

Prevalence of Salmonella Species Infection and Antibiotics Susceptibility of Isolates in Day-Old-Chicks from Hatcheries and Farm Markets in Ibadan, Nigeria

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Abstract:- Salmonellae is a prevalent infection in the chicken industry. The infection in poultry is a persistent global problem that poses a hazard to both animal and public health. Salmonellae leads to reduced production efficiency and mortality in poultry, resulting in significant economic losses worldwide. In order to ensure the health and productivity of poultry, it is essential to begin with high-quality day old chicks that are free from diseases. Poultry meat and eggs are significant contributors to the animal protein supply in Nigeria. A significant number of newly hatched chicks utilized for production are mostly sourced from the south-western states of Ogun and Oyo, and then moved to other regions within the country. This study aimed to examine the prevalence of Salmonellae infections and the antibiotic susceptibility pattern of isolates from day-old chicks produced in hatcheries and marketed in major markets in Ibadan, Oyo states, Nigeria.

This study was conducted using a cross-sectional design and focused on key farm markets where day-old chicks are sold, as well as three hatcheries that were carefully selected. Farm markets and their respective locations, including the local government regions, were identified in Ibadan.

A total of 135 cloacal swabs were collected from randomly selected day-old chicks. These chicks were obtained from 10 sellers at three major agricultural markets in three Local Government Areas (LGAs) and three hatcheries. Salmonellae isolation was performed using culture techniques that involved buffered peptone water, Rappaport-Vassiliadis broth, and Xylose Lysine deoxycholate agar. The isolates were characterised using standard biochemical testing and antibiotics susceptibility determined using agar diffusion.

The overall prevalence of *Salmonellae* infection old day old chicks produced by hatcheries and sold in major farm markets in Ibadan is 4.4% (6/135). Day old chicks from the farm markets in egbeda had the highest prevalence of 10.0 % followed by Ibadan South West of 3.3% and Ibadan North Est of 0.0%. from the hatcheries, day old chicks from hatchery A has the highest prevalence of 13.3% while hatchery B and C had 0.0%.

All the six *Salmonellae* isolates used for the antibiotics susceptibility test showed 100% resistance to Ampliclox, Amoxicillin clavulanate (Augmentin), Cefotaxime, Imipenem and Nalidixic acid. The isolates had moderate resistance to Ofloxacin (83%), Nitrofurantoin (83%), Ceftriaxone (67%) and Levofloxacin (67%). The *Salmonellae* isolates were found to be only 50% susceptible to Cefexime, 33% susceptible to Gentamycin, 17% susceptible each to Cefuroxime and Nitrofurantoin while all the isolates were not susceptible (0%) at all to the remaining eight antibiotics.

Salmonellae infections of day old chicks sold in major markets in Ibadan was confirmed in this study. The isolates were multi-drug resistant and portending challenge to treatment as well as public health risks. There is a need for regular *Salmonellae* surveillance of day old chicks in farm markets and hatcheries, increased awareness programs for farmers and hatchery operators by government on proper biosecurity measures and risks involved in indiscriminate use of antibiotics in poultry and the resultant effects of antimicrobial resistance on animal and human health.

Keywords:- *Salmonellae*, Day-Old Chicks, Hatchery and Anti-Microbial Resistance.

I. INTRODUCTION

Salmonellae infection in chicken is a persistent global problem that poses a hazard to both animal and public health (Leon, 2015). The reason for its prevalence in the food sector is its ability to endure and spread across many stages or phases in chicken production. *Salmonellae* is a group of bacteria belonging to the family Enterobacteriaceae. These bacteria are characterised by being Gram-negative, oxidase negative, catalase positive, and having a rod-like shape without the ability to make spores. Additionally, they are facultative anaerobes. The ideal temperature for the growth of *Salmonellae* is 37°C. However, it has been observed to thrive at temperatures as low as 2-4°C and as high as 54°C. *Salmonellae* is capable of surviving in a broad variety of pH levels, ranging from a minimum of pH 3.8 to a maximum of pH 9.5. However, it thrives best in an environment with a pH between 6.5 and 7.5. A water activity (*a_w*) below 0.94 prevents the growth of *Salmonellae*. However, at specific

temperatures, a low *aw* is thought to provide protection against *Salmonellae* (Ryan et al., 2017). *Salmonellae* is widely found in the environment and can cause a variety of infections in both humans and animals. It occurs naturally in the intestines of both domestic and wild animals, such as chickens, swine, cattle, birds, dogs, rats, tortoises, turtles, and cats (Demirbilek, 2017).

The agricultural sector continues to be the primary driver of the Nigerian economy, responsible for more than 38% of non-oil foreign exchange revenues and employing around 70% of the working population. The poultry sub-sector in Nigeria's agriculture is highly commercialised and has significantly improved the lives of the less privileged population through minimal investment and low-cost technologies (Jibril et al., 2020). Every year, a total of 454 billion tonnes of meat and 3.8 million eggs are produced, from a population of 180 million birds. Poultry meat and eggs are the primary sources of animal protein in Nigeria, as well as in several developing nations, due to their cost-effectiveness and widespread acceptance. Regrettably, the expansion of this significant agricultural subsector is severely jeopardised by several infectious diseases, including those induced by *Salmonellae* species (Jibril et al., 2020). *Salmonellosis*, a significant food-borne illness worldwide, is projected to cause around 93.8 million cases of gastroenteritis annually, resulting in 155,000 deaths (Majowicz et al., 2010/2017).

