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Impact of Micro-Dams on Animal Health: Cross-Sectional Study in South-Eastern Zone of Tigray, Ethiopia

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Abstract: The aim of the study was to determine impact of micro-dams on animal health. The study was conducted in South-Eastern Zone of Tigray, Hintallo-Wajerat woreda, Danglat, Mesanu and Arasegeda kebeles, in which micro-dams are used as site of watering for Livestocks and Ayinalem located in nearby Mekele City in which micro-dams didn't appeared and did not use stagnant water as site of watering for livestock. Fecal sample was collected and examined using direct microscopic, floatation and sedimentation techniques. Generally, out of 902 animals, 798 were observed to be positive with over all prevalence of 88.47%, bovine (699) (88.15%), ovine (55) (93.22%), caprine (7)(87.5%), equine (28)(87.5%) and camel (9)(90%). The gastro-intestinal parasites found with their respective prevalence (%) and burden (mean ± S.D of egg per gram/EPG/) in this study from highest to lowest are: *Strongylus* (74.9%, 1503.66±3285.053), *Eimeria* (58.6%, 0.59±0.493), *Ascaris/Parascaris* (38.4%, 248.68±811.410), *Fasciola* (24.1%, 1.52±527), *Schistosoma* (13.3%, 0.64±1.899), *Monezia* (10.4%, 0.10±0.306), *Paramphistomum* (10%, 0.702±695), *Dicrocoelium* (1.2%, 3.10±45.084) and *Trichuris* (4% 0.18±0.930). The highest and lowest prevalence rate was encountered in Dengolat (98.07%), one of affected area and Ayinalem (82.23%), comparative area, respectively with significant difference ($P<0.05$). Also variation in animal species, sex and age and body condition scores was studied. Different methods of reducing negative impacts of the micro-dams on animal health were recommended despite deworming diseased animals.

Key words: Prevalence ・ Parasitic burden ・ Aynalem ・ Dingolat ・ EPG ・ varietion

INTRODUCTION

Ethiopia had been depending on the rain-fed agricultural production facing different risk of drought and famines [1]. Together with war, Tigray region was mostly affected regions by severe famines occurred in Ethiopia during 1974 and 1984.To mitigate such problem occurred due to dependence on rain fed agriculture and improve food production, regional state of Tigray started to construct micro-dams and introduce irrigation systems [2].

Despite improving agricultural productivity, stored water has negative impacts on health. The Study done by Tedros *et al*. [2] indicates that, malaria and schistosomiasis are more prevalent in peoples living surrounding these micro-dams due to its creating good environment for mosquitoes and snails intermediate hosts respectively. This development of water resources may have also negative impacts on animal health [3]. Trematodal diseases of livestock are increasing problem as new dams, irrigation projects and improved water facilities provide new habitats for snail intermediate hosts within which larval stage develop to infective stage [4, 5]. Since this collected water is also used for animal watering and defecate in or nearby the dam, it creates favorable environment for development of larva of nematodes to infective stage and distributed among livestock.

These parasitic diseases have greater impact on animal health in terms of number of animals affected, morbidity and mortality [3, 6]. Economic losses are caused by gastrointestinal parasites in a 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

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costs and mortality in heavily parasitized animals [7]. Though impacts of micro dam irrigations on human health have been done at study area, its impact on animal health hasn't been done.

Objectives of the Study: The major objective of the study was to determine the impact of micro dams on animal health, as the specific objectives include:

- To assess prevalence of Gastro-intestinal parasites
- To determine burden Gastro-intestinal parasites
- To increase awareness of people on care given to reduce impacts.

MATERIALS AND METHODS

Study Design: The study design involves both descriptive and comparative (Observational) cross-sectional study that enable to determine the prevalence of gastrointestinal parasites, generally and their class and general specifically together with their burden and associations, so that able to determine micro dam impact on epidemiology of gastro intestinal parasites on animal health.

Description of Study Area: The study was conducted in southern zone of Tigray region, in three specified sites (Kebeles/Peasant Associations/PAs) named Dengolat, Mesanu and Arasegeda, each having one or more micro dams and many diversions of HintalloWajerat Woreda and fourth site named Aynalem located around Mekele City where animas do not used microdams as watering site

Study Population/Animal: A total of 902 animals, including bovine (793), ovine (59), equine (32), camel (10) and caprine (8) species, were selected randomly from 3 affected areas, Dengolat (207), Mesanu (261), Arasegeda (192) and one kebele of comparative area where did not exposed, named Aynalem (242). Their respective sex, age and body condition score was recorded individually during sample collection.

Sampling and Sample Size: Simple random sampling method was used for sampling animals irrespective of their age, sex, physiological state or body condition and animal type but that graze or drink water in the dam and it's surrounding.

