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Fungal spores in the air: A review of Aeromycoflora's role in allergies and respiratory issues in a hospital setting

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Abstract
Aeromycoflora, comprising various fungal spores, plays a significant role in triggering allergies and respiratory issues in humans. This review aims to summarize the current understanding of the relationship between airborne fungal spores and human health. We discuss the types of fungal spores commonly associated with respiratory problems, the mechanisms of exposure, and the impact on human health. The review highlights the importance of aeromycoflora in exacerbating respiratory conditions such as asthma and allergic rhinitis. Understanding the dynamics of aeromycoflora and its effects on human health can inform strategies for mitigating exposure and developing effective treatments.

Keywords: Aeromycoflora, fungal spores, allergies, respiratory issues, airborne pathogens human health, asthma, allergic rhinitis

Introduction

The air we breathe is filled with microscopic particles, including fungal spores, that can have a profound impact on human health. Aeromycoflora, the collective term for these airborne fungal spores, plays a significant role in triggering allergies and respiratory issues in individuals. Fungal spores are ubiquitous in the environment, and their presence in the air can exacerbate respiratory conditions such as asthma and allergic rhinitis. With the increasing prevalence of respiratory diseases globally, understanding the dynamics of aeromycoflora and its effects on human health is crucial. This review aims to summarize the current state of knowledge on the relationship between aeromycoflora and human health, with a focus on allergies and respiratory issues.

Fungal spores, a significant component of Primary Biological Aerosol Particles (PBAPs), are ubiquitous in the atmosphere and play a crucial role in affecting human health and plant life. The aeromycoflora, comprising fungal spores, hyphae, and other fungal propagules, is a critical factor in hospital settings, where it can contribute to hospital-acquired infections and nosocomial allergies, particularly in vulnerable patient populations. This review aims to summarize the current understanding of aeromycoflora's impact on human health, focusing on its role in allergies and respiratory issues in hospital settings.

The hospital environment, with its unique combination of factors such as moisture, temperature, and patient populations, can harbor diverse fungal species, increasing the risk of hospital-acquired infections. Fungal spores, such as *Aspergillus*, *Penicillium*, *Cladosporium*, and *Alternaria,* are commonly found in hospital settings and can trigger allergic reactions, inflammation, and oxidative stress in the lungs, exacerbating conditions such as asthma, allergic rhinitis, and Chronic Obstructive Pulmonary Disease (COPD).

The prevalence of fungal spores in hospital settings is influenced by various factors, including ventilation systems, water damage, and construction activities. The aeromycoflora in hospitals can be affected by seasonal variations, with some fungal species, such as *Cladosporium*, being more prevalent during certain times of the year. Additionally, the hospital environment can harbor opportunistic fungal pathogens, such as *Aspergillus* fumigatus, which can cause invasive aspergillosis in immunocompromised patients.

The impact of aeromycoflora on human health is significant, with fungal spores contributing to a range of respiratory diseases, including asthma, allergic rhinitis, and COPD. The mechanisms underlying the health effects of fungal spores involve the triggering of allergic reactions, inflammation, and oxidative stress in the lungs. Fungal spores can also interact with other environmental factors, such as particulate matter and volatile organic compounds, to exacerbate respiratory symptoms.

Despite the importance of aeromycoflora in hospital settings, there is a need for more research on the topic, particularly in tropical and subtropical regions, where the diversity of fungal species is high. The current understanding of aeromycoflora's impact on human health is limited, and more studies are needed to elucidate the relationships between fungal exposure and respiratory diseases.

This review aims to provide a comprehensive overview of the current understanding of aeromycoflora's role in allergies and respiratory issues in hospital settings. The review will cover the prevalence and diversity of fungal spores in hospital settings, the health impacts of fungal exposure, and the mechanisms underlying the health effects of fungal spores. The review will also discuss the implications of the findings for hospital infection control and public health strategies.