The global public health community is greatly concerned about the isolation of *Salmonellae* from food products and its antibiotic resistance (Ishola et al., 2021). Research has demonstrated that *Salmonellae* serotypes exhibit resistance to many drugs (Ziba et al., 2020). Antimicrobial resistance can be attributed to either mutations in genes found in the chromosomes (known as intrinsic resistance) or the acquisition of resistance determinants through plasmids (known as extrinsic resistance). The primary cause of intrinsic resistance is selection pressure, while extrinsic genes are obtained through horizontal transfer (Katiyar et al., 2020). Antimicrobial resistance (AMR) has become a major concern in both human and animal medicine worldwide. It is now widely acknowledged as a substantial and growing threat to global public health and food security (Wall et al., 2016).

A hatchery is a controlled environment facility or building specifically designed for the artificial incubation of eggs (McMahon, 2022). A hatchery fulfils the crucial function of gathering hatching eggs from the breeder farm and distributing recently hatched chicks to a commercial poultry farm (Kim & Kim, 2016). The contemporary approach to constructing hatcheries aims to provide an optimal physical setting that maximises the effectiveness of converting a hatching egg into a viable and robust chick using artificial incubation and hatching techniques (Deori et al., 2019). The hatchery facility consists of multiple rooms dedicated to particular functions. The rooms in a hatchery typically consist of a shower room, sorting room, fumigation room, egg holding room, pre-incubation warming room, setter room, candling or dark room, hatcher room, chick holding room,

wash room, clean-room, and additional rooms specific to the type of hatchery. These additional rooms may include a small office, lounge and lunch room, rest room, generator or tool room, box storage room, and electrical control room (Tamil Nadu Agriculture University, 2019).

Ensuring proper hygiene is crucial when it comes to designing and managing a hatchery. Optimal hatching rates and chick quality necessitate this. The safeguarding against the introduction of harmful substances into hatching eggs and newly hatched chicks or poults, especially in relation to targeted disease prevention measures (such as *Salmonellae*), is becoming more and more important in the functioning of hatcheries (Behoir, 2021). The hatchery is a significant source of disease risk across the entire poultry production cycle (Deori et al., 2019). Inadequate biosecurity measures at hatcheries not only diminish the calibre and volume of newly hatched chicks, but also facilitate the transmission of disease-causing agents, result in ecological contamination, and impact the well-being of employees (FAO, 2015). Effective hatchery management encompasses The owner's living area should be separated from the hatchery set-up. Before entering and after leaving the hatchery, it is necessary to change footwear and wash hands. There should be a one-way movement and unidirectional flow of air. It is important to have separation between the incubation, hatching, and bird delivery areas. Fumigation of eggs, egg trays, egg setters, and hatchers should be done using formaldehyde solutions or potassium permanganate (Esatu et al., 2016). This process should take place in a properly equipped egg fumigation cabinet.

Salmonellae is often spread in two ways: vertically (from parent to offspring) or horizontally (between individuals). The hatchery is a significant source of both vertical and horizontal transmission of *Salmonellae* (Liljebjelke et al., 2005). Transmission of *Salmonellae* from parent to progeny birds through vertical transmission (transovarian) has been observed for multiple *Salmonellae* serotypes. Experimental evidence has demonstrated that *Salmonellae* infection can occur in developing eggs within the reproductive canal, specifically in the ovary (unshelled eggs) and shell glands of infected hens (Liljebjelke et al., 2005; Cardoso et al., 2021). Transovarian infection in the egg leads to subsequent infection in chicks or poults and is a significant method of transmitting salmonellosis in chickens. Certain chickens that are infected become asymptomatic carriers and consistently pass on the infection to their offspring. The method of disease transmission is very crucial in hatcheries since it might lead to the extensive spread of the diseases. Kuria, 2023 Chicks that are infected by hens typically become carrier chickens, capable of spreading the infection through hatching, handling, and transit. *Salmonellae* bacteria reside within the gall bladder and exhibit resistance to antibiotics, rendering them impervious to eradication (Overzicht, 2022).

The transmission of *Salmonellae* horizontally occurs by the route of ingestion of faecal matter (Kuria, 2023). The majority of adult chickens become sick by consuming foods that have been polluted. *Salmonellae* can be mechanically

transmitted by dogs, cats, rodents, and insects (Kuria, 2023). Additionally, Salmonellae can enter a day-old chick through production materials like tools, egg trays, crates, and containers that have not been cleaned or disinfected (Overzicht, 2022). Additionally, transmission through cannibalism and inhalation has been documented (Kuria, 2023).

During vertical transmission, birds that are infected with Salmonellae spp. From their mother to them internally and they become carriers of the bacteria. This not only poses a threat to the economic aspects of poultry production, but also to public health in general. These birds appear to be in good health and are charming, but they have the ability to spread Salmonellae to any animal or human they come into contact with. The Centre for Disease Control and Prevention (CDCP) in 2022 documented instances of Salmonellae transmission from newborn chicks to humans. Annually, instances of Salmonellae outbreaks arise when individuals come into touch with baby poultry harbouring the Salmonellae bacterium. The source of this information is the Minnesota Department of Health, specifically from the year 2022.

