

Prevalence of Ectoparasite Infestation in Chicken in and Around Ambo Town, Ethiopia

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Abstract

A cross sectional study was conducted from July to October 2013 to estimate prevalence and identify different species of ectoparasites infesting chicken in semi-intensive and backyard chicken farms in and around Ambo Town, West Shewa, Ethiopia. A total of 390 chickens were randomly selected. Age, sex, breed and management system of the study population was simultaneously recorded. Ectoparasites were collected from different parts of the body including shank scraping and identified with stereomicroscopy or light microscopy. An overall 67.95% (265/390) prevalence was recorded and five species of ectoparasites under three orders (*Phthiraptera* (lice), *Siphonaptera* (flea) and mite) were identified. The prevalence of pediculosis, flea infestation and mange were 52.1%, 44.36% and 34.62%, respectively. Three species of lice (*Cuclotogaster heterographa* (50%), *Menacanthus stramineus* (1.28%) and *Lipeurus caponis* (6.15%)), one species of flea (*Echidnophaga gallinacean* (44.36%)) and mite (*Cnemidocoptes mutans* (34.62%)) were identified. Higher prevalence rate was recorded in male (83.89%) than female (58.09%), young (74.45%) than adult (61.79%) and local (87.55%) than exotic (26.4%) breed chicken. There was no infestation of chicken with ectoparasite in semi-intensive farming system while 87.46% (265/303) of chickens kept under extensive management system were infested. Statistically, there was significance difference between categories of sex ($\chi^2=28.145$, $p<0.05$), age ($\chi^2=8.083$, $p<0.05$), management ($\chi^2=2.37$, $p<0.05$) and breed ($\chi^2=1.458$, $p<0.05$) groups in prevalence of ectoparasite infestation ($p<0.05$). Male, young and local breed chicken groups were 3.757 (CI=2.265-6.234), 1.883 (CI=1.214-2.921) and 19.6 (11.427-33.618) times more likely infested by ectoparasite than female, adult and cross breed groups, respectively. In conclusion, infestation of chicken with ectoparasites was important constraint in poultry production sector. Therefore, application of integrated control strategy, good management practices, creation of awareness and further detailed study were recommended.

Keywords: Ambo; Ectoparasites; Infestation; Risk factors; Chickens; Prevalence

Introduction

Ethiopia accounts 42 million poultry population [1] from the total 18 billion of the world's population [2]. About 80% of poultry population in Africa and Asia are kept under free range system [3]. From the total population of chicken in Ethiopia, 99% are raised under the traditional back yard management system [4] with inadequate housing, feeding and health care [2,5].

In developing countries, animal production is being subjected to great pressure to satisfy the demand for animal protein required by the continued increase in human population, and also to have surplus for international trade. Among the animal production activities, poultry sector is the fastest growing. Nevertheless, it has been adversely affected by a variety of constraints [6]. Among the constraints, parasitism ranks top in village chicken production [7].

External parasites of poultry are common in the tropics because of the favourable climatic conditions for their development and the poor standards of poultry husbandry. Some of the ectoparasites are of particular importance as vectors of pathogens and host specific [8]. They can inhibit the skin or outgrowths of the skin of the host organism for various periods [9]. Some are blood suckers while others burrow in the skin or live on or in the feathers [10]. Ectoparasites, such as ticks, mites and fleas, live on domestic chickens. Mites have long been recognized as a cause of dermatitis and skin damage on all classes of poultry [11].

Despite their devastating effects, ectoparasites received little attention in almost all the production systems. Hence, study with regard to determining magnitudes of such parasites and identifying their types is fundamental to devise appropriate control methods [12]. However,

no studies were conducted on poultry ectoparasites in and around Ambo town, Ethiopia, where chicken are source of income generation and food. Thus, the current study was undertaken to determine the prevalence of chickens' ectoparasite, identifies species of ectoparasites infesting chicken and assess potential risk factors.

Methods

Study area

The study was conducted from July to October, 2013 in and around Ambo town, West Shewa zone, Ethiopia. Ambo town is administrative center of West Shewa zone and Ambo district, and located at a latitude and longitude of 8°59'N 37°51'E 8.983°N 37.85°E and an elevation of 2101 meters above sea level (asl) and 114 Km west of Addis Ababa, capital of Oromia region and Ethiopia. The agro-ecology of the study area is 23% highland, 60% midland, and 17% lowland. It has an annual rainfall and temperature ranging from 800–1000 mm and 20–29°C, respectively. The livestock population of the district includes 145371 cattle, 50152 sheep, 27026 goats, 105794 chickens, 9088 horses, 2914 donkeys and 256 mules [13].

