Follow -Up of Infertility Problems of Indigenous Zebu and Crossbred Dairy Cows in Dairy Farms in Gondar, North West Ethiopia

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Abstract: Regular follow up was conducted to determine the infertility problems of dairy cows. The study populations comprised of 266 indigenous and 384 crossbred cows, randomly selected from 138, 98 and 7 smallholder; medium and large scale managed dairy farms, respectively. A total of 650 cows were examined of which 352 (54.15%) had at least one of the infertility problems. The infertility problems encountered were repeat breeder 82 (23.29%), silent estrous 54 (15.34%), postpartum anoestrus 43 (12.22%), true anestrous 34 (9.66%), ovarian cyst 31 (8.81%), retained fetal membrane 23 (6.53%), clinical endometritis 22 (6.25%), abortion 21 (5.97%), dystocia 17 (4.82%), pyometra 14 (3.98%) and stillbirth 11 (3.13%), respectively. This study indicated a higher incidence of infertility in crossbred and in higher age groups. Large scale farm cows were less affected than small and medium scale farm dairy cows. The highest infertility problem occurred in multiparous cows than in primiparous cows. Primiparous cows have the highest fertility among dairy animals followed by a decline in fertility with further parity. High incidence of infertility was found in emaciated and thin cows than average and heavy body condition scores.

Key words: Crossbred · Dairy Cows · Gondar · Indigenous Bred · Infertility

INTRODUCTION

Regular breeding depends up on the normal function of the reproductive system. In order to breed regularly, Normal cyclic cows display estrous behavior, mate, conceive, sustain the embryo through gestation, calve and resume estrous cyclicity and restore uterine function after calving. When the function of the reproductive system is impaired cows fail to give birth regularly. Infertility remains a limitation to achieve optimal efficiency of milk production in many dairy herds throughout the world [1].

Many countries have experienced very fast development in dairy sector in or around the largest urban centers, responding immediately to the market demand and profiting from the lack of links between the rural producer and the urban consumer. In Ethiopia too, urban and peri- urban dairy production systems are emerging as an important component of the milk production system. This system is contributing immensely towards filling in the large demand-supply gap for milk and milk products in urban centers, where consumption of milk and milk products is remarkably high. The urban and peri-urban dairy production system has tremendous potential for development and could play a significant role in minimizing the acute shortage of dairy products in urban centers of Ethiopia [2].

Despite the huge livestock population; milk production is very low. The country's per capita milk consumption is estimated to be about 19.2 kg per year, which is far below the average per capita consumption of Africa (37.2kg) per year [3]. In Ethiopia, urban and peri-urban dairy production systems are emerging as an important component of the milk production system. This system is contributing immensely towards filling in the large demand-supply gap for milk and milk products in urban centers, where consumption of milk and milk products are remarkably high [4].

Dairying is practiced almost all over Ethiopia involving a vast number of small, medium, or large-sized, subsistence or market-oriented farms. The difference between large and smallholder farms is mainly determined by herd size [5]. Large-scale farms keep large herds of cross dairy breeds and involve high inputs in terms of

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land, labour, housing, feed and health management. The main source of feed is both home produced or purchased hay; and the primary objective is to get additional cash income from milk sale [6]. The main objective was to identify infertility problems of indigenous zebu and crossbred dairy cows in small, medium and large scale dairy farms by method of regular follow- up.

MATERIALS AND METHODS

Study Area: The study was conducted in urban and peri urban areas of Gondar town dairy farms which are located North West part of Ethiopia in Amhara regional state. Gondar town is found about 727 km from the capital city Addis Ababa. It is located at latitude, longitude, altitude of 12.3-13.8°N, 35.3-35.7°E and 2200 m.s.l, respectively. The annual mean minimum and maximum temperature of the area vary between 12-17°C and 22-30 °C, respectively. The area is located under woyna dega, agro-climatic zone and receives a bimodal rainfall the average annual precipitation rate being 1000 mm that comes from the long and short rainy seasons. The short rainy season occur during the months of March, April and May while the long ones extend from June through September [7].

Sample Size: A sampling frame i.e. the list of the dairy farms was acquired from the urban agricultural development office at the beginning of the study. Dairy farms / cows were selected from this list using a stratified sampling procedure to ensure the selection of proportional and representative sampling of dairy farms and cows. Sampling stratification was done based on number of cows as described by ILRI [8] Farms owning (n = 2), (3= n =10) and (n = 11) cows were taken as to small, medium and large dairy farms, respectively. The total number of animals sampled from the study area was determined by using the appropriate formula for proportional sample size determination in proportional stratified random sampling; the size of each stratum was proportionate to the population size of the strata across the entire population. This means that each stratum had the same sampling fraction. A sampling fraction of ½ (50%) randomly sampled. Three strata with dairy farms 138, 98 and 7 dairy farms subjected from each stratum respectively [3].

