

IDENTIFICATION OF GERM NUMBER AND THE EXISTENCE OF LEGIONELLA PNEUMOPHILLA WITH COMPLAINTS OF SICK BUILDING SYNDROME

Putri Widelia Welkriana¹; Tedy Febriyanto²

^{1,2} Department of Medical Laboratory Technology, Politeknik Kesehatan Kementerian Kesehatan Bengkulu, Indonesia
Corresponding email: putri@poltekkesbengkulu.ac.id

Abstract

Buildings with air conditioning are associated with the growth of Legionella pathogenic bacteria that cause legionnaire's disease and sick building syndrome. Legionella became agent of pneumonia in humans. This disease occur through inhalation of aerosols or microaspiration of water containing L. pneumophila. This study aimed to link the presence of Legionella and the incidence of sick building syndrome complaints. This research used an observational analytic with cross sectional method and consist of 50 samples of employees in Bengkulu office buildings in 2020. The result showed 12% for 1 complaint, 20% for 2 complaints, 30% for 3 complaints, 4 complaints as much as 28%, 5 complaints for 6%, and 5% for 6 complaints. The presence of Legionella was identified in the D office building. The relationship between Legionella's existence has a risk of 0.134 times in the occurrence of SBS. This study has a suggestion that office buildings are facilitated by temperature and humidity measurement devices to periodically calibrate the measuring instrument to conform to the predetermined standards. Then do an evaluation every 3 months. Monitoring the health of office employees by conducting periodic health checks or health screening, at least once a year.

Key Words: *Existence of Legionella, Sick Building Syndrome, Germ Count*

INTRODUCTION

Air is an important component for the survival of living things. The chemical, biological and physical composition of air directly affects air quality. Inadequate air quality will have a negative impact on human health, especially the respiratory tract (Ardian & Sudarmaji, 2014). Problems that interfere with indoor air quality are generally caused by several things, namely the lack of air ventilation, the presence of sources of contamination in the room, contamination from outside the room, microbes, building materials, and others.

Indoor air quality is a problem that needs attention because 4% of global health problems are caused by indoor air pollution. In fact, the EPA states that one of the 5 most pressing environmental problems for public health is indoor air quality. Air conditioners are used instead of natural ventilation to increase the comfort and productivity of occupants, but air conditioners that are not routinely maintained can become breeding grounds for microorganisms (Burge, 2004).

According to the EPA, buildings that use Air Conditioning are associated with the growth of pathogenic bacteria *Legionella* and Sick Building Syndrome. In this case, the EPA stated that one of the pathogenic bacteria associated with the room is *Legionella* bacteria which can cause Legionnaire's disease and Pontiac fever. *Legionella* is the causative agent of pneumonia in humans and up to 90% of Legionnaires disease cases have been reported to be caused by *Legionella pneumophila* (Epa, 2003).

This disease can occur through inhalation of aerosols or microaspiration of water containing these microbes. These symptoms are only felt during activities in the building and disappear naturally on holidays or when leaving the building. SBS is influenced by several factors such as HVAC system, chemistry and biology. Meanwhile, the environmental factors that influence the occurrence of SBS are temperature and humidity. Other factors that contribute to the incidence of SBS are gender, type of work, smoking habits. Employees in air-conditioned buildings have 2-3 times more symptoms than employees in buildings with natural ventilation (Doleans et al., 2004). Based on the survey, Burge also stated that SBS occurrences occur more in buildings that use air conditioning than buildings with natural ventilation.

METHOD

Research Design and Subject

This research is analytic observational. It was conducted to 50 employees of Building in Bengkulu Kota and also did a test to AC water.

Instruments and Data Analysis Techniques

Samples of 50 employees of Building in Bengkulu Kota were asked to fill out questionnaire. Meanwhile test to AC water did by planted in BHIB or NA media. Then, planted on BCYE PAC AND BCYE PVA media and incubated in an incubator at 37°C for 24 hours. Then stained with Gram's reagent and observed under a microscope.

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The data taken used primary data obtained based on the results of the examination for the presence of Legionella pneumophylla. Data were collected by researchers from each respondent in Kota Bengkulu.

RESULTS

Table 1 SBS Complaints to Office Employees in Bengkulu

SBS Complaints	Amount	Percent
0	1	5.0
1	6	12.0
2	10	20.0
3	15	30.0
4	14	28.0
5	3	6.0
6	1	5.0
Total	50	100.0

Table 2 SBS Incidence based on Characteristics of Respondents

Characteristics of Respondent	SBS		Non SBS		Total	
	N	%	N	%	N	%
Sex						
Men	6	85.71	1	14.29	7	100.0
Women	43	100	0	0	43	100.0
Age(Years)						100.0
21-30	14	100.0	0	0	14	100.0
31-40	12	100.0	0	0	12	100.0
41-50	13	92.85	1	7.15	14	100.0
51-60	10	100.0	0	0	10	100.0
Working Hours/days						100.0
8 Hours	40	100.0	0	0	40	100.0
More than 8 Hours	9	90	1	10	10	100.0

Table 3. Results of Examination of Air Germ Numbers in Bengkulu City Office Buildings

	Total Number of Bactery (CFU/m ³)	Standard of Kepmenkes RI No.1204/Menkes/SK/X/2004
Building A	419	200 – 500 (CFU/m ³)
Building B	310	
Building C	444	
Building D	485	

Table 4. Relationship of Legionella's Presence with SBS Complaints in Bengkulu office building

	SBS (%)	Complaint	Legionella	OR
Building A	7 (87.5)	-	-	
Building B	18 (100)	-	-	
Building C	12 (100)	-	-	
Building D	12 (100)	+	+	0,134

DISCUSSION

The results of the study on the detection of *L. pneumophila* bacteria in AC water in several offices in Bengkulu City obtained positive results of 12.5%. AC water is one of the transmission routes for Legionella, which is an optimal condition for breeding and contains nutrients for its growth. Based on research reports (Fathimah & Ginanjar, 2020), the positive percentage of Legionella found in warm water is 25%, spas are 3.5%, and swimming pools are 10%.

