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Geohelminth infections in egg laying domestic fowls and associated financial losses in poultry production

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Abstract
Domestic fowls especially egg layers (of the genus *Gallus gallus domesticus*: Galliformis) in different poultry farms in Rivers State of Nigeria were observed to either die in their numbers or perform poorly. On post mortem examinations of 500 birds carcasses which were routinely carried out over a period of 6 months, it was observed tha tmany of them had parasitic helminthes in their gastro intestinal tracts.These were majorly responsible for much of the mortality and low productivity in the birds.Two hundred and seven(207 ie 41.4%) of them were found with helminthes in their gastro-intestinal tracts. These included several species of stomach and intestinal worms such as *Ascariidia galli*(50.2%),*Taenia*sp.(40.6%), *Heterakis gallinaerium*(4.3%),*Capillaria retunsa*(2.9%)and *Tetramere americana*(1.9%).Two of the helminthic species-*Taenia* sp. and *Ascariidia* sp. were found to cause more severe damage to the layers especially in terms of mortality and loss of eggs. The economic implications(costs of prophylaxis and other therapeutic measures for prevention and/or removal of the helminthes in these poultry farms) of this level of infestation and their adverse effects on profitable commercial poultry-production was analyzed. The financial losses associated with the loss of the birds and their products were considered. This was observed and reported to be in millions of naira.
Keywords: Domestic fowl, Egg layers, Financial loss, helminthosis.

1.Introduction

The domestic fowl (*Gallus gallusdomesticus*:Galliformes) is a known source of valuable animal protein and promotes the nutritional and financial status of the farmers.Elenwo (2000) reported that a poultry farmer raising 500 birds makes a profit of over a million naira in one-year of layer-production (from sale of eggsand spent or old-layers).The sources ofprotein from poultryare the meat and eggs and ranking over 90% the world over (Smith 1990). In 2007, Food and Agriculture Organization (FAO) reported that about 20 billion poultry exist worldwide, and of these, about 15 billion (75%) are in developing countries (Marizvikuru & Masika 2011).

From past records, it was learnt that the average animal protein availability in Nigeria was less than 5g per head per day. However, 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 and rapid returns(Job 1992). The profit could be more, as proceeds would come from the droppings (as manure for crop,agriculture and/or feed for aquaculture) as well.

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 domestic fowl production (Shah-Fischer & Say, 1981; Baines 1979; Soulsby 1982; Mcnitt 1983; Obioha *et al* 1989; Olaka & Wekhe, 1997; Vetech 2000; Elenwo 2002).

It has been estimated that a healthy layer produces between 270 and 280 eggs annually, and so a farmer raising about 1000 laying birds, would have between 270,000 and 280,000 eggs per annum (Elenwo & Okafor-Elenwo, 2014). Reports have shown that helminthosis causes between 40% and 60% deaths (losses) of domestic fowls on a farm.In this instance, a 50% loss of 270,000 eggs due to the activities of gastro intestinal helminthosis would be 135,000 eggs lost, equivalent to 4,500 crates (Elenwo & Okafor-Elenwo 2014).In addition to loss of eggs due to the death of the layers, the authors also reported huge egg loss due to reduced egg production by the layers, meat loss due to the death of the layers and manure loss due to the death of the layers. Limited studies have been carried out on commercial farms, which raise mainly exotic birds, on the gastro-intestinal helminthes in different part 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 possible financial losses associated with the presence and activities of gastro-intestinal helminthes of 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 helminth 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 economic losses (particularly in monetary terms). Thus, we believe that this would make these neglected killers

and 'economic saboteurs' become better recognized by 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 Rivers State, the Niger Delta, Nigeria and the entire tropical world.

This paper is therefore devoted to analyzing the huge financial losses due to gastro-intestinal helminthiasis in egg-laying domestic-fowl production. These study and analyses were stimulated by cases of deaths and poor performances reported in and observed from some poultry farms in Rivers State.

2. Materials and Methods

2.1 Study sites and sample collection.

The domestic-fowl (*Gallus gallusdomesticus:* Galliformes) involved in this study were from poultry farms covering five Local Government Areas in Rivers State, Nigeria. These farms were either visited or, death and (sometimes) live-birds were obtained from the farms.Information on the case histories of the birds and the farms were obtained(corroborating Tudor, 1967 and Fraser *et al*, 1986). Domestic-fowls of different ages between two (2) weeks of age to over seventy-two (72) weeks old were examined, although only those that were lost as laying birds were involved in this study. The birds were composed of layers and pullets, most of which (about 95%) were being raised on deep-litter, while 5% were raised on cages. They were taken to the veterinary clinic for thorough examination.

