

# Prevalence of *Salmonella* and *Shigella* species in Chicken Eggs from Poultry Farms in Owerri, Nigeria

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## Abstract

*Salmonella* and *Shigella* contamination of eggs and egg shells has been identified as a public health concern worldwide. A recent shift in consumer preferences has impacted on the egg industry, with a push for cage-free egg production methods. There has also been an increased desire from consumers for raw unprocessed foods, potentially increasing the risk of salmonellosis and shigellosis. The present study was conducted to determine the prevalence of *Salmonella* and *Shigella* in chicken eggs from different poultry farms in Owerri, Imo state. Egg shell and egg content of 360 eggs were examined for *Salmonella* and *Shigella* using cultural method on Salmonella-Shigella agar. The bacterial isolates were identified using colony morphology, Gram staining technique and biochemical tests. Data were analyzed using Analysis of Variance (ANOVA) at 5% significance level. Of a total of 360 samples screened, 37 samples were contaminated with *Salmonella* species and comprised of 24 (6.67%) egg shell samples and 13 (3.61%) egg content samples while 21 samples were contaminated with *Shigella* species and comprised of 15 (4.17%) egg shell samples and 6 (1.66%) egg content samples. The overall prevalence of *Salmonella* in egg shells and contents was 37 (10.28%) while that of *Shigella* in egg shells and contents was 21 (5.83%). The results of this study indicated that egg shell contamination with fecal material was significantly higher than that of egg contents. Contamination of eggs by *Salmonella* and *Shigella* species reported in this study may cause an outbreak of food-borne disease in the study area due to eating raw eggs or its products.

**Keywords:** Prevalence, *Salmonella*, *Shigella*, Chicken eggs, Food-borne disease, Public Health.

## Introduction

Food-borne diseases caused by microorganisms are a large and growing public health problem [1]. Contamination of eggs and egg products with microorganisms can affect egg quality, which may lead to spoilage and pathogen transmission. This may induce food-borne infection or intoxication to

consumers. Today, eggs remain a staple food within the human diet, consumed by people throughout the world. They are consumed nationwide in the form of pastries, stew and beverages and are considered very nutritious and a cheap source of protein [2].

Though eggs are considered as complete food for growth and substance, studies indicate that microorganisms often contaminate egg. Freshly laid eggs are generally devoid of microorganisms, however, following exposure to environmental conditions such as soil, faeces and dirty nesting materials, eggs become contaminated with different types of microorganisms [3]. Furthermore, these microorganisms may contaminate the egg contents either by penetration or withdrawal through pores of the shells and also through predisposing factors such as environmental temperature and humidity, thus enhancing infection and spoilage [4]. This study aims at determining the prevalence of *Salmonella* and *Shigella* species in chicken eggs from different poultry farms in Owerri, Imo State.

## Methodology

### Study Design and Sampling

A cross-sectional survey was undertaken to determine the prevalence of *Salmonella* and *Shigella* in chicken eggs from different poultry farms in Owerri, Imo state. A total of 360 egg samples were collected randomly from 15 different poultry farms in the 3 Local Government Areas of Owerri (Owerri Municipal, Owerri West and Owerri North). A total of 24 eggs were collected from each poultry farm by systematic random sampling. The sampled eggs were packed in sterile plastic bag and taken to the laboratory of the Department of Microbiology, Imo State University, Owerri, Imo State for bacterial analysis.

### Isolation of Sample

This was carried out using standard method by [5]. For the isolation of bacteria from the surface of the egg shells, sterile cotton swab sticks were moistened in normal saline and used to swab the surface of the egg shells. The swabs were inoculated on Salmonella-Shigella agar plates. The

plates were incubated at 37°C for 24 h. For the isolation of bacteria from the contents of the eggs, the surface of each egg was disinfected with 70% ethanol. A sterile spatula was used to create an opening into the egg and the content thoroughly mixed. A 0.1 ml of the mixture of egg white and yolk was inoculated on Salmonella-Shigella agar plate using a sterile needle and syringe. The plates were incubated at 37°C for 24 h. After incubation, the plates were examined for characteristic colonies of *Salmonella* and *Shigella*.