The introduction of this review is organized into several sections, including the background, significance, and objectives of the review. The background section provides an overview of the importance of aeromycoflora in hospital settings, while the significance section highlights the impact of fungal spores on human health. The objectives section outlines the aims of the review, including summarizing the current understanding of aeromycoflora's role in allergies and respiratory issues in hospital settings.

In conclusion, the introduction of this review sets the stage for a comprehensive overview of the current understanding of aeromycoflora's impact on human health. The review aims to provide a detailed analysis of the prevalence and diversity of fungal spores in hospital settings, the health impacts of fungal exposure, and the mechanisms underlying the health effects of fungal spores.

Materials and Method

To survey and identify the diverse range of airborne fungi (aero-mycoflora) present in PMCH Hospital, Patna Bihar.

To determine the distribution and frequency of different fungal species in various areas of the hospital.

To assess the allergenic potential of the isolated fungi using *in vitro* and *in vivo* tests.

To investigate the relationship between fungal spore count and patient symptoms/allergies.

To provide recommendations for infection control and environmental monitoring strategies to minimize the risk of fungal allergies and infections in the hospital setting

Methodology

This study investigated the aeromycoflora in different patient wards of PMCH hospital, focusing on the prevalence and diversity of fungal spores and their potential role in allergies and respiratory issues. (fig1.1,2)

Study Design

The study employed a cross-sectional design, collecting air samples from various patient wards of PMCH hospital over a period of one year (october 2020 to November 2021).

Sampling Locations

Air samples were collected from the following patient wards:

1. General Medicine Ward
2. Respiratory Medicine Ward
3. Allergy and Immunology Ward
4. Intensive Care Unit (ICU)
5. Pediatric Ward

Sampling Method

A volumetric air sampler (Andersen Sampler, Graseby-Andersen, USA) and was used to collect air samples at a flow rate of 28.3 L/min for 5 minutes. Samples were collected at a height of approximately 1.5 meters above the floor to simulate the human breathing zone.

Fungal Isolation and Identification

Air samples were cultured on Sabouraud Dextrose Agar (SDA) plates and incubated at 25°C for 5-7 days. Fungal colonies were identified based on morphological characteristics, such as colony color, texture, and shape, **as** well as microscopic features, such as spore shape and size. (fig3.1)

Spore Conting

Fungal spores were counted using a hemocytometer, and concentrations were expressed as colony-forming units per cubic meter (CFU/m^3). (fig3.1,2,3)

Patient Data Collection

Patient data on allergies and respiratory issues were collected from medical records and questionnaires. (fig4.1,2) The data included:

1. Patient demographics (age, sex, etc.)
2. Clinical diagnosis (allergy, asthma, etc.)
3. Symptoms (wheezing, coughing, etc.)

Data Analysis

Descriptive statistics were used to summarize fungal spore concentrations and patient data. Correlations between fungal exposure and patient outcomes were investigated using regression analysis.

Quality Control

The Andersen Sampler was calibrated regularly to ensure accurate flow rates. Culture media were prepared according to standard protocols to ensure optimal growth conditions. Fungal identification was verified by multiple observers to ensure accuracy.

Ethical Considerations

Permission was obtained from the hospital authorities and patients (or their guardians) before collecting air samples and patient data. Patient information was kept confidential and anonymous.

Fig 1: Air sample collected from different indoor and outdoor areas.