II. METHODS

A. Study Area

The location for this study was Ibadan. Ibadan is the capital of Oyo State, Nigeria. Oyo State is an inland state in South-western Nigeria, with coordinates of 7.377° N and 3.947° E.

B. Study Design

The study was a cross sectional study involving day-old chicks produced by hatcheries sold at major Farm Markets situated within three randomly selected local government area (LGA). The LGAs are Ibadan North East, Ibadan South West and Egbeda local government area. One-hundred and Forty-five (145) samples were collected from vendors and hatcheries from randomly selected hatcheries and three major markets within the LGAs.

Sample Size

Sample size estimation for day old chicks was determined using the formula;

$$n = \frac{Z^2 Pq}{d^2} \text{ (Thrusfield, 2005)}$$

Where Z= level of significance (1.96), P=Prevalence, q=1-P, d = level of precision (5%)

$$\begin{aligned} Z &= 1.96, P = 5\% \text{ (Ezeibe et al., 2019)} \quad d = 0.05, \\ &= (1.96)^2 * 0.05 * (1 - 0.05) / (0.05)^2 \\ &= 3.8416 * 0.05 * 0.95 / 0.0025 \\ &= 73 \\ n/1-f, \text{ where } f &= 10\% \text{ contingency} \\ 73/1-0.1 &= 81 \end{aligned}$$

C. Sample Technique and Collection.

A multi-stage sampling method was used to select chicks for sampling. First, three hatcheries and three local government areas (LGAs) in Ibadan namely Ibadan North

East, Ibadan South East and Egbeda Local government were randomly selected for the study and a total of three (3) farm markets, one from each of the three LGAs, were purposefully recruited based on the presence of commercial chick vendors consent. Each Farm market was visited twice with 15 samples collected per visit and the hatcheries were visited once with 15 samples collected per visit. Three vendors were randomly selected from which three chicks were sampled using the systematic random sampling method per-vendor. Afterwards, each vendor was asked further questions for more information.

Cloacal swab samples were collected by gently rotating the cotton swab within the cloacae, with care taken to avoid contact with other areas to prevent contamination. All samples were transported in sterile tubes on ice to the Veterinary Public Health Laboratory of the Department of Veterinary Public Health and Preventive Medicine, University of Ibadan, for bacteriological analysis

D. Study Population

The study population were day-old-chicks produced at the hatcheries and sold by vendors at the selected markets.

The vendors (n=30) were also used as the study population to obtain information regarding the use of vaccines and or drugs on the day-old-chicks.

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F. Inclusion Criteria

Samples were obtained from chick vendors in major market locations within Ibadan North East LGA, Ibadan South East LGA and Egbeda LGA having chick markets. Samples were collected from live birds irrespective of the source, breed, clinical status and vaccination status.

G. Exclusion Criteria

Vendors selling other poultry birds and chickens more than one-day old were excluded from the study. Dead chicks were also excluded from the samples.

III. RESULTS

A. Identification of Major farm Markets where Day-Old-Chicks are Sold in Ibadan

The major farm markets where day-old-chicks are sold in Ibadan include Obasanjo farm market located at Oluyole, Ibadan South-West Local Government Area (LGA), Provider farm market located at Monatan, Ibadan North East LGA and Easy farm market located at Ice-block along new Ife-road, Egbeda LGA, Ibadan.

➤ *Isolation on Xylose Lysine Deoxycholate Agar*

All sample tested positive for Rappaport Vassiliadis with Soya (RVS) broth as colour change was observed in the RVS from blue to colourless (Fig. 1). Isolation and identification were carried out using Xylose Lysine Deoxycholate agar. Colonies of varying sizes, small and transparent with black centres and slightly raised were observed (Fig. 2). Of all the 135 samples, sixty-nine (80) were positive for *Salmonellae* on XLD agar (Table 1).

➤ *Result of Triple Sugar Iron (TSI) Agar Test for Salmonellae*

Eighty (80) isolates were tested with TSI agar out of which sixty-nine (69) tested positive due to glucose fermentation, non-lactose and or sucrose fermentation, positive result for gas production and positive result for hydrogen sulphide (H₂S) production ((Table 1; Figure 3); indicative of sulphite reaction by the production of black Ferrous Sulphate as stated by (Lehman, 2016).

➤ *Gram Staining*

Upon viewing of microscopic slides at x100 Magnification, pinkish short rod shape bacilli cells were seen which indicates a Gram-negative-bacteria.



