

Major Management and Health Problems of Calves in Dairy Farms Found in Jimma Town, Ethiopia

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Abstract: A Cross-sectional study involving a questionnaire, observational (by farm visiting) and one time clinical examinations were conducted from November 2013 to April 2014 to assess major health problems and management practices of dairy calves in 52 dairy farms found in Jimma town. A 52 calves out of 204 calves were included in the present study. Most of the farm owners were males, with elementary level of education. Use of calving pen, disinfection of navel and general supervision of new borne calves were less practiced. In case of calf feeding, 26.9 % of the owners let the calves to suckle, whereas 73.1% of them practiced hand feeding for their new born calves. The majority of them (88%) let the calves to feed Colostrum within 6 hours of the total farm owners, 59.6% of them provide water to their calves starting 3 days of their birth and the access to concentrate feeds started one month of age in 46 (85.5%) of the dairy farms. House hygiene and housing of the calf together with the adult animals (cows) were the major management problems whereby 76.5% of the farms kept their calf in poor to very poor housing hygiene and 59.6% kept their calves together with adult animals. The questionnaire survey results revealed that pneumonia and diarrhea were reported by 44.3% and 38.4% the farm owners, respectively as the predominant calf health problems. Navel ill and lameness were the other health problems which were reported by 11 (21.2%) and 8 (15.3%) of the interviewees, respectively. The clinical examination showed that diarrhea and pneumonia as the first and the second prevalent health problems of the calves under study with a prevalence of 6.4% and 5.9%, respectively while eye problems (hyperemia, Lacrimation and paleness), navel illness and lameness were relatively less prevalent health problems diagnosed during the on farm clinical examination work. These health problems were found to be relatively higher in the male calves than the females affecting 12 (17.1%) and 19 (14.1%) out of the total 70 and 134 male and the female calves, respectively. Among the potential risk factors considered for analysis, age at first colostrum feeding, birth condition and housing hygiene were found to be significantly associated with the occurrence of diseases problems ($p < 0.05$). In general, most of the calf health problems identified in this study were management related problems. Therefore, improving of the management practices should be given a higher emphasis by the advisory personnel.s

Key words: Calf • Dairy Farms • Health • Management • Risk Factors • Jimma

INTRODUCTION

The health and management of replacement animals are important components of total herd profitability [1]. This is true because, the future of any dairy production depends among other things on successful program of raising calves and heifers or replacement animals [2]. Nevertheless, many farmers focus more on managing the milking dairy cattle and give little attention to calf health. Hence, calf health, as reflected in morbidity and mortality,

is a consistent and major issue facing the dairy farmers. Data on mortality pattern in dairy animals under organized herd management conditions at Karnal clearly show that dairy calf mortality up to 2 months of age accounted for a major share (50–60% or higher) in different breed groups, representing a significant economic impact on the dairy farm economy [3].

Diseases are the main causes of calf mortalities, which results from complex interaction of the management practice, environment, infectious agent and the calf itself.

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Calves generally suffered from all the diseases affecting adult livestock, but different authors have identified septicemia, diarrhea and pneumonia as the three most important disease problems in the young calf [4, 5]. Several factors affect the health and vigor of the calves immediately after birth [4]. The poor immune system and lack of previous exposure to infection and poor management make new born calves susceptible to infectious diseases [6]. Proper nutrition is fundamental for calf growth and for the general profitability of calf rearing enterprise. In young stock, a good nutritional strategy optimizes rumen development and growth while minimizing stress and disease. Livestock housing conditions greatly affects health and productivity [7]. 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 [5].

The impacts of calve diseases could be direct (causing calf deaths) and indirect through increased treatment expenses and decreased life time productivity and survivorship [8]. Furthermore, it is good to know that the costs of poor calf management go beyond just calf mortality losses. For example, failure of passive transfer of immunity in calves not only results in increased mortality early in life [9], but also has long term effects on calves' lives. Failure of passive transfer in heifer calves is linked with decreased rate and efficiency of growth and decreased first and second lactation milk production [10]. In developing parts of the world including Ethiopia, there is a growing trend in the development of dairy farming which is becoming an important source of income particularly for smallholder farmers. However, this cannot be realized without the application effective calf health and management practices as the future of any dairy farming production depends on the successful program of raising replacement animals (calves). With the above background, the objectives of the present study were to assess the major management practices and to identify the major health problems of calves in dairy farms found in Jimma town.

