



ECTOPARASITOSIS IN DOMESTICATED TURKEYS (*MELEAGRIS GALLOPAVO*) IN JERE AREA, BORNO STATE, NIGERIA

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ABSTRACT

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The present cross sectional study was carried out to determine the prevalence and identify the species of ectoparasites infesting domestic turkeys (*Meleagris gallopavo*) in Jere area. The study was conducted from the month of April to October, 2016 of the study period. Out of the total of 300 domesticated turkeys examined for the presence or absence of ectoparasites, 185 (61.67%) were found to be infested with one or more ectoparasites. The prevalence rate according to the study locations varies as Galtimari Ward (15.0%), Mairi emirate (12.67%), Fori ward (12.33%), University Staff Quarters (11.0%) and Mairi Kuwait (10.67%) of Jere. Among the Four different types of ectoparasites encountered, Lice (31.67%) were found to be the most prevalent followed by the Flea (15.33%) and Mites (12.0%) while the Ticks (2.67%) are the least prevalent. However, among the eight (8) different species of ectoparasites found on the infested turkeys; the most prevalent species of ectoparasites found was *Lipeurus tropicalis* (17.67%), followed by *Echidnophaga gallinacean* (15.33%), *Menacanthus stramineus* (8.33%), *Dermanyssus gallinae* (7.0%), *Chelopistes meleagridis* (5.67%), *Epidermoptes bilobatus* (3.0%), *Argas persicus* (2.67%) and *Cnemidocoptes mutans* (2.0%) in a descending order of prevalence rate. There was mixed infestation with two or more species of ectoparasites in some infected turkeys. Ectoparasites infestation was found to be significantly higher in Adult (44.0%) than in the young (17.67%) turkeys ($P = 0.0148$; $RR = 1.202$). Ectoparasites infestation was also found to be higher in the female (33.0%) than in the male (28.67%) turkeys, but the difference was not statistically significant ($P = 0.3102$; $RR = 0.9240$). Ectoparasites infestation was found to be significantly higher in turkeys reared under the extensive (50.0%) compared to those reared under the intensive (11.67%) management systems ($P < 0.0001$; $RR = 1.622$). This is the first survey to determine the prevalence and identify the species of ectoparasites among domestic turkeys in Jere area of Borno State, Nigeria. The occurrence of ectoparasites in domestic turkeys indicated the existence of diverse ectoparasites fauna in the present study area which is associated with inadequate management system such as poor hygienic rearing system, poor husbandry and lack of strategic ectoparasites control practices.

Contribution/Originality: This present study has contributed to the existing literature of the occurrence of ectoparasites in poultry species in Nigeria. This study also represents one of very few studies which have investigated the prevalence of ectoparasites in domesticated turkeys in Nigeria. However, this is the first survey to

determine the prevalence and identify the species of ectoparasites among domestic turkeys in Jere area of Borno State, Nigeria.

1. INTRODUCTION

Poultry are domesticated avian species (chickens, guinea fowls, ducks, pigeons, turkeys and quails) reared for the purpose of high quality animal protein (meat and eggs) [1, 2] as well as provision of petty cash (derived from the sales of live birds and eggs), job creation, poverty alleviation, as hobby and generally plays a vital role in the national economy as a revenue provider [3]. Village poultry production systems which involves either raising indigenous breed of poultry extensively (free range scavenging) or semi-intensively (partially restricted semi-scavenging) constitutes one of the major activities of rural farmers and low income holders in developing countries including Nigeria [4-6]. The turkeys are among the domesticated poultry species usually reared under both the extensive and semi-intensive management systems in most parts of the developing countries of Africa including Nigeria [7-9].

A turkey is a large bird in the genus *Meleagris* and the domestic turkey is descendant of *Meleagris gallopavo*, commonly known as the “wild turkey” which is native to the forests of North America [10]. Turkey rearing is not really very popular among Nigerian poultry farmers, but it is considered very significant next to other domesticated poultry species such as chicken, duck, guinea fowl, pigeon and quail in contributing to the national economy, nutritional status and food security of the increasing population of the country [10]. They are usually reared for meat and its meat is the leanest among other domestic avian species [11]. In Nigeria, the meats of turkey are in many instances demanded by high ranked and rich individuals especially those with health challenged ailments [12]. Diseases have been reported as one of the major constraint toward successful turkey production in developing countries including Nigeria, among which the effect of parasitism is often severe [9, 10, 13, 14].

