BRILL

Animal Biology 59 (2009) 289–297

Animal Biology
brill.nl/ab

Ectoparasites and gastrointestinal helminths of chickens of three agro-climatic zones in Oromia Region, Ethiopia

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Abstract
A survey for ectoparasites and gastrointestinal helminths was conducted in 150 chickens raised in a traditional backyard production system. The chickens were randomly selected from six sites in three agro-climatic zones in central Ethiopia, namely Bekoji and Chancho (highland), Woliso and Teji (midland), and Metehara and Zeway Dugda (lowland). The study indicated that in the three agro-climatic zones 126 (84%), 108 (72%) and 97 (64.67%) of the examined chickens were harbouring ectoparasites, nematodes and cestodes respectively. Out of 10 species of ectoparasites, *Menacanthus stramineus* (40%) was the most frequent species. Postmortem examinations revealed the presence of four species of nematodes (*Ascaridia galli, Heterakis gallinarum, Subulura brumpti* and *Capillaria caudinflata*) and four species of cestodes (*Raillietina echinobothrida, R. tetragona, R. cesticillus* and *Choanotaenia infundibulum*). The ectoparasite infestation was found to be sex specific in chicken, being significantly higher ($P<0.05$) in males. On the other hand, endoparasitic infection showed no such difference ($P>0.05$). No difference was found among the three agro-climatic zones in the frequency of ectoparasite and nematode infection. However, a significant difference ($P<0.05$) in the frequency of cestode infection among the three zones was observed.

Keywords
Agro-climatic zones; ectoparasite; helminths

Introduction

The poultry population in Ethiopia has been estimated to be 34.2 million in 2006 (FAO, 2006). Out of the total population, 99% consisted of native chickens and are managed in a scavenging system while the remaining birds are mainly kept in private farms under a modern management system (Hassen et al., 2006).

In Ethiopia, the traditional production system is characterized by minimum inputs from the owners, usually kept in small numbers and fed leftovers including occasional

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DOI 10.1163/157075609X454926

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 (Sonaiya, 1990; Edward, 1992; Tadelle, 1996). Though commercial poultry plays a significant role today, the situation regarding the commercialization has not been developed in Ethiopia (Hassen et al., 2006).

The main constraints to the development of indigenous chicken production in rural Ethiopia include diseases, predation, lack of feed, poor housing and to a lesser extent financial problems and management (Alemu, 1985). Poultry diseases were cited as the most important constraints responsible for reducing both the number and productivity (Alamargot et al., 1985).

Both internal and external parasites are common in the areas where the standard of husbandry is poor and the climatic conditions are favourable for the development of parasites (Abebe et al., 1997).

The objectives of the present study were, therefore, to identify the different species of ectoparasites and gastrointestinal (GI) helminths in local backyard chickens of three different agro-climatic zones in central Ethiopia and to assess the frequency of the parasitic infection.

Materials and methods

Study sites

Six randomly selected sites were studied from three agro-climatic zones. The study sites were:

Bekoji (highland zone). Bekoji is situated in the Arsi zone of the Lemu Billbilo district, 225 km southeast of Addis Ababa. The area has highland escarpment above 2400 meter. The mean maximum and minimum temperature were 28°C and 10°C, respectively. The annual rainfall was 700-1658 mm with a bimodal rainfall occurring from March to April (short rainy season) and from July to October (long rainy season).

Chancho (highland zone). Chancho is located at an altitude of 2800 meter above sea level (masl) and 40 km north of Addis Ababa. The area is classified as temperate or 'dega' climatic zone with an annual rainfall of about 1440 mm. The mean minimum and maximum temperature was 10°C and 14.9°C, respectively.

Woliso (midland zone). It is located at 114 km southwest of Addis Ababa. Woliso district has an average elevation of 2150 m with the annual rainfall 1350–1420 mm. The mean minimum and maximum temperature was 10.4°C and 27°C, respectively.

Teji (midland zone). It is located about 45 km southwest of Addis Ababa with an average elevation of 2000 masl with mean annual rainfall of 1360 mm. The mean minimum and maximum temperature was 10°C and 26°C, respectively.

