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Full Length Research Paper

Prevalence and seasonality of fowl typhoid disease in Zaria-Kaduna State, Nigeria

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A five years retrospective study (2003 - 2007) of the prevalence of fowl typhoid (FT) and other poultry diseases diagnosed at the avian unit of the Veterinary Teaching Hospital (VTH), Ahmadu Bello University, Zaria-Kaduna State, Nigeria was conducted. A prevalence rate of 18.4% (129 cases) was recorded for FT out of 700 cases of poultry disease. The highest number of outbreaks of FT was recorded during the rainy season (July - September). 48 cases (29.1%) of FT were recorded in birds 15 weeks and above, 124 cases (18.4%) in layers and only two cases (16.7%) in turkeys. Outbreaks of FT were closely associated with age, type and poultry species of birds (P < 0.05). The outbreaks of FT were also observed to be 3.1 times more likely to occur in December, 2.4 and 1.3 times more likely to occur in birds of 15 weeks and above and 1 - 5 weeks of age respectively. It was concluded from the study that FT is more commonly reported in the chicken than other poultry species and adult birds (>15 weeks) are more susceptible to the disease in Zaria, Nigeria. This study recommends that poultry farmers should be encouraged to practice prompt and regular vaccination of layers against fowl typhoid disease.

Key words: Salmonella enterica serovars Gallinarium, chicken, Nigeria.

INTRODUCTION

Fowl typhoid (FT) is an acute infectious enteritis (Okwori et al., 2007) causing heavy mortality in growers or adult birds although chicks can be affected (Jordan and Pattison, 1992). It is caused by the bacterium *Salmonella enterica* serovars Gallinarium (Jordan and Pattison, 1992; Aiello, 1998; Abdu, 2007), a member of the family enterobacteriaceae which is widely distributed throughout the world (Roa, 2000). *S. enterica* serovars Gallinarium is highly adapted and seldom causes significant problems in hosts other than chickens, turkeys and pheasants (Jordan and Pattison, 1992; Aiello, 1998; Mdegela et al., 2000; Okwori et al., 2007). It was formerly known as *Shigella gallinarum* when first isolated in 1889 by Klein in England (Okwori et al., 2007). It was named fowl typhoid (FT) in 1902 (Jordan and Pattison, 1992).

The disease has been eradicated from commercial poultry in many developed countries of Western Europe, USA, Canada, Australia and Japan with an intensive poultry industry (OIE, 2005). In Africa, FT has been reported in many countries including Nigeria (Sa'idu et al., 1994), Tanzania (Mtie and Msami, 1996), Uganda (Okoj, 1993), Zambia (Sharma et al., 1991), Libya (Hamid and Sharma, 1990), and Senegal (Arbelot et al., 1992). FT infection usually follows the ingestion of food or water contaminated by the fecal material. The clinically infected birds are carriers of FT which can also be transmitted by attendants through hands, feet, clothes and rodents (Jordan and Pattison, 1992; Aiello, 1998; Abdu, 2007; Okwori et al., 2007) or via eggs laid by vaccinated birds (Jordan and Pattison, 1992).

A definite diagnosis of FT requires the isolation and identification of *S. enterica Serovars Gallinarium*. However, a tentative diagnosis can be made based on the flock history, clinical signs, mortality and lesions (Barrow et al., 1992). The aim of this study was to review all the FT cases and other non-FT poultry diseases diagnosed at the Poultry Health Clinic, Ahmadu Bello University, Veterinary Teaching Hospital (ABUVTH) and confirmed in the Microbiology Laboratory from 2003 - 2007 and to determine if any association exists between prevalence of the disease and factors of the host and environment for example, breed, poultry species, types of bird and

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Table 1. Yearly distribution of fowl typhoid (FT) and other poultry diseases in Zaria, Nigeria.

Year	FT cases	Non FT cases	Year specific rate (%)	OR	95% CI on OR
2003	14	97	12.6	0.595	0.33 - 1.08
2004	15	88	14.6	0.722	0.40 - 1.30
*2005	17	126	11.9	0.536	0.31 - 0.93
2006	23	148	13.5	0.620	0.38 - 1.01
*2007	60	112	34.9	3.624	2.42 - 5.43
Total	129	571			

*significant at $p < 0.05$.

season of the year.