Urban and Peri-Urban Dairy Farm Scale: The dairy farms considered for this study were categorized into defined strata based on cow herd size; these were small scale

dairy farm (SSDF), medium scale dairy farm (MSDF) and large scale dairy farm (LSDF) having 1or 2, 3 to 10 and 11 to above as described by ILRI [8], respectively.

Follow-Up Study: The longitudinal study involved repeated visits and monitoring of dairy farms selected for follow upsized dairy farms based on the number of adult cows and pregnant heifers.

About 362 pregnant cows were selected in and around Gondar that were expected to give birth within the study period and 288 lactating and dry non pregnant cows were subjected to different clinical and gynaecological examinations including rectal examination at monthly intervals and findings were recorded accordingly.

Data Management and Statistical Methods: Data collected from the longitudinal follow up study were entered in Microsoft excel. For analysis of the data statistical package for social science (SPSS) (Version 18) was used. In this chi- square test, confidence interval and logistic regression were calculated. Multivariate analyses permit the simultaneous evaluation of a large number of explanatory variables to examine their effect on the outcome variable and allow for the examination of interactions between these variables and control confounding. Therefore, the data were further explored using multivariate analyses. Binary logistic regression analysis was used to study the effect of the predictors on the response variable of infertility problems in dairy cows.

Regression methods were an integral component of any data analysis concerned with describing the relationship between a categorical response variable and one or more explanatory factors. It was often the case that the outcome variable was discrete, taking on two (Fertile and infertile cows) binary logistic regression model could be used mainly for two reasons. The first was from a mathematical point of view, it was an extremely flexible and easily used function for binary outcome values and the second was that it leads itself to meaningful interpretation.

RESULTS

The incidence of infertility due to repeat breeder was the highest among all other infertility problems accounting for 82 (29%), in this study the indigenous bred showed higher incidence 37 (25.52%) of repeat breeder problem when compared to crossbred cows 45 (21.74%).

Table 1: The incidence of infertility problems in relation to breed and farm scale

Type of infertility	No of positive %	Breed		Farm scale		
		Cross	Indigenous	Small	Medium	Large
Repeat breeder	82(23.29)	45(21.74)	37(25.52)	49(30.06)	25(19.23)	8(13.56)
True anestrous	34(9.66)	21(10.14)	13(8.97)	12(7.36)	16(12.31)	6(10.17)
Silent estrous	54(15.34)	25(12.08)	29(20.00)	25(15.34)	20(15.38)	9(15.25)
Dystocia	17(4.82)	6(2.90)	11(7.59)	9(5.52)	6(4.62)	2(3.39)
RFM	23(6.53)	18(8.70)	5(3.45)	9(5.52)	8(6.15)	6(10.17)
Abortion	21(5.97)	9(4.35)	12(8.28)	6(3.68)	10(7.69)	5(8.47)
Pyometra	14(3.98)	11(5.31)	3(2.07)	7(4.29)	5(3.85)	2(3.39)
Clin endo	22(6.25)	20(9.66)	2(1.38)	8(4.91)	12(9.23)	2(3.39)
Stillbirth	11(3.13)	7(3.38)	4(2.76)	6(3.68)	4(3.08)	1(1.69)
Ovarian cyst	31(8.81)	21(10.14)	10(6.90)	11(6.75)	11(8.46)	9(15.25)
PPA	43(12.22)	24(11.59)	19(13.10)	21(12.88)	13(10.00)	9(15.25)
Total	352(100.0)	207(100.0)	145(100.0)	163(100.0)	130(100.0)	59(100.0)

Note: RFM = Retained fetal membrane, PPA =Postpartum anoestrus, *Clin endo=Clinical endometritis*

The dairy farm scale was taken into consideration for the occurrence of repeat breeder the small scale dairy farms showed the highest incidence 49 (30.06%) followed by medium scale dairy farms 25 (19.23%) and large scale dairy farms 8 (13.56%) from the total 82 repeat breeders. Concerning to true anoestrus accounting 34 (9.66%), the crossbred cows showed higher incidence 21 (10.14%) of true anoestrus problem when compared to indigenous bred cows 13 (8.97%). The dairy farm scale was taken into consideration for the occurrence of true anoestrus the medium scale dairy farms showed highest 16 (12.31%) followed by large scale dairy farms 6 (10.17%) and small scale dairy farms 12 (7.36%).

