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Production Losses Associated with Gastro-Intestinal Helminthiasis in Egg-Laying Domestic-Fowl (*Gallus Gallus Domesticus*: Galliformes) in Poultry Farms in parts of Rivers State, Nigeria

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Abstract
Cases of dead birds, and poorly performing birds, especially egg-layers of the genus *Gallus gallus domesticus:* Galliformes were observed. Post mortem examination of these birds was routinely carried out over a period of six months (February and July 2013). A total of five hundred birds were examined to ascertain the causes of their death and/or poor egg production. Out of this number, two hundred and seven (207) (i.e. 41.4%) of the posted birds were found with helminthes in their gastro-intestinal tracts. The production implications of this level of infestation and their adverse effects on profitable poultry-production was analyzed. This evaluation was done bearing in mind the adverse-effects of gastro-intestinal helminthes on the egg as well as meat production-propensities of the poultry farms in Rivers State. The production-losses associated with the loss of birds and their products were considered. These were observed and reported to be in millions of naira.
Keywords: Domestic fowl, Layers, Helminthiasis, Production loss.

1. Introduction

A substantial level of commercial as well as local poultry production activities are known to exist in Rivers State, Nigeria (Olaka1997; Olaka & Wekhe 1997; Elenwo 2002). These activities cut across the state, although this study focused mainly on Port Harcourt and its environs. As it is the case with most (if not all) parts of the world, the domestic- fowl (*Gallus gallus domesticus:* Galliformes) is a known source of valuable animal-protein (Bincan 1992; Elenwo, 2002; Nnadi & George 2010) -ranking over 90% the world-over (Smith 1990). In addition to nutritional value of chickens, they also improve the income of the poultry farmers (Marizvikuru & Masika 2011). Helminthes in chickens cause health problems ranging from anaemia, diarrhea, poor absorption of nutrients, to anorexia and others. Marizvikuru & Masika (2011) noted that helminthes can transmit other disease agents which can complicate the infection. For example *Heterakis gallinarum* a helminth of *Gallus gallus* transmits *Histmonas meleagridis* an agent that causes histomoniasis and characterized is by low growth rates and high mortality in chicks and low egg production in the adult female (Soulsb 1982). Studies carried out in some regions in Egypt on chickens (Kaingu *et a l* 2010) reported the presence of seven species of intestinal parasites which included majorly the helminthes and concluded that endoparasites are a common health problem in indigenous chicken in Kenya. Job (1992) observed that the average animal-protein availability in Nigeria is less than 5g per head per day and that the role of the domestic-fowl in bridging this protein deficiency gap cannot be over-emphasized as its production has one of the greatest potentials for fast-growth.

Despite the importance and significance of the domestic fowl production vis-à-vis the economic, nutritional and social importance in the world, Nigeria and the Niger-Delta region, gastro-intestinal parasites, especially helminthes have been observed, known and reported to be a major barrier to profitable and productive domestic-fowl production (Shah-Fischer & Say 1981; Baines 1979; Soulsby 1982; Mcnitt 1983; Obiora *et al* 1983; Olaka & Wekhe 1997; Vetech 2000; Elenwo 2002). Jordan & Anderson (2009) noted that severe forms of helminthosis retard growth of growing chickens leading to loss of productivity.

Elenwo (2002) and Shane (2005) indicated gastro-intestinal helmintiasis as responsible for tremendous losses in poultry production numerically running into hundreds of thousands of eggs and carcasses in Nigeria and the United State of America respectively. This, no doubts, leads to huge losses in the much-needed animal-protein. Limited studies have been carried out on commercial farms, which raise mainly exotic birds, on the gastro-intestinal helminthes in different parts of Nigeria by various workers, like Umeche & Eno (1987); Oyeka (1989); Obiora *et al* (1983) and Obanu *et al* (1984). However, little or nothing has been done on the actual or quantitative-losses associated with the presence and activities of gastro-intestinal helminthes in the domestic fowl generally and in Rivers State of Nigeria in particular.

