

Causes of Dairy Calf Morbidity and Mortality and its Associated Risk Factors in Selected Dairy Farms of and Around Bishoftu

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Abstract: Calf morbidity and mortality are important causes of economic losses on dairy farms globally. A cross-sectional study and clinical observations were conducted from November 2018 to April 2019 with the objective of determining calf morbidity and mortality and to investigate the potential risk factors in selected dairy farms in and around Bishoftu. Purposive sampling method was used. A total of 80 respondents engaged in market oriented small holder dairying were interviewed using a structured questionnaire survey about their farm and calf management practices and major calf health problems encountered and diseases that causes morbidity and mortality. The overall magnitude of morbidity and mortality of calves were 32.5% and 57.5%, respectively. The major calf diseases found were diarrhea (65.88%), pneumonia (16.47%), unidentified causes (9.41%), local abscess (2.94%), bloat (2.94%) and joint ill (2.35%). Risk factors weaning age, breed, colostrum feeding of calf and overall farm management were included. In this study 80.58% of calf mortality occurs under 3 months of age and 19.41% is above 3 months. In conclusion, the magnitude of calf morbidity and mortality greatly affect the productivity of the dairy farms through mainly decreasing the availability of replacement stock and production of milk. It is therefore, suggested that implementation of improved calf and farm management practices and proper environmental management in the study areas would significantly reduce calf morbidity and mortality.

Key words: Dairy Calf • Diarrhea • Morbidity • Mortality • Pneumonia • Risk Factors

INTRODUCTION

The livestock sector globally is highly dynamic. In developed countries, demand for livestock products is stagnating, while many production systems are increasing their efficiency and environmental sustainability. In developing countries, it is evolving in response to rapidly increasing demand for livestock products [1]. It is increasingly organized in long market chains that employ at least 1.3 billion people globally and directly support the livelihoods of 600 million poor smallholder farmers in the developing world [2]. 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 [3]. Peri-urban and urban dairies are intensive production systems, which keep high grade

cows and have better management practices but this is usually associated with increased susceptibility to disease, poor survival rate and poor reproductive performance [4]. Ethiopia has the largest livestock inventories in Africa and this sector has a significant contribution to the country's economy and is still expected to support its economic development [5]. Cattle production is one of the main agricultural industries in Ethiopia. The country produces over 3.8 billion liters of milk and approximately one million tons of beef per year valued at USD 2.5 billion and USD 5.1 billion, respectively [6].

To meet the ever-increasing demand for milk and milk products genetic improvement of the indigenous cattle has been proposed as one of the options [7]. However, shortage of understanding of the farming systems, prevalent limitations and prospects of possible

interventions in line with the socio-economic scenarios of the farmers constitutes by itself the major problem for the development of the livestock sub-sector in Ethiopia [8]. Dairy farming is an increasing livestock production system in Ethiopia. It is main source of income for urban and peri-urban poor communities. Because of better availability of milk market, most of the dairy farms are concentrated in urban and peri-urban areas of the country. About 12 to 14% of the world population is expected to live on dairy farms or within dairy farming households [9].

The growing human population together with increasing demand for food security is a serious challenge for developing countries like Ethiopia. Above 85% of the Ethiopian population depends on subsistence agriculture for their livelihood. Therefore, Agriculture is the basis of the country's economy and the main contributing sector to food security [10]. Smallholder dairy production is common in several parts of the developing countries, including Ethiopia, serving as a main nutritional source and income to millions of households. Given the substantial potential for smallholder income and employment generation from high-value dairy products development of the dairy sector in Ethiopia can contribute significantly to poverty alleviation and nutrition in the country [11].

Smallholder dairy farmers experience high calf mortalities which can go up to 50%. Unavailability of dairy replacement heifers is one of the main hindrances to the development of smallholder dairy production in developing countries [12]. The success of any breeding program and the future of the smallholder dairy farms based upon the rate of survival of calf crop produced and hence calf morbidity and mortality are of great concern of dairyman, since most of the dairy farms are threatened with serious problems of calf morbidity and mortality [13].