The desired sample size was calculated at 95% confidence level, 5% desired absolute precision and 50% average prevalence using Thrusfied formula;

$$N = \frac{(1.96)2P\exp(1-P\exp)}{d^2}$$

where;

n = required sample size
Pexp = Expected prevalence
d = desired absolute precision

This formula resulted in a total of 384. However to increase precision of the estimate, it was suggested that the sample size could be inflated by two to four fold accordingly, the sample was increased to 902 animals.

Sample Collection Methods: Primary descriptive data was taken from the owners and attendants of the animals regarding the age of animals and approved by direct observation of the animal from which fecal sample taken. Sufficient amount of faces was collected from the rectum with a plastic glove directly or fresh sample from the ground, with strict sanitation, when the animal was seen while defecating and kept in formalized (10%) universal bottle or immediately taken to refrigerator + 4 and /or 15^{0}C to be examined. The collected samples were subjected to qualitative and quantitative carpological examination using simple or direct microscopic examination; Brumpt's sedimentation concentration method for trematodes; and modified Wisconsin Sugar floatation methods. To determine burden of parasites, modified Stoll's egg counting method was used.

Direct smear techniques was also used for control purpose being both light and heavy eggs could be appreciated, all according to the procedure described in standard veterinary laboratory diagnostic manual [8]. This examination was needed for screening positive case and determining the status of infestation simultaneously multiplying as a formula given by Brumpt's sedimentation concentration method for each genera/species.

Data Analysis: The data was analyzed by using common statistical or computer program. SPSS.12 software, Chi-square test (Pearson test) and one way ANOVA in a General Linear Model (GLM) was used to analyze the data.

RESULTS

Prevalence Gastrointestinal Parasitic Diseases

Over All Prevalence of Parasites: From the total number of 902 animals sampled and examined, 798 were observed to be positive for gastro intestinal parasites with over all prevalence of 88.47%. For all livestock examined, respective number of infected animals and disease prevalence were presented according to their category in sites, species, sexes, ages and body condition scores (Table 1). Significant differences in prevalence rate was observed only among the sites with (P<0.05). The higher prevalence rate was encountered in Dengolat (98.07%) whereas the least one was in Ayinalem (82.23%).

Variation in Prevalence among Different Genera of Parasites: The gastro intestinal parasite examined was also categorized into different parasitic class as *Trematodes, Nematodes Cestodes, Coccidia* and Mixed form of two or more of them. Highest number of animals were infected with Mixed infection of Nematode and Coccidian (243)(30.45) (Table 2).

Variation in Prevalence, among Affected and Comparative Sites: The prevalence rate of each parasitic genera and difference between sites was also identified to be significant (P<0.05) with highest in Dingolat, one of affected area and lowest in Ayinalem, control area (Table 3).

Variation in Prevalence among Different Species of Animals: Variationof prevalence rate among species of animals were also determined being significant (P<0.05) for *Trichuris* (30%) and *Monezia/Anaplocephala* (40%) highest in camel and *Coccidia* highest in Ovine, 86.4% and *Caprine*, 75%. (Table 4).

Variation in Prevalence Between Sex of Animals

Variation of Parasitic Genera Prevalence and Sex Differences: Significant difference among sexes was seen only in that of *Schistosoma* and *Fasciola* being higher in male with highest, 14% (n=70) and 27.2 %(n=135) and lowest, 12.3% (n=50) and 20.2% (n=82) in female prevalence rate respectively (Table 5).

Table 1: Overall prevalence of parasites

Factors	Total positive Prevalence (%) and significance (P-Value)				
Site	Danglat (203)(98.07)	Mesanu (232)(88.89)	Arasegeda (164)(85.42)	Ayinalem (199)(82.43)	P<0.05
Species	Bovine (699)(88.15)	Ovine (55)(93.22)	Equine (28)(87.5)	Camel (9)(90) Caprine (7)(87.5)	P>0.05
Sex	Female (349)(86.79)	Male (449)(90.34)			P<0.05
Age	<2(66)(89.19)	26(521)(87.27)	>68(211)(89.78)		P>0.05
Bcs	Fat(79)(92.94)	Medium (388)(87.19)	Lean (263)(89.15)	Very lean (68)(88.31)	P>0.05
Total (n)	798(88.47)				

N: Total examined, n: Total positive, Bcs: body condition score and age counted in year

