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Original Article

Prevalence of Ectoparasites on Poultry Managed under backyard system in and around Ambo town, central Ethiopia

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Abstract

Introduction: Backyard poultry production is considered a source of meat and eggs. However, parasites are among the primary pathogenic agents that threaten poultry health and hinder productivity.

Methods: A cross-sectional study was conducted to investigate the prevalence and identify the species composition of ectoparasites in poultry managed under the backyard system. This study occurred from January 2024 to August 2024 in and around Ambo town in the Oromia region of central Ethiopia. A total of 334 chickens of different age groups, both sexes, and breeds were examined for the presence or absence of ectoparasites. Samples were collected from various body parts and identified at the species level using a stereomicroscope.

Results: Overall, 37.13% (124/334) of chickens were infested with ectoparasites, which were primarily grouped into fleas, lice, fowl ticks, and mites. Six species of ectoparasites were identified. The flea species, *Echidnophaga gallinacea,* had a higher prevalence rate of 23.35%, while the mite species, *Dermanyssus gallinae,* had a lower prevalence rate of 1.20%. Compared to male chickens, which had a prevalence rate of 25.00%, female chickens exhibited a higher prevalence rate of ectoparasites at 75.00%. The rate of ectoparasite infestation varied significantly ($P<0.05$) between the two sexes.

Conclusion: The present study revealed that ectoparasitic infestation was highly prevalent among chickens in the study areas, which may be attributed to a lack of attention and poor control practices regarding ectoparasites. Therefore, control of ectoparasites should be based on good management practices, biosecurity, and raising community awareness about the overall effect of ectoparasites on poultry productivity. Improving chicken productivity is essential, and further detailed studies are recommended, focusing on ectoparasite infestations and their impacts.

Keywords: Ambo, Backyard, Ectoparasite, Poultry, Prevalence

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Introduction

Poultry is found worldwide and coexists with humans as a food source, a hobby, and for research purposes. It plays a crucial role in closing the animal protein supply gap in a short period (1). Ethiopia's poultry population is estimated at around 57 million, contributing to the global total of 18 billion (2). Of Ethiopia's chicken population, 99% are raised under traditional backyard management systems with inadequate housing, feeding, and healthcare (3). Traditional poultry production is often characterized as a low-input, low-output system, with low productivity primarily caused by diseases, poor management, and insufficient feed. Despite these challenges, poultry farming is an integral part of balanced rural farming systems, providing high-quality protein to families. Beyond supplying nutritious protein, rural poultry farming offers households a readily disposable source of income and integrates well into other farming activities. It requires minimal labor and initial investment compared to other farm activities, making it a sustainable option. In Ethiopia, chickens are the most common livestock, with nearly every rural family owning them. They provide both a valuable source of family protein and a supplementary income (4).

Indigenous chickens raised under traditional scavenging systems play a vital role in the cultural and social lives of rural communities (5). The poultry sector is one of the fastest-growing in animal production. Yet, indigenous chicken farming in rural Ethiopia faces several significant challenges, including disease, predation, lack of feed, inadequate housing, and poor management practices (6). Among these, parasitism is a considerable constraint,

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particularly in village chicken production. Gastrointestinal helminths and ectoparasites are leading causes of reduced productivity in chickens, though they are often overlooked because they are rarely fatal (7). While the prevalence of parasitic diseases has been reduced in commercial poultry due to improved management practices, a wide variety of parasites remain common in rural scavenging systems (8).

Like other animals, poultry also suffer from a wide range of maladies and ectoparasite infestation. Ectoparasites are regarded as a basic cause of retardation in growth, lowered vitality, and poor condition of birds. Several types of arthropods constitute significant poultry ectoparasites, primarily lice, fleas, mites, and ticks. External parasites of poultry are prevalent in the tropical environment of the world since this climatic condition creates a favorable environment for the development of the parasites. Poor standards of poultry husbandry are also contributing factors to the abundance of the parasites (9,10).