The foregoing and the fact that several farmers in Rivers State have continued to suffer significant losses which

could be traced to helminthes infections of the gastro-intestinal tract; spurred these authors to investigate the infections, the associated deaths and poor production performance (especially egg production) and their related losses. Thus, these authors believe that this research and report would make these neglected killers and "economic saboteurs" to become better recognized for what they are and be more drastically and concertedly dealt-with until poultry production (and particularly domestic-fowl production) becomes adequately benefited from as should be, in River State, the Niger-Delta, Nigeria and the entire tropical world.

This paper is therefore, devoted to analyzing the production-loss implications of gastro-intestinal helminthiasis in domestic-fowl production, stimulated by cases of deaths and poor-performance reported in and observed from some poultry farms in Rivers State in the Niger Delta region of Nigeria. This research report is based on observed frequent cases of dead and poorly-performing birds (i.e. domestic-fowls) whose causes were found (through *post mortem* examination) to be gastro-intestinal helminthiasis / helminthosis.

2. Materials and Methods

2.1 Study area

The domestic-fowls (*Gallus gallus domesticus:* Galliformes) involved in this study were from poultry farms covering five Local Government Areas in Rivers State, Nigeria. These farms were either visited or dead and (sometimes) live-birds were obtained from the farms by these authors.

Further information was obtained from case histories on the birds and the farms accordingly. Domestic-fowls of different ages (between two (2) weeks of age to over seventy-two (72) weeks old) were involved in this study. The birds comprised of pullets and layers, most of which (about 95%) were being raised on deep-litter, while 5% were raised on cages.

The case-histories of the birds and farms were usually taken corroborating Tudor (1967) and Fraser *et al* (1986). The birds were externally examined and observations noted. The observations were made with unaided eyes, touching and palpation, watching the attitude, demeanor and general external appearances of the birds. Some of the farms were visited to examine/observe the poultry-pens, the litters, cages and droppings of the birds, etc. The visits also helped these authors to evaluate losses associated with helminthiasis in poultry-production in terms of:

- Egg-losses due to death of layers
- Egg-losses due to reduced egg-production
- Meat-losses due to death of layers, and
- Manure-losses due to death of layers

2.2 Parasite identification and analysis

The birds were systematically opened-up (i.e. dissected) with the aids of sharp metal knives and scissors, hands protected with disposable surgical-gloves. The dissected sections with/and their contents were examined grossly (with unaided-eyes) and microscopically (i.e. with optical hand-lens and light-microscope) for characteristic/typical lesions of the infective-agents and/or cause(s) of the deaths.

The alimentary tracts of the birds were usually removed from the body-cavities; the various parts (esophagus, crop, gizzard, intestine, caecum and rectum) were separated by ligature, to prevent the transfer of helminthes from one site to the other (if present). These parts were separately cut-open and their contents washed into separate containers under running water. The volume of each was made-up to two (2) liters, thoroughly mixed, the duplicate 200ml transferred to suitably labeled containers and preserved in 10%-formalin. The crop-mucosa were scraped-off and digested in a pepsin hydrochloric acid (HCL) mixture at 37% for six (6) hours.

Digests were made up to volumes of 2 liters with cold water and again 200mls of the sample duplicates taken. The intestinal-contents were taken and treated as for the crops but without scraping and digesting the intestinal-mucosae. The contents of the caeca were passed through a coarse mesh sieve (2-3mm appature) for any parasites present to be collected for preservation. 8.2mls of iodine solution was added to each 200ml sample above to make parasites' identification and collection easier (if present). After thoroughly mixing, 4mls of each suspension were separately and at various times transferred to petri-dish for parasites' identification. The worms seen were isolated and preserved in 10%-formalin after washing in saline. The larger worms were clearly seen without the microscope while the smaller and tiny ones were examined and better seen with microscope.

The high-number of birds observed to have helminthes (adults developmental-stages, particularly worm-eggs) and high mortality observed in the birds examined in this study caused these authors some serious concern, which led to the authors' decision to evaluate the production-loss implications of these deaths. These analyses are therefore based on the prevailing productivity of the poultry industry in Nigeria, particularly Rivers State. The analyses here are based on average/expected/estimated egg-production rates of the studied-farms to ascertain or proffer the loss-values of the birds at the various points at which they died. The loss of such other valuables as the meat and manure that should have come from the birds had they not died or adversely-been affected, were associated with the activities of the helminthes parasites

3. Results

The effects of helminthes infection on poultry (domestic fowl) production were reviewed from three major (and one minor) points with the results as shown below:

- Egg-losses due to death of layers
- Egg-losses due to reduced egg-production
- Meat-loss due to death of layers, and
- Manure-loss due to death of layers

3.1 Analyses of the production-losses in farms examined:

The number and percentage of dead layers due to helminthes infection are shown in table 1.