Table 2: Prevalence of parasitic classes

Parasitic class	No. infected	Prevalence (%)
Trematode	14	1.75
Nematode	170	21.30
Cestode	1	0.13
Coccidia	26	3.26
Trematode and Nematode	54	6.77
Trematode and Cestode	5	0.63
Trematode and Coccidia	12	1.50
Trematode, Nematode and Coccidia	185	23.19
Trematode, Nematode, Coccidia and Cestode	38	4.76
Trematode, Nematode and Cestode	3	0.38
Trematode, Cestode and Coccidia	2	0.25
Nematode and Cestode	18	2.26
Nematode and Coccidia	243	30.45
Nematode, Cestode and Coccidia)	24	3.01
Cestode and Coccidia	3	0.38
Total infected	798	100

Table 3: Variation in prevalence of parasites among sites

	Study sites, prevalence and Significance					
Parasitic genera	Dengolat	Mesanu	Arasegeda	Ayinalem	Overall (%)	P-Value
Schistosoma	64(30.9)	25(9.6)	25(13)	6(2.5)	120 (13.33)	<0.05
Fasciola	107(51.7)	51(19.5)	36(18.8)	23(9.5)	217 (24.06)	<0.05
Paramphostomum	55(26.6)	17(6.5)	13(6.8)	5(2.1)	90 (9.98)	<0.05
Dicrocoelium	17(8.20)	8(3.1)	6(3.1)	5(2.1)	36(4)	<0.05
Strongylus	164(79.2)	193(73.9)	141(73.4)	178(73.6)	676(74.95)	<0.05
Trichuris	6(2.9)	3(1.15)	2(1)	0(0)	11(1.22)	<0.05
Parascaris	151(72.9)	70(26.8)	63(32.8)	62(25.6)	346(38.36)	<0.05
Monezia	29(14)	28(10.7)	24(12.5)	13(5.4)	94(10.42)	<0.05
Coccidia	184(88.9)	151(57.9)	117(60.9)	77(31.8)	526(58.32)	<0.05
Total (N)	207	261	192	242	902	

N, number of sampled animals; n, number of infected animal

Table 4: Variation in prevalence among species of animals

	Animal species, prevalence and significance, df=4					
Parasitic genera	Bovine	Ovine	Equine	Camel	Caprine	Total (n)	P-value
Schistosoma	109(13.8)	8(13.6)	1(3.1)	2(0.2)	0	120	>0.05
Fasciola	197(24.8)	15(25.4)	3(9.4)	2(0.2)	0	217	>0.05
Paramphistomum	80(10.1)	6(10.2)	2(6.25)	2(0.2)	0	90	>0.05
Dicrocoelium	28(3.5)	4(6.8)	2(6.25)	2(0.2)	0	36	>0.05
Strongylus trichastronsylus	588(74.1)	48(81.4)	26(81.3)	7(70)	7(87.5)	676	>0.05
Trichuris	4(0.5)	4(6.8)	0(0)	3(30)	0	11	>0.05
Ascaris	315(39.7)	0(0)	27(49.9)	5(50)	2(25)	346	>0.05
Monezia	74(9.3)	30(28.8)	0(0)	4(40)	3(37.5)	94	>0.05
Coccidia	457(57.6)	51(86.4)	10(31.3)	5(50)	6(75)	529	>0.05
Total (N)	793	59	32	10	8	902	

N=Number of sampled animals; n=Number of infected animals

Table 5: Variation in prevalence of parasites between sex groups of animals

	Sex, Prevalence and Significance			
Parasitic genera	Female	Male	Total (n)	P-Value
Schistosoma	50(12.32)	70(14)	120	<0.05
Fasciola	80(20.2)	135(27.2)	217	<0.05
Paramphistomum	38(9.4)	52(10.5)	90	<0.05
Dicrocoelium	14(3.5)	22(4.4)	36	<0.05
Strongylus	295(72.8)	381(76.7)	676	<0.05
Trichuris	7(1.7)	4(0.8)	11	<0.05
Ascaris	144(35.6)	202(40.6)	346	<0.05
Monezia	48(11.9)	46(9.3)	94	<0.05
Coccidia	227(56)	302(60.8)	529	<0.05
Total (N)	405	497	902	<0.05

N, number of sampled animals; n, number of infected animals

Variation in Prevalence among Different Age Group of Animals: Variation of prevalence rate among age groups of animals were also determined being significant ($p<0.05$) only in coccidian being highest in ages less than two (<2) years and lowest in ages greater than six (<6) years with respective prevalence of 37% (n=54) and 51.5% (n=121) (Table 6).

Variation in Prevalence among Body Condition Scores of Animals: When variation of prevalence rate among body condition scores analyzed, significant difference was found only in *Shistosoma* and *Ascaris/Parascaris* with highest prevalence rate in very lean, 23.4% (n=18) and fat, 51.8) (n=44) and lowest prevalence rate in lean 1.9% (n=35) and medium, 35.1% (n=156) respectively (Table 7).

