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Burden of Gastrointestinal Helminths in Backyard Local Chickens in Selected Sites in East Shoa Zone, Oromia, Ethiopia

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Abstract

This study was conducted on the prevalence of gastrointestinal helminthes of 100 chickens raised under traditional management (back yard) system and originated from three-selected town in East Shoa of central Ethiopia, namely Bishoftu, Dukem and Modjo. The study indicated an overall prevalence of 94% parasitic infection in the three towns Out of the total, 69%, and 73% of the examined chickens were harboring nematodes and cestodes respectively. The nematodes identified were *Ascaridia galli* (13%), *Heterakis gallimarum* (20%), *Heterakis isolonche* (4%), *Heterakis dispar* (12%), *Alodapa sucturia* (6%), *Subura brumpti* (5%), and *Aucaria hamulosa* (4%) and the cestodes were *Raillietina tetragona* (13%), *R. Echinobothridia* (34%), *R. Cesticillus* (15%), *Choenetenia infundibulum* (15%), *Hymenolepis continana* (12%) and *Hymenolepis carioca* (14%) and The present study revealed a high prevalence of helminthes infection/infestation in backyard chickens. Therefore, appropriate prevention and control methods are recommended.

Keywords: Gastrointestinal; Prevalence; Helminthes; Bishoftu; Modjo and Dukem; Ethiopia

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 religions 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 [1].

The total poultry population in Ethiopia is estimated to be 38,127,504 [2] and approximately 99% of chicken is raised under the traditional back yard system of management [3,4]. In Ethiopia, endogenous chickens play important roles in the provision of poultry meat and eggs which are affordable sources of animal protein for the rural population [5].

In Ethiopia, the traditional production system is characterized by minimum inputs from the owners, usually kept in small numbers and feed leftovers including occasional grain feed and household wastes. They are kept in various types of houses and breed naturally. In some areas, primitive poultry houses are built with simple locally available materials. In most areas, the chickens share the same house with their owners at night. Nesting materials are often provided to simplify the collection of eggs and control of brooding. Fertile eggs are hatched using broody hens and the hens attend the clutches of chickens often without human intervention [6-8]. Though commercial poultry plays a significant role today, the situation regarding the commercialization has not been developed in Ethiopia [9].

The main constraints to the development of endogenous chicken production in rural Ethiopia include diseases, predation, lack of feed, poor housing, and to a lesser extent financial problems and management [10,11]. Besides, major causes of mortality in scavenging chickens kept under traditional system of management in Ethiopia include viral, protozoan and bacterial [10]. However, the less obvious but ubiquitous losses due to reduce productivity caused by helminthosis are economically very important to the scavenging chickens [12,13].

Parasites are common in tropics where the standard of poor husbandry practices and climatic conditions are favourable for the development of the parasites [12]. *Raillietina echinobothrida* and *Raillietina tetragona* are highly pathogenic while other species are not normally harmful unless the infection is extremely heavy, which cause significant decrease in production [14]. *Ascaridia galli* is the most important nematode species of considerable economic importance. The large size of these nematode parasites may cause intestinal occlusion [15].

Among the disease of poultry, gastrointestinal Tract (GIT) helminthes plays an important role in reducing the total poultry production potential of the country. However, there are currently a few information in Ethiopia that shows the prevalence and distribution of Gastrointestinal Tract (GIT) helminthes. According to reports, the prevalence of GIT parasitism reaches 91.01% [4,16], but it is limited by its coverage to certain region of Ethiopia, which is not representative of the whole picture of the prevalence in the country. Therefore, this study was initiated to provide baseline information on the prevalence and distribution of GIT helminthes of scavenging chickens rearing under traditional system in three town in East Shoa and to identify species of the most prevalent gastrointestinal helminthes in the study area.

