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Major Calf Health Problems and Exposing Risk Factors at Holeta Agricultural Research Center Dairy Farm, Holeta, Ethiopia

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Abstract: A longitudinal type of study was conducted to establish the incidence of major diseases and associated predisposing factors in calves up to six months old at Holeta Agricultural Research Center (HARC) dairy farm from November, 2009 to April, 2010.A total of 96 calves were included in this study. Calf diarrhea, the predominant calf health problem, with incidence rate of 12.5 %followed by pneumonia 11.5 % and pink eye 5.2 % were the major bacterial diseases of calves identified in this dairy farm. A Chi-square computed statistical analysis disclosed that the incidence of pneumonia ($\chi 2$=7.766; P=0.005) was significantly associated with the age groups of calves while the incidence of diarrhea ($\chi 2$=6.146;p<0.05) and pneumonia ($\chi 2$=8.659; p<0.05) directly associated with body condition score of the calves in the dairy farm.Univariatelogistic regression analysis of the putative risk factors signified that calves with poor body conditions were more likely to be associated with the incidence of diarrhea (due to *E.coli*) (OR= 11.154, 95% CI: 1.182-105.243) than calves with good body condition (OR=4.143, 95% CI: 0.473-36.257) while calves with the age of 0-3 months were more likely to be associated with the occurrence of pneumonia. *Escherichia coli* (12.5%), *Pastuerella multocida* (3.1%) and *Manhaemia hemolytica* (8.3%) and *Moraxella bovis* (5.2%) were the major bacterial pathogens isolated from diarrheic, pneumonic and infected eye of the calves in the dairy farm. Upon coproscopical examinations employed for identification of ova/oocyst from, fresh fecal samples, 10 (10.4%) *Coccidia* oocyt, 18 (18.8%) *Ascaris* spp and 30 (31.3%) *Coccidia* spp and *Ascaris* spp (mixed infection) eggs were identified. Breed type and body condition scores were the putative risk factors associated (p<0.05) with endo-parasitic infection of the calves in dairy farm. In conclusion, the present finding has demonstrated that bacterial and endoparasitic infections are one of the important pathogens in calves in the study farm. Therefore, further detailed investigations are needed to formulate appropriate and cost-effective strategies for the control of specific pathogens associated with calf health problems of dairy farms in Ethiopia

Key words: Calf · Dairy farm · Health problems · Risk factors · Holeta

INTRODUCTION

In Ethiopia dairy cattle production systems are classified into rural smallholder (mixed crop-livestock) production, pastoral and agro-pastoral production, urban and peri-urban smallholder dairy production and commercial dairy production systems [1,2]. Urban and peri-urban dairy is one of the four dairy production systems in Ethiopia producing milk either as a full-time or a part-time business [3].Currently a number of urban and peri-urban dairy farms are the major suppliers of milk and milk products to the urban consumers [4] and continue to be in the future.

In Ethiopia milk production is mainly from indigenous breeds, whose milk yield/cow/lactation is very low. Hence, the dairy system has not been in a position to satisfy the growing demand for milk and milk products of the nation [5]. In order to maximize the supply of the dairy

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products, different strategies have been designed and implemented. One of the strategies is crossbreeding of local dairy cattle with exotic dairy cattle, to incorporate the adaptive nature of local breeds with high productivity of exotic breeds [6, 7].

The productivity of cattle depends largely on their reproductive performance and the survival of calves [8]. This means the foundation of successful dairy industry using improved breed is laid on the consistent calf crop production. The proper care and management of calf crop, particularly for the replacement heifers is very crucial for the dairy enterprise to grow and prosper [9, 10]. Calf hood diseases have a major impact on the economic viability of cattle operations, due to the direct costs of calf losses and treatment and the long term effects on performance [11]. Calf mortality has a drastic influence on milk production by reducing replacement stock and milk let down [12].

