

Major Causes of Calf Morbidity and Mortality and Associated Risk Factors in West Arsi Zone of Oromia Regional state

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Abstract

A longitudinal observational study was carried out from November 2013 to April 2014 to determine the incidence and the major causes of calf morbidity and mortality in calves less than one year age in dairy farms locate in the study area. Since the dairy farms were dynamic due to calf entries and exits, the number of calves purposively included in the study varied from 122 at the start of the study to 150 at sometimes during the study period. The study calves were monitored every month for six months. During six month follow up period a total of 44 new cases were recorded.

The overall crude morbidity and mortality rates were 0.38 per calf-month at risk (38 cases per 100 calves) and 0.070 per calf-month at risk (7 cases per 100 calves), respectively. Diarrhea was the major cause of calf morbidity, which accounted for 52.3% of the total morbidity cases in calves followed by pneumonia (31.8%), dermatophytosis (9.1%), and septicemia (6.8%). Among the risk factors examined, those found significantly associated with the incidence of crude morbidity ($p < 0.05$) were time of first colostrum ingestion and age of the calves. Older calves were at lower risk of crude morbidity than younger calves. Higher risk of crude morbidity was observed in calves that ingested their first colostrum meal later than 12 hours of age as compared with those that ingested before 6 hours. An appropriate management measures should be taken to reduce the incidence of calf morbidity.

Keywords: Calf morbidity and mortality; Incidence; Risk factors; Longitudinal study; Dairy farms; West Arsi zone of Oromia

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Introduction

Calves are important assets with a proper start in life, be they destined for beef or dairy production. Dairy calf rearing is a long term investment in feed, labor and other resources to ensure high quality replacement for lactating herd. The future of dairy herds depends on rearing healthy calves to replace cows to leave the herd (Hartman., *et al.* 1997). The productivity of the herd can be negatively impacted by impaired growth of calves, spread of infectious disease from calves to adult cows, decreased milk production on animal, increased veterinary costs and the limited opportunity for genetic selection due to high mortality of replacement animals (Harris and Shearer, 2003).

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Calf loses are significant because of the lost revenue generating power of that calf and the investment made in maintaining the cows through her pregnancy with no return on investment. High death rate losses to shortage in replacement stock and therefore, uneconomic cows may have to be kept longer than they deserve (Grooms, 1998). Increasing livestock productivity would improve food security. If there is reducing calf mortality, there is a rapid means for increasing cattle productivity (Ganaba, *et al.* 2002).

Amongst the numerous factors responsible for the lowered production, calf mortality is the major one. Calves are immunologically incompetent and especially sensitive to poor management and diseases. They are highly susceptible to infectious diseases and vulnerable to attack by internal parasites. Most calves problems are caused by fault nutrition either inadequate colostrums or insufficient milk, lack of vitamins A or sometimes as a result of feeding too much or too rapidly (Radostits, *et al.* 2007). Therefore the objective of the present study was; - Describing the incidence of calf morbidity, mortality, and investigating the associated risk factors of calf morbidity and mortality in the study area. In order to forward prevention and control measures to ensure high quality replacement for lactating herd and to improve livestock production.

Materials and Methods

Study Area

This study was conducted from November 2013 to April 2014 in two selected woredas of West Arsi Zone of Oromia. Shashemene and Kofale were purposively selected as a representative of West Arsi Zone of Oromia. West Arsi zone is one of newly established zone since May 1998 E.C, in Oromia regional states. Shashemene is the capital town of the zone and located southern parts of the region. The capital town placed on the distance of 245 KM from Addis Ababa. The zone has 12 rural woredas (districts) and 1 administrative town. Moreover, the zone divided into three main agro-climatical zones, highland, midland, and lowland, which comprises of 45.5%, 39.6% and 14.9% respectively.

Study Population

The study population constituted calves less than one year of age found in the small holder dairy farms in the study area.

Study design and Sampling strategy

A longitudinal observational study design was employed to address the objectives of the study. Selection of the farms was purposive and also based on the willingness of the owners. At the beginning of the study there were 122 calves, however due to entries mainly from births, at the end of study data were available for 150 calves.

