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Prevalence and species composition of major internal and external parasites of calves in selected dairy farms of Bahir Dar milk-shade

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Abstract

This study was carried out from October 2013 to November 2014 in selected dairy farms of Bahir Dar milk-shade to estimate the prevalence and species composition of major internal and external parasites and to examine the associated risk factors in dairy calves. A total of 168 and 77 dairy calves less than 9 month old were used to study the prevalence of calf internal and external parasites, respectively. Type of internal and external parasites, degree of nematode infection (EPG) and packed cell volume (PCV) were determined by using standard parasitological and hematological procedures. The overall prevalence of internal and external parasites was 65.5% and 45%, respectively. The prevalence of Coccidia, Strongyle spp, *Ascaris, Monezia, Paramphistomum, Trichuris, Schistosoma and Fasciola* spp. was 25.6%, 20.8%, 17.1%, 14.3%, 6.0%, 3.0%, 1.8% and 0.6%, respectively. A significant difference ($p<0.05$) was observed in strongyle and coccidia infection across season and dairy production system. Major external parasites of calves were ticks (23.4%), flea (16.9%) and lice (7.8%). *Boophilus decoloratus* (17.1%), *Amblyoma varigatum* (2.6%) and *Rhipicephalus evertsi-evertsi,* (2.6%) were the prevailed tick species found in the study area. The prevalence of *B. decoloratus* was significantly ($p<0.05$) higher in peri-urban (26.8%) than urban (5.6%) dairy. Ctenocephalidae flea (18.4%) and two species of lice, *L. vitulli* (6.6%) and *D. bovis* (1.3%) were also recovered from dairy calves. In conclusion, the overall prevalence of calf internal and external parasites reported in the present study area was considerably high. This could affect the health and growth performance of dairy calves in the study ares. Therefore, as poorly managed calves are susceptible to most endo and ectoparasites, strategic deworming and acaricide application with subsequent implementation of improved calf management practices is warranted.

Keywords: Dairy calf; External parasites; Internal parasites; Prevalence; Species composition

Introduction

The urban and peri-urban dairy production systems are important components of livelihood transformation in Ethiopia that provide food and income for dairy farmers. However, its economic benefit is suboptimal due to multi factorial reasons such as high prevalence of disease and young stock mortality, scarcity of animal feed, poor husbandry practices, poor genetic potential, and low infrastructure and technological support. Animal diseases are among the major technical constraints of urban and peri-urban dairy production systems (Tegegne and Gebrewold, 1998; Belihu, 2002).

The health of replacement calves is an important component of total dairy operation profitability (Razzaque *et al*., 2009), as the future of the dairy herd solely depends upon the successful raising of young calves. Assessment of calf morbidity and mortality rate is useful to understand poor welfare associated with disease and lack of care (Ortiz-Pelaez *et al*., 2008). High incidence of calf morbidity and mortality incurs great economic loss to dairy producers through death loss, treatment cost, decreased life time productivity and survivorship (Waltner-Toews *et al*., 1986).

In this regard, parasitism is of supreme importance in many agro-ecological zones and still a serious threat to the livestock economy worldwide (Vercruysse and Claerebout, 2001). Internal and external parasites can cause lowered productivity, mortality and high economic losses and can affect the income of small holder dairy farming communities (Iqbal *et al*., 1993; Perry and Randolph, 1999; Hameed and Ahmad., 2009). In Ethiopia, several studies have been conducted on ruminant helminthiasis in various regions (Regassa *et al*., 2006; Dagnachew *et al.,* 2011). However, except few reports (Gulima, 2009; Ferede, 2013), no reliable information so far has been found on the prevalence and species composition of internal and external parasites of dairy calves in Baher Dar area. Moreover, knowledge of descriptive epidemiology on prevalence and the associated risk factors that influence their transmission within the given environment is crucial for successful formulation and implementation of effective parasite control strategy. Therefore, the objectives of this study is to estimate prevalence and identify the species composition of major internal

and external parasites of dairy calves and to examine the associated risk factors affecting parasitism in selected dairy farms of Bahir Dar milk-shade

Materials and methods

Study area description

This study was conducted in selected dairy farms of Bahir Dar milk-shade. Bahir Dar is the capital of Amhara National Regional State. It is located approximately 565 km North-West of Addis Ababa, at 11°36′ N 37°23′ E coordinates, and an elevation of 1840 m above sea level. Its temperature ranges from 10 to 38°C (Bahir Dar City Administration Report, 2000).

