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RESEARCH ARTICLE

PREVALENCE OF *SALMONELLA* SPECIES IN RAW CHICKEN AND QUAIL EGGS ISOLATED FROM SELECTED FARMS IN JOS PLATEAU STATE

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ABSTRACT

Investigations were carried out to ascertain the prevalence of *Salmonella* species in raw chicken and quail eggs isolated from selected farms in Jos Plateau state. One hundred and eighty egg samples each from chicken and quail were randomly collected from five poultry farms from the three Local Government Areas namely, Jos north. Jos south, and Jos east making a total of 360 samples. Samples were examined for the presence of *Salmonella* species using standard microbiological techniques. Isolates were confirmed phenotypically using biochemical characterization. Results showed that out of the 360 samples, only 3(1.7%) were positive for *Salmonella* species from chicken eggs. Negative result for *Salmonella* species from quail eggs was recorded. There was no significant difference of *Salmonella* species among quail and chicken eggs sampled. Results from five farms in Jos South LGA showed among the different locations sampled, Bukuru and Zawan were the only locations that recorded the prevalence of *Salmonella* species, with 1(8.3%) and 2(16.7%) respectively in Chicken eggs. Quail eggs recorded a prevalence of 0(0.0%) among all the locations sampled. From the egg shell and egg contents sampled, chicken eggs recorded a prevalence of 3(1.7%) from the egg shell and 0(0.0%) from the egg contents. Quail eggs recorded a prevalence of 0(0.0%) from both the egg content and shell. There was no significant difference between prevalence of *Salmonella* species isolated from quail and chicken eggs sampled. Infections caused by *Salmonella* species is of great public health importance. Adequate measures should be taken to eliminate *Salmonella i*n Poultry products so that infections arising from contamination of poultry products with this organism will be reduced to a minimal level.

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INTRODUCTION

Salmonella was first isolated and identified in 1885 by Daniel. E. Salmon and since then it has been recognized as a public health concern. Non-typhoidal *Salmonella* is the leading cause of food borne illness and is associated with increasing antimicrobial resistance (Gordon *et al.,* 2012). They have become the 2nd largest cause of food-borne illness after *Campylobacter*species (Mead *et al.,* 1999).The serotypes that causes non-typhoidal Salmonellosis are *Salmonella enterica*serotype*enteritidis* and *typhimurum* (Herikstad *et al.,* 2002; FAO, 2002). The illness caused by non-tyhoidal *Salmonella* is self-limiting, though systemic infections which can be fatal especially in individuals such as infants, children, pregnant women, elderly, organ recipient individual, cancer and HIV/AIDS patients can occur (Ellermeier and Slauch, 2006; Sebunya and Kapondorah, 2007; Voetsch *et al.,* 2004).

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Excellent sources of chlorine, selenium and riboflavin can be found in eggs. Eggs are rich in certain vitamins like A, D, E and K, folic acid, panthothenic acid and Zinc (Egg Nutrition Center, 2004). World over, consumption of eggs has gone up over the years considering the nutritional importance. There are two likely ways in which eggs can be contaminated by *Salmonella*, the shell of the egg may be contaminated with Salmonella from colonized gut or feces or environment (horizontal transmission). The second route is by direct contamination of its interior part (yolk) albumen, eggshell membrane or eggshell may be contaminated by penetration of the bacteria through the porous shell or when a chicken ovaries which is infected contaminate the egg during egg formation resulting from infection of reproductive organs with *salmonella enteritidis*(vertical transmission) (Gantois*et al.,* 2009). Consuming raw or undercooked poultry or poultry products for instance raw eggs, ice creams, homemade mayonnaise can cause infection with *Salmonella* by swallowing the bacterium (Egg Nutrition Center, 2004).

MATERIALS AND METHODS

Sample Size

A total number of 370 sample size was determine using prevalence rate from previous studies (Mai *et al.,* 2013) and the desired absolute precision with the formula:

$n=Z^2Pq/d^2$ Naing *et al*.(2006).

n = desired sample size (when population is greater than 10,000)
Z =Standard normal distribution of 95% confidence interval = 1.96.
P =Known prevalence of the infection.
d =allowable error which is taken at 5% = 0.05
q =1.0 –p

Using the formula Naing *et al.,* (2006)

= 337

Attrition rate = 10% of total sample i.e 33.7

= 370

Statistical Analysis: Data was analyzed using the SPSS version 20 computer statistical software package. Questionnaire was administered and treated, and cross tabulations were done to examine relationship between categorical variables. The Chi-square test was used to compare differences between proportions. The statistical analysis was set at 5% level of significance (i.e. $p < 0.05$).

