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Perceptions and practices of farmers of indigenous poultry towards *Salmonella* infections in North-Central Nigeria

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Abstract

Background: *Salmonella* infections continue to be of global concern to poultry health, productivity, and public health. About 44% of the poultry in Nigeria are indigenous and kept in close interaction with farmers who are mostly rural dwellers and have limited access to veterinary and extension services.

Aim: The perceptions and practices of farmers of indigenous poultry toward *Salmonella* infections were assessed to obtain and document baseline data that can be used to create awareness among farmers about these infections and their attendant public health implications.

Methods: A cross-sectional approach using a multistage sampling method was used in this survey. A total of 419 farmers keeping indigenous poultry were interviewed using a pre-tested electronic questionnaire in three randomly selected states within North-Central Nigeria. Data were analyzed using descriptive and regression analysis.

Results: Out of the 419 respondents, 138 (32.9%), 141 (33.7%), and 140 (33.4%) were from Benue, Kwara, and Plateau States, respectively. Of the 419, 55.4% were females, 40.8% were above 40 years, and 35.8% have over 10 years of farming experience. The majority of the poultry are not housed (58.5%) and farmers predominantly rear chickens (51.8%). Also, 49.9% of the birds were 1–6 months with 41.5% of the flock sizes being 11–20. Respondents had a poor level of perception toward *Salmonella* infection as the majority did not know that *Salmonella* affects poultry (89.3%) and that *Salmonella* infections are zoonotic (94.5%). Significant ($p = 0.000$) associations existed between categorized perception score and age, educational status, family size, and farming experience of farmers. There were significant ($p = 0.000$) associations of categorized practice scores with gender, age, education status, family size, and farming experience of farmers.

Conclusion: This study has revealed the poor perception of farmers on *Salmonella* infections and has highlighted their practices. There is a need to raise awareness about these infections to improve indigenous poultry health and productivity as well as public health.

Keywords: Indigenous poultry farmers, Perceptions, Practices, Nigeria, *Salmonella* infections.

Introduction

Indigenous poultry is also known as traditional, scavenging, backyard, village, local, family, rural, free-range, or native poultry (Padhi, 2016). These poultry categories are often kept in an extensive setting with minimal or no housing or feeding since birds are left to scavenge for food and water (Magothe *et al.*, 2012; Desta *et al.*, 2013; FAO, 2018). Also, they are hardy, can withstand harsh weather and environmental conditions (Ajayi, 2010), and are found primarily in rural community households (Kryger *et al.*, 2010).

The rearing of indigenous poultry has been reported globally, but they are more abundant in developing countries than in developed ones (Manyelo *et al.*, 2020). Approximately 80% of rural households are engaged in smallholder poultry production in sub-Saharan Africa

(Kryger *et al.*, 2010). Ethiopia has about 59.5 million poultry of which 91% are indigenous chickens (CSA, 2017). Similarly, Kenya has an estimated 32 million poultry, 81% are indigenous chickens that support the livelihood of over 21 million people in rural areas (Nyaga, 2007).

Nigeria is a lower-middle-income country with a population of 190 million people and a gross domestic product per capita of \$ 1,968. The country has about 102 million people living below the poverty line and over 70% of Nigerians are involved in poultry production directly or indirectly (FAO, 2019). Indigenous poultry constitutes about 80 million of the total 180 million poultry in Nigeria (FMARD, 2017; FAO, 2018) and is being kept by about 6.6 million households (FAO, 2018) who are primarily rural dwellers (Ajayi, 2010; Heise, 2015).

