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Microbial diversity of poultry house litters

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Abstract

Microbial Diversity of poultry house litters was carried out in this study. Different samples of poultry litters (feather, dust and faeces) were collected from poultry house around Federal Polytechnic Nekede and transported to the laboratory for microbiological analysis. The analysis was carried out using ten-fold serial dilution. After which 0.1ml of the 10^{-2} dilution was inoculated onto sterile plates of Nutrient agar, MacConkey agar, Nutrient agar and Saboraud Dextrose agar standard culture media for enumeration of microorganisms. Total Viable Count of the poultry house litters ranged from $2x10^3$cfu/g to $2.0x10^5$cfu/g. The total fungal load ranged from $1.0x10^3$cfu/g to $4.0x10^3$cfu/g. The bacterial isolates obtained were *Staphylococcus aureus*, *Escherichia coli*, *Bacillus* spp. and *Salmonella* spp. while the possible fungi species obtained were *Penicillium* spp., *Rhizopis* spp., *Alternaria* spp., *Sporotrichum* spp. The isolation of these microorganisms is of public health significance since they can be transmitted to man directly through contact with poultry litter or indirectly through contaminated poultry products such as eggs or meat. Chicken droppings should be treated before being used as an organic fertilizer to reduce the microbial load and diversity and also prevent disease occurrences in consumers of these agricultural products. People who rear birds are advised to wash their hands thoroughly after contact with the chicken droppings before they touch foods to avoid infection.

Keywords: Coprophagia, serovars, microbial diversity

1. Introduction

1.1 Background of study

When an animal eats, the food is digested and the remains of this food material is removed from its body inform of waste. Faeces from animals have a lower energy level compared to the original food which is eaten that contains up to 50% of the energy level, meaning that a significant amount of energy remains for the decomposers of ecosystems from food eaten (Bolan *et al*., 2010) [2].

Faeces serve as food and supplement to the usual diet of some animals. This is known as coprophagia and it occurs in different animal species such as young elephants eating the faeces of their mothers in order to gain essential gut flora.

Frugivore is a term used to describe animals that eat fruits. Animals that eat fruit, disperse the seed through faeces without knowing and in doing so, seed dispersal successfully takes place, as seeds dispersed at the base of a plant has a low possibility of growing and often suffer predation. Once the seed can withstand the digestive system, it can be potentially dispersed away from the parent plant when excreted and obtains its own fertilizer at the same time.

Pathogenic microorganisms can survive in poultry wastes. This leads environmental and health problems to livestock. The existence of these microorganisms which includes *Escherichia coli*, *Staphylococcus* and *Bacillus* species can cause various diseases in fowl. (Adegunioye, 2006) [1]. Contaminated drinking water sources by faeces of sick birds can be a source of transmission of diseases to bird flocks (Linda, 2016) [6].

One of the most commonly isolated bacteria from chicken dropping is *Salmonella. Salmonella* which is a genus of rod-shaped (*bacillus*) bacteria of the Enterobacteriaceae family. There are only two species of *Salmonella*, *Salmonella bongori* and *Salmonella enterica*, of which there are around six subspecies and innumerable serovars. The genus *Escherichia*, which includes the species *E. coli* belongs to the same family (Fabrega and Vila, 2013) [5].

Chicken dropping is a primary component of organic manure. However, the use of contaminated chicken dropping poses threat to public health because there is possibility of contamination of the agricultural products. Hence this work sought to isolate and characterize microorganisms from chicken droppings.

There is need to determine the microbial load diversity of chicken droppings as this will be an indication of the possible public health implication of consuming contaminated products, Hence the aim of this study which determines the microbial diversity of poultry house litters.

2. Materials and Methods

2.1 Collection of samples

Different samples of poultry litters (feather, dust and faeces, etc) were collected from poultry house around Federal Polytechnic Nekede and taken to the laboratory for microbiological analysis.

2.2 Microbiological analysis of the samples

One gram (1g) of the samples was weighed and placed in nine millilitre (9 ml) of sterile water contained in a test tube

and allowed to stand for about ten minutes to obtain a poultry litters; thereafter one millilitre (1 ml) of the solution was serially diluted using ten-fold serial dilution.

After the serial dilution, 0.1ml of the 10^{-2} dilution was inoculated onto sterile plates of Nutrient agar, MacConkey agar, Nutrient agar and Saboraud Dextrose agar standard culture media for enumeration of microorganisms. After inoculating the sterile media, they were incubated at 37^0C for 24 hours for the bacteriological media and at 27^0C for 48hours for the mycological media. After the incubation periods, the microorganisms enumerated on the culture plates were counted using the colony counter.

The microbial isolates obtained were thereafter identified using cultural morphology. The bacterial isolates were further characterized using gram staining and biochemical tests while the fungal isolates were further characterised using lacto phenol cotton blue staining techniques.

2.3 Identification of Bacterial isolates

Typical colonies stored on nutrient agar and MacConkey agar slants at 4 ºC were Gram-stained (Cheesbrough, 2006) [3]. Cultural characteristics and biochemical tests such as Motility, Oxidase, Catalase, Coagulase, Indole, Sugar Production test, Citrate utilization test were carried out to further confirm the isolates.