Material and Methods

Study area

The study was carried out from October 2016 to May 2017 in Bishoftu,

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Dukem and Modjo towns, East Shoa zone, Oromia, Ethiopia. Bishoftu is located 47 km south east of Addis Ababa at 9°N latitude, 40°E longitude and at an altitude of 1850 meters above sea level. Bishoftu experiences a bimodal pattern of rainfall with the long rainy season extending from June to September and a short rainy season from March to May and dry season from October to February with an average annual rainfall of 800 mm. The mean annual minimum and maximum temperature is 12.3°C and 27.7°C, respectively, with an overall average of 18.7°C. The mean relative humidity is 61.3% [17]. Dukem is located 37 km south east of Addis Ababa at 8°48′°N latitude 38°54°E longitude and an elevation of 2100 meters above sea level. Dukem experiences a bimodal pattern of rainfall with the long rainy season extending from June to September and a short rainy season from March to May and dry season from October to February with an average annual rainfall of 800 mm. The mean annual minimum and maximum temperature is 11.9°C and 25.83°C, respectively, with an overall average of 18.86°C. The mean relative precipitation is 861 mm (%) [17]. Modjo is located at 70 km from Addis Ababa in East Shewa zone of Oromia Region, Ethiopia. Lume is bordered on the south by the Koka reservoir, on the west by Ada'a Chukala, on the northwest by Gimbichu, on the north by the Afar Region and on the east by Adama. Mojo is the capital of the district; other towns and cities include Ejere, Ejersa and Koka. Most of this District altitude ranges from 1500 to 2300 meters above sea level (m.a.s.l), except for a small portion in the northern part, which is over 2300 m.a.s.l in altitude. The mean monthly temperature of the area ranges from 22°C to 34°C. A survey of the land in this district shows that 54.3% is arable or cultivable, 3% pasture, 2% forest, and the remaining 20% is considered degraded or otherwise unusable. Vegetables are an important cash crop of the area [17].

Study population and design

Cross-sectional study was conducted on one hundred apparently healthy local indigenous chickens bought from the local market of each of the three towns. 40, 30 and 30, respectively chickens were purchased from Bishoftu, Dukem and Modjo town. The chickens were categorized into two age groups, namely: growers (2 to 8 months) and adult (aged>8 months) according to Magwisha et al. [18] and 43 were male and 57 were female chickens. During purchasing exotic and hybrid chickens were excluded based on information obtained from the owners and physical observation of the chickens. For parasitological and post-mortem examination, the chickens were transported to Addis Ababa University, College of Veterinary Medicine and Agriculture, Parasitology and Pathology laboratory

Sample size determination and sampling method

The sample size was determined based on the formula recommended by Thrusfield for simple random sampling method. In this formula, the expected prevalence of 97.9% which was reported by Abebe et al. [12] in and around Addis Ababa and absolute precision of 95% were considered. Accordingly, a total of 32 chickens were needed. However, for this study a total of 100 chickens were included to increase the precision and accuracy of the result.

Laboratory examination procedure and gastrointestinal parasites identification

The chicken were sacrificed by the method of cervical dislocation and subjected to parasitological examination according to the procedure described in permin and hansen 1998. After incision of the visceral organ, the oesophagus with crop, gizzard with proventriculus, and caeca with the rest of the intestine were kept in three separate petridishes. The worms were collected from the different gastrointestinal pieces and preserved with 10% formalin for identification. Larger parasites were easily identified under stereomicroscope. However, parasites which were not identified by stereomicroscope were transferred to slide for further identification under light microscope with magnification ranging from 10X to 100X. Then, the parasites were identified depending on the size of the parasite using the characters described by Olsen and Soulsby [19,20].

Data analysis

The data collected during the study were entered into a Microsoft Excel database system and import to be analysed descriptively using statistical software STATA (version 13, USA). Many attribute data were imported to database system includes; age, sex, site and laboratory result. The prevalence of infection/infestation was calculated by dividing number of test positive chickens to total number of chickens examined. The association of the risk factors such as age, sex, and origin with the prevalence of infection was determined by using a chi-square (χ^2) test. A p-value of less than 0.05 at 95% confidence interval was considered as statistically significant.

Results

In the present study, 100 indigenous chickens (Gallus gallus domesticus) were screened for the presence of gastrointestinal helminthes parasites. Among 100 chicken screened, 94% of them were found positive of gastrointestinal helminths (cestodes and nematodes) parasites by gross and stereomicroscopic examination of gastrointestinal tract but no trematodes were found in this study.

