Aerial pathogenic micro fungi in medical classes on medical faculty

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Abstract. Microbiological air pollution consists of micro fungi and bacteria. Micro fungi are indoor air pollutant because its spores widely spread, floats in the air, surface, dust, and water, and can be pathogenic. Isolation and identification of aerial pathogenic micro fungi in study rooms in Medical Faculty attempted to find whether there was difference of micro fungi number in every study room. The research design is experimental descriptive research, using 8 samples with 3 repetitions. Data analyzed using Kruskal-Walls test. The research result showed the successfully identified 10 aerial pathogenic micro fungi which were: Aspergillus Niger, Aspergillus flavus, Aspergillus glaucus, Rhizopus sp., Mucor sp., Penicillium sp., Trichoderma sp., Syncephalastrum sp., Scopulariopsis sp., and Cladophialophorabantiana. The research also showed that there was difference of aerial pathogenic micro fungi number in every study rooms ranging between 16,490-73,026 CFU m⁻³, but statistically there wasn’t significant difference. (P Value = 0.459). The result was still considered as normal based on the regulation of ministry of health Republic of Indonesia.

1. Introduction
Air has a condition where the microflora in the form of bacteria and fungi can develop as spores in the air as important pollutants, are pathogenic and cause disease in humans [1]. Aerial with contaminants that micro fungi spread in the air, can cause various diseases, such as influenza, hypersensitivity (asthma, allergies), toxicities (toxins that spread in the room air contaminated and cause sick building syndrome (SBS). Symptoms that may occur are headaches, loss of concentration, irritation to the eyes and skin.
The definition of indoor air according to the NHMRC (National Health Medical Research Council) is the air contained in the room of a building (homes, schools, restaurants, hotels, hospitals, offices), which is occupied by a group of people with different levels of health, for at least one hour and is an important factor compared to outdoor air [2,3].

Medical student learning covers lecture halls, PBL rooms (tutorials), Skill lab rooms and laboratory rooms. Where laboratory space not only for learning but also for the activities of research students in the learning process will be influenced by the environment. Indoor air quality is generally affected by several things, namely the physical environment (temperature, humidity, light and ventilation), chemical environment (CO, SO₂, and NO₂) and the biological environment (bacteria, viruses, and micro fungi). Sources of indoor air pollutants associated with the condition of the building, equipment, temperature, humidity, air circulation and the activities contained in the room [4].
Based on the background described above, the problem can be formulated "identification of micro fungi which are micro fungi species of airborne pathogens and concentrations of aerial pathogenic micro fungi in the learning of medical faculties.

2. Method
This research is a quasi-experimental design. The population of this study are all learning spaces Governmental University Medical Faculty Gunung Jati. The sample of this study were 2 lecture halls (A and B), 2 PBL rooms (C and D), 2 Skills Lab rooms (E and F), and 2 laboratory rooms (G and H). Determination of the sample using purposive sampling method to determine the room will be a place of sampling. The sample size of this study was determined according to Gomez and Gomez (1995) formula for experimental tests, namely: (t) (r-1) ≥ 20.

The research procedure covers the sterilization of tools, materials and Saburoud Dextrose Agar (SDA) media. Then the isolation of the sample is carried out in the designated room by opening SDA media and placing it in 3 locations in one room diagonally for 3 minutes, then closing it again. After that, SDA media is stored for 7 days so that the isolate grows.

Measurement of the temperature and humidity of the room is done by placing a digital hygrometer for 30 minutes, then recorded the results of measurements of temperature and humidity of the room are obtained [3]. The examination was conducted by observing the shape, characteristics and color micro fungi colonies grown on SDA media, based on the book medically Important Fungi a Guide to Identification and the book Identification of Pathogenic Fungi [5]. Microscopic examination using KOH 10% [6].

