UNIVERSITY OF NAIROBI

COLLEGE OF AGRICULTURE AND VETERINARY SCIENCES

FACULTY OF VETERINARY MEDICINE

PROJECT REPORT IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR AWARD OF BACHELORõS DEGREE IN VETERINARY MEDICINE

Submitted by:

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J30/2623/2007

PROJECT TITLE:

A 10 year retrospective Study of Salmonellosis Cases Diagnosed in Poultry Clinic, Department of Veterinary Pathology, Microbiology and Parasitology, Faculty of Veterinary Medicine in the University of Nairobi

Supervisor: **PROFESSOR BEBORA L.C**

DECLARATION

This project report is my original work and has not been submitted for award of degree in any University.

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1.0 Introduction

Poultry is one of the most important disciplines of animal husbandry and veterinary science. Poultry provides a protective food in human nutrition in form of egg, and meat and employment opportunities at various levels. Poultry farming has become increasingly popular in both rural and urban areas (Sunil, 1994). This agrees with a report by Economic research Service/USDA, which indicates that worldwide consumption of poultry is increasing: with chicken, turkeys, ducks, geese, and other birds making up a large portion of the meat diet in many countries. (Ray, 2003).Disease is one of the greatest threats to success of poultry enterprise. Severe outbreaks of contagious and infectious diseases often result to heavy mortality. Whenever birds are kept together there is a danger of disease outbreak amongst them. (Sunil, 1994).Among the bacterial diseases of poultry, avian salmonellosis caused by *Salmonella* spp. is of great concern due to the high mortality (Choudhury*et al.,* 1985; Rahman*et al.,* 1999). It is also zoonotic causing severe gastroenteritis and septicemia in man and animals. Avian salmonellosis is of economic importance to the poultry keeper. This disease may cause high losses during the first three weeks after hatching. It can also cause reduced fertility and hatchability, reduced egg production and increased mortality among the adult flocks. The most damaging effect of salmonella infection on young chicks is stunted growth to an extent that infected birds are of low quality when they reach market age (Van Roekel, 1952).Domestic poultry constitute a large reservoir of salmonella organisms in nature. Almost 80% of salmonella organisms from animals serotyped in the United States were from chicken and turkeys. The natural close association of salmonella bacteria with domestic poultry and products, the important role that poultry products play in peopleôs daily diets, and the application of poultry products to variety of other food types has led to the emphasis on the importance of these products as sources of salmonella infections for man,

according to report by Moran, Van Houweling and Ellis (1965). Many of these bacteria are resistant to antibiotics creating a problem for their treatment and control by the use of antibiotics. The bacterial count in poultry housing systems is high in comparison to those of pig and cattle while little is known about the bacteria present in the poultry environment such as in poultry litter and air of poultry house (Saleh*et al.,* 2003).Bacteria present in poultry environment may enter into the flock to produce disease. There are also reports indicating that poultry feed and water may act as sourcesof various infectious diseases (Rahman*et al.,* 1999).

This study was carried out to establish the burden of disease to poultry production with respect to salmonellosis.

1.1 Objectives

1. To retrospectively identify and document salmonellosis cases in poultry within the last ten years

2. To establish and document the respective postmortem picture of the cases as given in the respective postmortem records