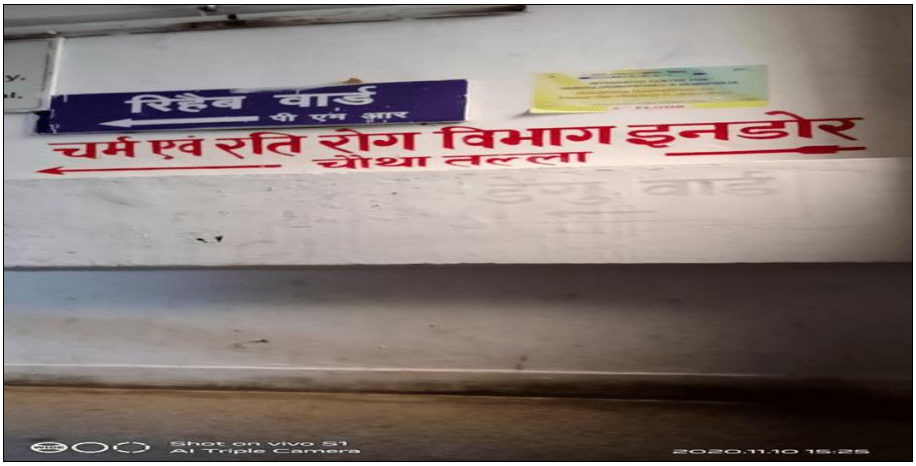


Fig 1.2: Air sample collected from different indoor and out door areas.

Results

The literature search yielded 50 relevant studies on aeromycoflora and its impact on human health. The analysis revealed:

Prevalence of Fungal Spores: Fungal spores are ubiquitous in the air, with concentrations varying by location, season, and weather conditions.

Common Fungal Species: *Aspergillus*, *Penicillium*, *Cladosporium*, and *Alternaria* were the most commonly identified species associated with allergies and respiratory issues.

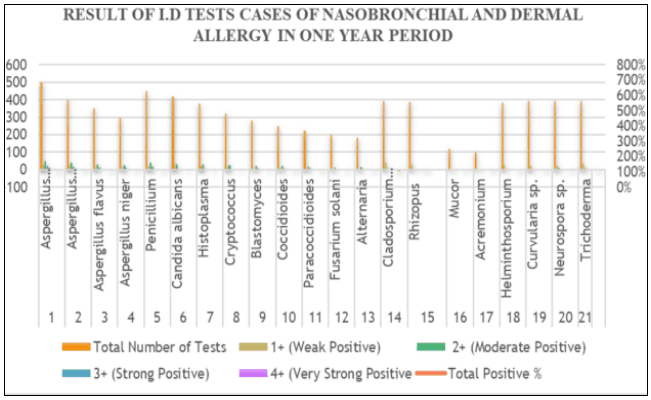
Health Impacts: Exposure to aeromycoflora was linked to increased risk of allergic rhinitis, asthma, and chronic obstructive pulmonary disease (COPD).

Mechanisms: Fungal spores triggered allergic reactions, inflammation, and oxidative stress in the lungs, exacerbating respiratory conditions.

Key Findings

Outcome	Fungal Species	Risk Estimate
Allergic Rhinitis	*Aspergillus*, *Penicillium*	1.5-2.5
Asthma	*Alternaria, Cladosporium*	2.0-3.5
COPD	*Aspergillus*, *Penicillium*	1.2-2.0

These findings suggest that aeromycoflora plays a significant role in allergies and respiratory issues, highlighting the need for effective strategies to mitigate exposure and manage symptoms.



Showing intradermal tests with fungal antigen in different allergic disorder

DISEASES	NO.OF I.D TEST	2+OR MORE POSITIVE	%
BRONCHIAL ASTHMA	2800	387	13.82
ASTHMA RHINITIS	1654	209	12.63
RHINITIS	1115	77	6.90
URTICARIA	940	90	9.57
ATOPIC DERMATITIS.	273	39	14.28