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There are several reports of *Salmonella* infections in commercial poultry (Muhammad *et al.*, 2010; Agbaje *et al.*, 2010; Fagbamila *et al.*, 2017; Mshelbwala *et al.*, 2017; Jibril *et al.*, 2020) but the *Salmonella* status of indigenous poultry in Nigeria has not been fully elucidated. This may partly be due to the little or no veterinary attention received by indigenous poultry (Adene and Oguntade, 2006). The implication is that human and poultry health becomes compromised leading to illnesses, decreased productivity, malnutrition, and loss of income among rural dwellers. If properly harnessed, there is enormous potential for the poultry industry in Nigeria to enhance food and nutritional security while contributing to household and economic growth (Heise, 2015). Despite the high population of indigenous poultry in Nigeria, there is still a dearth of information on the demographics of these farmers, their perceptions about salmonellosis, farming practices, its significant public health importance, and its impact on poultry productivity. Hence, in this study, we evaluated the perceptions and practices of farmers of indigenous poultry towards *Salmonella* infections which will help increase awareness of the disease among farmers, enhance poultry productivity and improve poultry and public health.

Materials and Methods

Study area and design

This study was conducted in the North Central geopolitical zone of Nigeria, one of the country's administrative divisions. The zone comprises six States, namely, Benue, Kogi, Kwara, Nasarawa, Niger, and Plateau.

A cross-sectional approach using a multistage sampling method was used in this survey. In the first stage, the North Central zone was purposely selected because it forms the hub of indigenous poultry keeping. Three States (Benue, Kwara, and Plateau States) out of the six states in the North Central zone were selected by balloting without replacement in the second stage. Each State has three senatorial districts from which three Local Government Areas (LGAs) were further selected in the third stage by balloting. In the fourth stage, two villages were randomly selected as sampling sites in each selected LGA. Hence, six villages were sampled per senatorial district to give a total of 18 villages in each State. The Local Government Areas sampled in the three States in North Central Nigeria are shown in Figure 1.

Data collection tool

A pre-tested, structured questionnaire was administered to farmers of indigenous poultry to assess their perceptions of *Salmonella* between November 2019 and December 2020. Households with indigenous poultry were considered eligible for the survey and were selected by the snowballing method. Questionnaire administration was carried out using the KoBo Toolbox to collect data from farmers across the three selected

States. KoBo Toolbox is an open-source suite of tools for data collection and analysis developed by the Harvard Humanitarian Initiative and the International Rescue Committee. This tool offers a quick and reliable means of gathering information about humanitarian crises and research. Briefly, farmers were asked questions on demographics, their perceptions of salmonellosis, and their farming practices. These questions had been inputted on smartphones, and their responses were sent online to a designated site for analysis.

Sample size determination

The prevalence rate for *Salmonella* infections in indigenous chickens in Nigeria is not known, so an assumed prevalence of 50% was used for sample size determination. The sample size was calculated using the formula for cross-sectional studies (Thrusfield, 2007).

$$N = \frac{Z^2pq}{d^2}$$

where N is the sample size

$Z = 1.96$ (constant)

p (prevalence) = 0.5

q ($1-p$) = 0.5

d (allowable error of 5%) = 0.05

$$N = \frac{1.96 \times 1.96 \times 0.5 \times 0.5}{0.05^2} = 385$$

Four hundred and nineteen ($N = 419$) farmers from different households were interviewed in the three States, with each State having at least 138 respondents across its three senatorial districts.

Questionnaire data collection

In each of the states sampled, the Veterinary Departments were contacted and approval was sought for farmers of indigenous poultry to be interviewed. Livestock extension workers were identified in each of the senatorial districts who further liaised with community leaders in the villages where farmers were interviewed. In the selected villages, farmers keeping indigenous poultry were considered eligible for the study. The farmers were informed of the purpose of the study and verbal and written consent was obtained before the interviews. Participation was voluntary and for the reliability of the research instrument and data, Livestock Extension Officers conducted the interviews which were done in the farmers' local languages.