In the past decade, recognition of the possibility of using genetic selection as a tool for improving disease resistance in dairy cattle has been hypothesized as a useful tool by both researchers and producers alike. Specifically, many studies have investigated the influence of genetics in common diseases of the dairy cow [13]. To date, there has been limited research published on the genetic effects of common diseases in dairy calves. The term calf refers to the young of bovine species up to six months of age after its birth [14].

The major constraints for the development of peri-urban dairying and the development of livestock industry in general have been summarized as policy, socioeconomic, institutional, technical and technological [4]. Therefore, considering these constraints, calf replacement should be given appropriate attention since the availability of heifer replacements for a dairy herd markedly influences the ability of a dairyman/dairy woman to increase production by allowing him/her to practice elective culling of low producing cows.

Animal diseases are among the technical and technological constraints for the peri-urban and urban dairy production systems [15]. Calf diseases that cause morbidity and mortality are the major problems faced in raising replacement stock. High incidence of calf morbidity and mortality incurs great economic loss to dairy producers. This arises from death loss, treatment cost, decreased lifetime productivity and survivorship [16].

It also causes the loss of genetic material for herd improvement and decreases the number of dairy heifers available for herd replacement and expansion. Calf morbidity and mortality are perennial problems for dairy producers worldwide. Calf mortality shows wide variation ranging from 1 to 30 % [17].

Calf diseases that cause morbidity and mortality are the results of complex interaction of the management practices and environment, infectious agents and the calf itself. Scours in neonatal period and pneumonia in older calves are known to be responsible for most of calf hood morbidity and mortality [16, 18]. Similar findings were reported from Ethiopia [19-21].To our knowledge, though most of the previous research works on dairy calf health problems in Ethiopia were carried out around Addis Ababa dairy farms, there is no published information about calf health problems from Holeta Agricultural Research Center dairy farm. Therefore, this study was intended i. To investigate the cause of calf health problems in Holeta Agricultural Research Center (HARC) dairy farm and to determine their cumulative incidence ii.To asses and identify the predisposing risk factors that impinge on health of calves

MATERIALS AND METHODS

Description of the Study Area: The study was conducted in central Ethiopia, Oromia region, in Holeta Agricultural research center dairy farm from November, 2009 to April, 2010.Holeta is located 45km west of Addis Ababa, at 09° 02' N latitude and 38°34'E longitude. The climatic condition of the area is predominantly temperate and receives a mean annual rain fall ranging from 84.5mm-89.7mm. The altitude is 2400 masl. In these areas the rainfall pattern is bimodal, with a short rainy period from February to April and a long rainy season from mid-June to September. The annual temperature ranges between 18°C to 24°C and the rainfall of the area ranges from 1000 to 1100 mm. The predominant soil type is vertisol and semi intensive farming is a common practice in both farms (Holeta agricultural research center) [22].

Description of HARC Dairy Farm: Based on the classification of management systems of animal production adopted by Richard [23], HARC dairy farm was classified as a semi-intensive dairy farm because the animals were kept in door and fed and watered in their house/shade by cut and carry system [24].

The farm holds both crossbred and Boran breed dairy cows. The farm had calving pens and individual calf pens for calves from 0-6 months old. Calves were isolated from their dams immediately after birth and taken to calf hatch for some times and then taken to calf pen, where they were housed and managed for about six months. In case of Boran breed, the calves were separated from dam immediately and taken to calf hatches for some minutes and taken back to dam for suckling. After suckling, the calf isolated from dam and then kept in calf pen where

they were housed and managed for about six months. Some feed stuffs given to calves include, hay straw, frushka and concentrate mixture. Amounts of milk given to calf decrease as their age increase. The weaning age of calves was three months. There were veterinary personnel to deal with management and health problem aspect of the farm.

There were regular dam vaccination practices to protect future calf mortality and to protect dam itself. Both artificial insemination and natural mating were used for reproduction performance. The attendants and the managers complained that calf mortality was serious problem in the farm caused mainly by diarrhea.According to the information obtained from the farm managers and personal observation, calves were regularly followed-up especially during delivery and was confirmed that sufficient amount of colostrum given to calves immediately after birth.