In most rural areas, the high prevalence of external parasite infestations in backyard chickens poses a significant challenge to the poultry industry, as the majority of external parasites are associated with poor hygiene in chicken houses and a lack of appropriate parasite control measures (11,12). The degree and types of infestation were influenced by the production method. These parasites live on or in the skin and feathers, characterized by possession of externally segmented bodies, jointed appendages, and chitinous exoskeletons. It can cause damage to the chickens either directly or indirectly by causing tissue damage, blood loss, irritation, discomfort, toxicosis, allergies, and dermatitis, which in turn reduce the quality and quantity of meat and egg production and may lead to death. Additionally, they act as vectors for several pathogens, such as *Pasteurella*, Fowl Pox, Newcastle disease virus, and possibly chlamydia. During heavy infestations, external parasites may weaken chickens and reduce their resistance to various diseases, potentially leading to death (13).

Poultry suffers from many diseases of various etiologies, resulting in morbidity as well as mortality in birds (14). Ectoparasites can pose significant clinical problems in poultry, severely affecting their physiology and feed efficiency by causing continuous irritation. This can lead to emaciation, anemia, and a decline in egg and meat production. Ectoparasites can cause a weight loss of approximately 711 grams per bird and reduce egg production by about 66 eggs per bird annually (15). Despite their harmful impact, ectoparasites have received minimal attention across most production systems. There is also limited data on comparative studies, distribution, burden, and the economic effects of ectoparasites in different poultry husbandry systems in Ethiopia. Additionally, information on the prevalence and species composition of poultry ectoparasites in the country, particularly in the current study area, remains scarce.

Therefore, the objectives of this study were:

- To estimate the prevalence of ectoparasites in the backyard chicken production system.
- To identify the major species of ectoparasites affecting backyard chickens in the study areas.

Materials and Methods

Description of Study Area

The study was conducted from January 2024 to August 2024 in and around Ambo town, West Shewa zone, Ethiopia. Ambo town serves as the administrative center of the West Shewa zone and the Ambo district. It is located at a latitude of 8°59'N and a longitude of 37°51'E, at an elevation of 2101 meters above sea level (masl). It is situated 111.3 km (77 miles) west of Addis Ababa, the capital of the Oromia region and Ethiopia. The agroecology of the study area consists of 23% highland, 60% midland, and 17% lowland areas. Annual rainfall ranges from 800 to 1000 mm, and temperatures range from 20 to 29 °C. The farming system is characterized by a mixed crop-livestock production system (16).

Study Population

The study population consisted of chickens raised in a backyard management system owned by individual farmers. The population of chickens in the area is approximately 105794. Chickens were selected to include both sexes (male and female), various breeds (local and exotic), and different age groups were examined for the presence or absence of ectoparasites. The age of the chickens was determined by observing the 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), together with information from the poultry farmers (10).

Study Design

A cross-sectional study was conducted from January 2024 to August 2024 to estimate the prevalence and identify the species composition of ectoparasites in poultry.

Sample Size Determination

Ambo town and its surrounding areas were considered the sampling frame from which backyard poultry were selected for the study using simple random sampling. The sample size of chickens required for this study was calculated using the equation provided by Thrusfield (17) for the random sampling method. This calculation was based on a previous study report on ectoparasites in chickens from the study area.

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

Where N = required sample size; Pexp = expected prevalence; and d = desired absolute precision (0.05).

Given the prior research in the study locations, which showed a prevalence of 67.95%, the sample size was determined with a defined precision of 5% and a 95% confidence level.

Sampling Technique

To collect and detect ectoparasites, a simple random sampling procedure was used to sample a representative group of chickens.

Data Collection Methods

Physical and Clinical Examination Procedure

Each bird's legs were tied with the assistance of a helper, and the feathers were manually deflected to examine them for external parasites. After being restrained, the entire body of each chick was closely inspected visually for ectoparasites. The inspection began with the head, followed by the neck, back, sides of the body, ventral region of the abdomen, wings, vent area, and legs.

Laboratory Sample Collection

Lice and fleas were collected from hosts by gently brushing the base of the feathers with a fine, soft brush onto white cardboard paper, while others were collected by hand picking and using non-toothed thumb forceps (18). A thorough examination of cracks and crevices in chicken houses was conducted early in the morning and during the night to ensure the presence of parasites with nocturnal activities. Each chicken examined was assigned a serial number and labeled with the necessary information on the sampling bottle for easy identification. The bio-data of each chicken, including sex, breed, age, and predilection sites, were recorded on a separate sheet. Representative ectoparasites found on the chickens' bodies were collected and placed in universal bottles (film holders or vials) containing 70% alcohol, then transported in an ice box to the Ambo University Veterinary Parasitology Laboratory.

