Academic Journal of Animal Diseases 6(3): 67-74, 2017
ISSN 2079-200X

DOI: 10.5829/idosi.ajad.2017.67.74

# Major Causes and Risk Factors Associated with Calf Mortality in Small Scale Dairy Farms in Gondar Town, Ethiopia

*Muluken Tadesse, Niguse Abebe, Mu-uz Gebru, Nirage Husen, Wassie Birhanu, Gashaw Bassazin and Birhanu Tamirat*

Mekelle University Collage of Veterinary Medicine, Ethiopia

**Abstract:** A cross sectional study was conducted from November 2016 to April 2017 with the objective of determining the prevalence of calf mortality in small scale dairy farms in Gondar town. Pre-designed structured questioner was developed pre-tested and administrated through personal interview to randomly selected farm owners and attendants. STATA version 11 was used for data analysis. From a total of 384 calves, 18 calves were. The total crude calf mortality rate of the all selective dairy farms in this study was 4.68% dairy farms. Among the causes of calf mortality, still birth was the leading cause with prevalence of 1.56% followed non-specific cause (3.14%). Among the calf risk factors assessed breed prevalence 1(0.26%) in local and 17(4.43%) in cross breeds ($\chi^2$=4.76, p= 0.03) and age ($\chi^2$=123.93, p=0.001) were found to be significantly associated with the death of calves. The result of this study showed that sex of the calf, parity status of the dam, herd size, farm experience of owners/attendants, calving facility, method of feeding, weaning age, housing and type of housing were non-significant for calf mortality. The most dominant clinical signs in calves was nonspecific cause of calf mortality and still birth with prevalence rate of 3.14% (n=12) and 1.56% (n=6), respectively. Majority (88.54%) of the farm owners had farm experience of greater than five years. Colostrum feeding was the common practice reported by all farms owners. In general, the calf mortality rate found in this study was higher beyond the economically tolerable limit. The major risk factors assessed during study period were improper management of calf feed, age, breed of the animal were found to be the most important risk factors of mortality. So, this study suggested that greater attention should be paid to the management of calves and proper nutritional feeding of the cow before birth.

**Key words:** Calf · Dairy farms · Mortality · Risk factors · Gondar

## INTRODUCTION

Human life is highly associated with livestock population in the different livestock production systems because livestock production consists one of the principal means of achieving improved living standards in many regions of developing world. In sub Saharan African countries, livestock plays a crucial role both for the national economics and the livelihood of rural communities [1]. And this is due to important economic, social and cultural roles for rural households to improve income and wellbeing of the rural family [2]. It is not only an important income-generating asset but also an indicator of wealth status, a source of food and nutrition security as well as insurance against future shocks and stresses [3]. In general, livestock systems occupy about 30% of the planet's ice-free earth surface area and this sector is increasingly organized in long market chains employing approximately 1.3 billion people globally and directly supporting the livelihoods of 600 million smallholding farmers in the developing countries [4].

Ethiopia is known for its high livestock population, being the first in Africa and tenth in the world. The country total cattle population is estimated to be about 56.71 million. Out of this the female cattle constitute about 55.45% and the remaining 44.55% are male cattle and 98.66% of the total cattle in the country are local breeds and remaining are hybrid and exotic breeds that accounted for about 1.19% and 0.14%, respectively [5]. The livestock sub-sector contributes about 16.5% of the

**Corresponding Author:** Muluken Tadesse, Mekelle University, Collage of Veterinary Medicine, Ethiopia.

national Gross Domestic Product (GDP) and 35.6% of the agricultural GDP [6]. It also contributes 15% of export earnings [7] and currently supports and sustains livelihoods for 80% of all rural population [6].

In Ethiopia dairy cattle production systems are classified into rural smallholder (Mixed crop-livestock) production, pastoral and agro-pastoral production, urban and peri-urban smallholder dairy production and commercial dairy production systems [8]. Urban and peri-urban dairy is one of the four dairy production systems in Ethiopia producing milk either as a full-time or a part-time business [9]. Currently a number of urban and peri-urban dairy farms are the major suppliers of milk and milk products to the urban consumers and continue to in the future [10].

