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Isolation And Characterization of Fungi from Indoor Air in New Boy's Hostel of the University of Abuja

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Abstract

This study explores the isolation and characterization of fungi, in the indoor air of the University of Abuja's New Boys Hostel. Sample collection were obtained by the exposure of Sabouraud dextrose agar (SDA) petri dish in the air for a period of one hour and taking to the microbiology laboratory, University of Abuja. Subsequently stained with lactophenol cotton blue stain to enable the identification of fungal species. This study (with percentage frequency of Occurrence) led to the discovery of diverse fungal species, *Aspergillus niger (39.11%), Aspergillus flavus (27.69%), Fusarium* sp. *(16.28%), Penicillium chrysogenum (11.21%)* and *Alternaria* sp. *(5.71%)*. Prevalence of *Aspergillus* sp. raises concern about indoor air quality, the presence of *Fusarium* sp. Prompts the need for vigilant monitoring of indoor air. This research concludes by emphasizing the complexity and presence of indoor air fungal growth in the New Boys' Hostel University of Abuja.

Keywords: Indoor air quality, Fungal spores, Airborne fungi, Bioaerosols, Fungal diversity.

1.0 Introduction

Indoor air fungi are a group of fungi that are commonly found indoors. These fungi can grow on various surfaces, including walls, ceilings, carpets, and furniture, especially in areas with high moisture levels especially where adequate hygiene is compromised. Exposure to indoor air fungi can lead to various health issues, particularly for individuals with allergies, asthma, or weakened immune systems. Symptoms can include respiratory problems, allergic reactions, headaches, and skin irritation (Amobonye et al., 2023)

With the increase in indoor air contamination, leading to respiratory illness and the major cause of premature loss of millions of lives worldwide (Fuller et al., 2022). Air pollution has continued to be one of the major health challenges in recent times, continues to be among the top cause of death in the world and linked to more than seven million deaths worldwide (WHO, 2023). Although, they are no indigenous microbes found in the air, poor indoor air quality can lead to chronic or acute respiratory disease that can be life threating disease to immunocompromised individuals. Fungi constitute a significant component of indoor air, they are naturally occurring in various environment such as soils, water and air. They encompass a wide variety of species, with molds being the most common indoor fungi, indoor fungi can originate from outdoor, especially during periods of natural ventilation *Aspergillus spp., Penicillium Isp., Cladosporium Isp.* are quite prominent in indoor air (Belizario *et al.,* 2021). Indoor spaces create conditions favorable for fungal growth, especially in areas characterized by high humidity, water damage, or inadequate ventilation. Different factors affect indoor air such as ventilation, cleanliness, human activity. To reduce the presence of indoor air fungi, it is important to control moisture levels, ensure proper ventilation, and clean affected areas thoroughly.

Asides from health implications, fungal growth can also compromise the structural integrity of buildings and leading to reduce lifespan of construction and materials used. This poses not just economic challenge but also raises concern about the safety and habitability of indoor spaces.

Each room in the university of Abuja new boy's hostel, was originally built to accommodate eight students, but due to lack of accommodations and the increasing population of students these rooms are now occupied by twice the approved number of students in each room during the exam periods, this number of students in each room become alarming. Over the years due to poor maintenance and student negligence and non-compliance to environmental cleanliness and sanitation, it has affected the ventilation, toilets and water channels of the hostels, this has then created a suitable and favorable environment for fungi growth in indoor air. Therefore, the aim of this research was to isolate and characterize fungi from indoor air in new boy's hostels of University of Abuja.

2. Materials and Method

2.1 *Study area*

This study was carried out at University of Abuja and is geographically located at approximately 9.0833° N latitude and 7.5333° E longitude, firmly anchoring it within the tropical savanna climate zone. This region experiences distinct wet and dry seasons, with the wet season typically spanning from April to October and the dry season prevailing from November to March. The study was carried out in New boy's hostel during the wet season in 24 randomly selected rooms.

2.2 *Sample collection*

Samples were obtained by exposing sabouraud dextrose agar (SDA) in the place in at different locations within the 24 selected rooms within the University of Abuja, New boy's hostels for a period of one hour.