Although, extensive rearing of turkeys usually requires low investment in facilities and equipment, and it is affordable and sustainable both for backyard turkey production investments from economic point of view [15]. However, it may expose the birds to several disease pathogens including ectoparasites since there is inappropriate housing and lack of appreciable pest control efforts [3, 16]. Avian ectoparasites can be broadly divided into mites, lice, ticks, fleas, and flies [17-19]. These parasites may constitute clinical problems; transmit a number of infectious diseases and can also act as transport/intermediate hosts of other parasites [20, 21]. They are considered among the basic causes of growth retardation and economic loss of the infested birds [22, 23]. They can also cause irritation, discomfort, tissue damage, blood loss, toxicosis, allergies and dermatitis, which in turn affect the quality and quantity of meat and egg production [13, 24]. The factors that influence the epidemiology of ectoparasitism includes: inadequacy in the management practice and husbandry system, poor sanitation, favorable climate and geo-ecological conditions. The present study was aimed to determine the prevalence rates of ectoparasites in domesticated turkeys in Jere area, Borno State, Nigeria.

2. MATERIALS AND METHODS

2.1. Study Area

The present study is conducted in Jere area of Borno State, North eastern Nigeria. Its headquarters are in the town of Khaddamari. It has an area of 868 km² and a population of 211,204 at the 2006 Nigeria national census. The most of population in Jere Town are Arabic tribes Baggara. The postal code of the area is 600. It is one of the Sixteen Local Government Areas that constitute the Borno Emirate, a traditional state located in Borno State, Nigeria [25].

2.2. Sampling Period

This study was conducted on domesticated turkey reared on extensive and intensive management systems in and around Jere area, Borno State, Nigeria from the month of April to October, 2016 which tallies with the wet and dry seasons of the sampling period.

2.3. Sample Size Estimation

The desired sample size for the study was calculated using the equation described by Thrusfield [26] since the exact prevalence of ectoparasites domestic turkeys (*Meleagris gallopavo*) in the study area was not known; to maximize the sample size it was assumed that the expected prevalence was 50%, absolute precision was 5% and the confidence interval level was set to be 95% as shown below,

$$n = \frac{1.96^2 \times pq (1 - p \exp)}{l^2}$$

Where, n= the required sample size, p = expected prevalence, q = 1 - p; and l= absolute precision, that is the largest acceptable differences between the true and the estimated prevalence.

As a result, 300 samples were collected for the study.

2.4. Sampling Procedure

A total of 300 domesticated turkeys of both sexes and different age groups were randomly selected from the study locations. The age groups of sampled turkeys were categorically considered into two: "Young and Adults" for reasons of convenient classification of the birds. Each turkey was examined gently, carefully and thoroughly with emphasis to the head, combs, eyelids, wattles, neck, feathers, breast, back, wings, shafts, legs.

2.5. Entomological Examinations

Each turkey was manually restrained to prevent unnecessary struggle or stress and then using hand brush, the plumage was gently brushed onto a white sheet of paper for the collection of ectoparasites. The feathers of the head, neck, wings, body, legs and cloaca were gently but quickly raised and thoroughly examined with a hand lens for ectoparasites. Attached ectoparasites such as lice and ticks, which could not be removed by brushing, were gently dislodged with a pair of thumb forceps and their sites noted. However, part of any turkey suspected to be infested by mite was gently scraped using a scalpel blade dipped in acetic glycerin. All collected samples were preserved in a bijou sample bottles containing 70% ethanol with 5% glycerin, labeled accordingly and transported to the Department of Veterinary Parasitology and Entomology research laboratory, University of Maiduguri for identification. All types of ectoparasites and scrapings collected were categorized. Permanent preparations were made on well labeled slides and then the ectoparasites were identified on the basis of their morphological characters as described by Soulsby [27]; Arends [20] and Walker [28].

2.6. Statistical Analysis

Data generated were analyzed with SPSS (version 10) Statistical Package. Chi-square was used to test for significant differences between age group, sex and management systems. Differences were considered significant at $P < 0.05$.

3. RESULTS

Out of the total of 300 domesticated turkeys examined 185 were found to be infested by different species of ectoparasites with an overall prevalent rate of 61.67%. However, five different study locations were visited for ectoparasites and other data collections from turkeys and their owners, the results revealed varying prevalence

rates in each location as follows in descending order: Galtimari Ward (15.0%), Mairi emirate (12.67%), Fori ward (12.33%), University Staff Quarters (11.0%) and Mairi Kuwait (10.67%) as shown in Table 1.

