Prevalence of *Salmonella* spp. in Poultry and Poultry Feeds in Makurdi Benue State, Nigeria

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Abstract: The study was undertaken to assess the risks of *Salmonella* infection present in faecal stained eggs, faecal materials and poultry feeds from live poultry markets and poultry feed shops in Makurdi-Benue State, Nigeria. A total of 300 samples comprised of 100 faecal stained egg surface washes, 100 faecal materials and 100 poultry feed samples were collected. Enrichment, isolation and identification of *Salmonella* was done according to International Standard Method, ISO-6579 (2017): non-selective enrichment, selective enrichment and isolation using buffered peptone water (BPW), Selenite-F-broth and xylose lysine deoxycholate (XLD) agar respectively. Suspected colonies on XLD agar were confirmed morphologically by Gram's staining and indole production test for biochemical test. Out of 300 samples, a total of 83(27.67%) samples were found to be positive for *Salmonella*. Out of the positive samples 3.67% were egg surface washes, 24% faecal materials and 0% poultry feeds. The prevalence of *Salmonella* in egg washings, faecal materials and poultry feeds was 11%, 72% and 0% respectively. Statistical analysis showed that there was a significant difference (P>0.05) on prevalence of the *Salmonella* among isolates from the sample sources and location. From the findings of the study, it is concluded that *Salmonella* isolates recovered in poultry origin-samples suggest this could be a potential vehicle for *Salmonella*-food-borne infection to humans. Hence, there is need to create awareness among the public, poultry sellers, farmers and local food vendors in the study area regarding adaptation of hygienic practices, strengthening biosecurity and implementation of preventive measures

Key word: Prevalence, *Salmonella*, poultry feeds, faecal, eggs

INTRODUCTION

Microbial food safety is an increasing public health concern worldwide (Mahdavi *et al.,* 2018), with food borne diseases being the foremost international health problems which are the origin of the major illness principally in developing countries, though many cases are not reported. Each year, millions of persons become ill from food borne diseases (Sukumar *et al.,* 2015). *Salmonella* is a leading cause of bacteria food-borne disease among the most serious health problems affecting public health (Mahdavi *et al.,* 2018). *Salmonella* spp are Gram negative, small rod shaped, non-sporing, non-capsulated, aerobic and facultative anaerobic organisms that are classified under the family, enterobacteriaceae (Akinola *et al*, 2019). The genus *Salmonella* includes a large group of serologically and biologically related bacilli, that are motile by means of peritrichous flagella, with exception of *Salmonella pullurum* and *Salmonella gallinarum* (Parbati *et al.,* 2017). *Salmonella* is an infectious and contagious bacterium that may be transmitted to humans, warm-blooded animals and reptiles, the most susceptible animals being poultry birds. *Salmonella* has long been associated with a wide spectrum of infectious disease such as typhoidal fever and non-typhoid salmonellosis, which cause public health problems in humans worldwide, and other numerous infectious diseases in poultry birds resulting to economic loss of livestock (Ezeigbo *et al.,* 2014). Avian salmonellosis is important both as a clinical disease in poultry, and as a source of food-borne disease of humans (Velasquez *et al.,* 2018).

Poultry meat and eggs are major sources of animal protein in many developing countries, because of their affordability and acceptance (Bettridge *et al.,* 2014, Fagbamila *et al.,* 2017). Poultry and poultry products are imperative elements within the human food chain responsible for most cases of salmonellosis but are widely accepted and are important reservoirs of intestinal and food-borne pathogens like *Salmonella* and recognized as vital sources of *Salmonella* infection in humans. Most cases of

Salmonella infection in humans are the consequences of consuming contaminated poultry, pork, beef and eggs (Nurudeen *et al.,* 2018). Infection by *Salmonella* is a common cause of food poisoning in humans (Barua *et al.,* 2014). Humans might get *Salmonella* infection during processing of poultry carcasses and close contact with poultry in live bird markets. *Salmonella* spp remains a significant public health concern globally with poultry products being a major source of foodborne salmonellosis. The prevalence of *Salmonella* spp in poultry, feacal material and poultry feeds is a persistent problem with potential contamination occurring at various stages of the poultry production stages of the poultry production chain. Despite implemented control measures, *Salmonella* continues to be isolated from poultry products, posing a risk to human health. The lack of comprehensive data on the prevalence of *Salmonella* spp in poultry, faecal material and poultry feeds in various regions hinders the development of effective control strategies, highlighting the need for more research to determine the current prevalence and identify areas for intervention to mitigate the risk of Salmonellosis.