Data analyses

The data generated was imported into an Excel spreadsheet (Microsoft Inc.) and exported to SPSS version 25.0 (PASW Inc.) for statistical analysis. Percentages were calculated as the ratio between the responses of farmers to key questions and the number of farmers interviewed. The percentage of each response was calculated separately and presented in Tables. Perception and practice variables were scored,

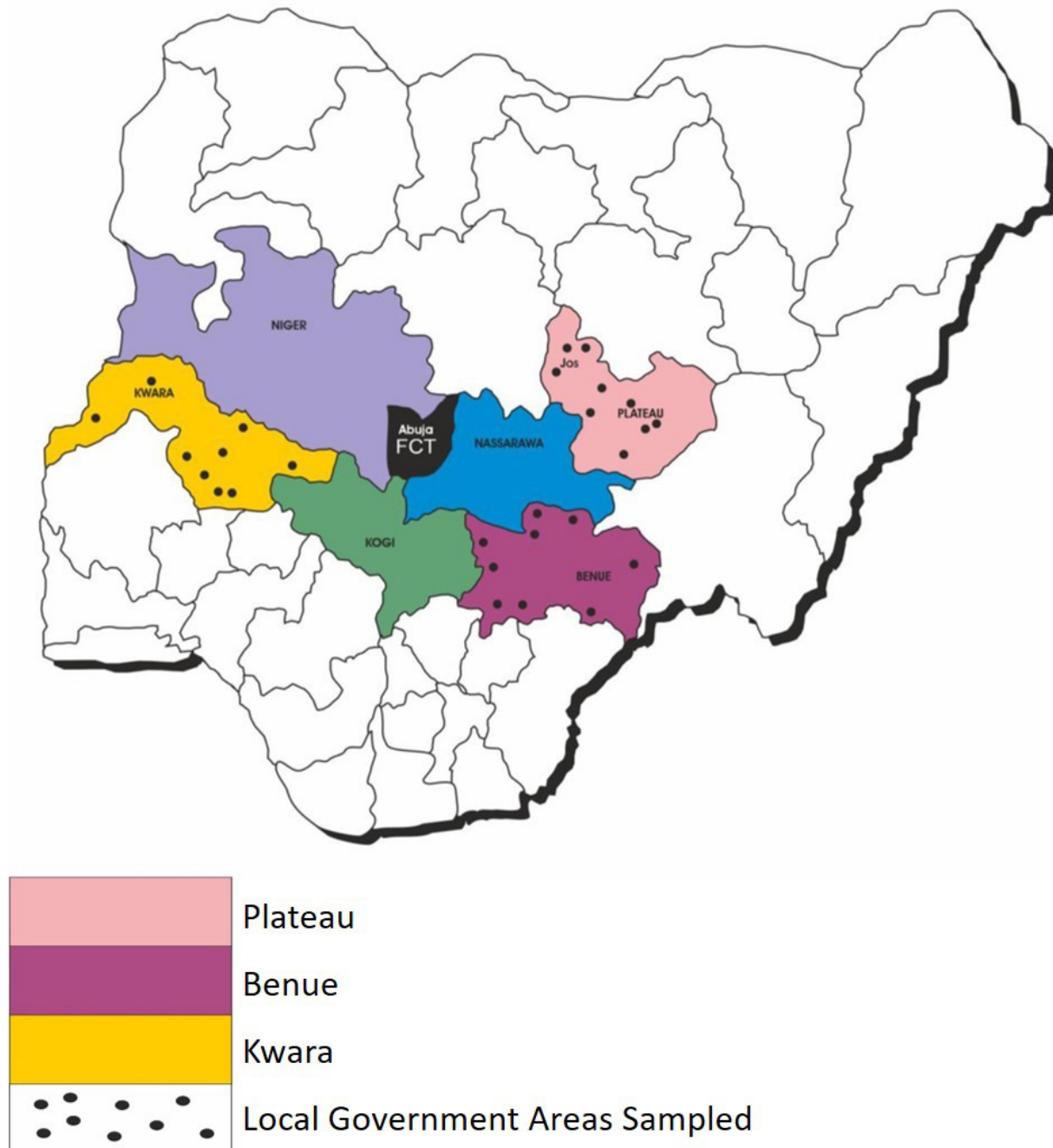


Fig. 1. Map of Nigeria showing the North Central States and the local government areas sampled in the three selected States.

and associations of categorized perception and practice scores with demographic variables were tested using Chi-square statistic. Values of $p \leq 0.05$ were considered to be significant.

