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Prevalence and Associated Risk Factors of Nematode Parasites of Cattle in Tullo District, West Hararghe Zone, Eastern Ethiopia

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Abstract: A cross sectional study was carried out from November, 2016 to March, 2017 to determine the prevalence and risk factors associated with gastrointestinal nematode parasitism of cattle in Tullo district, Western Hararghe, Oromia, Ethiopia. A total of 384 fecal samples of cattle of different sexes and ages were collected and examined for gastro intestinal nematode eggs using floatation techniques. Out of these, 120 (31.2%) animals were found positive for gastro intestinal nematode infection. The result of fecal examination revealed eggs of Strongle type, *Strongloids* and *Trichuris* species. Out of the total infected cattle, 21(36.2%) in Kira Kufis, 22(30.6%) in Rakkata Fura, 21(35%) in Meta Kesha, 20(35.7%) in Lubbu Dhekab 18(24.3%) in Oda Naga and 18(28.1%) in Chaffe was observed. There was no significant difference on infection rate between different peasant associations (P>0.05). Among 167 adult and 217 young animals examined, 43(25.7%) and 77(35.5%) were positive, respectively. There was no significant difference in age group (P>0.05). Among positive animals, 59(31.9%) good body condition, 60(31.1%) medium and 1(25%) were poor body conditions. There was significance difference on the body condition (P<0.05). Two hundred eleven Female cattle examined and 75(35.5%) were positive and 173 male also examined 45(26.02%) were positive. There was statistically significance difference in sex group (P<0.05). Among 196 wet and 188 dry examined 59(31.4%) and 62(31.1%) were positive respectively. There was statistically significance difference on season (P<0.05).

Key words: Cattle · Nematodes · Prevalence · Tullo District · West Hararghe

INTRODUCTION

Ethiopia possess the largest livestock population in Africa, with an estimated population of 7.8 million equines, 1 million camels, 47.5 million cattle, 39.6 million chickens, 26.1 million sheep and 21.7 million goats [1], with the livestock ownership contributing to the livelihoods of an estimated 80% of the rural populations. But this extensive livestock resource is not exactly exploited because of many constraints, of which poor animal production and management, improper evaluation of public health importance due to various individual parasitic diseases and inadequate knowledge of epidemiology of parasites which otherwise is of great relevance where the distribution of the disease determine the type and scope of control measures to be applied [2].

Ethiopia economy is largely dependent on agriculture that is influenced by livestock, which provides more than 90% drought energy required for crop production. The cause of food deficiency in the country could be numerous and it is difficult to separate. However, some livestock and human disease have obvious influences on the country are self reliance in food production [3, 4]. Gastrointestinal (GI) parasite infections are a worldwide problems for both small and large scale farmers, but their impact is greater in sub Saharan Africa in general and Ethiopia in particular due to the availability of a wide range of agro-ecological factors suitable for diversified hosts and parasite species [5]. They cause retarded growth, lower productivity and high economic losses. Thus, affect the income of small holder dairy farming communities. The low productivity is due to a number of factors among which are quantitative and qualitative; deficiencies in the feed resource base, diseases, poor animal performance level and insufficient knowledge on the dynamics of the different types of farming on the dynamics of the different types of farming systems existing in the country [6].

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Gastrointestinal parasites not only affect the health, but also affect the productive and reproductive performance of the cattle and. Gastro intestinal worms are recognized as by far the most significant part of diseases in livestock sector [7, 8]. The predisposing factors of internal parasites infection are climates, nutritional deficiency, grazing habits, immunological status, pasture management, presence of intermediate host and vector and the number of infective larvae and eggs in the environment [9, 10].

Nematodes are the most common gastrointestinal Parasites of cattle [11]. The nematodes genera *Trichostrongylus, Ostertagia, Cooperia* and *Nematodirus* often occur together in alimentary tract of ruminants. Their combined effect on the host, together with those of other alimentary nematodes such as *Oesophagostomum* and hook worms is commonly known as parasitic gastroenteritis. Gastro-intestinal parasitic infections are characteristic of pastoral grazing systems and many GI parasitic species have developed resistance to anthelmintic drugs [12, 13].

