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Preliminary results on sources of bacteria of economic importance from three broiler chicken farms in Uyo metropolis of Akwa Ibom State

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Target Audience: Poultry farmers, Feed millers and Poultry nutritionist

Abstract

Certain bacteria species are considered of economic importance in the poultry industry. This is as a result of economic losses farmers incur when birds are infected with such pathogenic bacteria. These include Salmonella, Escherichia coli (E. coli) and most importantly Clostridia perfringens. Feed and faecal droppings were collected from 3 farms in Uyo metropolis Akwa Ibom state. Three (3) six-weeks old broiler birds were purchased from each farm and slaughtered to obtain digesta samples from the crop. Salmonella, E. coli and Clostridia were isolated from both feed sample (ten from different feeding troughs) and faecal droppings (ten samples from different parts of the pen the birds were purchased from) collected from the three farms. The bacteria were also isolated from the crop content of the birds purchased from each farm. A positive growth of Clostridia was recorded in both feed and faecal droppings sampled. However, Salmonella and E. coli were only present in the droppings but not in feed sample collected. There was a high degree of prevalence of Salmonella in the crop of birds from two of the three farms sampled while a medium degree of prevalence of Clostridia was recorded in both farms.Conclusively, feed may not necessarily be the source of bacteria, however contamination of feed from management practices obtained in farms can. Continuous contact of the bird with its dropping and litter may eventually culminate in the bacteria getting into the gastrointestinal tract.

Keywords: *bacteria, Clostridia perfringens, Escherichia coli, feed, poultry farms, Salmonella*

Description of problem

Newly hatched broiler chickens do not come into contact with the hen in modern poultry husbandry; as a result, there is delayed development of the intestinal micro flora. In the first week of life, *enterococci* and *lactobacilli* dominate the crop, duodenum and ileum of broilers while *coliforms, enterococci* and *lactobacilli* dominate the caeca. Thereafter a complex micro flora with many obligate anaerobic bacteria starts to dominate the caeca, while *lactobacilli* dominate crop, duodenum and ileum. A typical microflora of adult birds is established in the small intestine of broiler chickens within two weeks, however, it takes up to 30 days or over three weeks post hatch for adult caecal flora to develop [1]. This is indicated by the stable concentrations of bacterial fermentation products (lactate, propionate, acetate and butyrate) in the intestines. In the caeca, acetate, propionate and butyrate are present in detectable amounts while lactate can only be detected during the first two weeks. Earlier reports stated that gut micro flora has significant effect on host nutrition, health and growth performance by

interacting with nutrient utilization and the development of gut-system of the host [2]. This interaction is very complex and depending on the composition and activity of the gut micro flora, it can have either positive or negative effect on the health and growth of birds. For example, when pathogens attach to the mucosa, gut integrity and function are severely affected and immune system threatened [3]. As mentioned earlier the gut flora gets established as the chick comes in contact with feed and the environment (litter) whether clean or dirty.

Certain bacteria species are considered of economic importance in the poultry industry and this is due to economic losses accruable to the farmer when their presence results in pathogenic infection and eventual death of birds. Bacteria under this category are pathogenic bacteria that can cause serious problems like water borne or food borne illness that are associated with the GIT (gastro intestinal tract) such as *Salmonella, E coli, clostridia* etc. Non typhoidal *salmonellae,* the type of *salmonella* typically associated with the human infection *salmonellosis*, are found in the gastrointestinal tract of the cattle, poultry and swine. The typhoid agents' *Salmonella typhi* and *paratyphi* are specific to humans and are therefore not zoonotic. A higher prevalence of *Salmonella* has been detected in larger chicken, dairy cow, swine, and animal feeding operations related to increased herd density and size as well as increased shedding of *Salmonella* [4]. Contaminated feed, perhaps through insect and animal vectors or as a direct source of bacteria itself, is also often implicated as a source of *Salmonella* in poultry flocks [5].

Escherichia coli are normal inhabitants of intestinal tracts and can be found in chicken feaces, litter, dust and rodent droppings. It may also contaminate feed and water [5]. It can cause diseases such as *collibacillosis* and air sacculitis in poultry, resulting in significant economic losses [6]. Economic impacts in broilers result from reduced growth, increased feed conversion rates, respiratory disease, mortality, treatment cost and condemnations, while in layers, losses are associated with decreased growth rates, mortality and egg production [7]. *Escherichia coli* is the most common bacteria recovered from birds affected with peritonitis, an infection of the lining of the abdominal cavity [5,8]. It is frequently due to secondary infections as a result of tissues damaged by viral infections which are susceptible to secondary bacterial infections. Early production *E. coli* peritonitis in breeder flocks is often related to the onset of egg production and can be secondary to respiratory disease. Late production infections are often related to vent trauma. *Clostridia* on the other hand produce the largest number of toxins of any type of bacteria. Among *clostridium* species, *C. perfringens* is the major toxin producer and is also the most wide-spread, being found as part of the microbiota of animals and humans and also in soil. Necrotic enteritis (NE) is caused by *C. perfringens* type A and more uncommonly, by *C. perfringens* type C. Necrotic enteritis is one of the most common infectious diseases in poultry, resulting in an estimated annual economic loss of more than $2 billion, largely related to impaired growth performance [9]; [10]. This enteric infection is commonly well controlled by anti – coccidias or antibiotic growth promoters. Necrotic enteritis is re-emerging as an important disease in poultry, and there is concern about the increased risk of contamination of poultry products for human consumption, as *C. perfringens* is one of the most common causes of food borne illness worldwide [7]. The disease occurs mostly in animals between 2 – 6 weeks of age and can vary from an acute to a subclinical form. The subclinical form is more prevalent, being responsible for the greatest economic losses in poultry production due to Necrotic enteritis,

