

Assessment of Calf Management and Hygiene Practices Adopted in Large and Small-Scale Dairy Farms in Wondo Genet Area, Southern Ethiopia

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Background: Although calf management is the cornerstone of dairy cattle productivity and profitability, little attention is given by researchers particularly in developing nations including Ethiopia. Therefore, this research was conducted to characterize calf management and hygiene practices adopted by dairy farmers at Wondo Genet, a potential milk shed for southern Ethiopia.

Methods: Calf management and hygiene practice-related data were collected from 57 dairy farms through a semi-structured pre-tested questionnaire and personal observation. All sampled farms were visited once by technical staff and administered the questionnaire by face-to-face interview during the period February 2017 to December 2019. The obtained data were analyzed using descriptive statistics.

Results: The majority (96.5%) of the farms had a slatted calf pen floor that was made of concrete. Although more than half of the farms (57.9%) had a good calf pen drainage system, only some (n = 8, 14%) are cleaned on a daily basis. All the calves (100%) had a history of calf scour, 96% survived from cowdriosis (heartwater). The majority of the calves born in the dairy farms (68.5%) received colostrum within 30 minutes of birth, but most of them (82.5%) were fed with waste milk till weaning age. Although the majority of the farms separately house recently born calves, 24.6% of the farms raise their calves together with other domestic animals.

Conclusion and Recommendation: Dairy farm owners in the study area adopted some established risky calf management and hygiene practices that might lead to high calf morbidity/mortality in the farm. Awareness creation and further study to identify the specific causes of mortality and morbidity should be in place to improve the management and hygiene of calves and implement specific control and preventive measures.

Keywords: calf management, farm hygiene practices, Wondo Genet

Introduction

Being a fast urbanizing country in sub-Saharan Africa, the development of market-oriented urban and periurban dairy farming in Ethiopia is showing tremendous growth.¹ These farms are becoming an important supplier of milk and milk products for the growing urban population. Moreover, small-scale intensive dairy production systems are a primary source of income and create employment opportunities for urban and periurban poor communities through maintaining supply of milk and milk products to the communities.²⁻⁴

Although the increasing demand and price of milk and milk products are driving sustained dairy production, the sector is challenged by several factors including shortage of adequate feed supply and space, diseases of different types, inadequate animal health services, lack of coordinated development programs between various levels of government institutions and poor reproductive performance of dairy cows and survival rate of calves.⁵⁻⁷

Good calf management, for a better health and survival rate of calves, is the cornerstone of dairy cattle productivity and profitability.^{8,9} Since the dairy heifer calves are the foundation of the future milking herd,¹⁰ high incidence of calf

morbidity and mortality results in great economic loss to the dairy producers associated with death loss, treatment cost, decreased lifetime productivity and survivorship¹¹ and limit dairy herd expansion and genetic selection.¹² The reduced heifer calf survivorship ultimately results in selection pressure on the producer and concomitantly keeping cows of poor performance, limits dairy herd expansion and genetic improvement.¹³

Several factors affect the health and vigor of the calves from birth to the age of weaning. Proper calf management, mainly on nutritional strategy, housing conditions and cleanliness of the barns, is fundamental for calf health, growth and ultimately for the general profitability of calf-rearing enterprises.^{14,15} Although several studies have been conducted on calf morbidity, mortality and survival rates of calves in different part of Ethiopia,^{1,15–18} there is limited information on the management and hygienic practices of dairy farms. Therefore, this study was conducted with the objective of assessing the calf management system and hygienic practices in dairy farms and investigating the potential risk factors of calf morbidity and mortality.

Materials and Methods

Study Area

The study was conducted in Wondo Genet, a district located southeast of Shashemene in the Sidama region. Wondo Genet is located about 265 km from the capital city, Addis Ababa, and about 14 km from the Shashemene town at an altitude range of 1800–2400 m above sea level. The area receives a mean annual rainfall of 1200 mm.¹⁹ Both smallholder dairy farmers as well as the Hawassa University dairy farm at Wondo Genet College of Forestry and Natural Resources were used to generate the appropriate data.

Study Design, Study Subjects and Population

A longitudinal type of study was undertaken to identify calf management and hygiene practices adopted in large to small-scale dairy farms. The study employed both questionnaire survey and regular follow-up/observational survey.

The number and location of the dairy farms in the district were identified in collaboration with the Livestock and Fisheries Resources Office experts. Accordingly, 56 dairy farms with a herd size of 5–20 dairy cattle and one dairy farm with 126 dairy cattle were included in the study. Crossbred dairy calves under 6 months old, of both sexes that were reared under these dairy farms were the study animals. The study population represents all calves from dairy farms of Wondo Genet districts.