Among the four type of ectoparasites encountered, Lice (31.67%) were the most prevalent followed by the Flea (15.33%) and Mites (12.0%) while the Ticks (2.67%) are the least prevalent as shown in Table 2.

The result of the present study found eight (8) different species of ectoparasites on the infested turkeys; the most prevalent species of ectoparasites found was *Lipeurus tropicalis* (17.67%), followed by *Echidnophaga gallinacean* (15.33%), *Menacanthus stramineus* (8.33%), *Dermanyssus gallinae* (7.0%), *Chelopistes meleagridis* (5.67%), *Epidermoptes bilobatus* (3.0%), *Argas persicus* (2.67%) and *Cnemidocoptes mutans* (2.0%) in a descending order of prevalence rate Table 3. There was mixed infestation with two or more species of ectoparasites.

Ectoparasites infestation was found to be significantly higher in Adult (44.0%) than young (17.67%) turkeys ($P = 0.0148$; RR = 1.202). However, infestation was found to be higher in the female (33.0%) than male (28.67%) turkeys, but the difference was not statistically significant ($P = 0.3102$; RR = 0.9240). Ectoparasites infestation was found to be significantly higher in turkeys reared under extensive (50.0%) compared to those reared under the intensive (11.67%) management systems ($P < 0.0001$; RR = 1.622) as shown in Table 4.

Table-1. Overall Prevalence of ectoparasites in domesticated Turkeys (*Meleagris gallopavo*) in Jere area, Borno State, Nigeria.

Sampling locations	Number of Turkeys Examined (N = 300)	Number of Turkeys Infested (%)	Prevalence (%)
Mairi Emirate	55	38 (69.09)	12.67
Mairi Kuwait	50	32 (64.0)	10.67
Galtimari Ward	81	45 (55.56)	15.0
Fori Ward	58	37 (63.79)	12.33
University Staff Quarters	56	33 (58.93)	11.0
Total	300	185 (61.67)	61.67

Table-2. Ectoparasitic infestation in domesticated Turkeys (*Meleagris gallopavo*) in Jere area, Borno State, Nigeria.

Ectoparasites	Number of Turkeys infested (N=300)	Prevalence rate (%)
Lice	95	31.67
Flea	46	15.33
Mites	36	12.0
Ticks	8	2.67
Total	185	61.67

Key: N = Total number of turkeys physically examined during the study period.

Table-3. Species Ectoparasitic infestation in domesticated Turkeys (*Meleagris gallopavo*) in Jere area, Borno State, Nigeria.

Ectoparasites	Species	No. of Turkeys infested (N = 300)	Prevalence (%)
Lice	<i>Lipeurus tropicalis</i>	53	17.67
	<i>Menacanthus stramineus</i>	25	8.33
	<i>Chelopistes meleagridis</i>	17	5.67
Flea	<i>Echidnophaga gallinacean</i>	46	15.33
Mites	<i>Cnemidocoptes mutans</i>	6	2.0
	<i>Dermanyssus gallinae</i>	21	7.0
	<i>Epidermoptes bilobatus</i>	9	3.0
Ticks	<i>Argas persicus</i>	8	2.67

Table-4. Risk factors associated with ectoparasites infestation in domesticated Turkeys (*Meleagris gallopavo*) in Jere area, Borno State, Nigeria.

Parameters	Risk factors	No. of Turkeys examined (N = 300)	No. of Turkeys infested (%)	Prevalence (%)	95% CI	P-value	RR
					LL – UL		
Age	Young	120	53 (44.17)	17.67	0.6198 – 0.7610	0.0148*	1.202
	Adult	180	132 (73.33)	44.0	0.5206 – 0.6323		
Sex	Females	145	99 (68.28)	33.0	0.5301 – 0.6560	0.3102	0.9240
	Males	155	86 (55.48)	28.67	0.5795 – 0.7036		
Management	Intensive	150	35 (23.33)	11.67	0.7471 – 0.8646	< 0.0001*	1.622
	Extensive	150	150 (100)	50.0	0.4420 – 0.5580		

Key: CI= Confidence interval; LL= Lower limit; UL= Upper limit; RR= Relative risk
*Statistical significance.

