Pre-Weaning Morbidity and Mortality of Crossbred Calves in Bahir Dar Zuria and Gozamen Districts of Amhara Region, Northwest Ethiopia

Yeshwas Ferede[1]*, Hailu Mazengia[2], Tewodros Bimrew[1], Addisu Bitew[1], Mohammed Nega[1], Adebabay Kebede[1]

[1]Andassa Livestock Research Center, Bahir Dar, Ethiopia
[2]Faculty of Agriculture and Environmental Science, Bahir Dar University, Bahir Dar, Ethiopia
Email: *yeshwasferede@yahoo.com
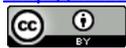
Abstract

A cross-sectional study was conducted from September 2009 to August 2010 with the objective of determining calf morbidity and mortality rates, to investigate the potential risk factors for mortality and morbidity and to determine the type and prevalence of major diseases of crossbred calves in Bahir Dar Zuria and Gozamen districts of Amhara Region. A total of 148 respondents engaged in small holder crossbred dairying were interviewed using a structured questionnaire survey about their calf management practices and major calf health problems encountered. About 396 crossbred calves were considered for this study. The overall magnitude of morbidity and mortality rates of crossbred calves were 58.4% and 30.7%, respectively. Higher mortality of crossbred calves was found in Gozamen district (39.6 %) than in Bahir Dar Zuria district (29.9 %). The major calf diseases found were diarrhea (21.4%), pneumonia (18.6%), septicemic conditions (12.4%) and navel ill (8.1%) and miscellaneous cases (39.5%). Risk factors such as study location, blood level, age, colostrum feeding and time of colostrum feeding were found to have statistically significant ($p < 0.05$) effects on crossbred calf mortality rate in both districts. Exotic genetic influence, age, colostrum feeding and time of colostrum feeding were also the major risk factors found statistically significant ($p < 0.05$) to affect calf morbidity. In conclusion, the magnitude of calf morbidity and mortality rates found in this study were much higher than economically tolerable level and could affect the productivity of the dairy farms through mainly decreasing the availability of replacement stock. It is therefore, suggested that implementation of improved calf management practices and optimization of more adaptable blood level of crossbred cattle in the study areas would significantly reduce calf mortality and morbidity.

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*Corresponding author.

Keywords

Bahir Dar Zuria, Crossbred Calves, Gozamen, Morbidity Rate, Mortality Rate, Pre-Weaning

1. Introduction

The productivity of cattle depends largely on their reproductive performance and the survival of calves [1] [2]. Calf morbidity and mortality are problems of major concern in all countries where cattle are raised under extensive husbandry practices [3], and the problem is more acute in developing countries due to bad calf management practices [4]. Calf mortality rates up to one year of age can go as high as 50% in the tropics due to bad management, poor adaptation of exotic breeds to the prevailing tropical environment and endemic diseases [5]. Calf replacement should be given appropriate attention since the availability of replacements heifers for a dairy herd markedly influences the ability of a dairy man to increase milk production by allowing him to practice elective culling of low producing cows [6]. Among other factors, calf diseases causing morbidity, mortality and fertility problems are among some of constraints faced in raising replacement stock. High incidence of calf morbidity and mortality incurs great economic loss to dairy producers. This arises from death loss, treatment cost, decreased life time productivity and survivorship [7]. It also causes the loss of genetic material for herd improvement and decreases the number of dairy heifers available for herd replacement and expansion.

Calf morbidity and mortality are perennial problems for dairy producers worldwide. A few studies conducted on calf mortality between 0 - 1 year in Ethiopia reported an overall mortality rates ranging from 10% to 33% [4] [8]-[10]. Previous estimates [5] indicated that a calf mortality rate of 20% can reduce net profit by 38% and therefore in a profitable dairy farm, calf mortality rate should be kept below 5% [8] [11]. According to ILCA [12]) calf morbidity and mortality were ranked next to mastitis as the second biggest problem for dairy production in Ethiopia. Scours in neonatal period and Pneumonia in older calves are known to be responsible for most of calf hood morbidity and mortality [13]-[15]. Similar findings were reported from Ethiopia [16]-[19]. Several environmental and managerial factors act as risk factors for the occurrence of calf morbidity and mortality [7] [20] [21]. In a study that included stillbirth and abortion, mortality rate was reported as high as 67% [22].