Fig 1: a and b Showing Rappaport Vassiliadis before Incubation, Bluish Colour (a) and after 24 Hours Incubation with Change in Colour to Colourless (b)



Fig 2: Result on XLD Agar

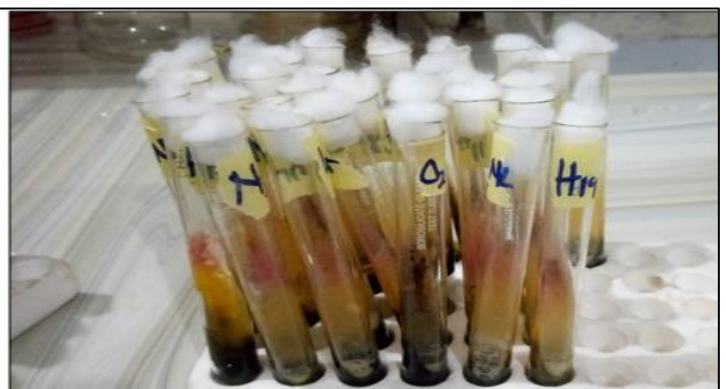
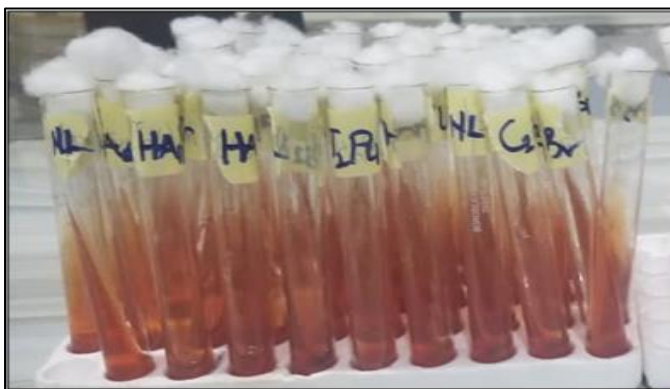


Fig 3: Result on Triple Sugar Iron test (TSI)

Table 1: XLD agar, Gram Staining and Biochemical Characterisation Results for *Salmonellae* spp. Isolated from Day Old Chicks Sold at Farm Markets and Hatcheries in Selected Local Government Areas in Ibadan

Location	No. of sample	XLD Agar	Gram Staining	TSI test	Catalase	Indole test	Oxidase test	Sugar fermentation test				
								Glu +ve	Malt +ve	Man +ve	Lac -ve	Suc -ve
Ibadan South East	30	17	17	16	16	16	15	1	1	1	1	1
Ibadan North East	30	15	15	15	15	15	11	0	0	0	0	0
Egbeda	30	22	22	20	20	10	19	3	3	3	3	3
Hatchery A	15	11	11	8	8	8	6	2	2	2	2	2
Hatchery B	15	4	4	3	3	3	2	0	0	0	0	0
Hatchery C	15	11	11	9	9	9	7	0	0	0	0	0
Total	135	80	80	69	69	69	60	6	6	6	6	6

➤ *Catalase Test*

Presumptive isolates for *Salmonellae* were confirmed as catalase positive for all isolates on TSI as it produced effervescence after a colony of the isolate was added to hydrogen peroxide using a microscopic slide (Table 1).

➤ *Indole Test*

The presumptive isolates for *Salmonellae* were confirmed indole negative for all isolates on TSI as they did not form red-rings at the meniscus of the overnight broth culture (Figure 4)

➤ *Oxidase Test*

Sixty (60) isolates for *Salmonellae* on TSI were confirmed oxidase negative as they do not change colour within five (5) seconds on treated filter paper with oxidase reagent (Table 1)

➤ *Sugar Fermentation*

Out of the fifty (50) selected isolates for sugar test, six (6) were confirmed with the colour change from red to yellow for the fermentation of Glucose, Mannose and Maltose with no colour change for non-fermentation of Lactose and Sucrose (Table 1).

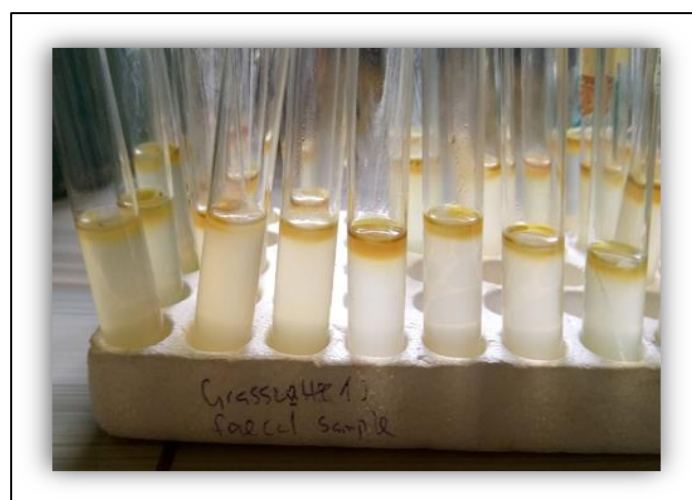


Fig 4: Result of Indole Test

B. Prevalence of Salmonellae in day-old chicks

Out of a total of 135 cloacal swab of chicks screened for *Salmonellae* spp., six (6) were confirmed positive with the overall prevalence of *Salmonellae* infection being 4.4% (6/135) (Table 2) (Figure 4). Total confirmed *Salmonellae* isolates from the farm market were four (4) with a prevalence of 2.9% (4/135) while the confirmed isolates from the hatcheries were two (2) with a prevalence of 1.5% (2/135) (Table 2).