Despite the huge number of cattle in the country, productivity is low due to constraints of disease, nutrition, poor management and poor performance of endogenous breed. This constraint results in poor reproductive performance of dairy cattle and lower economic benefit from the secretor [11].

The dairy industry is a large and dynamic segment of the agricultural economy of many nations and the major suppliers of milk and milk products to the urban and peri-urban consumers [12]. Peri-urban and urban dairies are intensive production systems, which keep high grade cows and have improved management practices but this is usually associated with increased susceptibility to disease, poor survival rate and poor reproductive performance [13].

Calf refers to the age group of young cattle from birth to nine month of age. Calves are at highest risk for death in the first two weeks of life (Especially in the first week). The two primary diseases are diarrhea and pneumonia and are the commonest disease in young calves and pre-weaned respectively. Even though other diseases like navel ill, arthritis, bloat, arthropod parasites and nutritional diseases feeding problem are also reported [12]. The proportion of calves weaned before six months of age increases from less intensive to more intensive systems of production [14].

Calf mortality has a drastic influence on milk production by reducing replacement stock and milk let down [15]. Calf mortality is a common problem for livestock producers; death of calves implies a loss of future breeding stock and replacement dairy cows, a loss of slaughter cattle, a loss of future draught oxen and a loss of milk production in breeds milked with the calf at foot [16]. Calf diseases that cause morbidity and mortality are the results of complex interaction of the management practices, environment, infectious agents and the calf itself [17].

Different managemental and environmental factors was reported to affect significantly, calf morbidity and mortality which include colostrums feeding, housing, calving assistance, production system, herd size, season and hygiene of micro- environment. The mode of passive transfer in neonates varies with the type of placenta and in the case of neonatal calves; it is based on an immediate postpartum ingestion of antibody rich colostrum [18]. The age of the calf is the most important factor affecting morbidity and mortality, approximately 75% of the mortality in dairy animals occur in the first month of their life [12].

High calf morbidity and mortality risks represent a major economic loss to the dairy operations [19]. In general, the most common cause of calf hood disease was diarrhea during early ages followed by pneumonia, joint ills, septicemia, umbilical diseases, trauma, congenital abnormality and dystocia [20, 21]. Calf losses were significantly reduced by introducing new techniques of management including on-time colostrum feeding, housing, feeding and nutrition [21].

There are so many dairy farms in Gondar that are aimed at provision of milk and milk by products to the society. Although there are many dairy farms, the productivity of such dairy cows is not as much as farmers expectations due to poor management practices that greatly responsible for high economic losses in dairy industry. Because of the fewer data on the major calf mortality problems in dairy animals in the study area, this study aimed to determine the prevalence of calf mortality in small scale dairy farms in Gondar town and to determine the associated risk factors for calf mortality in Gondar.

## MATERIALS AND METHODS

**Study Area:** The study was conducted from November 2016 to April 2017 in Gondar town, North West part of Ethiopia. Gondar town the capital city of North Gondar administrative zone, which is one of the eleven administrative zones located in western parts of Amhara regional state. The area is 740Km North West of Addis Ababa at latitude, longitude and altitude of 12.3 -13.8°N 35.3 35.7°E and 2200m.a.s.l, respectively. The annual minimum and maximum temperature of the area vary between 12.3-17.7°C and 22-30°C respectively. It could be categorized under woyna-dega climatic zone. The area is

also classified mainly in to two seasons, the wet season, from June to September and the dry season from October to May [22]. According to zonal agriculture office the livestock population of North Gondar is registered as1, 936, 514 cattle (Exotic, cross and local), 524, 083 sheep, 682, 264 goats, 36, 828 horse, 12, 473 mules, 223, 116 donkey and 3, 165, 068 poultry [5].

**Study Animals:** A total of 384 animals sample size (Dairy calves) in smallholder dairy farms were selected randomly from Gondar town. The study was conducted on dairy calves that were kept in different management systems. Sampled animal constitutes different age groups, breed and parity. Both local and cross breed calves were found at Gondar Town.