Calf diseases that cause morbidity and mortality are the results of complex interaction of the management practices, environment, infectious agents and the calf itself. Therefore, this study was mostly done on smallholder dairy farmers in two districts of Amhara Regional State, Northwest Ethiopia with the following major objectives:

- To determine the magnitude of pre-weaning crossbred calf morbidity and mortality rates.
- To determine the types and prevalence of major disease of pre-weaning calves.
- To assess associated risk factors for pre-weaning crossbred calf morbidity and mortality.

2. Materials and Methods

2.1. Study Area Description

This study was conducted in two model districts of Amhara region, Northwest Ethiopia. These districts were Bahir Dar and Gozamen which were selected purposively due to their geographic location representing mid and high altitude areas. In the study districts farmers were selected and included in small-holder dairy production packages launched and implemented by Regional government through distributing pregnant cross bred heifers to farmers. Bahir Dar zuria district is located, 565 km North West of the capital Addis Ababa. The mean altitude of the district is 1800 meter above sea level and the temperature of the district ranges from 10˚C to 380˚C along the year with annual rain fall of 800 - 1250 mL. The livelihood of major section of the population in the area depends on crop-livestock mixed farming. The district comprises 121,528 Cattle, 2346 Shoats, 37,839 Equine and 62,012 Poultry (Bahir Dar zuria BoA report, 2002).

Gozamen District is also located in Northwest Ethiopia at altitude of the district is 2400 meter above sea level. The average temperature for the area is 8˚C to 21˚C and the area receives with a minimum and maximum annual rain fall of 1448 to 1808 mm respectively [23]. The livelihood of the major section of the population in the area

depends on crop-livestock mixed farming. The district comprises 160,067 Cattle, 113,738 Shoats, 21,839 Equine, 46,368 Poultry (Gozamen woreda BoA report, 2002).

2.2. Study Animals, Study Design and Sampling Technique

Study animals were crossbred dairy calves (Local Zebu × Holstein-Friesian) of pre-weaning age in Bahir Dar, zuria and Gozamen districts. A cross-sectional study was carried out to determine the morbidity, mortality and major health problems of calves. Study sites and households were selected purposively based on the availability of cross breed animals and geographic locations. A total of 148 respondents who owned crossbred calves of pre-weaning age (below 15 months) were sampled and interviewed, and 396 cross bred calves (173 in Gozamen; 223 in Bahir Dar Zuria) were used for this study.

2.3. Data Collection

A structured questionnaire which has been composed of various questions focused on calf management and health concerns was administered to 148 households. Major risk factors including location, season of calf birth, condition of birth, sex, age, exotic genetic influence, colostrum feeding, time and method of colostrums feeding were the different variables covered during the interview. Data on history of calf deaths, history of illness, and quantity of milk feeding, feeding and type of feeds, watering and health care were also recorded. Major diseases syndromes of calves were recorded during the data collection process and were summarized and categorized in to four disease conditions/syndromes based on owners' traditional disease description knowledge with cross referenced to scientific disease interpretation. These were, Diarrhea, Pneumonia, Septicaemic condition and Navel ill (Omphalitis).

2.4. Data Management and Analysis

All data were first entered and managed using Microsoft Excel and analysis of data were made through Statistical Package for Social Sciences software version 16 (SPSS 16) [24]. To measure crude calf morbidity, mortality and disease conditions of calves, descriptive statistics was employed. While analysis of variance using GLM of SPSS was employed to measure the effect of risk factors (Milk shed location, % of exotic blood, season of birth, age, colostrum feeding and age at which colostrums feeding on calf morbidity, mortality and disease conditions of calves. A significance level ($p < 0.05$) and confidence level (95%) was set to determine the presence or absence of statistically significant difference between the given parameters.