Calf refers to the age group of young cattle from birth to nine months of age. Calves are at highest risk for death in the first two weeks of life. The two primary diseases are diarrhea and pneumonia. Even though other diseases like navel ill, arthritis, bloat, arthropod parasites and nutritional diseases feeding problem are also reported. The proportion of calves weaned before six months of age increases from less intensive to more intensive systems of production [14]. A successful dairy farm operation needs that a large percentage of cows wean alive healthy calf every year. Rearing healthy dairy calves to weaning time requires maximizing the calf's level of immunity against disease while minimizing its exposure to infectious agents [15].

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 neonatal calves is based on an immediate postpartum ingestion of antibody rich colostrum. 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 [16].

A number of factors affect the health and vigor of the calves immediately after birth [17]. Appropriate nutrition is vital for calf growth and for the general success of calf rearing enterprise. In young stock, a good nutritional strategy optimizes rumen development and growth while minimizing stress and disease [18]. Cleanliness of the barn influences calf health, as calves housed in unclean barns are at higher risk of diseases than calves housed in clean barns [19]. However, among the factors that have been hindering success of dairy industry, morbidity and mortality of calves is the one that causes major concern [20].

Calf morbidity and mortality were ranked next to mastitis as the second biggest problem for dairy production in Ethiopia. Most farmers do not have enough knowledge on significance of colostrum and good calf-feeding systems which provides disease resistance to calves. Apart from that, farmers target to optimize income by selling more milk and calves are, therefore, underfed [21]. According to Lorenz *et al.* [22], calf morbidity and mortality have short-term and long-term negative effects on performance of a dairy farm. They damage both growth rate and replacement ability of the herd (MacGurik and Ruegg, (Available at: <http://www.progressivedairy.com/dairy-basics/calf-and-heifer-raising/2230-0209-pdf-calf-diseases-and-prevention>). Referred in November 2018).

High calf morbidity and mortality risks represent a major economic loss to the dairy operations [23]. 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 [24]. Calf losses were significantly reduced by introducing new techniques of management including on-time colostrum feeding, housing, feeding and nutrition [25].

Calf hood diseases have, thus, a significant financial impact on dairies resulting from treatment costs, genetic loss and damaged future performance [26]. particularly the tropics is not an ideal location for calf rearing as the high

temperature and humidity introduce various potential disease problems to milk fed calves which harm proper heifer replacement [12]. The economic importance of neonatal diseases can be significant and a calf mortality rate of 20% can reduce net profit by 38% [27]. Mortality rate in dairy calves varied from a low of about 2% to high of 20% with mortality on individual farm through calf diseases. Calf diseases that cause morbidity as well as mortality are the results of complex interaction of the management practices and environment, infectious agents and the calf itself. Implementation of improved calf management practices is greatly suggested to reduce the high level of calf disease problems [19].

In developing parts of the world including Ethiopia there is a growing trend in the development of market-oriented urban and peri-urban dairy farming

Which is becoming an important supplier of milk and milk products to urban centers? However, studies conducted on problems of calf morbidity and mortality particularly on market oriented smallholder farms in Ethiopia is very few. There are so many dairy farms in Bishoftu and its surrounding is 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/owners expectations due to poor management practices that greatly responsible for high economic losses in dairy industry. Previously only few studies were conducted to assess the magnitude of calves morbidity and mortality. Hence, the present study is conducted with the objective of determining calf morbidity and mortality and its potential risk factors.

MATERIALS AND METHODS

Study Area: The study was conducted in Bishoftu, East Shoa Zone of Oromia Regional State from November, 2018 to April, 2019. It is located in 45km along South East of Addis Ababa. The area is located at 9°N latitude and 40°E longitude at altitude of 1850 m.a.s.l with annual rain fall of 866mm of which 84% is in the long rainy season June to September [28]. The annual average temperature ranges from 12.3°C to 27.7°C with an overall average of 18.7°C. The soil and climate are similar to those in many highland areas in Ethiopia. It is an important town where most Governmental Institutions, National and International Research Centers are located [29].

