 2015). Further detailed study on reproductive and productive performances of Kosali cattle maintained under farmer's management conditions in Central Plain Region of Chhattisgarh state demonstrated that average age at first calving, calving interval, service period and number of services per conception were found 54.64±2.18 months, 430.26±6.33 days, 159.59±2.67 days and 1.4±0.08, respectively. Production was recorded and average daily milk yield, peak yield, lactation milk yield, lactation length and dry period were estimated to be 0.92±0.23 kg, 1.27±0.15 kg, 210.3±4.19 kg, 230.7±9.11 days and 190.8±8.19 days, respectively. Observed indices showed poor performances which are below the national average (Asit *et al*., 2019). As per standard recommendation for determining the productive performance of crossbred dairy animals, average milk yield is 10-12 litres, lactation length is 305 days, average peak yield is 15 litres and dry period is 3 months, whereas standard recommendation for reproductive performance of cross breed dairy animals, average age at first calving is 1.5-2 year, average service period is 90 days, average service per conception 1-2 and calving interval is 12-14 months (Kumar, 2014).

## MATERIALS AND METHODS

The current study was conducted at the ICAR-National Dairy Research Institute in Karnal from 2020 to 2022. The location of this study was the state of Jharkhand. Out of, the total 14 districts, covered by JMF, the districts had been first classified into highly (More than 1000), moderately (500 to 999) and least (1 to 499) progressive dairy districts categories based on the size of member-producers available in the districts. From each category one district was purposively selected based on the highest number of member producers, bulk milk coolers (BMCs) and milk pooling points (MPPs) available. Thus, three districts *viz*. Ranchi, Latehar and Ramgarh districts were purposively selected from each stratum. From each district, one bulk milk cooler (BMC) operating at block level was randomly selected, again three Milk Pooling Points (MPPs) operating at village level under each BMCs were randomly selected, wherein 20 members and 20 non-members were randomly selected from each MPP. Overall, a total of 360 respondents (*i.e*. 180= members and 180= non-members), owning at least one dairy animal were finally selected from the study area. Further estimation of the reproductive and productive performance; 237 crossbred cattle, 94 indigenous cattle and 161 buffalos at lactating stage was randomly selected across both members and non-members. A structured interview schedule was developed for primary data collection. The data was analysed by using mean and standard deviation. The test of significance was interpreted using non-parametric test *i.e*. Mann Whitney U Test as the data was not normally distributed.

## RESULTS AND DISCUSSION

The analysis of results in Table 1 and Table 2 depicted the comparative analysis of reproductive and productive performance of dairy animals, precisely from three selected districts of Jharkhand State.

**Table 1:** Species wise reproductive performance of dairy animals.

| Parameters | Crossbred | | \|z\|-test score | Indigenous | | \|z\|-test score | Buffalo | | \|z\|-testscore |
|---|---|---|---|---|---|---|---|---|---|
| | Members | Non-members | | Members | Non-members | | Members | Non-members | |
| Farmers (nos.) | 180 | 180 | | 180 | 180 | | 180 | 180 | |
| Animals (nos.) | 135 | 102 | | 58 | 36 | | 82 | 79 | |
| | Mean±SD | Mean±SD | | Mean±SD | Mean±SD | | Mean±SD | Mean±SD | |
| Age at 1st calving (months) | 39.24± 3.15 | 40.57±3.58 | -9.878** | 41.90± 3.32 | 42.06± 3.08 | -3.738** | 48.18± 4.34 | 48.61±4.50 | -7.841** |
| Services per conception (in nos.) | 2.38± 0.57 | 2.45±0.75 | -10.811** | 2.27±0.76 | 2.41± 0.89 | -4.056** | 2.66±0.67 | 2.80 ±0.63 | -7.350** |
| Service period (days) | 106.85±10.88 | 106.07±12.74 | -8.652** | 99.50±15.27 | 101.69±20.46 | -3.247** | 148.67±14.52 | 147.73±17.46 | -7.031** |
| Calving intervals (days) | 391.23±15.26 | 398.29±17.49 | -9.107** | 396.03±17.47 | 395.13±21.51 | -3.566** | 448.60±15.31 | 444.44±15.40 | -7.429** |

Mann-Whitney U Test **significant at 0.05 probability level.