- . Losses from death of 207 layers
- Total no. of dead-birds examined post-mortem = 500
- **No. of layers lost (dead) due to helminthiasis = 207.**
- Percentage of layers dead by helminthiasis = 41.4%

3.1.1 Egg-loss due to death of Layers:

A layer is expected to produce between 250 and 280 eggs annually. A farm raising/housing 1000 laying-birds would have between 250.000 and 280,000 eggs, *per annum*. This could average 270,000 eggs (annually). Reports have shown that helminthosis causes between 40% and 60% deaths (loss) of domestic-fowl population on a farm. Where there is death of an average percentage (50%) of the birds due to gastro-intestinal helminthes infection, this amounts to 50% of 270,000 eggs = 135,000 eggs/year. This is equivalent to 4,500 crates of egg/year, table 2. These birds can lay for another two years. This gives a total of 2½ years of egg-production (i.e. 4,500 x 2½) =11,850 crates.

3.1.2 Egg-Loss due to reduced egg-production by the affected Layers:

Gastro-intestinal helminthes cause up to 60% reduction of egg-production in domestic fowl. One layer produces an average of 270 eggs annually. This means that the presence and/or activities of gastro-intestinal helminthes in the domestic-fowl reduce egg-production by 162 eggs per bird per annum. If the birds found with helminthiasis did not die but had reduced egg-lay, the presence of gastro-intestinal helminthes would cause a loss of up to 207 x62 eggs =33,034 eggs. This is equivalent to loss of 1101.1 crates of eggs per year, table 3.

3.13 Meat losses due to death of Layers:

In addition to egg-loss, the death of a layer also brings about meat-loss. This is because laying-birds have their meat mature and-enough for human-consumption. As such the loss of layers constitute a huge loss in meat-production and the much-needed animal-protein. The world Health Organization (WHO) recommended a minimum of 11g of animal-protein per person per day. The minimum carcass-weight of a laying domestic-fowl is 2kg. The loss of 207 laying birds obviously implies that the meat-loss will amount to 207 x 2kg = 414kg, table 4. This is equivalent to 4,140,000g of animal-protein which could have been enough to meet-up with the quantity required by 376,363 persons per in one day.

3.1.4 manure-loss due to death of layers:

A mature egg-laying bird is expected / estimated to produce up to 2kg of faeces in one month. Where such a bird is lost (due to death or sacrificed) there will be no more faeces (poultry-droppings) from it. It is known and has been reported that poultry-droppings are useful as manure in crop-production and feed in aquaculture, hence the importance of poultry-droppings as they have become part of the expected and necessary produce/products of poultry-production. In relation to the layers lost due to helminthiasis in this study, it becomes imperative that loss of 207 layers will result in the loss of manure and/or fish-feed to the tune of 207 times the quantity/volume produceable by one laying over a period of one year minimally expected of a layer to have laid eggs if it did not die during such expected minimum laying period.

4. Discussion

Although the losses in poultry production involve birds of different ages. This study involved and concentrated on the losses occurred in those at the point-of-lay. The estimated and associated production-losses here were observed to occur in four ways viz:

- . Egg-loss due to death of layers,
- Eggs loss due to reduced egg-production by layers.
- Meat-loss due to death of layers, and
- Manure-loss due to death of layers

From the results above two hundred and seven domestic fowl carcasses obviously may not have been the only birds that died due to gastro-intestinal helminthaisis on the farms. They were only the ones that were made

available for post-mortem examination, which had helminthes in them.
This research showed that gastro-intestinal helminthes infections can and do cause losses in egg-production, meat-production and poultry-manure that translate to loss of several crates of eggs, loss of much-needed animal-protein from the eggs and meat, as well as loss of manure from the dead-birds on the long-run. For example, figures as high as over thirty-three thousand and more crates of eggs, over 370,000 grams of animal-protein, and over 5,000 kilograms of poultry-manure, were recorded. as losses associated with direct loss of domestic-fowls, which could be more, especially where the farmers involved have an average of one thousand domestic fowls each.
These, no doubts, show that gastro-intestinal helminthes are no friends to the poultry farmers and human-beings generally, especially where human-nutrition and profitability of the poultry (domestic-fowl) production ventures are concerned.