2.2. External and internal examinations of the domestic fowls.

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 (house), the litters, cages and droppings of the birds, etc.

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 their contents were examined with unaided-eyes as well as optical hand-lens and light microscope, for characteristic/typical lesions and/or cause(s) of the deaths.

2.3.Preparation of the digestive organs for examination.

The alimentary tracts of the birds were usually removed from the body cavities and the various parts (esophagus, crop, gizzard, intestine, caecum and rectum) ligated separately. This was done to prevent the transfer of the helminthes from one site to the other, Thereafter they wereseparately opened and their contents washed into various 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 mucosae were scraped-off and digested in pepsin hydrochloric acid (HCL) mixtures at 37% for six (6) hours.

Digests were made up to volumes of 2 liters with cold water and again 200ml 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 mash-sieve (2-3mm apparatus) for any parasites present to be collected for preservation. 8.2mls iodine solution was added to each 200ml sample above to make parasites' identification and collection easier (if present). After thoroughly mixing, 4ml 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 tinnier ones were examined and better seen with microscope.

The high mortality observed in the birds (up to 41.4% of the 500 birds) involved in this study causesome serious concern, which motivated our decision to evaluate these deaths and their associated financial involvements and implications on domestic-fowl production and/or profitability. These economic analyses are therefore based on the prevailing situations, such as contemporary market-values of egg-layers in the poultry industry in Nigeria, particularly Rivers State. The analyses here are based on the estimated production costs (EPC), costs of procurement (COP) of the birds, and costs of inputs procurement (CIP) to ascertain or proffer the values of the birds at the points at which they died. The loss of such other valuables as the eggs, meat and faeces (i.e. droppings as manure and/or fish-feeds) that should have come from the birds had they not died or adversely been affected by the helminthes and their associated activities. The prophylactic and therapeutic expenses due to helminthiasis/helminthoses of the birds were analyzed.

3.Results

Five species of parasitic helminthes were obtained from different sites in the gastrointestinal tract of the domestic fowls examined. These were *Ascariidiagalli, Taenia sp. Heterakisgallinaerium, Capillariaretunsa and Tetramereamericana.*The rate of occurrence of the helminthes in the domestic fowl was shown in table 1. *A.galli* (50.2%) and *Taenia* sp.(40.6%) occurred higher than the others, while *Tetramere americanus* was lowest in occurrence(1.9%).

The financial implications of (financial-losses associated with) helminth infection(helminthiasis/helminthosis) on domestic fowl egg-layers production were reviewed from four major points and the results are as shown below:

- Egg-loss due to death of layers,

- Eggs loss due to reduced eggproduction by layers.
- Meat-loss due to death of layers, and
- Manure-loss due to death of layers.

3.1. Egg-loss due to death of layers

- Analyses of the financial loss due to death of 207 birds in the farms examined table 3: Total number of deadbirds examined post-mortem = 500

Number of domesticfowls lost (dead) due to helminthiasis/helminthosis = 207.

The losses at the point-of-lay were valued at about N1,500 for one bird(as at December, 2013). For 207 birds, the total sum of money lost is

207 x N1,500 = N310, 500.00

Considering the number of eggs expected from birds to be 260 per annum, thebirds would have produced -

207(layers) x 260 eggs =53,820 eggs,that is 1794 crates of eggs.

- In monetary terms:

A crate of egg is sold for N800 (February, 2014), then 53,820 eggs that is

1794x 800 = N1,535,200.00

On the whole, the farms examined lost a total of

N310,500 + N1,535,200 =N1,845,700.00

in six months due to gastro-intestinal helminthinfection/activities.

3.2. Egg-Loss due to reduced eggproductionby affected (i.e. infected 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 table 4.

If the birds found with helminthiasis did not die but had reduced egg-lay, the presence of gastrointestinal helminthes would cause a loss of up to-

207 x 162 eggs =33,534 eggs.

This is equivalent to loss of about 1,118 crates of eggs per year.

3.3. Meat-lossesdue to death of layers.

In addition to egg-loss, the death of a layer also brings about meat-loss. This is because layingbirds have their meat mature andenough for humanconsumption. 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 table7. The loss of 207 laying birds obviously implies that the meat-loss will amount to-

207 x 2kg = 414kg table 5.

This is equivalent to 4,140,000g of animal-protein which could have been enough to meat-up with the quantity required by 376,363 persons per in one day.

3.4.Poultry-droppings (manure/fish-feed) loss due to death of layers:

A mature egg-laying bird is expected/estimated to produce upto 2kg of faeces in one mont table 6. 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 poultryproduction. 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.This is quantity/volume produceable by one laying birdover 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.