**Table 2:** Species wise productive performance of dairy animals.

| Parameters | Crossbred | | \|z\|-test score | Indigenous | | \|z\|-test score | Buffalo | | \|z\|-testscore |
|---|---|---|---|---|---|---|---|---|---|
| | Members | Non-members | | Members | Non-members | | Members | Non-members | |
| Farmers (nos.) | 180 | 180 | | 180 | 180 | | 180 | 180 | |
| Animals (nos.) | 135 | 102 | | 58 | 36 | | 82 | 79 | |
| | Mean±SD | Mean±SD | | Mean±SD | Mean±SD | | Mean±SD | Mean±SD | |
| Avg. daily milk yield (l) | 6.77±0.38 | 5.76± 0.56 | -13.824** | 1.99±0.23 | 1.98±0.37 | -3.481** | 4.34±0.20 | 3.87±0.16 | -11.585** |
| Lactation length (days) | 277.26±10.49 | 273.33±7.22 | -2.289* | 265.52±7.59 | 264.56±7.74 | -3.217** | 264.98±8.40 | 261.39±8.43 | -5.583** |
| Avg. lactation milk yield (l) | 1705.63±9.86 | 1599.24±9.62 | -14.162** | 527.83±10.98 | 522.11±11.38 | -5.044** | 1149.01±10.04 | 1018.51±9.32 | -11.756** |
| Peak yield (l/day) | 11.37±1.07 | 9.37±1.41 | -12.123** | 3.48±0.31 | 3.47±0.30 | -4.159** | 8.91±0.51 | 8.25±0.44 | -8.406** |
| Dry period (days) | 119.42±10.29 | 124.26±12.09 | -9.334** | 130.35±11.85 | 131.06±12.65 | -4.242** | 184.05±9.43 | 183.42±10.31 | -7.464** |

Mann-Whitney U test **Significant at 0.05 probability level.

**Reproductive performances of dairy animals**

Reproductive performances of dairy animals reared by members and non-members of Jharkhand State is presented in Table 1. There productive performance of buffalo, Indigenous and crossbred cow was assessed on the parameters such as age at first calving, services per conception, service period and calving interval.

**Age at first calving (in months)**

This is one of the most important parameter in the reproductive performances of dairy animals. The reproductive performance of milch animals improves as the age at first calving decreases and vice versa. The data from the Table 1 revealed that the average age at first calving of buffalos was, 48.18±4.34 and 48.61±4.50 (in months) respectively in members and non-members. The average age at first calving of crossbred cattle was 39.24±3.15 and 40.57±3.58 in months respectively in members and non-members. The average age at first calving of Indigenous cattle was 41.90±3.32 and 42.06±3.08 in months respectively in members and non-members. According to the findings of Bohra *et al.* (2007), the age at first caving in cow and buffalo was 4 (3.6-4.5) years and 4.6 (4.0-5.5) years respectively. This was attributed to the reason that farmers adopted better heifer management practices which resulted in their lower age at first calving. Further, z-score indicated that, in case of buffalo, indigenous and crossbreed cattle there was significant difference in their average daily milk yield between members and non-members at 5 per cent level of significance.

**Services per conception (In nos.)**

This is one of the vital factors in the reproductive performances of dairy animals. Lesser number of services per conception, better the reproductive performance of milch animals and vice-versa. Table 1 revealed that the average services per conception of buffalo were 2.66±0.67 and 2.80 ±0.63 (in numbers) in members and non-members, respectively. The average services per conception of crossbred cattle were 2.38±0.57 and 2.45±0.75 (in numbers) in members and non-members, respectively. The average services per conception of Indigenous cattle were 2.27±0.76 and 2.41±0.89 (in numbers) in members and non-members, respectively. The number of services per conception is also affected by the timely availability of veterinary services and the availability of good quality semen, as well as the proficiency of the A.I. practitioner.

**Service period (In days)**

The data in the Table 1 shows that the average service period of buffalos was 148.67±14.52 and 147.73±17.46, (in days) in members and non-members, respectively. The average service period of crossbred was 106.85±10.88 and 106.07±12.74 (in days) in members and non-members, respectively. The average service period of indigenous was 99.50±15.27 and 101.69±20.46 (in days) in members and non-members, respectively. The optimal service period for dairy animals should be 60-90 days (TNAU Agritech Portal, 2016), although it was significantly greater in the study area. The longer service period could be owing to a failure to recognise heat signs in milch animals or the lack of insemination facilities in the area.

**Calving interval (In days)**

Shorter calving interval is the key for the profitable dairy enterprise. The date from Table 1 shows that the calving interval of buffalo was 448.60±15.31 and 444.44±15.40 days in members and non-members, respectively. The calving interval of Crossbred cattle was 391.23±15.26 and 398.29±17.49 days in members and non-members, respectively. The calving interval of indigenous cattle was 396.03±17.47 and 395.13±21.51 days in members and non-members, respectively. Enhanced calving interval indicates that the farmers received less milk from milch animal. The breeding, feeding and health management of dairy animal by the farmers affect the calving interval.

**Productive performance of dairy animals**

Comparative analysis of productive performances of dairy animals reared by members and non-members of Jharkhand State is presented in Table 2. The productive performance of buffalo, indigenous and crossbred cow was assessed on the parameters such as average daily milk yield, lactation length, dry period, average lactation milk yield, peak yield.

