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Gastrointestinal Helminths Are Highly Prevalent in Scavenging Chickens of Selected Districts of Eastern Shewa Zone, Ethiopia

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Abstract: A cross-sectional survey on gastrointestinal helminths was conducted on 124 chickens raised under traditional management system in two selected districts namely Ada'a and Adamitulu of Eastern Shewa zone, Ethiopia. Of these chickens, 111 (89.5%) were found to harbor one of the five different helminth parasites and 13 (10.48%) were free of helminths parasites. The study also found that 103 (83.0%) and 72 (58.0%) of the examined chickens were invariably infected by diverse species of cestodes and nematodes species, respectively. There was a statistically significant difference ($p<0.05$) in the prevalence between cestodes and nematodes of helminths parasites within the same district. The major cestode species recovered form chickens were *Raillietina echinobothrida* 79 (63.7%), *Raillietina tetragona* 70 (56.5%), *Raillietina cesticillus* 50 (40.3%) and *Choanotaenia infundibulum* 17 (13.7%), *Davainea proglottina* 10 (8.1%), *Hymenolepis contaniana* 22 (17.7%) and *Hymenolepis carioca* 7 (17.7%). The major nematode species encountered were *Heterakis gallinarum* 47 (37.9%), *Ascaridia galli* 40 (32.0%), *Gongylonema ingluvicola* 32 (25.8%), *Dispharynx nasuta* 5 (4.0%), *Heterakis isolonche* 11 (8.9%), *Allodapa suctoria* 9 (7.3%), *Capillaria anatis* 4 (3.2%) and *Heterakis dispar* 8 (6.5%). The study also tried to see the prevalence of these parasites in relation with age and sex however, it has no significant difference ($p>0.05$) with those risk factors. On the other hand district significantly affect the prevalence of some parasites ($p<0.05$). This study strongly suggested that helminthosis is a very serious problem of backyard chickens in eastern Shewa zone of Oromia and appropriate control strategies need to be devised.

Key words: Chicken, east Shewa, helminthosis, high prevalence, scavenging

INTRODUCTION

Poultry are kept in backyards or commercial production systems in most areas of the world. Compared to a number of other livestock species, fewer social and religious taboos are related to the production, marketing and consumption of poultry products. For these reasons poultry products have become one of the most important protein sources for man throughout the world (Abdul-Hamed, 1984).

The most commonly kept poultry are chickens (*Gallus* sp.), ducks (*Carina* sp.), geese (*Anser* sp.) and turkeys (*Meleagris* sp.). Among these, domestic chickens (*Gallus domesticus*) are the most important. This has been clearly demonstrated by numbers and the fact that during the last three decades egg production doubled and poultry meat production has tripled, whereas the production of duck, goose and turkey meat has only recently started to expand. This expansion in poultry production is in part due to easy industrialization, e.g., short turnover, low establishment costs and efficient disease prophylaxis, compared with production of other livestock. On a world basis, production of poultry meat has in the last 10 years increased from 20-30% (FAO, 1997; Alabi *et al*., 2012).

The total poultry population in Ethiopia is estimated to be 38, 127, 504 (CSA, 2009) and approximately 99% of birds is raised under the traditional back yard system 0 of management (Alamargot, 1987; Ashenafi and Eshetu, 2004). In Ethiopia, indigenous chickens play important roles in the provision of poultry meat and eggs which are affordable sources of animal protein for the rural population (Dessie and Ogle, 2001).

Major causes of mortality in scavenging chickens kept under traditional system of management in Ethiopia include viral, protozoan and bacterial (Alemu, 1985). However, the less obvious but ubiquitous, losses due to

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reduces productivity caused by helminthosis are economically very important to the scavenging chickens (Abebe *et al*., 1997; Shamul-Islam, 1985; Phiri *et al*., 2007).

Helminths parasites involving nematodes (roundworms), trematodes (flatworms) and cestodes (tapeworms) affecting scavenging chickens have been widely reported, with mixed infection being very common (Poulsen *et al*., 2000; Phiri *et al*., 2007). In Africa, prevalence (usually of multiple infections) of up to 100% has been reported (Ssenyonga, 1982; Oyeka, 1989; Negesse, 1991; Poulsen *et al*., 2000; Permin *et al*., 2002; Phiri *et al*., 2007).