Table 6: Variation in prevalence among age groups of animals

	Age (years), Prevalence and significance				
Parasitic genera	<2	2-6	>6	Total (n)	P-Value
Schistosoma	9(12.2)	75(12.6)	36(15.3)	120	>0.05
Fasciola	15(20.3)	137(23.1)	65(27.7)	21	>0.05
Paramphistomum	6(8.1)	57(9.6)	27(11.5)	90	>0.05
Dicrocoelium	1(1.4)	22(3.7)	13(5.5)	36	>0.05
Strongylus	60(81.1)	444(74.9)	172(73.2)	676	>0.05
Trichuris	2(2.7)	7(1.2)	2.(0.9)	11	>0.05
Ascaris	23(31.1)	224(37.8)	99(42.1)	346	>0.05
Monezia	8(10.9)	61(10.3)	25(10.6)	94	>0.05
Coccidia	54(73)	335(56.5)	121(51.5)	259	>0.05
Total (N)	74	593	235	902	>0.05

N, number of sampled animals; n, number of infected animals

Table 7: Variation in prevalence of parasites among different body condition scores/BCS/

	Bcs, Prevalence and Significance					
Parasitic genera	Fat	Medium	Lean	Very lean	Total (n)	P-Value
Schistosoma	13(15.3)	54(12.1)	35(11.9)	18(23.4)	120	<0.05
Fasciola	23(27.1)	111(24.9)	58(19.66)	25(0.3)	217	<0.05
Paramphistomum	10(11.8)	45(10.1)	25(8.9)	10(13)	90	<0.05
Dicrocoelium	6(7.1)	13(2.9)	14(4.8)	3(3.9)	36	<0.05
Strongylus	63(74.2)	323(74.6)	227(76.9)	63(81.8)	676	<0.05
Trichuris	0(0)	8(1.8)	3(1)	0(0)	11	<0.05
Ascaris	44(51.8)	156(35.1)	118(40)	28(36.4)	346	<0.05
Monezia	14(16.5)	48(10.8)	27(9.2)	5(6.5)	94	<0.05
Coccidia	59(69.4)	262(58.9)	165(55.9)	43(55.8)	529	<0.05
Total (N)	85	445	295	77	902	<0.05

N, number of sampled animals; n, number of infected animals. Bsc, body condition score

Table 8: Variation of parasitic burden among sites

	Sites, Mean and Standard deviation (S.D)										
	Dengolat		Mesanu		Arasegeda		Ayinalem		Total		
Parasitic genera	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	P-Value
Schistosoma	1.62	3.039	0.38	1.300	0.61	1.640	0.10	0.662	0.64	1.899	<0.05
Fasciola	3.64	5.080	1.17	3.234	0.83	2.064	0.64	2.159	1.52	3.527	<0.05
Paramphistomum	2.04	4.612	0.45	2.082	0.34	1.464	0.10	0.716	0.70	2.695	<0.05
Dicrocoelium	0.36	1.288	0.13	0.817	0.14	0.829	0.10	0.716	0.18	0.930	<0.05
Strongylus	1360.29	2016.888	1184.90	1743.513	1770.15	3386.910	1758.64	4924.214	1503.66	3285.053	<0.05
Trichuris	3.39	20.625	5.35	75.483	3.13	36.762	0.00	0.000	3.10	45.084	<0.05
Ascaris	520.34	1291.200	167.82	581.806	177.60	441.046	159.92	659.250	248.68	811.410	<0.05
Monezia	0.14	0.348	0.11	0.310	0.13	0.332	0.05	0.226	0.10	0.306	<0.05
Coccidia	0.89	0.315	0.58	0.495	0.61	0.489	0.32	0.467	0.59	0.493	<0.05
Total (N)	207		261		192		242		902		

Variation in Burden of Gastrointestinal Parasites: The burden of parasite was also determined to assess impact of microdam irrigations on animal health. The burden was analyzed from mean and standard deviation for counted EPG of all genera and their variation among sites, species, sexes, age groups and body condition score of animals.