Table 2: Prevalence of *Salmonellae* Infection in Day-Old Chicks from Major Hatcheries and Local Government Areas (LGAs) where the Major Farm Markets are Located in Ibadan

LGA/Hatchery	No. of Samples Collected	No of Confirmed <i>Salmonellae</i> Isolates	Prevalence
Ibadan South West	30	1	3.3%
Ibadan North East	30	0	0.0%
Egbeda LGA	30	3	10.0%
Sub-total	90	4	2.9%
Hatchery A	15	2	13.3%
Hatchery B	15	0	0.0%
Hatchery C	15	0	0.0%
Sub-total	45	2	1.5%
Total	135	6	4.4%

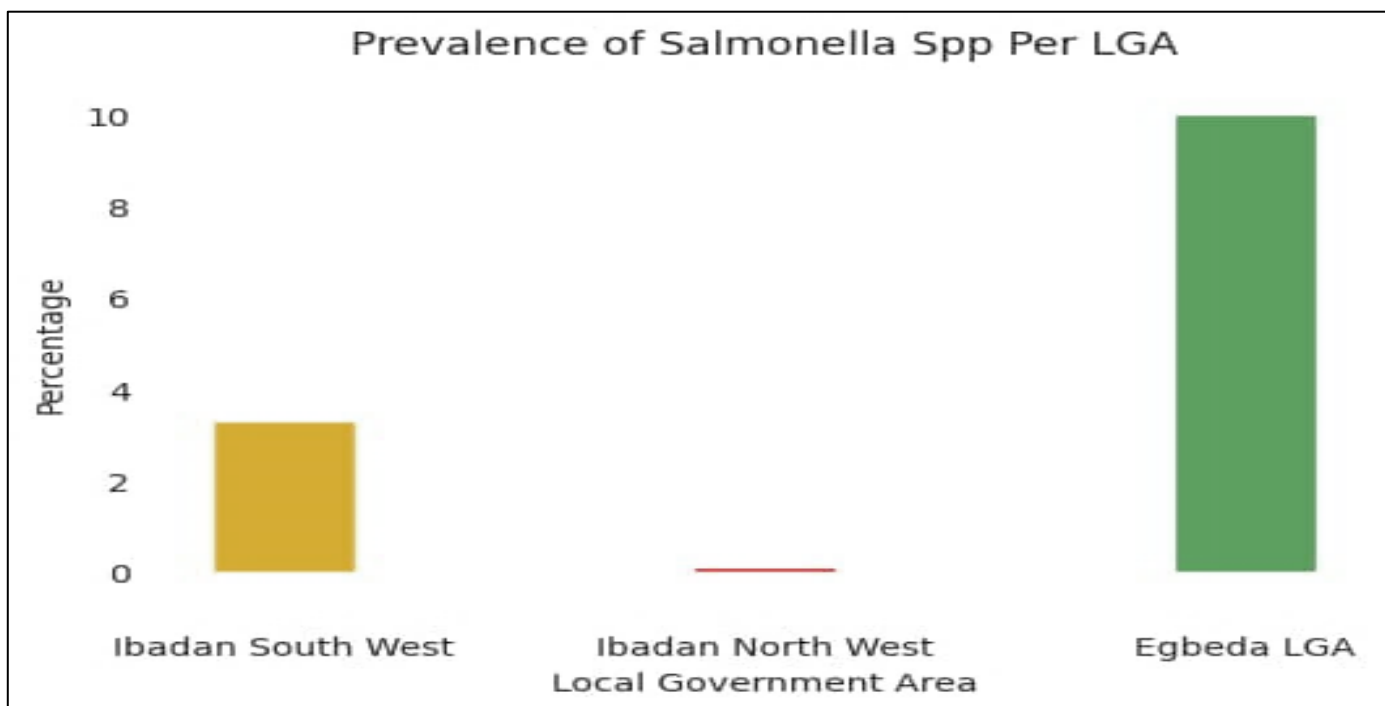


Fig 5: Prevalence of *Salmonellae* Infection in Day-Old Chicks from the Local Government Areas (LGAs) where the Major Farm Markets are Located in Ibadan