Study Population: The study population consisted of both pure Boran and crossbred calves. During the study, different age groups of calves were considered. The age group of the calves included 0-3months and 4-6 months of age. In addition, body condition score of calves was conducted as poor, good and very good

Study Design and Sample Size Determination: A longitudinal type of study design was conducted to determine the incidence of major calf health problem in the farm. Calves in the HARC dairy farm were regularly followed upon daily basis for determining the occurrence of new cases in the farm during study period. All calves in the dairy farm were included in the study. A total of 96 calves present in the farm were regularly followed daily and whenever there was a case, the diseased calf was examined clinically; appropriate samples (faecal sample from diarrheic calves, nasal swab from pneumonic calves and swab from the eyes during eye infection) were collected and analyzed accordingly, for bacterial isolation and identification.

Study Methodology

Sample Collection and Laboratory Analysis: Feacal samples were collected aseptically whenever a case of diarrhea was encountered for the identification of parasites and bacteria causing diarrhea. For a case of pneumonia nasal swab and eye swab (pink eye) samples were collected aseptically using cotton topped swabbed from the nose and eye and inoculated to appropriate microbial media.

Standard methods were followed for the isolation and identification of disease causing agents: Bacteria and parasites. Bacterial isolation from different specimen was employed by inoculation on different plates. Then, subsequent biochemical tests for Indole test, Methyl red test, Voges Proskauer test, Citrate utilization (IMViC) test, Hydrogen sulphide production test and spot test for indole, which revealed the existence of diseases (diarrhea, pneumonia and pinkeye) were conducted according to Quinn *et al*. [25] whereas parasitological samples were processed using the methods employed by Hansen and Perry [26].

Data Analysis: Data generated from laboratory investigations were recorded and coded using Microsoft Excel spreadsheet (Microsoft Corporation) and analyzed using SPSS version 17.0 statistical software. Descriptive statistics was used to determine the proportion of calves based on sex, breed, body condition, age and colostrum feeding methods. Chi-square test and the *p*-value were used to determine the presence of association among the different variables and the major calf health problems. A calculated $\chi 2$ value at the specified degree of freedom(df) greater than the tabulated value of $\chi 2$ at that df was reported as having a significant association and vice versa. A *p*-value less than 0.05 were considered as having statistically significant. Odd ratio was used to evaluate the degree of association among the risk factors and the disease. For this, logistic regression model and 95% confidence interval were used for interpreting the result. Cumulative incidence of the calf health problems was calculated as per the formula indicated in Thrusfield [27].

$$\text{Cumulative incidence} = \frac{\text{Number of animals developing disease during a time period}}{\text{Number of animals at risk at the beginning of that time period}} * 100$$

(The cumulative incidence of diseases was calculated as: the number of new cases over the total number of animals at the beginning of the study period).

RESULTS

Cumulative Incidence of Major Calf Health Problems Associated with Bacterial Infections in HARC Dairy Farm The overall cumulative incidence revealed that as 29.2 % (28/96) of major calf health problems associated with diarrhea (*E.coli*), pneumonia (*P. multocida* and *M.hemolytica*) and pink eye (*M. bovis*) in HARC dairy

Table 1: Cumulative incidence of diarrhea, pneumonia and pink eye

Diseases identified	Total number of calves examined	Number of positive samples for bacteria	Cumulative incidence
Diarrhea	96	12	12.5%
Pneumonia	96	11	11.5%
Pink eye	96	5	5.2%

Table 2: Cumulative incidence of bacterial infections between different age groups of calves

	Age (months)			
	0-3 (n =41)	4-6 (n =55)		
Disease	Positive (%)	Positive (%)	df	χ^2 (p-value)
Diarrhea	6.3	6.3	2	0.298(0.585)
Pneumonia	9.4	2.1	2	7.766(0.005)
Pink eye	1.0	4.2	2	0.292(1.112)

χ2=chi-square, df= degree of freedom, n =number of animals examined

farm. During the study period, calves were regularly followed up daily or the occurrence of the major calf health problems and accordingly, the observed calf's health problems which are associated with bacterial infections were; diarrhea (12.5%), pneumonia (11.5%) and infectious bovine kerato-conjunctivitis (IBK) (5.2%) (Table1).