Monitoring and Data Collection

At the beginning of the study the owners of different farms were interviewed using questioner format. The interview was focused on management practices, animal factors, farm history and general conditions (production and reproduction performance). Accordingly, management practices and risk factors that may have potential association with calf morbidity and mortality were investigated. Each calf recruited for the study was identified and information on date of birth, place of birth, sex, breed, time of first colostrum feeding, time of calf separated from dam, and existing health problems were recorded on a format prepared for each individual calf at the beginning of the study. Information related to feeding, watering, housing system, hygienic status of pen, method of colostrum feeding, and veterinary services given were also recorded. Monitoring of the selected dairy farms was carried out from November 2013 to April 2014. Each farm was monitored in every month and any clinical abnormalities observed on the calves were recorded.

Data Management and Analysis

The data obtained from longitudinal observational study were entered in micro-soft excel and analysis of data was done by SPSS 20 version statistical software. Microsoft excel (2007) was used to calculate the descriptive part. Statistical analyses of the associations between risk factors (explanatory variables) and outcome variables (status variables) were done by logistic regression. The association of individual risk factor with an outcome variable was screened by univariate logistic regression.

Results

Calf Morbidity and Mortality

At the beginning of the study 122 calves were present in the farms. Because of calf entries, at the end of the study data were available for 150 calves. However, due to withdrawals calves remained at the end the study were 141. All calves entries resulted from births within the study farms. Female calves contributed 23 (82%) of the entries over the observation period, the rest 5 (17.9%) were male calves. A total of 9 (6%) calves out of 150 which contribute to the follow ups exited from the farm before the end of the observation period due to deaths, all the exited calves were females. No clinical abnormalities were observed in all of the calves present at first visit of the farms.

A total of 44 disease conditions were recorded among the 150 calves that contributed to the risk period. The average number of calves at risk at the end of the study was 114[(122 +106)/2]. The crude morbidity rate was, therefore, 0.38 per calves month at risk (38 cases per 100 calves). The causes of morbidity in order of importance were diarrhea 23 (52.3%), pneumonia 14 (31.8%), dermatophytosis 4 (9.1%) and septicemia 3(6.8%). Table1.

Causes of morbidity	No. of cases (%)
Diarrhea	23 (53%)
Pneumonia	14 (31.8%)
Dermatophytosis	4 (9.1%)
Septicemia	3 (6.8%)

Table 1: Major cause of calf morbidity observed and their respective proportions.

Causes specific incidence rates

The six month incidence rates of the different causes of calf morbidity are given in Table 2, from the disease conditions or syndromes diagnosed during the study period, diarrhea was the leading causes of calf morbidity with incidence rate of 0.03 per calf month at risk (3 cases per 100 calves) followed by Pneumonia, which occurred at a rate of 0.02 per calf month at risk (2 cases per 100 calves).

Causes of calf morbidity	No. of calves at risk at the beginning of study	No. of calves at risk at the end of study	Average no. of calves at risk	No. of new cases	Incidence rate per animal month at risk
Diarrhea	122	127	124	23	0.18
Pneumonia	122	136	129	14	0.11
Dermatophytosis	122	146	134	4	0.03
Septicemia	122	147	135	3	0.02

Table 2: Incidence rate of specific causes of calf morbidity in the dairy farms during the study period.

*since the herd observed was dynamic, the denominator in the calculation of incidence rate was taken as the average number of calves at risk (i.e., no of calves at risk at the beginning of the study plus no of calves at risk at the end of the study period)/2.

Hypothesized risk factors

The result of univariate logistic regression analysis of calf morbidity with different risk factors are given in Table 3: Among the various study factors observed, the time of first colstrum feeding and age of calf were found significantly associated with calf morbidity (p < 0.05 for both factors).

Factors	No. of calves	No. of cases	OR (95% CI)	P-value
Time of First colostrum's ingestion				
3 hours	17	1	1	
6 hours	27	7	2.3 [0.01-0.40]	0.02
12 hours	24	7	1	
24 hours	82	29	2.5 [0.12-6.90]	0.001
Time of calf separated from the dam				
At birth	12	4	1	
After 24 hours	138	40	0.5 [0.116-2.38]	0.404
Hygienic status of pen				
Poor	81	34	1	
Medium	66	9	0.6 [0.36-1.30]	0.25
Good	3	1	0.36 [0.3-2.54]	0.27
Age of calves				
> 3 months	51	10	1	
< 3 months	99	34	3.5 [1.25-4.2]	0.014
Sex				
Male	22	8	1	
Female	128	36	0.6 [0.35-1.2]	0.077

Table 3: Univariate logistic regression analysis of calf morbidity with potential risk factors.