Overall prevalence of gastrointestinal helminthes

Out of 100 indigenous chicken studied 69 (69%) were found positive of nematodes parasites and 73 (73%) were found positive for Cestode parasites (Table 1). 95%, 93.3%, and 93.3% of the chicken were found positive for helminthes (cestode and nematode) in Bishoftu, Dukem and Modjo respectively. There was no statistically significant difference in overall prevalence of helminths among the study towns, (χ^2=0.118, p-value=0.943).

From the total 100 chicken examined, 97.67% (42/43) of male chicken and 91.22% (52/57) female chicken were found positive for the cestode and nematode parasites (Table 1). The prevalence of the disease in relation to sex had no significant difference (χ^2=1.81, p-value=0.179). Out of 66 adult and 34 grower chicken examined, 92.42% of adult and 97.67% of grower were found positive for both cestode and nematode helminthes (Table 1). The result indicated that there was no statistically significant association between helminthes infection and age of chicken (χ^2=0.85, p-value=0.355).

Risk factors	Number of Chicken Examined	Overall prevalence	χ^2	P-value
Site				
Bishoftu	40	95%,	0.118	0.943
Dukem	30	93.3%		
Modjo	30	93.3%		
Sex				
Male	43	97.67%	1.81	0.179
Female	57	91.22%		
Age				
Grower	34	97.06%	0.85	0.355
Adult	66	92.42%		

Table 1: Overall prevalence of Gastrointestinal Parasites of indigenous Chicken in relation to risk factor in Bishoftu, Dukem and Modjo towns.

Out of the overall 100 chicken examined, *Raillietina echinobothrida* and *Ascaridia galli* were the most common one with the proportion of 18.38 and 17.84 respectively while *Heterakis isolonche* and *Aucaria hamulosa* (Gizard parasites) were among the least Gastrointestinal Parasites of indigenous Chicken with the proportion of 2.16 and 1.08 respectively (Figure 1).

Prevalence of cestodes

Out of 100 examined chickens, the overall prevalence of cestode parasites in chicken of from the three towns was 73%. Out of 73%, 34% were found positive of *Raillietina echinobothrida* (Figure 2a), 13% were found positive for *Raillietina tetragona* cestode parasite, 15% (15/100) were found positive of *Raillietina cesticillus* (Figure 2b), cestode, 15% chicken were found positive of *Choenetenia infundibulum* cestode, 12% were found positive of *Hymenolepis continana* cestode, and 14% were found positive of *Hymenolepis carioca* cestode (Table 2).

Prevalence of nematodes

From total 100 examined chickens, the prevalence of nematode parasites was 69%. Out of the overall 69%, the prevalence positive *Ascaridia galli* (33%), *Heterakis gallimarum* (20%) *Heterakis isolonche* (4%), *Heterakis dispar* (12%), *Alodapa sucturia* (6%), *Subura brumpti*, (5%) and *Aucaria hamulosa* (4%) (Figure 3 and Table 3).

Discussion

The present study revealed a high prevalence of infection with gastrointestinal helminthes in backyard chickens in all the three sites of East shoa town (Bishoftu, Dukem and Modjo). The overall prevalence of the gastrointestinal infection in this study was found to be 94.0% which was higher than 86.3% prevalence in central Ethiopia by Hagos [21]. Such a high frequency of infection of the present study might be due to continuous exposure of chickens to the ranging condition that facilitate infection. This finding in general is comparable with a previous gastrointestinal Helminthes infection report of 92.5% from Bahir Dar [22] 89.5% [23] in East Shewa Ethiopia, 89.9% in Morocco (Hassouni and pandy) 90.8% from Soddo [24] and 91.01% in North East Amhara [16]. But the current finding was lower than the prevalence rate of gastrointestinal parasite infection of scavenging chicken which was

