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# Quality Assessment and Safety of Poultry Feed Sold Within Delta State Metropolis

***Opara, C. N[1*] and Anyiam, I. V.[2]***

[1, 2]Department of Microbiology, Faculty of Science, Federal University Otuoke, Bayelsa State, Nigeria.

*Corresponding author: E-mail: ifetgod@yahoo.co.uk

Phone: +2347039396744

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**Abstract**

*The bacterial load and species contaminating poultry feeds and the safety of poultry feeds sold within Delta Metropolis were studied. A total of 15 feed samples were collected from different feed types (broilers, layers and chicks feed) and sources (feeds from factories, feeds inside poultry farms and market feeds). Samples were analyzed by culture and bacterial isolates identified using conventional biochemical test. The contaminants isolated include Salmonella spp, Escherichia coli, Proteus spp, Streptococcus spp, Bacillus spp, Staphylococcus aureus, and Klebsiella spp. The occurren nce of E. coli was higher than other bacteria isolated, 15(23%), followed by Salmonella ssp 10(15.4%), Streptococcus ssp 10(15.4%), Bacillus ssp 9(13.8%), Proteus ssp 8(12.3%), Staphylococcus ssp 8(12.3%) and Klebsiella ssp 5(7.7%). The Total viable counts were found in the range of $5.5x10^6$ to $7.3x10^6$ cfu per ml from market feed, $5.0 x10^4$ to $7.4x10^5$ cfu per ml from poultry farm and $5.0x10^5$ and $6.0x10^4$ cfu per ml from feed factory. Bacteria isolates from broilers feed was lower 11 (27.5%), 12(30%) from chicks feed and 17(42.5%) from layers feed. Our findings showed a relatively high level of bacterial contamination of poultry feed in the studied area.*

## 1. Introduction

The safety and quality of poultry feed is a great issue of concerned in developed countries, whereby feed safety is considered an essential requirement for all animals [1]. The safety of poultry products is very significant in such that efforts are geared towards assessment and detection of microbial hazard, which poses a threat to the consumer. Poultry feed is regarded as one of the main sources of contamination of poultry products [2]. Contaminated poultry products are a risk factor of food-borne bacterial diseases [3], and of which the impact is notably associated with high morbidity and death globally [4]. Evidence clearly substantiates that when animals reared for the purpose of their meat are colonized by *Salmonella* and other pathogenic bacteria, they can be transmitted to humans through the food chain [5]. Despite different sources of feed shows different levels of risk of microbial contamination, contamination occurs along the feed production value chain, making it almost impossible to produce sterile feed [6]. Major considerable areas that have to do with contamination of poultry feed is the stock feed, raw materials and farms [7]. However, bacteria such as *Bacillus* spp, *E. coli, Campylobacter* and *Clostridium perfringens* can get into poultry feeds either from feed ingredients, farms workers, equipment or raw materials [8]. In addition, the contamination of poultry feed has also been frequently associated food-borne bacterial pathogens. However, there are paucity of data on risk assessment for most poultry-borne hazards, yet these data are of great

importance in developing food safety strategies. To ascertain the effect on the risk of foodborne illness as a result of contaminated poultry feed, evaluation of poultry production, processing and handling is considered of great importance. Furthermore, having knowledge of the threats associated with poultry consumption is crucial to developing effective sampling and identification methods that can be employed to design control policies [9].

Unfortunately, there is no extensive program in most developing countries generally and particularly in Nigeria that addresses animal feed contamination in food safety programs to aid the poultry industry and the public health sectors. Thus, the objective of this present study was mainly to investigate the bacterial quality of compounded poultry feed.

## 2.0. Materials and Method

### 2.1. Sampling

A total of 15 samples comprising poultry feed of chicks, broilers and layers were obtained from poultry Farm, Markets and Feed Factories in sterilized plastic containers and immediately taken to the laboratory for analysis within 4h. This collection was done twice in a month for a duration of two months.

### 2.2. Microbiological analysis

One gram of the sample feeds was serially diluted, and 0.2 ml aliquot of appropriate dilutions were inoculated on nutrient agar (Lab M Ltd, Heywood, UK) and MacConkey agar (Lab M Ltd.) using pour plate technique. The plates were incubated at 37°C for 24-48h, after which the microbial loads were obtained. The morphologically distinct bacterial colonies were selected and purified by repeated subculturing on fresh agar plates to obtain pure cultures. These cultures were identified by means of taxonomic schemes and descriptions [10].

### 2.3. Bacterial Identification

The bacterial isolates were identified using morphological and biochemical tests as compared with an identification scheme defined by [11].

## 3.0. Results and Discussion

The result of this study showed all feed samples were contaminated with viable microbes. Our finding agrees with the common view that poultry feed is vulnerable to microbial contamination from value chain, the environment, during movement, and storage on the farm. In addition, cross contamination from wild birds, insects, rodents are also involved [12]. The highest viable counts were observed amongst feed samples from market feed, which ranged between $5.5x10^6$ and $7.3x10^4$, with an average of $6.25x10^5$, followed by viable counts of samples from farm which ranged between $5.0\ x10^4$ and $7.4x10^5$, with an average of $7.2x10^4$. While, the viable counts of samples from factories ranged between $5.0x10^5$ and $6.0x10^4$, with an average of $5.63x10^6$ as shown in Table 1. The total viable counts are indicators of quality of a food product and plays role in determining the shelf-life of a product [13]. A total viable count of >107CFU/g) is said to expedite deterioration of the product [14].