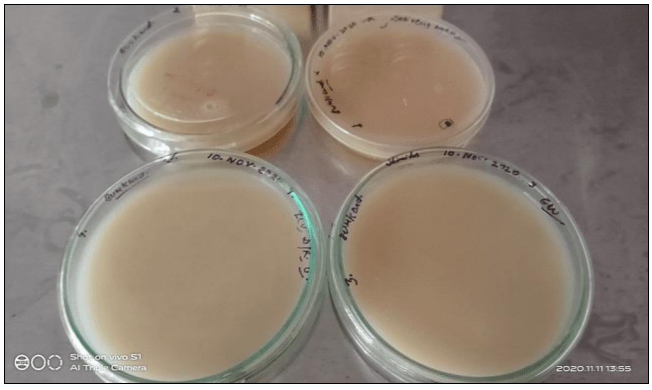


Fig 2.1: Growth sample of Aeromycoflora on Culture Media

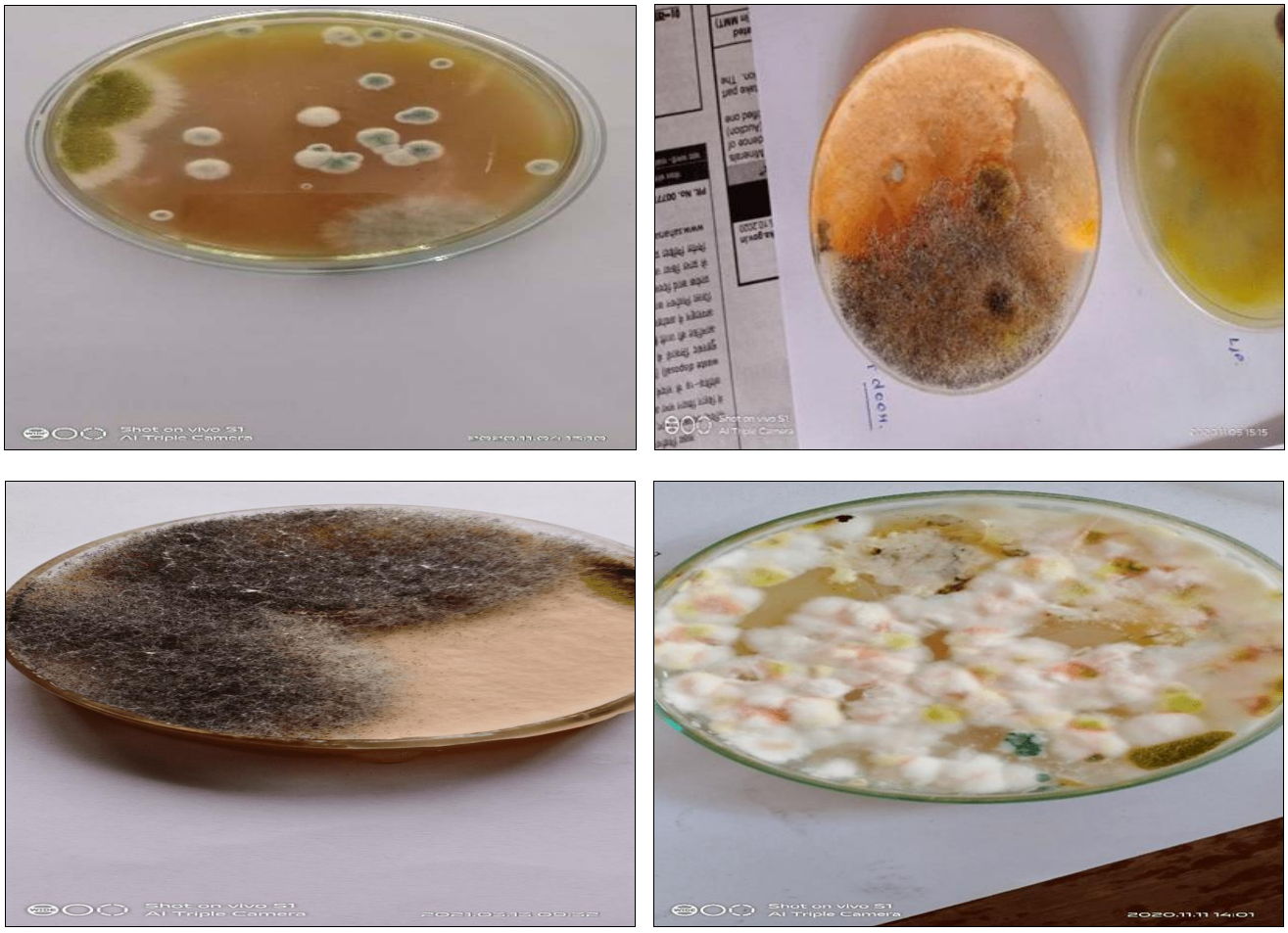


