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Research Article

Identification of Air Bacteriology in the City Center of Kendari Province of South Sulawesi

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Abstract: Air quality is a major factor affecting human health. Air quality is determined by a variety of bacteriologists that exist in the indoor circulation system. Bacteria are one of the factors that involve nosocomial infections. Decreasing air quality causes nosocomial infections with an average of 9.8% cases in Indonesia. This study aims to determine the quality of air microbiology in health centers throughout the city of Kendari. This research is a descriptive study carried out in July-August 2019. The population is all waiting rooms, general poly and emergency room in the Health Centers in the City of Kendari and samples are as much as a waiting room, public poly and IGD in the Health Centers in the City of Kendari as much as 45 rooms were obtained in total sampling. Data processed descriptively. The results showed that of the 45 rooms found 14 types of bacteria and most types of airborne bacteria were pseudomonas sp. There are 42 rooms in Community Health Centers (Puskesmas) whose room temperature does not meet the requirements, including 42 rooms in Puskesmas that do not meet the humidity requirements of the room, including 39 rooms in Puskesmas whose lighting does not meet the requirements, and there are 12 rooms in Puskesmas whose ventilation does not meet the requirements. condition. Freed for Health Office, Southeast Sulawesi Province and Health Office, Kendari City, to determine policies that support and improve surveillance capabilities at the airport. For Health Centers throughout the City of Kendari, to improve coordination for patients, waiters, and visitors by obeying the rules in the hospital. For further researchers to be able to analyze the relationship between physical quality and the number of bacteria in the Puskesmas.

Keywords: Temperature, Humidity, Lighting, Ventilation, Air Bacteria, Health Center.

INTRODUCTION

Air quality is one of the main factors that greatly influences human health (Kalwasinska, Burkowska, & Wilk, 2012). Air quality is influenced by bacteriological diversity that exists in the circulation system in a room. Bacteriological in the air is a very significant element of pollution as a cause of symptoms of various diseases including eye, skin, respiratory tract irritation (ISPA) and several diseases that are transmitted through the air including diphtheria, tuberculosis, pneumonia, whooping cough (Rachmatantri, Hadiwidodo, & Huboyo, 2015). Bacteria are one of the factors that play a role in nosocomial infections. Poor physical environment is proportional to the high number of germs in the room (Septiari, 2012).

Community Health Centers (Puskesmas) is a first-level health service facility that promotes preventive and promotive as well as a gathering place for the sick and the healthy (K. K. R. Indonesia, 2014). Health centers can be a place of transmission of a disease so that air pollution and health problems both sick and healthy people causing negative impacts such as nosocomial infections (Darmadi, 2008). INosocomial infections can occur in patients, health workers, and hospital visitors. This infection can be transmitted

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through health workers, sick people, visitors with carrier status or hospital conditions.

According to WHO, the percentage of nosocomial infections in health care centers around the world reaches 9% (variation 3–21%) or approximately 1.4 million inpatients around the world experience nosocomial infections. About 8.7% of 55 hospitals from 14 countries in Europe, the Middle East, Southeast Asia and the Pacific show cases of nosocomial infections and 10% in Southeast Asia (EPA, 2018). The prevalence of nosocomial infections in Indonesia, which is in 10 public teaching hospitals, is quite high at 6-16% with an average of 9.8%. Nosocomial infections can originate from the process of spread in health services, both patients, health workers, visitors, or other sources (Oktarini, 2013).

Based on Regulation of the Minister of Health No. 7 of 2019 concerning the environmental health of hospitals, germ index limits according to the function of the room or unit, especially in the treatment room 200-500 CFU / m3. Prevention and control of nosocomial infections must be considered given that health care facilities are health care facilities for sick people with a weak immune system and protect healthy people both visitors and workers both medical and non-medical workers in it (Ministry of Health, 2014). However, this regulation only regulates hospitals, even though there are other health service facilities that have the same potential, one of which is the Puskesmas.

Research on Air Pollution in patient waiting rooms, public poly rooms and emergency rooms in emergency centers is a room that has the potential to cause microbes, because activities in the waiting room, public poly and emergency rooms provide great opportunities for visitors, medical workers, non-medical workers, and patients at certain hours to interact in it. Every patient has access to be in the waiting room so that they are more likely to experience air pollution, as well as in general poly, most patients get their health checked in general poly and critical patients tend to be treated in emergency departments so that transactions and potential for bacterial pollution are higher. The cause of air pollution in the room is also related to temperature, humidity, air exchange, and other things related to the behavior of people who are in the room (Anwar, 2010).