The most important internal parasites of ruminants are the *Trichostrongylids*, nematodes from the abomasums or the small intestine with a direct life cycle. Ruminants are infected by ingestion of the infective third stage larvae (L3). For most species development to the adult stage takes between 2 and 3 weeks. Development may also be interrupted at a specific parasitic stage, usually the early fourth stage (EL4). This 'inhibited' or 'arrested' development or 'hypobiosis' is a complex phenomenon. In a number of species, but particularly in *Haemonchus,* it represents a seasonal phenomenon, enabling the parasite to survive unfavorable conditions such as winter or a dry season. However, inhibited development may also be associated with host resistance [14, 15].

Adult worms produce eggs that are passed to pasture in the feces. Under favorable conditions the eggs will hatch and the first and second stage larvae feed on bacteria in the feces until finally, the infective third stage (L3) is reached. This development to L3 is temperature dependent and may be as rapidly as 3 days under tropical conditions [16]. Economic losses are caused by gastrointestinal parasites in variety of ways: they cause losses through lowered fertility, reduced work capacity, involuntary culling, a reduction in food intake and lower weight gains, lower milk production, treatment costs and mortality in heavily parasitized animals [17].

The prevalence of gastrointestinal parasites, the genera of helminthes parasites involved, species and the severity of infection also vary considerably depending on local environmental conditions, such as humidity, temperature, rainfall, vegetation and management practices [18]. Nematode control has to be based on the epidemiological pattern of the important nematode species. It is necessary to know the annual pattern of these species under the local management conditions before rational control measures can be designed. This implies several years of epidemiological studies before measures can be implemented [19].

Nematode infections in cattle results effects on production losses through poor weight gain and reduced milk yield but, the gastrointestinal tracts (GIT) of animals harbor a variety helminthes, which causes clinical and sub clinical parasitism. Helminthes adversely affect the health status of animals which may be a cause of economic losses to the livestock industry [20]. Helminthes are recognized as by for the most significant part of diseases in livestock sector [8]. Gastro-intestinal nematodes infections have been observed to affect younger cattle than adults, with the super family Trichostrongyloidea having the biggest impact, leading to clinical manifestations including pale mucous membranes due to anemia, poor body condition [21] and reduced immunity [22].

The distribution of cattle nematodes is generally related to climate with *Cooperia* and *Tricuris* species found in all raising areas. *Ostertagiaostertagis* is probably the most important and pathogenic nematodes in all temperate zone, including region of south western area [23]. Prevalence of gastro-intestinal helminthes has been reported ranging from 0.7 to 84.1%in domestic animals from various parts of the world. There are many associated risk factors influencing the prevalence of gastro-intestinal helminthes including age, sex, weather condition and husbandry or management practices [24]. Most of the studies conducted on the prevalence and distribution of gastro-intestinal nematodes in the country tended to be in the central and Northern highlands and semi-arid regions of Eastern Ethiopia and little is known about the prevalence and distribution of gastro-intestinal nematodes infecting cattle in and around Gondar town [25].

To take the control measures assessment and epidemiological surveillance of nematode parasite by different diagnostic methods like fecal examination, egg per gram (EPG) determination and identification of specific species nematode is important [26, 27].

Prevention and control of the parasites that infect cattle are becoming increasingly difficult due to generating of overuse and improper use of the available ant-helminthics dewormers, which result in increasing

resistance by parasites to common anti-helminthics. The resistance occurs when a drug is over use and the parasites develop a tolerance to the drugs, making it no longer effective in killing them. Resistance making it difficult to effectively control *Haemonchus* because it lowers the number of option available to treat the parasites, especially since resistance to no drug often means that parasites will be resistance to all drugs is that compound class [28]. Therefore, the aim of this study was to determine the prevalence and major risk factors of parasitism of nematodes parasites of cattle in the Tullo district, West Hararghe Zone, Eastern Ethiopia.