4. DISCUSSION

This is the first reported prevalence of avian ectoparasites in domesticated turkeys in the study area. The present study revealed an overall prevalence rate of 61.67% of avian ectoparasites among domesticated turkeys examined. This prevalence rate of ectoparasites in domestic turkeys in this present study was considerably higher, which indicates that ectoparasites infestation is a common problem among turkeys in the study area. The prevalence rate was found to vary amongst the different study locations, the highest prevalence rate was recorded in Galtimari area (15.0%) compared to 12.67% and 12.33% from Mairi Emirate and Fori ward respectively while prevalence rate was least recorded in the University staff quarters (11.0%) and Mairi Kuwait (10.67%). The difference might be associated with the number of turkeys examined and the level of sanitation in each location where the turkeys were sampled. These factors were suggested to play significant role in the rate of ectoparasites infestations in poultry [29]. The high prevalence of ectoparasites in the present study may be connected to the free range, poor management and husbandry methods in the turkey production system; overcrowding in unhygienic environment and poor sanitation around turkey farmers' households as well as rearing turkey with other poultry species Figure 1 and Figure 2. The finding of the present study is comparable to 62.25% reported by Salifou, et al. [30] but lower than 94.0% reported by Iposu, et al. [10] and higher than 12.50%, 36.0% and 22.0% reported by Lane, et al. [31]; Hadi and Hind [32] and Razmi, et al. [33] respectively. The difference in the prevalence rates recorded in the present study and other previous similar studies elsewhere might be attributed to factors such as the variation in the methods of study, sample size, season of sample collection, turkey husbandry and management system, breed of turkey, climatic and seasonal variation in prevalence rates, agro-ecological factors and implemented methods of the ectoparasites control and prevention [34]. It was observed that most of the turkeys sampled from the five locations in the present study were reared under the extensive/scavenging and semi-intensive systems, where the turkeys are allowed to fully or partially roam around the compound, on rubbish dumps, mingling with other village poultry species like chickens Figure 3 and roost together in the same cage at night. This type of practice might allow cross-infestation of ectoparasites among different poultry species. This finding buttresses those of Bala, et al. [29] who suggested that ectoparasites can easily migrate from one bird host to another during roosting especially where they are overcrowded. Scavenging nature of the turkeys and mingling with other village poultry species have been reported to possibly expose them to ectoparasites infestations that are origin of other poultry species or wild birds [35]. This could be attributed to the reason why most of the common chicken ectoparasites were also abundantly found on the ectoparasites infested turkeys in the present study.

The affected turkeys in the present study were found to be infested with ectoparasites from four different groups namely; lice, mites, flea and tick. This finding is consistent with previous report of Iposu, et al. [10] and Rezaei, et al. [36] who have also reported these groups of ectoparasites from domesticated turkeys from Ogun State and Iran respectively, Mohammad, et al. [37] have reported only lice and mites in domestic turkeys from Malaysia. However, the prevalence rate of the ectoparasites in the present study revealed that lice (31.67%) was the most prevalent followed by flea (15.33%) and mite (12.0%) while the prevalence of tick (2.67%) was considered the least prevalent. This finding agrees with Mohammad, et al. [37] who have also reported that lice are the most prevalent ectoparasites in turkeys, but the findings of the present study did not tally with those of Iposu, et al. [10] who have reported mites (40.7%) and Rezaei, et al. [36] who reported ticks (24.66%) as the most prevalent ectoparasites in turkeys. Our study also buttresses results from other several similar researches that have reported lice as the most prevalent ectoparasites fauna in domesticated poultry species [29, 38-41]. The variations in the prevalence rates in various studies might be associated with factors which included difference in the geographical area of study, season of study, climatic factors, sample sizes and management system of birds from the respective study areas.

The results of the present study found eight (8) different species of ectoparasites on the infested turkeys; of which the most prevalent species of ectoparasites found was *Lipeurus tropicalis* (17.67%), followed by *Echidnophaga gallinacean* (15.33%), *Menacanthus stramineus* (8.33%), *Dermanyssus gallinae* (7.0%), *Chelopistes meleagridis* (5.67%),

Epidermoptes bilobatus (3.0%), *Argas persicus* (2.67%) and *Cnemidocoptes mutans* (2.0%). This finding buttress the report of Fabiyi, et al. [42]; Rezaei, et al. [36] and Ebrahimi, et al. [43] who have also reported these species of ectoparasites to infest turkeys and other domestic poultry species in their various researches.