Variation in Burden among Affected and Comparison Sites: The highest burden (epg) was seen in *Strongylus* (1503±3285.053)and*Ascaris/Parascaris*(248.68±811.410) when the lowest was that of *Anaplocephala* or *Monezia* (0.10±0.306) and *Dicrocoelium* (0.18±0.930), though it varies with sites, species, sexes, age groups and body

Table 9: Variation of parasitic burden among species of animals

	Species, Meaan and Standard Deviation (S.D)												
	Bovine		Ovine		Equine		Camel		Caprine		Total		
Parasitic genera	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	P-Val
Schistosoma	0.66	1.949	0.61	1.554	0.09	0.530	1.20	2.898	00	0.000	0.64	1.899	>0.05
Fasciola	1.52	3.422	2.24	5.273	0.56	1.933	1.50	3.808	0.00	0.000	1.52	3.527	>0.05
Paramphistomum	0.70	2.705	1.02	3.416	0.19	0.738	0.90	2.025	0.00	0.000	0.70	2.695	>0.05
Dicrocoelium	0.15	0.825	0.41	1.620	0.28	1.170	0.90	2.025	0.00	0.000	0.18	0.930	>0.05
Strongylus	1322.42	3231.710	2735.42	3306.812	3294.69	3492.350	2060.00	2987.827	2525.00	4297.424	1503.66	3285.053	>0.05
Trichuris	2.02	43.473	13.56	68.124	0.00	0.000	40.00	69.921	0.00	0.000	3.10	45.084	>0.05
Ascaris	236.95	748.962	0.0	0.0	757.31	2509.046	100.00	156.343	75.00	138.873	248.68	811.410	>0.05
Monezia	0.09	0.291	0.22	0.418	0.00	0.000	0.40	0.516	0.38	0.518	0.10	0.306	>0.05
Coccidia	0.58	0.494	0.86	0.345	0.31	0.471	0.50	0.527	0.75	0.463	0.59	0.493	>0.05
Total (N)	793		59		32		10		8		902		

Table 10: Variation of parasitic burden between sexes of animals

	Sex, Mean and Standard deviation (S.D)						
	Female		Male		Total		
Parasitic genera	Mean	S.D	Mean	S.D	Mean	S.D	P-Value
Schistosoma	0.56	1.700	0.70	2.046	3.64	1.899	>0.05
Fasciola	1.31	3.506	1.69	3.537	7.52	3.527	>0.05
Paramphistomum	0.68	2.691	0.70	2.703	0.70	2.695	>0.05
Dicrocoelium	0.16	0.930	0.19	0.932	0.18	0.930	>0.05
Strongylus	1472.32	2619.613	1531.88	3746.598	1703.66	3285.053	>0.05
Trichuris	4.69	61.360	1.81	24.959	3.10	45.084	>0.05
Ascaris	214.03	741.202	277.44	864.916	248.68	811.410	>0.05
Monezia	0.12	0.324	0.09	0.290	0.10	0.306	>0.05
Coccidia	0.56	0.497	0.61	0.488	0.59	0.493	>0.05
Total (N)	405		497		902		

Table 11: Variation of parasitic burden among age group of animals

	Age (Year), Mean and Standard deviation (S.D)								
Parasitic genera	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	P-Val
Schistosoma	0.65	1.876	0.56	1.727	0.83	2.279	0.64	1.899	>0.05
Fasciola	0.77	1.724	1.54	3.777	1.72	3.267	1.52	3.527	>0.05
Paramphistomum	0.61	2.163	0.65	2.726	0.84	2.770	0.70	2.695	>0.05
Dicrocoelium	0.04	0.349	0.16	0.891	0.26	1.127	0.18	0.930	>0.05
Strongylus/Trichostrongylus	23921.14	4353.894	1375.99	2058.692	1546.05	4962.191	1503.66	3285.053	>0.05
Trichuris	8.11	59.119	3.37	51.22	0.85	9.206	3.10	45.084	>0.05
Ascaris	110.81	216.173	251.43	857.283	285.15	808.582	248.68	811.410	>0.05
Anoplocephala	0.11	0.313	0.10	0.304	0.11	0.309	0.10	0.306	>0.05
Coccidia	0.73	0.447	0.56	0.496	0.60	0.491	0.59	0.493	>0.05
Total (N)	74		593		235		902		

condition score of animals (Table 8). Significant parasitic burden difference (p<0.05) was observed in all generas with the highest and lowest burden in Dengolat and Ayinalem respectively (Table 8).

Variation in Parasitic Burden among Species of Animals: Significant parasitic burden difference (P<0.05) among species were observed in *Dicrocoelium, Strongylus, Trichuris and Coccidia* with highest burden in Camel (0.90±2.025), Equine (3492.350±3492.350), Camel (40.00±69.921) and Ovine (0.86±0.345) respectively (Table 9).

Variation in Parasitic Burden Between Sex of Animals: Variation of parasitic burden was also determined to be scientifically significant (p<0.05) between sex only in *Stronglyus* with higher epg of (1531.88±2619.613) in female (Table 10).