3. Results and discussion
The Faculty of Medicine, Swadaya Gunung Jati University, located in the city of Cirebon was inaugurated on July 11, 2008. The building consists of 3 floors with complete air-conditioned learning facilities and infoc. These rooms consist of 4 classrooms, 8 tutorial rooms (PBL), 12 clinical skills laboratory rooms (Skill Lab), 4 biomedical integrated laboratories [7]. The data distribution can be found on table 1 In Table 1 shows the results of the Kruskal-Wallis test results obtained P Value 0.459. Value obtained P> 0.05, this shows there is no difference between the groups of data or the data can be interpreted micro fungi number of aerial pathogens in each room did not have a significant difference.

| Code | n | Brinkman index | P Value |
|------|---|----------------|---------|
| A    | 6 | 5,889 (4,711-23,557) | 0.459   |
| B    | 6 | 9,423 (2,356-54,181) |         |
| C    | 6 | 7,067 (2,356-9,423)   |         |
| D    | 6 | 9,423 (2,356-37,691)  |         |

Isolation micro fungi aerial pathogens in the learning room done in 1 day (1 time) with a vulnerable time at 14:30 to 15:30 within 30 minutes, it is meant for the vulnerable at the moisture in the minimal state [8]. The state of the room at the time of isolation micro fungi pathogens are in a state of space that is not used for learning and there are no people, and the room does not use AC (Air Conditioner). The reason for not using air conditioner when isolating a room sample is to be able to see the condition of the room naturally so that the data obtained becomes more homogeneous.

After sampling, the test sample taken to the laboratory and then observed the growth of micro fungi after being stored for 7 days.

In the table 2, the research shows that A and B with the highest temperature 28°C and humidity of 67% is obtained 7 number of colonies consisting of micro fungi species *Rhizopus sp.*, *Aspergillus Niger, Trichoderma sp.*, And *Syncephalastrum sp*. Room B with a temperature of 28°C and humidity of 65% found 15 colonies consisting of *Mucor sp*. Micro fungi species, *Cladophialophora bantiana, Scopulariopsis sp.*, *Penicillium sp.*, *Syncephalastrum sp.*, and *Rhizopus sp*. Room C with low...
temperature 24°C and humidity of 65% obtained 31 the number of colonies consisting of micro fungi species *Aspergillus Niger*, *Cladophialophora bantiana*, *Syncephalastrum sp.*, and *Mucor sp.* Room H with a temperature of 25°C and high humidity 73% obtained the number of colonies as many as 23 consisting of micro fungi species, *Aspergillus Niger*, *Aspergillus flavus*, *Cladophialophora bantiana*, *Mucor sp.*, *Rhizopus sp.*

While result in CFU Count, Room A, the number of micro fungi was 16.490 CFU / m³, room B obtained the number of micro fungi was 35.335 CFU / m³, room C obtained the number of micro fungi was 73.026 CFU / m³, and room D obtained the number of micro fungi was 21.201 CFU / m³. Whereas for room E, the number of micro fungi was 18.846 CFU / m³, room F obtained the number of micro fungi was 18.846 CFU / m³, room G obtained the number of micro fungi was 25.913 CFU / m³, and room H obtained the number of micro fungi was 54.181 CFU / m³. From these results it can be concluded that the highest number of aerial pathogenic micro fungi is in room C and the lowest in room A.

| No | Code | Humidity (%) | Temp (°C) | Colony Count | Species of micro fungi | CFU/m³ | CFU/m³ total |
|----|------|--------------|-----------|--------------|------------------------|--------|--------------|
| 1  | A    | 67           | 28        | 1            | *Rhizopus sp.*          | 2,356  | 16.49        |
|    |      |              |           | 1            | *Aspergillus Niger*     | 2,356  |              |
|    |      |              |           | 2            | *Trichoderma sp.*       | 4,711  |              |
|    |      |              |           | 3            | *Syncephalastrum sp.*   | 7,067  |              |
| 2  | B    | 65           | 28        | 2            | *Mucor sp.*             | 4,711  |              |
|    |      |              |           | 4            | *Cladophialophora bantiana* | 9,423  |              |
|    |      |              |           | 3            | *Scopulariopsis sp.*    | 7,067  | 35.335       |
|    |      |              |           | 3            | *Penicillium sp.*       | 7,067  |              |
|    |      |              |           | 2            | *Syncephalastrum sp.*   | 4,711  |              |
|    |      |              |           | 1            | *Rhizopus sp.*          | 2,356  |              |
| 3  | C    | 65           | 24        | 5            | *Aspergillus Niger*     | 11,778 | 73.026       |
|    |      |              |           | 3            | *Cladophialophora bantiana* | 7,067  |              |
|    |      |              |           | 21           | *Syncephalastrum sp.*   | 49.47  |              |
|    |      |              |           | 2            | *Mucor sp.*             | 4,711  |              |
| 4  | D    | 64           | 26        | 5            | *Cladophialophora bantiana* | 11,778 | 21.201       |
|    |      |              |           | 2            | *Mucor sp.*             | 4,711  |              |
|    |      |              |           | 1            | *Aspergillus flavus*    | 2,356  |              |
|    |      |              |           | 1            | *Trichoderma sp.*       | 2,356  |              |
| 5  | E    | 66           | 27        | 1            | *Trichoderma sp.*       | 2,356  | 18.846       |
|    |      |              |           | 2            | *Aspergillus Niger*     | 4,711  |              |
|    |      |              |           | 1            | *Rhizopus sp.*          | 2,356  |              |
|    |      |              |           | 1            | *Syncephalastrum sp.*   | 2,356  |              |
|    |      |              |           | 1            | *Mucor sp.*             | 2,356  |              |
|    |      |              |           | 2            | *Aspergillus flavus*    | 4,711  |              |
| 6  | F    | 63           | 29        | 1            | *Penicillium sp.*       | 2,356  | 18.846       |
|    |      |              |           | 2            | *Scopulariopsis sp.*    | 4,711  |              |
|    |      |              |           | 1            | *Mucor sp.*             | 2,356  |              |
|    |      |              |           | 1            | *Rhizopus sp.*          | 2,356  |              |
|    |      |              |           | 2            | *Cladophialophora bantiana* | 4,711  |              |
|    |      |              |           | 1            | *Aspergillus Niger*     | 2,356  |              |
Table 2. Cont.