There are currently a few in formations in Ethiopia that shows the prevalence and distribution of Gastrointestinal Tract (GIT) helminths. According to reports, the prevalence of GIT parasitism reaches 91.01% (Eshetu *et al*., 2001; Ashenafi and Eshetu, 2004). But it is limited by its coverage (region) of Ethiopia so that doesn't indicate the whole picture of the prevalence in Ethiopia. Therefore, this was the rationale that initiated this research project. The project was undertaken with the objectives:

- To provides base line information on the prevalence and distribution of GIT helminths of scavenging chickens rearing under traditional system in two districts in Eastern Shewa
- To identify the most common species types of helminths in chickens of the study area
- To see the possible association between hosts' age, sex and districts with the distribution of helminths species

MATERIALS AND METHODS

Description of study areas: The study was conducted in two selected districts representing different agroclimatic zones in Eastern Shewa, Oromia region of Ethiopia namely Ada'a and Adamitullu. Ada'a district is located at 47 km south east of Addis Ababa with an altitude of 1800 m above sea level in the central high lands of Ethiopia. It has annual average rain fall of 1152 mm, of which 84% falls down during the long rainy season that extends from June to September and short rainy season that from March to May with an average rain fall of 800 mm. The mean annual maximum and minimum temperature are 30.7 and 8.5°C, respectively and the mean relative humidity is 61.3 %. Its agroecological zones is mid high land (94%) (NMSA, 2009). Adamitullu district is situated in the mid-rift valley, East Shewa zone of Oromia Regional state, 160 km south of Addis Ababa, Ethiopia. It has an altitude of 1650 m above sea level with a bimodal unevenly distributed rain fall pattern. The average annual rain fall is 760.9 mm and consists of short rainy season (February to April) and long rainy season (June to September). The district has maximum and minimum temperature of 35 and 12.7°C, respectively (NMSA, 2009).

Study population and management: The chickens used in this study were those purchased from Ada'a district (market places Dire and Tuludito) and Adamitulu (market places Bulbula and Adamitulu) rural poultry markets entirely supplied by local farmers/producers. The approach was that the health status of animals purchased from rural markets could reasonably reflect the actual situation in the rural villages from which they were originated.

Sample size and sampling methods: Sample size was calculated according to Thrusfield (2005). From the previous study done by Eshetu *et al*. (2001) found 91.5% prevalence with the comparable agroecology and this was taken as expected prevalence. With a desired absolute precision of 10 and 95% level of confidence, sample sizes of at least 96 chickens were required. About 124 chickens (both sexes) and (adult and young) were purchased (31 from four markets in two districts).

Examination of chickens for type of worms: The chickens were slaughtered and the gastrointestinal tract was obtained. The gastrointestinal tract was then separated into oesophagus, crop, proventriculus, gizzard, small intestine and caecam. Each part was opened and its contents were emptied separately into labelled beakers. Then contents were washed into a Petri dish and examined under a stereomicroscope. The larger helminths were collected directly and smaller ones were isolated under the stereomicroscope. Worms were grouped and counted before being stored in plastic bottles contains 70% alcohol according to a method described by Ashenafi and Eshetu (2004).

Identification of worms: Identification of collected helminths was done at the National Animal Health Diagnostic and Investigation Center (NAHDIC). All helminths were identified under a light microscope with 10-100x magnification using helminthological keys of Calnek *et al*. (1991) and Ashenafi and Eshetu (2004).

Statistical analysis: Descriptive statistics using SPSS (SPSS Institute, Chicago, IL, USA) was used to compute the prevalence and mean of mixed infection of each helminth found in the chickens. A 2-tailed test was used to compare the means. Age and sex were examined with the prevalence of GIT parasites by χ^2 (Chi square). A p-value <0.05 was considered significant.