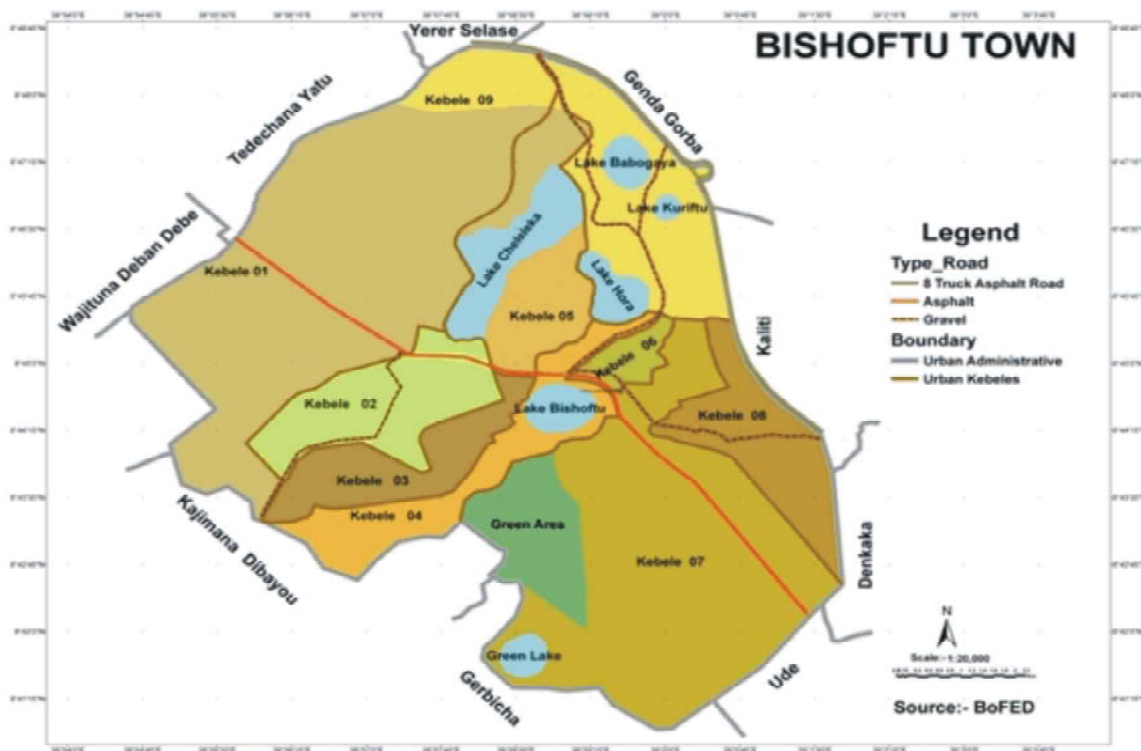


Fig 1. Bishoftu City Administration Map

Study Population: All calves from the selected 80 dairy farms in Bishoftu and its environment were study population. The area holds 69, 430 cattle and 5, 684 calves in 2009 and 72% of the farm owners practiced small holder dairy production per Kebele.

Study Design: A cross-sectional survey was carried out from November, 2018 to April, 2019 in selected dairy farms in and around Bishoftu then pre designed structured questionnaires administered to farm owners/ attendants of all dairy farms selected for this study. At the same time record was observed from case recording of those farms having record. Dairy farms owners/attendants were selected purposively based on the availability of calves and total of 80 respondents who owned calves of up to one year age were interviewed for this study.

Sampling Techniques: Selection of Study dairy farms was purposively based on the availability of calves and the willingness of the owners, attendants or manager of the farm.

Data Collection: A structured questionnaire which has been composed of various questions focused on calf management and health concerns was filled directly through face to face interviewing of 80 selected dairy farms owners/attendants. Major risk factors including awareness of colostrums feeding, availability of treatment for the calf, weaning age, housing system, breed, sex, age, birth condition, production system, hygiene of micro environment and different variables related with management system were recorded during the interview. Data on history of calf deaths, illness and type of feeds and health care and also major farm problems were also recorded. Major syndromes of diseases of calves were recorded during the data collection process and were summarized and categorized in to five disease conditions syndromes based on owners' traditional disease description knowledge with cross referenced to scientific disease interpretation.

Data Management and Analysis: All the collected data from the study area were entered and stored on and analysis of data were made through Statistical Package for Social Sciences software version 20 (SPSS 20). Descriptive statistic such as count and percentage was used for different variables and presented as tables. Chi square was also used forgetting significant level between variables and to evaluate the association among the risk

factors and calf morbidity and mortality. A statistical significance was set at a p-value of <0.05 and confidence level (95%) was set to determine the presence or absence of statistically significant difference between the given parameters.