2.3. *Identification and Characterization of Fungi Isolates*

A microscopic examination of the sub-cultured fungal isolateobtained from sabouraud dextrose agar after three (3) days of Sub-culturing. Identification and characterization was conducted using lactophenol cotton blue stain. This agent was selected cause of its effectiveness in aiding in viewing fungal features. A wet mount of lactophenol cotton blue was made by placing the fungal specimen unto a slide and the lactophenol cotton blue solution was poured on the slide, covered with a coverslip and examined using a light microscope at 40x objective lens. Identification and characterization of fungal species based on the morphology of various structures (Smith *et al*., 2023)

2.4. *Statistical Analysis*

Data obtained were subjected to Statistical analysis using the Statistical Package for Social Science (SPSS) package, ensuring robust and reliable interpretation of the research findings. Descriptive statistics was used to summarize the characteristics of the fungal isolates and environmental factors. Inferential statistics, including ANOVA (Analysis of Variance), was employed to examine relationships between variables obtained from the research.

3. Results and Discussion

3.1. *Fungal loads*

The research conducted at the New Boys Hostel, University of Abuja, delves into the isolation and characterization of fungi, from indoor air is shown in (Table 1) which sheds

light on the prevalence and variety of fungi in different locations within the hostel wings A and B (Figure 2), emphasizing on the dynamic nature of indoor air quality influenced by environmental factors, Ventilation, occupancy, and maintenance practices emerge as potential influencers, necessitating a comprehensive understanding of these dynamics to address indoor air quality concerns. The difference in species found was due to several factors ranging from temperature, humidity, level of cleanliness in the rooms (Figure 1). For instance, in sample 11, Wing A experiences an unexpected spike in fungal density (12.5 CFU), suggesting localized factors influencing fungal growth (Garcia *et al.,* 2021), Conversely, sample 12, Wing A undergoes a notable decrease (6 CFU) prompting further investigation into potential antifungal interventions (Brown *et al.,* 2019). The fluctuations in fungal densities across samples and wings emphasize the need for a holistic approach, considering environmental variables and targeted interventions (Chen *et al.,* 2022)

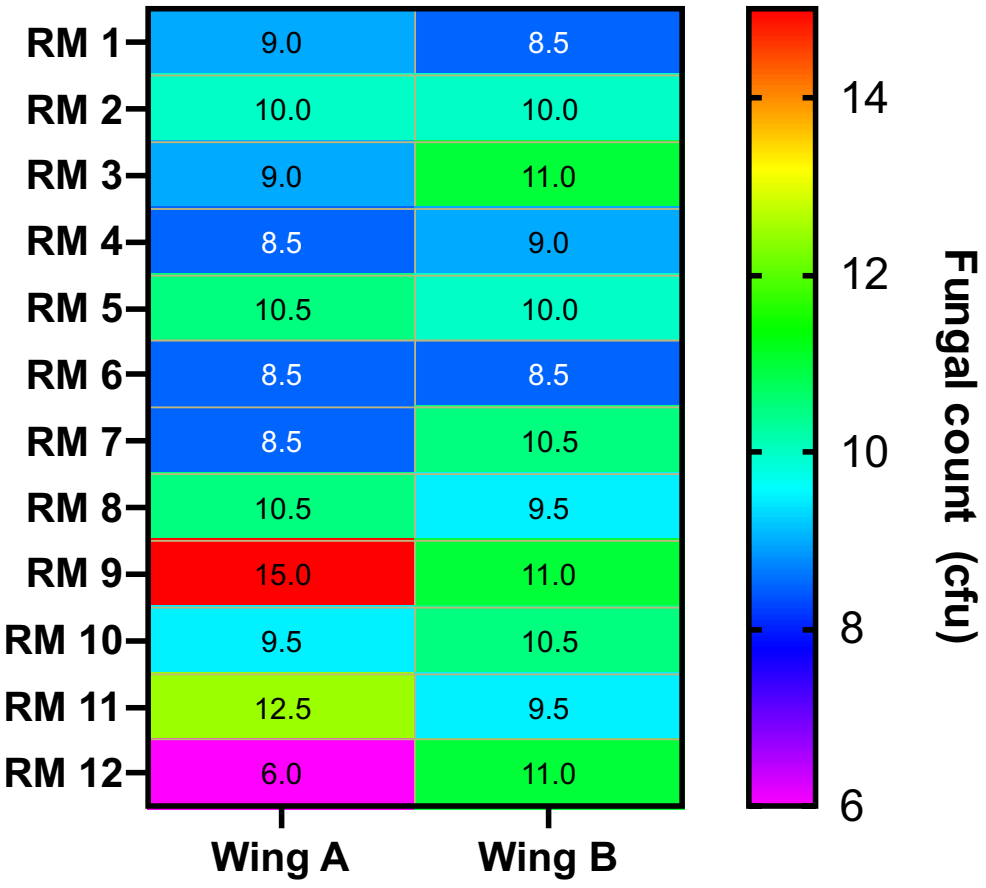

Figure 1. Fungi counts from the selected rooms.

