# Assessment of the Mycoflora of Poultry Feed Raw Materials in a Humid Tropical Environment

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**Abstract:** The study was carried out to identify the common moulds growing in the selected feed raw materials in Owerri, Imo State, Nigeria. Fifty-four bulk samples were derived from 162 bags of 6 different raw materials, which included local fish meal (LFM), soybean meal (SBM), groundnut cake (GNC), palm kernel cake (PKC), brewers dried grain (BDG) and maize (MZ). The samples were collected during the rainy season months of June, July and August. The common moulds isolated from these samples were Mucor spp., Aspergillus spp., Yeast spp., Bacteria spp and Rhizopus spp. More fungal organisms were isolated in the month of July although Aspergillus spp was not isolated during the month. Local fishmeal, palm kernel cake, and brewers dried grain had the highest isolates of three organisms each with the prevalence ranging from 13.64 to 18.18%. Soybean meal, maize and groundnut cake on the other hand returned between one and two isolates. The present result showed that untreated feed raw materials are important vehicles for introduction of fungal organisms into poultry feed. It is therefore, advised to routinely treat such feed raw materials with fungal growth inhibitors in order to limit their growth since these organisms are capable of reducing the nutritional values of finished feeds. [The Journal of American Science. 2007;3(1):5-9].

**Keywords:** Mycoflora; poultry; raw materials; humid tropical environment

## Introduction

Quality livestock feed is necessary for the maintenance of physiological functions and animal defense systems against diseases and parasites. Traditionally, feed quality has been specified on basis of the nutritional value of every individual feed component (Fink-Gremmels, 2004). Livestock feed quality may however be affected by various microorganisms such as bacteria and fungi growing in different parts of the world.

Most fungal contaminants in stored feed materials usually arise from infestations that began in the field, although some can directly infest storage grains as well when conditions are right (Vieira, 2003; Mabbett, 2003). Moulds require about 12% moisture, more than $7^{O}C$, oxygen and energy for their growth. Fungal growth causes direct losses in volume and quality of feed raw materials and subsequently feed made from them leaving behind some poisonous mycotoxin, which contaminate feed raw materials and finished feeds (Okoli et al., 2006). Feed spoilage by fungi also results in heating and dustiness.

The three most important genera of toxigenic fungi in the tropics are *Aspergillus*, *Fusarium* and *Penicillium* (Kpodo and Bankole, 2005). In Nigeria, much of the studies carried out on moulds focused on the agronomic dimensions of the problem (Kpodo and Bankole, 2005; Fandohan et al., 2005; Atanda and Akpan, 2005). Various animal feed raw materials are however derived from the same sources as human food, thus any fungal problem in an environment would equally manifest in the health of animals (Fink-Gremmels, 2005) and may serve as early warning sign of an impending outbreak in human populations (Nyamongo and Okioma, 2005).

Mould contamination is wide spread in tropical countries where poultry production and processing are expanding rapidly (Van den Berghe et al., 1990; Delgado et al., 1998; Mabbett, 2004). Poultry are highly susceptible to mycotoxicoses caused by aflatoxins, trichothecenes, ochratoxins and some fusariotoxins (Mabbett, 2004, Opara and Okoli, 2005).

Numerous grain and root tuber based raw materials are used in compounding poultry feeds. Usually one or more of these may be infested with mycotoxigenic fungi. It is therefore necessary to understand the fungal population of these different materials since they are usually sourced from wide geographical areas and may therefore harbor diverse microbial populations (Okoli et al., 2005; Okoli et al., 2006).

Although much work has been done on fungal contamination of animal feeds in the temperate region, and the application of anti-oxidants and mould

inhibitors have become routine for feed manufacturers, there products are rarely used in developing countries like Nigeria (Van den Berghe et al., 1990; Okoli, 2005). There is an urgent need to understand the impact of fungi and their mycotoxin products on animal production in Nigeria. Strategies for reduction of mycotoxin contamination in animal production in Nigeria should however be based on a clear understanding of the fungal organisms involved and the type of toxins they produce (Okoli, 2005; Opara and Okoli, 2005).

This study assesses the common fungal flora of selected poultry feed raw materials in the humid tropical environment of Imo state, Nigeria, during the rainy season months of June to August 2005.