RESULTS

Description of Farms Based on Questionnaire Result: During the present study, demography of respondents were collected and the result showed that majority of the respondents 34(42.5%) were uneducated, 30(37.5%) were elementary, 9(11.25%) secondary school and 7(8.75%) diploma. With regard to the type of the farms included in this study the present result showed that 39(48.75%) were Intensive, 31(38.75) Semi intensive and 10(12.5) Extensive system of production. Most of the Farms 51(63.75%) kept cross breed, 10(12.5%) exotic breed and 19 (23.75%) local breeds. Based on the interviewing in the most of MOSH dairy farm; male calves were sold soon after birth.

In the all surveyed farms owners/attendants have above 5 years farm experience. Majority 51(63.75%) of the owners use dairy farm as secondary source of income, whereas 29(36.25%) of owner mainly depend on the farm for their livelihood. In the surveyed farms, floor of farm were 57(71.25%) concrete and 23(28.75%) mud. In the studied farms house cleaning frequency were 57(71.25%) once and 23(28.75%) twice. According to the present result 49(61.25%) keep the hygiene of the farms regularly whereas 31(38.75%) of them have poor hygiene. In the meant time, data on house ventilation of the farms were gathered and the result revealed that 31(38.75%), 32(40%), 17(21.25%) have poor, medium and good ventilation systems respectively.

Most of the farms practiced dam vaccination to protect future calf morbidity and mortality. Of the studied 80 MOSH dairy owners/attendants interviewed, 62(77.50%) of them mentioned calf morbidity and mortality as one of the health problems in their farms and 54 farms complained that calf mortality was number one problem. For the rest of the farms (26) either reproductive problem or mastitis was the first complaint. In addition, the respondents indicated that at least the death of one calf was encountered in their farms last year as reported by 54(67.5%) of the interviewee. From farms owners/attendants that mentioned calf health problems as a problem in dairy production the majority of them (65.88%) complained diarrhea as a major cause of morbidity and mortality (Table 1).

Table 1: Respondents Feedback on their Demography and Dairy Farm

Variable	Categories	Frequency	Percent (%)
Educational level	Illiterate	34	42.5
	Primary	30	37.5
	Secondary	9	11.25
	Diploma	7	8.75
Farming system	Intensive	39	48.75
	Semi-intensive	31	38.75
	Extensive	10	12.5
Breed	Local	19	23.75
	Cross	51	63.75
	Exotic	10	12.5
Farming Experience	>5 years	57	71.25
	≤ 5 years	23	28.75
Farm as source of income	Primary source of income	29	36.25
	Secondary source of income	51	63.75
Housing	Separate pen	31	38.75
	With dam	49	61.25
Floor of farm	Concrete	57	71.25
	Mud	23	28.75
House cleaning frequency	Once	57	83.75
	Twice	23	28.75
Site of birth	Same cow barn	61	76.25
	Calving pen	19	23.75
House ventilation	Poor	31	38.75
	Medium	32	40
	Good	17	21.25
Hygienic status of pen	Yes	49	61.25
	No	31	38.75

Source: Authors Survey, 2019

Calves Management Based on Questionnaire Result:

According to the response of respondents of the various farms during the current study 19 (23.75%) reported that they assisted delivery while 61 (76.25%) didn't assist delivery as they give birth normally. This study indicated that only 65 (81.25%) of the respondents know the importance of colostrum feeding whereas 15 (18.75) of respondents responded as they do not know the importance of colostrum feeding. Among dairy farm owners and /or attendants, 29 (36.25%) responded that they allow free calf colostrum's feeding of their new-born calves, by leaving with their dams, while 51 (63.75%) dairy farm owners/attendants practiced hand feeding for their new born calves.

Among the respondents, 26 (32.5%) farm owner/attendants practice colostrum's feeding of their calves before 6 hours and 54 (67.5%) feed 6 hours post-delivery. In entirely visited farms fed their calf two times per day and the total amount of milk fed was four litters, which was during day and night. Majority 56 (70%) of the farmers used roughage for their calves as non-milk feed whereas the rest 24 (30%) used both

concentrate and roughage. But age to introduce non-milk feed and weaning age varied from farms to farms. The weaning age of calves in surveyed farms were 46 (57.5%) before four months while 34 (42.5%) after four months. The weaning age was lower for male calves as compared to female calves. Calves were housed separately away from adult animals in 31 (38.75%) while with their dam 49 (61.25%) of the farms. Naval treatment during birth of calves was practiced in only 17 (21.25%) of the farms.