2.0 Literature review

2.1 Biology

Salmonellae belong to the family Enterobacteriaceae which comprises the enteric bacilli i.e. those that are able to grow on enteric media like Mac konkey agar which contains bile salts and are residents of intestinal tracts of man and animals. Enterobacteriaceae are short, straight, asporogenous rods, aerobic to facultatively anaerobic, oxidase negative, catalase positive and reduce nitrates to nitrites. Most are motile by petrichous flagellation (Carter, 1984; Cowan, 1985) but *Salmonella* Typhi,*Salmonella* Gallinarum and *Salmonella*Pullorum are usually non motile. The genus does not grow in potassium cyanide broth (Krieg and Holt, 1984; Cowan, 1985). The typically non motile *Salmonella* Pullorum and *Salmonella*Gallinarum from poultry are often combined, but differ from each other in several characters; e.g. many strains of *Salmonella* Pullorum produce gas from glucose unlike few strains of *Salmonella* Gallinarum (Cowan *et al.*, 1993). Salmonellae usually produce hydrogen sulphide, are urease negative, do not ferment lactose, salicin and inositol (Krieg and Holt, 1984). Salmonellae also do not ferment sucrose. Although, by definition, salmonellae are non-lactose fermenters, lactose fermenting species have been isolated (Easterling*, et al*., 1969). Salmonellae do not form indole, do not coagulate milk, do not liquefy gelatin. In the environment, salmonellae can remain viable for a long time. Survival of 87 days in tap water, 115days in pond water, 120 in pasture soil, over 30 months in dried bovine manure,28 months in naturally infected avian feces and 47 days in manure slurry have been reported (Erskine and Margo, 1974).

2.2 Bacterial isolation

On Salmonella-Shigella Agar, salmonellae grow moderately as pale or colorless colonies, whereas if they form hydrogen sulphide, they develop in 12 hours a central black spot. On Mackonkey Agar they grow abundantly with pale or colorless colonies and on Triple Sugar Iron Agar produce alkaline slant, acid butt with or without gas and with or without blackening due to hydrogen sulphide produced (Pedro et al, 2003).

2.3 Pathogenicity

Salmonella Pullorum and *Salmonella* Gallinarum are adapted to domestic fowl. They are not very pathogenic for man; although cases of salmonellosis caused by these serotypes have been described in children. Many other serotypes are frequently isolated from domestic poultry that are not showing signs of disease; for that reason, these animals are considered one of the principle reservoirs of salmonellae. Pullorum disease caused by serotype *Salmonella* Pullorum, and fowl typhoid, caused by *Salmonella* Gallinarum, produce serious economic losses on poultry farms, if not well controlled. Pullorum disease appears within the first two weeks of life and causes high mortality (Pedro et al, 2003) .Salmonellae employ a mixture of toxins, invasions, and other virulence factors to enhance pathogenicity. They produce enterotoxin (AB) which inhibits protein synthesis and causes lysis of host cells (typhoid fever) and cytotoxin which induces fluid loss from intestinal cells (paratyphoid fever) in human beings (Madigan et al, 2006).

2.4 Transmission

Pullorum disease is transmitted vertically as well as horizontally. Carrier birds lay infected eggs that contaminate incubators and hatcheries. Fowl typhoid occurs mainly in adult birds and it is transmitted by fecal matter of carrier fowl. The infection may be transmitted vertically as in pullorum disease or by contamination of shell when it passes through the cloaca (Pedro et al, 2003). The initial source of bacterium is the intestinal tracts of birds and other animals. Humans acquire the bacteria from contaminated beef products, poultry, eggs and egg products or water. Around 45,000 cases a year are reported in the United States, but it is assumed that as many as 2 to 3 million cases are not reported (Willey et al, 2009).*Salmonella* species causing gastroenteritis in man are normally transmitted by ingestion of contaminated food .Birds and domestic fowl, especially, ducks, turkeys, and chickens including their eggs are commonly identified as the sources of salmonella infections (Ronald et al, 1984).

3.0 Materials and methods

3.1 Study materials

- Bacteriological records on poultry disease diagnosed over 10 years from 2001 to 2010. These were obtained from bacteriology laboratory of the department veterinary pathology, microbiology and parasitology, faculty of veterinary medicine, university of Nairobi.
- Post mortem reports as contained in poultry post mortem room diagnostic files obtained from the virology laboratory of the same department.

3.2 Study design

This study was retrospective and included perusing through the diagnostic records generated within 10years from 2001 to 2010 and recording cases of salmonellosis. In addition respective postmortem picture as documented in postmortem records for individual poultry salmonellae cases were noted and documented. Species, age and contact address from where the birds came from were also noted and documented.