**Study Design:** A cross sectional survey was carried out across the from November 2016 to April 2017 in Gondar town farms and then pre designed structured questionnaires were then pre designed structured questionnaires were developed, tested and administered to farm owners and attendants of all farms considered for the study. All cross bred dairy cows in the selected farms taken as a sample.

**Sample Size and Sampling Method:** The sample size required for this study was determined depending on the expected prevalence of and the desired absolute precision by the formula given by Thrusfield [23]. Using 95% confidence interval at 5% desired absolute precision and by assuming the expected prevalence of 50% using the following formula:

$$n = \frac{1.962xP\exp(1 - P\exp)}{d^2}$$

where, n=sample size

$P_{exp}$ = expected prevalence

$d^2$ = desired level of precision (5%)

As a result a total of 384 calves were collected for the study. From a total selective dairy farm 384 calves were collected. 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 /calves were selected from this list using a simple random sampling procedure to ensure the selection of proportional and representative sampling of dairy farms and calves. The number of farms sampled in the study was determined by N=0.25/SE2, where N= number of sampled farms, SE=Standard error [24].

**Data Collection**

**Questionnaire Survey:** A structured questionnaire was prepared and conducted on selected dairy farms to collect information from dairy farm owners; attendant/managers in one visit interview about the breed, feeding system, production system, health care and management risk factors including, sex and age of calf, the parity of the dam, method of colostrum provision, Amount of milk fed, cleanness of calf house, housing condition of calf, occurrence of calf mortalities and herd management aspect of the farm.

**Observational Study:** A regular visit (Once per a week) of the farms was carried out from November 2016 up to April 2017 to collect data on major causes of calf mortality and the associated risk factors of calf mortality during this period, observation and interview with the farm owners and workers were made on different aspects, associated with calf health problems and potential animal and management risk factors including, sex, type of feed cleanness of calf house, housing condition of calf and herd management aspect of the farm.

**Description of Variables:** In this study, there were various risk factors for the occurrence of calf mortality which was regarded as independent variables and an outcome variable (Dependent variable) which was. The possible risk factors to be studied in this study were including age, parity, breed and managemental problem and diseases and the dependent variables were calf mortality.

**Data Management and Analysis:** Every data collected through questionnaire interviews as well as personal observation was recorded on Micro soft Excel 2007 spread sheet, data were analyzed using descriptive statistics. Data was analyzed using STATA version11 (Stata corporation texas USA, 2006) program. Ch-square ($\chi^2$) test was used to evaluate difference between parameters to measure calf mortality.

## RESULTS

**Mortality:** Rate From a total of 384 calves, 18calves were. The mortality rate of all selective dairy farms in this study prevalence was 4.68% dairy farms (Figure 1). Among the causes of calf mortality, still birth was the leading cause with prevalence of 1.56% followed non-specific cause (3.14%).