3. Results

3.1. Description of Household and Livelihood Characteristics

The majority of respondents were male (72.5%) and the rest (27.5%) were female. The average age of the respondents was 44.13 years with a minimum and maximum of 20 to 80 years respectively. As far as households literacy rate is concerned; it was composed of illiterate (50.0%), read and write (23.6%), primary (13.6%) and secondary school completed (12.8%). In the surveyed districts, average family size was 6.36 and ranging from 1 to 15. An average land holding per household was 2.25 ha. About 91.1% of households' livelihood is entirely dependent on agriculture. Respondents who are engaged in other non-agricultural activities were; Merchant (2.7%), Retired (2.7%) and Government employed (2.5%). The average number of local and crossbred calves per household was 1.54 and 1.51, respectively. While, the average number of local and cross bred cows per household was 2.02 and 1.53 TLU, respectively.

3.2. Crossbred Calves Management Practices in the Study Areas

The study indicated that only 39.2% of the respondents know the importance of colostrum feeding. Of those do have knowledge, only 10.1% feed colostrum to their calves immediately after birth within six hours. Method of milk feeding is suckling (75.0%) and bucket feeding (25.0%). In the surveyed districts, 48.0% of the respondents feed their calf only hay and straw, 31.1% improved forage with straw and hay, and 10.8% of respondents feed concentrate with hay and straw. Of the total respondents, 45.3% explained that frequent mortality was observed in male than female calves. On the other hand, 25.0% of the respondents explained frequent mortality

was observed in females than males and the remaining 29.7% explained as both sexes were equally vulnerable to mortality. Thirty-six percent of the respondents explained that frequent mortality was observed in calves of below 3 months of age. On the other hand, 21.8% respondents explained as mortality was frequent from 3 to 6 months of age.

3.3. Crude Calf Morbidity, Mortality and Major Calf Diseases

The results of this study revealed that crude morbidity and mortality of pre-weaning age were 58.4% and 30.7%, respectively. The major calf diseases reported in this study were Omphalitis (8.1%) septicemic conditions (12.4%) pneumonia (18.6%), diarrhea (21.4%) and miscellaneous cases (39.5%) (**Table 1**).

3.4. Association of Potential Risk Variables with Morbidity and Mortality

A total of seven different potential risk factors (study location, % of exotic genetic influence, season, sex and age, colostrum feeding and time of colostrum feeding) were investigated for their association with the occurrence of morbidity, mortality and major disease conditions of calves. Five factors (study location, exotic genetic influence, age, colostrum feeding and time of colostrum feeding) were found significantly (p < 0.05) associated with calf mortality (**Table 2**). The other four (4) risk factors (exotic genetic influence, age, colostrum feeding and age at which colostrum feeding) were also found statistically significant (p < 0.05) with calf morbidity (**Table 2**).

3.5. Major Disease Conditions of Calves and Associated Risk Factors

The major calf diseases reported in this study were Diarrhea (21.4%), Pneumonia (18.6%), Septicaemic conditions (12.4%) and Omphalitis (8.1%). An association of putative risk factors with major diseases conditions of calves was tested (**Table 3**). Among analyzed risk factors, exotic blood influence, age, season, colostrum feeding and time of colostrum feeding were found statistically significant (p < 0.05) with calf diarrhoea. Season and colostrum feeding were risk factors which were found to have statistically significant effects on (p < 0.05) with calf pneumonia (**Table 3**).

4. Discussion

The crude calf morbidity (58.4%) and mortality rates (30.7%) found in this study found were much higher than the 3 to 5% calf mortality that can be achieved through good calf management and above the economically tolerable level at least by the standard of the western production systems [25] and even much higher than the reports of calf mortality (7% to 25%) in developing countries under poor management and major disease problems [26] and 18.0% of calf mortality rate in dairy farms of Debre Zeit and its surroundings [6]. However, the current mortality rate is found relatively lower than the previous report [5], calf mortality rates up to one year of age can go as high as 50% in the tropics due to bad management, poor adaptation of exotic breeds to the prevailing tropical environment and endemic diseases. This discrepancy might be attributed to differences in calf management

Table 1. Crude morbidity, mortality and major diseases of crossbred calves in the study districts.