The study was conducted in the IRINA F eye inpatient room of RSUP. Prof. Dr. R. D. Kandou Manado found bacteria, namely Bacillus subtilis, Lactobacillus sp., Coccus Gram negative, Enterobacter agglomerans, Enterobacter cloacae, and Staphylocccus epidermidis which have the potential to cause nosocomial infections.

Based on a preliminary study in the working area of the Kendari City Health Office, in 7 health centers in Kendari City in 2018 using a sanitarian kit, it was found that the most bacteria-found room was in the waiting room, general poly and emergency room with the number of bacteria exceeding the standard of 200 CFU / m3. Data recapitulation about nosocomial infections is not available in health care facilities, especially in health centers, but based on interviews with health workers found to have flu, cough, eye irritation and skin, therefore it is important to measure bacteria in the air and assess factors related to development bacteria in the Puskesmas room.

Based on the description, the researchers are interested in conducting research on the Identification of Air Bacteriology in Kendari City Health Centers in Southeast Sulawesi Province, which aims to find out the types of air bacteriology in Kendari City Health Centers in Southeast Sulawesi Province.

METHODOLOGY

This type of research is descriptive research. that is to describe the types of bacteria found in waiting rooms, public poly rooms and emergency rooms in all Puskesmas throughout Kendari City, the population of all waiting rooms, general poly and emergency room at all Puskesmas in Kendari City with sampling techniques using the method Total Sampling. Analysis of the data used Univariate analysis.

RESULTS

Types of Air Bacteriology

Table 1. Distribution of Bacteriology Types in Health Centers in Kendari City, Southeast Sulawesi Province

Types of Air Bacteriology	n	%
Aerococcuss viridans	7	15,6
Aspergillus sp	1	2,2
Candida sp	1	2,2
Citobacter freundii	2	4,4
Enterobacter cloacae	2	4,4
Klebsiella sp	4	8,9
Micrococcus sp	1	2,2
Neisseri sp	3	6,7
Proteus vulgaris	1	2,2
Pseudomonas Sp	11	24,4
Salmonela enterica	6	13,3
Serratia liquefaciens	4	8,9
Staphylococcus sp	3	6,7
Streptococcus sp	3	6,7
Total	**45**	**100**

Source: Primary Data, 2019

Table 1 shows that from 45 rooms, the most bacteria were Pseudomonas sp in 11 rooms (24.4%), then the least bacteria were Aspergillus sp, Candida sp, Micrococcus sp and Proteus vulgaris each in 1 room (1 2.2%).

Table 2. Distribution of Microorganisms in the Room of Health Centers in the City of Kendari in Southeast Sulawesi Province in 2019

Room	Room						Total	
	General Poly		The waiting room		IGD			
	n	%	n	%	n	%	n	%
Aerococcuss viridans	4	8,9	2	4,4	1	2,2	7	15,6
Aspergillus sp	0	0	0	0	1	2,2	1	2,2
Candida sp	0	0	0	0	1	2,2	1	2,2
Citobacter freundii	0	0	2	4,4	0	0	2	4,4
Enterobacter cloacae	1	2,2	1	2,2	0	0	2	4,4
Klebsiella sp	0	0	0	0	4	8,9	4	8,9
Micrococcus sp	0	0	1	2,2	0	0	1	2,2
Neisseri sp	0	0	2	4,4	1	2,2	3	6,7
Proteus vulgaris	0	0	0	0	1	2,2	1	2,2
Pseudomonas Sp	7	15,6	1	2,2	3	6,7	11	24,4
Salmonela enterica	1	2,2	0	0	1	2,2	2	4,4
Serratia liquefaciens	1	2,2	3	6,7	0	0	4	8,9
Staphylococcus sp	1	2,2	1	2,2	1	2,2	3	6,7
Streptococcus sp	0	0	2	4,4	1	2,2	3	6,7
Total	**15**	**33,3**	**15**	**33,3**	**15**	**33,3**	**45**	100

Source: Primary Data, 2019

Table 2 shows that out of 45 rooms, there were 15 types of bacteria spread in public poly, waiting rooms and emergency room. Bacteria found in the general poly space were mostly pseudomonas sp as many as 7 rooms (15.6%), then in the waiting room most of them were serratia liquefaciens namely 3 rooms (6.7%) and in the emergency room the majority were bacteria klebsiella sp namely 4 rooms (8.9%).