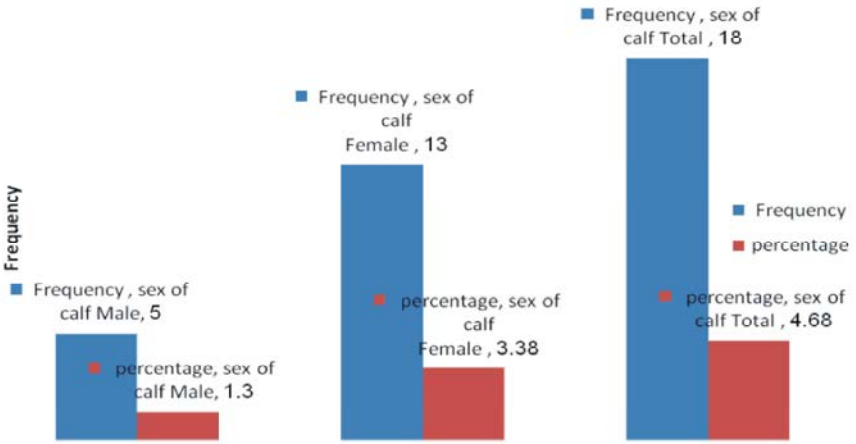


Fig. 1: Calf Mortality Rate Small Scale Dairy Farms In Gondar Town

Table 1: Risk Factors Associated with Calf Mortality

| Risk factors | | | | | | |
|---|---|---|---|---|---|---|
| Variables | Factors | No of calves | Percent (%) | Prevalence (%) | Chi-square | P-value |
| Age | Still birth | 6 | 1.56 | 6(1.56) | 123.93 | 0.001 |
| (Months) | ≥30days | 378 | 98.43 | 12(3.12) | | |
| Sex of the calf | Male | 179 | 46.61 | 9(2.34) | 0.09 | 0.77 |
| | Female | 205 | 53.48 | 9(2.34) | | |
| Breed | Local | 107 | 27.86 | 1(0.26) | 4.76 | 0.03 |
| | Cross | 277 | 72.13 | 17(4.42) | | |
| Parity | $2^{nd}$ -$4^{th}$ | 278 | 72.39 | 13(3.38) | 0.00 | 0.10 |
| | $5^{th}$ and above | 106 | 27.60 | 5(1.30) | | |

Table 2: Management and Environmental Risk Factors Associated with Calf Mortality (N=384)

| Risk factors | | | | | | |
|---|---|---|---|---|---|---|
| Variables | Factors | No. of calves | Percent (%) | Prevalence (%) | Chi Square($\chi^2$) | p-values |
| Herd size | Small (3-40) | 362 | 94.23 | 18(4.69) | 1.15 | 0.28 |
| | Medium (>=40) | 22 | 5.72 | 0(0.0%) | | |
| Experience | >5 years | 340 | 88.54 | 16(4.16) | 0.00 | 0.96 |
| | ≤5 years | 44 | 11.45 | 2(0.52) | | |
| Calving facility | Calving pen | 361 | 94.01 | 16(4.15) | 0.88 | 0.35 |
| | No calving pen | 23 | 5.98 | 2(0.52) | | |
| Method of feeding | Suckling | 354 | 92.18 | 16(4.16) | 0.28 | 0.26 |
| | Hand feeding | 30 | 7.81 | 2(0.52) | | |
| Weaning age | Before 6 month | 238 | 61.98 | 14(3.64) | 2.00 | 0.16 |
| | After 6 month | 146 | 38.02 | 4(1.04) | | |
| Housing | Separate pen | 324 | 84.37 | 16(4.16) | 0.76 | 0.38 |
| | With dam (same Barn) | 60 | 15.62 | 2(0.52) | | |
| Type of housing | Concrete | 197 | 51.30 | 13(3.38) | 3.31 | 0.07 |
| | Non-concrete | 187 | 48.69 | 5(1.30) | | |
| House cleaning frequency | Once | 331 | 86.19 | 13(3.38) | 3.10 | 0.09 |
| | Three times | 53 | 13.80 | 5(1.30) | | |

**Determinant of Calf Mortality**

**Calf Factor:** It was found that the risk factors associated with calf mortality; sex ($\chi^2$ = 0.09, P= 0.77), parity ($\chi^2$ =0.00, P = 0.10) which is statically non-significant whereas age ($\chi^2$ =123.93, P= 0.00) and breed ($\chi^2$=4.76, p=0.03) were found to be significantly (P<0.05) associated with the calf mortality (Table 1).

**Management and Environmental Risk Factors Associated with Calf Mortality:** The management aspect of dairy farm was also studied. Out of 384 respondents, male workers were 69.27% while the female workers were 30.73%. Majority (88.54%) of the farm owners had farm experience greater than five years. Colostrum feeding was the common practice reported by all farms owners. Method of

feeding ($\chi^2$=0.28, p=0.26), herd size ($\chi^2$=1.15, p=0.28), experience of the owner (÷2=0.00, p=0.96) weaning age ($\chi^2$=2.00, p=0.16), calving facility ($\chi^2$=0.88, p=0.35) housing condition ($\chi^2$=0.76, P=0.38), type of house ($\chi^2$=3.31, p=0.07) and house cleanness ($\chi^2$ =3.10, P=0.09) were non-significantly associated to the death of calves (Table 2).