Metehara (lowland zone). It is located about 195 km east of Addis Ababa with an average elevation of 910–980 masl and annual rainfall of 553–653 mm. The mean minimum and maximum temperature was 12°C and 38°C, respectively.

Zeway Dugda (lowland zone). The district is situated in the Arsi zone, 208 km southeast of Addis Ababa. The area has a lowland escarpment about 1600 masl. The mean maximum temperature and the mean minimum temperature were 30°C and 20°C, respectively. The annual rainfall ranged from 600-700 mm.

Study animals

Twenty-five apparently healthy local chickens aged between 4 and 6 months were bought from the local market from each of the study areas. In total, there were 65 male and 85 female chickens (table 1). The study was conducted between December 2006 and May 2007. The chickens were transported to the National Animal Health Diagnostic and Investigation Center, Sebeta (NAHDIC) to conduct a detailed necropsy examination.

Examination procedure

The birds were euthanized and subjected to parasitological examination according to the procedure described in Permin and Hansen (1998).

Ectoparasites. Immediately after sacrificing, the skin from each individual bird was medially incised, detached from the underlying tegument and together with the feather,

Table 1.
Frequency of infection with ectoparasites in chickens at six sites in three selected agro-climatic zones in central Ethiopia

Study area	Climatic zone	No. birds examined			No. birds infected			Frequency of infection (%)		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Bekoji	Highland	12	13	25	12	11	23	100	84.62	92
Chancho	Highland	9	16	25	9	10	19	100	62.50	76
Woliso	Midland	10	15	25	10	11	21	100	73.33	84
Teji	Midland	11	14	25	7	13	20	70	86.66	80
Metahara	Lowland	12	13	25	11	7	18	91.66	53.85	72
Zeway-Dugda	Lowland	13	12	25	13	12	25	100	100	100
Total (%)		66	84	150	62	64	126	93.94	76.19	84

kept tightened in a plastic bag to prevent the escape of ectoparasites. Collection of ectoparasites from the chickens was carried out by careful examination of the entire external body parts. The legs and featherless areas of the body with any seborrhea or crustation were scraped for microscopic examination. Visible ectoparasites were collected using thumb forceps. Minute ectoparasites were detected using magnifying glass and collected by scraping from live chickens. The detected external parasites were preserved in 70% alcohol for identification.

Gastrointestinal parasites. The viscera were detached from the mesentery and the GI tract was separated into smaller pieces. The oesophagus with crop, gizard with proventriculus, and caeca with rest of the intestine were kept in three separate containers. Each piece was identified and incised longitudinally. The worms were collected from the different intestinal pieces by washing with physiological saline in separate trays and placed in different beakers containing physiological saline. The parasites were examined in a stereomicroscope. The identification of GI helminths was carried out using the characters described by Beisters and Shwartz (1965), Olsen (1988) and Soulsby (1982). Ectoparasites were identified based on the criteria set by Kaufman (1996), Calnek et al. (1991) and Soulsby (1982).

Statistical analysis

The study was a completely randomized block design with eleven variables (six sites, two sexes and three groups of parasites). A computer based statistical package was employed in the comparison of the results. Pearson chi-square test was used for comparison of the possible variation between the study areas, and $p<0.05$ was considered significant.

Results

Ectoparasites

Out of the 150 chickens examined from the six study areas, 126 (84%) were found harbouring different ectoparasites. The frequency of infestation in male (93.94) was significantly higher ($P<0.05$) than female chickens (76.19%) (table 1). The analysis between different agro-climatic zones revealed no significant difference ($P>0.05$). *Menacanthus stramineus* (40%) was the most prevalent ectoparasite species followed by *Menopon gallinae* (26.67%) while *Echidnophaga gallinacea* (1.33%) was the least (table 2).

Gastrointestinal helminths

Nematodes. Out of 150 examined chickens, 108 (72%) were infected with different species of nematodes (table 3). There were no significant differences between the agro-climatic zones. The frequency of nematode infection revealed no significant ($P>0.05$) difference between male (69.70%) and female (73.81%) birds.