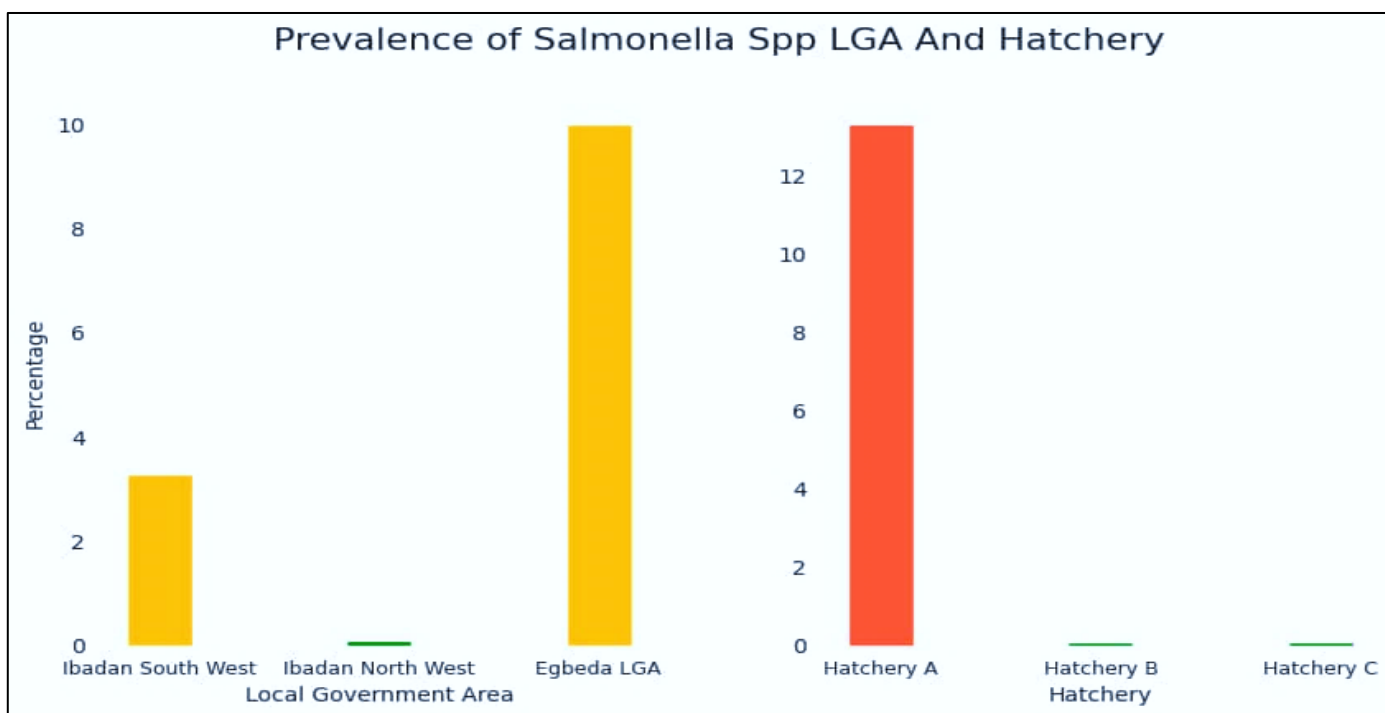


Fig 6: Prevalence of *Salmonellae* Infection in Day-Old Chicks from Major Hatcheries and the Local Government Areas (LGAs) where the Major Farm Markets are Located in Ibadan

C. Antibiotics Susceptibility Pattern of *Salmonellae* spp. in Day-Old Chicks

All the confirmed *Salmonellae* isolates (n = 6) subjected to antibiotic susceptibility test showed 100% resistance to Ampiclox, Amoxicillin clavulanate (Augmentin), Cefotaxime, Imipenem and Nalidixic acid. The isolates had moderate resistance to Ofloxacin (83%), Nitrofurantoin (83%),

Ceftriaxime (67%) and Levofloxacin (67%) (Tables 3 and 4) (Figure 9).

The *Salmonellae* isolates were found to be only 50% susceptible to Cefexime, 33% susceptible to Gentamycin, 17% susceptible each to Cefuroxime and Nitrofurantoin while all the isolates were not susceptible (0%) at all to the remaining eight antibiotics (Tables 3 and 4) (Figure 9).



Fig 7: Antibiotics Susceptibility Pattern of *Salmonellae* spp. with Arrow Showing zone of Inhibition

Table 3: Antibiotics Susceptibility Pattern

Isolates /antibiotics	CRO	ACX	ZEM	LBC	CXM	AUG	CTX	IMP	OFX	GN	NA	NF
Q/2/NL	I	R	R	I	R	R	R	R	I	S	R	R
A/2/BL	I	R	S	R	S	R	R	R	I	S	R	I
HA/14/NL	I	R	I	I	R	R	R	R	R	R	R	I
U/3/NL	R	R	S	I	I	R	R	R	I	R	R	I
R/1/NL	R	R	S	I	R	R	R	R	I	R	R	I
HA/2/BL	I	R	R	R	R	R	R	R	I	I	R	S

Table 4: Frequencies of Resistance, Intermediate and Susceptibility of Antibiotics Agent

S/N	Antimicrobial Agent	Frequencies of Sensitivity (%)	Frequencies of Intermediate (%)	Frequencies of Resistance (%)
1	Ceftriaxone	0.0	67	33
2	Amplicox	0.0	0.0	100
3	Cefexime	50	17	33
4	Levofloxacin	0.0	67	50
5	Cefuroxime	17	17	67
6	Amoxycillin	0.0	0.0	100
7	Cefotaxime	0.0	0.0	100
8	Imipenem	0.0	0.0	100
9	Ofloxacin	0.0	83	17
10	Gentamycin	33	17	50
11	Nalidixic acid	0.0	0	100
12	Nitrafuratoin	17	83	17

