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EPIDEMIOLOGICAL ASSESSMENT OF BODY WEIGHT LOSSES IN POULTRY CAUSED BY ECTOPARASITES: A CASE STUDY OF OLD ORLU, IMO STATE

Uttah, Emmanuel Chukwunenye[1], Eze, Chinedu Nobert[2], Uttah, Faustina Onyinye[1]
[1]Department of Animal and Environmental Biology, University of Cross River State, Calabar.
[2]Department of Biology, University of Agriculture and Environmental Sciences, Umuagwo, Imo State.

The study was aimed at assessing body weight losses in poultry caused by ectoparasites in Old Orlu, Imo State. Confined and free-range chickens were collected from four popular markets in Old Orlu, namely, the Orlu Main market, Eke Mgbidi market, Afor Umuaka market, and Orie Nnempi market. A total of 1000 birds were examined; comprised of 250 from each of the four markets, and sampled equally for confined and free range birds. The highest prevalence of infestation (92.2%) was recorded among the 1.1 - 1.5 kg weight category. The least prevalence rate (65.8%) was among the heaviest weight category (>3.0 kg). Infestation was significantly higher among those in > 2.0 kg weight category than those in the ≤ 2.0 kg weight category ($\times^2$-test= 12.342; p < 0.001). Chicken of the low weight (1.1 – 1.5 kg) category contributed the highest percentage (29.3 %) of all parasites counted in both the males (31.7 %) and females (26.3 %), whereas chicken of the heaviest weight (>3.0 kg) category contributed the least percentage (5.0 %) of all parasites counted; both the male (4.7%) and female (5.3%) chicken. The ectoparasite intensity of those that were ≤ 2.0 kg in weight were significantly higher than the intensity of those that were > 2.0 kg in weight (×2-test = 26.222; p < 0.001). In conclusion, high prevalence and high intensity of ectoparasites resulted in significant body weight losses in chickens in Old Orlu leading to economic losses. Routine actionable protocols for the prevention and control of ectoparasites in Old Orlu is recommended.

Keywords: Ectoparasites, prevalence, poultry, body weight loss, Orlu

1.0 Introduction

Poultry is one of the most important sources of protein for man, and this has resulted into a blossoming industry. Poultry population in Nigeria is about 160 million; with chickens comprising about 72.4 million (Akintunde *et al.,* 2015). Backyard poultry constitutes the most important form of poultry production (Mohammed and Sunday, 2015). The poultry industry plays a vital role in national economies as a revenue provider (Odenu *et al*., 2016). Its role includes improving income of small farmers with small land holdings (Poulsen *et al*., 2000; Yoriyo *et al.,*2008); contributing up to 15% of the country's gross domestic product (GDP) and accounting for 36% of total protein intake of the country (Odenu*et al.,* 2016; Akintunde *et al*., 2015). The trado-cultural and socio-religious acceptability of the production, marketing and consumption of the poultry products could be the principal reason for this success story (Beyene *et al*., 2014; Mohammed and Sunday, 2015).

The main constraints in poultry production in Nigeria are the common poultry diseases caused by poor housing, poor management, and arthropod-borne infections (Akintunde and Adeoti, 2014; Mohammed and Sunday, 2015). Arthropod ectoparasites especially have major impact on husbandry, productivity and welfare of domestic chickens (Bala*et al.*, 2011; Desoky *et al*., 2015). Ectoparasitic taxonomic groups such as lice, mites and fleas, live on domestic chickens (Tamiru *et al*., 2015; Angyiereyiri *et al.*, 2015); and cause severe dermatitis and allergies (Bala *et al*., 2011), anaemia (Zeryehun and Yohannes, 2015), anorexia or death (Permin *et al*., 2002), and may act as vectors for pathogenic agents, such as Rickettsia disease (murine typhus), bacterial disease (plague) and viral disease (myxomatosis) resulting in serious diseases not only in domestic chickens, but also in human population (Bala *et al*., 2011; Asresie and Eshetu, 2015; George *et al*., 2015). Ectoparasites may also cause diseases such as scaly leg and depluming mange. These eventually lead to losses in egg and meat production (Zeryehun and Yohannes, 2015).