4.0 Results

Table 3 shows the cases reported in the poultry clinic between 2001 to 2010, with focus on the production type, age, breed and the contact address from where they came from. Notably, most of them were from Nairobi and its environs. Table 1 gives the retrospective prevalence per year. It should be noted that while most years recorded only one case of salmonellosis prevalence ranging between 1.85% to 4.35%, the year 2002 had no recorded case, year 2003 had prevalence of 15.79%(3/19 cases), the year 2007 had prevalence of 11.11%(4/36 cases) and year 2004 had prevalence of 26.32%(15/ 57 cases). The number of cases that were attended to at the poultry clinic department of veterinary pathology, microbiology and parasitology were 10 in the year 2002, interestingly in the year 2004,there were more cases(57) attended to at the clinic and also had the highest prevalence of salmonella infections(26.32%).Cases that were presented at the clinic had varying postmortem lesions as given in Table 5.Itis worth noting that pathology of liver which in most cases involved focal necrosis was a common post mortem feature. However there were other concurrent lesions (Table 5). Comparing the prevalences of salmonella between broilers and layers that were brought to the clinic within the study period, they were found to be more or less the same i.e. for broilers it was 10.50%; for layers it was 10.20%(Table 2). Nevertheless, more broiler cases (181) than layer cases (89) were handled at the clinic. Comparison of the salmonella prevalence with respect to age of the birds (Table 4, Figure2), reveals the prevalence is highest in the young birds aged 0-8weeks (6.09%). The salmonellae species isolated mainly was*Salmonellae*Gallinarum.

Table 1: Salmonellae cases diagnosed and recorded in bacteriology laboratory

Year	Number of Poultry Bacteriologial Cases Processed	Number of Salmonellosis Cases	Percentage of salmonellosis
2001	32	1	3.13
2002	10	0	0.00
2003	19	3	15.79
2004	57	15	26.32
2005	54	1	1.85
2006	25	1	4.00
2007	36	4	11.11
2008	26	1	3.85
2009	30	1	3.33
2010	23	1	4.35
(Total within the period)	**312***	**28**	**8.97**

***312 included all poultry types**

Table 2: Prevalence of Salmonellosis in Broilers and Layers

Of all cases diagnosed with salmonellosis, percentages of Broilers and layers were as follows:

Breed.	No. of Cases Processed.	No. of Cases With Salmonella.	Percentage (%)
Broilers	181	19	10.50
Layers	89	9	10.12
Other birds	42	0	0.00
Total	270**	28	10.37

**** 270 is the total number of broilers and layers.**

Note that this is 42birds less of all birds. The other birds may be were ducks, geese, parrots.