Table 12: Variation of parasitic burden among different body condition scores/Bcs/

	Bcs, Mean and Standard deviation (S.D)										
Parasitic genera	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	P-Val
Schistosoma	0.71	1.831	0.55	1.783	0.60	1.910	1.21	2.446	0.64	1.899	<0.05
Fasciola	1.48	2.839	1.62	3.643	10.9	2.756	2.69	5.432	1.52	3.527	<0.05
Paramphistomum	0.74	2.655	0.69	2.828	0.61	2.372	1.05	3.107	0.70	2.695	<0.05
Dicrocoelium	0.28	1.098	0.13	0.792	0.23	1.123	0.12	0.584	0.18	0.930	<0.05
Strongylus	1424.71	1734.174	1312.92	2131.370	1765.69	4895.489	1689.22	2200.589	1503.66	3285.053	<0.05
Trichuris	0.00	0.000	5.62	63.600	1.02	10.050	0.00	0.000	3.10	45.084	<0.05
Ascaris	315.29	915.801	221.57	734.959	288.51	957.522	179.22	394.481	248.68	811.410	P<0.05
Anoplocephala	0.16	0.373	0.11	0.311	0.09	0.289	0.06	0.248	0.10	0.306	<0.05
Coccidia	0.69	0.464	0.59	0.493	0.56	0.497	0.56	0.500	0.59	0.493	<0.05
Total (N)	85		445		295		77		902		

Bsc, body condition score

Variation in Parasitic Burden among Age of Animals: The significant difference among age groups were seen only in infection of Strongylus and Coccidia with the highest epg in ages lessthan two (<2) years (2392.14±4353.894) and (0.73±0.447) respectively (Table 11).

Variation in Burden among Different Body Condition Scores of Animals: In this case significant difference were found only in *Schistosoma* and *Fasciola* with highest burden in Very lean with epg (1.21±2.446) and (2.69±5.432) respectively (Table 12).

DISCUSSION

This study was needed to determine the impact of microdam irrigation on epidemiology of GI-parasitic diseases. The total examined animals were categorized in their sites, species and sex, age and body condition score. This was needed to determine the impact of microdam irrigation on epidemiology of GI-parasitic disease, so that on animal health. Samples were collected from livestock of three kebeles of Hantallowajerat, namely Dengolat, Mesanu and Arasegeda with many micro dams and Ayinalem greater than 35 km away from the dams, as comparative area, to determine difference in epidemiology and variation in parasitic burden.

The study reveals that the overall prevalence of gastro-intestinal parasites of livestock to be 88.47% for total animal examined. Significant differences in prevalence rate was observed only among the sites (P<0.05). The higher prevalence rate was encountered in Dengolat(98.07%) whereas the least one was in Ayinalem (82.23%). This indicates that presence of microdam brought high impact on epidemiology of gastrointestinal parasites.

The prevalence was slightly higher than that reported by Ragasa *et al*. [9]. Being 50.2%, 75.3% and 84.1% in cattle, sheep and goats respectively and 69.6% for total of ruminants. The reason could be the dependence of animals on micro dams for watering and kept together for grazing under extensive management system. This could increase pasture contamination and development of larvae to infective stage and making easy for transmission and infection of new host.

Though there was no significant difference of prevalence (P>0.05) among species, 88.15%, 93.22%, 87.5%, 90% and 87.5% in Cattle, Sheep, Donkey, Camel and Goats respectively, highest one was the observed in Ovine (Sheep) (93.22%). This is due that large portion of ovine were infected with *Eimeria* (86.4%) and *Trichostongylus* (81.4%), similarly in Caprine 87.5% and 75% respectively and their respective smaller sample size.

The gastro intestinal parasite examined was also categorized into different parasitic class as *Trematodes, Nematodes, Cestodes, Coccidia* and mixed form of two or more of them. Highest No. of animals were infected with Mixed infection of *Trematodes*, *Nematode and Coccidia* 30.45 %(n=243). The presence of higher mixed infection of parasitic class including their respective genera show similarity with the report of Ayele *et al*. [10] as mixed infection were detected in 54.8% of the donkeys.

The maintenance of high infection rate of parasitic helminthes in the study area might be also associated with lack of any parasitic helminthes intervention program and the management system in the area were poor, being many species of animal allowed to graze together on small plots of land leading cross contamination between animals. This idea agree with justification given by Ayele *et al.* [10] and Regassa *et al*. [9] in their determination of epidemiology of gastrointestinal parasites of Donkeys in Dugda Bora District, Ethiopia and Ruminants in Western Oromia, Ethiopia respectively.

The major genera identified were: *Schistosoma* (13.3%), *Fasciola* (24.1%), *Paramphistomum* (10%), *Dicrosolium* (4%), *Strongylus* (74.9%) *Trichuris* (1.2%), *Ascaris* (38.4%); *Monezia* (10.4%) and *Eimeria* (58.6%). The highest prevalence rate was seen in *Strongylus*, 74.9% (n=676) and *Coccidia*, 58.6% (n=526) while the least was in *Trichuris*, 1.2% (n=11) and *Dicrocoelium*, 4% (n=36). This highest prevalence of *Strongylus* and *Eimeria* agree with the work Regassa *et al*.[9]. though higher than their report.

