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Isolation, Identification and Identification of Medically Important Microorganisms from Poultry Droppings at Selected Poultry Farms in Nnewi, Nigeria

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ABSTRACT

Poultry farming is a very lucrative business across Nigeria. One of the major challenges faced with this farming is transfer of microorganisms from the birds to humans through direct contact, animal danders, environment and poultry droppings. This study aimed at evaluating microorganisms of medical importance found in poultry droppings located at three poultry farms across Nnewi, Nigeria. A 1 g portion of each poultry dropping sample was homogenized in 10 ml buffered peptone water, after which, 0.1 ml of each homogenate was pour plated on nutrient agar, Mac-Conkey agar and Sabouraud's dextrose agar. The bacterial isolates were identified using morphological characterization, Gram staining and biochemical tests such as citrate test, methyl-red test, indole test and sugar fermentation test. Fungal Isolates were identified with slide culture method followed by fungal atlas identification. Poultry farm C had the most bacterial count in its chicken droppings which is 7.0×10^6 cfu/g while farm B had the highest fungal count of 8.5×10^4 cfu/g. Bacteria isolated were *E. coli, Bacillus* species and *Staphylococcus* species, while fungi identified were *Aspergillus* species and *Rhizopus* species. This study has been able to show that some medically important microorganisms can be present in poultry farms and thus requires strict hygiene to be observed in poultry farm maintenance.

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INTRODUCTION

The poultry industry is one of the fastest growing agro-based industries in the world. There is increase in poultry product demand mainly due to its acceptance by most societies. The continued productivity, profitability, and sustainability of the poultry industry will likely be dependent on the formulation of best management practices mitigate environmental consequences associated with air and water quality parameters that are impacted by land application and the development of cost-effective innovation technologies that provide alternative to land application of poultry wastes (Roth *et al*., 2019; Gupta *et al*. 2021).

Most of the poultry droppings are currently applied to agricultural land. When managed correctly, land application is a viable way to recycle the nutrients such as Nitrogen (N), Phosphorus (P), and Potassium (K) in the droppings. Poultry droppings are one of the major sources of manure by-products in many countries (Casey *et al,* 2006; Emmanuel-Akerele and Adamolekun, 2021). The droppings contain all essential nutrients including micronutrients and it has been well documented that it provides a valuable sources of plant nutrients, especially organic growers (Chan *et al,* 2008). Addition of poultry droppings to soils not only helps to overcome the disposal problems but also enhances the physical, chemical, and biological fertility of soils (Friend *et al,* 2006).

Poultry droppings contain a large and diverse population of microorganisms. Microbial concentrations in poultry droppings can exceed 10^{10} cells/g (Acosta Martinz and Harmed, 2006; Adebowale *et al*., 2016) and Gram positive bacteria account for nearly 90% of the microbial diversity. Two microbial groups of special interest to poultry industry are Nitrogen mineralizing microbes and pathogens. The microorganism of medical importance usually found in poultry droppings are; *Bacillus*

species, Escherichia coli, Salmonella species, Campylobacter jejuni, Listeria monocytogenes, Clostridium perfringens, Enterococcus species (Brooks *et al*., 2015).

Methods

Sample Collection

The poultry dropping samples were obtained from three (3) different poultry farms from Nnewi, Anambra State. The samples were transported in sterile containers immediately to Tansian University Laboratory for analysis.

Isolation and Identification of Microorganisms

A 1 g portion of each poultry dropping sample was homogenized in 10 ml buffered peptone water, after which, 0.1 ml of each homogenate was pour plated on nutrient agar, Mac-Conkey agar and Sabouraud's dextrose agar.

The bacterial isolates were identified using morphological characterization, Gram staining and biochemical tests such as citrate test, methyl-red test, indole test and sugar fermentation test. Fungal Isolates were identified with slide culture method followed by fungal atlas identification.

Results

Poultry farm C had the most bacterial count in its chicken droppings which is 7.0×10^6 cfu/g while farm B had the highest fungal count of 8.5×10^4 cfu/g (Table 1). Bacteria isolated were *E. coli, Bacillus* species and *Staphylococcus* species, while fungi identified were *Aspergillus* species and *Rhizopus* species.

Table 1: Microbial Counts in Chicken Droppings (cfu/g)

Samples	NA	MA	SDA
A	5.0×10^6	7.0×10^6	8.5×10^4
B	3.5×10^6	5.0×10^6	6.6×10^4
C	7.0×10^6	9.0×10^6	6.2×10^4

NA= Nutrient Agar; MA=MacConkey Agar; SDA=Sabouraud's Dextrose Agar

Table 2: Biochemical Characterization of Bacterial Isolates

Isolates	Colony morphology	Microscopic Morphology	Gram Reaction	Catalase	Indole	Lactose	Sucrose	Glucose	Manitol	Probable identification
1	Appear pink or red in macConkey agar	Rod-Shape	-	+	+	AG	AG	AG	AG	*Escherichia* spp
2	Appear milkish in nutrient agar	Rod-Shape	+	+	-	G	G	AG	G	*Bacillus* spp
3	Appear milkish or yellowish in nutrient agar	Cocci in grape-like clusters	+	+	-	AG	G	AG	G	*Staphylococcus* spp

A = Acid production; G = Gas production; + = Positive; - = Negative

Table 3: Macroscopic and Microscopic Morphological Characteristics of the fungal isolates

Colony Morphology	Microscopic Morphology	Probable Identity
Appear whitish initially and turns black later.	Large, globose, dark brown conidial heads	*Aspergillus* spp
Appear white becoming gray-brown on surface	Hyphae broad, not scarcely septate sporangiophores brown	*Rhizopus* spp

Discussion

As beneficial s poultry farming is, it poses possible contamination/infection problems to humans. From its handling, to the environment, to the air-borne animal danders and also their droppings, all pose as risks for infection to humans. Infections can range from respiratory infections (caused by *Bacillus* species and *Aspergillus* species) to enteric infections (*Salmonella* species). This study has evidently indicated that poultry droppings have high amount of bacteria and fungi of medical importance. Three samples of poultry droppings were collected three different farms at Nnewi and were analyzed using standard microbiological techniques. The total viable counts for bacteria ranged from 3.5×10^6Cfu/g to 7.0×10^6Cfu/g in Nutrient agar, 5.0×10^6Cfu/g to 9.0×10^6 Cfu/g in MacConkey agar whereas for fungi, it ranged from 4.5×10^4 8.5×10^6Cfu/g. The following bacteria were isolated: *Escherichia coli, Staphylococcus spp, Bacillus spp* whereas the fungal species isolated include: *Aspergillus spp and Rhizopus spp*. These findings partly correspond with the report of Bamidele *et al*. (2022), Emmanuel-Akerele and Adamolekun (2021) and Bindari *et al*.

(2021). It si therefore important that poultry dropping management be carried out hygienically in order to prevent transmission of any of these ediclly important organisms to humans who manage these poultry farms and consequent spread to the greater populace living within and around the farm areas.

Conclusion

This study has been able to show that poultry droppings are repertoires of medically important microorganisms and should thus be hygienically managed before disposal, so as to reduce risk of poultry-tohuman transmission of these microorganisms.

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