MATERIALS AND METHODS

Study area

Zaria is located between 11°07'N and 7°44'E within the Sudan Savannah Zone.The dominated vegetation is trees and grasses (Sa'idu et al., 2004). The average rainfall ranges from 1000 - 1250 mm and the average daily temperature ranges from 17 - 33°C (Sa'idu et al., 2004).

Samples

The samples submitted to the Veterinary Microbiology laboratory for investigation were intestine, liver, gall bladder, spleen, heart, fecal content and ovarian follicles collected from sick commercially reared and local chickens from Zaria and environs. The samples were immediately transported to the laboratories in a cool thermos and were processed for culture.

Cultures

Salmonella was isolated according to standard methods (ISO 6579, 1993). The intestine, liver, gall bladder, spleen and ovarian follicles were aseptically added to 9 ml of the pre-enrichment medium tetrathionate broth. All samples were incubated at 37°C for 24 h. One loopful from each of the enriched broths was streaked onto plates of *Salmonella Shigella* (SS) agar (Difco) and xylose lysine deoxycholate (XLD) agar (Difco) and incubated at 37°C for 24 h. The plates were examined for the presence of typical colonies of *Salmonella*, that is, transparent colonies with black centres on SS agar and red colonies with black centres on XLD agar (Antunes et al., 2003). Suspected colonies were confirmed positive by conventional biochemical methods (Lautrop et al., 1979; Nissen, 1984).

Data collection

The data on age, breed, type and poultry species were collected from the avian unit of ABUVTH, Zaria, Nigeria from January 2003 to December 2007. Information on FT was extracted from the clinic records and the non-FT cases were considered together as a group. A case was defined as a farm that reported an outbreak of a disease and diagnosis based on history, clinical signs, post mortem findings and laboratory results in ABUVTH, Zaria, Nigeria. The age of the birds were categorized as follows; (i) 1-5 weeks old, (ii) 6-10 weeks old, (iii) 11-15 weeks old, (iv) greater than 15 weeks old and (v) unknown age. The birds were categorized according to the purpose of keeping the birds i.e. Breeders, Layers, Broilers, Cockerels, and mixed breed, species that is, chicken and turkey, and breed, that is, local and improved breed (Halle et al., 1999).

The seasons in Zaria and environ were categorized as follows: (i) Dry season (January - March). (ii) Pre-rainy season (April - June). (iii) Rainy season (July-August). (iv) Pre-dry season (October – December) (Abdu et al., 1992). The monthly variation in the distribution of FT for the period of 2003 - 2007 was determined by reducing the 5 year data to one year using the 12 months ratios to moving average method (Saidu et al., 2007). The graph of the isolated monthly index (ISMI) was plotted.

Data analysis

The data were analyzed statistically using Genstat and SPSS computer based programs.

RESULTS

A total of 700 cases of poultry disease were documented with 129 (18.4%) of the diseases diagnosed positive for FT. The highest prevalence rate of 34.9% and lowest prevalence of 11.9% were recorded in 2007 and 2005 respectively (Table 1).

The month specific rate (MSR) for FT was highest in December (39.1%) and lowest in May (8.7%). However, only the odds ratios for July (1.29), August (1.09), October (2.15), November (1.08) and December (1.15) were significant at the 95% CI (Table 2). This means that FT was 1.29, 1.09, 2.15, 1.08 and 3.15 times more likely to occur in July, August, October, November and December respectively when all months were compared (Table 2). The isolated monthly index (ISMI) showed that FT peaked in July, August, October and December (Figure 1). The highest peak was in August and the lowest peaks were in Febuary, April and May. 50 (29.9%) cases were recorded in the rainy season and 16 cases (12.3%) were recorded in the pre-rainy season (Table 3). This means that FT was 2.42 times more likely to occur in the rainy season (July - September).

The age specific rate of FT showed that birds >15 weeks old had the highest rate (29.1%), followed by bird's 1 - 5 weeks old (21.6%) while the lowest (13.3%) was recorded in birds within the age 11 - 15 weeks old. This means that FT was 2.4 times more likely to occur in adult birds (Table 4).

The breed distribution of FT disease compared to other

Table 2. Monthly distributions of FT and other poultry diseases in Zaria, Nigeria.