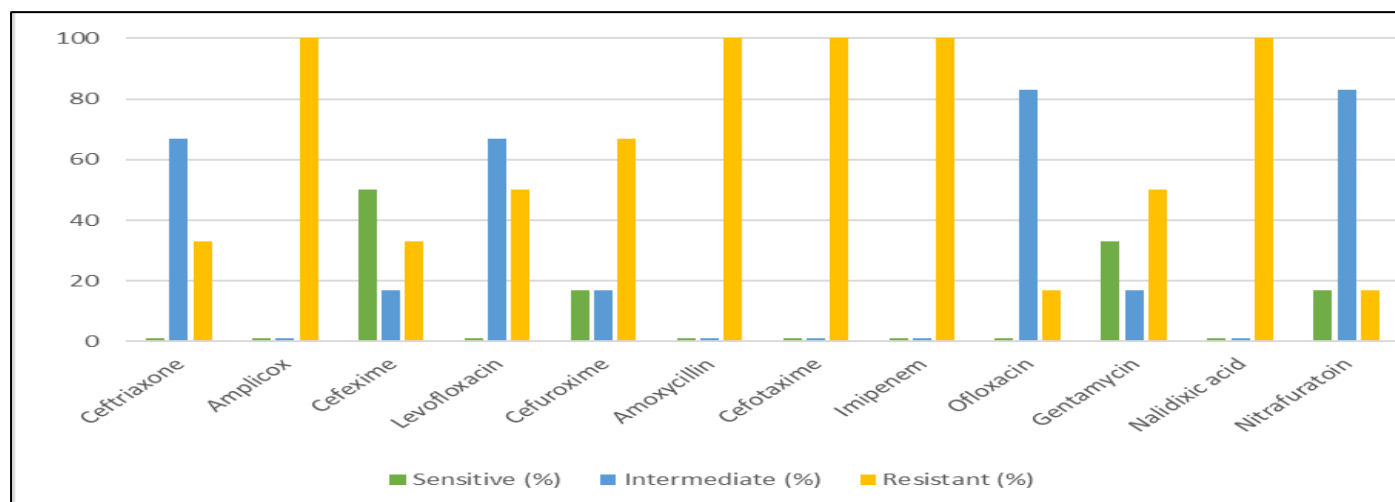


Fig 8: Antibiotics Susceptibility Pattern of *Salmonellae* spp.

D. Use of Vaccines and / or Antibiotics on Day-Old-Chicks by Vendors at Farm Markets and Hatcheries in Ibadan

Vendors (n=30) which (n=10) are from each LGA and Hatchery Operators (n=3) were asked some questions for

further information about the chicks. Out of the thirty (30) vendors, eight (8) vendors were found to administer drugs/antibiotics while 2 (two) vendors administered vaccine (Table 5) (Figure 9)

Table 5: Use of Vaccines and / or Antibiotics on Day-Old-Chicks by Vendors at Farm Markets and Hatcheries in Ibadan

LGA/Hatchery	Vaccine	Drug/Antibiotics
Ibadan South West (n=10)	1	5
Ibadan North East (n=10)	0	1
Egbeda (n=10)	1	2
Hatchery A (n=1)	0	0
Hatchery B (n=1)	0	0
Hatchery C (n=1)	0	0
Total	2	8

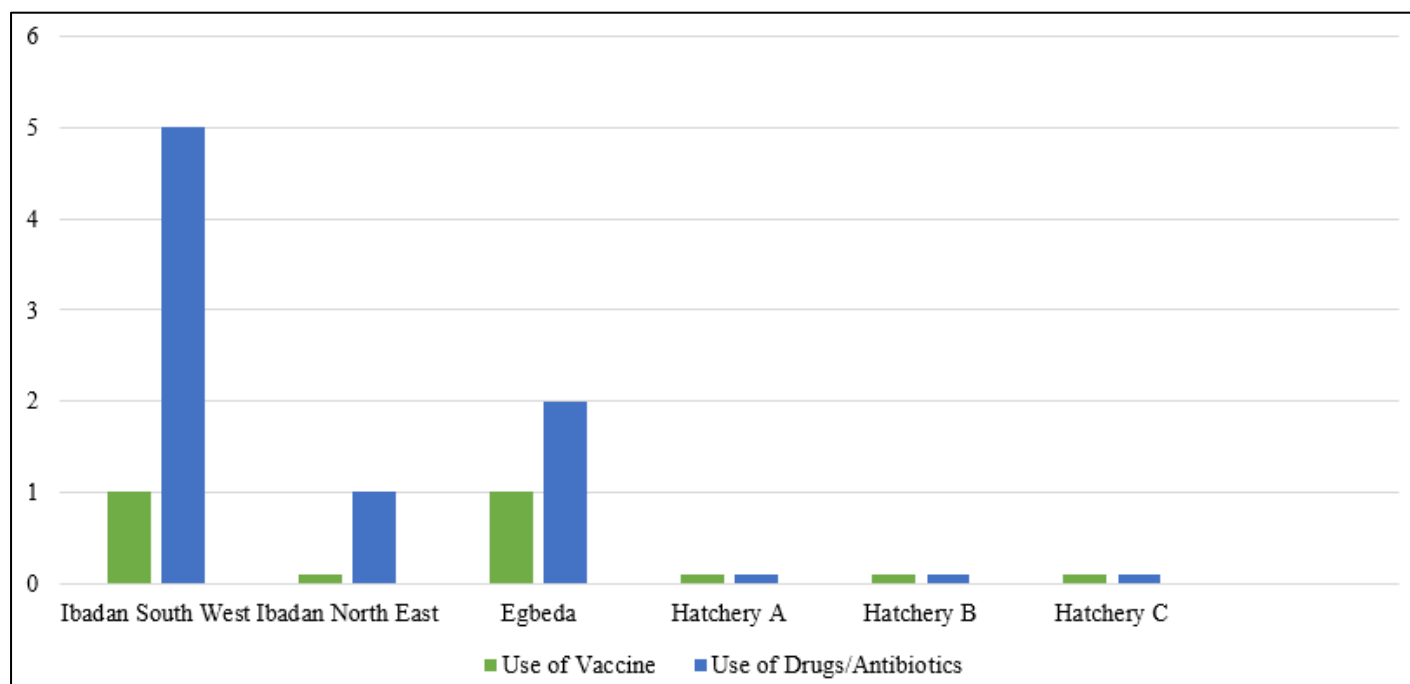


Fig 9: Use of Vaccines and / or Antibiotics on Day-Old-Chicks by Vendors at Farm Markets and Hatcheries in Ibadan