## DISCUSSION

In the present study, the prevalence of calf mortality was greater than Natore district (2.84%) and Joypurhat districts (2.84%) Pabna district (1.84%) reported by Bangar *et al*. [25] and Shaikh [26]. The prevalence of calf mortality was lower than 7 to 25% in pre-weaned calves in Ethiopia reported by many researchers [27, 28]. This might be due to excellent management practices adopted by the farmers and efficient veterinary services as well as awareness among farmers [25]. Higher mortality rate than present study was also reported to be 53% from three years record of Ada Berga dairy farm that keeps Danish Jersey breeds [28]. Shiferaw *et al.* [29] reported 7% of mortality rate in semi-intensive system in Friesian and Boran crossbred and Jersey and Boran crossbred up to pre weaning age (3 months). Other researchers also reported higher calf mortality percentage than current study to be 14.2% [30] 15% [14] 17.5% [31] and 25% [27] in different part of Ethiopia. The newborn calf has poorly developed defense mechanism. Also, the normal flora is not well established and unlike to newborn of primates, they are born with no circulating antibodies to combat infection [32]. Hence, overall management in general and feeding and hygiene in particular are the major factors for the survival in calves in contaminated environment. Large herd sizes and usually holding high exotic blood level animals among different studies were associated risk factor for calf mortality [33, 34] as lower number of calves per farm can easily be monitored and measures could be taken to avoid calf health problems.

The result of this study showed that sex of the calf, parity, herd size, farm experience, calving facility, method of feeding, weaning age, housing and type of housing were statistically non-significant for calf mortality. In the present study, herd size non-significantly associated with calf mortality which is not in line with Nielsen *et al*. [34] and Abdullatief *et al*. [35] who reported significantly effect of herd size on calf mortality rate. Abdullatief *et al*. [35], also reported the sex of the calves and experience of the owners to have significant effect on calf mortality rate. Debnath *et al*. [36]also reported the significant effect of sex on calf mortality. The cause of such variation may be due to the poor management of feeding in calves and hygiene of the calf pen particularly first two to three month after birth, can markedly affect morbidity and mortality.

In the preset study, age of the calf is significantly associated with calf mortality with prevalence of 4.7% which is in line with lower than the findings of Heinrichs and Radostits [12]. IAR livestock stations, Holetta and Adamitulu, Ethiopia reported an overall mortality rates ranging from 10% to 33% [17, 37-39] who reported 61.5% of crude morbidity rate. Breed was having significant effect on calf mortality in the current study and crossbred were recorded significantly higher mortality than local. Crossbred calves are not well adapted to the tropical environment and are often subjected to environmental stress which leads them to high risks of health problems. Wymann [15]and Uetake [40] also reported the significant effect of breed on the mortality in calves.Current finding showed that parity was statically non-significant for calf mortality which was not in agreement with the findings of Berglund *et al*. [41], Silva *et al*. [42] and Meyer *et al*. [43] in North America. These variations from current findings may be due difference in genetic make-up of dam as well as the overall management of calves.

The overall mortality of calf in the study was 4.68% which was lower than the findings of 20% in calves of in dairy farms in Sodo town, Ethiopia [44] 22% in calves in Ada'a Liben district of Oromia, Ethiopia [17]. The variation in calf mortality may be due difference in hygiene practices and feeding management among these areas. In the current findings were recorded to be 1.56% which was lower than 9.3%, 71.1% and 30.7% by Megersa *et al*. [45], Hossain *et al*. [46] and Ferede *et al*. [47] respectively. This difference might be due to better health management.

## CONCLUSION

Calf mortality represents economic losses to the dairy industry due to delayed genetic progress, fewer replacements available for voluntary culling of the lactating herd and increased cost of replacement. The present study revealed that there was considerable calf mortality particularly in those cross breeds because of different reasons where nonspecific causes of still birth were dominantly reported. There was variability in calf mortality rate depending on the age of calf, breed and parity status of the dam. Furthermore, factors such as house condition, cleaning frequency, colostrum feeding and weaning age were the most important determinates of

calf mortality in the study area. In general, the calf mortality rate found in this study was higher beyond the economically tolerable limit. The major risk factors assessed during study period were improper management of calf feed, still birth, Age, breed of the animal were found to be the most important risk factors of mortality. Because of the complex nature of dairy management systems, a variety of causes are responsible for diseases and mortality of calf. Hence, overall management in general and feeding and hygiene in particular are the major factors for the survival in calves in contaminated environment. Therefore, this study recommends paying attention to the management of calves and proper nutritional feeding of the cow before and after giving birth, to carry out Detailed investigations on the different risk factors for calf mortality, to increase the awareness creation among farm owners, managers and animal attendants on the cause of calf mortality and their respective preventive measure could be great importance in any attempt to maximize animal productive and farm income.