Laboratory Examination

Parasite identification and other relevant activities were conducted at the Ambo University Veterinary Parasitology Laboratory. Fleas, lice, and ticks were transferred from universal bottles to clean Petri dishes, mounted under a stereomicroscope, and identified. Additionally, a wet film was prepared from the scrap, to which 10% potassium hydroxide was added to digest debris, and then it was examined under a light microscope. All ectoparasites were identified based on their morphological characteristics using the entomological diagnostic guidelines of Taylor et al (19).

Data Management and Analysis

The collected raw data were compiled and coded using a Microsoft Excel spreadsheet. Data analysis was performed using Stata version 20. Descriptive statistics, including frequency, prevalence, and percentages, were computed to analyze the data. In addition to descriptive statistics, Pearson's chi-square test was used to evaluate the associations between the prevalence of ectoparasite infestation in poultry and several explanatory variables, including age, sex, and breed. A statistically significant P value was defined as 0.05 or less.

Results

Prevalence of Ectoparasite Infestation

Of the chickens inspected from the research locations, 37.13% (124 out of 334) were found to have various ectoparasites. Female chickens exhibited a higher prevalence of ectoparasites compared to male chickens. A statistically significant difference ($P<0.05$) in the occurrence of ectoparasites between the sex groups is presented in Table 1.

Prevalence of Targeted Ectoparasites Among Different Risk Factors

In the current study, the prevalence rates of fleas, lice, ticks, and mites were identified. Adult chickens exhibited a greater prevalence of fleas compared to young chickens. The results of the chi-square test indicated a statistically significant correlation ($P<0.05$) between flea prevalence and chicken age. Additionally, local chickens had a higher prevalence of mites compared to crossbred chickens. A statistically significant correlation ($P<0.05$) was found between chicken type and the frequency of mite, as shown in Table 2.

Percentage of Lice Species in Backyard Chicken

Three different types of chicken lice were identified in the current investigation. *Menopon gallinae* exhibited the highest frequency of occurrence among the detected lice species, followed by *Menacanthus stramineus* and *Goniocotes gallinae*, as shown in Table 3.

Predilection Sites of Targeted Ectoparasites in Backyard Poultry

In this study, the highest percentage of fleas was found

Table 1. Prevalence of targeted ectoparasites among different variables

Variable	No. of Examined	No. of Positive (%)	χ2	*P* Value
Age				
Young	117	46 (37.10)	0.3702	0.543
Adult	217	78 (62.90)		
Sex				
Male	116	31 (25.00)		0.004
Female	218	93 (75.00)	8.2376	
Breed				
Local	168	57 (45.97)	1.4802	0.224
Cross	166	67 (54.03)		
Overall	334	124 (37.13)		

Table 2. Prevalence of Ectoparasites in Backyard Chickens in and Around Ambo Town

Variables	No. of Examined	No. of Positive Samples (%)			
		Flea	Mite	Lice	Tick
Age					
Young	117	19 (24.36)	1 (25.00)	25 (78.13)	1 (10.00)
Adult	217	59 (75.64)	3(75.00)	7 (21.88)	9 (90.00)
χ2 (*P* value)		5.0916 (0.024)	0.1790 (0.672)	28.8796 (0.000)	2.8579 (0.091)
Sex					
Male	116	24 (30.77)	3 (75.00)	3 (9.38)	1 (10.00)
Female	218	54(69.23)	1 (25.00)	29 (90.63)	9 (90.00)
χ2 (*P* value)		0.7045 (0.401)	2.8962 (0.089)	10.0372 (0.002)	2.7813(0.095)
Breed					
Local	168	34 (43.59)	4 (100.00)	15 (46.88)	4 (40.00)
Cross	166	44 (56.41)	0 (0.00)	17 (53.13)	6 (60.00)
χ2 (*P* value)		1.8326 (0.176)	4.0003(0.045)	0.1660(0.684)	0.4249 (0.515)
Overall		78 (23.35)	4 (1.20)	32 (9.58)	10 (2.99)

Table 3. Percentage of lice species on backyard chickens in the study areas

Lice Species	Frequency	Percent
Menopon gallinae	12	3.59
Menacanthus stramineus	11	3.29
Goniocotes gallinae	9	2.69
Total	32	9.58