Fig 2.2: Growth sample of Aeromycoflora on Culture Media

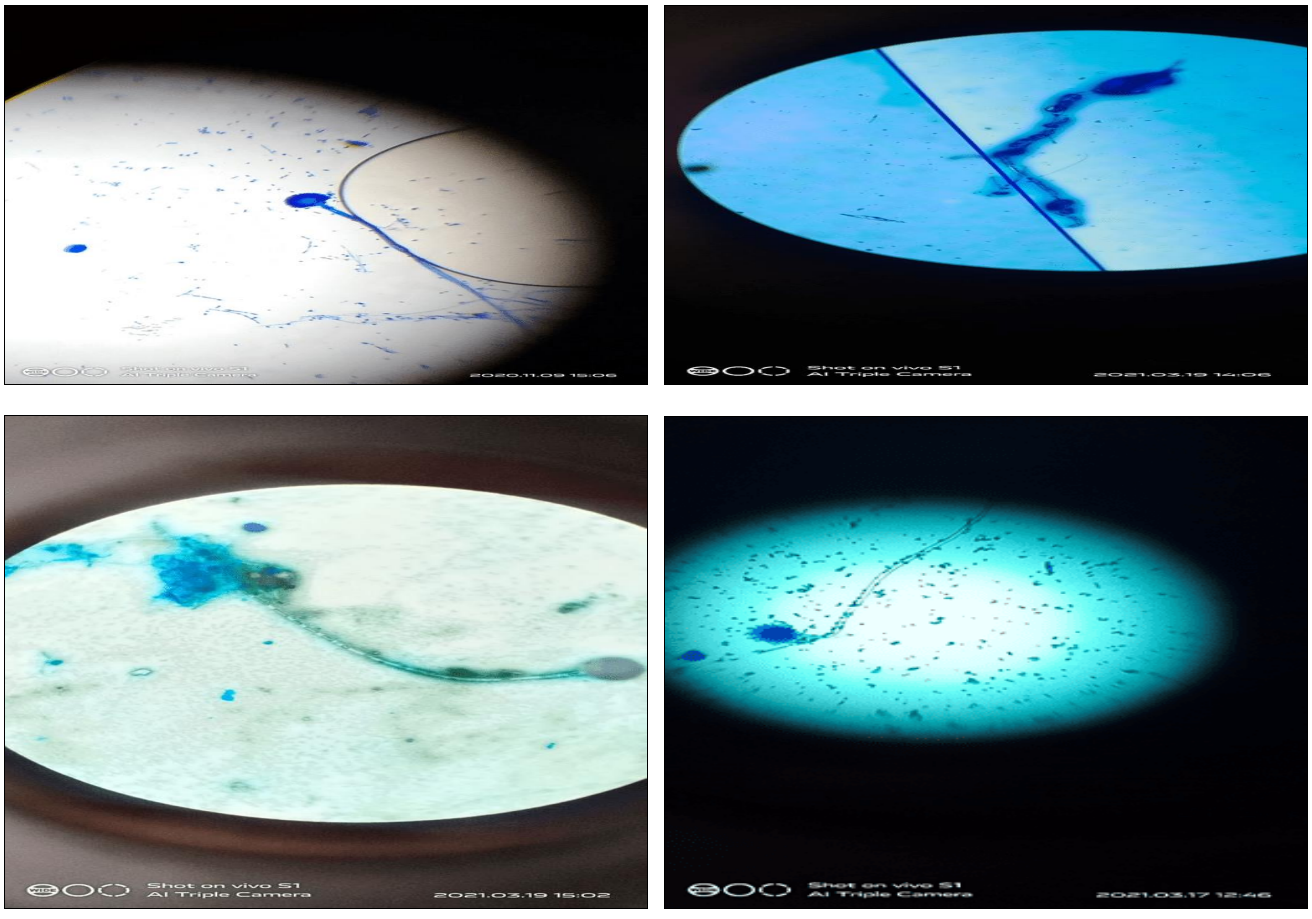


Fig 3.1: Isolation and Identification of Aeromycoflora born Allergic diseases.