Study farms and animals

Urban and peri-urban dairy production system classification was made based on location, spatial land use and integration with crop production (Tegegne and Gebrewold, 1998). Dairy farms located in regional city and district town were considered as urban dairy farms which hold high grade of cross bred cows for commercial purpose. Dairy farms located in the outskirts of the respective city and towns were considered as peri-urban dairy farms. These types of farms keep both local and crossbred dairy animals and practice mixed crop-livestock agriculture. Both cross (local x Holstein Fresian) and local bred of calves below 9 month of age were considered for this study.

Study design and sampling methodology

Data on dairy calf management practices was obtained through house hold questionnaire interview from 73 dairy producers. Cross-sectional study design was carried out from October 2013 to November 2014 in selected dairy farms of Bahir Dar milk-shade to determine the prevalence of calf internal and external parasites of dairy calves. Study areas were selected purposively based on their dairy potential. Simple random sampling technique was employed to select study farms and calves. During sampling, having lactating cow/s and being at weaning age (<9-month) were the inclusion criteria considered during farm and individual animal selection, respectively.

Sample size determination

To estimate the prevalence of calf internal and external parasite, sample size was determined by using simple random sampling method given by Thrusfield, (2007). In this regard, no previous report has been conducted on calf internal and external parasites in the present study area. Thus, 50% expected prevalence was considered during sample size estimation. The other parameters considered during sample size estimation were 95% confidence interval and 5% desired absolute precision. Accordingly, a total of 384 calves were proposed to be sampled. However, the total estimated pre-weaning calf population in and around Bahir Dar was about 652 (BOA, 2013), which was relatively small. Therefore, in relatively small populations, it is possible to select a smaller sample to achieve the same degree of precision by adjusting the required sample size, $\mathbf{n}_{adj}$ as per the formula given by Thrusfield, (2007), n_{adj} = where n is the sample size, based on an infinite population and N is the size of the study population. Accordingly, n_{adj} = =241 calves. Accordingly, a total of 243 (168 for internal parasites and 77 for external parasite) calves were sampled for this study.

Specimen collection

Calf internal parasite survey was carried out in both dry and rainy season, while the external parasite survey was conducted only in dry season. The individual calf details such as Id, sex, age, blood level and study district were registered along with collected specimens. After the calf detail was taken, fecal samples (approximately 10 g) were collected directly from the rectum and then put into 10% formalin filled universal sampling bottle. Similarly, each external parasite (ticks, flea and lice) were collected and put in to universal sampling bottle filled with 70% Ethyl alcohol. Blood samples were collected from marginal ear veins using capillary tube to determine packed cell volume (PCV).

Laboratory analysis

After labeling with specific identification number, each sample was transported to Bahir Dar Animal Health Investigation and Diagnostic laboratory for parasitological and hematological analysis. Parasitological examination was done by sedimentation and flotation techniques following the standard procedures (Hansen, 1994; Shah-Fischer, 1989). The eggs of different parasite species/genera were identified and Egg per Gram of Feces (EPG) was counted using the

protocols given by Soulsby (1982) and Hansen and Perry (1994). Moreover, collected external parasites were examined and identified to genus and species level by using stereomicroscope as per the standard identification keys given by Walker *et al* (2003).

Data analysis

SPSS (version 22) was employed for data analysis. Descriptive statistics was employed to estimate prevalence of internal and external parasites, EPG and PCV. Chi-square (X^2) test was used to measure association between prevalence of the parasites and various risk factors. A significance level ($p=0.05$) and confidence level (95%) was set to determine the presence or absence of statistically significant difference between the given parameters.