Crude morbidity and mortality	Percentage
Morbidity	58.4
Mortality	30.7
Major calf diseases	**Relative morbidity percentage**
Omphalitis (Naval ill)	8.1
Septicemic condition	12.4
Calf pneumonia	18.6
Calf diarrhea	21.4
Miscellaneous cases	39.5

Table 2. Association of potential risk variables with calf morbidity and mortality based on GLM, multivariate analysis.

Risk factors	Mortality and morbidity		
	N	Morbidity (%)	Mortality (%)
Location		NS	*
Bahir Dar zuria	278	56.5	28.1
Gozamen	119	65.0	37.0
Exotic blood level (%)		*	*
Up to 25	85	47.1[a]	18.8[a]
>25 - 50	103	55.3[a]	25.2[b]
>50 - 75	167	61.1[b]	34.7[c]
>75	42	78.6 [c]	52.3[d]
Season		Ns	NS
Wet season	121	65.3	28.1
Dry season	88	55.7	33.0
Sex of calf		Ns	NS
Male	230	68.2	38.1
Female	166	42.5	26.3
Age of calf (in month)		*	*
Up to 3	75	64.3[a]	39.3[a]
>3 - 6	115	52.4[b]	30.4[b]
>6 - 12	158	39.1[cb]	18.5[c]
>12	48	21.5[c]	14.5[c]
Colostrum feeding		*	*
Yes	172	42.8	33.9
No[**]	224	68.0	66.1
Time of colostrums feeding		*	*
<6 hr	75	39.0	15.8
>6 hr	97	60.5	32.0

N = number of observations; * = Significant (p < 0.05); NS = not significant (p > 0.05); ** = Calves totally inhibited from colostrum; Percentage with different superscripts letters (a, b, c, d) within the same column and class are statistically different.

practices across the study location, and agro-ecological variation. The present finding agrees with other studies conducted on calf mortality between 0 - 1 year in Ethiopia, reported an overall mortality rates ranging from 10% to 33% [4] [8]-[10] The magnitude of crude morbidity reported in this study slightly agrees with the finding of Wudu *et al.* [6], who reported 61.5% of crude morbidity rate and Virtala *et al.* [27] and Debnath *et al.* [9] reported 52% rate of crude morbidity in crossbred calves.

The major surveyed calf diseases were diarrhea (21.4%), septicaemic conditions (12.4%), pneumonia (18.6%), naval ill (8.1%) and miscellaneous cases (39.5%). Except calf diarrhea, the current prevalence of surveyed calf diseases are higher than the results reported by Wudu *et al.* [6] in dairy farms in Debre Zeit and its surroundings, in which calf diarrhea, pneumonia, septicaemic condition and naval ill were 42.9%, 4.9%, 3.9% and 3.7% respectively. The discrepancy might be attributed to differences in knowledge of calf management practices, agro-ecology and study design employed (the previous study used longitudinal study design to determine the incidence rate of these diseases, where as this study used cross-sectional study design by using questionnaire to determine the prevalence of these diseases). The predominance of calf diarrhea followed by pneumonia as a major calf health threat reported in this study is consistent with various reports in Ethiopia and many other studies elsewhere, which reported diarrhea and pneumonia as the first and second important disease complexes that affect calf health [9] [14] [15] [17] [20].

Risk factors statistically associated with calf mortality were study location, exotic genetic influence, age, co-

Table 3. Association of potential risk variables with major disease conditions of calves based on GLM, multivariate analysis.