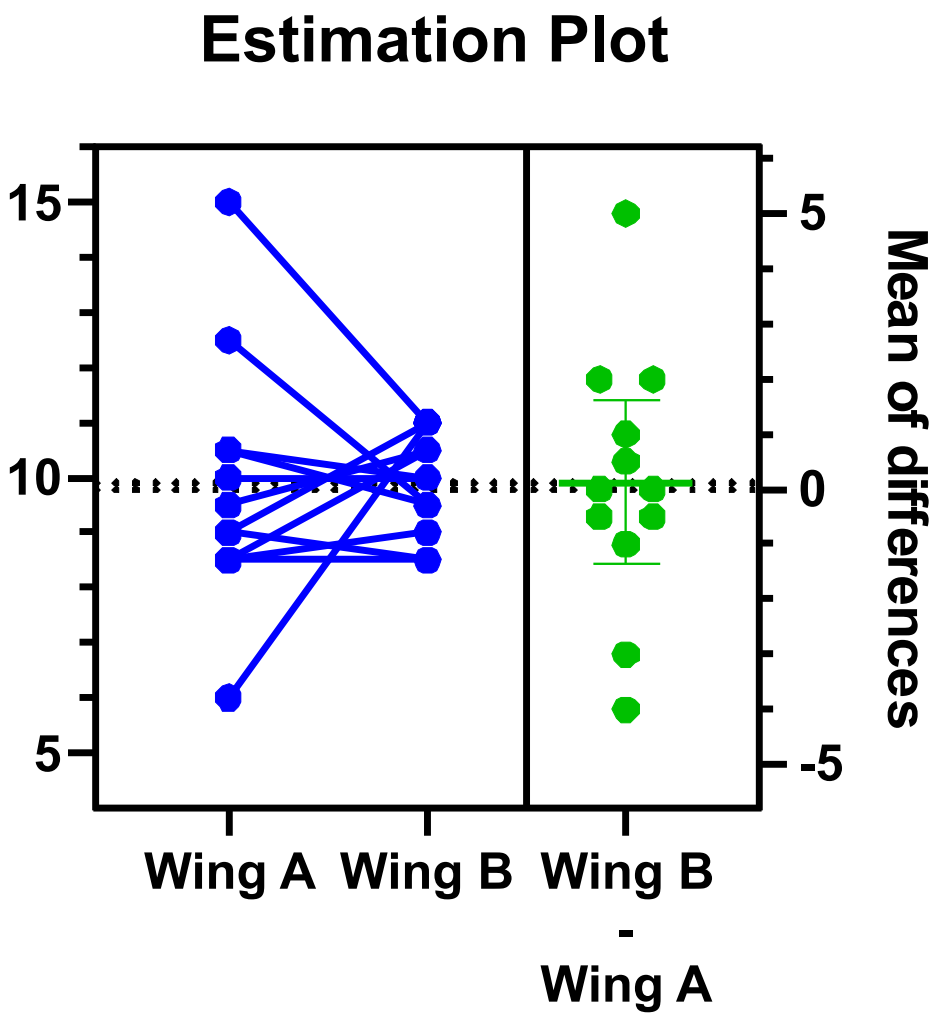

Figure 2: Fungal counts distribution in the two wings of the new boy's hostel

3.2. ***Identification of fungal isolates***

The macroscopic and microscopic characteristics of different variety of fungi present in the indoor air of the New Boys Hostel at the University of Abuja are shown in Table 1. These fungi isolates are *Aspergillus niger, Aspergillus flavus, Penicillium chrysogenum, Fusarium* sp., and *Alternaria* sp (Figure 3a-e). The presence of the fungal species is in agreement with several studies who listed the fungal species as being present in the atmosphere of indoor air (Belizario *et al.,* 2021, Awad *et al.,* 2020, Sauliene *et al.,* 2023)

Table 1: Morphological and microscopic characteristics of fungal isolates

Cultural characteristics	Microscopic characteristics	Suspected Organism
Black compact colony, appear yellow on the reverse.	Septate hyphae, black conidial heads, unbranched conidiophores.	*Aspergillus niger*
Yellowish green compact colony, appear gold on the reverse.	Septate hyphae, greenish color conidial heads, unbranched conidiophores.	*Aspergillus flavus*
Colonies appear pink in center & with white edges.	Multicellular, spindle like conidia, branched conidiophores, Septate hyphae.	*Fusarium* sp.
Bluish green colony, appear brown in reverse	Septate hyphae, tree-like appearance, oval conidia	*Penicillium chrysogenum*
Dark green deeply grown	Septate hyphae, branched conidiophores	*Alternaria* sp.

