

Isolation and Identification of Pathogenic Fungi from Air Conditioners in Tutorial Rooms of the Faculty of Medicine, Universitas Padjadjaran

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Abstract

Background: Awareness about health problems caused by air conditioner is very important. Thus, it is crucial to have knowledge about proper maintenance of air conditioner. At the Faculty of Medicine, Universitas Padjadjaran, air conditioners are used in every tutorial rooms. This study was performed to provide adequate information on the fungi, such as *Aspergillus*, *Penicillium* and *Mucor*, found in air conditioners.

Methods: A descriptive laboratory study was used to identify the presence and the type of pathogenic fungi from air conditioners in tutorial rooms. Thirty-four samples were collected from the air outlet grille of the air conditioners and cultured on Sabouraud agar at 27°C for 2 weeks. Fungi presence were then identified microscopically

Results: The results showed that the majority of air conditioners in tutorial rooms of the Faculty of Medicine, University Padjadjaran contained many types of fungus that grew in Sabouraud agar. From 34 samples, thirty two samples were positive and 2 samples were negative. Various fungus have been identified, those were *Penicillium* (37.5%), *Aspergillus* (25%), *Mucor* (2.5%) and unidentified (35%)

Conclusions: The majority of air conditioners in tutorial rooms of the Faculty of Medicine, Universitas Padjadjaran contained many types of opportunistic fungus. [AMJ.2014;1(1):21-4]

Keywords : Air conditioner, *Aspergillus*, fungi, *Mucor*, *Penicillium*

Isolasi dan Identifikasi Jamur Patogen dari Pendingin Udara di Kamar Tutorial dari Fakultas Kedokteran, Universitas Padjadjaran

Abstrak

Latar Belakang : Kesadaran tentang masalah kesehatan yang disebabkan oleh pendingin udara sangat penting. Dengan demikian , sangat penting untuk memiliki pengetahuan tentang perawatan yang tepat dari pendingin udara. Di Fakultas Kedokteran, Universitas Padjadjaran, pendingin udara digunakan di setiap kamar tutorial . Penelitian ini dilakukan untuk memberikan informasi yang memadai tentang jamur, seperti *Aspergillus*, *Penicillium* dan *Mucor*, yang ditemukan di pendingin udara.

Metode: Sebuah studi laboratorium deskriptif digunakan untuk mengevaluasi keberadaan dan jenis jamur patogen dari pendingin udara di kamar tutorial. Tiga puluh empat sampel dikumpulkan dari kisi-kisi pendingin udara dan dikultur pada Sabouraud agar pada 27 °C selama 2 minggu. Pertumbuhan jamur kemudian diidentifikasi secara mikroskopis.

Hasil : Hasil penelitian menunjukkan bahwa pada sebagian besar pendingin udara di ruang tutorial Fakultas Kedokteran Universitas Padjadjaran terdapat banyak jamur yang dapat tumbuh di Sabaroad agar, 32 hasil positif dan 2 hasil negatif untuk pertumbuhan jamur . Jamur yang tumbuh adalah *Penicillium* (37,5%), *Aspergillus* (25%), *Mucor* (2,5%) dan tidak teridentifikasi (35%).

Simpulan : Sebagian besar pendingin udara di ruang tutorial Fakultas Kedokteran Universitas Padjadjaran Jatinangor menunjukkan adanya pertumbuhan jamur oportunistik

Kata kunci : *Aspergillus*, jamur , *Mucor* , *Penicillium*, pendingin udara

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Introduction

In this era, the most frequently used cooling machine for buildings is the air conditioner. Air conditioner has brought benefits to human's life in the form of comfort during hot weather. Even though air conditioner has its own disadvantages such as being costly compared to other appliances and uses a lot of electricity. People are very keen in using air conditioner and they are unaware about the health problems that might be caused by the air conditioner.

Appropriate knowledge on proper maintenance of air conditioner is very important because some pathogenic microorganisms, such as *Aspergillus* sp., *Penicillium* sp, *Legionella*, and others, may grow in the air conditioner and pose risks for human being.^{1,2} According to a research conducted in Poland, it has been proven that there are increased concentrations of mycotoxin moulds *Penicillium* sp and *Aspergillus* sp. in the air of buildings with poor ventilation or damaged and ineffective air conditioning systems.³ Mycotoxin is a poisonous substance produced by fungi which is capable of causing diseases and death in humans and animals.⁴

Another research was conducted in the United States to reveal the statistics of infection caused by *Aspergillus* sp., known as aspergillosis. It has also been confirmed that there is an increase in the number of aspergillosis-related hospitalization. The average hospitalization days of patients with aspergillosis is longer and the cost is also higher compared to patients without aspergillosis.⁵ However, less data are provided for Asian countries such as Indonesia and Malaysia. More studies should be conducted in Asian countries to know the prevalence and emerging of the pathogenic infections caused by fungus. By understanding more about pathogenic fungus, we can prevent the infection through creating public awareness through various public health programs. This is to guarantee a healthier life and a better future for the community.

The setting of tutorial rooms is selected because students of the Faculty of Medicine, Universitas Padjadjaran spend almost nine hours every week in the tutorial rooms compared to other rooms such as the clinical skill room and lecture hall where they spend less time.

