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The Occurrence and Antibiotics Sensitivity Profile of *Salmonella* and *Escherichia coli* in Commercial Poultry Feeds in Minna, Niger State

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Abstract
The study was conducted to determine the presence of *Escherichia coli* and Salmonella pathogens from different brand of commercially available poultry feeds in Minna metropolis. A total of 60 samples from three poultry feeds namely; Starter, finisher and layers were aseptically collected and analyzed using standard microbiological techniques. All samples analyzed were cultured on Nutrient agar media by spread plate's technique and subsequently on selective media for total bacterial count. Total viable count (TVC) of Salmonella and *E. coli* recorded in the feeds were as follows: starter 3.47cfu/g, finisher 4.84 cfu/g and layers 9.02 cfu/g. There was a significant ($p<0.05$) trend in the overall percentage distribution of *Salmonella* and *E. coli* contamination across the feed's category, with the higher distribution recorded in layers 100% and finisher while, starter had (66.6%) distribution. The overall result of antibiotics susceptibility tests of Salmonella and *E. coli* revealed the sensitivity of (53.8%), and resistant of (46.1%) in *E. coli* while, *Salmonella* had (38.4 %) sensitivity and (61.5%) resistant to all antibiotics tested. Thus, all the poultry feeds were found to be contaminated with bacteria which may pose a public health risk to human. Therefore, the occurrence of Salmonella and *E. coli* in poultry feeds reinforces the need for effective control measures, hygiene in processing and handling of feeds.

Keywords: Poultry feeds, *Salmonella*, *E. coli*, Sensitivity, Contamination

1. Introduction

Poultry feeds are food materials utilized in raising poultry birds. Poultry feeds are referred to as complete feeds, as they are intended to contain all the dietary materials required for appropriate development, meat and egg production in birds. Different brands of poultry feeds are in existence relying upon the capacities it acts in the winged animals. In this manner, there are growers, finishers, layers, starters among others [1]. Poultry feeds can possibly get tainted with food borne pathogenic microorganisms during collecting and possible advertising of the packed away feedstuffs. Poultry feeds sullied with microscopic organisms pathogenic to people can add to human food borne ailment through the feed-poultry-food-human chain [2]. There is considerable proof that poultry feeds are generally defiled with food-borne bacterial microbes. Animal feed has been demonstrated to be a significant vector for the transmission of Salmonella and other microscopic organisms to the farm processing plants [3].

However, the wellbeing and nature of poultry feeds are great subject in developed nations, that feed security is a necessity for all creatures. Risky feed may likewise cause incredible monetary misfortunes in view of crushing an infected group of flying creatures and there are proof that poultry feed is frequently infected with food-borne pathogenic microscopic organisms [4]. The production of poultry feeds requires microbiological guidelines to get away from microbial contamination of the product. Prominent among these microorganisms, *Salmonella* and *E. coli* contaminations of poultry have been demonstrated to be of basic significance in Nigeria [2].

In modern poultry production, antibiotics are utilized for treatment and prevention of infectious diseases in farm animals intended for food production in livestock and to shield general wellbeing from food borne illnesses. Antibiotics treatment is viewed as a significant issue that promotes the emergence, selection and spreading of antibiotic resistant microorganisms in both veterinary and human medicine [5]. Common antibiotics agents utilized are Bacitracin, Chlortetracycline, Erythromycin and Penicillin. The fluoroquinolones are significant members from the quinolone group of anti-microbials used to treat ailments in people and their utilization in domesticated animals [6]. The contamination of animal feeds has been believed to be among the reasons for

different diseases, for example, salmonellosis, the runs, bacillary looseness of the bowels, colibacillosis, staphylococcus's, listeriosis and erysipelas are generally found in livestock. However, the potential and all more lethal risk connected with animal feed is the antibiotics resistance acquired by the contaminating organisms [7].

Hence, the objectives of this present study are to investigate (i) Isolation and identification of *Salmonella* and *E. coli* species from different sources of poultry feeds. (ii) Determined their antibiotics susceptibility tests on arrays of antibiotics.