Results

Overall prevalence of calf internal parasites

A total of 168 fecal samples were collected and examined. Out of total calves sampled, 110 calves were found positive with one or more of eggs of gastrointestinal parasites with an overall prevalence of 65.5% (Table 1). The prevalence of *Coccidia, Strongyle spp, Ascaris, Monezia, Paramphistomum, Trichuris, Schistosoma* and *Fasciola* was 25.6%, 20.8%, 16.1%, 14.3%, 6.0%, 3.0%, 1.8% and 0.6%, respectively.

Table 1. Overall prevalence of calf internal and external parasites in the study areas

Type of internal parasite identified at genus level	Number of calves examined	Number of calves positive	Prevalence (%)
Strongylespp	168	35	20.8
Trichuris spp.	168	5	3.0
Ascarisa	168	27	16.1
Paramphistomum	168	10	6.0
Schistosoma	168	3	1.8
Fasciola	168	1	0.6
Coccidia	168	43	25.6
Monezia	168	24	14.3
Total	168*	110**	65.5 %***

**number of calves positive for any one of the parasites considered ***proportion of calves positive for at least one of the helimenth, *Total calves sampled for fecal sample

Prevalence of calf internal parasites

The dominant internal parasite found in the study area were coccidia (25.6%) followed by Strongyle spp (20.8%). Relatively lower prevalence of *Fasciola* (0.6%) and *Schistosoma* (1.8%) was recorded (Table 1). Higher prevalence ($p<0.05$) of coccidia infection was recorded in peri-urban dairy farms (33.3%) than urban ones (14.3%) (Table 2). A significant difference ($p<0.05$) was observed in *coccidian spp*(48.6% vs 9.2%), *strongyle spp*(30.6% vs 7.1%) and *Trichuris* spp (22.4% vs 7.1%) prevalence during wet and dry season, respectively (Table 2).

Overall prevalence of calf external parasites

A total of seventy-seven (77) calves were considered for external parasite survey. Of which 35 calves were positive with one of the external parasites comprising an overall prevalence of 45% (Table 3). Ticks (23.4%), fleas (16.9%) and lice (7.8%) were the major identified calf internal parasites in the study area (Table 3).

Table 2. Prevalence of calf internal parasites across study location, breed, sex and season

Risk factors	Type of internal parasites identified at genus level								
	No. examined	Strongyle spp	Trichuris	Ascaris	Paramphistoma	Fasciola	Schistosoma	Coccidia	Monezia
		+ve (%)	+ve (%)	+ve (%)	+ve (%)	+ve (%)	+ve (%)	+ve (%)	+ve (%)
Dairy farm									
Urban	81	14(17.3)	1(2.8)	14(17.3)	7(8.6)	0	0	14(14.3)	12(14.8)
Per. Urban	87	21 (24.1)	4(12.9)	13(14.9)	3(3.4)	1(0.72)	3(2.2)	29(33.3) *	12(13.8)
Total	168	35(20.8)	5(3.0)	27(16.1)	10(6.0)	1(0.6)	3(1.8)	43(25.6)	24(14.3)
Breed									
Local	37	8(26.6)	0	4(10.8)	2(5.4)	0	0	13(35.1)	5(13.5)
Cross	130	27(20.8)	5(3.8)	23(17.7)	8(6.2)	3(2.2)	3(2.2)	30(23.1)	19(14.6)
Total	167	35(21.0)	5(3.0)	27(16.2)	10(6.0)	3(1.7)	3(1.7)	43(25.7)	24(14.4)
Season									
Dry	70	5(7.1)	3(4.3)	5(7.1)	9(12.9)	0	0	9(9.2)	20(28.6)
Wet	98	30(30.6) *	2(2.0)	22(22.4)*	1(1.0)	1(1.02)	3(3.1)	34(48.6) *	4(4.1)
Total	168	35(20.8)	5(3.0)	27(16.1)	10(6.0)	1(0.6)	3(1.8)	43(25.6)	24(14.3)
Sex									
Male	72	16(22.2)	2(2.9)	11(15.3)	7(9.7)	0	0	18 (25.0)	8(11.1)
Female	95	19(20.0)	3(3.2)	16(16.8)	3(3.2)	1(0.9)	3(3.2)	25 (26.3)	16(16.8)
Total	167	35(21.0)	5(3.0)	27(16.2)	10(6.0)	1(0.6)	3(1.7)	43 (25.7)	24(14.4)