Figure 1: Prevalence of Salmonellosis in Broilers and Layers

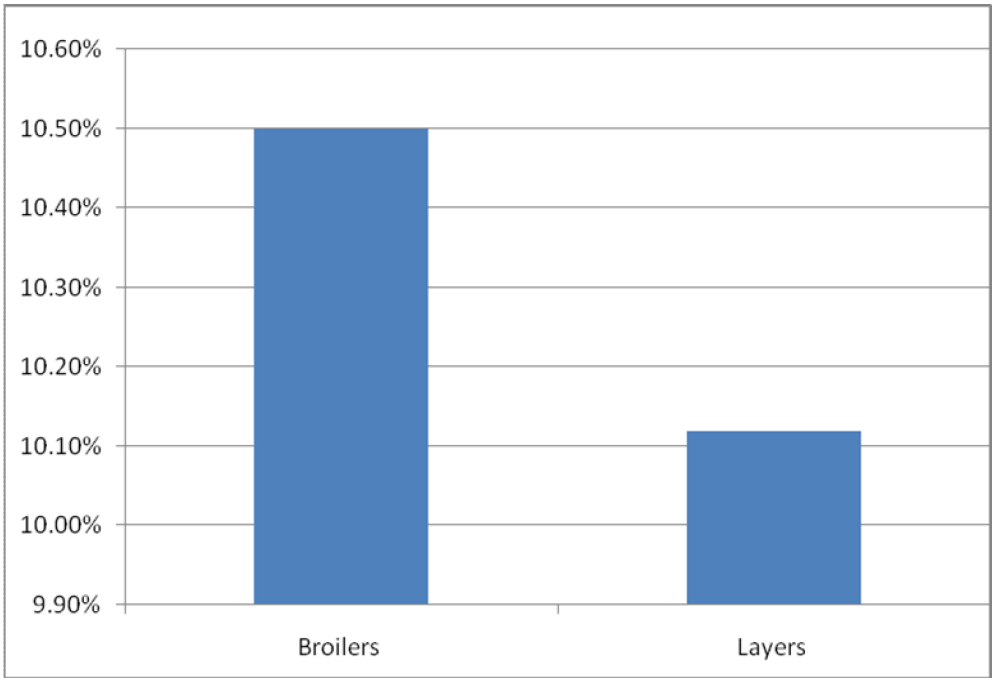

Table 3: Annual cases reported and recorded by Species, Age, Breed and contact address

Year	Date	Poultry Clinic Case No.	Bacteriology Case No.	Production type	Age	Broiler/ Layer	Contact Address *(**Numbered 1-20)*
2001	28/8/2001	DV68/2001	95/01	Avian	7 weeks	Broiler	MamQuist Box 347kiambu**(1)**
2002	---	---	---	---	---	---	---
2003	10/3/2003	DV4/2003	2/03	Avian	5 months	Layer	Box 3127, Thika**(2)**
	14/3/2003	DV11/2003	5/03	Avian	18weeks	Broiler	Dr. Mandieka J.M**(3)**
	26/3/2003	DV39/2003	24/03	Avian	5days	Broiler	Box 6244, Nairobi**(4)**
2004	16/2/2004	DV1/04	1/04	Avian	11days	Broiler	WairimuNderitu Box766Village market**(5)**
	18/2/2004	DV2/04	2/04	Avian	12days	Broiler	Susan Njoroge Box 439, Kikuyu**(6)**
	8/4/2004	DV8/04	6/04	Avian	5 months	Layer	Mrs. Nduati Box 64939 nairobi Loresho**(7)**
	10/4/2004	DV28/04	24/04	Avian	1 week	broiler	Mr. Andrew M. muthemba Box 22003-00400**(8)**
	14/7/2004	DV31/04	27/04	Avian	Chick	Broiler	Kabete area**(9)**
	16/7/2004	DV32/04	28/04	Avian	6days	Broiler	University Vet farm**(10)**
	26/7/2004	DV34/04	32/04	Avian	6weeks	Broiler	DrAsimba Box6397-00200 Nairobi**(11)**
	28/7/2004	DV32/04	33/04	Avian	5 days	Broiler	Box 29053 Nairobi**(12)**
	9/8/2004	DV35/04	39/04	Avian	6days	Layer	Margaret wambui**(13)**
	19/8/2004	DV38/04	41/04	Avian	6days	Broiler	Prof. mitaru Box 45406 Nairobi**(14)**
	27/8/2004	DV40/04	43/04	Avian	18month	Layer	Mrs. Nduati Box 64939 Nairobi Loresho**(7)**
	17/9/2004	DV45/04	50/04	Avian	Chick	Broiler	MrMuturi Nairobi**(15)**

	17/9/2004	DV46/04	51/04	Avian	6months	Layer	Mrs. Nduati ,Loresho Box 64939 Nairobi**(7)**
	29/9/2004	DV48/04	56/04	Avian	14days	Broiler	KimaniGithogo Box 242470 Nairobi**(15)**
	2/11/2004	DV58/04	65/04	Avian	8days	Broiler	Eddahwambuiwaingajo Nairobi**(16)**
2005	1/1/2005	DV75/05	43/05	Avian	10days	Broiler	Dr Joshua mbugua**(17)**
2006	3/3/2006	DV14/06	14/06	Avian	6days	Broiler	Joyce Mwangi**(18)**
2007	25/6/2007	DV40/07	49/06	Avian	1 year	Layer	Niemman Box 44038 Nairobi**(19)**
	27/6/2007	DV41/07	50/07	Avian	4weeks	Broiler	Joyce Mwangi**(18)**
	7/9/2007	DV54/07	7/07	Avian	5weeks	Broiler	Joyce mwangi**(18)**
	18/12/2007	DV72/07	---	Avian	11months	Layer	Thuowathongo**(19)**
2008	---	DV/08	---	Avian	3 weeks	Broiler	---
2009	4/2/2009	DV6/09	---	Avian	6months	Layer	Francis kamau**(20)**
2010	---	DV27 /010	---	Avian	5months	Layer	----