MATERIALS AND METHODS

Study Area: The current study was conducted in Jimma town which is located in Oromia region, South West of Ethiopia, at a distance of about 352 km from Addis Ababa. Geographically, Jimma is located at 7°13' and 8° 56' N latitude and 35° 52' and 37° 37E longitude. The area has an altitude ranging between 1720 to 2110 m above sea level having an annual rainfall ranging between 1200 to 2000 mm. In normal years, the rainy seasons extend from

February to October. The annual mean temperature ranges from about 12.1°C to 28°C [11]. Jimma zone has a livestock population of about 2016823 (cattle), 942908 (Sheep), 288411 (Goats), 74574 (Horses), 49489 (Donkeys), 28371 (Mules) and 1139735 (Poultry) [12].

Study Population: The target population constitutes all small-scale dairy farms found in Jimma town. According to the data obtained from the Agricultural offices of Jimma town, there are about 52 private owned small dairy farms that possess 4 and above cows per farm and 2 farms that belong to Jimma University. However, data about the herd composition of the farms on age basis were lacking. The study animals for this particular study were dairy calves under 10 months of age. Subsequently, a total of 204 found in 52 farms were included in this study.

Study Design: A cross-sectional study involving questionnaire, observational and clinical survey was conducted.

Data Collection: The data for this particular study was collected by using questionnaire survey, direct farm visiting as well as clinical examination of the registered calves. The owners and / or attendants of the included dairy farms were interviewed using structured and open ended questionnaires. The questions included the gender and education background of the responsible personnel, size of the farm, calf rearing practices, feeding and housing of the animals, disease incidence and disease-control practices as well as the breed and age of calves were also included.

Questionnaire Survey: In each farm, a cross-sectional questionnaire survey was conducted by way of personal interview to determine farm characteristics, calf management techniques including peri-parturient care, feeding and housing and previous history of calf diseases. The questionnaire was closed type for its major part and administered by the investigator.

Calf Management: During the farm visits time, an observational assessment of the housing and hygiene including making an assessment of the condition of the barn floor (drainage system and accumulation of cows' dung) and general hygiene in calf house and its surroundings was made. Housing hygiene was graded from 1 to 4 (1 = very clean, 4 = very poor). Other management practices such as feeding; health management practices were also assessed.

Clinical Examination: Clinical examinations which involved, physical examinations including taking of the normal body parameters like temperature, pulse rate and respiratory rates were performed. The calves were examined by clinical condition and were diagnosed based on presenting clinical signs. Calves were visited and examined only once. The final tentative diagnosis was made depending on the clinical findings and the health problems encountered during the intervention time were categorized based on their clinical signs as follows.

Diarrhea: Any condition characterized by passing of loose or watery feces with increased frequency, which could or could not be accompanied by other systemic signs like dehydration, decreased appetite or fever.

Pneumonia: When frequent coughing observed with or without respiratory discharges and fever.

Navel Ill (Omphalitis): Swelling of umbilical cord which is painful when palpated and with or without abscess formation.

Lameness: Disability or imperfection of walking due to crippling of the legs or feet.

Others: Different health problems that could not be grouped in any one of the other groups mentioned before and diagnosed relatively less frequently.

Data Analysis: The data collected from the study area were coded and SPSS version 16 was used to analysis the variations of disease conditions in different variables (risk factors). Percentage to measure the prevalence of health problems and chi-square to measure association between prevalence of the health problems and different risk factors were employed. The confidence interval was held at 95% and $p < 0.05$ was set for significance level.

RESULTS

Questionnaire Survey Analysis: Farm Owners Data; Based on the questionnaire survey results, it was found that male entrepreneurs cover majority of the dairy farm operations. Out of the 52 respondents, 36 (70.6 %) were males and 15 (29.4%) were females. With regard to educational status, 22 (42.3%) had received elementary school education, 9 (17.3%) College or degree level, 12 (32.1%) secondary school and the remaining 9 (17.3%) had no formal education (Table 1).

Farms and Study Animals: A total of 204 calves were surveyed from 52 dairy farms found in and around Jimma town. The majority of the calves surveyed, 134 (65.7%) were females and the rest 70 (34.3%) were males. Out of the 204 calves, 8 (3.93%) were assisted delivery while 196 (96.07%) were delivered normally.