Ethical approval

Ethical approval for this work was obtained from the National Veterinary Research Institute Vom Animal Use and Care Committee (AEC/02/70/19).

Results

Demographic characteristics of farmers of indigenous poultry in North-Central Nigeria

A total of 419 respondents were interviewed across the three selected States of which 138 (32.9%), 141 (33.7%), and 140 (33.4%) respondents were from Benue, Kwara, and Plateau States, respectively (Table 1). Out of the total 419 respondents interviewed, 232 (55.4%) were

Table 1. Demographic characteristics of farmers of indigenous poultry in North Central Nigeria.

Characteristic	Frequency (N = 419)	Percent (%)
State of origin		
Benue	138	32.9
Kwara	141	33.7
Plateau	140	33.4
Gender		
Female	232	55.4
Male	187	44.6
Age range (years)		
15–25	27	6.4
26–35	108	25.8
36–45	113	27.0
Above 45	171	40.8
Educational status		
Adult education	30	7.2
None	72	17.2
Primary	58	13.8
High school	165	39.4
Tertiary	94	22.4
Family size (number)		
1–5	168	40.1
6–10	201	48
11–15	35	8.4
More than 16	15	3.6
Farming experience (years)		
Less than 1	11	2.6
1–5	138	32.9
6–10	120	28.6
Over 10	150	35.8

females, and 187 (44.6%) were males. Based on the age distribution, 27 (6.4%) respondents were 15–25 years, 108 (25.8%) were 26–35 years, 113 (27.0%) were 36–45 years, and 171 (40.8%) were above 40 years. Thirty (7.2%) respondents had adult education, 72 (17.2%) had no education, 58 (13.8%) had primary education, 165 (39.4%) high school education, and 94 (22.45) had tertiary education. One hundred and sixty-eight (40.1) had a family size of 1–5, 201 (48.0%) had 6–10, 35 (8.4%) had 11–15, and 15 (3.6%) had family size of more than 16. Based on years of farming experience, 11 (2.6%) respondents had less than 1 year farming experience, 138 (32.9%) had 1–5 years, 120 (28.6%) had 6–10 years, and 150 (35.8%) respondents had over 10 years farming experience (Table 1).

Management practices of farmers of indigenous poultry in North-Central Nigeria

Based on the type of poultry, 217 (51.8%) respondents reared chickens, 37 (8.8%) turkeys, 24 (5.7%) ducks, 9 (2.2%) guinea fowls, and 132 (33.5%) kept mixed species. More respondents, 174 (41.5%) had poultry flock size of 11–20, 60 (14.3%) had 1–10, 107 (25.5%) had 21–30, and 78 (18.6%) had flock size of over 30 birds. Seventy-one (16.9%) respondents reared birds for the purpose of having assets, 113 (27.1%) for consumption, 231 (55.1%) for income, and 4 (0.9%) reared birds for other purposes. Based on the ages of birds in the flock, 177 (42.2%) respondents had birds less than 1 month old, 209 (49.9%) had birds 1–6 months old, and 33 (7.9%) had birds aged 7 months and

above. Two hundred and forty-one (57.5%) respondents bought their birds from neighbours, 50 (11.9%) obtained them as gifts, 99 (23.6%) from inheritance, and 29 (6.9%) from other sources. Only 174 (41.5%) respondents housed their birds, while 245 (58.5%) do not.