Regarding to silent estrous accounting 54 (15.34%). The indigenous bred dairy cows showed higher incidence 29 (20.00%) of silent estrous problem when compared to crossbred cows 25 (12.08%). The dairy farm scale was taken into consideration for the occurrence of silent estrous, in all dairy farm scales almost similar results 20 (15.38%), 25(15.34%) and 9 (15.25%) in MSDF, SSDF and LSDF, respectively.

With respect to dystocia accounting 17 (4.82%). The indigenous bred cows showed higher incidence 11 (7.59%) of dystocia problem when compared to crossbred cows 6 (2.90%). The dairy farm scale was taken into consideration for the occurrence of dystocia. The small scale dairy farms showed highest 9(5.52%) followed by medium scale dairy farm 6 (4.62%) and in large scale dairy farm 2 (3.39%)

The present study also found that retained fetal membrane accounting 23 (6.53%), the crossbred showed higher incidence 18 (8.70%) of retained fetal membrane problem when compared to indigenous bred 5 (3.45%). The dairy farm scale was taken into consideration for the occurrence of retained fetal membrane the large scale dairy farm showed highest 6 (10.17%) followed by medium scale dairy farm 8 (6.15%) and small scale dairy farm 9 (5.52%).

The incidence of abortion was accounting 21 (5.97%), the indigenous bred showed higher incidence 12 (8.28%) of abortion problem when compared to crossbred 9 (4.35%). The dairy farm scale was taken into consideration for the occurrence of abortion, the large scale dairy farm showed 5 (8.47%), medium scale dairy farm 10 (7.69%) and small scale dairy farm 6 (3.68%).

Pyometra was found that accounting 14 (3.98%), the crossbred cows showed higher incidence 11 (5.31%) of pyometra problem when compared to indigenous bred cows 3 (2.07%). The dairy farm scale was taken into consideration for the occurrence of pyometra small scale dairy farm showed 7 (4.29%), medium scale dairy farm 5 (3.85%) and large scale dairy farm 2 (3.39%).

Concerning to clinical endometritis accounting 22 (6.25%), the crossbred cows showed higher incidence 20 (9.66%) of clinical endometritis problem when compared to indigenous bred cows 2 (1.38%). The dairy farm scale was taken into consideration for the occurrence of clinical endometritis the medium scale dairy farm showed highest incidence 12 (9.23%) followed by small scale dairy farm 8 (4.91%) and large scale dairy farm 2 (3.39%).

Stillbirth accounting for 11 (3.13%), the crossbred cows showed higher incidence 7 (3.38%) of stillbirth problem when compared to indigenous bred cows 4 (2.76%). The dairy farm scale was taken into consideration for the occurrence of stillbirth the small scale dairy farm showed 6 (3.68%) followed by medium scale dairy farm 4(3.08%) and large scale dairy farm 1 (1.69%).

The incidence of ovarian cyst was accounting for 31 (8.81%), the crossbred cows showed higher incidence 21 (10.14%) of ovarian cyst problem when compared to indigenous bred cows 10 (6.90%). The dairy farm scale was taken into consideration for the occurrence of ovarian cyst the large scale dairy farm showed highest incidence 9 (15.25%) followed by 11 (8.46%) medium scale dairy farm and in small scale dairy farm 11 (6.75%).

Post partum anoestrous was accounting for 43 (12.22%), the indigenous bred cows showed higher incidence 19 (13.10%) of post partum anoestrous problem when compared to crossbred cows 24 (11.59%). The dairy farm scale was taken into consideration for the occurrence of post partum anoestrous large scale dairy farm showed highest incidence 9 (15.25%) followed by small scale dairy farm 21 (12.88%) and in medium scale dairy farm 13 (10.00%).

DISCUSSION

Infertility in indigenous and crossbred cows was the major cause of economic loss for dairy farming. Out of 650 cows examined during this study 54.15% cows were infertile. The result agrees with previous studies where the infertility incidence was recorded as 56,5% in Ada district zone [9] and 62% in Ebrahim [10], 43.7%, Molalegne and Shiv [11] around in district Bedelle, similar incidence were reported [12] 39% in central highlands of Ethiopia which have the same environmental condition with that of Gondar. On the contrary Gebremariam[13] in Mekelle reported 29.1%. Emebet and Zeleke [14] in Dire Dawa 30.8%, 26.7% in Kombolcha, Haftu and Gashaw [15] 21.6% in Yimer [16] which is 39.9% in Woliso which were lower than in the present study this could be probably due to environmental conditions which was different from that of Gondar.