Calf Management: 46 (88.5%) of the surveyed farmers did not use a calving pen while 6 (11.5%) of them used a calving pen. Calving supervision was practiced only in the 12 (23.1%) of the farms and 21 (41.4%) of the farms practiced immediate removal of the newly born calf from the calving place. Visiting of the new born at night and day time were practiced in 50 (96.2%) and 30 (57.6%) of the farms while navel disinfection exercised only in 7 (13.5%) of the farms. Calf-Dam separation was done > 6 hours in 42 (80.8%) farms and < 6 hours in 10 (19.2%) of the farms (Table 2).

The calf management practices differ from farm to farm. For instance, 14 (26.9 %) of them were feeding their calves by leaving the new born calves with their dam (suckling), while 38 (73.1%) dairy farms practiced hand feeding for their new born calves. Colostrums feeding of calves before 6 hours were practiced in 46 (88.5%) farms and after 6 hours in 6 (11.5%) of the farms. The amount of milk fed daily in the farms was < 4 liter, in the 10 (19.2%) of the farms, ≥ 4 liter, in the 27 (51.9%) of the farms and unknown in the 15 (28.9%) of the farms. The unknown is the amount of suckled milk. Nearly, 31 (59.6%) of the dairy farms provided water to their calves starting from 3 days of their birth and access to concentrate feeds started from one month of age in 46 (85.5%) of the dairy farms. Respondents wean their calves at different stage of calves age, 6 (11.5 %) of the respondents wean their calves at the age of less than 3 months, while 31 (59.6%) weans after 3 months and the remaining, 15 (28.9%) had no idea about the weaning age of their calves. (Table3).

Health Related Management Practices and the Major Calf Health Problems: Majority of the farm owners 46 (88.6%) were not practicing vaccination. However the reverse is true in case of using anthelmintic, with a frequency of 2 times per year in the majority of the cases (65%). Calf death was reported by 16 (30.7%) of the respondents to have occurred in their herd in last 1 years prior to the study. Those respondents were also asked the main symptoms before death of calves, 11 of them mentioned diarrhea has been the main clinical signs they observed and the rest of them reported coughing as a main symptom observed before death of calves.

Table 1: Gender and educational level of dairy farm owner

Variables	Category	Frequency	Percentage
Gender of the farm owners	Female	15	29.4
	Male	36	70.6
Educational status	No formal education	9	17.3
	Elementary school	22	42.3
	Secondary school	12	23.1
	College/ University	9	17.3

Table 2: Calf management practices during and immediately after birth as given in the questionnaire survey

Factors	Category	Frequency (N =52)	Percent
Use of calving pen	Yes	6	11.5
	No	46	88.5
Calving supervision practice	Yes	12	23.1
	No	40	76.9
Calf removal time from the birth place	Immediate	21	41.4
	Late	31	59.6
Visit of the new born at day time	Yes	50	96.2
	No	2	3.8
Visit of the new born at night time	Yes	30	57.6
	No	22	42.4
Navel disinfection	Yes	7	13.5
	No	45	86.5
Calf-Dam separation time	>6 hours	42	80.8
	<6 hours	10	19.2

Table 3: Management practices in 52 dairy farms as given in the questionnaire survey

Factors	Category	Frequency	Percent
No of calves on the farm	Female	134	66.7
	Male	70	34.3
Method of feeding	Suckling	14	26.9
	Hand feeding	38	73.1
Amount of milk feed per day	>4L	27	51.9
	<4L	10	19.2
	Unknown	15	28.9
Age at water access	3 days	31	59.6
	7 days	21	40.4
Age at concentrate access	1 month	46	88.5
	3 weeks	2	3.8
	Unknown	4	7.7
Weaning age	>3months	31	59.6
	<3months	6	11.5
	Unknown	15	28.9
Age at first colostrums feeding	<6 hours	40	76.5
	>6hours	12	23.5
Housing hygiene	Clean	12	23.5
	Poor	32	61.5
	Very poor	8	15.4
Housing in the cow barn	Yes	31	59.6
	No	21	41.4
Individual calf housing	Yes	4	7.7
	No	48	92.3
Use of litter material	Yes	28	53.8
	No	24	46.2

Table 4: Major calf health problems as perceived by the farmers

Health problems	No of farms affected (N=52)	Percent (%)
Diarrhea	23	44.2
Pneumonia	20	38.4
Lameness	8	15.3
Navel ill	11	21.2
Other	9	17.3