The measurements taken by farm owners or attendants when the calves get sick include; call for veterinarian and take to veterinarian. With regard to the site of birth of new calves the current result showed that 61 (76.25%) of the respondent said that their cows gave birth on the same barn which was shared by other animals whereas 19 (23.75%) separate calving pen. With regard to providing of pens for their newborn calves the present result showed that 16(20%) provide beddings but 64(80%) didn't provide them. The details on the respondents' feedback on the calves' health and management situations in those selected farms (Table 2).

Table 2. Respondents' feedback on calves health and management in Bishoftu and its environs

Variable	Categories	Frequency	Percent (%)
Weaning age	Before 4 month	46	57.5
	After 4 month	34	42.5
Age at first colostrum ingestion	≤6 hours	26	32.5
	>6 hours	54	67.5
Use of bedding	Yes	16	20
	No	64	80
Naval treatment	Practiced	17	21.25
	Not practiced	63	78.75
Age of calf	< 3 month	48	60
	>3 month	24	30
Knowledge about the Importance of colostrum	Yes	65	81.25
	No	15	18.75
Knowledge on the optimum age to feed colostrum	Yes	31	38.75
	No	49	61.25
Birth condition	Normal	61	76.25
	Assisted	19	23.75
Availability of treatment for died calf	Yes	40	50
	No	24	30
	No death	16	20
Method of feeding	Suckling	29	36.25
	Hand feeding	51	63.75

Source: Authors Survey, 2019

Table 3: Distribution of major cause for calf mortality in selected dairy farms in Bishoftu and its environs from questionnaires survey

Disease conditions	Local name	Number of died calves	Cause specific mortality rate (%)
Calf diarrhea	Albaatiiwaati	112	65.8
Respiratory problem	Qufaa	28	16.47
Local abscess	Dhita	5	2.94
Joint ill	Dhitaajilba	4	2.35
Bloat	Bokokaa	5	2.94
Unidentified causes	Sababa hin beekamne	16	9.41
Died Age less than 3 month		137	80.58
Died Age greater than 3 month		33	19.41

Source: Authors Survey, 2019

Table 4: Percentage and causes of calf morbidity between the selected dairy farms in Bishoftu and its environs from questionnaires survey

Factors	Number of farms	Frequency (number of calves)	Percentage (%)
Calf diarrhea	80	54	67.5
Respiratory problems	80	16	20
Local abscess	80	4	5
Bloat	80	5	6.25
Navel ill	80	4	5
Unidentified causes	80	11	13.75

Source: Authors Survey, 2019

Major Cause of Calf Mortality and Morbidity: Disease was the sole cause of calf mortality in the study dairy farms. Among disease conditions/ syndrome inferred as causes, calf diarrhea was the predominant cause of calf loss as explained by (65.88%) of the respondents followed by Respiratory problems (16.47%). The other causes of death were Local abscess, Joint ill, Bloat and Unidentified causes. The mortality in age less than 3 months indicates higher Mortality of calves at early age. Details on

distribution of the major cause for calf mortality in Bishoftu and its surrounding are shown in (Tables 3 and 4).

Association of Risk Factors with Occurrence of Calf Morbidity and Mortality: A total of 20 different potential host and farm management related risk factors were considered for this study. The results for crude morbidity revealed that five risk factors (Condition of birth ($p < 0.01$),

Table 5: Potential risk factors significantly associated (p< 0.05) with the occurrence of crude calf morbidity from Chi- square analysis

Factors	Categories	Frequency	X ²	df	p-value
Weaning age	Before 4 months	34 (42.5%)	0.091	1	0.001
	After 4 months	46 (57.5%)			
Age of calf	<3months	48 (60%)	2.116	18	0.000
	>3months	24 (30%)			
Birth condition	Normal	61 (76.25%)	0.008	1	0.002
	Assisted	19 (23.75%)			
Hygiene	Yes	49 (61.25%)	0.962	2	0.03
	No	31 (38.75%)			
Age at first colostrum ingestion	6 hours	26 (32.5%)	1.241	1	0.043
	>6 hours	54 (67.5%)			