However, knowing that the two hundred and seven (207) carcasses examined were not the only deaths recorded in the two hundred and fifty poultry farms involved in this study, further picture of the financial losses caused by or associated with gastro-intestinal helminthiasis/helminthosis of the domestic-fowl can be seen by the following analysis;

3.4.Cost of Medication (prophylaxis and therapeutics) against gastro-Intestinal helminthes:

This involves the appraisal of the costs of prevention, controlling and/or treatment of the birds, bearing in mind the ubiquitous nature of these gastro-intestinal parasites table 7viz.

Under good poultry management practices, the birds would normally be medicated against helminthes up to five (5) times, these would cost up to two hundred and fifty (250) naira (about $1.80) per bird (between day-old and fifty-second (52^{nd}) week of age i.e. (one year old).

For a farm raising 1000 layers, to control/address gastro intestinal helminthes problems on the farm, the farmer would spend

N250 x 1000 = N250,000.00 (i.e. about $ 1666.67) annually.

Since a layer farm can produce eggs up to three (3) years under good management, with the birds living up to three (3) years before being disposed of as spent layers, the farmer could spend up to-
N250,000.00 x3 = N750,000.00 (i.e about $5000).
For the farms involved in this study, if all were raising 1000 layers each, it means that in one year, the farms in the area would spend-
N250,000.00 x 250 = N62,500,000 (about $416,666.67),
per year in the control/treatment of gastro-intestinal helminthes alone.
For three years of keeping these layers. The total expense on the control/treatment of gastro-intestinal helminthes on the farm could get up to
N62,500,000.00 x 3 = N187,500,000.00 (about $1,250,000).

3.5.Estimated Economic/financial Losses based on the value of Birds at Point/Age `of Death:
This gives a picture of what the death of the birds at various ages would translate of in monetary terms.
3.5.1. The loss of birds based on the point of death.
This was looked at on various ages.

- The loss of expected eggs from the dead birds especially when they have reached egg production ages before they died.
- Loss based on the value (i.e. EPC) of the birdpoint of death.

***3.5.2. Loss at age of two weeks*:**
A pullet at two weeks old is valued at N350 (i.e. about $2.33). The death of a pullet at two weeks due to helminth-infection of the gastro-intestinal tract would result in the loss of N350 ($ 2.33).
With up to 50% of the birds dying as a result, a farm raising 1000 pullets would lose x 500 x N350=N175,000 when the birds die at two weeks old. For 250 farms in this study, the loss of pullets at two weeks old due togastro-intestinal helminthiasis/helminthosis equals.
N175,000 x 250 = N43, 750,000.00 (about $291, 666.67) annually .
3.5.3 Death at Point of Lay (P. O. L).
If the birds died at point of lay (i.e. between 18th and 24th weeks of age) one of such birds is valued at N2,500 (about $ 16.67) based on EPC (as most of the routine (i.e. prophylactic), operations (vaccinations, deworming, anti- bacterial, debeaking, etc.) would have been done at this age the birds are also old-enough for consumption). With 50% dying, a farm with 1000 at the point of lay would lose,
N500 x 1000 = N500,000.00 (about $3333.33).
for the 250 farms in this study, the loss of pullet at P. O. L level=
250 x N5,000,000 = N125,000,000.00 ($833,333.33).
***3.5.4. Death of Laying Birds*:** (i.e. above 24 weeks of Age):
When birds are lost as layers, the death of one would be a 'dual-handed' loss to the farm, viz:

- Loss of the birds and input to age of lay (i.e. loss of EPC) and
- Loss of eggs,
  However, the loss of eggs would be handled separately in this paper. When bird dies as a layer, following gastro-intestinal helminthiasis/helminthosis, a farm in Rivers State (especially Port Harcourt and its environ) losses at least N1,500.00

For a farm having 1000 layers, with death of 50% the loss would be-
N1,500 x 500 = N750,000 ($5,000).
For 250 farms, the total sum lost when birds die as layers equals-
N750,000 x 250=N187,500,000.00 (about $250,000) per annum.

3.5.5. Egg-Loss due to reduced egg production by affected layers
It is known and has been reported that gastro-intestinal helminthes cause up to 60% loss of egg-production in domestic fowl. It is also known that one layer produces an average of 270 eggs annually. This means that the activities of gastro-intestinal helminthes in the domestic-fowl can reduce this by 162 eggs per bird per annum.
In a farm having 1,000 layers, the presence of gastro-intestinal helminthes would cause a loss of up to 162,000 eggs, (where the birds did not die of the infection). This is equivalent to loss of 5,400 crates of eggs year. In monetary terms, the farm would lose
N800 x 5,400 = N4,320,000 ($ 28,800.00).
Where this be the case in the 250 farms evaluated in this study, the loss of egg-production (by reduction) in the area of this study, would be-
N4,320,000.00 x 250 = N1,080,000,000.00 (about $72,000.00).