Quality of Bacteriology in the Air

Table 3. Distribution of Air Bacteriology Quality in Health Centers in Kendari City in Southeast Sulawesi Province in 2019

Quality of Air Microorganisms (CFU/m^3)	n	%
> 200	45	100
≤ 200	0	0
Total	**45**	**100**

Source: Primary Data, 2019

Table 3 shows that out of 45 rooms, there were all bacteria> 200 CFU / m3 (100%).

Room temperature

Table 4. Distribution of Room Temperature at Health Centers in Kendari City of Southeast Sulawesi Province in 2019

Room temperature	n	%
Qualify	3	6,7
Not eligible	42	93,3
Total	**45**	**100**

Source: Primary Data, 2019

Table 4 shows that of the 45 rooms, most of the room temperatures did not meet the requirements of 42 rooms (93.3%) and the rest met the requirements of 3 rooms (6.7%).

Room humidity

Table 5. Distribution of Room Humidity in Kendari City Health Centers in Southeast Sulawesi Province in 2019

Humidity	n	%
Qualify	10	22,2
Not eligible	35	77,8
Total	**45**	**100**

Source: Primary Data, 2019

Table 5 shows that of the 45 rooms, most of the humidity in the room did not meet the requirements of 35 rooms (77.8%) and the rest was the humidity that met the requirements of 10 rooms (22.2%).

Room Lighting

Table 6. Distribution of Room Lighting in Health Centers in Kendari City of Southeast Sulawesi Province in 2019

Room Lighting	n	%
Qualify	6	13,3
Not eligible	39	86,7
Total	**45**	**100**

Source: Primary Data, 2019

Table 6 shows that out of 45 rooms, most of the room lighting did not meet the requirements of 39 rooms (86.7%) and the rest were eligible for 6 rooms (13.3%).

Room Ventilation

Table 7. Distribution of Room Vents in Kendari City Health Centers in Southeast Sulawesi Province in 2019

Ventilation	n	%
Qualify	33	73,3
Not eligible	12	26,7
Total	**45**	**100**

Sumber : Data Primer, 2019

Table 7 shows that out of 45 rooms, most of the ventilation rooms fulfilled the requirements of 33 rooms (73.7%) and the rest did not meet the requirements of 12 rooms (26.7%).

DISCUSSION

The microbiological quality of air is the bacteria in the room air that is the bacteria that grows on the medium of bacterial growth (for McConkey) that has been prepared in a Petri dish wrapped in Cling Wrap. The measurement time of the sample during effective working hours is 09.00. Exposure of agar medium to room air is carried out for ± 1 hour. Then incubated for 1 × 24 hours at the Regional Health Laboratory of Southeast Sulawesi Province, after which an examination of samples of growing bacteria was carried out.

The results showed that from 45 rooms, there were 15 types of bacteria. The most bacteria were Pseudomonas sp in 11 rooms (24.4%), then the least bacteria were Aspergillus sp, Candida sp, Micrococcus sp and Proteus vulgaris each in 1 room (2.2%). Bacteria are spread in public poly, waiting rooms and emergency room health centers throughout the city of Kendari, while the bacteria contained in public poly spaces are mostly pseudomonas sp as many as 7 rooms (15.6%), then in the waiting room most are serratia bacteria liquefaciens is 3 rooms (6.7%) and in the emergency room most of the bacteria are klebsiella sp namely 4 rooms (8.9%). The highest bacterial rate is 15,084 CFU / m^3 Proteus vulgaris found in the health center waiting room while the least bacteria are Pseudomonas sp as much as 949 CFU / m^3.

This study is in line with the research of Rompas, Pinontoan, and Maddusa (2019) which found that the average number of inpatient air germ rooms did not meet the requirements, namely class I, the fir room I was 588 CFU / m^3 and fir room 2 was 924.5 CFU / m3, class II is lotus 1 at 203 CFU / m^3 and lotus 2 is 1366 CFU / m^3), and class III is jasmine 1 room at 781.5 CFU / m^3 and rose 1 space is 857 CFU / m^3.

This research is confirmed by the theory proposed by Septiari (2012) that several types of organisms can survive well in hospital environments, for example in water, moist areas, and sometimes in sterile or disinfecting products, such as Pseudomonas, Acinobacter and mycobacterium.