Source: SPSS output

Table 6: Potential risk factors significantly associated (p< 0.05) with the occurrence of crude calf mortality from Chi- square analysis

Factors	Categories	Frequency	X ²	df	p-value
Weaning age	Before 4 months	34 (42.5%)	0.091	1	0.001
	After 4 months	46 (57.5%)			
Age of calf	<3months	48 (60%)	1.625	18	0.000
	>3months	24 (30%)			
Sex of calf	Male	23 (28.75%)	0.28	1	0.041
	Female	57 (71.25%)			
Age at first colostrum ingestion	6 hours	26 (32.5%)	1.241	1	0.043
	>6 hours	54 (67.5%)			

Source: SPSS output

Age of calves (p<0.001), Age at first colostrum ingestion (p<0.001), Barn cleanness (p<0.05) and Weaning age (p<0.01) had significant effects (Table 5) Whereas only four (Age of calves (p<0.01), Age at first colostrum ingestion (p<0.05), Sex of calf (p< 0.05) and Weaning age (p<0.01)) were found to be significantly associated with crude Calf mortality (Table 6). The rest variables were not found to be significantly associated to the illness and death of calves for this particular study.

DISCUSSION

Morbidity and Mortality: This study tried to determine dairy calf morbidity and mortality, identifying the importance and magnitude of the factors that place dairy calves at risk of morbidity and mortality. The overall morbidity and mortality recorded in this study were 32.5% and 57.5%, respectively. This result is in line with where the crude dairy calf morbidity of 31.0% and mortality of 58.37% [30] and far close where the crude dairy calf morbidity was 62.0% and mortality was 22.0% [19] and with the overall morbidity and mortality of 66.7% and 20%, respectively [31]. Although diarrhea was the most important cause of morbidity and mortality in both studies, the prevalence of diarrhea in this study was higher (63.8 %) than the prevalence of diarrhea which was 42.9 % [19]. The outcome of this study confirmed the finding of Gulliksen *et al.* [32] that diarrhea was the most frequent health disorder of calves.

Age specific mortality in the current study was inversely related with age, higher in the first 3 months of age and declining gradually. This could be explained by failure of passive immunity in hand feeding practices and high susceptibility of new borne calves to many of infectious diseases causing diarrhea and pneumonia [33].

Calf disease that causes mortality is the results of complex interaction of the management practices, environment, infectious agents and the calf itself. The major surveyed calf diseases/ syndromes were calf diarrhea as shown by (65.88%) of the respondents and, respiratory problem (16.47%), followed by local abscess (2.94%), Joint ill (2.35%), bloat (2.94%) and unidentified causes (9.41%) which showed that calf diarrhea was the leading cause of calf mortality followed by respiratory problem which is in agreement with the previous reports, Awol *et al.* [34], Asefa and Ashenafi[31] and Bekele *et al.* [35] reported rates of 44%, 63.2% and 39% respectively. At the same time, the current occurrences of calf diarrhea and respiratory problem are higher than the rates of 26.44 % and 42.9% respectively [19].

Calf diarrhea as a leading health problem in growing dairy calves in the study areas. According to different literatures calf diarrhea is common in the first three month of life. The high incidence of mortality in the current study suggests the significance of improving farm management and failure of adequate nutrition to calves. No effort has been done to identify causes of diarrhea and pneumonia during this study. However, previous reports indicated

that viruses such as Rotavirus and Coronavirus Enterogenic bacteria particularly *E.coli* and *Salmonellosis* and Protozoal infections such as *Cryptosporidium* and *Coccidia* were incriminated as causes of diarrhea and consequent mortality at early age [19, 30, 33, 36-38].

All calves kept on mud floored farm give uncomfortable environment to calves and illness. This might be because of the difficulty in keeping mud floors clean and dry. Besides, they were also none effectively disinfected. As reported by Lindsay [39], muddy, wet conditions have proven to be the source of increased morbidity because the disease causing bacteria can grow rapidly. The most important determining factor of whether a herd had high or low calf morbidity and mortality is the quality of calf management. In hundred percent's of the surveyed farms, dairying and cattle rising served as the primary source of income to the owners. Farmers working in farms with less number of animals will have much less income from the farm. Therefore, they spent much of their time on working with their farm but due to less modernized mechanisms the mortality and the morbidity number is still high. This poor caring and low quality availability of treatment for sick calves might result in the significantly high mortality.