Chi-square Analysis of Association of the Putative Risk Factors with Bacterial Infection of Calves: A Chi-square analysis revealed that cumulative incidence of disease(s) between different age groups (pneumonia) (Table 2) and body condition scores (diarrhea and pneumonia) (Table 3) were significantly associated (p<0.05) with bacterial infection of calf health problems.

Table 3: Cumulative incidence of bacterial infection in calves among different body condition scores

	Body condition				
	Poor n =18	Good n=48	Very good n=30		
	Positive (%)	Positive (%)	Positive (%)	df	χ^2 (p-value)
Diarrhea	5.2	6.3	1.0	2	6.146 (0.046)
Pneumonia	1.0	10.4	0.0	2	8.659(0.013)
Pink eye	0.0	4.2	1.0	2	2.152 (0.341)

χ2=chi-square, df= degree of freedom, n =number of animals examined

There was high (9.4%) cumulative incidence of pneumonia in calves with in age groups 0-3 months period occurred as compared to calves with 4-6 months age (2.1%). This difference was found to be statistically significant (p<0.05) while diarrhea and pink eye due to bacterial infection were insignificantly associated (p>0.05) with the age groups of the calves (Table 2). On the contrary to this, diarrhea and pneumonia infections were significantly associated (p<0.05) with the body condition scores of the calves as depicted in Table 3.

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Univariate logistic regression analysis of risk factors associated with the incidence of diarrhea and pneumonia in calves

Univariate logistic regression analysis of the putative risk factors indicated that calves with poor body conditions were more likely to be associated with the incidence of diarrhea (due to *E.coli*) (OR= 11.154, 95% CI: 1.182-105.243) than calves with good body condition (OR=4.143, 95% CI: 0.473-36.257) (Table 4) while calves with the age of 0-3 months were more likely to be associated with the occurrence of pneumonia (Table 5).

Bacteria Isolated from Diseased Calves: As per the procedures stated in the materials and methods, standard bacterial isolation procedures were followed for the identification of bacterial cause of diarrhea, pneumonia

Table 4: Analysis of body condition with the incidence of diarrhea using univariate logistic regression model

			95% Confidence Interval	
Body Condition	OR	P-value	Lower	Upper
Poor	11.154	0.035	1.182	105.243
Good	4.143	0.199	0.473	36.257

*Very good= Reference category, OR= odds ratio

Table 5: Analysis of age groups with the incidence of pneumonia using univariate logistic regression model

Variables			95% confidence interval	
age group (months)	OR	P-value	Lower	Upper
0-3	7.453	0.014	1.514	36.686

*Calves with 4-6 months age group = Reference category, OR= odds ratio

Table 6: The cumulative incidence of endo-parasites of dairy calves

Total number of calves	Number of new cases	Cumulative incidence
96	58	60.4%

Table 7: The cumulative incidence of each genus of parasite in dairy calves

Parasite identified (Ova/Oocyst)	Total calves examined	Number of calves positive	Cumulative incidence
Ascaris spp	96	18	18.8%
Eimeria spp	96	10	10.4%
Ascaris and *Eimeria* spp	96	30	31.3%

and eye infections. Accordingly, the bacteriological examination of feaces, nasal swab, eye swab from diarrheic calves, pneumonic calves and calves with pink eye, respectively, revealed that *E. coli* (12.5%) from the diarrheic calves, *P.multocida* (3.1%)(3/96) and *Manhaemia hemolytica* (8.3%)(8/96) from pneumonic calves and *Moraxella bovis* (5.2%)(5/96) from calves with eye infections.