Sample collection: A total number of 360 sampled eggs were collected, 180 samples from chicken and 180 samples from quail eggs were collected randomly from three (3) different locations in Jos town namely; Jos south, Jos north and Jos east.

Table 1. Prevalence of *Salmonella* species isolated from raw quail and chicken eggs in selected farms in Jos south LGA

Locations (Jos South LGA)	QUAIL EGGS		CHICKEN EGGS		Total	
	Number of samples Examined	Number Positive (%)	Number of samples Examined	Number Positive (%)	Number of samples Examined	Number Positive (%)
Bukuru	12	0(0.0)	12	1(8.3)	24	1(4.3)
Vwang	12	0(0.0)	12	0(0.0)	24	0(0.0)
Shen	12	0(0.0)	12	0(0.0)	24	0(0.0)
Zawan	12	0(0.0)	12	2(16.7)	24	2(8.3)
Guratopp	12	0(0.0)	12	0(0.0)	24	0(0.0)
Total	60	0(0.0)	60	3(5.0)	120	3(2.5)

Table 2. Prevalence of *Salmonella* species isolated from quail and chicken eggs in selected farms in Jos east LGA

Locations (Jos East LGA)	Quail Eggs		Chicken Eggs		Total	
	Number of samples Examined	Number Positive (%)	Number of samples Examined	Number Positive (%)	Number of samples Examined	Number Positive (%)
Fobor	12	0(0.0)	12	0(0.0)	24	0(0.0)
Angware	12	0(0.0)	12	0(0.0)	24	0(0.0)
Lamingo	12	0(0.0)	12	0(0.0)	24	0(0.0)
Shere hills	12	0(0.0)	12	0(0.0)	24	0(0.0)
Kwanga	12	0(0.0)	12	0(0.0)	24	0(0.0)
Total	60	0(0.0)	60	0(0.0)	120	0(0.0)

Table 3. Prevalence of *salmonella* species isolated from quail and chicken eggs in selected farms in Jos north LGA

Locations (Jos North LGA)	QUAIL EGGS		CHICKEN EGGS		Total	
	Number of samples Examined	Number Positive (%)	Number of samples Examined	Number Positive (%)	Number of samples Examined	Number Positive (%)
Faringada	12	0(0.0)	12	0(0.0)	24	0(0.0)
Eto Baba	12	0(0.0)	12	0(0.0)	24	0(0.0)
Mista Ali	12	0(0.0)	12	0(0.0)	24	0(0.0)
AngwaRukuba	12	0(0.0)	12	0(0.0)	24	0(0.0)
Naraguta	12	0(0.0)	12	0(0.0)	24	0(0.0)
Total	60	0(0.0)	60	0(0.0)	120	0(0.0)

Table 4. Prevalence of *Salmonella* species isolated from chicken and quail egg shells and contents

Type of sample	SOURCE		TOTAL
	QUAIL Number positive (%)	CHICKEN Number positive (%)	Quail and Chicken (%)
Egg shell (n=180)	0(0.0)	3(1.7)	3(1.7)
Egg Content (n=180)	0(0.0)	0(0.0)	0(0.0)
TOTAL (n=360)	0(0.0)	3(0.8)	3(0.8)

(χ^2=3.000, P< 0.005, df=1)

Table 5. Serological identification of Salmonella isolates (Slide Method)

Test	Results
Polyvalent O Antisera	Agglutination (+)
Polyvalent H Antisera	No agglutination (-)

Packaging for laboratory analysis: Chicken and quail eggs were collected in separate sterile plastic bags each, egg shell surfaces were swabbed with sterile swab stick and placed into buffered peptone water (BPW), to avoid dryness of the swab.

Sample transport: All samples were placed in sterile plastic bags and then packaged in an ice box and transported immediately to microbiology unit of Central Diagnostic Laboratory Department of National Veterinary Research Institute Vom, Plateau State Nigeria.

Sample processing: All samples were processed according to standard guidelines of detecting salmonella both in the egg shell and internal content by International Standard Organization (ISO): 6579, (2012) and Office International des Epizooties (OIE), (2012).

Media used for inoculation and isolation: All the media (Nutrient Agar, (NA), Buffer Peptone water (BPW), Rappaport-vassiliadis broth (RVB), Xylose Lysine Desoxycholate Citrate Agar (XLD), Deoxycholate Citrate Agar (DCA)) used for inoculation and isolation were all prepared according to manufacturer's standards as adopted by Cheesebrough (2001).