Therefore, this study was designed to assess the risks of *Salmonella* infection associated with poultry faecal stained eggs, faecal materials and commercial poultry feeds sold in Makurdi, Nigeria with special reference to isolation of *Salmonella* by conventional culture methods based on sample source and location.

MATERIALS AND METHODS

Sample collection and sample size: A total of 300 samples comprised of 100 fecally stained egg surface washes, 100 faecal materials and 100 poultry feed samples were collected from live poultry markets, farms and poultry feed shops in Markudi, Benue State, Nigeria. Samples were collected from different live birds Markets (Wurukum Market, Modern Market and North Bank Market) and poultry feeds stores (God-4-us Livestock consult, Omega Livestock and Devine Favour Livestock stores) in Makurdi town, Nigeria.

Sample of egg shell surface: Samples from eggs stained with faecal materials were collected from egg shops by immersing the faecal stained faecal egg shell in 5 ml of normal saline and egg shell rinse was immediately stored in sterile test tube, labelled and promptly conveyed to the lab within the Department of Microbiology at Joseph Sarwuan Tarka University Makurdi, Nigeria.

Sample collection from faecal material: About 5 g of fresh faecal samples were collected aseptically into sterile vials with a spatula, labelled and promptly conveyed to the lab within the Department of Microbiology at Joseph Sarwuan Tarka University Makurdi, Nigeria.

Sample collection from poultry feeds: About 5 g of commercial poultry feeds were collected aseptically into sterile vials with the help of a spoon, labelled and promptly conveyed to the lab within the Department of Microbiology at Joseph Sarwuan Tarka University Makurdi, Nigeria.

Isolation and identification: The isolation and identification of *Salmonella* was done according to international standard method, ISO-6579 (2017). About 1 ml of sample was transferred immediately into sterile test tubes containing 9 ml of buffered peptone water and incubated at 37^{o}C overnight for pre-enrichment. An aliquot of 0.1 ml was inoculated into test tubes containing 10 ml of Selenite-F-broth and incubated at 37^{o}C for 24 hours for selective enrichment. A loopful of culture from the selective enriched broth were streaked onto xylose lysine deoxycholate (XLD) agar and incubated for 24 hours at 37^{o} C for selective isolation. For samples from faecal materials and poultry feeds, about 1.0 g of sample was added to sterile test tubes containing 9 ml of buffered peptone water and incubated at 37^{o}C overnight. An aliquot of 0.1 ml was inoculated into test tubes containing 10 ml of Selenite-F-broth and incubated at 37^{o}C for 24 hours. A loopful of culture from the selective enriched broth were plated onto

xylose lysine deoxycholate (XLD) agar and incubated for 24 hours at 37^{o}C. The cultural characterization of isolated bacteria was done by observing the colonies for shape, size, colour and opacity displayed on XLD agar. Biochemical examinations included Gram Staining, Oxidase production test and indole test (CLSI, 2013).

Data analysis: Statistical analysis showed that there was a significant difference (P>0.05) on prevalence of the *Salmonella* among isolates from the sample sources and location.

RESULTS

A total of 300 samples comprised of 100 faecal stained egg shell surface washes, 100 faecal materials and 100 poultry feed samples were collected from live poultry markets, farms and poultry feed shops in Markudi-Benue State, Nigeria. Out of the 300 samples, the overall prevalence of 27.67 % (83 positives) of *Salmonella* was recorded. Out of the positive samples 3.67% egg shell wash, 24% faecal materials and 0% poultry feeds were found to be positive based on cultural, morphological properties and biochemical test (Table 1.)