Notwithstanding the status of ectoparasites, as one of the major causes of decrease in chicken productivity, they are rarely studied (Dinka *et al*., 2010), and often neglected (Dube and Aisien, 2005).

Periodic examination of the flock can help to detect an early infestation and can help to prevent a larger flock outbreak (Maina, 2005). This is extremely necessary to forestall damages to local poultry Moreki *et al.,* 2003), such as injuries caused during blood-feeding, weight loss, blemishes, and lowered egg production (Kaufman, 2019). This study has become necessary to conduct an epidemiological assessment of weight losses in poultry due to ectoparasitic infestations. The scope will be limited to chickens,*Gallus gallusdomestica*,in communities in the Old Orlu area of Imo State.

2.0 Materials and methods

2.1 Description of the study area

Orlu town is the headquarters of the old Orlu Region in the present Imo State, Nigeria, located between 58358° N and 7.01968° E, having an area of 129.8 km^2 and a population of 420,000 in 2006 census (NPC 2006). It is presently referred to as the Imo West Senatorial zone.

Orlu is characterized by two distinct tropical seasons, the rainy and dry seasons. The rainy season (April to September) with annual rainfall between 200mm and 450mm, while the dry season (November to March) also comes with harmattan weather from December to February during which night temperature is relatively very low.

Majority of inhabitants in Orlu are predominantly agrarian and depend on poultry products either consumed as food (meat and egg) or traded as a source of income.

2.2 Sampling and field examination of the birds

The study consisted mainly of confined and free-range chickens, collected from four popular markets in different areas of the Old Orlu. These markets were Orlu Main market, Eke Mgbidi market, Afor Umuaka market, and OrieNnempi market. In all, a total of 1000 birds were examined. This comprised of 250 chickens examined from each of the four markets and their environs, and sampled equally for confined and free range birds.

2.3 Procedure for examination of birds

The objectives of this study was comprehensively explained to chicken owners prior to the start of the bird examinations, to allay suspicion and to encourage active and honest participation.

Ectoparasites were collected from the birds by displaying the feathers horizontally against their anatomical direction of alignment so as to expose them. Lice were collected from hosts by parting the hairs or feathers, gently brushing the base of the feathers with a fine soft brush so as to prevent injuries on the chickens. Mites were collected by scarping the skin surface with the edge of a slide. All the parasites collected were counted and placed in sampling bottles containing 70% alcohol.

Each chicken examined was assigned a serial number on the sampling bottle for easy identification. Information was obtained regarding each of the chicken sampled including sex, feather patterns, and age of the chickens.

2.4 Identification of parasites

The ectoparasites were placed in 10 % KOH (clearing agent) two to three days before identification. Species determination was based on microscopic examination using dissecting and binocular microscopes to study their morphological characteristics.

2.5 Laboratory analysis

Laboratory analysis involved a thorough examination of the parasites for identification. Samples of the observed parasites were removed with a thumb forceps or camel hair brush and transferred to a petri dish containing 10% alcohol. They were cleared with lactophenol and fixed on a microscopic slide using a little quantity of polyvinyl, alcohol and lactophenol solution before detailed morphological examination and identification using a compound microscope.

2.6 Data analysis

Chi square (χ^2-test) was used to test the significance of differences between the parameters tested while student's t-test was used to analyze difference in parasites intensity. Values of $P<0.05$ will be considered as statistical significant.

The Geometric Mean Intensity (GMI) of infestation was calculated as antilog ($\sum$log (x+1)/n), with x being the number of ectoparasites counted, and *n* being the number of positive individuals examined.

3.0 Results and discussion

3.1 Prevalence of ectoparasitic infestations in relation to weight

Prevalence of ectoparasitic infestations in relation to weight is presented in Table 1. The highest prevalence (92.2%) was among the 1.1 - 1.5 kg weight category followed by 90.2% among 0.6 – 1.0 kg weight category. The least prevalence rates

(65.8% and 71.3%) were among the heaviest weight categories >3.0 kg and 2.5 – 3.0 kg weight categories respectively.