+ve= positive *=Significant ($p<0.05$)

Table 3. Overall prevalence of calf external parasites in the study areas

Type of external parasite identified	Number of calves examined	Number of calves positive	Prevalence (%)
Ticks	77	18	23.4
Flea	77	13	16.9
Lice	77	6	7.8
Total	77*	35**	45***

***proportion of calves positive for at least one of the external parasites examined* Total calves sampled

Specific prevalence of calf external parasites

Boophilus decoloratus (17.1%), *Amblyoma varigatum*(2.6%) and *Rhicephalus evertsi-evertsi(*2.6%) were the major tick species identified. Likewise, *Ctenocephalidae* flea (18.4%) and two lice species, *Linognathus vituli* (6.6%) and *Damalinia bovis*(1.3%) were identified (Table 4).The prevalence of *Boophilus decoloratus* was significantly ($p<0.05$) higher in peri-urban (26.8%) than urban (5.6%) dairy farms.

Table 4. Major calf external parasites identified at species level in the study areas (N=77)

Risk factors	Tick					Flea		Lice				
	B. decolorutus	A.varigatum		R.evertsi-evertsi		Cephalidae		L. vitulli		D.bovis		
	N	+ve (%)	N	+ve (%)	N	+ve (%)	N	+ve (%)	N	+ve (%)	N	+ve (%)
Dairy farm												
Urban	36	2(5.6)	36	2(5.6)	36	1(2.8)	36	5(13.9)	36	4(11.1)	36	1(2.8)
Peri-urban	41	11(26.8)*	41	0	41	1(2.4)	41	9(22.0)	41	1(2.4)	41	0
Total	77	13(17.1)	77	2(2.6)	77	2(2.6)	77	14(18.4)	77	5(6.6)	77	1(1.3)
Breed												
Local	17	2(11.8)	17	0	17	1(5.9)	17	4(23.5)	17	1(5.9)	17	0
Cross	59	11(18.6)	59	2(3.4)	59	1(1.7)	59	10(16.9)	59	4(6.8)	59	1(1.7)
Total	76	13(17.1)	76	2(2.6)	76	2(2.6)	76	14(18.4)	76	5(6.6)	76	1(1.3)
Sex												
Male	38	6(15.8)	38	1(2.6)	38	0	38	10(26.3)	38	3(7.9)	38	0
Female	38	7(18.4)	38	1(2.6)	38	2(5.3)	38	4(10.5)	38	2(5.3)	38	2(5.2)
Total	76	13(17.1)	76	2(2.6)	76	2(2.6)	76	14(18.4)	76	5(6.6)	76	1(1.3)

+ve=positive*=significant ($p<0.05$)

Predilection sites of external parasites

Sixty-five percent of external parasites were recovered from the neck and head region, in which ticks, flea and lice accounted 35%, 40% and 5%, respectively (Table 5).

Table 5. Predilection sites of external parasites of calves (N=77)

Type of external Parasite recovered	Body Region			
	Neck and head	Belly/flank	Udder/ scrotum	Legs/tail/groin
Ticks *	35%	-	-	22%
Flea(*Cephalidae*)	40%	-	-	-
Lice (*L.vitulli D. bovis*)	5%	-	-	-

**B. decolorutus A. varigatum and R.eversi-evertsi*

EPG and PCV profiles

Strongyle eggs identified during coprological examinations were subjected for further EPG analysis. Among positive cases, 29.6% and 70.4% of calves were classified as light and mild degree of infections and none of the calves were found in heavy degree of infection. Mean EPG and PCV was 229.6 ± 119 and 34.6± 8.6, respectively (Table 6).