Methods

This study was a descriptive study to identify the presence of pathogenic fungi in air conditioners of tutorial rooms at the Faculty of Medicine, Universitas Padjadjaran. Samples used for this research were swabs from air outlet grille of the air conditioners in tutorial rooms. The sampling method was simple random sampling based on the number of the tutorial rooms. The inclusion criteria were samples from air conditioners that were routinely used and had not been cleaned for more than a month. Air conditioners that were out of service and tutorial rooms which are not frequently used were excluded from the study to avoid bias.

The experiment was started by taking swabs from the inner surface of the air conditioner where the air outlet grille was located. The cotton swab was then placed in a sterile container with physiologic saline as a transport medium. Later, the cotton swabs used to take the samples from air conditioner were inoculated directly on the Sabouraud's agar with chloramphenicol. The samples that were inoculated onto the Sabouraud's agar were then incubated for 2 weeks at 27 °C and observed everyday for the growth of fungi. The growing colonies were later observed macroscopically and microscopically.

Microscopic examination was performed on by first wiping the object glass using cotton balls soaked with 95% alcohol or burnt directly over the spirit lamp to free the slide from fat.⁶ Then, samples from every growing colony were retrieved using the cellophane tape. A drop of lactophenol cotton blue was added to the slide and the specimen from the cellophane tape was gently applied on the cleansed object glass.⁷ The slide was the examined under a microscope. The identification of fungus was made by observing the reproductive structures, such as the spores, and the macroscopic appearance of the culture.

Results

Microbiological examinations were conducted on 34 samples from swabs that were collected from the air conditioner's air outlet grille. These samples were collected over a period of 2 weeks from the tutorial rooms of the medical faculty. The samples were inoculated directly onto the Sabouraud agar on the same day when the samples were collected.

Table 1 Fungal Growth on Sabouraud Agar

Fungal growth	Total growth	Percentage (%)
Positive	32	94.1
Negative	2	5.9

The positive samples were then evaluated macroscopically and microscopically for identifying the fungus according to the features of the fungus, such as like hyphae, spore, color, and others. The total number of colonies was 80.

Table 2 Fungus colony identification

Fungus colony	Number of colony	Percentage (%)
Penicillium	30	37.5
Aspergillus	20	25
Mucor	2	2.5
Unidentified	28	35

Discussion

This study shows that the majority of air conditioners in tutorial rooms of the Faculty of Medicine, Universitas Padjadjaran contain many types of fungus that can grow a colony in Sabouraud agar. This may be due to a number of reasons such as the air conditioners are not serviced, cleaned, and maintained as they should, so there is an ample time for the fungus to grow. Fungi can grow on soft porous insulation materials known as the filter, which is used in air conditioners to absorb moisture and volatile organics.⁸ These organics are used by fungus as nutrients for growth.⁸ The temperature of the air conditioner when it is on and off can affect the growth of fungus because fungus can survive in cold and warm temperature.⁹

In addition, the condition of the tutorial room itself can affect the growth of fungus. The windows in tutorial rooms are seldom opened because the air conditioner is switched on. A closed area will have a poor air ventilation and this will trap the indoor air which contains dust in the room, making it the nutrition source for the microorganisms.¹⁰

Furthermore, the presence of trash under the table and in the garbage bin also provides the necessary nutrition for fungus and other microorganisms.¹⁰ Thus, there are many factors that help the fungus to grow in the tutorial room. To prevent this condition, routine cleaning is the simplest way to control fungal contamination in air conditioners.¹⁰

The types of fungus that can grow in the air conditioners, as shown by this study are, among others, *Aspergillus*, *Penicillium* and *Mucor*, which are categorized in opportunistic fungus.¹² This is in line with the types of fungus commonly found in air conditioners in the other studies.^{8,12} These opportunistic fungus, normally take advantage from those with weakened immunity but does not normally cause illness in people with healthy immune system.⁷ When there is a decrease in human immune system, the spore from *Aspergillus*, *Penicillium* or *Mucor* that is inhaled will produce an allergic reaction, with lungs as the most common organ to be attacked. Infection by *Aspergillus* is known as aspergillosis, while infections caused by *Penicillium* and *Mucor* are referred to as penicilliosis and zygomycosis, respectively.¹²

A research in Pune, India, on air conditioners in operating theaters of several different hospitals showed fungal isolation in split air conditioner and window-mounted units with a prevalence of 3.1% and 30.3%, respectively. However, fungus in air conditioners in tutorial rooms of Faculty of Medicine shows a higher prevalence of *Aspergillus* and *Mucor*.¹¹ Nonetheless, there are no Standards or Threshold Limit Values (TLVs) established yet to judge what the acceptable, tolerable, or normal quantity of mold.^{13,14}

In conclusion, it is revealed that the pathogenic fungi are presence in the air conditioners from tutorial rooms with the frequency of 94.1%. The types of fungus found are *Penicillium* (37.5%), *Aspergillus* (25%), *Mucor* (2.5%) and unidentified (35%). Measures should be taken in order to prevent further dispersal of these pathogenic fungi to the surrounding air to maintain high quality air. Actions that should be implemented first are regular cleaning, servicing, and maintenance of air conditioner to prevent microorganisms' growth. Adequate knowledge on pathogenic fungi is essential to create public awareness to avoid diseases that can be caused by fungus. As a result, it is important to emphasize that fungal colonization of air-conditioning systems should not be ignored, especially in hospital settings.⁸

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