Overall Prevalence of Calves Endoparasites Ova/Oocystand Internal Parasite Identified at Genus Level: Parasitological analytical data indicated that 58 of 96 total calves examined harbored either single or mixed infection. The cumulative incidence of endo-parasites in the HARC dairy calves was 60.4% as depicted in Table 6. Higher cumulative incidence (31.3%) of parasite infection was observed in mixed (*Ascaris and Eimeria* spps.) infection compared to infection by individual parasites. *Ascaris* spp. was found in higher (18.8%) incidence compared to *Eimeria* spp. (10.4%) (Table 7).

Chi-square Analysis of Association of the Putative Risk Factors with Endo-parasitic Infestation of Calves: A Chi-square analysis revealed that breed type and body condition scores were significantly associated ($p<0.05$) with endo-parasitic infestation of calf health problems. Higher cumulative incidence of *Eimeria* spp and *Ascaris* spp (mixed infection) (18.8%), *Ascaris* spp (7.3%) and *Eimeria* spp (9.4%) (Single infection) was observed in BOF breed of dairy calves. The differences observed in this study indicated as the parasitic infections were significantly associated (($p<0.05$) with the breeds of calves as depicted in Table 8.

Table 8: The cumulative incidence of endo-parasites of calves among different breeds

	Breeds						
Parasite Identified	BOF n =52	BOFxFn =14	BOn =6	BOxFn=24	df	χ^2	*p*-value
Emeiria	9.4%	0%	0%	1%	9	17.312	0.044
Ascaris	7.3%	6.3%	2.1%	3.1%			
Emeira and *Ascaris* spp	18.8%	1.0%	3.1%	8.3%			

*Keys: BOF=Boran x Fresian, BOFXF= Boranfresian x Fresian, BO= Boran, BOXF= Boran x Fresian, n =number of animals examined

Table 9: Cumulative incidence of parasites with different body conditions

	Cumulative incidences of parasite infection in calves with different Body conditions (%)		
Parasites identified	Poor (n =18)	Good (n =48)	Very good (n =30)
Eimeria spp	2.1	6.3	2.1
Ascaris spp	4.2	12.5	2.1
Eimeria and Ascaris	8.3	16.7	6.3

$\chi 2 = 14.595$, df = 6, *p*-value =0.024, n =number of animals examined

In addition to this, calves with good body condition scores were highly infected by endo-parasites (both mixed and single infection) than the calves with poor and very good body condition and the incidence of parasitic infection was significantly associated with the body condition score of the calves in the study farm (Table 9).

DISCUSSION

The present study established an overall cumulative incidence of 29.2 %(28/96) major calf health problems associated with bacterial infections in case of diarrhea (*E.coli*), pneumonia (*Pasteurella multocida* and *Manhaemia hemolytica* and pink eye (*Moraxella bovis*) while the coproscopical examinations employed for identification of ova/oocyst indicated that as the cumulative incidence of endo-parasites was 60.4% in the HARC dairy farm calves.

In the present investigation, calf diarrhea was found to be the predominant calf health problem with incidence rate of 12.5 % (12/96) followed by pneumonia 11.5 % (11/96) and pink eye 5.2 % (5/96).The prevalence of calf diarrhea in the present study is comparable with the report of Darsema [28] (13.5%) from North Western of Ethiopia. In contrary to this, the present finding is less than previous studies [10, 16] with 42.9% and 34%, respectively. The difference can be caused by many factors including variation in ingestion of colostrums, hygienic condition of feeding utensils and condition of housing [29].

Diarrhea was also the leading cause of mortality in the study farm. This finding is in agreement with reports of [16,20, 30] in Ethiopia and many other studies elsewhere, which reported diarrhea and pneumonia as the first and second important disease complexes that affect calf health [31,32]. In contrary to this finding, there were studies which found pneumonia as the leading cause of calf mortality [21, 33].

Previous studies by Wale [34] in selected dairy farms in and around Kombolcha (10.6%) and Mengesha [29] in dairy farms of Mekelle environs (7.57%) reported respiratory problems (pneumonia) in dairy calves which is relatively comparable with the present finding (11.5%). This slight variation might be due to environmental factors, ventilation of the house and immunity development [29].