Table 5: Calf health problems encountered during on farm clinical examination of each registered calf

Variables	Category	Frequency	Percent
Abnormal appearance	Yes	32	15.7
	No	172	84.3
Feces consistency	Dry	4	1.9
	Soft	7	3.4
	Watery	9	4.4
	Blood tinged	2	0.98
	Normal	182	89.2
Dehydration	Normal	192	94.1
	Moderately	11	5.4
	Sever	1	0.5
Respiration	Normal	192	94.1
	Coughing	11	5.4
	Nasal discharge	1	0.5
GIT problems	Normal	189	92.6
	Diarrhea	13	6.4
	Tenesmus	2	0.5
Integumentary	Normal	187	91.7
	Hair loss	4	1.9
	Rough hair coat	13	6.4
Lameness	Present	4	1.9
	Absent	200	98.1
Navel status	Normal	196	96.2
	Illness	8	3.8
Eye problems	Normal (shiny, bright)	192	94.1
	Lacrimation	4	1.9
	Paleness	1	0.5
	Hyperemia	13	3.4

Table 6: Sex and Age wise distribution of health problems

Factors	Total no of calves	No of calves affected	Percent
Female	70	12	17.1
Male	134	19	14.1
Before weaning	142	25	17.6
After weaning	62	7	11.3

Table 7: Association of risk factors with health problems of calves

Variables	95% CI	X ²	P- value
Housing hygiene	0.565-0.980	4.311	0.027
Age at first colostrum feeding	0.174-0.396	8.203	0.005
Birth condition	0.137-0.271	38.148	0.000
Age	0.122-0.247	1.301	0.117

The major calf health problems in the farms as perceived by the respondents were broad, but those encountered by most farms of this study were diarrhea and pneumonia which were reported by 23 (44.2%) and 20 (38.4%) of the farms respectively (Table 4).

Clinical Examination

Clinical Findings During on Farms Examination of Calves: During clinical examination of each registered calf, a total of 204 calves were examined for any abnormalities and 31 (14.97%) calves out the total were

found with different types of abnormalities. 15 (7.3%) of the total examined calves or 48.3% of calves out of the calves with abnormalities were found with GIT problems such as diarrhea and tenesmus, while 12 (5.9%) of the total or 38.7% out of those with abnormalities were experiencing respiratory problems like coughing and nasal discharges. In addition to the above mentioned problems, others such as; feces consistency, abnormalities in body temperature, hydration status, integumentary, giant, navel and eye problems were assessed and different ranges of results were recorded (Table 5).

Sex and Age Wise Distribution of Calf Health Problems:

Health problems assessment results obtained from the clinical examination of the calves showed that the problems were higher in male calves 9 (12.85%) as compared to female calves 19 (1.5%) and was higher before weaning than after weaning (Table 6).

Association of Risk Factors with Health Problems of Calves:

Among the factors selected for analysis, housing hygiene, age at first colostrum feeding, delivery condition were found to significantly associated with health problems of the calves ($P<0.05$; Table 7)

DISCUSSION

The study revealed that the 70.6% of the farm owners were males and the remaining 29.4% were females. The involvement of women in dairy farming was relatively improved as compared to the previous report of 11% women ownership of smallholder dairy farming in Jimma by Chernet [13]. This indicates that the role of smallholder dairy farming in providing self-employment to women and, therefore, its contribution to the alleviation of poverty in this particular group is on growing. The reason for this could be the result of women supportive strategies made to enhance the livelihood of women by the local government and the county's as whole.

A total of 52 dairy farms and 204 calves were included in the present study. Among the total calves 4.4% of the calves delivered with assistance, while 95.6% delivered normally. The calves which were delivered with assistant were found to be at higher risk of diseases than those delivered normally without any difficulties during birth. This finding is in agreement with the study that reported, 41 percent of the disease burden in calves could be attributed to their difficult birth [14]. This could be due to different health problems associated with the prolonged

labor during birth. Research findings have indicated that metabolic, respiratory and mixed acidosis develop frequently at birth in calves, as a result of prolonged or difficult labor and dystocia. This acidosis at birth may have detrimental effect on colostrums immunoglobulin absorption [15].