|   |    |    |   |                      |
|---|----|----|---|----------------------|
| 7 | G  | 72 | 25| Aspergillus Niger     |
|   |    |    | 1| 9,423                 |
|   |    |    | 1| Aspergillus flavus    |
|   |    |    | 1| 2,356                 |
|   |    |    | 2| Trichoderma sp.       |
|   |    |    | 1| 2,356                 |
|   |    |    | 2| Syncephalastrum sp.   |
|   |    |    | 3| 4,711                 |
|   |    |    | 3| Cladophialophora bantiana |
|   |    |    | 25,913           |
| 8 | H  | 73 | 25| Aspergillus Niger     |
|   | 10 |    | 23,557           |
|   |    |    | 2| Aspergillus flavus    |
|   |    |    | 4,711            |
|   |    |    | 9| Cladophialophora bantiana |
|   | 21,201         |
|   |    |    | 1| Mucor sp.            |
|   | 2,356         |
|   |    |    | 1| Rhizopus sp.         |
|   | 2,356         |

Total micro fungi pathogen conditioned on each room has a variety of types and amounts vary. These variations can be influenced by factors of temperature, oxygen, moisture, pH and nutrients [9-11]. Differences between the micro fungi also be caused by spores that attach to the material contained in the room, even student’s clothes or user space [12].

Analysis showed the room C has a number of high humidity micro fungi highest room. This could be due to lack of air circulation that causes the growth of micro fungi quickly [13,14]. A previous study by Geller et al, adding that the number of micro fungi air can also be influenced by the presence of air-conditioning that will affect the growth of biological agents, such as fungi and bacteria, which will secrete mycotoxins compound [15]. It should be noted, because these mycotoxins can attack the respiratory system which can cause infections, allergies and toxicity [16].

Temperature and humidity measurement in this study are the factors that can affect the air in a room pathogen. These results can be concluded that a space has higher humidity, lower the room temperature, as well as rooms with high humidity and low temperatures can affect micro fungi number of pathogens in the room.

This is consistent with previous studies of the factors that can increase the number micro fungi in the room is the room temperature, the oxygen in the room, a room humidity, pH room, and nutrients for growth micro fungi in the room [11]. In addition to these factors, there are significant of other factors, such as moisture from the outdoor circulating in the room and the presence of water in the room [17]. Micro fungi number of aerial pathogens is high and the highest indoor humidity in the room G and H also can be caused by spores that spread through cracks in the walls and roof, so that the growth of broad micro fungi developed. Previous research conducted by Sheik et al, add a practicum that uses micro fungi specimens in the laboratory can increase the number of micro fungi in the room [18].

While the amount of the lowest air micro fungi visible in the room A. The chambers were included into the room that has the quality of the air vents, room temperature, and humidity of the room are standardized. In this study shows the number of aerial pathogens in the room micro fungi University School of Medicine Study Governmental Gunung Jati still be considered normal, but still need to do prevention so the number of aerial pathogens can be minimized micro fungi existence.