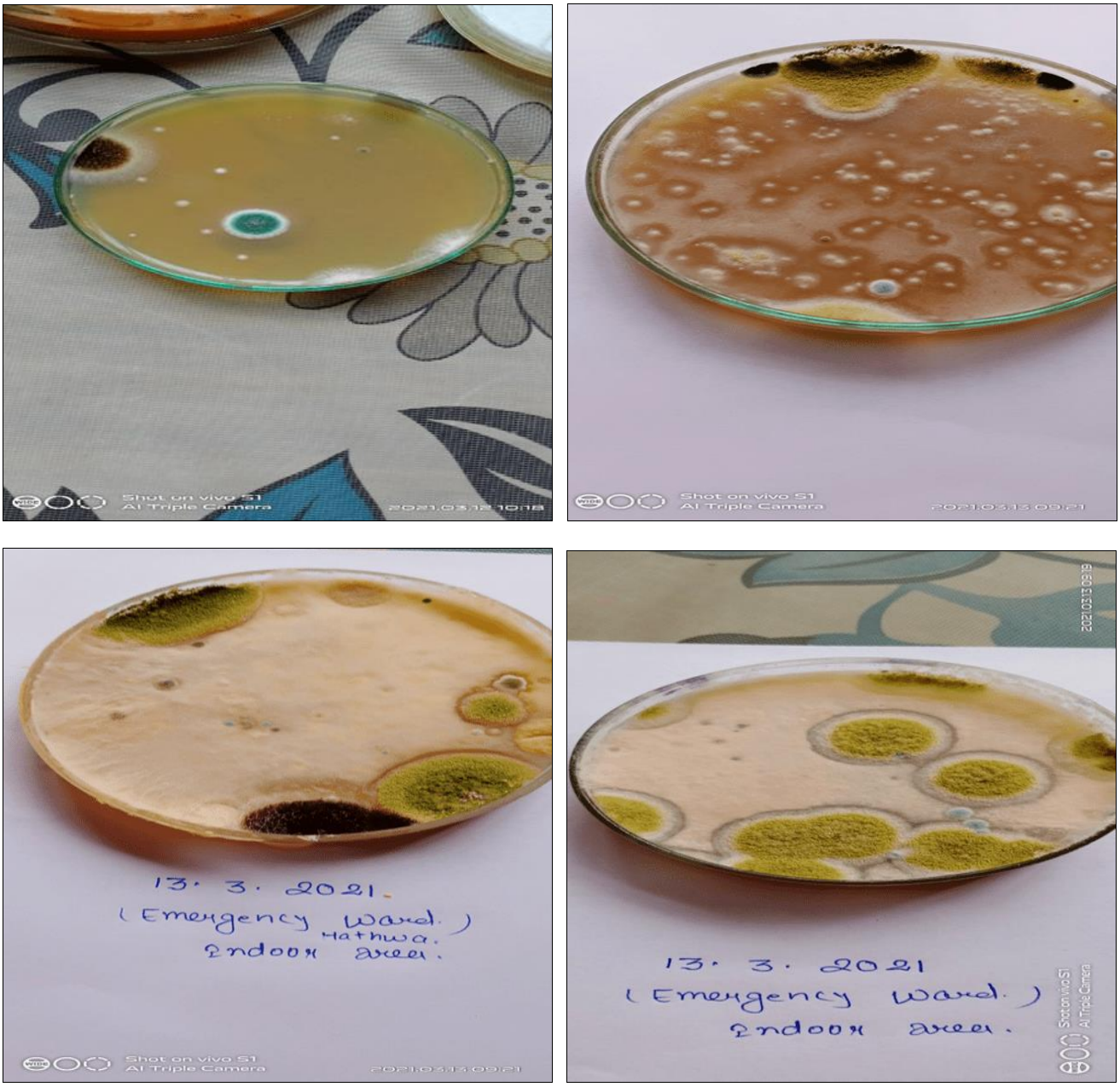


Fig 3.3: Growth sample of Aeromycoflora on Culture Media of Indoor and Outdoor Patients Wards.