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Even though there is some initiation for semi-intensive and intensive farming system, traditional farming system is still the dominant. Both local and exotic breeds chicken are raised in the area with predomination of local breed.

Study design and animals

A cross sectional study was conducted on a total of 390 local and exotic (Rhodes Island Red (RIR)) breeds from both sexes of chickens. The chickens were randomly selected from backyard chickens and selected semi-intensive farms. Information on the breed and management system was obtained from the owners and by assessment. Age of the chickens was determined by observing color of the shank and growth of the spur and categorized as young (less than 12 weeks of age) and adult (greater than 12 weeks of age).

Study protocols

All parts of the chickens were thoroughly inspected using naked eyes and hand lens. Ectoparasites were collected by hand picking and non-toothed thumb forceps. The collected parasites were further examined by light or stereomicroscope and identified according to guidelines of William [14]. Shank scraps were collected on clean petri-dish. Wet film was prepared from the scrap and 10% potassium hydroxide was used to emulsify debris and examined under light or stereomicroscope.

Data analysis

The collected data were coded and entered in to Microsoft Excel spread sheet and analyzed using Statistical software for Social Sciences (SPSS) version 16.0. Frequency was used to calculate the prevalence. Chi-square was used to test the statistical significance difference between the risk factor groups in prevalence of ectoparasite infestation. Odd ratio was used to estimate risk in groups of risk factors at 95% confidence interval (CI). P-value less than 0.05 ($p < 0.05$) was considered as statistical significance difference.

Results

An overall 67.95% (265/390) prevalence of ectoparasites infestation

Table 1: Prevalence and species of ectoparasites identified in and around Ambo town.

Parasite		No. of chickens examined	No. of positive (%) chickens
Order	Species		
Sinophthera (flea)	<i>E. gallinacean</i>	390	173 (44.36)
Mite	<i>C. mutans</i>	390	135 (34.62)
	<i>L. caponis</i>	390	24 (6.15)
Phthinaoptera (lice)	<i>M. stramineus</i>	390	5 (1.28)
	<i>C. heterographa</i>	390	195 (50)
Total		390	265 (67.95)

was recorded. Positive chickens were found to harbor one or more parasites. About 70.94% (188/265) of positive chickens or 48.21% of the total examined chickens (188/390) were found to be infested with more than one species of ectoparasites while 29.06% (77/265) of the positive chickens or 19.74% (77/390) of total examined chickens were infested with single species. Five species of ectoparasites categorized under three orders, *Echidnophaga gallinacean* (*E. gallinacean*) (order: Sinophthera or flea), *Cnemidocoptes mutans* (*C. mutans*) (order: mite) and three species of Phthinaoptera or lice order including *Cuclotogaster heterographa* (*C. heterographa*) (head lice), *Lipeurus caponis* (*L. caponis*) (wing lice) and *Menacanthus stramineus* (*M. stramineus*) (body lice) were identified. *Cuclotogaster heterographa* (50%) was the most prevalent species followed by *E. gallinacean* (44.36%) and *C. mutans* (34.62%) while *M. stramineus* (1.28%) was least prevalent one followed by *L. caponis* (6.15%) (Table 1).

Prevalence of the infestation was higher in male (83.89%) than female (58.09%), young (74.45%) than adult (61.79%) and local (87.55%) than exotic (26.4%) breed chickens. There was no infestation of chickens with ectoparasite in semi-intensive farming system while 87.46% (265/303) of chickens kept under extensive management system were infested. Statistically, there was significance difference between categories of sex ($\chi^2=28.145$, $p < 0.05$), age ($\chi^2=8.083$, $p < 0.05$), management ($\chi^2=2.37$, $p < 0.05$) and breed ($\chi^2=1.458$, $p < 0.05$) groups in prevalence of ectoparasite infestation ($p < 0.05$). Male, young and local breed chicken categories were 3.757 (CI=2.265-6.234), 1.883 (CI=1.214-2.921) and 19.6 (11.427-33.618) times more likely infested by ectoparasite than female, adult and cross breed categories, respectively (Table 2).

Overall 52.1% (203/390) prevalence of pediculosis was recorded. It was higher in male (65.77%), young (60.67%) and local breed (66.42%) groups than female (43.57%), adult (44.81%) and exotic breed (21.6) groups, respectively. There was no infestation in semi-intensive management system while 67% (176/390) was recorded in extensive farming system. There was statistical significance difference between categories of sex ($\chi^2=18.187$, $p < 0.05$), age ($\chi^2=9.755$, $p < 0.05$), breed ($\chi^2=68.349$, $p < 0.05$) and management (Fisher's exact=1.216, $p < 0.05$) groups. Male (2.489 times), young (1.9 times) and local breed (7.178 times) chickens had more chance to encounter infestation than female, adult and exotic breed chickens, respectively (Table 3).