From 52 farm owners and/or attendants interviewed in this study (76.5%) replied that they practiced feeding of colostrums to the new born before 6 hours of their birth. In the present finding those calves which fed colostrums after six hours of birth were found to be at higher risk to disease than those fed before 6 hours of birth. As to the association of delayed first colostrums 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 colostrums immunoglobulin takes place [2, 16] and higher risk of morbidity was related to failure of passive transfer of colostrums immunity during this period [17]. The amount of milk fed per calf per day was; <4liter in the 10 (19.2%) of the farms, ≥ 4 liter, in the 27 (51.9%) of the farms and unknown in the 15 (28.9%) of the farms. The unknown amount was the milk fed by suckling. Hand feeding was practiced in 73.1% of dairy farms and by suckling from dam was practiced in 26.9% of them. In the farms where feeding by suckling practiced, calves were allowed to suckle after milking. The amount of milk available to the calf was, therefore, determined by the quantity of milk remaining after milking. This in turn imposes a difficulty in providing the right quantity of milk to the calf that can satisfy its requirements. Furthermore, Leaving calves to suckle colostrum from their dam is not recommended as there is no guarantee that they will have a sufficient intake. In contrast to the above mentioned drawback, residual calf suckling have the advantage of reducing contamination, the feeding of cold milk to the calf and incidence of mastitis in the dam Mdegela *et al.* [18].

In the present study, 55.6% of the farms kept their calves in the same barn with cows. The prevalence of diseases was higher in calves kept together with than those raised in individual calf pen. This agrees with the findings of Lema *et al.* [19]. Furthermore, Cleanliness of calf barns was the most important factor that had significant association with calf morbidity. Other studies [20, 21] also documented the existence of significant association between higher risk of morbidity and dirtiness of calf barn. More than half of the calves' housings considered in this study had poor or very poor hygiene, with a poor

drainage system, flat floors and potholes. Farmers frequently disposed of dung and waste materials in the vicinity of the animal housing which often resulted in unhygienic calf-rearing conditions. This condition has a negative effect on the well being of the calves and hence their profitability. Housing hygiene affects calf health, especially for the calves with low immune status [5].

The calf health problems as perceived by the owners were broad, but calf diarrhea and pneumonia were found to be the predominant calf health problems covering 44.2% and 40.3% of the farms (n=52) respectively. These findings are in agreement with different reports in Ethiopia and elsewhere worldwide, who reported diarrhea and pneumonia as the first and second important disease complexes that affect calf health [4, 19, 22]. This higher incidence of diarrhea and pneumonia could be contributed by the poor-very poor hygiene housing used by most the farmers involved in this study.

The on farm clinical examination result also revealed diarrhea and pneumonia as the first and the second calf health problems of the study farms affecting 6.4% and 5.9% of the total calves (n=204) in the farms involved in this study. This finding is in agreement with the findings of Wudu *et al.* [5] who reported calf diarrhea and pneumonia the predominant calf health problems in dairy calves at Ada'a district of Oromia region. However, the present finding is lower for diarrhea and higher for pneumonia as compared to Bekle *et al.* [23] who recorded a prevalence of 10% and 0.7% for diarrhea and pneumonia respectively.

These differences could be emanated from the difference in management and other factors such as; housing hygiene, ventilation, environment, age, season, herd size and others related factors. Navel ill and lameness were the other calf health problems which diagnosed with a prevalence of 3.8% and 1.9% respectively. In agreement with these findings, there are similar reports of lower prevalence of these disease conditions than diarrhea and pneumonia [5, 24]. However, the 3.8% prevalence of navel illness in present study was relatively higher than the 2.7% prevalence of navel illness reported by Wudu *et al.* [5]. This may be contributed by the difference umbilical care practices. In this study, the umbilical care practices were poor in which only 13.5% of the farms practice navel disinfection and below half of them remove the newly born calf immediately from the calving area to the clean area in order to minimize contamination.

Health problems were higher in male calves (17.1) than female calves (14.1%). This finding agrees with

Bekele *et al.* [23] finding who reported higher health problems in male calves than females particularly during the first months of their age. This could be due to the less attention and management care given to the male calves as their role in the farms was considered not profitable in this study. So, it is important to know that the feeding and the general management, of male calves needs to be improved for animal welfare reasons as well as for more profitable utilization of beef from these calves for consumption. However there is also another reason that should be taken in to account that is male calves have less absorption ability of serum immunoglobulin's than female calves and they could become more immuno deficient than female calves as described by Khan *et al.* [25].