Swabs from surface of egg shell: Surface swabs from egg shells collected was directly incubated in 9ml BPW in screw capped bottles and then incubated at 37^0C for 24hrs for pre-enrichment. About 1ml of the pre-enrichment broth was transferred into tubes containing 10ml RVB, then sub-cultured by streaking onto DCA and XLD agar. The sub-cultured plates were incubated at 37^0C for 24hrs (OIE, 2012).

Egg internal content: Eggs from the sterile plastic bag were aseptically opened with sterile scissors and the egg shell aseptically broken and the content from each egg ware homogenized in a glass flask. Exactly1m of the homogenized egg was transferred in to 9ml of buffered peptone water (BPW) (Pre-enrichment broth) and incubated at 37^0C for 24hrs.

Biochemical test for identification of isolates: Gram staining, Sugar fermentation, motility, indole, oxidase, catalase, Methyl red and Voges-Proskauer test, Citrate utilization test, Urease test, Triple sugar iron test were all carried out adopting methods of Cheesebrough (2001) for identification of isolates.

Serotyping: Cultures of organisms from a pure culture identified as Salmonella by biochemical tests was serotyped. The serological identification of Salmonella species was done using polyvalent salmonella H antisera and Salmonella O antisera (Oxiod, UK).

Three to five colonies of isolate was suspended in 0.5ml normal saline used as antigenic suspension. One drop of the polyvalent antiserum and normal saline was placed on a clean glass slide divided into parts with glass pencil as control. A drop of the antigenic suspension was placed to the antiserum and normal saline on another part of the glass slide. The suspension was mixed by tilting the glass slide back and forth for one minute. Big agglutination within one minutes was observed and recorded as positive. Delayed or weak agglutination was recorded as negative. Standard positive and negative controls was also run concurrently (Cowan and Steel, 1993).

DISCUSSION

Prevalence of Salmonella in the different locations sampled, Bukuru and Zawan were the only locations that recorded the prevalence of Salmonella, with 1(8.3%) and 2(16.7%) respectively in Chicken eggs. Quail eggs recorded a prevalence of 0(0.0%) among all the locations sampled. From the egg shell and egg contents sampled, chicken eggs recorded a prevalence of 3(1.7%) from the egg shell and 0(0.0%) from the egg contents. Whereas quail eggs recorded a prevalence of 0(0.0%) from both the egg content and shell. In a similar study conducted in Jos, Mai *etal*.(2013) reported a high prevalence(32.5%) of salmonella in table eggs sold at different markets in Jos south. The higher prevalence observed in the study by Naik *et al*. (2015) and others may be due to type of samples and location of the study. These differences could also be attributed to the high level of salmonella species contamination in their findings compared to this study. The low prevalence observed in this study may perhaps be due to increased awareness on the prevention and control of poultry diseases. This has increase the level of bio-security and may be attributed to the fact that poultry farmers practice strict bio-security practices and care in most of the poultry farms surveyed.

Another reason for the low prevalence in this study can be attributed to the fact that the eggs sampled in this study area were freshly laid eggs confined within the selected poultry houses. It is observed that the level of external contamination is minimal when compared with those eggs already in the retail shops and those already transported to various destination before consumption. It also confirms the report recorded by Bata *et al*. (2016) who reported prevalence of salmonella from raw beef and quail eggs from farms and retail outlets as 1.3% (3/235) of which 1.7% from egg shell and 0.8% from egg content. From this study, it showed salmonella contamination was from the egg shell. It was also noted that the three isolates were recovered during the rainy season. During this period, there was high humidity, this, encourages the growth and invasion of microorganisms. At this season of the year, poultry droppings, litters and laying nests are seen wet and damp. These can also encourage survival of microorganisms like the Salmonella species and then contaminating the egg shell. Contamination perhaps could be horizontally transmitted from the feaces or housing environment of the farms. Salmonella in droppings can penetrate egg shell despite the multiple barriers, salmonella is capable of migrating to the yolk (Messens*et al.,* 2005). Temperature difference between the newly laid egg and the environment it comes into contact plays a great role. When the egg is exposed to the environment cooler that the chicken body temperature which is 42^0C, a negative pressure develops and can lead to migration easily through the egg shell and membrane to the liquid portion of the eggs. When the eggs are broken like for preparation of food, Salmonella from the egg surfaces could find it way into the food which could pose potential health hazards.

Conclusion

It was established from findings of this study that prevalence of *Salmonella* species was1.7% from raw egg shells of chicken only, and none was recorded from egg contents of both chicken and quail. Although 1.7% prevalence of salmonella recorded in this study may be negligible, it is important to state that this percentage is of public health importance.

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