The prevalence differed among sample sources, out of the sampled areas in the study, 29 % positive samples were from Modern market, 7% from North Bank market, 47% from Wurukum market and 0% from Veterinary shops (Table 2.)

Culture appearance displayed the presence of circular, smooth black centered colonies on XLD agar plates after incubation (figure 1).The thin smears prepared from colonies on XLD agar for Gram's staining revealed a Gram-negative, pink coloured, small rod-shaped appearance arranged in a single (or paired) under the microscope.

Biochemical test revealed that all the isolates were negative for both oxidase and indole test showing no colour change.

Table 1: Prevalence of *Salmonella* spp in poultry and poultry products

Source	Total sample	Positive sample	% of *Salmonella* spp
Egg wash	100	11	3.67
Faecal material	100	72	24
Commercial Poultry feeds	100	0	0
Total	300	83	27.67

Table 2. Prevalence of *Salmonella* spp in poultry and poultry products according to locations

Source	Modern Market	North Bank market	Wurukum market	Vertinary shops
Egg wash	0	7	4	0
Faecal material	29	0	43	0
Commercial Poultry feeds	0	0	0	0
Total	29%	7%	47%	0%

DISCUSSION

The findings of our survey on *Salmonella* contamination in selected poultry and poultry feeds in Makurdi have important implications for various stakeholders. Our findings indicated that *Salmonella* was present in the samples collected and analyzed in the laboratory. The overall prevalence rate of 27.67 % of *Salmonella* recorded suggests the samples tested were contaminated with *Salmonella* bacteria and is a potential widespread risk of salmonella infection in the study environment which can lead to outbreaks and transmission of the bacteria. Similarly, Kilonzo-Nthenge *et al*. (2016) isolated *Salmonella* eggs shells and reported slightly lower prevalence rate of 3.6 % than this study which got 3.67%. *Salmonella* is a well-known foodborne pathogen responsible for causing

gastroenteritis and other severe illnesses. *Salmonella* contamination can lead to food poisoning, which can be severe and life threatening especially for vulnerable populations like the elderly, young children and people with compromised immune systems. The presence of Salmonella in poultry products and faecal stained eggs highlights a potential risk to human health (WHO, 2014). Consumption of contaminated poultry products, such as eggs or improperly cooked poultry meat, can lead to *Salmonella* infections in humans. Dey *et al.* (2016) reported clinical isolates that caused self-limiting gastroenteritis in both genders and all age groups. This emphasizes the importance of adopting stringent food safety measures and ensuring proper cooking and handling practices to minimize the risk of *Salmonella* transmission to consumers. The study revealed absence of *Salmonella* in the commercial poultry feeds which is a positive finding, suggesting a low risk of contamination and a high level of quality control in manufacturing process. It suggests that the manufacturers of these feeds have implemented effective quality control measures and have successfully minimized the risk of *Salmonella* contamination. Similarly, the findings of Ezeigbo *et al.* (2014) who conducted a study to determine the occurrence of *Salmonella* species in Aba, Nigeria from different brands of feed, revealed that no *Salmonella* species were obtained from all the samples collected from commercial feeds. This is crucial for safeguarding the health of poultry and reducing the potential for *Salmonella* transmission throughout the production chain. Furthermore, the significant difference of prevalence among sample sources (Table 2) observed suggest a high potential risk to widespread of *salmonella* infection especially from Wurukum Market which had the highest prevalence rate out of the sampled areas in the study.

CONCLUSION

The study revealed *Salmonella* contamination of 3.67% in egg wash, 24% of poultry faecal material, and 0% of poultry feed samples in Makurdi indicating a significant food safety risk. The findings have crucial implications for public health, as *Salmonella* is a leading cause of foodborne illness, and highlight the need for: Enhanced egg handling and processing practices to reduce contamination risk, Continued monitoring of poultry feed quality to ensure *Salmonella*-free supplies, Increased awareness and education among poultry producers, processors, and consumers about *Salmonella* risks and control. These findings contribute to the existing body of knowledge on *Salmonella* epidemiology in poultry and emphasize the importance of evidence-based interventions to mitigate the risk of foodborne salmonellosis in Makurdi.

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