The relatively lower incidence of pneumonia in this study could be due to the small herd size of farm in contrary to the findings of Shiferaw *et al*. [21] and Agerholm *et al*. [33] which found pneumonia as the leading cause of calf mortality. Large herd size has strong correlation with environmental stress that exposes calves to respiratory problems; it was observed that a 50% decrease in stocking density was increasing the ventilation rate by 20 times thereby decreasing the risk of pneumonia [16].

In the present work, the putative risk factors found statistically associated with the occurrence of pneumonia (bacterial infection) in calves were age groups and body condition scores. There was high (9.4%) cumulative incidence of pneumonia in calves with in age groups of 0-3 months period occurred as compared to calves of 4-6 months old (2.1%) while the incidence of pneumonia was higher in calves with good body condition scores (10.4%) compared to the calves with poor and very good body condition. This revealed as the difference in age groups and body condition scores were significantly associated with the incidence of pneumonia in dairy calves of the present study ($p<0.05$) while the difference in age groups were insignificantly associated with the incidence of diarrhea due to bacterial infections ($p>0.05$). However, pink eye bacterial infection was not associated with both age groups and body condition scores in the present study.

The present study revealed that age group was significantly associated ($p<0.05$) with bacterial infections of calf health problems. There was high (9.4%) cumulative incidence of pneumonia in calves with in age groups of 0-3 months period occurred as compared to calves with 4-6 months old (2.1%). This revealed that as the occurrence of pneumonia in calves was significantly associated with the difference in age groups ($p<0.05$) while diarrhea and pink eye due to bacterial infection were insignificantly associated ($p>0.05$) with the age groups of the calves in the study farm. This finding is in contrary with the findings of [35, 36]who reported younger calves were at high-risk of calf diarrhea due to *E. coli* infection. In addition to this, the incidence of bacterial diarrhea and pneumonia were significantly associated with body condition score of the calves ($p>0.05$).

Univariate logistic regression revealed that poor body condition score (OR=11.154) was the foremost risk factor for the incidence of bacterial diarrhea in calves in relation to good and very good body condition score while 0-3 months age group(OR=7.453) was major the risk factor compared to calves with 4-6 months age group.

According to the present finding, *E coli* was the bacterial agent cultured with the relatively lower frequency of 12.5 % from diarrheic calves in this study, a finding that agrees with results of Janke [37] (10%) and

Blanco *et al*. [38](13.4%). But, the present result is much lower than that reported by Ashenafi [39] with 74% in kombolcha dairy farms, Dawit [40] with 64% in Addis Ababa and DebreZeit dairy farms and [36] with 69.6% in dairy farms of MukeTuri, DebreTsige and Fitche towns of North Shewa, Ethiopia.

Moreover, the difference could be due to failures in proper management practices such as inadequate sanitation, improper hygienic management, which increase the opportunity for exposure to these organisms. In addition, the existence of relatively good management and availability of adequate feed for the calves in the study farm could be apparently associated with the lower occurrence of *E. coli* infection. Although these pathogens can be isolated from healthy calves as well, the excretion rate is higher in diarrheic calves indicating their role as a cause of calf diarrhea [36].

Pasteurella multocida and *Mannheimia haemolytica* are the most and second most common bacterial pathogens of respiratory disease in calves [41]. The bacteriological culture of samples from the nasopharyngeal swabs revealed that *P. multocida* (3.1%) and *M. haemolytica* (8.3%) were the most common causal organisms isolated from pneumonic calves in the present study. This study finding was in contrary with the findings of Mohammadi *et al*. [42] that isolated 80 (61.54%) *P. multocida* and 41(31.54%) *Manheamia haemolytica* from calves with dairy calf pneumonia.

Incidence of infectious bovine kerato-conjunctivitis (IBK) was related to age of the calf. At approximately 45 days of age, the number of calves infected per day began to increase. From approximately 80 to 130 days of age, the number of calves infected per day remained high. After 130 days of age, the incidence began to decline until all calves were weaned. Previous studies indicated that calves less than 90 days of age were highly susceptible to IBK [43]. The present study established the high level (4.2%) of susceptibility and/or exposure to 4-6 months of age.