***2002-** Of all the poultry cases brought in the clinic none wasdiagnosed with salmonellosis*

*** Farmers assigned numbers (1-20) for anonymity*

Table 4: Prevalence of salmonellosis by Age

Age(weeks)	No of birds salmonella cases processed for the period of study	Frequency	Percentage of salmonella cases (%)
0 to 8(Chicks)	312	19	**6.09**
8 to20(Growers)	312	4	**1.60**
20 to 72(Layers)	312	5	**1.28**
Total	312	28	**8.97**

Figure 2: Prevalence of salmonellosis by Age(weeks)

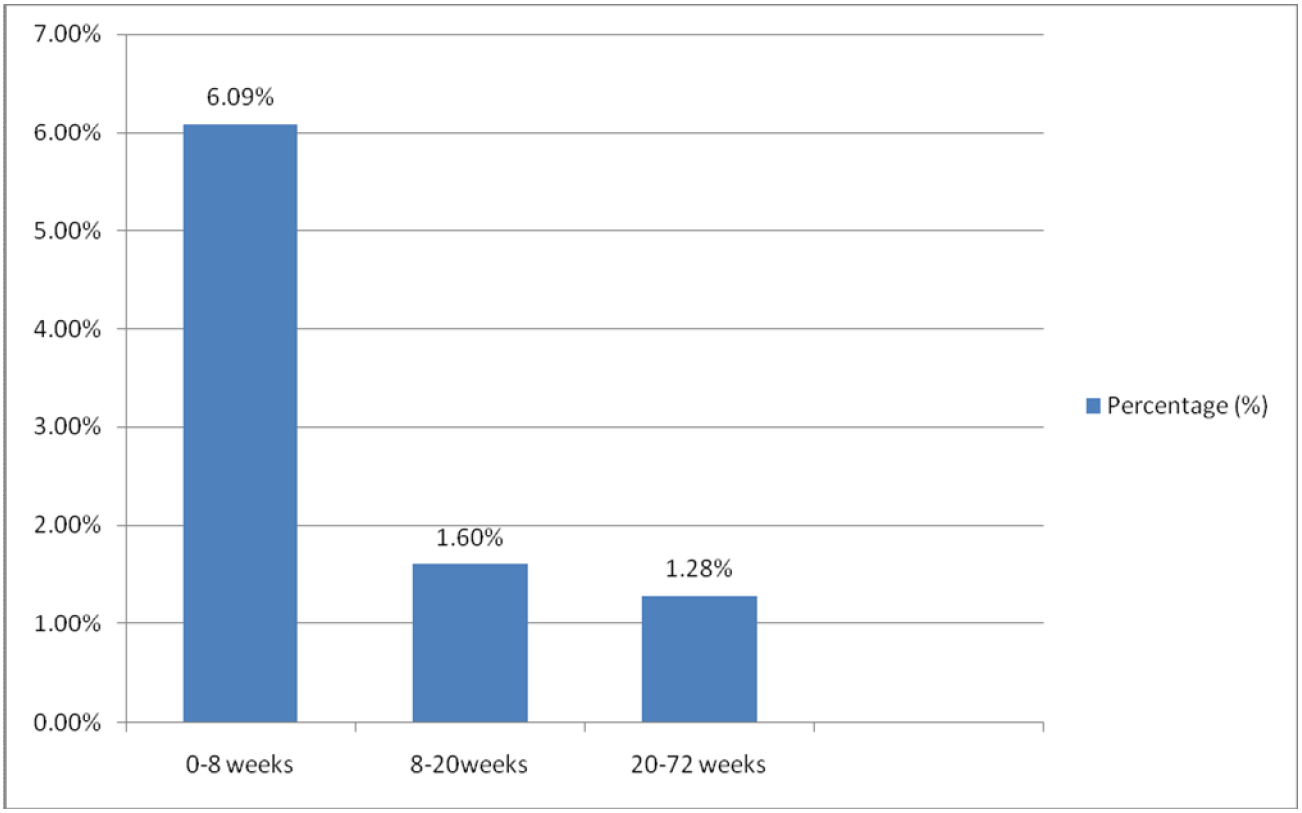

Table 5: Corresponding Post mortem findings

Year	Case No.	Postmortem Findings
2001	DV/68/2001	Severe fibrin Clots around Chest, white necrotic liver lesion in liver, cloudy air sacs, skin discolorations
2003	DV/4/2003	Diarrhea, depression, lethargic, egg production dropped, egg peritonitis.
	DV/11/2003	Yellow diarrhea, anemia, sudden death
	DV/39/2003	Dull, general body weakness, Good nutritional condition, congested liver and spleen.
2004	DV/1/2004	**C**hicks had many lesions in liver probably as a result of bacteremia(septicemia)
	DV/2/2004	Enlarged spleen, with areas of hemorrhage, enlarged kidneys with one **c**hick also showing areas of hemorrhage in the liver.
	DV/8/2004	Congested liver, spleen and kidney. Focal whitish spots in the liver.
	DV/28/2004	Congestion, omphalitis, grayish infarcts of liver and spleen, necrotized spleen.
	DV31/2004	Traumatic injury and hemorrhagic hematoma on the wing in one. Oversized gizzard.
	DV/32/2004	Carcass congested as well as other organs, there is inflammation of sinuses, trachea, eyes, and air saccullitis with fibrin deposition. spleen very swollen, liver also swollen with grayish infarcts
	DV/34/2004	Septicemia, liver and spleen heavily congested with some gray spots
	DV/35/2004	Four Carcasses congested, two had gastrointestinal tract, and kidney are pale and urea deposits. Liver had pale areas while spleen is heavily congested and appear necrotized