## ACKNOWLEDGMENT

Above all, I would like to thank Almighty God for supplying me health, wisdom and strength in my work and for his perfect protection and guidance of my life. Secondly, I would like to express my deepest gratitude and thanks to my advisors Mr. Nigus Abebe and Dr. Mu-uz Gebru for their valuable guidance, encouragement, material provision and meticulous correction of this paper. My special thanks also go to Dr. Niraj Kumar for his general advice and manuscript edition. Finally, I would like to express my respect and love to my hero and beloved family; my dad, Tadesse Alemu, my mom, Harege Alemu, my brothers and sisters as well as my best friends. It is not pretty simple to express what they did to me in my life and I have no word to state it.

## REFERENCES

1. ILCA (International livestock center for Africa), 1998. Animal reproduction for African countries, report of a joint semin by international foundation for science and Swedish international program on animal production ILCA, Addis Ababa, Ethiopia.
2. Moyo, S. and F. Wanepoel, 2010. Multi functionality of livestock in developing communities and the role of livestock in developing communities. The Technical Centre for Agricultural and Cooperation and University of the Free State, pp: 345-356.
3. Randolph, F., E. Schelling, D. Grace, F. Nicholson, L. Leroy, C. Cole and W. Demment, 2007. Invited Review Role of Livestock in Human Nutrition and Health for Poverty Reduction in Developing Countries. Journal of Animal Science, 85: 2788-2800.
4. Thornton, P., 2015. Review Livestock production: recent trends, future prospects. Philosophical Transactions of the Royal Society, 365: 2853-2867.
5. CSA, 2015. Report on livestock and livestock characteristics. The Federal Democratic republic of Ethiopia, Private Peasant Holdings. Statistical Bulletin 570, Addis Ababa, Ethiopia, pp: 21-29.
6. Metaferia, F., T. Cherenet, A. Gelan, F. Abnet, A. Tesfay, J. Ali and W. Gulilat, 2011. A Review to Improve Estimation of Livestock Contribution to the National GDP. Ministry of Finance and Economic Development and Ministry of Agriculture.Asdia Ababa, Ethiopia, pp: 21-29.
7. Behnke, R., 2010. The Contribution of Livestock to the Economies of IGAD Member States: Study Findings, Application of the Methodology in Ethiopia and Recommendations for 69 Further Work, IGAD LPI Working Paper 02-10. Odessa Centre, IGAD Livestock Policy Initiative, Great Wolford, UK.
8. Asmare, K., W. Sibhat, G. Molla, J. Ayelet, A. Shiferaw, E. Martin and J. Godfroid, 2013. The status of bovine brucellosis in Ethiopia with special emphasis on exotic and cross bred cattle in dairy and breeding farms. ActaTropica Journal, 126: 186-192.
9. Geresu, A., G. Ameni, T. Kassa, G. Tuli, A. Arenas and G.M. Kassa, 2016. Seropositivity and risk factors for Brucellain dairy cows in Asella and Bishoftu towns, Oromia Regional State, Ethiopia. Afican Journal Microbiology Research, 10(7): 203-213.
10. Tegegne, A. and A. Gebrewold, 1998. Prospects for periurban dairy development in Ethiopia. Proceeding of 5 conference of Ethiopian society of animal science 15-17 May 1997, Addis Ababa Ethiopia, pp: 28-39.
11. Shiferaw, Y., A. Tenhagen, M. Bekana and T. Kassa, 2005. Reproductive disorders of crossbred dairy cows in the central highlands of Ethiopia and their effect on reproductive performance. Tropical Animal Health and Production, 37: 427-441.
12. Heinrichs, J. and M. Radostits, 2001. Health and production management of dairy calves and replacement heifers In: Radostits, O.M. (ed.): Herd Health, Food Animal Production Medicine 3rded Philadelphia, W.B. Saunders Company, pp: 333-395.