MATERIALS AND METHODS

Study Area Description: The study was conducted in peasant association (PA) of Tullo district. It is located 371 Km from Addis Ababa, 45 Km from Chiro, zonal town. The woreda is characterized by the main seasons in a year. The dry season (bega), which extends from January to the ends of April and also long rain season (keremt) that extends from July to the ends of September. The district has daily mean temperature ranging from 18°C-26°C and mean annually rain fall ranging from 550m-800m above sea level. The agro-ecological of the zone of the district is highland (dega) 40%, amid high land (weynedega) 57% and 3% kola. The topography of the district medium high land 1500 m.a.s.l, high land 1500-2500 and very high land >2500 m.a.s.l and relative humidity 21.9%-65%. The climate conditions of altitude 1500-3100 m.a.s.l. The soil type of the district clay 43%, sand 55% and silt 2%. The major crop cultivation is sorghum, maize, barley, teff and wheat. The livestock population of the Woreda is 125915 cattle, 37973 goat, 13177 sheep, 171499 poultry, 5905 donkey and 338 horse and 274 mules. The total area coverage of the woreda is 45679 hectares, of which 30275 hectare is cultivated land, 6325 hectare is forested land and 253 are bush land and 1000 miscellaneous land. The woreda has 33 peasant association and three towns with total human population of 14648, of which male71691 and female 74798 [29].

Study Animals: The study of the animal was local breed of cattle that were managed under extensive and semi-intensive production systems and the animal were randomly selected from peasant association of Tullo district.

Study Design: A cross sectional study design using simple random sampling was conducted from November, 2016-March, 2017. Fecal sample were collected from Tullo district to assess the prevalence of gastro-intestinal parasites of cattle in different peasant associations by coprological examination. Animals were restrained by the farmer for sampling and the sample collected into the universal bottle then, transported to Hirna Regional Veterinary Laboratory.

Sampling Method: In the first stage the two study districts were purposively selected based on based on accessibility, availability of infrastructure and number of cattle populations. In the second stage, with the help of animal health workers, development agencies and peasant associations, which means the smallest administrative unit of the districts were randomly selected from the two districts. Households and individual animal were selected using two stage sampling methods. The selected households were informed by animal health worker to provide their cattle for sampling purpose. A Simple random sampling technique was employed to selected peasant associations, households and animals from the total of 33 peasant associations in Tullo district, among them six were randomly selected based on the livestock populations and Peasant associations (PAs) size of the district in the study area.

Sample Size Determination: The number of animals required for the study was determined using the formula given by Thrusfield [30]. The prevalence of nematodes in the area was not studied. Therefore, expected prevalence of 50% with required precision (0.05) was used. Based on this formula a total of 384 animals were included in the study.

$$n = \frac{1.96^2 x P_{exp}(1 - P_{exp})}{d^2}$$

where,

n = Required sample size
P_{exp} = Expected prevalence
D = Desired absolute precision (usually 0.05)

Sampling Strategy: A total of 384 samples were collected during the study period from all settlements by using simple random sampling in each settlement. The examined animals were only bovine and sample size for each settlement varies with availability of cattle.

Study Methodology

Coprological Examination: Fecal samples were collected from rectum where possible for freshly voided feces. The fecal samples were put into sampling bottles,

identified appropriately and transported to Hirna veterinary Regional Laboratory to be processed and preserved into universal bottle of 5% formalin and stored until the time of testing. Sample was kept in refrigerator at 4°C to be examined for coproscopy.

Flotation Technique: For coprological examination of the fecal samples, simple test tube floatation techniques described by Hansen and Perry [19] were employed. In flotation, 3 gm of feces was dissolved in 50 ml of sodium chloride solution and suspension was strained through tea strainer. The resulting fecal suspension was transferred to 15ml of test tube. The tube was allowed to stand with cover slip on top for 20 minutes. The cover slip was lifted off the tube, together with some fluid adhering to it and examined under the microscope (x10).