	DV/38/2004	Both in fair condition, signs of septicemia, omphalitis, enlarged liver, one showing generalized, one showing milliary white spots on liver and some hemorrhagic streaks on left thigh
	DV40/2004	Carcass in fair condition, diffuse white to grey foci in the liver, enlargement of the spleen and kidney, mild enteritis, numerous worms in jejunum and duodenum
	DV/45/2004	History: Bird showed star gazing syndrome. On opening, the liver and spleen, kidneys were congested, pericardial sac was a little cloudy and thigh and breast muscles had a few streaks.
	DV/46/2004	Enlarged liver, kidney and spleen, with white foci, lungs appeared pneumonic, and the farmer had lost birds through salmonellosis.
	DV/48/2004	Pale muscles, enlarged intestines and congestion of intestines. Mottled liver. Part of intestines necrotized
	DV/58/2004	Carcass were congested, and had septicemia , there were necrotic foci on the swollen liver and spleen, Lungs were congested, there was mild enteritis while yolk sac was inflamed
2005	DV/72/05	One carcass in good condition but the other in bad condition. Liver has pale areas , yolk material not absorbed , pseudo membranes Covering the intestines, liver, spleen, and other abdominal organs
2006	DV/14/06	Enlarged inflamed yolk sac gray necrotic foci in the liver, enlarged spleen and kidney, congested liver and lungs
2007	DV/40/07	Carcass in fair condition , enlarged spleen and mottling of liver, pneumonic lungs and air sacculitis, peritonitis, numerous worms in the intestinal tract and caecum, excess mucus in trachea.
	DV/41/07	Hemorrhages on thigh muscles, proventriculus, bursa of fabracious and kidney. Necrotic foci in the liver. Enlarged spleen and kidney. Blood clots in trachea, heavily congested lungs, and hemorrhagic payers patches.
	DV/54/07	Ruffled feathers white diarrhea, bile stained (greenish) liver with a few necrotic foci, splenomegaly and enlargement of kidney, in one bird yolk was unabsorbed.