Table 1. Prevalence of helminth parasites in the domestic fowls

Parasite type	Number of fowls infected	Percentage infection
Ascariidiagalli	**104**	**50.2**
Taenia sp.	**84**	**40.6**
Heterakisgallinaerium	**9**	**4.3**
Capillariaretunsa	**6**	**2.9**
TetramereAmericana	**4**	**1.9**

Table 2. Loss of birds due to helminthiasis

No. of birds examine post-mortem	500 birds
No. of birds with helminthes	207 birds
%age of birds lost from helminthiasis	41.4%

Table3: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 / 30 =1,529 crates.
Cost of number of eggs (crates) lost @ N800 per crate	1,529.08 crate x N800 =N1,224,263.00

Table 4:Egg-loss due to reduced productivity (egg-lay) of layers

Number of birds with helminthes	207 birds
Expected average no. of eggs per bird per year	270 eggs
Estimated average no. of eggs lost by (60%) reduced productivity of 207 birds	207 x 162 eggs = 33,034 eggs
No. of crates of eggs lost by (60%) reduced of 207 egg-layers dueto helminthiasis	33,034/ 30 = 1,101 crates (were the birds alive and laid eggs for 1year).
Cost of crates (of eggs) lost due to reduced productivity @ N800/crate	1,101 x N800 = N880,800 (were the birds alive and laid eggs for 1year)

Table 5: 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/animalprotein lost by helminthiasis	4,140,000g
Cost of meat lost @ N1,500 per 2kg of bird	207 x N1,500 = N310,500

Table 6: Droppings-loss due to death of layers

No. of layers lost by helminthiasis	207
Volume (in kg) of droppings (Manure/fish-feed) lost by a layer per month	2kg
Volume (in kg) of droppings (Manure/fish-feed) lost by 207 birds in a year	207 x 2kg x 12= 4,968 kg = 198.72 bags
Cost of poultry-droppings for fish-feed/crop-manure @ N200/bag	N200 x 198.72 = N38,744.00

Table 7: Over-all financial-loss due to death of layers:

Cost of egglosses due to death of layers	1,529.08 crates x N800 = N1,224,263.00
Cost of Meatlosses due to death of layers	207birds x N1,500 = N310,500
Droppings-loss due to death of layers	N200 x 198.72 = N38,744.00
Over-all financial-loss due to death of layers	N1,224,263 + N310,500 + N38,744.00 = N1,573,507.00

4. Discussion

From the results above both prophylactic and therapeutic administrations against gastrointestinal helminthinfections are of appreciable economic significance to the poultry farmers. The two hundred and seven domestic fowl carcasses found to have been affected by gastro-intestinal helminthes caused a financial-loss of two hundred and seven thousand naira (N207,000) based on their values, and, eight hundred and seven thousand three hundred naira (N807, 300), due to reduced egg-production, giving a total of one million, fourteen thousand, three hundred (N1,014,300) as the associated financial-loss. These obviously may not have been the only birds that died due to gastro-intestinal helminthiasis on the farms. They were only the ones that were made available for post mortem examination, which had helminthes in them.

However, going by earlier research findings/reports, some estimations were drawn from the findings of this research which gave 'pictures' showing that gastro-intestinal helminthinfections can and do cause financial-losses that translate to millions of naira on the long-run, in the area studied. For example, figures as high as one hundred and eighty seven million, five hundred thousand naira (N187, 500,000) and one billion, two hundred and sixty five million, six hundred and twenty-five thousand naira (N1,265,625,000) were recorded as possible level of losses associated with direct loss of domestic fowls and those of eggs accrued from such deaths respectively, where the farmers involved have an average of one thousand domestic fowls each.

In line with the foregoing, a number of researchers had commented on the dangers of helminthiasis in fowls whether they be exotic or indigenous .Gastrointestinal helminthes was said to hamper the productivity of chickens as it not only cause direct diseases but also can transmit diseases from various agents with devastating effects (Marizvikuru&Masika 2011). There had been reported cases of chickens having anaemia, diarrhea, poor absorption of nutrients, low growth rate and high mortality as a result of helminthiasis (Soulsby Vetech 2000; Kaingu *et al* 2010; Elenwo & Okafor-Elenwo, 2014).

These, no doubts, show that gastro-intestinal helminthes are no friends to the poultry farmers especially where profitability of the ventures is concerned.