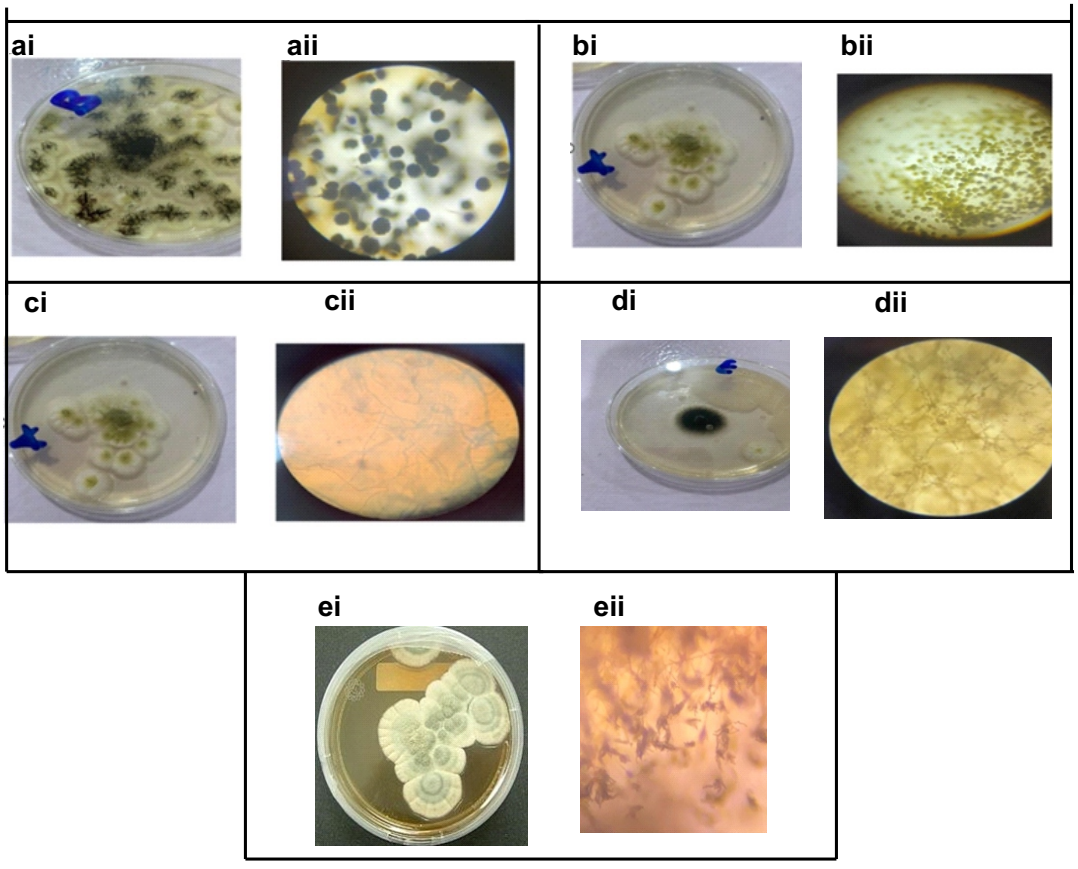

Figure 3a-e: ai Macroscopic view of *Aspergillus niger*, aii. Microscopic view of *Aspergillus niger.* bi. Macroscopic view of *Aspergillus flavus, bii.* Microscopic view of *Aspergillus flavus. ci* Macroscopic view of *Fusarium* sp., cii. Microscopic view of *Fusarium* sp., di. Macroscopic view of *Alternaria* sp., dii. Microscopic view of *Alternaria* sp., ei. Macroscopic view of *Penicillium chrysogenum*, eii. Microscopic view of *Penicillium chrysogenum*

3.3 ***Distributions of Fungal Occurrence***

This provides an overview of fungal occurrences in the indoor air of the New Boys' Hostel at the University of Abuja, the total number of fungal isolates gotten from wing A was (235) and Wing B was (238), which reveals distinctive patterns, on the prevalence and variety of fungi within the hostel. Distribution patterns showcases distinctive fungal occurrences in the two (2) different wings of the hostel, the total distribution across both wings emphasizes a prevalence of *Aspergillus* sp., with *Fusarium* sp., *Alternaria* sp.. and *Penicillium chrysogenum* also contributing significantly (Table 2). This distribution pattern underscores the importance of targeted interventions to mitigate potential health risks associated with these fungal species. Furthermore, *Fusarium* sp. and *Penicillium chrysogenum* are noteworthy contributors, indicating potential concerns related to mycotoxin production and indoor air quality (Garcia *et al.,* 2021).