In this study, 31(38.75%) of the farm owners/attendants responded that their calves were kept in separated barn while 49 (61.25%) of the farm owners/attendants responded that their calves were kept with their dam in the same house. Separate barn provide an opportunity for the owners/attendants to feed, clean and monitor the calves. Calf diarrhea was reported by the owners/attendants as the most common disease conditions in the calves. This is in agreement with other reports [35, 40, 41].

Among a range of putative risk factors tested for their association with crude morbidity and mortality, age was found to be the most important calf factor affecting both crude morbidity and mortality. It was the only risk factor significantly associated with risk of mortality in all age groups. In this study, younger calves under three months of age were at higher risk of morbidity and mortality. Similar age pattern of morbidity and mortality has been reported by previous studies [42]. On the other hand, there are also studies, which indicated higher mortality in older calves than younger ones [18] and mortality rates unrelated to age [43]. The relatively higher risk of mortality in young calves observed in this study suggests the need of more careful management for very young calves.

Early weaning age was also found to be a risk factor statistically associated with risk of mortality. Based on literature, under good management, dairy calves can be safely weaned as early as 7-8 weeks of age [3]. Based on this fact, the age considered early and found out to be risky for calves in the present study was within the range of the optimum age for weaning. Therefore, what seemed to operate as risk factor in the study farms is the procedure of weaning calves rather than of the actual age of weaning. In this study sex was found to be statistically significant with the occurrence of calf mortality which agreed with lower mortality rate for females compared to males [44].

Delayed first colostrum feeding (later than 6 hours of age) was associated with higher risk of mortality in weaned calves, but this was not the case when calves of all age groups taken together. This seems unsound, as the colostral immunity is more important in very young age when calves' own immunity is weak; and the age at which it is ingested should matter more in young calves [45]. As to the association of delayed first colostrum feeding with morbidity, this result is in agreement with other reports. Several previous studies have shown that the first six hours of life is the period in which maximum absorption of colostral immunoglobulin takes place and higher risk of morbidity was related to failure of passive transfer of colostral immunity during this period [46, 47].

Birth condition was found to be risk factor associated with calf morbidity which is in line with, Quigley [48] who noted that calves that were born from cows with dystocia have a higher morbidity than calves delivered normally. Newborn calves stressed due to dystocia are weak enough to adapt to life in the external environment. This stress to the calves probably reduced the immunoglobulin absorption efficiency as well as delayed or decreased intake of colostrum. Hence, the longer calves are without adequate colostrum, the more opportunity for the pathogens that provoke diarrhea to invade the gut.

From the present study it was found that hygiene was significantly associated with the health of the calves. The higher risk of morbidity was associated with the dirtiness of calf house, poor management of the farm and inadequacy of availability of treatment for the sick calf. This finding is in agreement with the results of Shiferaw *et al.* [49] who reported the effect of the micro environment of calves as affecting the occurrence of calf mortality and morbidity in Holleta Ethiopia. Bendali *et al.* [50] also reported that uncleaned calf housing, as being associated with high risk of calf scour. It has been

revealed that poor housing, malnutrition and poor disease control strategies are the main factors limiting survival and performance of dairy calves on the farms Gitau *et al.* [18]. Other factors related to health and survival of calves include overcrowding, failure to keep calves separated into age groups and continual use of the same calf-rearing paddock which can predispose them to scours and other disease conditions [51]. Adequate amounts of high quality colostrum at birth, sufficient quantities of milk or milk replacer, proper weaning management and adequate dry feed intake are all of great importance for the overall survival and growth of young calves.

CONCLUSION AND RECOMMENDATIONS

The current result showed that the degree of calf morbidity and mortality was found to be relatively high in the examined dairy farms. The leading disease condition associated with morbidity and mortality was found to be diarrhea. Calf disease that causes morbidity and mortality is the results of complex interaction of the management practices, environment, infectious agents and the calf itself. The high rate calf of mortality in the current study suggests the significance of improving farm management and failure of adequate nutrition to calves. Adequate amounts of high quality colostrum at birth, sufficient quantities of milk or milk replacer, proper weaning management and adequate dry feed intake are all of great importance for the overall survival and growth of young calves.