	DV72/07	Hemorrhages on lungs, white foci in an enlarged liver, congested kidney and spleen. Fair body condition. A number of worms in the intestines.
2008	DV/08	White-gray spots in liver with congested spleen and kidney. Body condition fairly good.
2009	DV6/09	Spleen enlarged and mottled liver, pneumonic, peritonitis, several gastro intestinal tract worms present.
2010	DV/27/2010	White diarrhea, green diarrhea, carcass in good condition, empty gizzard and intestines brown

5.0Discussion

The results obtained above are a retrospective study for poultry salmonella cases diagnosed for a period of ten years with focus on age prevalence, production type, including respective postmortem pictures.

The subtype identified was *Salmonella* Gallinarum, with highest incidence 26.32% (15/57), (Table1) realized in the 2004.Of the total salmonellosis cases diagnosed in 2004, 20% (3/15) were from one farm; *number 7* (Table 3). This occurred in layers between April and September. This must have adversely affected egg production since disease control is one of management tools that influence egg production. There was also increased risk of vertical transmission of salmonellosis in eggs laid, thus posing risk to consumers of same. They were all layers above five months of age, whose cases were reported in interval of six months (between April and September 2004). The recurrence of the disease can be attributed to poor management in terms of hygiene or failure of implementation of recommendations given at the poultry clinic. This scenario indicated continued presence of organisms within the premises.

A year later the number of bacteriological cases processed remained significantly high but there was a drastic decrease in the prevalence of salmonellosis to 1.85% (1/54) in 2005.This decrease can be attributed to prompt implementation of recommendations from the poultry clinic. The farmers affected in 2004 must have improved hygiene and control measure to curb losses realized thus the picture seen in 2005. (Table 3)

Early 2006(March) there was a case of salmonellosis from farm*number 18* which accounted for 4% (1/25) (Table 1) of bacteriological cases processed. Later in 2007, between June and September, two cases of salmonellosis were diagnosed within an interval of three months from the same farm *number18*. This involved broilers at ages of 4 and 5weeks, when they were almost ready for market. Mack et al, 1990records that most commercial growers reach marketable weight of 2.0 kg in about 45days, on average. In the year 2007 there was more than one case, from farm*number 18* in less than three months. Broilers in this farm *number 18*were aged below 5 weeks (Table 3).This accounted for 50% of salmonella cases diagnosed in that year. It was also noted that there was a case of salmonellosis from farm *number 18* the previous year in March.

However in 2002, there was no salmonellosis cases reported. This does not necessarily mean that the salmonellosis control was effective. It is also important to note that, this was the year with least number (10) of poultry bacteriological cases processed (Table 1).Probably the hygiene levels were higher compared to other years or the farmers sought services from other facilities.

Percentage of salmonella cases in broiler and layers brought to the clinic within period of study (table 2, Figure 1) are almost same (10.50% and 10.12% respectively). However, for the period of this study, the number of bacteriological cases reported was higher in broilers (181) than in

layers (89). It may therefore be concluded that, there is no difference between broilers and layers, with respect to susceptibility to avian salmonellosis.

The birds aged between 0-8 weeks had the highest prevalence of salmonellosis at 6.09% (19/312)compared to those above two months (Table 4,Figure 2).This agrees with van Roekel, (1952)ǿs observation. It was observed that as the age increased the prevalence dropped.

In some cases the post mortem picture had mixed lesions i.e. they were not entirely due to salmonellosis. For instance, helminthosis (DV40/04), (DV40/07), history of star gazing DV45/04, Hemorrhages on thigh muscles, proventriculus, bursa of Fabricious and kidney *(DV41/07),* ruffled feathers and white diarrhea (Table 5). It can therefore be inferred that management with respect to hygiene, worm control, and prophylaxis in the above mentioned farms needed to be improved since they may not have been sufficient. Post mortem lesions of grey to white spots in liver, hemorrhage, and enteritis are postmortem lesions that featured in most cases of this study. This agrees with what is described by Jones T. C, 1983.

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