The standard of bacteria in the room is based on the Minister of Health Regulation No. 7 of 2019 concerning the environmental health of hospitals that limits the index of germ numbers according to the function of the room or unit, especially in the treatment room 200-500 CFU / m^3 (Ministry of Health, 2019). Based on Ministry of Health (2004), the standard of microorganisms in public poly rooms is 200-500 CFU / m^3, waiting room 200-500 CFU / m3 and emergency room installation is 200 CFU / m^3.

Research conducted by Abdullah and Hakim (2011) found that one of the biggest contributions of physical environmental factors to germ numbers is temperature, as well as research by Rachmatantri et al. (2015) found that the presence of microorganisms in a room is influenced by temperature. This was confirmed by Slamet (2000) who suggested that high temperatures in the room could increase the temperature of water making it easier for the process of evaporation of water and increase water particles that can move small cells such as dust on the surface, whereas bacteria can be carried by the wind with dust.

Frick and Koesmartadi (2008) several sources that influence room temperature are the use of biomass fuel, inadequate ventilation, occupancy density, building materials and structures, Geographical conditions, and Topographic Conditions.

The lack of light entering the room so that makes the humidity of the room becomes higher. The high humidity of a room caused by the low temperature of a room. Humidity that is too high or too low can cause fertile growth of microorganisms. To get a good level of humidity should increase lighting.

Fithri, Handayani, and Vionalita (2016) about factors related to the number of air microorganisms in the 8th floor classroom of Esa Unggul University showed that there was a relationship between the physical quality of the room in the form of humidity and the presence of bacteria in the room.

Humidity of the room that is considered comfortable is 40-60%. If the humidity of the room is above 60%, it will cause a proliferation of pathogenic organisms and allergen organisms. However, if the humidity of the room is below 40% (for example 20-30%) it can cause discomfort, eye irritation and dryness of the mucous membrane (eg throat)(Chandra, 2007).

Research on Air Pollution at the Puskesmas was conducted by Izzah (2011) that physical factors of light intensity affected the concentration of fungi by 21.3% while 78.8% were influenced by other factors such as ventilation, room conditions, dust content, building materials and the frequency of room cleaning wait for the health center.

Lighting that can affect bacteria is light from sunlight. Lighting from sunlight in the room can inhibit the growth of bacteria (Pommerville, 2010).

Sunlight has bactericidal activity and takes an important role in spontaneous sterilization that occurs in natural conditions because sunlight contains ultraviolet light. The high intensity of ultraviolet light exposure

can result in bacteria experiencing radiation which has an impact on bacterial abnormalities and death (Shrieve & Loeffler, 2010).

Room ventilation is determined by comparing the size of the room ventilation with the area of the Puskesmas building, qualifying if the ventilation hole area in public poly, waiting room and emergency room is ≥ 15% and not meeting the requirements if the ventilation area is <15%.

This research is in line with the research of Purnamasari, Suharno, and Selviana (2017) which states that one of the causes of air quality problems in a room is caused by several things, namely the lack of air exchange in the room so that it allows various sources of contamination to settle in the room. And if the ventilation area in the room <15% of the floor area will result in reduced oxygen concentration and increased concentration of carbon dioxide which is toxic to visitors and watchdog patients.

According to Waluyo (2009), wind also determines the presence of microorganisms in the air. In calm air, particles tend to fall by gravity. But a little air flow can keep them in suspension for a relatively long time. Wind is important in spreading microorganisms because it takes them further. Wind also produces air turbulence which causes vertical distribution of air microbes. Global weather patterns also affect vertical spread. Altitude limits the distribution of microbes in the air.

CONCLUSION

The type of air microbiology in Kendari City Health Center is mostly pseudomonas sp bacteria in 7 public poly spaces, then klebsiella sp bacteria in 4 waiting rooms and serratia liquefaciens bacteria in 3 emergency rooms. Most of the temperature in the Health Centers in the City of Kendari in Southeast Sulawesi Province does not meet the requirements and is generally located in the waiting room. Most of the humidity in the Puskesmas in Kendari City of Southeast Sulawesi Province does not meet the requirements and most are in the waiting room. Most of the lighting in the Health Centers in Kendari City of Southeast Sulawesi Province does not meet the requirements and most are in public polyclinics. Most of the air vents in the Health Centers in Kendari City of Southeast Sulawesi Province (73.7%) fulfilled the requirements and most were in general poly.

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