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Comparative Study on Ascaridiosis and Parasitic Burden of Calves Reared Under Different Production System in and around Jimma

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Abstract

Cross sectional study was conducted from October 2019 up to July 2020 in and around Jimma to determine the status of Ascaridiosis and parasite burden in calves. A total of 384 fecal samples of calves were collected and examined. Calves were selected randomly from 40 dairy farms included in the study purposively. Out of the total examined calves 21(5.5%) were harbor the parasite with 13 (61.9%), 6 (28.6%) and 2 (9.5%) were infected lightly, moderately and heavily respectively. Significantly higher prevalence of Ascaridiosis was observed in calves less than 3 months of age than calves with age of greater than 3 months (P<0.05). Likewise, significant variation in overall prevalence between local breed and cross breed calves were observed (P<0.05), higher prevalence of the disease was recorded in local calves. Significant differences in the prevalence between different body conditioned calves were observed; in which higher values were observed in poor body condition calves (P<0.05). In this study; age, body condition score and breed are risk factors associated with prevalence of calve Ascaridiosis in the study area. In the study area poor nutrition, awareness of the owner regarding the disease in calves is likely to be aggravated by this disease. Therefore, regular deworming, improvement of housing and feeding management should be recommended to increase the productivity of cattle in the study area.

Keywords: Ascaridiosis • Burden • Calves • Jimma • Status

Introduction

Ethiopia is believed to have the largest livestock population in Africa. This livestock sector has been contributing considerable portion to the economic development of the country. The total livestock population for the country is estimated to be about 56.71 million of cattle, 29.11 million goats, 29.33 million sheep and 0.92 million camels [1]. Livestock is an integral part of the agriculture and the contribution of live animals and their products to the agricultural economy accounts for 40%, excluding the values of draught power, manure and transport of people and products. Livestock serve for Ethiopian economy as sources of food traction, manure, raw materials, investment, cash income, security, foreign exchange earnings and social and cultural identity. The livestock sector is estimated to account for 10% of the GDP and provides employment to over 30% of the agricultural labor force [2]. Moreover, the livestock sector supports and sustains enterprises and groups linked and associated with the livestock value chains, such as the livestock traders, transporters, slaughter processors, feed manufacturers, and veterinary drug suppliers.

Despite the largest cattle population, the productivity of Ethiopian livestock is low, and the direct contribution to the national economy is limited. Calf morbidity and mortality are perennial problems for dairy producers worldwide. Calf mortality is considered as one of the major constraints to herd expansion and genetic improvement in the dairy sector. The calf morbidity and mortality studies in Africa indicate high calf loss both in the subsistence and market oriented dairy production systems. Studies of calf mortality on smallholder farms indicate preweaning and early postweaning mortality rates in the range of 15% to 25%. In some African countries for instance calf mortality rates range from 9% to 45% (Tanzania), 10% to 25% (Mali) and 4.9% (Khartoum). In Ethiopia, 30% preweaning calf mortality rate was reported in mixed crop-livestock production systems in the Amhara region and 18% mortality rate was reported in market-oriented dairy farms in Central Ethiopia [3].

Gastrointestinal parasite infection is one of the major causes of wastage and decreased productivity exerting their effect through mortality, morbidity, decreased growth rate, weight loss in young growing calves. Among the Gastrointestinal parasite infection, calf ascaridiosis due to *Toxocara vitulorum* is considered to be a major limiting factor in organized farms, due to high morbidity, mortality, loss of production and in effective implementation of breeding programmed. *T. vitulorum* is nematodes that inhabits the small intestine of bovine animals including buffaloes, cattle, and zebu, and is especially common in the tropical and subtropical geographical areas. It is responsible for high morbidity and mortality rates of young cattle resulting in serious economic losses and zoonotic importance. *T. vitulorum* seriously affects bovid calves of <3 months of age and this infection is generally recognized as an important limiting factor in calf rearing because of high morbidity, loss in production and disturbance in the breeding programmed [4].

In Ethiopia most of the studies have been conducted on the prevalence and distribution of gastro intestinal parasite infection in cattle. However, information regarding to the status, the infection rate and intensity of Ascaridiosis in calves of the study area was not yet conducted. Likewise, the information of high rate of calf mortality and poor growth were recorded but the underlining causes were not well investigated. Therefore, the objective of this study was to determine the status and parasite burden of Ascaridiosis in calves less than one year.