The significantly higher incidence of infertility problems encountered in crossbred cows 59.6% than in indigenous zebu 52.6% may be due to the fact that European cross─breds are less adapted to tropical conditions, diseases and low feed quality than zebu cattle [17] making them more susceptible than indigenous zebu. Another reason may also be due to the fact that, crossbreds require more elaborated management, feeding and better health care than the indigenous zebu to get better fertility and productivity in the tropics [18].

Detailed research has illustrated that some of the pathophysiological pathways explaining the association between the increase in milk production and the decrease infertility. It has been reported that production levels go along with a deeper and more prolonged negative energy balance as can be measured by lowered levels of glucose, insulin growth factor 1 and insulin and elevated levels of metabolites like ketone bodies and urea. As most of these metabolites are able to reach the ovaries and affect several cell types and hence negatively influence fertility [19].

Contrary to the widely accepted profile of declining fertility, Ricardo *et al.* [20] suggested that declining herd fertility has been happening only in some farms but not in all. The latter reflects a significant herd variation in the occurrence of risk factors for reduced fertility and proves that acceptable fertility performances are still feasible even in herds with very high productions.

In the present study, multiparous cows 60.15% emaciated cows 60.00% and cows above 6 years of age 62.73% were the most affected by infertility problems which is higher than the previous finding by Takele *et al.* [18] that were recorded 19.23% in and around Nazareth town. This could be due to the repeated exposure of the genital tract of multiparous cows to environmental pathogenic microorganisms then causing gradual decrease in the efficiency of immune mechanism due to ageing.

The current finding of higher incidence of infertility problem seen in cows with relatively poor body condition score of emaciated 60.00% and thin 56.6% compared to those with average 36.5% and heavy 36.4% body condition score seems to contradict pervious finding in which cows with good body condition had higher prevalence of infertility problems than cows with poor body condition score Takele *et al.* [18], in and around Nazareth town. Poor conditions and poor health make the animal susceptible to reproductive problems. Furthermore, weak expulsive force to expel out the fetal membranes leading to secondary complications [20]. The causes of retained placenta might be due to abnormal parturition, hypocalcaemia (milk fever), selenium, vitamin A and E deficiency[20].

There were statistically high significant variations among different farm scales with regard to occurrence of infertility problems. In the present study, the incidence was highest in small scale dairy farms i.e. 46.31% followed by medium scales dairy farms 36.93% and large scale farms 16.76%. Large scale farm cows were less affected than small and medium scale farm dairy cows because in large scale farms the management and feeding was good, due to differences in general management, environment and herd health control conditions there was highest incidence of infertility problems in small scale dairy farms with compared to medium and large scale dairy farms.

The study revealed statistically significant variation among different hygienic conditions of dairy farms. Poor hygiene farms had higher infertility problems than good and very good dairy farms; which might be due to exposure of animals to contamination during and after parturition.

In the present study incidence of repeat breeding was found to be 23.29% which was almost similar with earlier reports by Desalegn [9] 21.8% and 27.8% [21]. The reasons for repeat breeding might be due to improper timing of insemination- breeding too early or too late,high incidence of uterine infection,improper insemination technique or use of semen damaged during storage or handling and embryonic or fetal mortality [17]. The incidence of typical repeat breeder was reported ranging between 5.5- 33.33% in cattle by Saxena [22] 5-15% by Perea *et al.* [23] 4.6% prevalence rate recorded and lower than the 21.8% prevalence rate was reported by Maizon *et al.* [24] Although, Takele *et al.* [18] in and around Nazareth town and Molalegene and Shiv [11], in and around Bedelle reported 1.7% and 2.5% respectively and also 6.2%, Shiferaw [12] 1.4% and Haftu and Gashaw [15] 6.2%. Repeat breeder can be caused by a number of factors, including sub-fertile bulls, endocrine imbalance, malnutrition, reproductive tract infections and poor management practices such as wrong time of insemination or faulty heat detection, inappropriate semen handling and defective insemination techniques [25]. In addition to these, communal use of bull for natural services may also be a contributing factor. Hence the difference between the findings of the current study and previous reports may be attributed to the above-mentioned factors.

CONCLUSIONS

Based on the result of the present study, it is evident that the crossbred cows 207 (58.81%) were mostly affected due to infertility problems than the indigenous cows 145 (41.19%). Infertility in cows increases with increasing age and parity. The incidence of infertility due to repeat breeder was the highest among all other problems. The indigenous cows showed higher incidence when compared to crossbred cows. Small scale dairy farms showed highest incidence followed by medium and large scale dairy farms.

Recommendations: Good management system should be implemented which includes, individual record for each animal and its maintenance. In general, the development and use of simple and understandable recording systems in all farm scales is of paramount importance.

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