The two factors which were significantly associated with crude morbidity in the initial univariate analysis were also remained significant after step wise multivariate logistic regression analysis. The odds of calf morbidity were 2.5 times higher in calves ingest colostrum after 12 hours than those ingest colostrum immediately after birth within 6 hours. On the other hand, the odds of calf morbidity were 3.5 times greater in calves below 3 months of age than those calves above 3 months of age.

A total of nine deaths occurred during the period of observation. Eight from nine deaths (88.8%) resulted from diarrhea and the other death was due to pneumonia. The crude mortality rate in relation to the average number of calves at risk was 0.07 per calf-month at risk (7cases per 100 calves). The incidence rate of calf mortality in the study area was calculated as 0.012 deaths per calf-month. i.e.; the denominator calculated as the average number calves at risk (No of calves at risk at start of the time period plus No of calves at risk at the end of time period)/2 multipaied by length of study period.

Result of Questioner Survey

All farms raise their own replacement stock. Navel treatment during birth of calves was not practiced. Only 24% of the dairy farmers do not have awareness of importance of colostrums to neonatal calves in the study area and a deliberate effort to feed calves to colostrums at the right time was practiced in intensive farms. None of the farms practiced dam vaccination or any other measures to protect future calf morbidity and mortality. From farmers that mentioned calf health problems as a problem in dairy production the majority of them (43%) complained diarrhea as a major cause of morbidity and mortality.

To summarize the major findings of the whole study in brief, the incidence of crude calf morbidity and mortality was 38% and 7% respectively, in the study herds. Among the different disease conditions diagnosed, calf diarrhea was the predominant calf health problem followed by pneumonia. From a number of risk factors analyzed for their association with incidence of calf morbidity and mortality, time of first colostrum feeding and age of calves were found most important in affecting the occurrence of calf health problems.

Discussion

At the beginning of the study there were 122 calves in the dairy farms which was increased to 150 at the end of the study were investigated for occurrence of morbidity and mortality for six months. The dynamics of the study calves were present due to entries and exits. There was a consistently higher entries rate compared to exits rates of calves resulting to increase of the originally recruited cohort. Births contribute the whole entries (100%) and exits were due to death.

As a result of investigation a crude morbidity and mortality of 0.38 per calf-month at risk (38 cases per 100calves) and 0.07 per calf-month at risk (7 cases per 100 calves), respectively was recorded. This study has revealed a moderate rate of calf morbidity, but low rate of mortality in calves less than one year old in the study area. This is due the number of calves per farm were small and the farmers can easily monitor calves and takes measures to avoid calf health problems.

The most important factors found to be associated with calf morbidity were time of first colostrum feeding and age of the calf. The incidences of calf morbidity were significantly higher in calves less than one month, than those greater than three months and delayed colostrum feeding. In the present study calves ingest colostrum after 12 hours were more often at risk than those ingest colostrum immediately after birth within 6 hours. This could be due to inability of the calves to get sufficient and fresh uncontaminated colostrum directly from their dams and other reason could be due to the loss of passive immunity in the colostrum resulting from improper storage and contamination.

If the way of handling of colostrum is not proper the effectiveness of the colostrums would be less as compared to the one that obtain on time directly from their dam. According to Mc Guirk (2003), inadequate cooling and storage of colostrum result in amplification of any bacterial populations that are present after collection and dirty calf bottles represent the final source of bacterial contamination of colostrums. When the calves stay with their dams for some hours, they obtain the colostrum directly from the dam which was fresh and free from any contamination. Similar to this finding, a lower calf morbidity and mortality rate has been reported in Ada Berga dairy farms in calves that stayed for five days in the maternity pen with their dams and it was stated that when calves were separated from their dams at birth and placed in an area which is very cold, wet and new environment, they were easily be affected, but if they were left with their dams they could have obtained some service from their mother (Assegd and Birhanu, 2004).

Diarrhea was found to be the major cause of calf morbidity, which accounted for 52.3% of the total cases followed by pneumonia (31.8%), dermatophytosis (9.1%) and septicemia (6.8%). The occurrence of other diseases was relatively very low. In agreement with the present finding, previous studies have identified diarrhea as the most important disease problem in the young calves (Assegd and Birhanu, 2004; Temesgen, *et al.* 2004). Diarrhea was also the leading cause of mortality in the study herds. This findings are in agreement with reports of Hussien (1998) in Ethiopia.