Materials and Methods

Study area and population

The study was conducted from October 2019 to July 2020 in different dairy

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farms found in and around Jimma town. Jimma is located in Oromia regional state, South West Ethiopia. This town is located 355km South-Western of Addis Ababa. The area lies between a latitude of 7°41'n and longitude of 36°50'e and has an average elevation of 1704 meters above sea level. The area is characterized by humid tropical climate of heavy annual rainfall ranges from 1200-2000 mm per year. About 70% of the total annual rainfall is received during rainy season, which lasts from the end of May to early September. The main annual maximum and minimum temperature ranges from 25 ℃-30 ℃, and 7 ℃-12 ℃ respectively. Dairy farm of the study area mainly kept cross breed but some farms also kept both local and cross breed. Farms are owned by private individual or governmental sector and located either together or far from the living house and also both concentrate and roughage feed were offered to animal but concentrate are very expensive and scarce, this decreases the dairy farm productivity. The management system of the farms was intensive and semi-intensive. In this study, calf is defined as young cattle less than 12 months of age and calve in each farm were categorized based on different risk factors like three age groups, (<3 months), (3-6 months) and (>6 month) management system (intensive, semi-intensive) breed (local and cross) and body conditions (poor, moderate and good).

Study design, sample size and sampling methods

A cross sectional study design was employed from October 2019 up to July 2020 to address the objectives of the study. Out of the total 192 dairy farms found in the study area 70 dairy farms were purposive selected based on willingness of the owner, calves age and calves' number. Each sampling unit was included in this study by simple random sampling. Number of calves were included from each farm was proportionally allocated based on the population of calves each farm had (minimum 2 calves/farm and maximum 8 calves/farm).

The sample size was calculated using the formula given by Thrusfield with 50% expected prevalence. This was due to no recent information about the prevalence of the disease; in this case we will use 50% of the prevalence, 95% confidence interval and absolute precision (5%).

$$n = \frac{(1.96)^2 \ Pexp \ (1 - Pexp)}{d^2}$$

Where, n= required sample size, Pexp= expected prevalence, d= desire absolute precision. Therefore, based on the above formula a total of 384 calves were included in the study.

Faecal sample collection and parasitological examination

Fresh fecal samples approximately 10 g were collected directly from the rectum of calves and samples placed in sampling bottle without preservative and labeled. Samples were transported to the laboratory with ice box contain filled ice bag hence, no significance changes on the egg morphology. Following transportation of fecal sample, laboratory analysis was carried out at the same day or the remaining samples were kept under 4 ℃ and examined up on the next days. In the laboratory, fecal samples were examined for detection of Ascaris eggs using standard procedures of flotation method. Whenever eggs of Ascaris encountered, the corresponding faecal samples were subjected to further investigation of degree of parasite infection by McMaster egg counting technique [4].

Data analysis

The collected data from study areas were stored into a computer on a Microsoft excel spreadsheet and were analyzed using SPSS version 20 software program. The prevalence was calculated as the number of calves having parasite, divided by the total number of calves examined. Descriptive statistics was used to determine the prevalence of the parasites and Chi-square test ($\chi 2$) was used to determine the association between the prevalence of Ascaridiosis age, breed, sex, body condition and management. To evaluate the strength of association binary logistic regression was implemented. All statistical analysis, a P-value less than 0.05 were taken as significant.

Results

Overall result

Coprological examination revealed that from the total examined calves 21 (5.5%) was found positive for *Toxocara vitulorum* in the study area. Of the total calves harbor the parasite 13 (61.9%), 6 (28.6%) and 2 (9.5%) where infected lightly, moderately and heavily respectively (Table 1).

Age wise prevalence

Out of 384 calves examined 21 were found positive 16 (18%), 5 (4%) and 0% were from <3-month, 3-6 month and >6month of age respectively. Significantly higher prevalence of the parasite was recorded in calves <3 months of age than the other (X2 =6.383; P=0.041) (Tables 2 and 3). Of the total calves less than 3 month of age infected with Ascaridiosis 56.25%, 31.25% and 12.5% harbor light, moderate and heavy infection respectively. While calves with age in between 3-6 month infected by Ascaridiosis 80% harbor light infection and 20% moderate.

Sex wise prevalence

From the total 200 female and 184 male calves examined (6%) and (4.9%) were found to harbor eggs of the parasite respectively. Higher prevalence of *Toxocara vitulorum* infection was recorded in female calves than male. However, sex wise significant difference was not recorded (X2 = 0.228; P=0.633) (Table 3). From the total infected female caves 67%, 25% and 8% were harbor light, moderate and heavy infection of Ascaridiosis, where as 56%, 33% and 11% of male caves harbor light, moderate and heavy infection (Figure 1).