Data Analysis: Data were classified, filtered, coded using Microsoft Excel sheet and was transferred and analyzed using SPSS version 20. Pearson Chi-Square was used to evaluate the statistical significance of the associations of different categorical variables with prevalence of nematodes parasites of cattle. P-value less than 0.05 was taken as statistically significant. The data which were collected from the study area, results obtained from fecal examination was recorded in the format developed for this purpose.

RESULTS

In this study, a total of 384 cattle were examined and 120 collected fecal samples were positive. The overall prevalence of nematodes parasites was 31.2%.

Table 1: Species based prevalence of GI nematodes in the study area

Species	Number of tested animals	Positive	Prevalence (%)
Strongle	172	28	16.14
Strongyloid	150	13	8.6
Trichuris	62	3	5.5
Total	384	120	31.2

Table 2: Prevalence of nematodes parasites of cattle in selected villages of Tullo district

Vilages	No of tested animals	No of positive	Prevalence %	χ^2 (P-value)
Kira Kufis	58	21	36.2	
Rakkata Fura	72	22	30.6	
Meta Kasha	60	21	35	1.018 (0.988)
Lubbu Dekab	56	20	35.7	
Oda Naga	74	18	24.3	
Chafe	64	18	28.1	
Total	384	120	31.2	

Table 3: The prevalence of nematodes parasites of cattle based potential risk factors

Risk Factors	Variables	No of examined animals	No of positive animals	Prevalence (%)	χ^2	P-value
Age	Young	217	77	35.5	4.06	0.41
	Adult	167	43	25.7		
	Total	384	120	31.2		
Sex	Female	211	75	35.5	4.021	0.006
	Male	173	45	26		
	Total	384	120	31.2		
Breed	Local	245	84	34.28	8.76	0.067
	Cross	139	34	24.46		
Season	Wet	188	59	31.4	0.03	0.034
	Dry	196	61	31.1		
	Total	384	120	31.2		
BCS	Good	187	59	31.6	0.08	0.012
	Medium	187	77	31.1		
	Poor	4	51	25		
	Total	384	102	31.2		
Management	Medium	187	77	41.1	12.99	0.002
	Poor	187	51	27.3		
	Extensive	232	102	43.96		
	Semi-intensive	152	85	55.92		

Table 4: The univariable and multivariable logistic regression analysis of risk factors

		Univariable logistic regression		Multivariable Logistic regression	
Variable	Prevalence (%)	(95% CI)	χ^2 (P-value)	(95% CI)	χ^2 (P-value)
Age					
Adult	25.7	1		1	7.3(0.007)
Young	35.5	2.4 (29.12-42.24)	0.1 (0.8)	2(29.12-42.24)	
Sex					
Male	26.0	1		1	1.3 (0.02)
Female	35.5	3.1(29.09-42.40)	9.5(0.002)	2.1 (0.7- 1.6)	
Season					
Dry	31.1	1		1	2.6 (0.3)
Wet	31.4	6 (24.82-38.53)	7.3 (0.08)	1.2 (0.8-1.7)	
BCS					
Good	31.6	1			
Medium	31.1	6.3(24.63-38.13)		1.8 (0.9-3.6)	0.5 (0.9)
Poor	25.0	2(0.6.30-80.58)	2.8 (0.2)	1.8 (7-2.7)	

The highest prevalence (36.2%) was recorded in kira kufis village while the lowest prevalence (24.3%) was recorded in oda naga village. Meanwhile, statistically not significant variation was recorded among the studied villages (P>0.05).

Host and environment related potential risk factors like sex, age, season and body condition score of the animals were associated nematodes parasites of the cattle. However, the risk factors such as sex, body condition scores and season statistically significant (P<0.05) in prevalence of nematodes parasites of cattle but age is not statistically significant (P< 0.05) (Table 3).

The chi square test showed that there was no statically significant difference in infection rate between different age and breed groups (X^2 = 4.06, 8.76, P>0.05) respectively and also chi square test showed that there was statically significant difference in infection rate between different sex, season body condition score and management groups (χ^2 = 0.006, 0.034, 0.012 and 0.002, respectively (P<0.05) in below (Table 3).