Table 2.
Frequency of ectoparasites at six study sites in three selected agro-climatic zones in central Ethiopia

Ectoparasites species	Bekoji (n = 25)	Chancho (n = 25)	Woliso (n = 25)	Teji (n = 25)	Metahara (n = 25)	Zeway Dugda (n = 25)	Total (N = 150)
Ticks							
A. persicus *	0	0	4	0	8	8	3.33
Mites							
*D. gallinae**	16	4	12	0	0	4	6
O. bursa	0	0	4	0	4	12	3.33
K. mutans	8	4	0	8	4	8	5.33
Flea							
E. gallinacea	4	0	0	0	4	0	1.33
Lice							
M. stramineus	52	24	24	28	32	56	40
M. gallinae	28	36	36	16	40	36	26.67
G. gigas	36	8	8	4	8	16	18.67
G. gallinae	16	20	20	36	8	20	12.67
C. heterographus	16	0	0	0	0	0	2.67
Total	92	76	84	80	72	100	84

* This may not show the exact frequency since *D. gallinae* and *A. persicus* both live on their host for short period of time and usually at night.

Ascaridia galli was the most common nematode species showing an intensity of 1.76 per chicken followed by *Heterakis gallinarum* (1.15) while *Capillaria caudinflata* (0.05) was found to be the least abundant (table 3).

Cestodes. Of the 150 examined chickens, 97 (64.67%) were found to harbour different cestode species (table 4) with significant difference ($P<0.05$) among the agro-climatic zones, being highest (82%) in the lowlands and lowest (38%) in the highlands. The difference in frequency of cestode infection between males (66.67%) and females (61.90%) was not significant ($P>0.05$).

Discussion

The present study revealed a high frequency of infection with ectoparasites and gastrointestinal helminths in backyard chickens in all the six sites of the three agro-climatic zones. Out of the total chickens examined, 84%, 72%, and 64.67% accounted for ectoparasites, nematodes and cestodes, respectively. Such a high frequency of infection might be due to continuous exposure of chickens to the range condition that facilitate infection.

The overall incidence of ectoparasite infestation was highest in Zeway Dugda (100%) and lowest in Metahara (72%) which might be due to climatic variations.

The infestation with *M. stramineus* (40%) showed highest incidence followed by *M. gallinae* (26%), which is in agreement with the findings of Bersabeh (1999), Hagos (2000) and Ashenafi and Yimer (2005) in Ethiopia. However, a much higher incidence

Table 3.
Frequency and worm burden of nematodes in chickens at six sites in three selected agro-climatic zones in central Ethiopia

	No. birds examined			No. birds infected			Frequency of infection (%)			No. of different species of nematode (average number in parentheses)				
Study area	M	F	T	M	F	T	M	F	T	*Ascaridia galli*	*Heterakis gallinarum*	*Subulura brumpti*	*Capillaria caudinflata*	Total
Bekoji	12	13	25	7	10	17	58.33	84.62	72	36 (1.44)	48 (1.92)	4 (0.16)	8 (0.32)	68 (2.72)
Chancho	9	16	25	6	12	18	66.67	75	72	48 (1.92)	48 (1.92)	0	0	72 (2.88)
Woliso	10	15	25	8	11	19	80	73.33	76	64 (2.56)	36 (1.44)	0	0	76 (3.04)
Teji	10	15	25	6	12	18	60	80	72	56 (2.02)	36 (1.44)	0	0	72 (2.88)
Metahara	12	13	25	11	11	22	91.67	84.62	88	28 (1.01)	0	80 (3.2)	0	88 (3.52)
Zeway dugda	13	12	25	8	6	14	61.54	50	56	32 (1.28)	4 (0.16)	40 (1.6)	0	56 (2.02)
Total (%)	66	84	150	46	62	108	69.70	73.81	72	264 (1.76)	172 (1.15)	124 (0.83)	8 (0.05)	432 (2.88)

M: male; F: female; T: total

Table 4.
Frequency and worm burden of cestodes in chickens at six sites in three selected agro climatic zones in central Ethiopia