Table 4. Predilection Sites of Ectoparasites on the Chicken Body

Type of Ectoparasite	Predilection Sites	Frequency	Persent
Fleas	Comb	36	46.15
	Eyelid	9	11.54
	Wattle	33	42.31
	Total	78	100.00
Mite	Breast region	4	100.00
	Total	4	100.00
Lice	Below wings	15	46.88
	Feather bases	12	37.50
	Neck region	3	9.38
	Wing feather	2	6.25
	Total	32	100.00
Tick	Skin	6	60.00
	Comb	1	10.00
	Eyelid	2	20.00
	Wattle	1	10.00
	Total	10	100.00

on the comb, while the lowest rate of lice was observed beneath the wing feathers. These findings are summarized in Table 4.

Discussion

In the current study, the overall prevalence of ectoparasite infestation observed in chickens managed under a backyard system was 37.13%. Out of 334 examined chickens, 124 were found to harbor at least one species of external parasite. The value from the Ambo district, which was 67.95% (10), supports the observed overall prevalence of 37.13% for ectoaparasite infestation in the current study. Conversely, the present findings were comparatively higher than those of Al-Saffar and Al-Mawla (20) in Iraq (19%) and Tolossa and Tafesse (18) from Central Ethiopia (2.6%). However, the prevalence was lower than the 63.0% reported by Rebuma et al (14,21) in the Guder town, as well as 40% reported by Kebede et al (22) in and around Jimma Town, and 65.6% reported by Mata et al (23) in south-western Ethiopia. The observed variation in prevalence between the present study and prior research may be attributed to various factors, including breed, season, management style, agroecology, and differing climatic conditions such as temperature and humidity. These factors may also impact the population dynamics of parasites, as well as the disease control and prevention strategies employed in the study areas. Such practices can expose chickens to substandard hygiene conditions in chicken houses, leading to infection with harmful ectoparasites.

The present study revealed a significant difference in the prevalence of ectoparasite infestation in village chickens when age was considered as one of the hypothesized risk factors. The findings indicated that adult village chickens (62.90%) were significantly more infested than young chickens (37.10%). This result aligns with that of Lawal et al (24), who reported that adult chickens (61.75%) were more infested by ectoparasites compared to younger ones (22.75%). The high prevalence rate of ectoparasites in adult chickens compared to the young ones may be attributed to the fact that adult chickens scavenge over a wider area, often alongside other poultry or animals. As a result, they may be exposed to infested environments

and other sources of infestation for a longer duration than young chickens (24). However, the current finding was inconsistent with the result of Mulugeta et al (25), who reported that young chickens (44.41%) were more infested with ectoparasites compared to the adult chickens (13.66%).

The result of the current study revealed that crossbred chickens (54.03%) had more exposure to external parasites than local breed chickens (45.97%), with no statistically significant association ($P>0.05$). Therefore, crossbred chickens may be more vulnerable to ectoparasites than local breeds (26,27). This finding is less consistent with the report of Serda and Abdi (13), who reported a prevalence of 63.16% in crossbred chickens and 53.57% in local breeds in the Harromaya district. The higher prevalence observed in crossbreds may be attributed to differences in management, hygiene practices, and healthcare facilities provided to the flocks.

The current study showed that fleas had the highest prevalence of external parasites at 23.35%, followed by lice (9.58%), ticks (2.99%), and mites (1.20%). The stick-tight flea (*Echidnophaga gallinacea*) was the only species of flea identified in the study area. This finding was nearly identical to results from Bishoftu town reported by Kebede et al (12), who observed a prevalence of 20.6%. In comparison, the current finding was greater than those reported by Amede et al (28) (6%) in Eastern Ethiopia and Mirzaei et al (29) (8%) in Iran. However, it was lower than the reports of Tessema (30) in Mareka Woreda of the Dawuro zone and Mata et al (23) in Jimma, south-western Ethiopia, who reported prevalences of 83.5% and 26.6%, respectively. These differences in prevalence may be attributed to variations in geographical areas, sample size, and study periods.

Lice (9.58%) were the second most frequent ectoparasites identified in the present study. This prevalence is lower than the 25% reported by Wondimu (31) in the Wolaita zone. However, the current study's findings on lice infestation were lower than those of Serda and Abdi (13) in the Haromaya district, who reported a 27.1% prevalence, but higher than the 6.9% prevalence reported by Belihu et al (3) in Ethiopia.