Data Collection

Questionnaire Survey

A total of 57 owners/managers of small to large dairy farms were identified and interviewed using semi-structured and open-ended questionnaires. The questions included demographic characteristics of the respondents, and calf management-related points including calf size in the farm, feeding and housing of the animals, colostrum feeding times, disease incidence, and mortality. Moreover, the breed, age, sex and body condition score of calves were also included.

Regular Follow-Up

A regular follow-up/monitoring of dairy farms for calf morbidity and mortality was carried out for 12 months from January 2019 to December 2019. For the purpose of this study, calves were defined as young cattle less than six months of age, morbidity as any sickness that has a recognizable clinical manifestation which warranted therapeutic intervention and mortality was defined as any observed death of calves after 24 hours of live birth. At the beginning of the follow-up period, all calves in the selected farms were identified and recorded on the prepared format. Moreover, calves born during the follow-up were also included for the follow-up. All selected calves were regularly visited twice per month by the investigator as well as by an assigned enumerator until the calves reached 6 months of age. Calves were withdrawn from the follow-up when they reached 6 months of age. A total of 200 calves of Friesian crosses (34.5% male and 65.5% female) that were at different age groups were regularly followed for the intended purpose. Their body condition score (BCS) was assessed according to the Wildman scale,²⁰ which is composed of a 1–5 scale, with 0.5 point increments (Table 1). Hygienic scores of the farms were assessed and classified as Good Score (Cleaning of floor with disinfectants

Table 1 Calf Demography

Variables	Level	Frequency	Percent (%)
Age	<1 week	104	52
	1–2 week	42	21
	3–6 week	30	15
	>6 week	24	12
Sex of calf	Male	69	34.5
	Female	131	65.5
Breed	Cross	200	100
Body Condition Score	Good	90	45
	Medium	49	24.5
	Poor	61	30.5

every day, no movement of unauthorized people and vehicle access in farm, regular washing of udders with antiseptics before milking and washing of milker's hand with antiseptics before milking); Moderate score (Cleaning of floor with only water regularly, unauthorized people and vehicle access is not prohibited, regular washing of udders with water before milking, washing of milker's hand with antiseptics before milking) or Poor Score (the floor is made generally from concrete, cleaning of floor with locally prepared broom once or twice per week).

Data Analysis

Data collected from study sites were entered and stored in a Microsoft Excel spreadsheet program and coded for analysis. Statistical analysis was done using statistical program for social science version 20.0 (SPSS). Data generated were analyzed using descriptive statistics (mainly counts and percentages).

Results

The majority of the farm owners/managers in the current study (42%) were in the age range of 35–44 years, had primary school level education (28%), and were male (65%) (Table 2).

Out of 200 calves regularly followed during the study period, nearly all calves (96.5%) had history of cowdriosis (heartwater) and 56% had pneumonia. Nearly 70% of the calves exposed for one or more ailments were male. Calf scour was recorded in all the farms ($n = 57$) and hence morbidity with this and/or other disease was 100%. Death of calves because of disease was recorded in 45 (78.9%) dairy farms (Table 3).

The majority (96.5%) of the farms had a slatted calf pen floor that was made of concrete. Most of the farms (80.7%) clean the calf pen floor with water and over half of the farms (56.14%) had a good drainage system for the calf pen. Although the majority of the calves (75.44%) were housed separately, all of the calves shared feeding utensils with other calves and other domestic animals. Over half of the farms (56.14%) used surface water (from pond, river, etc.) as the major drinking water supply for their calves (Table 4).

Table 2 Socio-Economic Characteristic of Farmers in the Study Areas

Variables	Level	Frequency	Percent (%)
Education	Illiterate	14	24.5
	Primary school	16	28
	High school	14	24.5
	College and above	13	23
Age (years)	24–34	16	28.5
	35–44	24	42
	45–54	13	22.5
	>55	4	7
Sex	Male	37	65
	Female	20	35

Table 3 Farm and Calf Level Morbidity, Mortality and Common Disease Conditions

Variables	Level	Frequency	Percent (%)
History of calf scour	Yes	200	100
	No	0	0
Death in the past 1 year	Yes	45	78.9
	No	11	19.1
History of morbidity	Yes	57	100
	No	0	0
History of heartwater	Yes	193	96.5
	No	7	3.5
History of pneumonia	Yes	112	56
	No	88	44

Table 4 Farm Management Level and Hygienic Practice

Variables	Level	Frequency	Percent (%)
Hygiene score	Moderate	32	56.14
	Poor	25	43.86
Type of floor	Concrete	55	96.49
	Soil	2	3.51
Drinking water	Surface water	32	56.14
	Tube well	25	43.86
Pen cleaning	Water cleaning	46	80.70
	No water cleaning	11	19.30
Frequency of calf pen cleaning	Daily	8	14.04
	Weekly to monthly	49	85.95
Drainage system	Good	33	57.89
	Moderate	21	36.84
	Poor	3	5.26
Other animals in farm	Yes	14	24.56
	No	43	75.44
Housing of calf after birth	Single	44	77.20
	Group	13	22.80
Feed storage condition	Good	44	77.19
	Moderate	9	15.79
	Poor	4	7.02

A significantly high number of farms separated calves immediately after birth and fed colostrum by bottle within 30 minutes. Waste milk or residual milk suckling was the major feed for 82.5% of calves. The weaning age of calves in the study area is 3–5 months, however the majority (59.5%) wean at the end of the third month (Table 5).