RESULTS

Helminth prevalence: One hundred and twenty four chickens were examined out of which 60 (48.38%) were females and 64 (51.6%) were males. One hundred and eleven (89.5%) of the chickens were infected by helminths parasites. Fifteen (8 nematodes and 7 cestodes) helminths species were recovered. Of the 124 chickens slaughtered and examined 10 (8.1%) and 62 (50.0%) had single and mixed nematode infections and 9 (7.3%) and 94 (75.8%) had single and mixed cestode infection, respectively. The sites with double or triple nematodes infections were the intestinal tracts, proventriculus and Caeca (Table 1).

One hundred and three (83.0%) chickens had cestode species insides their crop, oesophagus, proventriculus, gizzard, intestines and caecam. These included *Raillietina echinobothrida*, *Raillietina tetragona*, *Raillietina cesticillus*, *Choanotaenia infundibulum* and *Davainea proglottina* were the most prevalent ones. Intestinal, gizzard and caecam nematodes including *Ascaridia galli, Heterakis gallinarum* and *Gongylonema ingluvicola* accounted for 72 (58.0%) of all recovered nematodes in the examined chickens (Table 2).

Table 1: Prevalence of nematodes and cestodes of examined chickens

Helminths	Status	No. of positive	Prevalence (%)
Nematode	Single infection	10	8.1
	Mixed infection	62	50
	Total	72	58
Cestode	Single infection	09	7.3
	Mixed infection	94	75.8
	Total	103	83

Table 2: Prevalence of the various chicken parasites and their predilection site

		Frequency	
Helminths species	Predilection sites	No.	%
Cestode			
Raillietina echinobothrida	Small intestines	79	63.7
Raillietina tetragona	Small intestines	70	56.5
Raillietina cesticillus	Small intestines	50	40.3
Choanotaenia infundibulum	Small intestines	17	3.7
Davainea proglottina	Small intestines	11	8.1
Hymenolepis carioca	Small intestines	7	5.6
Hymenolepis contaniana	All parts of intestines	22	17.7
Nematodes			
Heterakis gallinarum	All parts of intestines	47	37.9
Ascaridia galli	All parts of intestines and gizzard	40	32.3
Gongylonema ingluvicola	Small intestines and caeca	32	25.8
Heterakis isoloncha	Caeca	11	8.9
Dispharynx nasuta	Gizzard	5	4.0
Allodapa suctoria	Caeca	9	7.3
Capillaria anatis	Caeca and oesophagus	4	3.2
Heterakis dispar	Caeca and small intestines	8	6.5

Parasites distribution: The study found insignificant difference ($p>0.05$) of parasitic infection within the studied districts for some helminths. In both districts chickens were presented similar prevalence of helminths species except *Allodapa suctoria* and *Heterakis dispar* there was significance difference ($p< 0.05$) between districts. In both districts all parasitized chickens harboured at least one from the five helminths species and the mean numbers of helminths per chicken were 12.5 and 3.36 for cestodes and nematodes, respectively (Table 3).

This study found no significant difference between parasitic infection (number and prevalence of each species) and host sex. Male and female chickens presented similar prevalence of helminths species regardless of burden of helminths parasites (Table 4).

Burden of helminths: The prevalence of helminths in the study area was 111(89.5%) in all the chickens. A total of 1967 (1550 cestodes and 417 nematodes) helminths were recovered. All parasitized chickens harboured at least one from the five helminths species and the mean number of helminths per chicken was 12.5 and 3.36 for cestodes and nematodes, respectively. All the segments of the digestive tract examined were parasitized (Table 5). Significance difference ($p<0.05$) between districts. In both districts all parasitized chickens harboured at least one from the five helminths species and the mean numbers of helminths per chicken were 12.5 and 3.36 for cestodes and nematodes, respectively (Table 3).

This study found no significant difference between parasitic infection (number and prevalence of each species) and host sex. Male and female chickens presented similar prevalence of helminths species regardless of burden of helminths parasites (Table 4).