13. Goshu, G. and H. Singh, 2013. Lactation specific and life time demographic parameters in a Holstein Friesian herd in the central highlands of Ethiopia. Livestock Research for Rural Development, 25.Article number 200. Available at: http://www.lrrd.org/ lrrd25/11/gosh25200.htm.
14. ILRI., (International livestock researcher instituted), 1996. International livestock researcher instituted annual project report 1995, Addis Ababa, Ethiopia, pp: 74-75.
15. Wymann, N., 2005. Calf mortality and parasitism in peri-urban livestock production in Mali. Philosophisch-Naturwissenschaftlichen Fakultat, der Universitat Basel, PhD. Thesis.
16. Bebe, B., S. Abdulrazak, P. Ogore, J. Ondiek and T. Fujihara, 2001. A note on risk factors for calf mortality in large-scale dairy farms in the tropics. A case study on rift valley area of Kenya. Australia Journal of Animal Science, 14: 855-857.
17. Wudu, T., 2008. Study of calf morbidity and mortality in dairy farm in DebreZiet and it is environs, Ethiopia. Faculty of Veterinary Medicine, Addis Ababa University, DebreZiet, Ethiopia. MSc Thesis.
18. Tizard, I., 1995. Veterinary Immunology, 4th ed. W.B. Saunders Company, Philadelphi.
19. Stevenson, C., A. Linder and S. O. Olsson, 2006. Mortality in Swedish dairy calves and replacement heifers. Journal of Dairy Science, 89: 4769-4777.
20. Gulliksen, S., K. Lie and O. Osteras, 2008. Calf health monitoring in Norwegian dairy herds. Journal Dairy Science, 92: 1660-1669.
21. Razzaque, A., M. Bedair and S. Abbas, 2009. Performance of pre weaned female calves confined in housing and open environment hutches in Kuwait. Pakistan. Veterinary Journal, 29(1): 1-17.
22. Gondar Agricultural Rural Development Office, 2008. Gondar Agricultural Rural Development Office. Gondar, Ethiopia.
23. Thrusfield, M., 2005. Determinants of disease. Veterinary Epidemiology (3rd ed). Blackwell Publishing, pp: 345-543.
24. Arsham, H., 2005. Questionnaire design and surveys sampling (9thed). Available at: http://home.ubalt.edu/ntsbarsh/statdata/Surveys.Accessed on March 15, 2017).
25. Bangar, Y., T. Khan, A. Dohare, D. Kolekar, N. Wakchaure and B. Singh, 2013. Analysis of morbidity and mortality rate in cattle in village areas of Pune division in the Maharashtra state. Veterinary Medicine, 8: 512-515.
26. Shaikh, R., 2009. Estimation and analysis of morbidity and mortality in cattle under village condition of NMaharashtra. MVSc Thesis submitted to Indian Veterinary Research Institute Izatnagar and Uttar Pradesh.
27. Sisay, A. and A. Ebro, 1998. Growth performance of Boran and Their Semmintal cross calves. Proceedin of 6thnational conference of the Ethiopia society of animal production (ESAP).Addis Ababa, Ethiopia, pp: 157-162.
28. Hassen, Y. and E. Brannag, 1996. Calving performance and mortality in Danish Jerse cattle at Ada Berga state farm, Ethiopia. The proceeding of the 10thconference of Ethiopian veterinary association, Addis Ababa, Ethiopia.
29. Shiferaw, Y., A. Yohannes, Y. Yilma, A. Gebrewold and Y. Gojjam, 2002. Dairy husbandry and health management at Holleta.
30. Amoki, T., 2001. Management of dairy calves in Holleta area, central highlands of Ethiopia. Faculty of veterinary medicine, Addis Ababa University, Debre Zeit, Ethiopia, MSc thesis.
31. Hussen, C., 1998. A study on calf mortality at Adamitulu Livestock research center. In Proceeding of 5th conference of Ethiopian Society of Animal Science, Addis Ababa, Ethiopia, pp: 157-162.
32. Bath, L., R. Dickinson, A. Tucker and D. Appleman, 1985. Dairy Cattle: Problems, Practices, Problems and Profits, 3rd ed. Philadelphia: Lea and Febiger, pp: 325-338.
33. Wudu, T., 2004. Calf morbidity and mortality rate in dairy farms in Bishoftu and its environs, Ethiopia. MSc. thesis, Addis Ababa University, Faculty of veterinary medicine, Bishoftu, Ethiopia, pp: 38-41.
34. Nielsen, P., B. Jensen and L. Lidfors, 2008. Milk allowance and weaning method affect the use of a computer controlled milk feeder and the development of cross-sucking in dairy calves. Applied Animal Behaviour Science, 109: 223-237.
. Abdullatief, E., M. Mansour, E. Atif, Abdelgadi, E. Ibtisam and M. El-Zubeir, 2014. Major causes and risk factors associated with calf mortality in dairy farms in Khartoum State, Sudan. Journal of Veterinary Medicine and Animal Health, 6(5): 145-153.
35. Debnath, C., K. Sil, A. Selim, A. Prodhan and M. Howlader, 1995. A retrospective study of calf mortality and morbidity on smallholder traditional farms in Bangladesh. Preventive Veterinary Medicine, 9: 1-7.