The viable counts of samples tested indicated that samples from markets were most loaded with bacteria ($6.25x10^5$ cfu/g of feed, in average), followed by samples from Farm and the least loaded were those from feed Factories. It could be attributed to the level of contamination in the environment of poultry farms and feed storage conditions in markets. The high occurrence of bacterial species is of public health concern and this may indicate obvious health hazard in terms of direct consumption of contaminated feed or their toxins by farm animals [15].

Table 1: Total viable bacterial count of poultry feed samples. (cfu per ml )

| Samples | Feed Factory | Market | Poultry farm |
|---|---|---|---|
| Grower mash | $5.6x10^5$ | $7.5x10^3$ | $6.0x10^5$ |
| Layer mash | $6.0x10^4$ | $7.3x10^4$ | $7.4x10^4$ |
| Broiler starter | $5.0x10^2$ | $6.0x10^3$ | $5.0x10^4$ |
| Mean viable count | $6.2x10^4$ | $8.7x10^4$ | $7.2x10^4$ |

Key:
Cfu- Colony forming unit

Table 3 shows the percentage distribution of isolated bacteria from the feed sample. The bacteria belonged to six genera identified as: *Klebsiella, Salmonella, Escherichia coli, Streptococcus, Staphylococcus* and *Bacillus*. The presence of *E. coli, Proteus* spp, *Staphylococcus* spp and *Streptococcus* spp may suggest faecal as well as environmental contamination. Some of these organisms are well known pathogens of birds and farmed animals [16].
*Staphylococcus aureus* and *Streptococcus* (known pathogens) were also isolated with percentage of 12.3%, 15.4% (Table 3) of the tested samples, respectively. These organisms could have an impact on public health [17]. However, poultry feed may contain diverse micro-flora that can be acquired from multiple environmental sources including dust, soil and insects. Furthermore, the inoculation of poultry feed material with pathogens could occur at any time during growing, harvesting, processing and storage of feed [18].

Tables 2: Occurrence of bacterial isolates in different feeds

| Bacterial isolate | Feeds ($10^{-5}$cfu/g) | | |
|---|---|---|---|
| | Grower mash | Layer mash | Broiler starter |
| *Salmonella* spp | 2 | 5 | 3 |
| *Proteus* spp | 0 | 3 | 5 |
| *Bacillus* spp | 2 | 2 | 5 |
| *Streptococcus* spp | 3 | 3 | 4 |
| *E. coli* | 5 | 7 | 3 |
| *Klebsiella* spp | 3 | 1 | 1 |
| *Staphylococcus* spp | 7 | 2 | 1 |

Table 3: Percentage Distribution of Isolated Bacteria from the Feed Sample.

| Bacterial isolate | No. of positive sample | Occurrence (%) |
|---|---|---|
| *Salmonella* spp | 10 | 15.4 |
| *E. coli* | 15 | 23.0 |
| *Proteus* spp | 8 | 12.3 |
| *Streptococcus* spp | 10 | 15.4 |
| *Bacillus* spp | 9 | 13.8 |
| *Staphylococcus aureus* | 8 | 12.3 |
| *Klebsiella* spp | 5 | 7.7 |

*Salmonella* are important poultry pathogens and was isolated from samples of this study, but only from feeds inside poultry farms. This finding indicated that birds and their environment are the main source of contamination with *Salmonella* species. This finding is in accordance with previous works of [16], who found *Salmonella* in poultry feed in farms. Importantly, feed has been said to be the source of human infection due to eating chickens fed *Salmonella*-contaminated feeds. *Salmonella* was found in 15.4% of samples. This outcome was found comparable with the result of [19], who reported a percentage of 5.4% of his total number of isolates [20], and up to 70% of broiler carcasses have been found to be contaminated with *Salmonella* and he attributed that to contamination via rodents, feed, and animals. Some farms may produce feeds for commercial purpose and this is obviously dangerous. Farm workers, air and wild birds may contribute to transfer *Salmonella* from bird cages to area of feed manufacture in farms. Other feed sources were found free of *Salmonella*, but can be contaminated from feed ingredients, particularly, those of animal origin is not treated adequately.

About 33% of the isolates in this study were from samples obtained from factories, followed by markets (45%) and the least contaminated feeds (23%) were those obtained from inside commercial feed factories. This result showed that the farm environment is most contaminated. Period of feed storage and storage conditions (humidity and temperature) are suspected to be behind the higher level of contamination in market feeds than feeds from factories.

It was found that layer mash feed samples are most contaminated, about 43% of isolates were from this type of feed, and followed by grower mash (30%) and the least contaminated was broilers starter feed. This is mainly attributed to the nutritive value of broilers feed which is usually has higher protein content. The greatest isolation was found among animal proteins and by–products of animal origin such as bone meal, meat meal, fishmeal and vegetable proteins, particularly sesame and groundnut cakes [7].

With the high colonization of bacteria in poultry feeds, this calls for public health concern. Nevertheless, good manufacturing practice, handling, and retailing methods can be improved on to enhance the bacterial quality of these products. In this study, we found it is necessary to evaluate a feed safety and to conduct a thorough bacteriological examination of imported poultry feed; to ensure safety and quality of feed in order to prevent poultry diseases and great economic losses.

## 4.0. Conclusion

Our findings showed a relatively high level of bacterial contamination of poultry feed in the studied area. It is therefore important to carryout routine bacteriological scanning on poultry feeds to ensure safety and quality of feed, to prevent disease and spread of human pathogen.

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