In unavailable logistic regression analysis, male had 3.1 times the odds of being negative for affected by nematodes parasite than female (OR=3.1; CI=29.09-42.40) on fecal examination. Similarly, animals in good body score had 6.3 times of being negative for nematodes parasites (OR=6.3; CI=24.63-38.13). Both in univariable and multivariable analysis, sex remained significantly (P<0.05) associated with nematodes parasites. However, the other factors remained statistically insignificant (P>0.05) (Table 4).

DISCUSSION

The current study revealed an overall prevalence of 31.2% gastro intestinal (GI) nematode infection of cattle. This result is lower than the findings in Zimbabwe (43%) by Pfukenyi *et al*. [31] and Waruiru *et al*. [32], 85.5% in Kenya. In this study, the gastro intestinal (GI) nematode parasites identified were *Strongyles*, *Trichuris* and *Strongloids* with the prevalence of each of the parasites 16.14%, 5.5% and 8.6%, respectively. In the case of *Trichuris*, the prevalence disagrees with the reports of Fikru *et al*. [5], in western Oromia (1.6%) and that of Etsehiwot [33] in and around Gondar town (1.2%). This might be due to differences in the study design and ecology, season, management system and sample size differences.

This study clearly demonstrated the effect of age on the occurrence of gastro intestinal nematodes with the prevalence being highest in young 35.5% and 26.34% in adult cattle. This finding is in agreement with the earlier reports of Waruiru *et al*. [32], Anene *et al*. [34]. Young 34.1% and adult 23.07%, which showed that the susceptibility and pathogenicity of nematode infections were greater in young animals than in mature animals. This also could be due to the fact that younger animals are more susceptible than adult counter parts. Because age has an effect on responsiveness or to the development of immunity causing lower worm fecundity in adult animals Ploeger [35]. This is because of the adult animals may acquire immunity to the parasites through frequent challenge and expel the ingested parasite before they establish infection. This could be due to differences in agro-ecology of the study areas, the management systems and sample size taken.

The present study clearly shows that the effect of sex on the occurrence of gastro-intestinal nematodes with the prevalence being higher in female (35.5%) and (26.2%) in male cattle. In this study, there were sex-related differences in the prevalence of GI nematodes in cattle.

The absence of association between sexes in the prevalence of GI nematodes in cattle is disagreement with that of Fikru *et al*. [5] in Western Oromia, Which was 69.2% female and 56.4% male Cattle. Higher prevalence of nematode parasites in females compared with males may be because of lowered resistance of female animals due to their reproductive events and insufficient/unbalanced diet against higher needs. In addition to this, host factors were responsible for immunological impairment around parturition and thus resulted in periparturient eggs rise Connan [36].

The study further revealed that body condition of the animals was show significant association with the prevalence of the parasites. Good body condition animals have higher prevalence than medium and poor body condition animals which is 31.9%, 31.1% and 25%) respectively. The prevalence in body condition agrees with previous reports of Fikru *et al*. [5] but, disagrees with that of Keyyu *et al*. [37].

Relatively Higher prevalence of helminthes parasitic infection during wet than dry season which is the prevalence of 31.4% and 31.1% respectively. This might be due to high temperature and moisture content which favors the growth and development of larvae on pasture resulting in increased contact between the host and parasites. The result of the preset study showed significantly higher GI nematodes infection rate in extensively managed cattle (55.92%) than semi intensive (43.96%) managed cattle. This finding agrees with the report of Keyyu, *et al*. [38].

CONCLUSION

The gastrointestinal parasites are the major problems in young animals in the area that could cause major economic loss in the cattle production due to stunted growth, insufficient weight gain, poor food utilization and mortality and losses associated with control measures and treatments. The prevalence of the nematodes infections of cattle in Tullo district indicated the significance of these parasites nematode parasites in cattle in the study area were by hampering growth, productivity and reproductive potential of the cattle in the area. The predominant *Strongyle* followed by S*trongloids* and *Trichuris.* The role of cattle in the contribution of the country's economy and individual cattle owners is said to be high. In order to benefit from cattle, attention should be given and more works are expected to emerge.

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