Pediculosis (52.1%) was the most prevalent (Table 3) followed by flea infestation (44.36%) while cnemidocoptic mange (34.62%) was the least prevalent. Prevalence of *E. gallinacean* and *C. mutans* was higher in male, young and local breed chicken while *L. caponis* prevalence was higher in male, adult and local breed. *Menacanthus stramineus* was more prevalent in female, adult and local breed whereas *C. heterographa* was prevalent in female, young and local breed. Chickens kept under

Table 2: Prevalence of chicken ectoparasite and its association with hypothesized risk factors.

Factor	Categories	No. examined	Positive (prevalence- %)	OR	95% CI	χ^2 /Fisher's exact	p-value
Sex	Female	241	140 (58.09)	1	2.265- 6.234	28.145	0.000
	Male	149	125 (83.89)	3.757			
Age	Young	178	134 (74.45)	1.883	1.214-2.921	8.083	0.004
	Adult	212	131 (61.79)	1			
Breed	Local	265	232 (87.55)	19.600	11.427-33.618	1.458	0.000
	Exotic	125	33 (26.4)	1			
Management	Extensive	303	265 (87.46)	-	-	2.37	0.000
	Semi-intensive	87	0	-			
Total		390	265 (67.95)				

Table 3: Prevalence of chicken pediculosis and its association with risk factors.

Factors	Category	No. examined	No. of positive (Prevalence in %)	OR	CI (95%)	χ ² /Fishers'exact	P-value
Sex	Female	241	105 (43.57)	1	3.801-1.630	18.187	0.000
	Male	149	98 (65.77)	2.489			
Age	Young	178	108 (60.67)	1.900	1.268-2.848	9.755	0.002
	Adult	212	95 (44.81)	1			
Breed	Local	265	176 (66.42)	7.178	4.369-11.792	68.349	0.000
	Exotic	125	27 (21.6)	1			
Management	Extensive	303	203 (67.00)	-	-	1.216	0.000
	Semi-intensive	87	0	-			
Total		390	203 (52.1)				

Table 4: Prevalence, risk estimate, presence or absence of statistical significance difference in prevalence for each species of identified ectoparasites.

Factors	Category	No. examined	No. of positive (prevalence in %)				
			<i>E. gallinacean</i>	<i>C. mutans</i>	<i>L. caponis</i>	<i>M. stramineus</i>	<i>C. heterographa</i>
Sex	Female	241	85 (35.27)	63 (26.14)	11 (4.56)	4 (1.67)	99 (41.08)
	Male	149	88 (59.06)	72 (48.32)	13 (8.72)	1 (0.67)	96 (64.43)
	χ ² /Fishers'exact		21.114	20.015	2.760	0.711	20.082
	p-value		0.000	0.000	0.097	0.653	0.000
	OR (M/F)		2.648	2.642	-	-	2.598
	95% CI		1.740 - 4.030	4.066-1.717	-	-	1.703-3.963
Age	Young	178	86 (48.31)	76 (42.67)	11 (6.18)	2 (1.12)	105 (58.98)
	Adult	212	87 (41.03)	59 (27.83)	13 (6.13)	3 (1.42)	90 (42.45)
	χ ² /Fishers'exact		2.076	9.448	0.000	0.065	10.583
	p-value		0.150	0.002	0.984	1.000	0.001
	OR (Y/A)		-	1.932	-	-	1.950
	95% CI		-	1.267-2.948	-	-	1.301-2.921
Breed	Local	265	145 (54.71)	130 (49.06)	19 (7.160)	4 (1.51)	170(64.15)
	Exotic	125	28 (22.4)	5 (4)	5 (4)	1 (0.8)	25 (20)
	χ ² /Fishers'exact		35.940	76.184	1.478	0.338	66.226
	p-value		0.000	0.000	0.224	1.000	0.000
	OR (L/E)		4.186	23.111	-	-	7.158
	95% CI		2.577-6.799	9.151-58.368	-	-	4.319-11.861
Management	Extensive	303	173 (57.1)	135 (44.55)	24 (7.92)	5 (1.65)	195 (64.35)
	Semi-intensive	87	0	0	0	0	0
	χ ² /Fishers'exact		89.275	59.284	7.343	1.454	1.120
	p-value		0.000	0.000	0.004	0.591	0.000

Keys: M- male, F- female, Y-young, A-adult, L-local, E-exotic

extensive management system were frequently infested while no chicken kept under semi-intensive management system was infested by ectoparasite. Prevalence, presence or absence of statistical significance difference in prevalence of each species of identified ectoparasites and the risk estimate for variables are given in Table 4.