Conclusion
The egg-production and human-nutrition losses caused by (or at least associated with) gastro-intestinal helminthes-infection in domestic fowl in the tropics generally and in Port Harcourt and its environs (in Rivers State, Nigeria) in particular cannot be over-emphasized. As such, it should neither be over-looked, nor wished-away.
This stems from the observed and reported losses (as shown above) associated with the presence of gastro-intestinal helminthes on domestic-fowl farms/production ventures. Many species of parasites inhabit the gastrointestinal tract of the domestic fowl and do interfere with its physiology. Fabiyi (1972) observed nematode parasites, cestodes and trematodes from the faecal droppings of domestic fowls obtained from various markets in Plateau State, Nigeria. The presence of these parasites have been described as "ubiquitous" yet not much is being done anymore (or at all) to commensurate the enormity of the damage they are causing/posing to egg-layers productivity, human nutrition as well as the attribute and (inadvertently) the health of the people in the tropics and particularly Nigerians. Factors that are likely to generate excessive helminthes infestation in the domestic birds include, improperly constructed poultry pens, leaking roof or water from the drinking troughs which dampen the floor and provide breeding grounds for the helminthes. Studies have also noted that insects, other arthropods, rats, lizard and even poultry attendants are either sources or agents of gastrointestinal parasites of domestic fowl in the poultry farms as they contaminate the environment, poultry houses, feeds and water with infective stages of these gastro intestinal parasites (Fraser *et al* 1986; Olaka & Wekhe, 1997) .This research therefore reveals much that should warrant a re-focus on gastro-intestinal helminthes (in particular) and helminthiasis generally, with the aim of eradicating or (at least) reducing their occurrences and associated damages drastically. The need for further research and necessary action(s) against these parasites has become an emergency and should be treated as such. The need for total eradication is obvious since these parasites cause the poultry farmers, poultry-production and human-nutrition a reasonable/significant ratio or percentage of their productivity, profit and associated benefits.

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Table 1: Loss of birds due to helminthiasis

Number of birds examine post-mortem	500 birds
Number of layers with helminthes	207 birds
Percentage of layers lost from helminthiasis	41.4%

Table 2. Egg-loss due to death of Layers

Number of birds with helminthes	207 birds
Expected average number of eggs per bird per year	270 eggs
Estimated average number of eggs lost by death of 207 birds	207 x 270 eggs = 45,890 eggs
Number of crates of eggs lost by the death of 207 egg-layers due to helminthiasis	45,890 eggs divided by. 30 = 1,529, 08 crates (had the birds been alive and laid eggs for 1year.)

Table 3. Egg-loss due to reduced productivity (egg-lay) of Layers**.**

Number of birds with helminthes	207 birds
Expected average number of eggs per bird per year	270 eggs
Estimated average number of eggs lost by (60%) reduced productivity of 207 birds.	207 x 162 eggs = 33,034 eggs
No.No.Number of crates of eggs lost by (60%) due to helminthiasis	33,034 eggs divided by 30 – 1,101.1 crates (where the birds alive and laid eggs for 1year).

Table 4. Meat-losses due to death of Layers

Number of Layers lost by helminthiasis	207
Volume (kg) of meat lost by helminthiasis	207 x 2kg = 414kg
Volume(g) meat/animal protein lost by helminthiasis	4,140,000g
Number of persons denied animal-protein per day by this loss	376,363 persons

Table 5. Manure-loss due to death of Layers

Number of layers lost by helminthiasis	207
Volume of (kg) manure lost by a layer per month	2kg
Volume of (kg) manure lost by 207 birds in a year	207 x 2kg x 12= 4,968 kg