Month	FT cases	Non FT cases	Monthly specific rate (%)	OR	95% CI on OR
Jan	6	38	13.6	0.684	0.28 - 1.66
Feb	4	38	9.5	0.305	0.11 - 0.87
Mar	8	36	18.2	0.993	0.45 - 2.19
Apr	4	41	8.9	0.414	0.15 - 1,18
May	4	42	8.7	0.492	0.17 - 1.40
Jun	8	68	10.5	0.489	0.23 - 1.05
Jul	17	60	22.1	1.293	0.73 - 2.30
Aug	19	78	19.6	1.092	0.64 - 1.88
Sept.	14	65	17.7	0.948	0.51 - 1.75
* Oct	18	40	31.0	2.153	1.19 - 3.89
Nov	9	37	19.6	1.082	0.51 - 2.30
* Dec	18	28	39.1	3.145	1.68 - 5.88
Total	129	571			

*significant at $p < 0.05$.

Table3. Seasonal distribution of FT and other poultry diseases in Zaria, Nigeria.

Season	FT cases	Non FT cases	Season specific rate (%)	OR	95% CI on OR
*Dry (Jan-March)	18	132	12.0	0.539	0.316 - 1.921
*Pre-rainy (Apr-Jun)	16	114	12.3	0.568	0.323 - 0.996
*Rainy (Jul-Sept)	50	117	29.9	2.420	1.610 - 3.638
Pre dry (Oct-Dec	45	208	17.8	0.935	0.627 - 1.395
Total	129	571			

*significant at $p < 0.05$.

poultry disease revealed that the breed specific rate was high in improved breeds (18.5%) (Table 5).

The poultry species specific rate for FT showed that chicken had the highest rate (18.5%) compared to turkeys (16.7%) (Table 6).

The chicken type specific rate for FT showed that broilers had the highest rate of 25% followed by layers 18.4%. This means that FT was 1.5 and 0.9 times more likely to occur in broilers and layers, respectively (Table 7).

DISCUSSION

The prevalence of FT in this study was 18.4% which was higher than the 8.4% reported in Kaduna by Salami et al. (1989) and 9.4% reported in Jos by Okwori et al. (2007) with 2007 having the highest year specific rate (34.9%). These may be due to increases in the number of backyard poultry farmers in Zaria that are compounding feeding by themselves in the period under study.

In this work, FT was observed to occur mostly from July to December, the ISMI showed that the disease has three peaks; one continuous peak from June to July followed by July to August another one from October to December. It is important to note that these months fall within the rainy season in most parts of Nigeria including the study area, this is similar to what was reported by other workers (Calnek, 1995). These months are characterized by wet weather and it is the period of high egg production (Calnek, 1995). Roa (2000) also reported that outbreaks of FT were seen in summer particularly when the weather is wet and moisture is persistant in the air.

The most susceptible age groups to FT in this study were birds >15 weeks, followed by 1 - 5 weeks and 6 - 15 weeks. This observation is similar to the work of Calnek, (1995) who reported that FT is a disease of adult and growing chickens but mortalities have been recorded in young chicks. The outbreak of FT in young chicks may be associated with vaccination against FT practiced by most breeders which leads to vertical transmission of the disease (Jordan and Pattison, 1992; Roa, 2000). In this work, the least susceptible age groups to FT are 6 - 10 weeks and 11 - 15 weeks, this may be due to the fact that in this environment, layers are usually vaccinated against FT at 6 weeks. This may protect them throughout their growing age. It is also important to note that infected chicks remain carriers of the disease (Falade and Ehizokhale, 1981; OIE, 2005) and any stress may trigger an outbreak of FT (Aiello, 1998).

The layers and broilers were at the highest risk of FT than other type of birds; this may be due to the fact that

Table 4. Age distribution of FT and other poultry diseases in Zaria, Nigeria.

Age group	FT cases	Non FT cases	Age group specific rate (%)	OR	95% CI on OR
1-5	8	29	21.6	261	0.56 - 2.83
6-10	2	12	14.3	0.748	0.17 - 3.38
11-15	2	13	13.3	0.689	0.15 - 3.09
* >15	48	117	29.1	2.368	1.57 - 3.58
Unknown	67	402	14.3	0.475	0.31 -0.70
Total	129	571			

*significant at $p < 0.05$

Table 5. Breed distribution of FT and other poultry diseases in Zaria, Nigeria.