The prevalence rate of each parasitic genera and difference between sites was also identified being significant (P<0.05) in all *Schistosoma, Fasciola, Paramphistomum, Dicrocoelium, Trichuris, Ascaris, Monezia* and *Coccidia* showing lowest prevalence rate in Ayinalem for all cases, except *Stronglus* remained showing no significant difference among sites (P>0.05). The lowest prevalence of *Schistosoma*, *Fasciola*, *Paramphistomum*, *Dicrocoelium* (Trematodes) in Ayinalem was due to its being far from microdam (>35 km) or loss of grazing area around water bodies or dams, whereas increased prevalence in target area indicates provision of suitable environment for Snail population which are the intermediate host for digenetic trematodes. So, that presence of natural water body and the snail species are the main risk factor for occurrence of bovine schistosomiasis in the area, ilala river, Mekelle, Ethiopia. In his work, 7.17% prevalence of schistosomiasis was observed, but in this study higher prevalence was observed in bovine (13.8%) indicating artificial water body (microdams) creating higher risk factore in the study area. The same is true for fasciolosis. The water loged and poorly drained area with acidic soils in the Highlands are often endemic area for fasciolosis that agree with finding of Michael *et al*. [11]. The prevalence of ovine fasciolosis in hashenge and its surroundings, Southern Tigray, Ethiopia was reported to be 21.7% Yishak [12]. whereas, in this study, it was observed to be 25.5% in Ovine showing higher prevalence of fasciolosis that is also due to additional marshy area created artificially.

Significant difference in prevalence of *Trichuris, Ascaris, Monezia* and *Eimeria* being lower in Ayinalem also indicated that, suitable temperature and humidity created by microdams in target sites resulted in increase of prevalence by highly contamination of water by feces of animals during their watering so that increasing transmission to healthy animals. The idea is also in agreement with Urquhart *et al*. [3] and Soulsby [13].

Variation of prevalence rate among species of animals were also determined being significant (P<0.05) for Trichuris, Monezia/anaplocephala and Coccidia with highest prevalence rate in Camel (30%), Camel (40%), Ovine (86.4%) respectively. The higher prevalence of *Eimeria* in ovine and caprine (75%) show similarity with work of Ragasa *et al*.[9]. In case of sheep the prevalence is higher while it is slightly lower in case of goats compared to their report 75.3% and 84.1% respectively. This can be due to difference in feeding habit of these species. Ovine depend only on grazing on pastures from the ground, surrounding the microdams.

Highest prevalence rate of *Schistosomosis, Fascioloses, paramphistomum* and *coccidian* were observed in bovine and ovine That of *Trichostongylus* being higher in Ovine (81.4%) than that of cattle. In case of *Trichostongylus* and *Eimeria* increased in prevalence it is also in agreement with many reports Dheressa [14] and Maichomo *et al*. [15]. In equine prevalence of *Strongylus* being 81.3% is lower than that reported by Ayele *et al*. [10] and Mulata [16] and Yoseph *et al*. [17] to be 100% and Fiqru *et al*. [18], 98%. The reason could be due to smaller sample size. However prevalence of *Fasciolosis* in Donkeys in this study (9.4%) is higher than that reported by Ayele *et al*. [10] that was only 1.5%. This higher prevalence might be due to difference in ecological conditions for the development of intermediate snails and the parasite.

Significant difference among sexes was seen only in that of *Schistosoma* and *Fasciola* being higher in male with highest, 14% (n=70) and 27.2% (n=135) and lowest, 12.3% (n=50) and 20.2% (n=82) in female prevalence rate respectively. This idea is in contrast with the some reports saying there is no significant difference between both sexes. In this study the reason of higher prevalence in male could be the more grazing of male animals after ploughing of irrigated lands near diverted water and the more feeding of dairy cows at house for their milk.

Variation of prevalence rate among age groups of animals were also determined being significant (P<0.05) only in coccidian being highest in ages less than two (<2) years and lowest in ages greater than six (<6) years with respective prevalence of 73% (n=54) and 51.5% (n=121) respectively. This could be the reason that innate or acquired immunity development against Eimeria species in older animals. This idea is in agreement with that given in Urquhart *et al*. [3].