The sources of poultry feed were commercial in 92 (22.0%), scavenging in 133 (31.7%), grains in 181 (43.2%), and others in 13 (3.1%) respondents. Sixty-three (15.0%) respondents sourced water from boreholes, 21 (5.0%) from streams, lakes and rivers, 46 (11.0%) from pipe borne water, and 289 (69.0%) from wells. A total of 333 (79.5%) respondents had separate drinking points for poultry. Other animals kept were pets (dogs and cats) by 47 (11.2%), ruminants by 165 (39.4%), swine by 20 (4.8%) and mixed by 55 (13.1%) respondents; 132 (31.5%) respondents kept no other animals (Table 2).

Perceptions of farmers of indigenous poultry towards *Salmonella* infection

Among the respondents, 373 (89.0%) knew that *Salmonella* affects humans, 45 (10.7%) knew that *Salmonella* affects poultry. Additionally, 19 (4.5%) respondents had recorded *Salmonella* infection in their flocks out of which 11 (57.9%) had digestive signs, 2 (10.5%) respiratory, 5 (26.3%) mixed signs, and 1 (5.3%) recorded death. Only 23 (5.5%) respondents knew that *Salmonella* infections in humans can affect poultry and vice versa (Table 3).

The associations of demographic characteristics of farmers of indigenous poultry with categorized perception score of *Salmonella* infection in North Central Nigeria were assessed (Table 4). There were statistically significant associations with age ($\chi^2 = 23.230$; $df = 3$; $p = 0.000$), education status ($\chi^2 = 21.656$; $df = 4$; $p = 0.000$), family size ($\chi^2 = 20.731$; $df = 3$; $p = 0.000$) and farming experience ($\chi^2 = 19.260$; $df = 3$; $p = 0.000$) of farmers with the poor level of perception.

Practices of farmers of indigenous poultry towards *Salmonella* infection

Out of the 419 respondents, 261 (62.3%) administer medication to poultry flock and this medication included solely antimicrobials [191 (73.0%)], antimicrobials and others [21 (8.0%)], and vaccines [13 (5.0%)]. Out of the 261 that give medication, 204 (78.2%) administered for 1–3 days, 49 (18.8%) for 4–7 days, and 8 (13.0%) gave for over 1 week (Table 5). Fifty-one (19.5%) respondents provided self-veterinary care, 176 (67.4%) sought veterinary care from veterinary assistants, and 34 (13.1%) sought veterinary care from veterinary doctors (Table 5).

The associations of demographic characteristics of farmers of indigenous poultry with categorized practice score towards *Salmonella* infection in North Central Nigeria revealed statistically significant associations with gender ($\chi^2 = 14.245$; $df = 1$; $p = 0.000$), age ($\chi^2 = 21.545$; $df = 3$; $p = 0.000$), educational status

($\chi^2 = 41.498$; $df = 4$; $p = 0.000$), family size ($\chi^2 = 22.295$; $df = 3$; $p = 0.000$) and farming experience ($\chi^2 = 25.155$; $df = 3$; $p = 0.000$) of farmers with good level of practice (Table 6).

Discussion

Poultry farming generally thrives in Nigeria due to its acceptability across cultural and religious lines. Demand for poultry is also higher because of population growth, economic growth, and lifestyle changes. Indigenous poultry keeping will readily provide protein sources for consumers both at the rural and urban settings at lower rates than what is obtainable for commercial poultry due to the lower cost of production.

Our findings revealed that more women in rural areas keep poultry compared to men. This finding agrees with Siyaya and Masuku (2013), who reported more female farmers of indigenous poultry in Swaziland than males. This might be because poultry are mostly raised around the home where women take care of the children and perform other chores. Women are known to use their income, mostly generated from the sale of poultry products (OECD, 2009) to provide for family needs such as food or medical care (Wong *et al.*, 2017). Men are more likely to be involved in rearing cattle and crop farming, leaving the rearing of poultry to the women and children. In contrast, Mose *et al.* (2018) and Moussaa *et al.* (2018) reported more males involved in indigenous poultry in Kenya (76.3%) and Niger Republic (56.9%), respectively. Our findings revealed older persons compared to younger ones are involved in raising indigenous poultry. This could either be as a result of urban migration by the younger generation seeking a better life or the hierarchical nature of rural settings where animals owned by family members are all under the direct care of the head of the family. A high proportion of our respondents (39.4%) had high school education which is relevant for understanding and translating knowledge to improve livelihoods. In most instances, highly educated individuals prefer to stay in townships, leaving the not-so-educated in the villages. It is, therefore, worthy of note that even with high school education, most of the farmers (94.5%) were not aware of the zoonotic nature of *Salmonella*. The study has revealed that the average family size of indigenous farmers in North-Central Nigeria is large (between 6 and 10 members). This might be due to the value placed on children as assets of labour in agrarian settings, as a social symbol, or for physical or security purposes (Owumi *et al.*, 2016; Alaba *et al.*, 2017).