The species of lice found to be most prevalent in the present study was *Lipeurus tropicalis* at a prevalence rate of 17.67%. This finding is lower than 23.5%, 40.0 % and 78.0% reported by Iposu, et al. [10]; Mohammad, et al. [37] and Fabiyi, et al. [42] in turkeys respectively. *Lipeurus tropicalis* is one of the most pathogenic species of poultry lice as it causes severe anemia by feeding on the host blood. Its bite results in inflammation of the skin and the extensive scab formation and eventually feathers loss [44]. Other species of lice found were *Menacanthus stramineus* and *Chelopistes meleagridis* at prevalence rates of 8.33% and 5.67% respectively. This finding is lower than *Menacanthus stramineus* (48.0%) and *Chelopistes meleagridis* (33.0%) reported by Fabiyi, et al. [42]. Our prevalence rate of *Menacanthus stramineus* is also lower than 12.5%, 62.25% and 2.0% reported by Lane, et al. [31]; Salifou, et al. [30] and Hadi and Hind [32] respectively but higher than 8.0% reported by Rezaei, et al. [36] in turkeys from other parts of the world. *Lipeurus tropicalis* and *Menacanthus stramineus* are common louse found on most village poultry species especially the chickens and guinea fowls while *Chelopistes meleagridis* is the turkey louse found on turkeys as its original host [42, 45, 46]. The finding of common chickens louse on turkeys in the present study unveiled the common practice of village poultry farmers in the study area who are fond of rearing different species of poultry together in a mixed poultry farming. This suggested the chances of the parasites migrating from their natural host to infest the turkeys especially during roosting together at night or overcrowding situations as previously reported by Bala, et al. [29]. The occurrence of the turkey louse (*Chelopistes meleagridis*) on turkeys in the present study unveiled the poor management system and inadequate sanitation involved in turkey rearing in the current study area.

The present study reveals *Echidnophaga gallinacean* as the only flea that infest turkeys in the study area with a prevalence rate of 15.33%. This finding is lower than 35.0% reported by Fabiyi, et al. [42] but higher than 6.0% reported by Rezaei, et al. [36]. The difference in the prevalence rate of fleas from the various studies might be attributed to variation in the husbandry and management system, poor hygiene and sanitation, climatic conditions, humidity, season of study and other agro ecology influencing the distribution and proliferation of fleas.

Dermanyssus gallinae in the present study was the most prevalent mite species with an overall prevalence of 7.0%. This finding is lower than 12.66 % reported by Rezaei, et al. [36]. The prevalence rate of *Dermanyssus gallinae* found in the present study is also lower than 100 % reported by Cencek [47] 39.3 and 43.45 % in central and northeastern Iran by Razmi, et al. [33] and Yakhchali, et al. [48] respectively. These variations in the prevalence of *Dermanyssus gallinae* in the various researches might be associated with variation in ecological and geographical factors such temperature and humidity as well as season of sampling, endemic situation and inadequate husbandry and management system [21, 48]. Other species of mite found in the present study are *Epidermoptes bilobatus* and *Cnemidocoptes mutans* at prevalence rates of 3.0% and 2.0% respectively. This finding is lower than *Epidermoptes bilobatus* (20.0%) and *Cnemidocoptes mutans* (10.0%) reported by Fabiyi, et al. [42] and *Cnemidocoptes mutans* (6.0%) reported by Rezaei, et al. [36].

Argas persicus was found on infested turkeys as the only identified tick species with an overall prevalence rate of 2.67%. This finding is comparable to 2.0% reported by Hadi and Hind [32] from Iraq but lower than 24.66% and 50.0% reported by Rezaei, et al. [36] and Fabiyi, et al. [42] respectively. It is usually difficult to report the actual prevalence rates of *A. persicus* among infested birds because the parasite usually visits the host briefly at night for blood meal. Ticks have been reported to play significant role in the transmission of some bacterial, rickettsial, viral parasitic and spirochaetal diseases in poultry [49].

Ectoparasites infested turkeys in the present study were found to harbored one or mixed ectoparasites species. The mixed infestation of ectoparasites in turkeys as found in this study corroborate with similar findings in other village poultry species like the chickens [16, 36, 42]. The occurrence of mixed infestation of ectoparasites in

domesticated poultry species might be attributed to the poor husbandry and management systems, mixed rearing of different poultry species in the same house, agro-ecology and climatic factors as well as inadequate ectoparasites control measures.