Table 6. EPG and PCV profiles of sampled calves in the study areas (N=168)

Parameter	Min	Max	Mean
Egg Per Gram of Faces (EPG)	50	450	229.6 ± 119.5
Packed Cell Volume (PCV%)	20	58	34.6± 8.6

Discussion

The 65.5% overall prevalence of calf internal parasite reported in this study is found relatively higher when compared to other previous reports, 55.5% in Gozamen and Bahir Dar zuria district (Ferede, 2013), and 26.3% in Western part of Amhara Region (Gulima, 2009). However, the present study was found lower than report by Regassa *et al* (2006), who reported 69.6% prevalence in ruminants in western Oromia, Ethiopia. The discrepancy of overall prevalence reports could be partly explained by seasonal and management differences. The availability of moisture and environmental temperature critically affects the prevalence and distribution of internal parasites (Gulima, 2009). The in-

vestigated internal parasites of calves (coccidia, *Strongyle spp, Ascaris, Monezia, Paramphistomum, Trichuris, Schistosoma* and *Fasciola)* identified in this study has also been reported previously in other localities (Regassa *et al*., 2006; Dagnachew *et al*., 2011; Ferede, 2013). The prevalence of *strongyle spp* and *coccidia* was significantly higher in west season than dry season. This seasonal variation might be associated with climatic factors; wet season is believed to be favorable for the maintenance and multiplication of internal parasites.

The present study revealed that the overall prevalence of calf external parasites was 45% with relative prevalence of tick (23.4%), flea (16.9%) and lice (7.8%). However, this overall prevalence was not compared with other similar reports due to lack of published reports. The magnitude of tick infestation in the present study was relatively lower than some previous reports (Tiki and Addis, 2011; Wasihun and Doda, 2013). This discrepancy could be attributed to seasonal variations (as this report covered only dry season), geographical location, management practices and climatic differences. Only three tick genera (*Amblyomma, Boophilus* and *Rhipicephalus)* were identified, of which *B. decoloratus* accounts relatively the highest (17.1%) prevalence followed by *A. varigatum* (2.6%) and *R. evertsi-evertsi* (2.6%). This finding was found in agreement with previous studies (Sileshi *et al.,* 2007; Shiferaw 2005; Wasihun and Doda, 2013). However, it is also inconsistent with reports of Tiki and Addis *(*2011), Morel (1980); Pegram *et al* (1981), who described that *A. variegatum* was the most abundant tick species and widely distributed cattle tick in Ethiopia. This study showed that the distribution and prevalence of *B. decoloratus* was significantly affected by dairy production system, with the highest prevalence in peri-urban (26.8%) than urban (5.6%) dairy farms. This could be associated with dairy animal management practices, where free grazing is commonly practiced in most peri-urban dairy farms.

This study showed that the neck and head region was the major predilection site of external parasites. The predilection sites found in this study were in line with other works (Siyoum, 2001; Assefa, 2004; Obiora *et al*., 2013; Tiki and Addis, 2011). Two lice species, *Linognathus vitulli* (blood sucking louse) and *Damalina bovis (chewing louse)* were recovered from young calves. These two species of lice are distributed worldwide and are more common in cattle than in any other domestic animals (Nafstad and Grønstøl, 2001).

The average egg per gram of feces (EPG=229), recorded by this study was found in acceptable range (201-800) of nematode infection (FAO, 1994). This

result was also found in congruent with the report of Ferede (2013). Besides, the average packed cell volume (PCV=34.6%) recorded from sampled calves was found in normal (24-46%) range (Petter and Cockcroft, 2002).

Conclusion

This preliminary study provided baseline information on prevalence, and species diversity of internal and external parasites in the present study area. This study reported major internal and external parasites of dairy calves in selected dairy farms of Bahir Dar milk shed. The overall level of parasitism reported by this study was higher, which could significantly affect the health and growth performance of dairy calves in those dairy farms. As grazing and poorly managed calves are susceptible to most internal and external parasites, strategic deworming and acaricide application is warranted with subsequent implementation of improved calf management practices.

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Conflict of interest

The authors declare that there is no conflict of interest.

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