IV. DISCUSSION

The presence of Salmonellae in day-old chicks is one of the most important risk factors for the introduction of Salmonellae into poultry farms. Salmonellae infection does not only decrease production performance, it also causes death of poultry birds (Wang et al., 2020). In this study, only three (3) major farm markets where day-old-chicks are sold in Ibadan which are located in Oluyole, Ibadan South-West LGA, Monatan, Ibadan North East LGA and Ice-block along new Ife-road, Egbeda LGA, Ibadan were identified. Considering the importance of day-old-chicks to development of poultry industry, there is a need to have more well-organised farm markets where day-old-chicks are sold in Ibadan.

In this study, out of the 135 day-old-chicks examined for the presence of Salmonellae species, 2.9% (4/135) prevalence were from the Farm markets and 1.5% (2/135) from the hatcheries with an over-all prevalence of 4.4% (6/135). This findings were lower than that of Ezeibe et al.,

(2019) who reported 5% prevalence of Salmonellae spp. in day-old-chicks in Akwa-Ibom State in Nigeria and also Jibril et al., (2023) who reported 10.7% prevalence of Salmonellae spp. in day-old-chicks in three (3) states of the northwest Nigeria. Result of findings were lower than that of Albuquerque et al., (2014) who reported 0.58% prevalence of Salmonellae spp. in day-old-chicks in Brazil. Salmonellae infection is still one of the most important problems of poultry worldwide despite various prevention and control measures including vaccine and drug use (Wang et al., 2020). Studies has shown that Salmonellae illness in humans have been linked to zoonotic transmission from day-old-chicks via poultry products to humans and day-old-chicks have previously been associated with multistate outbreaks of salmonellosis (Jibril et al., 2023).

The results of this study showed that day-old-chicks from Hatchery A had the highest (13.3%) while the other two hatcheries had lowest (0.0%) prevalence of Salmonellae. This could be due to better hygienic practices by Hatcheries B and C. Kuria (2023) reported that there can be transmission of

Salmonellae from the hatching environment to the chicks. The higher (10.0%) prevalence of Salmonellae infection in day-old-chicks from the farm market located in Egbeda LGA compared to the other two farm markets within Ibadan South West and Ibadan North East LGAs could probably be due to poor biosecurity by the vendors at Egbeda LGA.

This findings from the antimicrobial susceptibility test in this study showed that all the confirmed Salmonellae isolates had total resistance (100%) to Ampiclox, Amoxicillin clavulanate (Augmentin), Cefotaxime, Imipenem and Nalidixic acid; and high to moderate resistance to Ofloxacin, Nitrofurantoin, Ceftriaxone and Levofloxacin. Hence, many of the Salmonellae spp. isolated from day-old-chicks from the sampled hatcheries and farm markets were resistant to commonly available antibiotics and showed multi-drug resistance (MDR) patterns being resistant to three or more classes of antimicrobials. The resistance and MDR patterns of the Salmonellae isolates is indicative of abuse of these antibiotics by vendors at the farm markets and most poultry farmers. This trend agrees with the report by Orum et al. (2022). Most of the vendors at the farm markets confirmed giving of Gentamycin antibiotics to the day-old-chicks routinely. Since Salmonellae organism can be vertically transmitted; antibiotics resistant genes of Salmonellae spp. in parent stocks can also be transmitted vertically to the offspring (chicks) (Castro-Vargass et al., 2020). Thus, constituting a public health risk.

In addition, according to Schokker et al., (2017), chicks are born with commensal microorganism responsible for the development of immunomodulatory processes and intestinal architecture. Therefore the administration of antibiotics at day-old will result in death of the commensal bacterias exposing the gastrointestinal tract of the day-old chicks to gastrointestinal insults or infections. It is very worrisome that all the isolates had zero to low susceptibility to more than 90.0% of the 12 antibiotics tested in this study.

V. CONCLUSION

The study was able to identify the major farm markets where chicks are sold in Ibadan and their location.

In addition, this study established that some of the day-old-chicks produced by hatcheries and sold in major farm markets in Ibadan are infected with *Salmonellae* species. The prevalence of *Salmonellae* infection in the day-old-chicks from the study locations was 4.4%. The isolated *Salmonellae* in this study were multidrug resistant and had low or no susceptible to almost all the antibiotics tested.

➤ Recommendation

- Vendors at farm markets and hatcheries operators should be trained on biosecurity principles and measures to minimize or totally eradicate the horizontal transmission of Salmonellae to day-old-chicks.
- Researchers should conduct more studies on how to prevent vertical transmission of Salmonellae to chicks to facilitate Salmonella-free eggs and chicks

- Government should make and enforce laws to restrict non-licensed veterinary medical practitioners from using antibiotics indiscriminately in poultry to prevent antimicrobial resistance.
- Farmers and vendors need to be educated on the resultant effect of irregular use of antibiotics on the birds at day-old

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