This study also found that age of calves, age of first colostrum feeding and barn cleanness were important risk factors associated with calf morbidity while age of calves, age of first colostrum feeding and weaning age were the most important determinants of calf mortality.

Cause-specific mortality rates of these causes were higher than reports so far in other area of Ethiopia. Therefore, based on the above conclusion and present investigation, the following recommendations are forwarded:

- A more detailed study is suggested to identify the major infectious agents causing diarrhea and pneumonia.
- Implementation of improved management practices regarding calving and overall farm management should be in place.
- There should be education to create awareness about disease of calves as well as way of transmission for smallholder dairy farmers.

- Implementation of improved calf management practices such as allowing calves to take adequate and quality colostrum within 12 hours of birth, improved health care, housing and feeding through sustainable training should be warranted, to reduce calf morbidity and mortality to optimum level.
- The current study showed that an increased emphasis of farm management, cleanness of the house, well calving management with scientific advice should be in place primarily by veterinary practitioner or any trained animal husbandry personnel.

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APPENDICES

Questionnaires Format

Part.1. General Information

1. Owners' name _____ District _____ Kebele _____ age ___ sex ___ M/F
2. Production system _____ Farm location _____
3. Level of education: A. Illiterate B. primary C. secondary D. certificate/ Diploma
4. Breed of your calves
5. Local bred: A <5 B 5-10 C > 10 cross bred : A <5 B 5-10 C >10 Exotic bred : A <5 B 5-10 C > 10 D > 10
6. How many dairy calves do you have?
Local bred: A <5 B 5-10 C > 10 cross bred: A <5 B 5-10 C >10 Exotic bred: A <5 B 5-10 C >10
7. Farming experience in years A>5 B ≤ 5

Part. 2. Manager data

8. Calf care take a) owner b) hired
9. Sex a) male b) female
10. Experience a)>5yrs b) ≤ 5yrs

Part. 3. Risk factor assessment

11. Birth condition of calf a) normal delivery b) assisted delivery
12. Awareness of importance of colostrum to neonate a) yes b) no
13. Do you know the appropriate time when a calf should get colostrum? a) Yes b) no
14. If yes within how many hours after birth do you feed them? a) ≤ 6hours b) >6hour
15. Method of feeding a) suckling b) hand feeding
16. Hygienic status of pen a) Yes b) No
17. Bedding material a) present b) absent
18. House cleaning frequency a) once/day b) twice/day
19. Feed availability a) adequate b) inadequate
- 18 Water availability a) shortage b) sufficient
19. Major health problem in your farm a) calf Diarrhea b) respiratory problems c) local abscess d) navel ill e) trauma and accident f) unidentified g) bloat
20. Was there Calf mortality in your farm from 2017 -2018?a) Yes b) No
21. If yes, what causes calf mortality a) calf diarrhea b) respiratory problems c) local abscess d) joint ill e) trauma and accident f) unidentified g) bloat
22. If yes, what was the age of your Died calf a) less than 3months b) greater than 3months c) I did not remember
23. How many calves died in your farm in the last year? a) 1calf b) 2calves c) >3calves
24. Calf morbidity a) yes b) no
25. How many calves were diseased in your farm? a) 1calf b) 2calves c) >3calves
26. If yes, what causes calf morbidity a) calf diarrhea b) respiratory problems c) local abscess d) navel ill e) trauma and accident f) unidentified g) bloat
27. Do you cull your dairy calves? a) Yes b) no
28. If yes what is the reason for culling? a) Sex b) feed shortage c) shortage of farming area d) weak calf e) others
29. Do you keep health records? a) Yes b) No
30. Culling records a) yes b) no
31. What is the weaning age of your calves? A) Before 4 months B) after 4 months
32. Floor types of your dairy calves' house? A. concrete B. mud
33. Navel treatment a) practiced b) not practiced
34. Did you treat your died calf (availability of treatment for died calf) a) yes b) no c) no death
35. Site of birth; a) the same cow barn b) Calving pen
36. Sex of calf a) male b) female
37. Housing type; a) the same cow barn b) separate calf pen