2. Materials and Methods

2.1 Study Area

Minna is a city in middle belt Nigeria. It is the capital of Niger state and situated in Bosso with geographical coordinate of 90 36 '500N and 60 33' 25E. The metro area population of Minna in 2019 was 434000 consisting of Nupe, Gwari, Kambari and Hausa as most speaking dialect in the State.

2.2 Sample collection

A total of 60 samples of poultry feeds belonging to three varieties; namely starter, finisher, and layer were collected randomly from different selling outlet in Minna. The samples were kept for microbiological examination in the laboratory.

2.3 Bacteriological Analysis

The feeds samples collected were subjected to four-fold serial dilution (10^{-4}) according to [8] as modified. 1g of each poultry feed was added to 9 ml of sterile water in test tubes. 0.5 ml of the aliquot of 10-4 diluted samples were inoculated onto already prepared solidified Nutrient agar plates using spread plate technique by sterilized bent glass rod gently on the media and then incubated over night at 37 ^{o}C. Resultant growth colonies were further subculture on selective media of EMB agar, MacConkey agar and SS agar (HiMedia). The plates were then incubated for 37 ^{o}C for 24 h. Pure culture of isolated colonies was maintained on Nutrient ager slants.

243 Total Viable Count (TVC)

E. coli and Salmonella were recognized by the colour morphology on selective media. Total viable count was carried out by the mean of the colony on the media multiply by 1000 µl (1gm of the sample).

Count of *E. coli* = Mean of the colonies × 1000 µl

Count of *Salmonella* = Mean of the colonies × 1000 µl

2.45Antibiotics Susceptibility Test

Pure cultures of all isolated isolates were prepared in nutrient broth and standardized using 0.5 McFarland standard. The antibiotics susceptibility tests were carried out using Kirby-Bauer disc diffusion method, according to the guide lines [9].

The antibiotics tested includes: Amoxicillin (25 µg), Amoxiclav (30 µg), Ampicillin (2 µg), Amikacin (30 µg) Chloramphenicol (25 µg), Cephalothin (30 µg), Ciprofloxacin (5 µg), Erythromycin (15µg), Kanamycin (30 µg), Neomycin (10 µg), Nitrofurantoin (300 µsg), Penicillin G (10 units), Streptomycin (25µg), Tetracycline (30 µg) and Gentamycin (30 µg). Diameter zone of inhibition was then measured to the nearest millimeter and then reported.

2.56Statistical Analysis

The three brands of poultry feeds data collected were subjected to statistical analyses package; SPSS 16.0 to determine the mean. The differences within the means were expressed using one- way analysis of variance. Data obtained were presented in tables.

3. Results and Discussion

3.1 Results

The bacterial counts of commercial poultry feeds for three brands of feeds in Minna, revealed a complete feasible checks cfu/g for *Salmonella* and *E. coli*. The most elevated bacterial count was recorded in layers (9.02%) and least in starters (3.47%) (Table 3.1). The results likewise in Table 3.2 demonstrated a huge contrast ($p< 0.05$) in the entire rate of feed conveyance classes: starter (66.6%), finisher and layers (100%). The general consequence of anti-toxins vulnerability trial of Salmonella and *E. coli* uncovered the affectability of (53.8%), and safety of (46.1%) in *E. coli* while, Salmonella had (38.4 %) affectability and (61.5%) impervious to all anti-toxins tried as shown in (Table, 3.4).

Table 3.1: Total Viable Count of Different Feed Samples

Feed Category	Mean of The Colony		TVC (cfu/g)
	E. coli (10^{-4})	*Salmonella* (10^{-4})	
Starter	2.34	1.13	3.47
Finisher	3.12	1.72	4.84
Layer	5.62	3.40	9.02

TVC; = Total viable count, cfu/g; = Colony Forming Units

Table 3.2: Occurrence and Distribution of Bacterial in Commercial Poultry Feeds in Minna

Feed category	*E. coli*	*Salmonella spp*	Others	*Overall % Distribution of Feed category
Starter	+	-	+	66.6[a]
Finisher	+	+	+	100[b]
Layer	+	+	+	100[b]
% Distribution	100	66.6	100	------
% Occurrence (n=53)	23.4	4.6	5.7	------