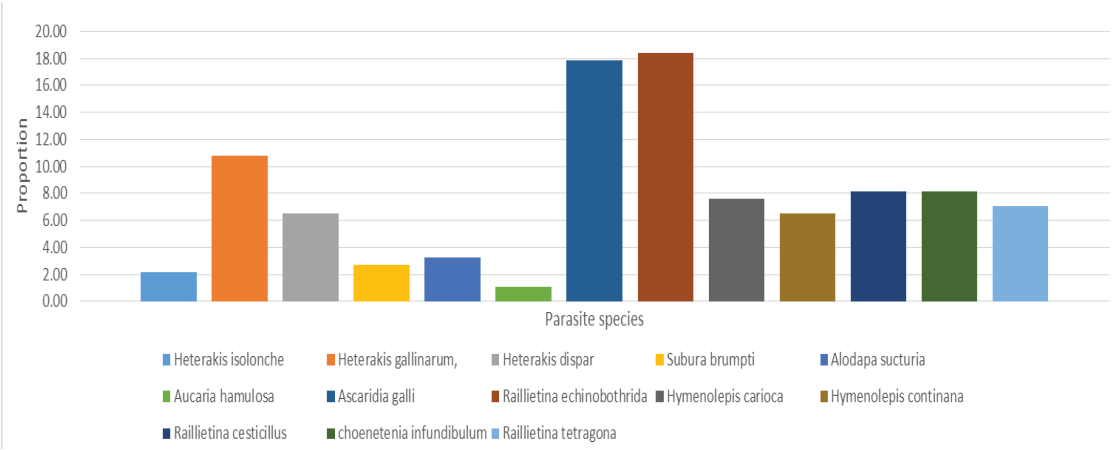

Figure 1: Overall proportion of different species of gastrointestinal parasites of indigenous chicken in Bishoftu, Dukem and Modjo towns.

Figure 2: A). *Raillietina echinobothrida* B). *Raillietina cesticillus.*

Name of the Parasite	Number of Chicken Examined	Number of Chicken Infected	Prevalence %
Reillietina echinobothridia	100	34	34%
R tetragona	100	13	13%
R.cesticillus	100	15	15%
Choenetenia infundibulum	100	15	15%
Hymenolepis carioca	100	14	14%
Hymenolepis continana	100	12	12%

Table 2: Prevalence of Cestode of indigenous chicken from Bishoftu, Dukem and Modjo towns.