**Average daily milk yield (in liters)**

When evaluating the performance of the animals, the milk yield of the milch animals is crucial. It is revealed from the Table 2 that the average daily milk yield of buffalos was 4.34±0.20 and 3.87±0.16 in members and non-members, respectively. The average daily milk of crossbred cattle was 6.77±0.38 and 5.76± 0.56 in members and non-members, respectively. While the average daily milk of indigenous cattle was 1.99±0.23 and 1.98±0.37 in members and non-members, respectively. The proportion of indigenous cattle in cattle population is more in non-members and productivity of the indigenous cattle is very low in Jharkhand State. Raja *et al.* (2012) found in their study, that the daily milk yield was 6.69±0.99 litres in crossbreed cows and 1.07±0.10 litres in indigenous cows, which was comparable to the least progressive dairy states.

**Lactation length (in days)**

One of the most important measures of milch animal performance is optimal lactation length. It is depicted from Table 2 that the average lactation length of buffalo was 264.98±8.40 and 261.39±8.43 (days) in members and non-members, respectively. The average lactation length of Crossbred was 277.26±10.49 and 273.33±7.22 (days) in members and non-members, respectively and the average lactation length of Indigenous cattle was 265.52±7.59 and 264.56±7.74 (days) in members and non-members, respectively. Lactation lengths of 305 days were found to be ideal (Cole *et al.*, 2011). Lactation length was determined to be the longest in crossbred animals, followed by Buffalo

and Indigenous cattle in the state. In Sunderban, West Bengal, Raja *et al.* (2012) discovered that the average lactation was 224.88±6.72 days for indigenous cows and 232.00±2.00 days for crossbreed cows.

**Average lactation milk yield (in liters)**

The average lactation milk yield has a positive relationship with the milch animals' total productivity. The average lactation milk yield of buffalo was 1149.01±10.04 and 1018.51±9.32 (in liters) in members and non-members, respectively. The average lactation milk yield of crossbred cattle was 1705.63±9.86 and 1599.24±9.62 (in liters) in members and non-members, respectively. While the average lactation milk yield of Indigenous cattle was 527.83±10.98 and 522.11±11.38 (in liters), respectively in members and non-members. Because of the availability of superior germplasm such as Murrah buffalo and local cattle breeds like Bachaur, Sahiwal and Tharparkar, the average lactation yield of all species is very high in members compared to non-members. Crossbred cattle performed well in Jharkhand, whereas buffalo and indigenous cattle performed poorly. It could be because local breeds of indigenous cattle were mostly used for draught purposes.

**Peak yield (in liters/day)**

A perusal of the Table 2 revealed that the average peak milk yield of buffalo was 8.91±0.51 and 8.25±0.44; (in liters/day) respectively in members and non-members. The average peak milk yield of crossbred cattle was 11.37±1.07 and 9.37±1.41 (in liters/day) respectively in members and non-members. The average peak milk yield of Indigenous cattle was 3.48±0.31 and 3.47±0.30 (in liters/day) respectively in members and non-members.

**Dry period (in days)**

Longer dry period causes economic losses to the farmers. A glance of the Table 2 revealed that the average dry period of buffalos was 184.05±9.43 and 183.42±10.31 in members and non-members, respectively. The average dry period of Crossbred cattle was 119.42±10.29 and 124.26±12.09 in members and non-members, respectively. While the average dry period of Indigenous cattle was 130.35±11.85 and 131.06±12.65 in days respectively in members and non-members. Lower the dry period better the conception rate of the animals and vice-versa. Jadoun *et al.* (2015) found that the average dry period of Integrated Murrah Development Schemes (IMDS) beneficiaries was 102.02 days and for beneficiaries it was 111.49 days in Haryana. The longer dry period in the present study could be attributed to the wide variation of breeds and management practices in the different states. Overall, the assessment on reproductive and performance of dairy animals were in line with the findings of Kale *et al.* (2018), Kumar (2012), Manjusha *et al.* (2016) and Meena *et al.* (2015).

## CONCLUSION

It can be inferred from the study that, the advent of JMF in Jharkhand state has created enormous potential for improving the reproductive and productive performance of the crossbred, indigenous cattle and buffaloes and overall dairy development. Further, to enhance the productivity of dairy animals; chelated mineral mixtures, protein supplements and cattle feed are supplied to member farmers as part of the animal nutrition programme, which also promotes the ration balancing programme. JMF also offers free veterinary and artificial insemination services to its members. In Jharkhand, majority of the indigenous cattle are non-descript and used majorly for draft purposes. These large number of non-descript indigenous cattle can be improved by upgrading with suitable indigenous high milk yielding breeds such as Tharparkhar, Sahiwal and Gir. The state has suitable agro-climatic conditions for rearing crossbred cattle and buffalo breeds like Holstein Friesian, Jersey and Murrah, along with few available registered indigenous breeds like Purnea and Bachaur. Therefore, in the least dairy progressive (Jharkhand) state concerted efforts should be made on breed improvement, veterinary infrastructure and farmers' managerial skills to improve the productive and reproductive performance of dairy animals.

**Conflict of interest**

All authors declare that they have no conflicts of interest.

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