Key: n = Total number of isolates; + = Present; - = absent; * = Percentage value with different alphabet are statistically significant (P > 0.05)

Table 3.3: Antibiotics susceptibility test of isolates in feeds samples

Antibiotics	*E. coli*	*Salmonella spp*
	S	R
Amoxicillin (25 µg)	R	S
Amoxiclav (30 µg)	S	S
Amikacin (30 µg)	R	R
Chloramphenicol (25 µg)	R	R
Cephalotan (30 µg)	S	R
Ciprofloxacin (5 µg)	S	S
Erythromycin (15 µg)	S	S
Kanamycin (30 µg)	R	R
Neomycin (10 µg)	S	R
Penicillin (10 units)	R	R
Streptomycin (25 g)	R	R
Tetracycline (30 µg)	S	R
Gentamycin (30 µg)	S	S

R; = Resistant, S; = Sensitive

Table 3.4: Overall Percentage Distribution of Antibiotics Profile of Isolates in Feeds Samples

Organism	% Sensitive	% Resistant
E. coli	53.8	46.1
Salmonella spp	38.4	61.5

3.2. Discussion

The occurrence of *Salmonella* and *E. coli* in commercial poultry feeds in Minna poses great economic and public health concern. Their presence shows faecal contamination of crude materials during preparing or bundling of completed item [10]. The presence of *E. coli* a coliform and *Salmonella sp* in the poultry feeds recommends faucal defilement either at industrial facility or by retailers, which can be linked to inadequate cleanliness [8]. Earlier, White and Collins [11] had isolated *Salmonella spp*. from numerous commercial poultry mills. This harmonizes with the discoveries of this current investigation. The presence of these microorganisms in the animal feeds suggest that the feeds contain adequate supplements for the development of these organisms and the activities of these microorganisms on the feeds under examination may cause degradation subsequently diminishing the nutrients that would have been completely available for the birds to benefit from. This is in agreement with the reports of Arotupin *et al.*, [12] on animal feeds and the pattern of sensitivity associated with microorganisms. Additionally, these microorganisms may likely have existed from the raw materials from which the feeds were prepared.

In this present study, the antimicrobial susceptibility test showed *Salmonella spp* to be more strongly resistant (61.5%) (Table 3.4). The susceptibility pattern observed for this study recorded overall sensitivity of (53.8%) in *E. coli* and (38.4%) *Salmonella spp*, were comparable to those reported [6, 13]. However, this could be attributed to poor hygienic measures in control and processing of the feeds.

Likewise, the antibiotics resistance of *Escherichia coli* isolated from poultry and poultry environment of Bangladesh were studied and discovered positive for *Escherichia coli* [5]. The transmission of *Salmonella spp* appeared to be reoccurring, and poultry feeds have truly been linked to *Salmonella* contamination in poultry [14]. So also, the occurrence of *Salmonella spp* (2.33%) in poultry feed in Jordan, out of 1546 feed samples taken from north, middle, and south districts, 36 suspected *Salmonella* were isolated [15]. The contamination of *Salmonella* in poultry feed samples was tantamount to levels of 2% in Egypt and 4.4% in Brazil [16]. Six isolates of *Salmonella* from 37 (16.2%) imported boiler fish meal were recuperated and pound feed containing fish, meat and bone suppers generally utilized for layer breeder were undeniably more frequent (21% and 4%) respectively contaminated with *Salmonella.* Broiler and layer feed are one of the significant sources of chicken ranch contaminated with *Salmonella*.

4. Conclusion

The presence of these bacteria in commercially available poultry feeds in Minna, Nigeria, calls for attention in the production strategies employed by the poultry feeds manufacturers. The role of poultry farmers in ensuring safety when handling animal droppings and contaminated feeds need not be under emphasized. This is because most pathogenic bacteria contamination of feeds are either from handling during processing,

packaging and/or storage or the contaminated water sources used during pelleting of feeds.

Conflict of interest

The authors declared no competing interest.

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