and is characterized by chronic intestinal mucosal damage, which leads to poor digestion and absorption [10]; [11].

This study was designed to determine the prevalence of these three bacteria in poultry farms in Uyo metropolis and the degree of their presence in the gut of broiler birds raised in specific farms sampled.

Materials and Methods

The study (slaughter and collection of digesta samples after purchase of birds) was carried out at the Teaching and Research farm of University of Uyo, Akwa Ibom State. A total of three (3) six-weeks old broilers were purchased from three different farms totaling nine (9) birds. The first three birds were purchased from a poultry Farm located around Nwaniba Road Uyo and named G1. The second three birds were from a farm located around Osong-ama street Uyo and named G2, and the last three birds were from a farm located close to University of Uyo and named G3 all in Uyo metropolis, Akwa Ibom state. All nine birds were slaughtered and digesta samples collected from the crop by emptying it into sterile sample containers under sterile conditions. The feed (ten samples from different feeding troughs within the pen) and droppings (from ten different locations within the pen) were collected from the respective poultry house of purchase (i.e. directly from the pen were the purchased birds were taken for sale). Collected faecal samples were placed in a sterile container and taken to the Department of Microbiology Laboratory at University of Uyo Medical Center for bacteria isolation. The test organism (*E. coli, Salmonella* and *Clostridium spp*) were isolated clinically from droppings, feed and the crop on bacteria specific agar after serial dilution. One mile of the fifth diluent of the serial dilution was used. *Escherichia coli* was isolated on MacConkey agar, *Salmonella* on *Salmonella shigella* agar and *Clostridia* on Chocolate agar. The isolations were done on triplicate bases respectively for each sample collected and the mean reported in the results.

Results and Discussion

Feed as source of bacteria

From the results obtained (Table 1) on occurrence of bacteria of economic importance, *Salmonella, E. coli* and *C. perfringens* was isolated from Vital feed and Amo byng feed taken from three different farms G1, G2 and G3 all in Uyo metropolis, Akwa Ibom State. The Amo byng feed was taken from farm G1 while the vital feed was taken from the second (G2) and third farm (G3). There was no growth of *Salmonella* and *E. coli* recorded for both feeds collected from the three farms. Absence of *Salmonella spp* growth in feed samples collected could be an indication that the feeds were well covered and not exposed to rats or other vectors which are sources of *Salmonella* contamination of feed prior to feeding. The environment around farms was disinfected to scare away rats as sources of *Salmonella* in the feed. According to [4] contaminated feed perhaps through insect and animal vectors or as a direct source of bacteria itself in poultry flocks could be the source of *Salmonella* contamination in feed. The absence of growth with regards to *E. coli* in feeds sampled from the three farms for both feeds can be attributed to the fact that *E. coli* lives in the intestine of birds and may not necessarily be found in the feed [12]. *Escherichia coli* are normal inhabitants of intestinal tracts and can be found in chicken feces, litter, dust, and rodent droppings. It may also contaminate feed and water [5]. According to [13] numerous potential sources of *Salmonella* infection and product contamination exist in an integrated poultry farm. The control of *Salmonella* infections in poultry farms need to be with good farming practices and appropriate management associated with strict sanitary measures [14]

which was observed in farm G1. In addition to this, preventive and curative measures can be applied to reduce the incidence of *Salmonella* colonization in chickens at the farm level [15].There was positive growth of *Clostridia* in the feed sampled from the three farms and this is because the feed was collected from the feeding trough and the birds could have contaminated the feed in the feeding trough by picking the bacteria from the ground via their litter or droppings to the feeding trough repeatedly thereby acting as a source of contamination in the feeds.