5. Conclusion.

The Financial implications of gastro-intestinal helminth infection in domestic fowl production in the tropics generally and in Rivers State of Nigeria in particular cannot be over-emphasized. As such, it can 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 in or on domestic-fowl farms/production ventures. 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 the economy as well as the nutrition and (inadvertently) the health of the people in the tropics and particularly Nigerians. 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 both prophylactic and therapeutic actions against these parasites cost the poultry farmers a reasonable/significant ratio or percentage of their profit.

References

Baines, B. S. (1979) "*A Manual of Poultry Diseases*". F. HoffinanLA Roche and Ltd Company: Basle, Switzerland. 162, 247-252.

Bincan, J. N. (1992). "*The Nigerian Livestock Industry Problems and Prospects*"

A Key note address presented at aworkshop on the Nigerian Livestock Industry held in April, 1992 in Jos by Livestock Planning, Monitoring and Evaluating.Unit, Federal Ministry of Agriculture and Rural Development, Abuja, Nigeria.

Elenwo, A. C. (2002). "Gastro-Intestinal Parasites of Exotic domestic Fowl (*Gallus gallus domesticus:* Galliformes) and Their Effects on Commercial Poultry Production in Port Harcourt and its Environs". A postgraduate Thesis, Universityof Port-Harcourt, Nigeria.

Elenwo A. C. & Okafor-Elenwo E. J. (2014)."Production losses associated with gastrointestinal helminthiasis in egg laying domestic fowl (*Gallus gallus domesticus*: Galliformes)in poultry farms in parts of Rivers State, Nigeria". Journal of Natural Science Research, Vol.4(1): 14-19.

Fraser, C. M. A. & Huebner, R. A. (1986)."*A handbook of Diagnosis Therapy, Disease Prevention and Control for Veterinarians"*8th Edition Merck and Co. Inc. Rahway.New York Jersey U.S.A 93.

Job. T. A. (1992). "Poultry Production in Nigeria: Status, Problem and Prospects proceedings of Workshop on Proposed Livestock Subsector Review": *The Nigerians Livestock Industry Problem and Pprospects: held in Jos Plateau State, Nigeria*, Feb, 26-27, 1991, 100-108.

Marizvikuru, M. & Masika, P. (2011) "Point prevalence study of gastrointestinal parasites in village chickens of Central District South Africa". African Journal of Agricultural Research, Vol.6(9): 2033-2038.

Mcnitt, J. I. (1983)."*Livestock Husbandary Techniques"*, EIBS Lowprice Edition, London 199241.

Obanu, Z. A; Obioha, E. C; Nwosu, C. C. & Nwafor, W. E. (1984)."Evaluation of the Organolepic and Chemical Characteristics of meat from the Nigerian native chicken and Exotic Strain". *World Review of Animal Production*, 20: 53 57

Obioha, F. C., Nwosu, C. C. Gown f., Etim, D. E., Oanu, Z. A. Ihemelandu, E. & Onuora, G. I (1983)."Comparative meat yield and anthropometic indices of the Nigerian native chicken and exotic strain". W*orld Review of Animal Production*, 9:59-64.

Olaka, O. S. (1997). *"A Laboratory Manual for the Diagnosis of Animal Parasitic Diseases"*U. S. T. Port Harcourt.39-46.

Olaka, O. S. & Wekhe, S. N (1997). "The Role of Gastro-Intestinal Parasites in Livestock" in Port Harcourt and Environs, Rivers, State. *Deltal Agric*4:1-5.

Oyeka C. A (1989)."Prevalence of Intestinal Helminths in Poultry Farms in Anambra State Nigeria".*Bulletins of Animal Health and Production in Africa*.37: 217-220 .

Shane, S. (2005). "Handbook on poultry Disease".*Technical Bulletin: Poultry*, Dalilah Gahzalay: http://www.asasea.com.!

Shah-Fischer, M.& Say, R. R. (1981)."*Manual of Tropical Veterinary Parasitology"*C. A. B International. 111-151.

Smith, A. J. (1990). "The tropical agriculturalist-poultry". Centre for Tropical Veterinary Medicine University of Edinburgh. C. T.A Macmillan Publishing Co.

Soulsby, E.J. L. (1968) "*Helminths, Arthropods and Protozoa of Domesticated Animals"*.6th Edition.BaillereTindall and Cassel, London.

Soulsby, E.J.L. (1982). "*Helminths, Arthropods and protozoa of Domesticated animals* 8th Edition. ElBS. London.

Vetech Laboratories Inc. (2000). "*Immunocox Coccidiosis Vaccine*,"The Natural Solution forCoccidiosis Control with a future, 3-13.