Table 5 Calf Management and Hygienic Practice for Calf

Variables	Level	Frequency	Percent (%)
Separation of calf	Immediately after birth	137	68.5
	<12 hours	37	18.5
	>12 hours	26	13

(Continued)

Table 5 (Continued).

Variables	Level	Frequency	Percent (%)
First colostrums	Within 30 min	139	69.5
	Within 2 hours	35	17.5
	>2 hours	26	13
Waste milk feeding	Yes	165	82.5
	No	35	17.5
Navel disinfection	Yes	143	71.5
	No	57	28.5
Weaning age	3 Month	119	59.5
	4 Month	64	32
	5 Month	17	8.5

Discussion

The majority of the farms in the study area are owned and/or managed by males. In line with this Samuel et al²¹ also reported the same result and indicated that dairy farming is a labor-intensive agricultural activity that usually involves males. Even in those few farms owned by females, the major task forces directly involved in the husbandry are hired males. On the contrary, several research findings indicate that females are the dominant dairy farmers in most developing nations.¹³ Based on the epidemiological observations, however, calf mortality is lower when females or family members of the ownership of the farm manage the calves.²²

A remarkable number (28%) of farmers of the present study completed only primary level of education. This finding agrees with the findings of Chang'a et al,¹³ Tekle and Berihe²³ and Genet and Adane.²⁴ On the contrary, some studies conducted in Ethiopia²⁵ revealed that most urban and peri-urban dairy farms are managed by people who are illiterate. Although education and training intensify a farmer's capability and preparedness to make the necessary modifications to their management practice, the level of education and availability of tailor-made training for dairy farmers is lacking in most developing nations, including Ethiopia.

The mortality rate recorded in the current study (19.1%) generally agreed with the mortality rates reported by different studies in Ethiopia. Based on the recent report of Ephrem et al¹ made by reviewing 25 original research papers, calf mortality rate in the country was between 0.9% and 37% and the pooled prevalence of calf mortality was 14.79%. However, it was higher than the reported 12% calf mortality rate in smallholder dairy production in Sub-Saharan Africa²⁶ and from the western world which reported in the ranges of 9–13% for Europe and 6.4 (n = 12) mortality and 27.8% (n = 52) morbidity cases in the report of Meribo and Mustefa.⁷ The variation in calf mortality rates among the different studies are largely explained by differences in calf management practices. What so ever the cause, calf mortality and morbidity are considered to be important indicators of dairy farm health and welfare status.²⁷

In the present investigation, calf scour (calf diarrhea) was found to be the predominant calf health problem followed by heartwater, and pneumonia. This finding is in agreement with the findings of Wudu et al,¹⁴ Genet and Adane,²⁴ Meribo and Mustefa,⁷ and Tekalign and Tesfalem²⁸ who reported calf diarrhea and pneumonia as the predominant calf health problems in different part of the country. Numerous observational studies conducted abroad also indicated diarrhea and pneumonia as the most important reasons of death.^{29–31} However, there is variation in the prevalence of these diseases among the current and the aforementioned studies probably because of the difference in the management, environmental and host-related factors. Feeding and housing systems, overall hygiene and cleanliness,⁷ disease prevention and control measures taken, age, birth condition and vigor of the calves,³² level and time of colostrum feeding are a few to mention.

The current study revealed that a significant number of calves are housed and managed in farms with poor hygienic conditions (43.86%). Although the majority of the calves were housed in calf pens with concrete floors that had moderate to good drainage systems, most of these pens were not regularly/daily cleaned (85.96%) preferably with water. In line with this, Genet and Adane²⁴ indicated that 76.5% of the farms in Jimma town kept their calf in poor to very poor

housing hygiene and 59.6% kept their calves together with adult animals. On the other hand, all dairy farms clean the calf pens daily and even some clean twice daily. The difference observed among the different studies on the frequency of cleaning, housing and floor system may be partly explained by the level of awareness, availability of space and attention given for the calves. Cleanliness of the barn and housing system influences calf health, as calves housed in unclean barns and/or with adult animals are at higher risk of disease than calves housed in clean barns separately.¹⁴ Specifically, insufficient cleaning of calf pens and feeding utensils might increase the chance of spread of different diarrheal and respiratory disease pathogens among calves.