In brief description the present study revealed that the management problems assessed in the dairy farms involved in this study were seriously affecting the health of the calves in the farms. Among risk factors assessed; housing hygiene, time at first colostrum feeding and birth condition were found to be significantly associated with the incidence of disease problems having a p value of ($P=0.027$), ($p=0.005$) and ($P=0.000$), respectively. This significant association of housing hygiene with disease problems found in present study was in agreement with other reports [20, 21] who documented the existence of significant association between higher risk of morbidity and dirtiness of calf barn. Similarly, a significant association of age at first colostrum feeding with calf morbidity was reported different researchers [2, 5, 16] and higher risk of morbidity in late fed (after 6 hours) was related to failure of passive transfer of colostral immunity during this period [17] and the association of birth condition with calf health problem identified in the present study was in agreement with Sanderson [14] who reported that 41 percent of the disease burden in calves could be attributed to their difficult birth.

In contrast to the above mentioned risk factors age was found to have no significant association with the calf health problems this finding contradicts with many other findings majority of which reported a significant association with higher morbidity in younger than in older calves [8, 26]. On the other hand, there are also studies, which indicated higher health problems in older calves than younger ones [7]. Never the less, it is important to know that even if statistically insignificant result was obtained in this study the prevalence was higher in younger (< 3months) 17.4% than those older calves (>3months) 11.3% (Table 6) indicating the need of more careful management for younger calves.

CONCLUSION AND RECOMMENDATIONS

The health and management problems of calves have negative effects on dairy farm productivity due to their detrimental effect on the survival and reproductive efficiency replacement animals and consequently the profitability of an operation. Calf diarrhea and pneumonia were the predominant calf health problems of the farms involved in this study. The majority of the farms kept their calves together with the adult animals (cows) and more than half of them were using poor to very poor housing hygiene which is not recommended as far as good calf management is considered. Among the potential risk factors evaluated for their association with the occurrence of calf health problems; age at the first colostrum feeding, housing condition and birth condition were found to be significantly associated with calf health problems. Most of the calf health problems found in the present study were management related and hence they can be effectively addressed through implementation of good management practice.

Based on the above conclusion the following recommendations are forwarded.

Greater attention should be given to proper management practices such as; hygienic conditions and optimum time of colostrum feeding to minimize calf health problems and hence their mortality.

More researches 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 like use of vaccination or other methods.

The Government needs to work on awareness creation among dairy farms owners about good calf managements practices and their roles in productivity of dairy farming investments through extension services.

Conflict of Interest: The authors declare that there is no any conflict of interest regarding the publication of this article.

REFERENCES

1. Perez, E., J.P.M. Noudhuizen, L.A. Van Wakjhuise and E.N. Stassen, 1990. Management Factors Related to Calf Morbidity and Mortality Rates.
2. Bath, D.L., F.R. Dchinson, H.A. Tucker and R.D. Appleman, 1985. Raising calves growing heifers. In Dairy cattle practice and profits 3rd ed. Lea and Febiger, Philadelphia, USA, pp: 325-338.
3. Prasad, S., N. Ramachandran and S. Raju, 2004. Mortality Patterns in Dairy Animals under Organized Herd Management Conditions at Karnal India. *Trop. Anim. Hlth and Prod.*, 36: 645-654
4. Sivula, N.J., T.R. Ames and W.E. Marsh, 1996. Management risk factor for morbidity and mortality in Minnesota dairy heifer and calves. *Prev. Vet. Med.*, 27: 273-182.
5. Wudu, T., B. Kelay, H.M. Mekonen and K. Tesfu, 2008. Calf morbidity and mortality in small holder dairy farms in Ada'a liben districts of Oromia, Ethiopia. *Trop. Anim. Hlth and Prod.*, 40: 369-376.
6. Darsema, G., 2008. Major causes of calf mortality in dairy farm and two cattle ranches in western region, North Western Ethiopia. *Ethiop Vet. J.*, 12: 59-68.
7. Gitau, G.K., J.J. Mc Dermott, D. Waltner-Toews, K.D. Lissemore, J.M. Osuma and D. Muriuki, 1994. Factors influencing calf morbidity and mortality in small holder dairy farms in kiambu district of Kenya. *Prev. Vet. Med.*, 21: 167-177.
8. Waltner-Toews, D., S.W. Martin, A.H. Merk and I. McMillan, 1986. Dairy calf management, morbidity and mortality on Ontario Holstein herds *Prev. Vet. Med.*, 4: 103-135.
9. Wells, S.J., D.A. Dargatz and S.L. Ott, 1996. Factors associated with mortality to 21 days of life in dairy heifers in the United States. *Prev. Vet. Med.*, 29(1): 9-19.
10. Faber, S.N., N.E. Faber, T.C. McCauley and R.L. Ax, 2005. Effects of colostrum ingestion on lactational performance. *Prof. Anim. Sci.*, pp: 21: 425.
11. JZARDO, 2001. Jimma Zone Agricultural and Rural Development Office.
12. CSA, 2009. Livestock number of breed, age, sex and purpose in: report on livestock characteristics (private peasant holding), statistical bulletin. Vol 2 Addis Ababa.
13. Chernet, A., 2009. Prevalence of bovine gastrointestinal helminthes parasite and socio-economic survey in smallholder dairy farms of Jimma Town, pp: 43.
14. Sanderson, M.W. and D.A. Dargatz, 2000. Risk factors for high herd level calf morbidity risk from birth to weaning in beef herds in the USA. *Prev. Vet. Med.*, 44: 97-106.
15. Besser, T.E., O. Szenci and C.C. Gay, 1990. Decreased colostral immunoglobulin absorption in calves with postnatal respiratory acidosis. *J. Am. Vet. Med. Assoc.*, 196: 1239-1243.