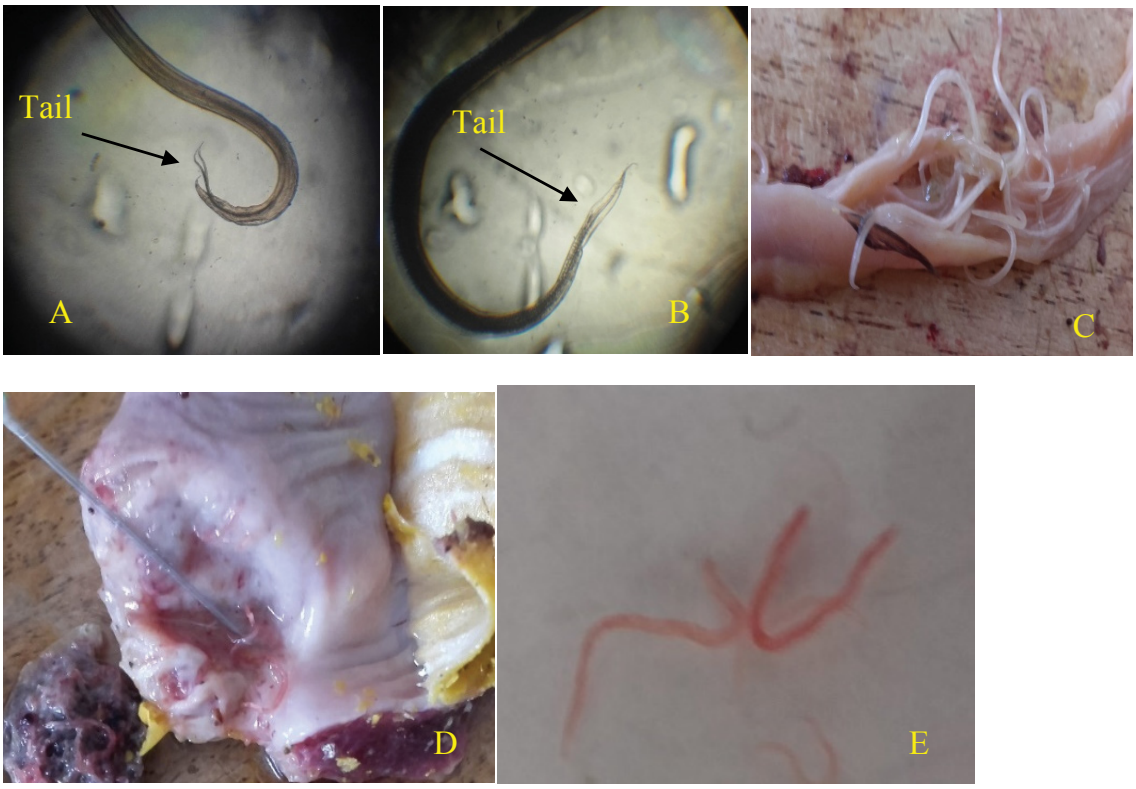

Figure 3: A). *Heterakis isolonche* with double tail, B). *Heterakis dispar* with single pointed tail C). *Ascaridia galli*, D). Necrotized area by *Aucaria hamulosa,* in gizzard E) *Aucaria hamulosa.*

Name of the Parasite	Number of Chicken Examined	Number of Chicken Infected	Prevalence %
Ascaridia galli	100	33	33%
Heterakis gallinarum	100	20	20%
Heterakis isolonche	100	4	4%
Heterakis dispar	100	12	12%
Alodapa sucturia	100	6	6%
Aucaria hamulosa	100	4	4%
Subura brumpti	100	5	5%

Table 3: Prevalence of Nematode Parasites of Indigenous Chicken from Bishoftu, Dukem and Modjo towns.

reported to be 100% in Central Ethiopia [25], in southern Ethiopia [26] and Zimbabwe [13].

Out of the total chicken examined, 69%, and 73% accounted for nematodes and cestodes, respectively. These findings were slightly lower than other reports of 86.32% and 75.79% cestode and nematode respectively in Ethiopia [4] and 72% nematode and 64.67% cestode Arsi zone Ethiopia [27].

In the present study, seven species of nematodes were identified. The most frequent nematode species encountered were *A. galli* (33%) followed by *H. gallinarum* (20%) and *H. dispar* (12%). These findings were in agreement with the previous studies from other parts of Ethiopia (21, 25 and 27) except that *C. caudinflata* was the third most prevalent in these reports rather than *H. dispar* in the current study. The prevalence of *A. galli* in the current study was lower than the findings of 71.6% in Addis Ababa [12], 67.2% in dire dawa [28], 61.2% in Bahir Dar [22], 64.3% in Soddo [24], 47.3% in central Ethiopia [25], but it was comparable with the prevalence reports 35.6% by Eshetu et al. [16] in north east of Amhara region and 29.5% by Helina [29] in central Ethiopia.

Six species of cestodes were recorded. The most frequent cestode species encountered during the present study was *R. echinobothrida* (34%) followed by *R. cesticillus* and *choanetenia* infundibulum each with 15% prevalence. This finding was in agreement with the finding of Yacob et al. [27] in that *R. echinobothrida* ranked first, but 100% infection with *R. tetragona* was reported from Zimbabwe [11]. The prevalence of *R. echinobothrida* (34%) was lower than the previous report of 48.9% in arsi zone [30] but higher than 25.8% in Amhara regional state [16]. These differences in the prevalence rate of cestodes could be partly attributed to the difference in the prevailing environmental conditions. This study showed a complete absence of trematodes which agrees with previous studies by Fabiyi [31] in Bauchi, [32] in Borno State [33] in Anambra State, [34] in Zaria, Kaduna State [35] in Zaria, Kaduna State and [36] in Bauchi.

Conclusion and Recommendations

The present study indicated that cestode and nematode were highly significant helminth infections of local chicken in the study towns. According to the result, the highest prevalent cestode species were *Raillietina echinobothrida*, *Choanotaenia infundibulum* and *R. cesticillus* while *Ascaridia galli, Heterakis gallinarum* and *H. dispar* were among the commonly encountered nematode species. Study area, sex and age had no significant influence on the prevalence of poultry helminthes. In general, there was a higher overall prevalence of nematodes and cestodes in local chicken indicating that Helminthes infection is one of the obstacles of poultry production in the study area. Based on the above conclusive remarks the following points are recommended:

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

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