Breed	FT cases	Non FT cases	Specific rate (%)	OR	95% CI on OR
Improved	129	569	18.5	-	-
Local	0	2	0	-	-
Total	129	571			

*significant at $p < 0.05$.

Table 6. Distribution of FT and other poultry diseases in Zaria, Nigeria based on poultry species.

Poultry species	FT cases	Non FT cases	Specific rate (%)	OR	95% CI on OR
Chicken	127	561	18.5	0.903	0.25 - 3.23
Turkey	2	10	16.7	0.883	0.19 - 4.08
Total	129	571			

*significant at $p < 0.05$.

Table 7. Distribution of FT and other poultry diseases in Zaria, Nigeria based on type of birds.

Type of bird	FT cases	Non FT cases	Specific rate (%)	OR	95% CI on OR
Layers	124	551	18.4	0.900	0.33 - 2.45
Broilers	4	6	25.0	1.483	0.30 - 7.43
Mixed breed	0	2	0	-	-
*Breeder	1	0	100	-	-
Cockerel	0	2	0	-	-
Total	129	571			

*significant at $p < 0.05$

most backyard and commercial farmers in Zaria raise layers and the stress of egg production depresses their ability to resist infection (Saidu et al., 2004). The broilers are at high risk because most backyard poultry farmers that keep these types of birds for meat do not vaccinate them against FT.

In this study, 98.4% of all the FT cases were recorded in chickens and 1.6% was recorded in turkeys. This observation lends support to the work by Kaupp and Dearstyne, (1924) cited by Calnek, (1995) who reported that turkeys are less susceptible than chickens. The small number of backyard and commercial farmers in Zaria that raise turkeys may be the reason why a low number of FT outbreaks were reported in turkeys. In conclusion this study observed that FT was common in improved breed of birds and occurred in adult birds, and this may be due to the stress of egg production. This study recommends that poultry farmers should be encouraged to practice prompt and regular vaccination of layers. The breeders should not be vaccinated instead regular blood testing should be done to cull and replace infected birds after two consecutive testings.

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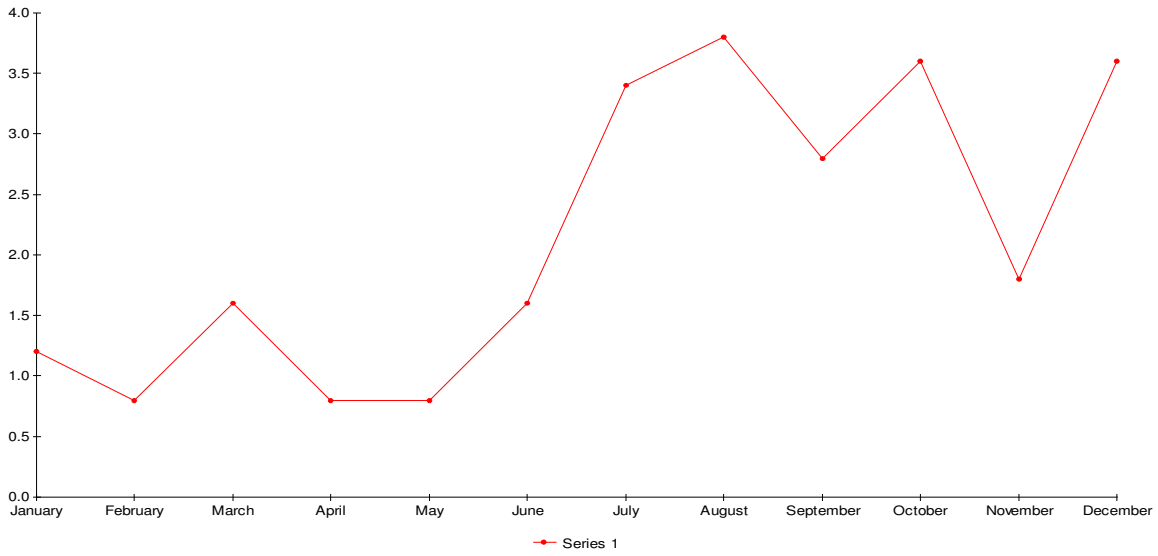

Figure 1. Monthly distribution of fowl typhoid in Zaria, Nigeria.

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