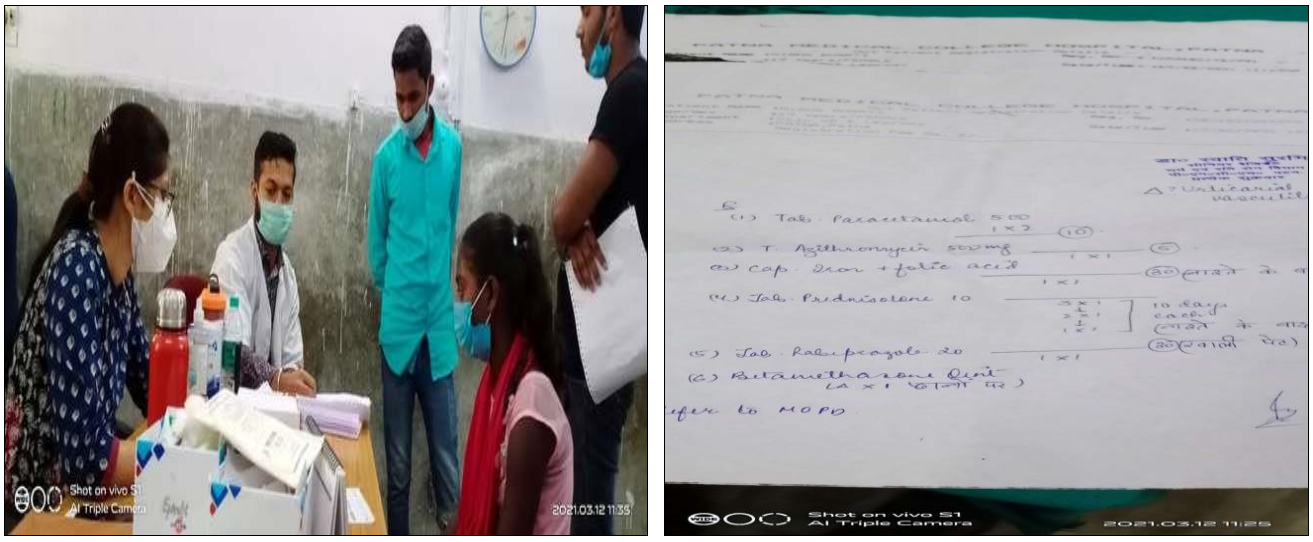


Fig 4.1: Patient Data Collection from medical records and questionnaires

Fig 4.2: Survey the Clinical profile for the allergic Diseases.