Age was the important calf factor found to affect the occurrence of calf diarrhea and other causes of morbidity as well. The risk of diarrhea was the highest in the youngest calves (less than three months of age) and the risk was observed to decrease with increasing of age. In line with the present finding, Heinrichs and Radostits (2001) have stated that approximately 75% of the mortality in dairy animals less than one year of age occurs due to diarrhea in the first month of their life. Since diarrhea was the major cause of morbidity anything that affected the occurrence of diarrhea in calves would likely affected crude morbidity.

The crude mortality observed in this study (0.07 per calf-month at risk) was low when compared to previous reports in the country. Different authors reported a wide range of calf mortality levels in Ethiopia. High crude mortality rate of 18% was reported by Temesgen, *et al.* (2004). The lower mortality rate in the present study might have resulted from a good management care provided. In agreement with this, Heinrichs and Radostits (2001) have stated that in good management practices, annual mortality of calves can be reduced to 3-5%.

Conclusions and Recommendations

This study has revealed a moderate rate of calf morbidity, but low rate of mortality in calves less than one year old in the study area. Time of first colostrum feeding and age of the calves were the most important risk factors found to be associated with calf morbidity. Diarrhea was observed to be the most important causes of calf morbidity in the dairy farms of study area and calves below three months of age were the most affected age groups.

A decrease in calf morbidity risk was observed with increasing age. Due to the problem encountered to secure the ELISA kit for detection of rotavirus, bovine coronavirus and *E. coli* strain K99, and other constraints in the study area laboratory examination could not be performed. So, laboratory confirmation is the paramount importance to identify the specific causes of calf diarrhea, planning preventive measures and controlling the disease in the study area. Therefore, taking these facts in to account the following points are recommended.

- Calves should have to be provided with colostrums on time immediately after birth
- Since young age is the critical time for calves, producers should have to give special attention for young calves.
- Each disease condition should be addressed by animal health professionals as early as possible in all farms.
- Laboratory confirmation is the paramount importance for planning preventive measures and controlling the disease.

Annexes

Annexe 1: Sample of Questionnaire Format

1. Farm identification

- 1.1. Owners' name _____ 1.2. district _____ 1.3. Kebele _____
1.4. Production system _____ 1.5. farm location _____

2. Manager data

- 2.1. Calf care take a) owner b) hired 2.2. sex a) male b) female 2.3. Experience a) >5yrs b) <5yrs

3. Risk factor assessment

- 3.1. Birth condition of calf a) normal delivery b) assisted delivery
3.2. Awareness of importance of colostrums to neonate a) yes b) no
3.3. Time of first colostrums feeding a) within 3hrs b) at 6hrs c) in 12hrs d) in 24hrs
3.4. Method of feeding a) suckling b) hand feeding
3.5. Hygienic status of pen a) poor b) medium c) good
3.6. Bedding a) present b) absent
3.7. If present, type of bedding a) hay b) straw
3.8. How frequently changed a) >once per wk b) once per wk c) < once per wk
3.9. House ventilation a) poor b) good
3.10. Time of calf separated from the dam a) at birth b) after 24 hrs
3.11. Feed availability a) adequate b) inadequate
3.12. Water availability a) shortage b) sufficient
3.13. Medication a) yes b) no
3.14. Vaccination a) yes b) no
3.15. Major health problem a) Diarrhea b) pneumonia c) septicemia d) other _____
3.16. Calf mortality a) yes b) no

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Annex 2: Sample of Calf identification format

- Owner name _____ District _____
Address _____ Code _____
1. Date of birth; month _____ date _____
 2. Site of birth; a) the same cow barn b) Calving pen _____
 3. Condition of birth; a) normal delivery _____ b) assisted delivery _____
 4. Sex; a) male _____ b) female _____
 5. Time of colostrum ingestion; a) within 3hrs __ b) at 6hrs __ c) in 12hrs __ d) in 24hrs __
 6. Method of colostrums feeding; a) hand feeding _____ b) Suckling _____
 7. Time of calf separated from the dam; a) at birth _____ b) after 24hrs _____
 8. Housing type; a) the same cow barn _____ b) separate calf pen _____
 9. Bedding; a) present _____ b) absent _____
 10. Cleanness of the calf house; a) poor _____ b) good _____
 11. Case incidence record; _____
 - Major clinical symptoms _____
 - Diagnosis _____
 - Teratment _____

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