2.4 Identification of Fungal Isolates

The fungal isolates were identified by morphological characteristics on Saboraund Dextrose Agar (SDA) and microscope examination after lactophonol cotton blue staining technique.

3. Results and Discussion

3.1 Results

The results of the microbial load of the poultry house litters is presented in Table 1.

Table 1: Total Microbial Load of the Poultry house litters

Sample	TVC (cfu/g)	TFC (cfu/g)
A	$2.0x10^5$	$1.0x10^3$
B	$3.0x10^4$	$1.0x10^3$
C	$6.0x10^3$	$4.0x10^3$
D	$2x10^3$	$1.0x10^3$
E	$5x10^3$	$2.0x10^3$

TVC = Total Viable Count, TFC = Total Fungal Count, cfu/g = colony forming unit per gram

Table 2: Morphological and Biochemical Characteristics of Bacterial isolates from poultry house litters

Samples	Media	Morphological characteristics	Gram Reaction	Oxidase Test	Mot. Test	Indole Test	Spore stain	Catalase Test	Citrate Test	Coagulase Test	Sugar Ferm. Test				Possible Bacteria
											S	B	G	H_2S	
poultry house litters	N.A	Milkish rasied non mucoid colonies	Gram positive cocci	-	-	-	-	+	-	+	No reaction				*Staphylococcus aureus*
poultry house litters	N.A	Pinkish raised mucoid colonies	Gram negative rod	-	-	+	-	-	+	-	Y	Y	+	-	*Escherichia coli*
poultry house litters	N.A	Milkfish flat non mucoid colonies with rough edges	Gram negative rod	-	-	-	+	+	-	-	R	Y	-	-	*Bacillus* spp.
poultry house litters	SSA	Milkish flat mucoid separated colonies	Gram negative rod	-	-	-	-	-	+	-	Y	Y	+[2]	+	*Salmonella* spp.

Key: N.A = Nutrient agar, + = positive, - = negative, S = slope colouration, B = Butt colouration, G = Gas production, H_2S = Hydrogen sulphate production, Y = Yellowish colouration (acidic), R = Reddish pinkish colouration (alkaline production). Mot. = Motility Test, SSA = Salmonella-Shigella agar

Table 3: Identification of Fungal Isolates

Sample	Macroscopic appearance on SDA	Microscopic characteristics	Possible Fungi
poultry house litters	Whittish broom-like cottony colony with greenish centre	Septate hyphae with conidia bearing sterigmata	*Penicillium* spp.
poultry house litters	Whittish broom-like cottony colony	Non septate hyphae with terminal spore	*Rhizopis* spp.
poultry house litters	Front pink reverse black capitate cottony colonies	Branched conidia	*Alternaria* spp.
poultry house litters	Front cream reverse brown cerebriform and fluffy	Branched aseptate hyphae	*Sporotrichum* spp.

3.2 Discussion

The results of the Total Microbial load of the poultry house litters as presented in Table 1 showed that the Total Viable Count of the poultry house litters ranged from $2x10^3$cfu/g to $2.0x10^5$cfu/g. The total fungal load ranged from $1.0x10^3$cfu/g to $4.0x10^3$cfu/g. Lu *et al.* (2003) [7] reported the microbial composition of chicken dropping in the range of 10^9cfu/g. Also reported microbial load of 10^{10}cfu/g of poultry litter. However, the values obtained in this study were lower than those reported by the authors. The difference in the microbial load obtained in this study may be attributed to the age and nutrition of the birds used in this study. The bacterial isolates obtained were *Staphylococcus aureus*, *Escherichia coli*, *Bacillus* spp. and *Salmonella* spp. These pathogens can readily contaminate food produce if they are used as organic manure. Also isolated similar bacteria. The isolation of these bacteria is of public health significance since they can be transmitted to man directly through contact with poultry litter or indirectly through contaminated poultry products such as eggs or meat. Also reported the presence of *S. aureus* and *E. coli* from poultry litter. These bacteria are well known in causing disease such

as gasterointeritis and *Staphylococcus* food poisoning. The fungal species obtained included *Penicillium* spp., *Rhizopus* spp, *Alternaria*

4. Conclusion and Recommendation

4.1 Conclusion

The outcome of this study has shown that poultry house litters contains pathogenic bacteria and fungi. The bacteria isolates were *Staphylococcus aureus*, *Escherichia coli*, *Bacillus* spp. and *Salmonella* spp. while the fungal species obtained were *Penicillium* spp., *Rhizopus* spp., *Alternaria* spp. and *Sporotrichum* spp. The isolation of these bacteria and fungi is of public health concern.

4.2 Recommendation

Chicken droppings should be treated before being used as an organic fertilizer to reduce the microbial load and diversity and also prevent disease occurrences in consumers of these agricultural products. People who rear birds should ensure that they wash their hands thoroughly after contact with the chicken droppings before they touch foods to avoid infection.

5. Conflict of interest

The authors declared that there is no conflict of interest regarding the publication of this manuscript.

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