	No. birds examined			No. birds infected			Frequency of infection (%)			No. of different species of cestode (average number in parentheses)				
Study area	M	F	T	M	F	T	M	F	T	*Raillietina echinobothrida*	*Raillietina tetragona*	*Raillietina cesticillus*	*Choanotaenia infundbulum*	Total
Bekoji	12	13	25	3	7	10	25	53.85	40	0 (0)	24 (0.96)	20 (08)	0 (0)	40 (1.6)
Chancho	9	16	25	3	6	9	33	37.50	36	8 (0.32)	28 (1.01)	0 (0)	0 (0)	36 (1.44)
Woliso	10	15	25	10	12	22	100	80	88	56 (2.24)	44 (1.76)	0 (0)	4 (0.16)	88 (3.52)
Teji	10	15	25	8	7	15	70	46.67	60	24 (0.96)	36 (1.44)	0 (0)	0 (0)	60 (2.4)
Metahara	12	13	25	11	11	22	91.67	84.62	88	88 (3.52)	0 (0)	0 (0)	0 (0)	88 (3.52)
Zeway Dugda	13	12	25	10	9	19	77.92	75	76	64 (2.56)	8 (0.32)	8 (0.32)	0 (0)	76 (3.04)
Total (%)	66	84	150	44	52	97	66.67	61.90	64.67	240 (1.6)	140 (0.93)	28 (0.19)	4 (0.027)	388 (2.59)

(90% in adult and 80% in young) of infestation with *M. stramineus* was observed by Permin et al. (2002) in Zimbabwe. *M. stramineus* is the most pathogenic species among the poultry lice. It causes severe anemia in the host by feeding on blood that oozes out. It also causes inflammation of skin and extensive scab formation (Urquhart et al., 1996). However, exact impact on the chicken was not determined.

Argas persicus and *Dermanyssus gallinae* were encountered with a frequency of 3.33% and 6%, respectively. It might not be the true figure, since both parasites live on the hosts for a short period of time and usually at night (Urquhart et al., 1996). The low frequency of *A. persicus* was also observed by Permin et al. (2002) in Zimbabwe and Sadiq et al. (2003) in Nigeria.

In the present study, four species of nematodes were identified. The most frequent nematode species encountered was *A. galli* (44 %) followed by *H. gallinarum* (28.67%) and *C. caudinflata* (1.33%). These findings are in agreement with the previous studies from other parts of Ethiopia (Gedion, 1991; Asfaw, 1992; Teshome, 1993; Abebe *et al.*, 1997; Bersabeh, 1999 and Hagos, 2000). However, in Zimbabwe the most prevalent nematode species in chickens was *Allodapa suctoria* (Permin et al., 2002) which was not found in the present study.

Four species of cestodes were recorded. The most frequent cestode species encountered during the present study was *R. echinobothrida* followed by *R. tetragona*. The reason for the higher incidence of *R. echinobothrida* might be the abundance and accessibility of the intermediate host (dung beetle). This finding is also corroborated with the finding of Bersabeh (1999), but 100% infection with *R. tetragona* was reported from Zimbabwe (Permin et al., 2002).

This study revealed the incidence of different species of ectoparasites and GI helminths in backyard local chickens that were kept under poor and low input management system in three agro-climatic zones. Despite local chickens are harbouring diverse ectoparasites and GI helminths, they are the major source of eggs and meat to the majority of Ethiopians. However, it does not indicate that the people are getting maximum benefits from indigenous chickens. On the other hand, due to the high mortality rate and lack of adaptation to the rural environment in exotic breeds, professionals are arguing that the crossbreeding scheme underway in the country is not based on justified ground. Also the merits and demerits of both the existing and imported germplasms have not been studied thoroughly.

According to FAO (2006), the chicken population in Ethiopia is very low compared to other livestock populations and has not increased much since 2000. The constraint chicken production might be due to the different endo- and ectoparasitic diseases, which can be overcome by a minimum effort of using antiparasitic drugs affordable by rural people.

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