Management wise prevalence

Of the total calves reared semi-intensively and intensively 6.7% and 3.07% were harbor the parasite. However, statistically significant difference between production systems was not recorded (X2 =262; P=0.323) (Table 3). From

Table 1. Over all prevalence of Ascaridiosis.

Number of Caves Examined	Positive	Prevalence %	Degree of Infection		
			Light	Moderate	Heavy
384	21	5.5	13 (61.9%)	6 (28.6%)	2 (9.5%)

Table 2. Age wise result.

Age	Examined	Negative	Positive	Prevalence	Burden		
					Light	Moderate	Heavy
<3 month	200	184	16	8%	9(56.25%)	5 (31.25%)	2 (12.5%)
3-6 month	126	121	5	4%	4(80%)	1 (20%)	-
>6 month	58	58	0	0%	-	-	-
Total	384	363	21	5.50%	13(62%)	6(28.5%)	2(9.5%)

Table 3. Summary of statistical result of Ascaridiosis in calves.

Risk Factor		No. Examined	No. Negative	No. Positive	Prevalence %	X2	P=value
Age	<3 months	200	184	16	8%	6.383	0.041
	3-6 months	126	121	5	4%	-	-
	>6 months	58	58	0	0%	-	-
Breed	Local	151	134	17	11.30%	16.135	0
	Cross	233	229	4	1.70%	-	-
Sex	Female	200	188	12	6.00%	0.228	0.633
	Male	184	175	9	4.90%	-	-
Body Condition	poor	95	82	13	13.7.0%	19.049	0
	Moderate	141	134	7	5.00%	-	-
	Good	148	147	1	0.70%	-	-
Management	Intensive	130	126	4	3.07%	262	0.323
	Semi intensive	254	236	17	6.70%	-	-

the total infected calves managed semi- intensively 58.8%, 29.4% and 11.8% harbor light, moderate and heavy infection. Likewise, from the total infected calves intensively managed 75% and 25% were harbor light and moderate infection.

Body condition wise prevalence

The current study revealed highest infection rate was recorded in poor body condition calves (13.7%) followed by medium body condition (5%) and good body condition calves have low infection rate (0.7%). Body condition-based prevalence of Ascaridiosis was statically significant (X2 =19.049; P =0.000) (Table 3). 61.5%, 23.1% and 15.4% of infected poor body conditioned calves harbor the parasite lightly, moderately and heavily. From medium body condition calves acquired Ascaridiosis 71.4% and 28.6% were harbor light and moderate level of the parasite.

Breed wise prevalence

The prevalence of Ascaridiosis in local breed and cross breed calves of the study area was 11.3% and 1.7% respectively. Statistically significant variation in the prevalence of parasite infection was recorded between local and cross breed calves (X2 =16.138; P=0.000) higher in local breed calves (Table 3). From the total local caves acquire the parasite 58.8%, 29.4% and 11.8% harbor light, moderate and heavy infection of the parasite, while 75% and 25% of infected cross breed calves harbor light and moderate infection of Ascaridiosis (Figure 2).

Discussion

Ascaridiosis is among the most serious parasitic diseases causing high mortality and morbidity in calves. The adult cattle are the source of infection while suckling calves play a potential role for maintenance of the infection. The current study revealed that out of 384 calves examined 21(5.5%) were infected with *Toxocara vitulorum*. The overall prevalence of current finding is in agreement with the works of Kebede reported the prevalence of (3.8%) from Mekelle, Milkessa reported 6.63% from East Wollega reported 7.01% from Bedella. However, current finding is by far less than reports of Tamire M and Beredo B [5] 63% prevalence from Senkale Faris peasant association, 16.3% from South Ethiopia and Beksisa reported 15.9% prevalence. Similarly, current finding is slightly higher than findings of Ras reported 1.0% prevalence from Ejere district. The prevalence difference of these studies could have resulted from difference in management system, feeding, hygiene, topography, deworming practice and climatic condition that favors the survival of parasite and sampling season.