16. Matte, J.J., G. C. Girard, J.R. Seosne and G.J. Brisson, 1982. Absorption of colostral immunoglobulin G in new born calf. *J. Dairy Sci.*, 65: 1765-1770.
17. Wittum, T.E. and L.J. Perino, 1995. Passive immune status at postpartum hour 24 and long term health performance of calves. *Am. J. Vet. Res.*, 56: 1149-1154.
18. Mdegela, R.H., L.J.M. Kusiluka, M. Kapaga, E.D. Karimuribo, F.M. Turuka, A. Bundala, F. Kivaria, B. Kabula, A. Manjurano, T. Loken and D.M. Kambarage, 2004. Prevalence and determinants of mastitis and milk borne zoonoses in small holder dairy farming sector in Kibaha and Morogoro districts in Eastern Tanzania. *Tour. Vet. Med.*, 51: 123-128.
19. Lemma, M., T. Kassa and T. Tegegne, 2001. Clinically manifested major health problems of crossbred dairy herds in urban and periurban production systems in the central highlands of Ethiopia. *Trop. Anim. Hlth and Prod.*, 33: 85-93.
20. Bendali, F., H. Bichet, F. Schelcher and M. Sanna, 1999. Pattern of diarrhea in newborn calves in south-west France. *Veterinary Research*, 30: 61-74.
21. Shiferaw, Y., A. Yohannes, Y. Yilma, A. Gebrewold and Y. Gojjam, 2002. Dairy husbandry and health management at Holleta. *Proceeding of the 16th conference of the Ethiopian veterinary association*. Addis Ababa, Ethiopia, pp: 103-119.
22. Abraham, G., D.T. Roeder and Z. Roman, 1992. Agents associated with neonatal diarrhea in Ethiopian dairy calves. *Tropical Animal Health and Production*, 25: 239-248.
23. Bekele, M., Abudba, R. Alemayehu, A. Fufa and A. Kasahun, 2009. Prevalence and incidence rate of calf morbidity and mortality and associated risk factors in small holder dairy farms in Hawassa, Southern Ethiopia. *Ethiop. Vet. J.*, 13(2): 59-68.
24. Britney, J.B., S.W. Martin, J.B. Stone and R.A. Curtis, 1984. Analysis of early calfhood health status and subsequent dairy herd survivorship and productivity. *Prev. Vet. Med.*, 3: 45-52.
25. Khan, M.A., H.J. Lee, W.S. Lee, H.S. Kim, K.S. Ki, T.Y. Hur, G.H. Suh, S.J. Kang and Y.J. Choi, 2007. Structural growth, rumen development and metabolic and immune responses of Holstein male calves fed milk through step-down and conventional methods. *J. Dairy Sci.*, 90: 3376-3387.
26. Virtala, A.M., G.D. Mechor, Y.Y. Grohn, H.N. Erb and E.J. Dubovi, 1996. Epidemiologic and pathologic characteristics of respiratory tract disease in dairy heifers during the first three months of life. *J. Am. Vet. Res.*, 208: 2035-2042.