All the respondents indicated that calves in their farm were fed with colostrum within 30 minutes to 24 hours, the majority (87%) were fed within 12 hours using bottles. Studies suggest that newborn calves should receive sufficient colostrum (about 6% of their body weight) within 6 hours after birth for maximum protection against infection. However, if calves receive colostrum by direct suckling rather than bottle feeding or are fed colostrum after 6 hours of birth, the mortality rate could be higher than the expected.^{30,33} In line with this, Syensson et al³⁴ revealed that the odds of having diarrhea was higher in calves <3 months of age that was provided colostrum by suckling compared with calves fed colostrum by bottle. Studies indicated that colostrum is the sole source of immunoglobulins for the neonatal calves and is known for a variety of other important ingredients such as cytokines and growth factors as well as a superior nutritional value compared with whole milk.^{35,36}

Residual calf suckling or waste milk feeding was the major source of milk (82.5%) for the calves in the study area. This finding is comparable with the reports of Chang'a et al,¹³ Admasu and Hassen,²⁵ and Tekle and Berihe²³ who reported 83%, 88.7% and 82.7%, respectively. Since many farmers in developing countries rely on the sale of milk to get income for their resource-poor families, calves are allowed to suckle only the residual milk in the four quarters after milking. However, in most of the cases, residual milk is inadequate to meet the requirement of the calves and hence calves could be easily starved, stunted and exposed to a number of diseases.^{13,37}

Although the majority of the calves born in the study farms were removed from their dam immediately after birth (68.5%), nearly 25% of the calves were housed either pooled or along with other domestic animals (including poultry and small ruminants) and humans. In line with this, studies conducted previously in different parts of the country^{23,24,38} also indicated a trend of keeping calves in the same barn with cows and other animals. However, to reduce calthood morbidity and mortality in dairy farms, early removal of the calf (before standing) and housing of calves in separate and individual calf pens has been widely recommended.³⁹

The weaning age of calves in the study area (3–5 months, the majority being in the 3rd and 4th months) were comparable with several studies conducted in Ethiopia and other African countries.^{1,13,28,40–42} In developed nations, mainly in the USA and Canada, the typical weaning age is 6–8 weeks.⁴³ Since weaning calves from liquid to solid feed (non-milk feed) is a stressful event that can affect their life, growth rate and welfare, Schwarzkopf et al⁴⁴ suggested an increase in weaning age to 17 weeks for a smooth transition of physiological functions from the pseudo-monogastric status to full ruminant status in dairy calves. In general literatures suggest that calves can be weaned once they consistently consume 1 kg of concentrates per day or when they are capable of thriving on a non-milk feed.^{22,36}

The study further indicated that about 30% of the calves are with poor body condition (score between 1 and 2.5). This could be explained by the poor management practice both during prenatal and postnatal periods including the amount of milk provided, and the quality and nutritive value of the feed provided. In calf feeding and overall management, the major focus is on optimizing rumen development, fast growth and minimal stress and diseases.³⁷ Unfortunately, calves in the study area did not receive the recommended 3–4 liters of milk per day,⁴⁵ good quality concentrate,⁴⁶ ad libitum clean water⁴⁷ and disease prevention measures (including deworming and vaccination). Moreover, providing surface water for calves, recorded in 55.5% of the study farms of the current study, might increase several fold the risk of introduction of many water-borne diseases to the farm with concomitant reduced weight gain and poor body condition scores.

Conclusions and Recommendations

It can be concluded from the present survey that the small herd sized dairy farm owners in the study area adopted some established risky calf management and hygiene practices that might lead to high calf morbidity/mortality in the farm. The poor/risky calf management practices with the concomitant high mortality and morbidity of calves might have reduced

the interest among farmers about dairy farming in the study area. Calf diarrhea, heartwater, and pneumonia were the predominant calf health problems of the study farms.

An extension service through tailored training and awareness creation work among dairy farm owners and farmers should be in place to improve the health, survivorship and welfare of calves. Moreover, further research should be conducted to identify the causative agent of the major health problems identified in this research as this is crucial in formulating effective preventive and control strategies such as use of vaccination or other methods.

Data Sharing Statement

The data sets used and/or analyzed during the current study are available from the corresponding author upon request.

Ethics Approval and Consent to Participate

Written ethical approval was obtained from the Research Ethics Review Board of the College of Natural and Computational Sciences, Hawassa University (reference REB_CNCS/012/2019). Since the research does not involve experimentation on animals, all the data obtained during the study were with the consent of the dairy farm owners (verbal consent). Prior to the commencement of the research they were clearly informed about the purpose and benefit of the study, and agreed to maintain the confidentiality of the information.

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