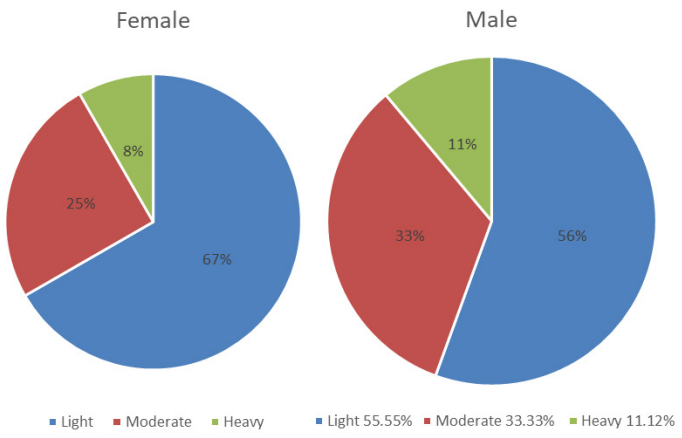

Figure 1. Parasite burden in infected calves.

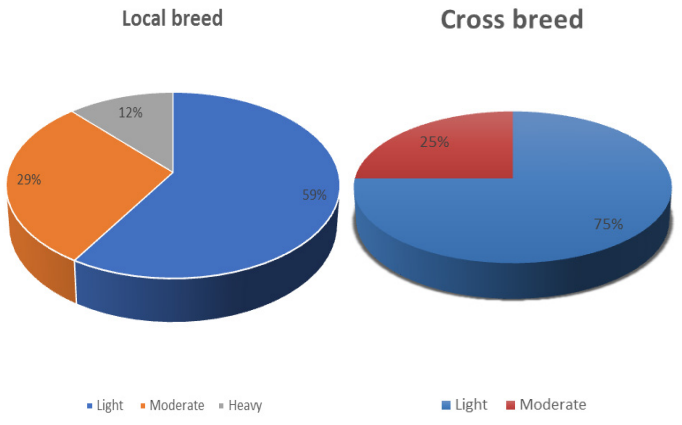

Figure 2. Parasite burden in infected breed calves.

The prevalence in calves with less than 3 month of age (8%) was found to be significantly higher ($p<0.05$) as compared to calves in the age group of 3-6 month (4%) and >6 month (0%). The current finding is in line with reports of Tamire and Bedore and Rast. This finding attributable to several important factors including; the larvae do not develop into adults in the adult animal but remain as third-stage larvae, when infected dams become pregnant, the larvae migrate from the liver to the mammary glands and suckling calves receive the infection *via* milk and the larvae develop into adults and then begin shedding thousands of eggs in the feces of infected calves [6]. In addition, this might be due to in calves more than 6 month of age, total egg count will be reduced as the animal gain immunity.

The present study revealed that significantly higher prevalence of Ascardiosis in local breed (11.3%) was recorded than the cross-breed calves (1.7%), this finding is in agreement with Kebede. This might be due to use of anthelmintic in cross breed as well as the owners provide attention for their cross-breed calves than the local one (poor management in local breed calves). Even if higher prevalence was recorded in female calves (6.0%) as compared with male (4.9%) but significant ($p>0.05$) difference between male and female calves is not recorded. The current finding is in line with reports conducted by Devi, Kebede and Raza. Slightly higher prevalence of the parasite recorded in female than male is attributed to female calves are allowed to suckle frequently and more milk than that of male calves as they considered as replacement stock and attention is given to these group, they are more exposed to higher risk of infection though transmammary route.

The prevalence according to body condition was 13.7%, 5% and 0% in poor, moderate and good body condition scores. Higher prevalence of disease recorded in poor body condition calves of this finding is in agreement with reports of Kebede. In the current study, statically significant variation ($p<0.05$) was recorded between calves of different body condition score. The higher prevalence in poor body condition is due to the parasite share nutrients of animals, impairment of digestion and absorption and predispose for further infection [7].

The prevalence of *Toxocara vitulorum* in semi-intensive management system (6.7%) is higher than calves managed under intensive production system (3.07%). This might attribute to regular or strategic use of anthelmintic, improved hygienic measures at farm level in intensive management system and a limited exposure to parasitic infected pasture in intensive management system [8].

Conclusion and Recommendations

This study was conducted to determine the prevalence and magnitude of calves Ascaridiosis and the current finding showed that it is an important health problem in the study area by affecting the well-being and productivity of dairy farm. The prevalence was significantly associated with age, breed, body condition score of the calves and also a significant number of calves harbor the parasite heavily and moderately. The attention given to the parasitic disease so far has not been sufficient as it is the most important parasite in calves which cause for calf mortality and morbidity. Therefore, treatment of infected young calves is critical in controlling Ascaridiosis, awareness on management of animals, effect of parasites and control methods should be implemented.

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Conflict of Interest

The authors declare no competing interests.

Data Availability

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

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