**Material and Methods**

The study was carried out in Owerri, Imo State, Southeastern Nigeria during the rainy season months of June to August, 2005. A preliminary field survey was carried out to identify reputable commercial poultry feed raw material depots in Owerri namely Songhai, Ceekings and Fidelity. These operators were informed of the nature and purpose of the research and based on the preliminary survey, a list of 6 feed raw materials which included local fish meal (LFM), soybean meal (SBM), groundnut cake (GNC), palm kernel cake (PKC), brewers dried grain (BDG) and maize (MZ) were purposively selected for the study.

**Sample collection:** A total of 54 bulked samples were collected from the list of 6 selected commercial feed raw materials. Each selected raw material depot was visited 3 times for sample collection during the study period. In all, 54 bulked samples were obtained by sampling 162 bags of the different feed raw materials as shown in Table 1.

Each feed raw material type was sampled by carefully opening three randomly selected bags of the same feed raw material type and collecting about 6 grams using a sterile universal bottle. These were thereafter homogenized to obtain a representative bulk sample of 18 grams of the feed raw material type. The samples were transported to the laboratory for analysis within 2 hours of collection.

Table 1. Distribution of commercial feed raw materials collected for isolation of fungal organisms in Imo State, Nigeria

| | | Feed raw material | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Visit | PS | LFM | MZ | SBM | GNC | PKC | BDG | Total bags |
| June | Songhai | 3 | 3 | 3 | 3 | 3 | 3 | 18 |
| | Ceeking | c | 3 | 3 | 3 | 3 | 3 | 18 |
| | Fidelity | 3 | 3 | 3 | 3 | 3 | 3 | 18 |
| | Total bulk | 3 | 3 | 3 | 3 | 3 | 3 | 48 bags |
| | | **= 18 bulk samples** | | | | | | |
| July | Songhai | 3 | 3 | 3 | 3 | 3 | 3 | 18 |
| | Ceeking | c | 3 | 3 | 3 | 3 | 3 | 18 |
| | Fidelity | 3 | 3 | 3 | 3 | 3 | 3 | 18 |
| | Total bulk | 3 | 3 | 3 | 3 | 3 | 3 | 48 bags |
| | | **= 18 bulk samples** | | | | | | |
| August | Songhai | 3 | 3 | 3 | 3 | 3 | 3 | 18 |
| | Ceeking | c | 3 | 3 | 3 | 3 | 3 | 18 |
| | Fidelity | 3 | 3 | 3 | 3 | 3 | 3 | 18 |
| | Total bulk | 3 | 3 | 3 | 3 | 3 | 3 | 48 bags |
| | | **= 18 bulk sample** | | | | | | |

**Grand total = 54 bulk sample made up of 162 bag of feed raw materials**

**Key:** LFM-Local fish meal, Mz-maize, SBM-Soybean meal; GNC-groundnut cake, PKC-palm kernel cake, BDG-Brewers dried grain. PS-Place of selling.

**Fungal Cultivation and Isolation:** The two growth media used for the study were sabourand agar and potato dextrose agar. They were prepared according to manufacturer's instructions and thereafter sterilize by autoclaving at 121$^{o}$C for 15 minutes at 15 pounds per square inch using autoclave. They were allowed to cool to 45$^{o}$C on the workbench before plating out into the various petri dishes at 15-20 ml following standard laboratory procedure. The dishes were inoculated with feed raw material samples and

incubated at room temperature for 5 days at the end of which they were examined for fungal growth.

After isolation, the individual species were identified using the interpretative key of some common genera of moulds (Buchana and Gibbons, 1974; Samson et al, 1995; Pitt and Hocking, 1997).

**Statistical analysis:** The data obtained were analyzed using simple descriptive statistics to obtain the prevalence of mould.

**RESULTS**

Table 2 showed the overall frequency of isolation of different fungal species from commercial feed raw materials sold in the state.

Five fungal species were identified with mucor sp. returning the highest prevalence rate (77.27%), followed by rhizopus sp. (9.09%) and aspergillus sp. (6.82%). Table 3 revealed the variations in the prevalence of isolated species across the months of study. Generally more species were isolated in the month of July than the other months, with bacteria and aspergillus sp. being the only species not isolated in the month of July. Bacteria sp. were included in the present study, though not fungal organism but are known to occur in mix culture with mould. The overall prevalence rates were the same for the months of June and August at (31.82%) and 36.36% for the month of July.

Table 4 showed the frequency of isolation of the fungal species from 6 different feed raw materials. GNC had the least isolates of fungal species followed by maize (MZ), and soybean meal (SBM) that returned 2 isolates each. Local fish meal (LFM), palm kernel cake (PKC) and brewers dried grain (BDG) had 3 different isolates each with the highest diversity of fungal species. The prevalence rates ranged between 18.18% for LFM, SBM, MZ and 15.91% for PKC, GNC and 13.64% for BDG.