Three species of lice were recorded during the present study: *Menacanthus stramineus, Menopon gallinae,* and *Goniocotes gallinae.* Among those identified lice species, *Menopon gallinae* (3.59%) had the highest frequency of occurrence. This finding is lower than that of Bala et al (26), who reported a prevalence of 8.1% in Nigeria and 14.3% reported by Amede et al (28). In the current study, *Menacanthus stramineus* was the second most frequent lice species with a prevalence of 3.29%, which is close to the reports of Moyo et al (32) in South Africa, who reported 5.3%. However, this finding was lower than 6.9% reported by Bala et al (26) in Nigeria and Ashenafi and Yimer (33) in Central Ethiopia, who reported 71.6%. *Goniocotes gallinae* (2.69%) was the least frequent lice species in the study areas, which is somewhat similar to Tessema (30) in the Dawro Zone, who reported 6.42%. This finding was lower than the reports of Other researchers (34-49) and Mekuria and Gezahegn (50) in Wolaita Sodo town, who reported a prevalence of 44.95%, and also lower than the 2.9% reported by Kebede et al (12) in Bishoftu town. The variation in the prevalence of lice may be attributed to factors such as management system, sample size, season of study, and other agroecology influences on the distribution of lice. Additionally, less attention to culling infected chickens in developing countries may contribute to this distribution (34,35).

In the present study, the prevalence of tick infestation among ectoparasites was recorded at 2.99% for the fowl tick (*Argas persicus*). This finding is lower than the 6.8% reported by Al-Saffar and Al-Mawla (20,36) in Mosul. The disparity between the current and previous findings may be attributed to differences in breed and disease control and prevention strategies employed in the study area (37-44).

The overall prevalence of ectoparasite infestation showed that mites were the least prevalent, with a prevalence of 1.20%. *Dermanyssus gallinae* was the only species of mite identified in the current study area. This finding is similar to the result of previous studies by Tolossa and Tafesse (18), who reported 2.6% mite infestation in poultry in Ethiopia. In contrast, higher prevalences of 86.67% from Bangladesh (27), 91.5% from Central Ethiopia (3,45), and 100% from Nigeria (26,46) have been reported. The variation in mite prevalence could be attributed to agro-climatic differences between the study areas and the control measures implemented against mites in these chickens (47-51).

Conclusion

Despite their importance, external parasites of poultry are common in the tropics due to favorable climatic conditions for their development and poor standards of poultry husbandry. The different species of ectoparasites identified in the current study provide evidence of a diverse ectoparasite fauna in the study area. Sex, breed, and age were significant risk factors in the study. However, fleas were the most prevalent ectoparasites, followed by lice, ticks, and mites. Three species of lice were identified: *M. straminus*, *M. gallinae,* and *G. gallinae*. Additionally, only one species of flea (*E. gallinacea*), one species of tick *(A. persicus)*, and one species of mite (*D. gallinae*) were identified. The attachment sites of external parasites identified in the current study included the eyelid, ear, comb, wattle, skin, wing feather, breast region, and feather base. Overall, backyard chickens in the present study were affected by various ectoparasite infestations, primarily due to a lack of appropriate management systems and effective disease control practices.

Recommrndations

Therefore, based on the above conclusion, the following points are recommended:

- Veterinary service delivery to poultry producers in rural, peri-urban, and urban areas should be improved.
- Further investigations should be conducted to identify and assess the effects of external parasites on poultry productivity and health.
- The government should raise awareness in the community about the overall impact of ectoparasites on poultry productivity.

Authors' Contribution

Conceptualization: Nuguse Refisa, Mersha Chanie, Tesfaye Rebuma, Yagoob Garedaghi.
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Funding acquisition: Nuguse Refisa, Yaghoub Firouzivand, Mersha Chanie, Tesfaye Rebuma, Yagoob Garedaghi.
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Supervision: Mersha Chanie, Tesfaye Rebuma.
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Writing–original draft: Mersha Chanie, Tesfaye Rebuma.
Writing–review & editing: Mersha Chanie, Tesfaye Rebuma, Yagoob Garedaghi.

Competing Interests

The authors declare that there is no conflict of interest.

Ethical Approval

Not applicable.

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