4. Conclusion

In this study identified several species of airborne pathogenic micro fungi, including Aspergillus Niger, Aspergillus flavus, Aspergillus glaucus, Rhizopus sp., Mucor sp., Penicillium sp., Trichoderma sp., Syncephalastrum sp., Scopulariopsis sp., And Cladophialophora bantiana.

In this study, it was found that there were differences in the number of airborne pathogenic micro fungi in each learning room with an average of 16.490-73.026 CFU / m3, but there was no statistically significant difference (P Value = 0.459).
References

[1] Dillon H K, Heinsohn P A and Miller J D (Eds.) 2005 *Field guide for the determination of biological contaminants in environmental samples* (AIHA)

[2] Peraturan Menteri Kesehatan Republik Indonesia Nomor 1077/MENKES/PER/V/2011 *Pedoman Penyehatan Udara Dalam Ruang Rumah* (Jakarta: Menteri Kesehatan; 2011)

[3] Lisyastuti E 2010 Jumlah Koloni Mikroorganisme Udara Dalam Ruang dan Hubungannya Dengan Kejadian Sick Building Syndrome (SBS) Pada Pekerja Balai Besar Teknologi Kekuatan Struktur (B2TKS) BPPT di Kawasan Puspitek Serpong (Depok: Universitas Indonesia)

[4] Ahmad 2014 *Gambaran Kualitas Fisik dan Bakteriologis Udara dalam Ruangan Puskesmas Bontomaranu Kabupaten Gowa*

[5] Larone D H 1976 *Medically Important Fungi a guide to Identification*. Hagerstown, Maryland, New York, San Francisco, (London: Medical Department Harper adn Row Publisher Hagerstown)

[6] Campbell C K, Johnson E M and Warnock D W 2013 *Identification Of Pathogenic Fungi* (Health Protection Agency)

[7] FK Unswagati 2016 *Sejarah Pendirian Fakultas Kedokteran Universitas Swadaya Gunung Jati* [online] Retrieved from http://fkunswagati.ac.id/profile/sejarah-pendirian/, accessed on 11 Agustus 2016

[8] Institut Pertanian Bogor *Kelembaban Udara* (Bogor: Departemen Geofisika dan Meteorologi, Fakultas Matematika, dan Ilmu Pengetahuan Alam Institut Pertanian Bogor)

[9] Merlin 2012 *Studi Kualitas Udara Mikrobiologis Dengan Parameter Jamur Pada Ruangan Pasien Rumah Sakit* (Depok: Universitas Indonesia)

[10] Fitria L, Wulandari R A, Hermawati E and Susanna D 2018 *Kualitas Udara Dalam Ruang Perpustakaan Universitas X Ditinjau Dari Kualitas Biologi, Fisik, Dan Kimiawi Lingkungan* (Depok: Universitas Indonesia)

[11] Nandini A 2011 *Kualitas Udara Mikrobiologis Dalam Rumah Yang Diakibatkan Oleh Banjir Rob Dikaitkan Dengan Jenis Material Bangunan* (Depok: Universitas Indonesia)

[12] Hastuti R B 2009 Isolasi dan Identifikasi Jamur Indigenous Rhizosfer Tanaman Kentang dari Lahan Pertanian Kentang Organik di Desa Pakis, Magelang *Bioma: Berkala Ilmiah Biologi*, 11(2) 45-53

[13] Augustowska M and Dutkiewicz J 2006 Variability of airborne microflora in a hospital ward within a period of one year *Annals of Agricultural and Environmental Medicine*, 13(1), 99-106

[14] Atlas R M and Bartha R 2002 *Ecología microbiana y microbiología ambiental* (Pearson-Addison Wesley)

[15] Geller R J, Rubin I L, Nodvin J T, Teague W G and Frumkin H 2007 *Safe and Healthy School Environments* *Pediatr Clin North Am*

[16] Curtis I, Lieberman A, Stark M, Rea W and Vetter M 2004 *Adverse Health Effects of Indoor Molds* *The Journals of The Australasian College of Nutritional and Environmental Medicine*

[17] Prescott L M, Harley J P and Klein D A 2005 *Microbiology 6th Edition* (McGraw Hills International Edition)

[18] Sheik G B and Ismail A 2015 *Assessment of Bacteria and Fungi in air from College of Applied Medical Sciences (Male) at AD-Dawadmi , Saudi Arabia* (Al-Dawadmi: Shaqra University)