**Identification of Isolates**

Pure colonies of all the isolates were identified using colony morphology, Gram staining and biochemical tests such as catalase, urease, citrate utilization, indole, oxidase, coagulase and methyl red tests as described by [5].

**Statistical Analysis**

Prevalence of *Salmonella* and *Shigella* was expressed in percentage. Data were analyzed using Analysis of Variance (ANOVA) at 5% significance level.

**Results**

**Prevalence of *Salmonella* and *Shigella* species in chicken eggs from poultry farms**

Out of the 360 samples collected, 37 samples were contaminated with *Salmonella* species, with an overall prevalence of 10.28% while 21 samples were contaminated with *Shigella* species with an overall prevalence of 5.83% as shown in Table 1.

Table 1: Prevalence of *Salmonella* and *Shigella* species in chicken eggs from poultry farms

Organism	Total	Number sample contaminated	%
<i>Salmonella</i> sp	360	37	10.28
<i>Shigella</i> sp	360	21	5.83
Total		58	16.11

**Frequency distribution of *Salmonella* species in egg shells and contents**

Out of a total of 360 samples screened, 37 samples were contaminated with *Salmonella* species and comprised of 24 (6.67%) egg shell samples and 13 (3.61%) egg content samples as shown in Table 2.

Table 2: Frequency distribution of *Salmonella* species in egg shells and contents

Sample type	Total	Number sample contaminated	%
Egg shell	360	24	6.67
Egg content	360	13	3.61
Total		37	10.28

**Frequency distribution of *Shigella* species in egg shells and contents**

Of a total of 360 samples examined, 21 samples were contaminated with *Shigella* species and comprised of 15 (4.17%) egg shell samples and 6 (1.66%) egg content samples as shown in Table 3.

Table 3: Frequency distribution of *Shigella* species in egg shells and contents

Sample type	Total	Number sample contaminated	%
Egg shell	360	15	4.17
Egg content	360	6	1.66
Total		21	5.83

**Discussion**

In poultry farms, *Salmonella* and *Shigella* species are among the most significant zoonotic bacteria [6]. The extreme importance is to evaluate the level and place of contamination for making a decision to control *Salmonella* and *Shigella* infections in chickens. Contamination inside the egg can occur with the infected ovary of the hen [7] while egg shell contamination can occur through egg contact with fecal material, insects, feed or even through transportation, storage or during handling. The results of this study indicated that egg shell contamination with the fecal material was significantly higher than that of egg contents. Similar observation was reported by [8]. The high prevalence of *Salmonella* and *Shigella* species reported in this study could be due to poor sanitation, handling and storage.

This study reports the contamination of shell and contents of eggs by *Salmonella* and *Shigella* species but quantification of such contamination should be further investigated. *Salmonella* and *Shigella* species are deleterious for egg quality and they are hazardous for consumers' health. This fact suggest the importance of establishing good animal health practice in poultry farms as practiced in other countries in an attempt to prevent the contamination of chicken eggs. Horizontal transmission of *Salmonella* and *Shigella* species is usually derived from fecal contamination of the egg shell which may be able to contaminate egg contents by migration through the egg shell and membranes. Such a route is facilitated by moist egg shells, storage at ambient temperature and shell damage but can be effectively reduced by cleaning and disinfection of the environment and by good production and handling practices.

**Conclusion**

It is emerging that *Salmonella* and *Shigella* species possesses particular characteristics that increase its fitness along the infection route; most especially, it has the ability to alter its cell surface dramatically,

and its mode of growth may be especially significant. However, to minimize the potential risk of salmonellosis and shigellosis due to the consumption of egg and egg products, good manufacturing and handling practices should always be observed. Reference can be made to a World Health organization [9] educational brochure which outlines the safe procedure for consumers as well as food handlers to follow when handling and preparing eggs and food containing eggs.

Although researches will continue for vaccine-based prevention against *Salmonella* and *Shigella* chicken/hen infection and human disease, continued improvement and implementation of detection and environmental controls will also be effective in reducing egg contamination and therefore improving public health. Moreover, egg and egg products are safest when stored in the refrigerator individually and thoroughly cooked and promptly consumed. The higher the microbial load of *Salmonella* and *Shigella* species present in egg, the more likely to cause food borne illness.

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