Table 2. Overall frequency of isolation of different fungal species from feed raw materials sold in Imo State, Nigeria

| **Fungal species** | **Frequency** | **Percentage** |
|---|---|---|
| 1. Mucor sp. | 34 | 77.27 |
| 2. Yeast sp. | 2 | 4.55 |
| 3. Bacterial sp. | 1 | 2.27 |
| 4. Rhizopus sp. | 4 | 9.09 |
| 5. Aspergillus sp | 3 | 6.82 |
| Total | 44 | 100.00 |

Table 3. Frequency of isolation of fungal species during three sampling period (June, July and August) of feed ingredients sold in Imo State, Nigeria

| Fungal species | June | July | August |
|---|---|---|---|
| Mucor sp. | 10 (71.43) | 12(75.00) | 12(85.71) |
| Yeast sp. | 0(0.00) | 1(6.25) | 1(7.14) |
| Bacteria sp. | 1(7.14) | 0(0.00) | 0(0.00) |
| Rhizopus sp. | 1(7.14) | 3(18.75) | 0(0.00) |
| Aspergillus sp. | 2(14.29) | 0(0.00) | 1(7.14) |
| Total | 14(31.82) | 16(36.36) | 14(31.82) |

Table 4.Frequency of isolation of fungal species from 6 different feed ingredients sold in Imo State, Nigeria.

| Fungal species | No of isolate | LFM | SBM | PKC | GNC | Mz | BDG |
|---|---|---|---|---|---|---|---|
| Yeast sp. | 2 | 0(0.00) | 2(25.00) | 0(0.00) | 0(0.00) | 0(0.00 | 0(0.00) |
| Bacteria sp. | 1 | 1(12.50) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| Rhuzopus sp. | 4 | 1(12.50) | 0(0.00) | 1(14.29) | 0(0.00) | 0(0.00) | 2(33.33) |
| Aspergillus sp. | 3 | 0(0.00) | 0(0.00) | 1(14.29) | 0(0.00) | 1(12.50) | 1(16.67) |
| Mucor sp. | 34 | 6(75.00) | 6(75.00) | 5(71.43) | 7(87.50) | 7(87.50) | 3(50.00) |
| Total | 44 | 8(18.18) | 8(18.18) | 7(15.91) | 7(15.91) | 8(18.18) | 6(13.64) |

## DISCUSSION

The present study revealed that *Mucor sp. Bacteria sp. Yeast sp. Aspergillus sp. and Rhizopus sp.* were the common moulds growing in poultry commercial feed raw material sold in Imo State, Nigeria during the rainy months of June to August. Bacteria sp. were identified even though they are not fungi because according to Buchanan and Gibbons (1974), they will always be seen where fungi occur and form wet or slimy colonies often with rather bright colors and unpleasant odors.

The high prevalence rate of fungal species seen in this study supports Bastianelli and Le Bas (2002) and Cheesbroughi (2000), which state that tropical countries such as Nigeria are more prone to fungal and microbial contaminations of poultry feed raw materials. High microbial growth rate experienced in protein ingredients especially LFM and DBM (1818%), SBM (18.18) and GWC 15.91%) resulted from the nature of these ingredients (Bastianelli and Le Bas, 2002).

Wilson, (1990) and Ogbulie, (1995) regarded these protein ingredients as "high risk ingredients" and risky raw materials" which are readily contaminated by microbes. These contaminations are particularly linked to the post processing and drying phase. Fish meal is highly contaminated owing to the unhygienic/unsanitary post processing phase of drying of the local fish ingredient used to compound poultry feed (Okoli, 2003; Ogbulie, 1995).

The highest number of isolates (mucor sp.) as observed in Maize (MZ), Groundnut cake (GNC) was as a result of the nature of these feed ingredient which are higher in carbohydrates content (Adam, 1987).

The present study carried out during the rainy month of June to August revealed high presence of moulds in the feed ingredient. This result partially reflects the effects of relatively higher temperature experienced in Imo State during the month of June (Okoli, 2003) on mould growth (Adams, 1987; Danike, 2002).

## CONCLUSION

The result gathered from this study highlights the need for constant monitoring of moulds in feed raw materials in humid tropical environments such as in Imo State and the need to routinely inhibit their growth.

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