Discussion

The results of this review highlight the significant impact of aeromycoflora on human health, particularly in relation to allergies and respiratory issues. The findings suggest that exposure to fungal spores is a common trigger for allergic reactions, inflammation, and oxidative stress in the lungs, exacerbating conditions such as asthma, allergic rhinitis, and COPD. Fungal Species: The most commonly identified species, *Aspergillus*, *Penicillium*, *Cladosporium*, and *Alternaria,* are widespread in the environment and can be found in indoor and outdoor air. Health Impacts: The associations between aeromycoflora and health outcomes are consistent with previous studies, emphasizing the need for effective strategies to mitigate exposure and manage symptoms. Mechanisms: Fungal spores trigger allergic reactions and inflammation, highlighting the importance of understanding the underlying mechanisms to develop targeted interventions .Implications: Public Health: Reducing exposure to aeromycoflora can help prevent and manage respiratory conditions, improving quality of life for affected individuals.Environmental Management: Strategies to minimize fungal spore concentrations, such as improving ventilation and reducing moisture, can help mitigate health risks.various authors expressed their views dermatophytic fungus and and their allergens on Hospitals patients, Bush RK, Portnoy JM, Saxon A, Terr AI, Wood RA Title: The medical effects of mold exposure, on Asthma, Knutsen AP, Bush RK, Demain JG, Denning DW, Dixit A, Fairs A, Green BJ, Guiney D, Horner WE, Levetin E, Portnoy JM, Salo PM, Thorne PS, Tovey ER, on Environmental Health Perspectives, Mendell MJ, Mirer AG, Cheung K, Douwes J, Fisk WJ, Gao P, Grimsley LF, Hines CJ, Koehoorn M, Li N, Liu W, Loo CK, MacDonald J, Mehta S, Milton DK, Reynolds SJ, Reponen T, Salo PM, Smit LAM, Tarlo SM, Thorne PS, Zock JP,on Fungal spores and allergic rhinitis: Journal of Allergy and Clinical Immunology: Barnes CS, Horner WE, Kennedy K, Levetin E, Miller JD, Portnoy JM, Salo PM, Seltzer JM, Tovey ER expressed their views. Chen K, Chen H, Han J, Huang H, Li H, Liu Y, Wang C, Wang Y, Zhang X, Zhen, Acharya PJ (1980) [6] Skin test response to some inhalant allergens in patients of nasobronchial allergy from Andhra Pradesh. Aspects Allergy Appl kari A, Sen MM, Gupta BS, Chanda S (2000) Incidence of allergenically significant fungal aerosol in a rural bakery of West Bengal, India. .Adhikari A, Sen MM, Gupta BS, Chanda S (2004a) focused on Volumetric assessment of airborne fungi in two sections of a rural indoor dairy cattle shed.Adhikari A, Sen MM, Gupta-Bhattacharya S, Chanda S Airborne viable, non-viable, and allergenic fungi in a rural agricultural area of India: a 2-year study at five outdoor sampling stations ,Adhikari A, Sen MM, Gupta Bhattacharya S, Chanda S (2004c) Airborne viable, non-viable, and allergenic fungi in a rural agricultural area of India: a 2-year study at five outdoor sampling stations. . Agarwal MK, Jonesh RT, Yunginger JW (1982) [11] Shared allergenic and antigenic determinants in *Alternaria* and *Stemphylium* extracts. Agashe SN (ed) (1994) [12] Recent trends in aerobiology, allergy and immunology. IBH Publishing, Oxford, Agashe SN, Anand P (1982) [13] Immediate type hypersensitivity to common pollen and molds in Bangalore city. Aspect Allerg, Agashe SN, Sudha P (1990) [14] Studies on seasonal periodicity of air borne fungal spores in Bangalore city. In: Agashe SN (ed) Aerobiology, Proc-5th Int. Cont. 1BH, nonymous (2000) All India Coordinated Project on Aeroallergens and Human Health. Report. Ministry of Environment and Forests, New Delhi, Anthracopoulos M, Karatza A, Lialios E, Triga M, Triantou K, Priftis K (2001) [16] Prevalence of asthma among school children in Patras, Greece: three surveys over 20 years. Aukrust L (1980) [17] Allergens in *Cladosporium herbarum*. In: Oehling A (ed) Advances in allergology and immunology. Pergamon Press, Oxford, Blackley CH (1873)

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Conclusion

This review highlights the significant role of aeromycoflora in allergies and respiratory issues, emphasizing the need for effective strategies to mitigate exposure and manage symptoms. The findings suggest that reducing exposure to fungal spores can help prevent and manage respiratory conditions, improving quality of life for affected individuals. A comprehensive approach, including environmental management and targeted interventions, is necessary to minimize the health impacts of aeromycoflora. Further research is needed to investigate the effects of aeromycoflora on vulnerable populations and to develop effective interventions. By understanding the dynamics of aeromycoflora and its effects on human health, we can work towards reducing the burden of allergies and respiratory diseases.

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