Table 3: Prevalence of Cestode and Nematode helminths in districts and markets

			Positive (%)		
District	Market	No. of examined	Cestode	Nematode	χ^2 (p-value)
Adamitulu	Adamitulu	31	28 (22.5)	14 (11.29)	7.23 (0.076)
	Bulbula	31	26 (20.96)	19 (15.32)	
Ada'a	Dire	31	22 (17.74)	19 (15.32)	
	Tuludito	31	27 (21.77)	20 (16.12)	
Total		124	103 (83)	72 (58)	

Table 4: Prevalence of cestode and Nematode helminths in relation with sex

		Positive (%)		
Sex	No. of examined	Cestode	Nematode	χ^2 (p-value)
Female	60	50 (48.54)	37 (51.38)	25 (0.89)
Male	64	53 (51.45)	35 (48.61)	
Total	124	103 (100.0)	72 (100.0)	

Table 5: Mean helminths found at each chicken

Helminths	No. of examined	Minimum	Maximum	Mean	95% CI
Nematodes	124	0	12	03.36	0.6-6.6
Cestodes	124	0	25	12.50	5.52-19.5

Burden of helminths: The prevalence of helminths in the study area was 111(89.5%) in all the chickens. A total of 1967 (1550 cestodes and 417 nematodes) helminths were recovered. All parasitized chickens harboured at least one from the five helminths species and the mean number of helminths per chicken was 12.5 and 3.36 for cestodes and nematodes, respectively. All the segments of the digestive tract examined were parasitized (Table 5).

DISCUSSION

The study disclosed an overall prevalence 111 (89.5%) of gastrointestinal helminths. This finding in general is comparable with previous report of 89.9% in Morocco (Hassouni and Pandy, 1989) and 91.01% in Ethiopia (Eshetu *et al*., 2001) and 164 (86.32%) of Cestodes and 144(75.79%) of nematodes in Ethiopia (Ashenafi and Eshetu, 2004) however, slightly lower than the prevalence rate of gastrointestinal parasites of scavenging chickens which was reported to be 100% in Zimbabwe (Phiri *et al*., 2007). Furthermore, the number of identified helminth species varied from 10 (6 nematodes, 4 cestodes) in Cameroon to 15 (8 nematodes, 7 cestodes). The overall figure indicates high prevalence of gastrointestinal helminths in local domestic chickens in Eastern Shewa and the chickens were infected with many different species. It might be a result of continuous exposure of chickens to the range conditions that facilitates infection. Local chickens satisfy their nutrient requirement by roaming from place to place and they usually seek their food in the superficial layers of the soil which is often contaminated with living organisms of all kinds, including various insects or earth worm that serve as paratenic or intermediate hosts for helminths parasites that infest poultry. This indicates the importance of gastrointestinal helminths in backyard poultry farming (Hassouni and Pandy, 1989).

Raillietina echinobothrida and *Raillietina tetragona* are considered to be studied harmful to chicken (Ashenafi and Eshetu, 2004). *Raillietina echinobothrida* induces the formation of nodules in the intestinal wall which can lead to confusion with lesions of avian tuberculosis (Calnek *et al*., 1991). Of 100 and 24 examined chickens, 103(83.0%) prevalence was obtained. *Raillietina echinobothrida* was the most prevalent 79(63.7%) cestode species in the chickens. Its prevalence was within the range of the prevalence of (25-84%) reported in Ethiopia (Eshetu *et al*., 2001). Other workers also reported similar prevalence rate range 34-81% for the same parasite (Poulsen *et al*., 2000; Permin *et al*., 2002; Irungu and Kassuku, 2004; Ashenafi and Eshetu, 2004).

Raillietina tetragona found 70(56.5%) which is higher than the previous study 45.69% (Eshetu *et al*., 2001) and 35.8% (Ashenafi *et al*., 2004) in Ethiopia. However, it is lower than the previous study 81% in Ghana (Poulsen *et al*., 2000). On the other side *Raillietina cesticillus* 50 (48.5%) which is also higher than the previous study results, 5.62% (Eshetu *et al*., 2001) in Ethiopia, 2% (Poulsen *et al*., 2000) in Ghana and 19% (Ashenafi and Eshetu, 2004) in Ethiopia. The relatively higher prevalence of *Raillietina* sp. can be attributed to the wide spread and easy accessibility of intermediate hosts (dung beetles, ants) to the local scavenging chickens.