Considering age as one of the hypothesized risk factors associated with ectoparasites infestation in domestic turkeys. The present study revealed significantly high prevalence rate of ectoparasites in adult (44.0%) compared to the young (17.67%) turkeys. Several studies related to the ectoparasites infestations in domesticated poultry have revealed higher prevalence rates in adults birds compared to the young ones [41, 50-52]. In most cases, the reasons have been associated with the fact that adult birds are usually allowed to scavenge through a longer distance areas searching for food and mating mates as well as mingling with other poultry species than the younger birds. However, some researchers have reported the high prevalence rates of ectoparasites in younger birds than in adults [16, 53].

In the present study, the female (33.0%) turkeys were more infested than the male (28.67%) ones, although the difference was not significant. This non-significant variation between the sexes in ectoparasites infestation suggested both sexes of turkeys share equal chance of getting ectoparasites infestation especially where reared in the same pen, allowed to mate with each other, exposed to the same species of ectoparasites fauna and where there is overcrowding, inadequate husbandry system and poor sanitation. Comparatively, several studies have reported high ectoparasites infestation in female compared to the male domesticated poultry species [29, 41, 50-52]. Our finding buttress the reports from other studies conducted by Mohammad, et al. [37]; Sabrina [54]; Banda [34]; Mekuria and Gezahegn [55] and Ekpo, et al. [18] who have also reported that ectoparasites infestation is similar between male and female domesticated poultry species including turkeys. However, the finding of the present study is inconsistent with those of Hadi and Hind [32] who reported significantly high ectoparasites infestation in male turkey compared to the female ones. However, reports from similar researches have excluded the impact of sex to ectoparasites infection in village poultry species [56, 57]. Both sexes are basically reared together without discriminations. Moreover, the high prevalence of ectoparasites in the female turkeys might as well be associated with the reduced distance roaming and stationary in the nest of female birds during incubation of eggs which allows the female turkeys to become more prone to ectoparasites infestations than the males. Although, higher ectoparasites infestation in male than female domestic birds with statistical significance difference have been reported [16, 58, 59].

The present study found that turkeys reared under the extensive management systems (50.0%) are statistical significantly more infested with ectoparasites than those reared under the intensive management system (11.67%). This might be connected to better measures and practices related to good husbandry system, ectoparasites control measures, proper sanitation and feeding employed in intensive compared to extensive system. The high prevalence rate of ectoparasites fauna recorded in extensive management system in the present study could be associated to the majority free-range rearing system of the turkeys practiced in the study area, which might exposes the turkeys to poor hygienic environments thus, enabling them to come in contact with a wide range of ectoparasites. This finding is consistent with reports of Mungube, et al. [58]; Mekuria and Gezahegn [55]; Malann, et al. [51] and Kebede, et al. [41] who have also reported that the free-range scavenging system practiced in rearing the village poultry species in most developing countries provides a more sustainable environment for the parasites coupled with lack of inadequate control measures towards these parasites. Some of the turkeys reared intensively were also found to harbor ectoparasites in the present study, this signifies that infestation by ectoparasites may occur in both management systems where the ectoparasites control measures are inadequate.



Figure-1. Domestic turkeys scavenging on rubbish dump.



Figure-2. Overcrowded intensively reared turkeys in a pen.



Figure-3. Turkey mingling with other domesticated poultry species.

5. CONCLUSION

In conclusion, eight species of ectoparasites were identified infesting turkeys in the present study, with the parasites more in the adults, females and extensively reared turkeys compared to the young, males and intensively managed turkeys. Most of the ectoparasites found in this current study have been reported elsewhere to also infest turkeys and other village poultry species. This indicated the existence of diverse ectoparasites fauna in the study area which is associated with extensive management system, inadequate sanitation, poor husbandry and lack of strategic ectoparasites control practices.

6. RECOMMENDATIONS

To improve turkey production in the study area, it is therefore recommended that poultry farmers should be educated through institutions and public awareness campaign on the economic importance of ectoparasites infestation in turkeys and also to be trained on how to carry out strategic ectoparasites control measures in their poultry flock. The role of Veterinarians in the study area is very important in assisting turkey farmers in using the correct control measures. Therefore, further studies are required to elucidate the economic significance and impacts of multiple ectoparasites infestations on turkeys reared in the current study area.

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