Discussion

Ectoparasites are important constraints to poultry production sector. Some parasites exist only on one defined area of the host's body while others can exploit wider range of hosts [15]. The observed overall prevalence of 67.95% of ectoparasite infestation in the current study is comparable to 70.73% report from Meerut [16]. However, higher prevalence rate of 91.5% [5], 86.67% [17] and 100% [3] were recorded in East Shoa zone (Ethiopia), Bangladesh and Nigeria, respectively. The difference between the current and previous findings may be due

to breed, seasonal, management, agroecological, and implemented methods of the disease control and prevention [18,19]. The current study was undertaken during heavy rainy season (July to October) while others like Belihu et al. [5] was conducted in dry and short rainy season.

Positive chickens were found to harbor one or more ectoparasite species. About 48.21% of the total examined chickens were found to be infested with more than one species while 19.74% were infested with single species. Slight higher mixed infestation (67.4%) was reported from Haramaya intensive poultry farm, Ethiopia [12]. From the positive chickens, about 70.94% and 29.04% chickens were infested with mixed and single infestation, respectively. However, 19% single and 81% mixed infestation were recorded in Iraq [20]. The observed variation in the proportion of single and mixed infestation would be related to difference of implemented management system.

Pediculosis (52.1%) was the most prevalent followed by flea infestation (44.36%) while mangle (34.62%) was the least prevalent. The current study is consistent with report from Wolayta Soddo town, Southern Ethiopia, in which 88% lice, 16.5% flea and 8.1% mite was reported [19]. Similarly, highest prevalence of lice infestation (90%) was reported from Kenya [21]. This may be related to favourable climatic condition in tropics for their development [8].

Five species of ectoparasites, namely *E. gallinacean*, *C. mutans*, and *C. heterograha*, *M. stramineus* and *L. caponis*, were identified in the present study. Most of these species were reported from different parts of Ethiopia [5,12,19], Nigeria [3] and Bangladesh [17]. This indicates widespread of these ectoparasite species.

Among the identified ectoparasite species, *C. heterograha* was most frequently identified (50%) species while *M. stramineus* (1.28%) was the least one. However, highest prevalence of 70% and 65.33% *M. stramineus* was reported from Bangladesh [17] and Ethiopia [5], respectively. In Iran, 40% of chickens harbored *M. stramineus*, but the prevalence of *C. heterograha* was 8% [22]. The prevalence of 6.15% of *L. caponis* is comparable to 5% reported by Bala et al. [3], but higher than 0.67% report of Belihu et al. [5], and much lower than 32% [22] and 48% [17]. Prevalence of *E. gallinacean* (44.4%) is in line of agreement with 51.16% in East Shoa, Ethiopia [5]. *Cnemidocoptes mutans* (34.5%) in the present study is higher than reports of 9.4% [3] and 0.89% [23]. The difference might be due to management, climatic and geographic (altitudinal) difference among these studies.

Higher infestation rate observed in male than female chickens with presence of statistical significance difference in current study is consistent with finding of Belihu et al. [5]. According to Mekuria and Gezahegn [19] and Bala et al. [3], the infestation was higher in female than male group. Young chickens were more affected (74.5%) than adult chickens (61.79%) with 1.9 times greater probability to acquire the infestation. This result disagrees with the finding of Sabuni et al. [21] and Nnadi and George [7] where 100% and 92% of adult and young chickens were infested, respectively with statistical significance difference. Management difference in different study areas may attribute to such differences.

Local breed chickens (87.55%) were more infested than exotic breed chickens (26.4%) with statistical significance difference. Slightly comparable finding of 2.35% was reported from Debrezeit semi-intensive farm [24] and 100% in free ranging chickens [3]. Local breeds are allowed to free-range, thus becoming more vulnerable to ectoparasitism than exotic breed, which are almost kept in indoor. In this study, the prevalence was nil in semi-intensive management system while it was 87.46% in extensive management system, which is similar with work of Mekuria and Gezahegn [19]. This is due to better measures and practices related to good housing, feeding and husbandry system applied in semi-intensive farms where exotic breeds are kept.

In the current study, young chickens group were found 1.9 and 1.932 times more likely to be infested with lice species and *C. mutans* than adult chickens category, respectively. The result agrees with findings Mekuria and Gezahegn [19] where young chickens were 5.2 times more infested than adult chicken group and disagrees with 2.8 times more likely infestation of adult chickens than young chickens with *C. mutans*.

In conclusion, infestation of chickens with ectoparasites was important constraint of in the study area. Five species of ectoparasites were identified. Sex, age, breed and management were important risk factors with statistical significance difference. Therefore, application of integrated control strategy, good management practices, creation of awareness and further detailed study were recommended in the study area.

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