A comparison of prevalence among relatively less weighty (2kg or less) and more weighty (2.2 kg and above) chicken (see Figure 1) shows that prevalence among the former was significantly higher than among the latter ($\times^2$-test= 12.342; $p < 0.001$).

3.2 Parasite Geometric Mean Intensity (GMI) in relation to weight of chicken

The GMI of ectoparasitic infestation in relation to weight of chicken is presented in Table 2. The highest GMI were 7.91 and 7.57 for chicken belonging to the 1.1 – 1.5 kg and 0.6 – 1.0 kg weight categories respectively. The least GMI were 6.14 and 6.37 for chicken belonging to the heaviest weight categories, that is, >3.0 kg and the 2.6 – 3.0 kg respectively.

Relative contributions to parasite intensity by chicken of various weight categories is presented in Figure 2. Chicken of the 1.1 – 1.5 weight category contributed the highest percentage (29.3 %) of all parasites counted in both the males (31.7 %) and females (26.3 %). Furthermore, chicken of the heaviest weight category (>3.0 kg) contributed the least percentage (5.0 %) of all parasites counted in both males (4.7%) and females (5.3%).

For further comparative analysis, the chicken were divided into two broad categories namely, those that were ≤ 2.0 kg and those that were > 2.0 kg, and the parasite intensity of these two groups were compared and presented in Figure 3. The overall parasite intensity of those ≤ 2.0 kg in weight were significantly higher than the parasite intensity of those that were > 2.0 kg in weight ($\times^2$-test = 26.222; $p < 0.001$).

Table 1.Prevalence of ectoparasitic infestations in relation to weight (kg)

Weight (kg)	Number Examined			Number Positive (%)		
	Males	**Females**	**Total**	**Males**	**Females**	**Total**
00 – 0.5	68	52	120	58 (85.3)	44 (84.6)	102 (85.0)
0.6 – 1.0	93	81	174	84 (90.3)	73 (90.1)	157 (90.2)
1.1 – 1.5	171	97	268	156 (91.2)	91 (93.8)	247 (92.2)
1.6 – 2.0	86	77	163	69 (80.2)	63 (81.8)	132 (81.0)
2.1 – 2.5	58	51	109	47 (81.0)	37 (72.5)	84 (77.1)
2.5 – 3.0	46	41	87	33 (71.7)	29 (70.7)	62 (71.3)
>3.0	41	38	79	27 (65.8)	25 (65.8)	52 (65.8)
Total	563	437	1000	474 (84.2)	362 (82.8)	836 (83.6)

Figure 1. Comparing the prevalence between relatively less weighty (2kg or less) and more weighty (2.2 kg and above) chicken

Table 2.GMI of the ectoparasitic infestation in relation to weight (kg)

Weight (kg)	**Males**			**Females**			**Total**		
	No. counted	No. infected	GMI	No. counted	No. infected	GMI	No. counted	No. infected	GMI
0– 0.5	642	58	6.46	456	44	6.12	1098	102	7.00
0.6-1.0	1003	84	6.91	946	73	6.85	1949	157	7.57
1.1-1.5	1631	156	7.40	1106	91	7.01	2737	247	7.91
1.6-2.0	871	69	6.77	774	63	6.65	1645	132	7.41
2.1-2.5	427	47	6.06	444	37	6.10	871	84	6.77
2.6-3.0	331	33	5.80	253	29	5.53	584	62	6.37
>3.0	244	27	5.50	221	25	5.40	465	52	6.14
Total	5149	474	8.55	4200	362	8.34	9349	836	9.14

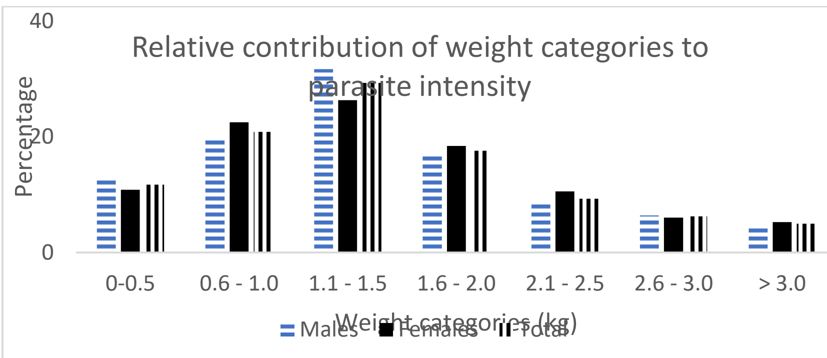

Figure 2. Relative percentage contributions to parasite intensity by chicken of various weight categories