Chickens are accepted across different cultures, which could explain why they are the most commonly kept indigenous poultry, as observed in this study (51.8%). Similar finding (59.2%) was obtained in Niger Republic (Moussaa *et al.*, 2018). The practice of farmers keeping more than one species of animal has been brought to the fore. Farmers do this to increase the income-generating

Table 2. Management practices among farmers of indigenous poultry in North Central Nigeria.

Management practice	Frequency (N = 419)	Percent (%)
Types of Poultry reared		
Chickens	217	51.8
Turkeys	37	8.8
Ducks	24	5.7
Guinea fowls	9	2.2
Mixed	132	33.5
Flock size		
1–10	60	14.3
11–20	174	41.5
21–30	107	25.5
over 30	78	18.6
Purpose of rearing birds		
Asset	71	16.9
Consumption	113	27.1
Income	231	55.1
Others	4	0.9
Age of birds in the flock		
Less than 1 month	177	42.2
1–6 months	209	49.9
7 months and above	33	7.9
Source of birds		
Purchased from a neighbour	241	57.5
Gift	50	11.9
Inheritance	99	23.6
Others	29	6.9
Housing of birds		
Yes	174	41.5
No	245	58.5
Poultry feed source		
Commercial	92	22.0
Scavenge	133	31.7
Grains	181	43.2
Others	13	3.1
Feeding pattern		
Once daily	192	45.8
Twice daily	159	37.9
Thrice daily	19	4.5
Others (Specify)	49	11.7
Source of drinking water for poultry		
Boreholes	63	15.0
Streams, lakes, rivers etc.	21	5.0
Pipe borne water	46	11.0
Wells	289	69.0

Continued

Management practice	Frequency (N = 419)	Percent (%)
Separate drinking point for poultry		
Yes	333	79.5
No	86	20.5
Other Animals kept by farmers		
None	132	31.5
Pets (dogs/cats)	47	11.2
Ruminants	165	39.4
Swine	20	4.8
Mixed	55	13.1

Table 3. Perception of farmers of indigenous poultry towards *Salmonella* infections in North Central Nigeria.

Variables	Frequency (%)
<i>Salmonella</i> affect humans	
Yes	373 (89.0)
No	46 (11.0)
<i>Salmonella</i> affects poultry	
Yes	45 (10.7)
No	374 (89.3)
<i>Salmonella</i> infection recorded in flock	
Yes	19 (4.5)
No	400 (95.5)
Signs of <i>Salmonella</i> infection	
Digestive	11 (57.9)
Respiratory	2 (10.5)
Mixed	5 (26.3)
Death	1 (5.3)
<i>Salmonella</i> infections in humans can affect poultry and vice versa	
Yes	23 (5.5)
No	396 (94.5)

power of their families. Flock sizes are generally small (averagely 11–20 birds as seen in this study). These poultry were kept as a regular source of marginal income or sold to buy food or medical supplies (Wong *et al.*, 2017). Families may treat visitors to sumptuous dishes made from the poultry they own.