The prevalence of *Heterakis gallinarum* in the current study was 47(37.9%). This was in line with the work of Ashenafi and Eshetu (2004) who found 62 (32.6%). It was higher than reported to be 17.28% in Ethiopia (Eshetu *et al*., 2001), 22.8% in Kenya (Mungube *et al*., 2008) and 32.8% in Zambia (Phiri *et al*., 2007). *Heterakis gallinarum* has a major effect on the health of chicken by sharing feed, thus causing stunted growth and low productivity which may be related to damage to the intestinal mucosa (Permin *et al*., 2002). Sometimes the parasite is observed causing major irritation and inflammation to the mucosa thus interfering with the absorption of food and shows on the caeca marked inflammation and thickening of the mucosa with petechial hemorrhages. *H. gallinarum* may produce nodular diarrhea, emaciation and death (Urquhart *et al*., 1987).

Ascaridia galli identified with the prevalence rate of 40(32.3%) amongst the intestinal nematodes identified in studied chickens. This was comparable with other studies in Ethiopia and Kenya reported to be 35.58% (Eshetu *et al*., 2001) and 33.3% (Mungube *et al*., 2008), respectively and lower prevalence of 10-14% (Irungu and Kassuku, 2004). Ashenafi and Eshetu (2004) recorded higher prevalence of 105(55.3%). In other African countries, the prevalence of *Ascaridia galli* was comparable to the current estimate ranging 24-36% (Magwisha *et al*., 2002; Permin *et al*., 2002; Poulsen *et al*., 2000). Other nematodes *Gongylonema ingluvicola* was identified to be 25.8% in this study which is higher than prevalence reported to be 5.3% in Kenya (Mungube *et al*., 2008) and *H. isoloncheo* was 8.9% and a lower prevalence than previously reported to be 16% (Poulsen *et al*., 2000) in Ghana. Reasons might be the geographical variation in the distribution of the parasites or intermediate hosts of worms.

In this study, no significant difference ($p>0.05$) was observed in parasitic infection (No. of species and prevalence of each species) due to the variation in hosts sex, age and districts except *Allodapa suctoria* and *Heterakis dispar*, there was difference in significance ($p<0.05$) between districts, respectively. In both districts all parasitized chickens harboured from 1 to 5 helminths species.

The mean numbers of helminths per chicken (3.36 and 12.5) nematode and cestode, respectively. It is emphasized that in nature, hosts often harbour more than one parasites species (Permin *et al*., 2002). The frequency distribution of the number of helminths species apparently followed a normal distribution which indicates that these helminths species probably were obtained by independent random infection. Helminths commonly are over-dispersed or aggregated within the host population (Fabiyi, 1972). Aggregation can be caused by several factors including heterogeneity in the host behaviour influencing the uptake of infective stage, spatial heterogeneity in the distribution of infective stages.

In the study mixed infections (up to five species of helminths parasites) were recorded in all chickens originated from all the two study areas. The present result of mixed species infection is slightly lower than the previous result reported to be (up to 7, 10 and 13 species of GI helminths) were reported in Dire Dawa (Gedion, 1997) Addis Ababa (Abebe *et al*., 1997) and Debre Zeit (Bersabeth, 1999), respectively.

CONCLUSIONS AND RECOMMENDATIONS

The result indicated that there was significance difference in prevalence between nematodes and cestodes among districts. The most commonly isolated nematode and cestode species in chickens in this study were *Heterakis gallinarum* 47 (37.9), *Ascaridia galli* 40 (32.3), *Raillietina echinobothrida* 79 (63.7) and *Raillietina tetragona* 70 (56.5). In the current study area sex and age had no any significant influence on the prevalence of poultry helminths. This study indicated that cestode and nematode are a highly significant helminth problem of local chicken in these districts. Based on the above conclusive remarks the following points are recommended:

- Firm measures should be undertaken to control this economically important parasites
- Further large-scale studies may be required to know why this parasites are prevalent in these are and to devise appropriate prevention and control methods, with improved management systems
- The farmers in the areas should be aware on the impact of helminths
- Appropriate intermediate host control methods should be taken
- Regular strategic deworming should be given
- Studies should be done on the production and weight loss

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