When variation of prevalence rate among body condition scores analyzed, significant difference was found only in *shistosoma* and *Ascaris/Parascaris* with highest prevalence rate in very lean, 23.4% (n=18) and fat, 51.8 (n=44) and lowest prevalence rate in lean, 1.9% (n=35) and medium, 35.1% (n=156) respectively. The reason could be feeding habit or damage of parasites on animal together with their predilation site, *Schistosomes* in mesenteric vessel and Ascaris/parascaris in small intestine.

The burden of parasite was also determined to assess impact of microdam irrigations on animal health. The burden was analyzed from mean and standard deviation for counted epg of all genera as: *Schistosoma* (0.64±1.899), *Fasciola* (1.52±527), *Paramphistomum* (0.702±695), *Dicrocoelium* (0.18±0.930), *Strongylus* (1503.66±3285.053), *Trichuris* (3.10±45.084), *Ascaris/parascaris* (248.68±811.410) when the lowest was that of *Anaplocephala* or *Monezia* (0.10±0.306), *Dicrocoelium* (0.18±0.930) and *Coccidia/ Eimeria* (0.59±0.493). This increased burden could be the provision of suitable climate for development of larva of parasites in to infective stage by better humidity and temperature and different in fecundity between animals. However smaller number and higher number couldn't show exact variation in their impact or pathogenicity of parasites. This idea can be associated with the reason stated by Hansen and Perry [19], fluke egg in fecal sample is not an accurate indication of intensity of infection nor the amount of damage being done to the host, since eggs only expelled from the gall-bladder due to contraction during digestion process otherwise, they may remain there to serve as reservoir of eggs for considerable time.

Significant parasitic burden difference ($P<0.05$) was observed in all genera with the highest and lowest burden in Dengolat and Ayinalem respectively except for *Strongylus* burden which was almost the same in all sites. This specifically indicates impact of microdam irrigations in addition to increasing prevalence. In fact the increasing EPG indicates high number of adult parasites in the animals.

Significant parasitic burden difference ($P<0.05$) among species were observed in *Dicrocoelium, Strongylus, Trichuris and Coccidia* with highest burden in Camel (40.00±69.921). This is the reason that the animals are mixed together around the dams for grazing, increasing level of contamination of pastures. In this study the burden and prevalence of flukes are almost nil in Caprine that could be due to their feeding habit or their relative smaller in number. This agree with the bases of FAO [5] that the impact of small ruminants fascioliasis on species showed that it is higher in sheep than goats that can be due to the grazing habits of the ruminants that can greatly influence the epidemiology of the parasites as confirmed by this study. The lawer burden (epg) of fasciola spp. (0.56±1.933) in Donkeys agree with idea of Take Fayera [20], due to their acquired resistance and intermittent shedding of parasite eggs, which is infiluenced by digestion of feed that hinders to give definitive diagnosis of fasciolosis during fecal examination. Similarly. Nansen *et al*. [21] also justify that horses are less susceptible to fasciolosis than ruminants and overcome the migrating fluke at an early stage so that few reach the liver.

Variation of parasitic burden was also determined to be scientifically significant ($P<0.05$) between sex only in *Strongylus* with higher epg of (1531.88±3746.598) in Male and Lower (1472.32±2619.613) in female.

Significant difference among age groups were seen in infection of *Strongylus* and *Coccidia* with the highest epg in ages less than two (<2) years (2392.14±4353.894) and (0.73±0.447) respectively the reason can be the difference in immunity. Adult animals may acquire immunity to the parasites through frequent challenge and expel the ingested parasite before they establish infection.

Significant difference was observed among very lean body condition scores in those disease positive for *Schistsomiasis* and *Fasciolosis* with EPG (1.21±2.446) and (2.69±5.432) respectively. The reason could be their chronic effect on animal health. Generally the increased parasitic prevalence and burden indicates direct and indirect impact of micro-dams on health of animals in study area. Providing these finding for related institution and projects, all animals in affected area was dewormed.

CONCLUSION AND RECOMMENDATIONS

Results of this study suggested presence of higher prevalence and burden of gastrointestinal parasites in livestock grazing and watering from the micro dams and its surrounding than control areas. This indicates that the micro dam irrigations have negative impact on animals' health. Hence, it is imperative to forward the following recommendations.

- Movement of animals toward the dams for watering and grazing should be reduced by building barriers; providing clear drinking water from uncontaminated borehole or piped water; and changing the grazing area.
- Snail control measures from micro dams should be practiced by applying moluscicide, fencing, draining to avoid stagnation of the water and development of algae which form good shed for snails that intermediate host for trematodes.
- Improve the veterinary service or treatment and control of the disease by regular strategic application of anthelmintic drugs at regular interval.

- Increasing awareness of community using micro-dams about its impact on animal health and how to reduce it.
- Generally government needs to expect such negative impacts of any project and prepare mechanisms of reducing or using best alternative ones.

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