Interestingly, most farmers/respondents reported not housing the indigenous poultry (58.5%). This is in agreement with Moussaa *et al.* (2018) who reported a similar finding (60.6%) in Niger Republic. Poultry could perch on trees, fences, and any other such places (Adene and Oguntade, 2006). Most of the respondents (43.2%) feed their poultry on grains. This practice is most seen where farmers pour grains for poultry in the mornings before the go out to scavenge. This practice is quite good as it boosts their nutrition in combination with scavenging/free-ranging and has the potential to

increase flock sizes. It is, however, intriguing why the flock sizes are quite small in the households.

Water can be a significant source of contamination and disease transmission in rural areas. Findings from this study revealed that most farmers use well water (69%) as drinking water for their poultry, with the majority (79.5%) having separate drinking points for poultry. This practice is very important in preventing food-borne diseases infections such as *Salmonella* infections. Significant differences between poultry-keeping duration were also observed. This observation implies that more farmers had been rearing poultry for a long period in the villages as a “way of life.” Poultry keeping duration suggests that farmers who kept poultry for longer periods were more at risk of getting *Salmonella* infections than those who do not. This is true because birds that harbor *Salmonella* shed the

Table 4. Association of demographic characteristics of farmers of indigenous poultry with categorized perception score of *Salmonella* infection in North Central Nigeria.

Characteristic	Categorized score (N = 419)		χ^2	df	p-value
	Poor (%)	Good (%)			
State of origin					
Benue	128 (30.5)	10 (2.4)	0.082	2	0.960
Kwara	131(31.3)	10 (2.4)			
Plateau	131(31.3)	9 (2.1)			
Gender					
Female	231 (55.1)	20 (4.8)	1.065	1	0.333
Male	159 (37.9)	9 (2.1)			
Age range (years)					
15–25	23 (5.5)	4 (1.0)	23.230	3	0.000*
26–35	91 (21.7)	17 (4.1)			
36–45	109 (26.0)	4 (1.0)			
Above 45	167 (39.9)	4 (1.0)			
Educational status					
Adult education	24 (5.7)	6 (1.4)	21.656	4	0.000*
None	62 (14.8)	10 (2.4)			
Primary	52 (12.4)	6 (1.4)			
Secondary	161 (38.4)	4 (1.0)			
Tertiary	91 (21.7)	3 (0.7)			
Family size (number)					
1–5	145 (34.6)	23 (5.5)	20.731	3	0.000*
6–10	197 (47.0)	4 (1.0)			
11–15	33 (7.9)	2 (0.5)			
More than 16	15 (3.6)	0 (0.0)			
Farming experience (years)					
Less than 1	9 (2.1)	2 (0.5)	19.260	3	0.000*
1–5	119 (28.4)	19 (4.5)			
6–10	115 (27.4)	5 (1.2)			
Over 10	147 (35.1)	3(0.7)			

bacteria intermittently into the environment serving as a source of infection to newer additions to the flock and also the farmers. *Salmonella* infections tend to occur in older birds. Shedding happens when birds are exposed to stressors such as extreme weather changes (Gole et al., 2017).

In this study, we also observed that majority of the farmers (89%) were aware of *Salmonella* infections in humans known as typhoid fever but unaware of the same in poultry as revealed by most of the respondents (89.3%). A high proportion of farmers (95.5 %) also reported never having recorded *Salmonella* infection in their flocks. These knowledge gaps among farmers may be associated with poor disease surveillance and weak veterinary extension services in the villages/rural areas. More worrisome is that these farmers do not know

the inherent risks related to zoonotic transmission of *Salmonella* infections commonly associated with poultry as seen in this study. The close interaction between poultry, farmers, and the environment in which *Salmonella* could be shed will enhance its persistence in the environment and horizontal transmission in the ecosystem. However, strengthening the veterinary and extension services to rural areas will improve farmer knowledge and public health of the communities. Additionally, 62.3% of the respondents revealed that they give medication to their poultry out of which 78.2% admitted that they only give these medications for between 1 and 3 days. This may be connected to the high cost of medication and drug availability in rural areas. The practice can lead to the development of antimicrobial resistance in poultry and subsequently

Table 5. Practices of farmers of indigenous poultry regarding *Salmonella* infections in North Central Nigeria.