Table 2: Distributions of Fungal Occurrence

Locations	Number of Sample	Isolates	Frequency
Wing A	12	*Aspergillus flavus*	87
		Aspergillus niger	105
		Fusarium sp.	49
		Penicillium chrysogenum	53
Wing B	12	*Aspergillus flavus*	44
		Aspergillus niger	80
		Fusarium sp.	28
		Alternaria sp.	27
Total	24		473

3.4 ***Frequency of Occurrence (%)***

A Comprehensive breakdown of the frequency of occurrence of various fungal isolates is shown in (Figure 4). A total of 473 microbial isolates were obtained of which (39.11%) were *Aspergillus niger* while *Alternaria* sp. showed the lowest frequency (5.71%) which is in accordance with recent studies on indoor fungal diversity emphasizing the ubiquitous nature of *Aspergillus* sp. (Smith *et al.,* 2021). *Fusarium* sp. and *Penicillium chrysogenum* also contribute significantly, necessitating vigilant monitoring and targeted interventions. Recent studies by (Wang *et al.,* 2020) suggest that *Fusarium* species may produce mycotoxins associated with respiratory issues, necessitating thorough air quality management. These findings correlate with research on indoor fungal diversity, stressing the importance of understanding the ecological dynamics of different fungal species within confined spaces (Wang *et al.,* 2022).

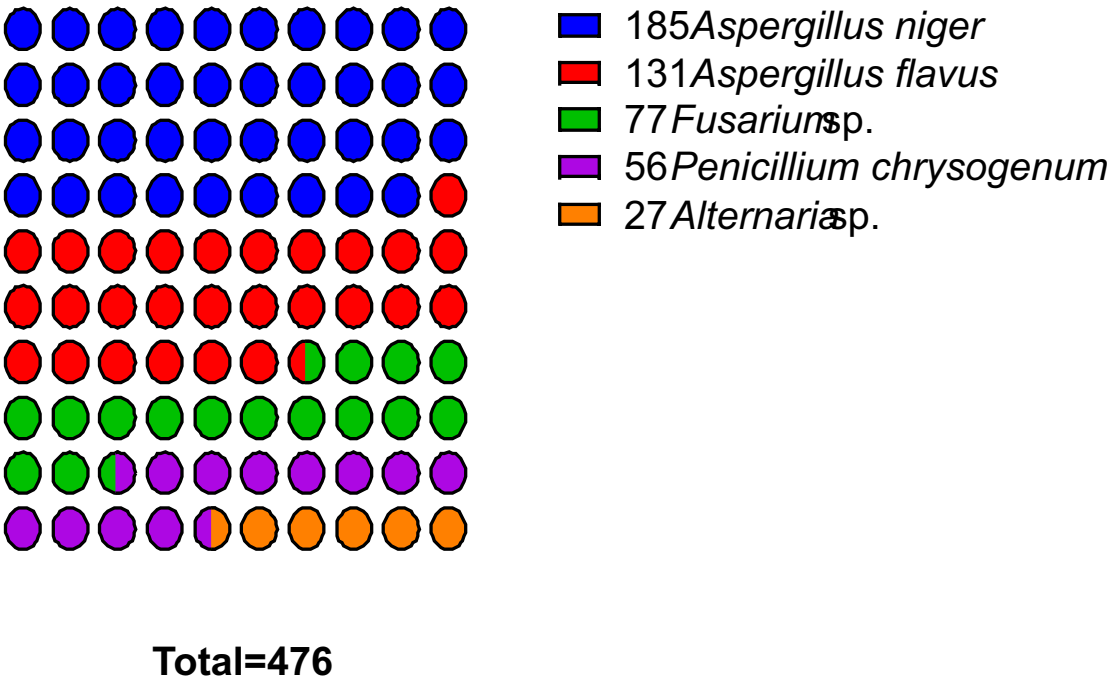

Figure 4: Frequency of occurrence of the isolated fungi

4. Conclusion

The result of the study indicates that indoor air of new boy's hostel in University of Abuja, Nigeria is harbor fungal population which can lead to health challenges *Aspergillus niger* showed the highest number of occurrence and *Alternaria* sp.. showed the lowest frequency of occurrence. The prevalence of potentially harmful fungi, such as *Aspergillus* and *Fusarium* species, necessitates the attention of students to be cautious to mitigate health risks associated with indoor air exposure.

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