Figure 3. Comparing the percentage contributions to parasite intensity between chicken ≤ 2.0 kg and those >2.0 kg.

Two relationships were established in this study between ectoparasitic infestation and body weight loss in chicken. Firstly, prevalence of infestation was significantly higher among birds in the lower weight (≤ 2.0 kg) than those in the higher weight

(>2.0 kg) category. Secondly, intensity of ectoparasites was significantly higher among birds in the lower weight (≤ 2.0 kg) than those in the higher weight (>2.0 kg) category. These findings are corroborated by the observations of Riwidiharso*et al*. (2020) that the higher the ectoparasites attack, the lower the chicken's body weight. In another study, strong relationship was established between ectoparasite prevalence and chicken weight loss (Nik-Hasan *et al*., 2015; Riwidiharso *et al*., 2020). The highly infested birds with high parasite intensity lost weight due to effects of parasitization such as anaemia, increased stress, feather pecking, and restlessness (Koutinas *et al*., 2019). According to Ikpeze *et al*. (2008), adverse effects of ectoparasitic infestation included irritation, reduced mating potentials in cocks, reduced egg laying in hens, and loss of weight in broilers, pullets and cockerels. Ectoparasites generated a decrease in weight gain among broiler chicken (Sáenz, 2021). All things being equal, chronically infested chickens were found to be underweight when compared with their non-infested counterparts (Akinwunmi *et al*., 1978). Interference with feed consumption by ectoparasites would lead to emaciation, and this together with anaemia (also caused by ectoparasites) brought about weight loss in chicken (Mishra *et al*., 2017). Elucidating further on this, Okechukwu and Ikpeze (2020) stated that infestations by biting, chewing, and suckinglice caused feather-perking, feather-loss, and restlessness in infested chickens, which led to reduced feed in-take, general debility, weight loss and low egg production. Ectoparasitic infestations could result in mortality (Sáenz, 2021), and disease transmission (Kouam *et al*., 2022). Furthermore, skin-damage by biting and sucking activities of lice might reduce market value of chickens (Ikpeze 2008).

Indeed, ectoparasites in chicken are prevalent and a very important factor in poultry (Riwidiharso *et al*., 2020). They have been shown in many studies in both the tropical and temperate regions to cause economic damage (Kaufman, 2019), and to adversely affect economical productivity (Mungube *et al*., 2006 Nyoni *et al*., 2012; Onyekachi, 2021). In the village chicken production systems particularly, ectoparasitic infestation is of great economic importance (Firaol *et al*., 2014). Globally, the annual loss in poultry production, caused by external parasites, has been estimated at one billion US dollars (Akinwunmi *et al*., 1978).

Chicken mortality caused by ectoparasitic infestations is higher than those attributed to some chicken viral infectious diseases such as Newcastle disease and fowl pox disease (Nnadi and George, 2010; Opara *et al*., 2014). High mortality of village poultry pose a serious threat not only to food security and livelihood of many rural families (Musa *et al*., 2008), but to efforts of Government to alleviate poverty and discourage urban migration for white-collar jobs (Lawal *et al.*, 2016).

4.0 Conclusion/ Recommendation

In conclusion, high prevalence and high intensity of ectoparasites result in significant body weight losses among chickens leading to serious economic losses. This calls for planned action on the part of Government for mitigation. In this regard, routine actionable protocols for the prevention and control of ectoparasites should be put in place in Old Orlu, and Imo State in general. Furthermore, mounting robust educative campaigns to create awareness, among poultry farmers, on the economic importance of ectoparasites on the quantity and quality of poultry production has become extremely necessary in Nigeria.

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