Variables	Frequency (%)
Medication of poultry flock	
Yes	261 (62.3)
No	158 (37.7)
Type of intervention	
Antimicrobials alone	191 (73.0)
Antimicrobials and others	21 (8.0)
Vaccines	13 (5.0)
Do not know	36 (14.0)
Duration of medication for poultry	
1–3 days	204 (78.2)
4–7 days	49 (18.8)
Over 1 week	8 (13.0)
Provision of veterinary care	
Self	51 (19.5)
Veterinary assistant	176 (67.4)
Veterinary doctor	34 (13.1)

Table 6. Association of demographic characteristics of farmers of indigenous poultry with categorized practice score of *Salmonella* infection in North Central Nigeria.

Characteristic	Categorized score (N = 419)		χ^2	df	p-value
	Poor (%)	Good (%)			
State of origin					
Benue	53 (12.6)	85 (20.3)	0.048	2	0.976
Kwara	53 (12.6)	88 (21.0)			
Plateau	52 (12.4)	88 (21.0)			
Gender					
Female	113 (27.0)	138 (32.9)	14.245	1	0.000*
Male	45 (10.7)	123 (29.4)			
Age range (years)					
15–25	7 (1.7)	20 (4.8)	21.545	3	0.000*
26–35	49 (11.7)	59 (14.1)			
36–45	57 (13.6)	56 (13.4)			
Above 45	45 (10.7)	126 (30.1)			
Educational status					
Adult education	9 (2.1)	21 (5.0)	41.498	4	0.000*
None	32 (7.6)	40 (9.5)			
Primary	28 (6.7)	30 (7.2)			
Secondary	79 (18.9)	86 (20.5)			
Tertiary	10 (2.4)	84 (20.0)			

Continued

Characteristic	Categorized score (N = 419)		χ^2	df	p-value
	Poor (%)	Good (%)			
Family size (number)					
1–5	74 (17.7)	94 (22.4)	22.295	3	0.000*
6–10	80 (19.1)	121 (28.9)			
11–15	2 (0.5)	33 (7.9)			
More than 16	2 (0.5)	13 (3.1)			
Farming experience (years)					
Less than 1	3 (0.7)	8 (1.9)	25.155	3	0.000*
1–5	61 (14.6)	77 (18.4)			
6–10	60 (14.3)	60 (14.3)			
Over 10	34 (8.1)	116 (27.7)			

in humans. Most of the prescriptions are done by veterinary attendants who are mostly working without equipment/ reagents for diagnosis.

Our findings showed that 58% of the 19 farmers that had experienced *Salmonella* infections in their flocks noticed digestive signs while 26% reported digestive and respiratory signs. Taken together, these data highlight the potential importance of *Salmonella* infections as causes of ill health in the indigenous poultry and also a possible source of salmonellosis in humans in North-Central Nigeria.

Conclusion

This study has provided some baseline data on the demographics of farmers that raise indigenous poultry in the North-Central part of Nigeria. Management practices and other vital information about rearing indigenous poultry have also been brought to the fore. Knowledge gaps among farmers of indigenous poultry towards *Salmonella* infections, their potential significance in causing ill health among poultry and its attendant public health implications have been highlighted.

There is a need to conduct in-depth studies to underpin the salmonellosis burden and its significance in this poultry sub-sector. There is also a need for further studies on the interactions between indigenous poultry, humans, and the environment as regards the occurrence, control, and prevention of *Salmonella* infections. This will help improve public health, poultry productivity, and enhance food security.

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Conflict of interest

The authors declare that there is no conflict of interest.

Authors' contributions

NMS and IOF: designed the study, analyzed the data, and contributed to the writing of the manuscript. PDL, FNM, RPW, MM and JE: interpreted and analyzed the data and also involved in the writing of the manuscript.

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