Risk factors	Major diseases of calves (%)			
	Pneumonia	Diarrhea	Omphalitis	Septicemic condition
Location	Ns	*	Ns	Ns
B/Dar zuria	17.4	19.6	8.6	14.6
Gozamen	25.3	30.3	6.7	22.3
Exotic blood level (%)	Ns	*	Ns	Ns
Up to 25	7.5	14.2[a]	4.7	7.6
>25 - 50	23.1	18.9[ab]	12.6	19.3
>50 - 75	20.9	26.1[b]	7.2	22.2
>75	19	30.0[c]	7.0	25.0
Season	Ns	*	Ns	Ns
Wet season	16.2	26.1	7.8	18.8
Dry season	29.2	15.6	8.4	18.2
Sex of calf	Ns	Ns	Ns	Ns
Male	14.0	28.3	6.8	22.0
Female	13.7	27.4	10.6	15.6
Age of calf (in month)	*	*	Ns	Ns
Up to 3	22.6[a]	28.1[a]	11.2	15.9
>3 - 6	16.9[b]	18.6[b]	11	14.8
>6 - 12	11.9[c]	12.2[b]	3.4	20.5
>12	8.2[cb]	7.5[c]	4.8	26.4
Colostrum feeding	*	*	Ns	Ns
Yes	10.0	9.0	12.8	21.9
No[**]	21.3	29.6	5.0	13.7
Time of colostrums feeding	Ns	*	Ns	Ns
<6 hr	16.0	13.4	10.8	12.8
>6 hr	23.8	24.2	9	19.5

N = number of observations; * = Significant (p < 0.05); NS = not significant (p > 0.05); ** = Calves totally inhibited from colostrums; Percentage with different superscripts letters (a, b, c) within the same column and class are statistically different.

lostrum feeding and time of colostrum feeding. Exotic genetic influence, calf age, colostrum feeding and duration of at which colostrum feeding were risk factors found statistically associated with calf morbidity. Mortality differences were found statistically significant between study districts. Higher mortality and morbidity was recorded from Gozamen district, despite its agro-climatic condition is seemingly favorable for cross bred calves due to lower daily temperature ranges than Bahir Dar district. The variation of mortality among study areas might be due to differences in calf management practices, number and exotic genetic influence of crossbred calves kept. The relatively poor over all calf management practices observed in Gozamen district may contribute for high mortality and morbidity rates observed in this study. On the other hand, the degree of mortality and morbidity rates were found with increment trends as blood level of cross bred calves increases and a declining trend as age increases. The higher magnitude of mortality and morbidity was recorded from calves of above 75% exotic genetic influence than other percentages of exotic blood level influence. This is due to the fact that, the tropical environment for which temperate and cross breeds are not well adapted might have been an additional stress to increase the risks of mortality and morbidity [6]. Similar reports emphasized that keeping crossbred dairy cows of the intermediate exotic blood (62.5% - 75%, Friesian inheritance) is suggested for better production [28]. The declining trend of mortality and morbidity as age increases found in this study is in line with the previous finding [7], 60% of all deaths occurred in the first months of life over a period of four months.

Colostrum as well as age at colostrum feeding was found statistically significant with calf morbidity and

mortality, higher mortality and morbidity was recorded from calves inhibited from colostrum feeding. Several studies have reported the effect of delayed colostrum intake on calf health and survival [6] [14] [29]. Each hour of delay in colostrum ingestion in the first 12 hours of age increased the chance of a calf becoming ill by 10% [26]. Calves with inadequate colostral immunoglobulin concentration within 24 hours of birth were at greater risk of neonatal morbidity and mortality, pre-weaning morbidity and morbidity and respiratory morbidity [29]. Moreover, an association of calf mortality with delayed colostrum intake in weaned calves was also reported [6].

5. Conclusion and Recommendation

In conclusion, the degree of morbidity and mortality found in this study were much higher than the economically tolerable level. This is a great hindrance to improve dairy production and productivity throughout these study areas. It has also been found that factors such as exotic genetic influence, colostrum feeding, time of colostrums feeding and age of calf were the most important determinant factors of calf mortality, morbidity and disease conditions. Higher mortality and morbidity rates were recorded in calves having above 75% exotic genetic influence. Therefore, to reduce calf morbidity and mortality in the study areas, implementation of improved crossbred calf management practices such as allowing calves to take adequate colostrums within 24 hours of birth, improved health care, housing and feeding through sustainable training and optimization of appropriate crossbreeding should be warranted. As calf diarrhea and pneumonia were found to be the major diseases and of which are both etiologically complex diseases, a more comprehensive study is suggested to identify the major infection causing agents. Further comprehensive research on the role and association of different epidemiological factors such as calf (host factor), environmental and etiological factors that might influence calf morbidity and mortality is also recommended.

Acknowledgements

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