The coproscopical examinations employed for identification of ova/oocyst include flotation, sedimentation and direct smear techniques which revealed the existence of parasitosis (mixed or single) with overall prevalence of 60.4% of the calves in the HARC dairy farm and the study established two endo-parasites ova/oocysts namely, *Ascaris* spp and *Eimeria* spp with mixed or single infection. Higher cumulative incidence (31.3%) of parasite infection was observed in mixed (*Ascaris* and *Eimeria* spp) infection compared to infection by individual parasites.

Previous studies by Darsema [28] (4.77%) and Megersa *et al*. [10](2.2%) from western part of Amhara Region and small holder dairy farms of Hawassa, respectively, reported lower prevalence of *Ascaris* spp than the present study (18.8%). The moderately high prevalence of *Ascaris* spp in the present study could be associated with provision of fresh grass in addition to frequent interaction with adult animals which possibly predisposed the calves to infection [10].

The present study showed a lower rate of *Eimeria* spp. (10.4% %) which was lower than the previous reports by Kassa *et al*. [44] in Bahirdar (24.9%), by Kebadu [45] in DebreZeit (20%), by Ferid [46] in Eastern Ethiopia (22.7%), [47] in Egypt (25.4%). However, the result of the present study virtually agrees with the report of Herrera-Luna *et al*. [48] in Austria (10.4%). The lower prevalence of coccidiosis recorded in this study as compared to the aforementioned areas with the higher prevalence areas could be due to the differences in agro-ecology, management types and husbandry practices of the study animals in different countries. Moreover this could also be due to the fact that the study has been undertaken mainly in dry season; hence, higher prevalence would have been recorded if the study was carried out in the rainy season [49].

Analysis of the potential risk factors associated with endoaparasite infection revealed that calves with good body condition scores were highly infected by endoparasites (both mixed and single infection) than the calves with poor and very good body conditions and the incidence of parasitic infection was significantly associated ($p<0.05$) with the body condition score of the calves in the study farm.

The breed of calf showed significant variations in the infection of *Ascaris* spp. And *Eimeria* spp (both single and mixed). Higher cumulative incidence of *Eimeria* spp and *Ascaris* spp mixed infection (18.8%) was observed in BOF breed while a higher cumulative incidence (7.3%) of *Ascaris* spp and 9.4% of *Eimeria* spp (single infection) was observed in Boran X Friesian (BOF) breed. The differences observed in this study indicated as the parasitic infections were significantly associated (($p<0.05$) with the breeds of calves. This finding is in contrast to the works of Muktar [36] and Berhanu [50] who reported as breed was not significantly associated with any of the entero-pathogenes in the dairy calves.

CONCLUSION AND RECOMMENDATION

The findings of this study established the major calf health problems and exposing risk factors at Holeta Agricultural Research Center Dairy Farm. Calf diarrhea,

pneumonia and pink eye were the major bacterial diseases of calves identified in the dairy farm. The incidence of pneumonia was significantly associated with the age groups and body condition score of the calves while the incidence of diarrhea was directly associated with body condition score of the calves in the dairy farm. Among the putative risk factors associated with major calves' health problems, poor body condition was more likely associated with the incidence of diarrhea than calves with good body condition. *E. coli*, *P. multocida*, *M. hemolytica* and *M. bovis* were the major bacterial pathogens isolated from diarrheic, pneumonic and infected eye of the calves in the dairy farm. Moreover, upon coproscopical examinations employed for identification of ova/oocyst of the parasites from fresh fecal samples, *Coccidia* oocyt and *Ascaris* spp eggs were identified. Breed type and body condition scores were the major putative risk factors associated with endo-parasitic infection of the calves in the study area. Therefore, more proactive measures should be taken to protect the calves from bacterial and endo-parasitic pathogenes in the study farm.

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