36. Alemu, G. and Y. Teshome, 1987. Note on Calf Mortality Rate at Two IAR Livestock Stations, Holetta and Adamitulu. Proceedings of the 1st National Livestock Improvement Conference, IAR, Addis Ababa, pp: 76-80.
37. Mengesha, F., 1993. A Retrospective Study of Cattle Mortality at Holetta Research Center. Proceedings of the 7th Annual Conference of Ethiopian Veterinary Association (EVA), Addis Ababa, pp: 101-104.
38. Temesgen, Y., 2004. Cal Morbidity and Mortality in Dairy Farms in DebreZiet and Its Envirions. MSc Thesis, Faculty of Veterinary Medicine, Addis Ababa University, Addis Ababa, pp: 1-47.
39. Uetake, K., 2012. Newborn calf welfare A review focusing on mortality rates Animal Science Journal, 84: 101-105.
40. Berglund, B., L. Steinbock and M. Elvander, 2003. Causes of stillbirth and time of death in Swedish Holstein calves examined post mortem. Acta Veterinary Scand, 44: 111-120.
41. Silva, N., S. Stewart, P. Rapnicki, M. Chang and M. Fricke, 2007. An observational analysis of twin births, calf sex ratio and calf mortality in Holstein dairy cattle. Journal Dairy Science, 90: 1255-1264.
42. Meyer, L., J. Berger and J. Koehler, 2000. Interactions among factors affecting stillbirths in Holstein cattle in the United States. Journal Dairy Science, 83: 2657-2663.
43. Asefa, A. and W. Ashenafi, 2016. Dairy calf morbidity and mortality and associated risk factors in Sodo town and Itssuburbs Wolaita zone, Ethiopia. Slovak Journal Animal Science, 49: 44-56.
44. Megersa, B., A. Yacob, A. Regassa, F. Abuna, K. Asmare and K. Amenu, 2009. Prevalence and incidence rates of calf morbidity and mortality and associated risk factors in smallholder dairy farms in Hawassa, Southern Ethiopia. EthiopianVeterinary Journal, 13: 59-68.
45. Hossain, M., H. Kamal and K. Rahman, 2013. Retrospective study of calf mortality on Central Cattle Breeding and Dairy Farm (CCBDF) in Bangladesh. Eurasian Journal of veterinary Science, 29: 121-125.
46. Ferede, Y., H. Mazengia, T. Bimrew, A. Bitew, M. Nega and A. Kebede, 2014. Preweaning morbidity and mortality of crossbred calves in Bahir Dar Zuria and Gozamen districts of Amhara region, Northwest Ethiopia. Open Access Library Journal, 1: 600.