Table1: Occurrence of Bacteria of Economic Importance in Poultry Feed and Droppings

Feed/Droppings	*Salmonella*	*Escherichia coli*	*Clostridia perfringens*
Amo byng	No growth	No growth	Positive growth
Vital Feed	No growth	No growth	Positive growth
Droppings	Positive growth	Positive growth	Positive growth

Faecal droppings as source of bacteria

There was positive growth for all the bacteria sampled in the droppings collected from the three farms. A positive growth of *Salmonella* was recorded for the three farms sampled. This could be as a result of one or two birds in each individual farm must have been infected with *Salmonella* and had gone unnoticed by the farmer. Once such infected birds defecate and it mixes with the litter, as other birds in the same pen ingest feed that has spilled on the litter, they become predisposed to *Salmonella* infection. This continuous process of picking on litter with faecal droppings and wasted feed inter - mingling, can gradually increase the number of infected beds and spread of the bacteria within the pen and eventually the farm [16]. There was positive growth of *E. coli* in all the farms. The bacteria being a normal inhabitant of poultry intestinal tract can commonly be found in poultry droppings. *E*scherichia *coli* bacterium is ubiquitous wherever faecal material from animal is found. Water can cause *E. coli* infection according to [5]. So the drinkers in these farms if not properly washed and if the water is not changed on time, this could be a challenge.

The caecum is colonized by anaerobes and only by a small number of facultative anaerobes [17] (Lu et al. 2003). Culture-independent studies revealed the presence of proteobacteria of which Clostridia is a typical example [18] (Qu et al. 2008). *Clostridia* showed positive growth in droppings collected from the three farms because the birds could have been infected through resumption of the bacteria from litter containing infected droppings via the cloaca i.e. by sitting on the droppings. Shedding of *Clostridia* in faecal droppings from the cloaca is another possible means of the bacteria spreading in the pen.

Prevalence of bacteria

The degree of prevalence of bacteria of economic importance in poultry crop of birds from the three farms is presented in Table 2. In farm G1 a medium level of prevalence of *Salmonella* (**) was recorded in the crop with a low level of prevalence (*) of *Clostridia.* The farm was observed to be neat and the birds were immunized a week before the samples were taken for analysis. However, the farm was visited without any prior notice or purpose of sample collection. These bacteria can be gotten through the environment and improper management of birds. Farms G2 and G3 recorded a high level of prevalence (***) of *Salmonella* and medium level of *Clostridia* (**). The environment in which the birds were being raised in both farms was not clean; the litter had not been recently changed. There was

also the presence of lots of wet litter and this could have contributed to these bacteria easily getting into the crop of the birds through picking on the litter and feeds littered on it. It is evident from the current study, that management practices upheld by farms can go a long way to determine the prevalence of certain bacteria of economic importance as well as occurrence of pathogenic infection induced by such bacteria. This points to earlier reports that contaminated feed perhaps through insect and animal vectors or as a direct source of bacteria itself in poultry flocks can be sources of pathogenic bacteria [4]. While the birds were feeding, they could contaminate the feed in the feeding trough by picking bacteria from the ground via their liter, droppings or any other material found on the ground to the feeding trough again. This process can be a major pathway for *Clostridia* and *Salmonella* prevalence in the gut of birds sampled. According to previous report [16], when birds gain access to feeders and contaminate the feed, coinciding with the highest excretion of *Salmonella* in droppings, then the rest of the birds ingest the bacteria and the whole flock gets infected in a few days. It is well known that *Salmonella* contaminated feces are an important source of environmental contamination and chicken infection [19].

Table 2: Prevalence of Bacteria of Economic Importance in Crop of Birds from three Poultry farms

Farms	*Salmonella*	Degree of prevalence	*Clostridia*	Degree of prevalence
G1	Positive	**	Positive	*
G2	Positive	***	Positive	**
G3	Positive	***	Positive	**

***:** Low level of prevalence, **: Medium level of Prevalence, ***: High level of prevalence

However, this problem does not seem to be restricted to the hatchery and rearing period [20]. Feed withdrawal, loading and transportation from farm to slaughter house are known to be stressful for animals [21]; [22]. According to some authors, stress causes a disturbance of intestinal functions and may lower the resistance of the live animal and increase the spread of intestinal bacterial [23]; [22]; [24] and eventual contamination status of the final food products [20]. These authors suggested that lowering the farm prevalence of the bacteria and stress during transport are important strategies to lower the risk of contaminated meat products entering the food chain. *Escherichia* coli bacterium is ubiquitous wherever faecal material from animal is found. Water can also cause *E. coli* infection according to [5]. So the drinkers in these farms if not properly washed and if the water is not changed on time, this could be a challenge. A previous report by [7], stated that *Clostridium perfringens* causes chronic intestinal mucosal damage, which leads to poor digestion and absorption in poultry. Summarily where there is a high prevalence of *C. perfringens*, poor growth performance will be recorded which is not desirable to the farmer. A worst-case scenario is high mortality of birds which further increases economic losses to the farmer.

Conclusion and Application

1. The type of feed used in a farm may not necessarily be the source of certain bacteria (*Salmonella and Escherichia coli*) but rather due to contamination

of feed as well as management practices obtained on the farm.

2. *Clostridia perfringens* can be of feed source as result of contamination of feed.
3. Results of the current study have highlighted the need for poultry farmers to maintain good management practice as a preventive measure against contamination of feed with *Salmonella, E. coli* and *Clostridia*.

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