In this study, the identification results showed that from 24 water samples, five samples showed the characteristics of this bacterium. This shows that a sample of air-conditioning office water in Bengkulu contains *L. pneumophila* bacteria. Legionella bacteria can grow intracellularly in macrophages and monocytes, while in aquatic habitats various amoeba and ciliates act as hosts. The infection is acquired when water containing Legionella is inhaled into the lungs, the infection not only occurs in humans but also in animals.

Pneumonia was present, Legionella infection could be considered as one of the causes (Pt et al., 2009). There are at least 12 serogroups of *L. pneumophila*. Serogroup-I is responsible for more than 84% of legionellosis cases worldwide. A study in France comparing Legionella isolates of clinical origin and environmental origin showed that 28% of *L. pneumophila* serogroup one was obtained from the environment while 95% was obtained from clinical (St. Geme & Rempe, 2018). However, this study did not identify the subgroups. Odor perception is the most frequently complained problem, especially in D building. There is a foul smell in the building room D. The source of the smell is unknown and it is suspected that it could come from the AC system, which could be overgrown with fungus.

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Factors Affecting SBS in the Office Room, the measured relative is above the requirements, especially in building D. Symptoms that appear more at relative humidity above 60% are eye irritation, eye tiredness and sneezing. Relative humidity below 30% and above 60% can increase the growth of bacteria and viruses proliferate at relative humidity below 50% and above 70% (Fauzi, 2015). The emergence of bacteria, viruses and other organic matter can cause health manifestations both infectious and irritant. So that the emergence of SBS symptoms in the form of sneezing and eye irritation which could be one of the body's immune responses to foreign material that enters the respiratory tract even though it is etiologically difficult to explain (Gomzi & Bobić, 2009). The results showed that there was no significant effect between relative humidity on symptoms and cases of SBS. There are similar studies that also have no relationship between the appearance of SBS symptoms and physical parameters (Goyal & Khare, 2011).

The direct effect of humidity on the appearance of symptoms can be seen in conditions of low relative humidity, namely the risk of irritant effects on the mucous membranes caused by dry air which will increase sensitivity and easy damage to the mucosa (Kantor et al., 2014). Although the etiology of the direct etiology of the influence of high relative humidity on SBS symptoms, it is necessary to keep the humidity low, it is very important to do besides the risk of growth of pathogenic microorganisms, high humidity can accelerate the formation of gas from VOCs such as formaldehyde which is commonly used in furniture (Kristiyanti). & F, 2019).

The insignificant effect of relative humidity on the appearance of SBS symptoms and PSI may be due to the absence of a direct relationship between the amount of humidity itself that can cause manifestations because there is a variable between the number of germs and fungi or certain irritant chemicals caused by high humidity, temperature or humidity, other parameters (McDade, 2008). Women more often feel psychosocial disorders and along with it increasing SBS complaints.

The longer a person is in the room, the higher the potential for exposure to certain room conditions, so the potential for SBS symptoms to appear is higher. Most of the respondents stayed less than 8 hours indoors (Mukono et al., 2005). The measurement results show that the percentage of SBS symptoms is relatively higher in respondents who stay less than 8 hours than respondents who stay more than 8 hours.

However, the percentage of sneezing and headache symptoms was higher in employees who stayed longer than 8 hours. The magnitude of SBS cases was the same between the groups of less or more than 8 hours of stay. Length of stay is a variable that does not affect SBS with $p = 0.459$ it could be because the average length of stay of respondents is still within the limit of working hours in a day, which is 8 hours so that it may not pose a risk for symptoms or cases of SBS (Pt et al., 2009).) and (Muliadi, 2015). Most of the symptoms and cases of SBS suffered more by respondents who lived less than 8 hours a day, so even though the length of stay of employees was still within limits, it should not rule out the possibility of SBS. Length of stay is not a factor that affects the emergence of SBS, therefore, even though the length of stay of employees is still in accordance with standard working hours, controlling the quality of the indoor environment must still be considered. Chemical pollutant control is important.

CONCLUSIONS AND SUGGESTIONS

This study has several conclusions, including (1) SBS complaints in Bengkulu office buildings in 2020 have a complaint rate of 12% as much as 12%, 2 complaints as much as 20%, 3 complaints as much as 30%, 4 complaints as much as 28%, 5 complaints as much as 6%, and 6 complaints as much as 5%. (2) The presence of Legionella was identified in office building D. (3) the relationship between the presence of Legionella has a risk of 0.134 times in the occurrence of SBS. This study has a suggestion that office buildings are facilitated by temperature and humidity measurement tools such as a thermohygrometer and monitored every day by recording temperature and humidity and periodically calibrate the measuring instrument to conform to predetermined standards. Then do an evaluation every 3 months. Monitoring the health of office employees by conducting periodic health checks or health screenings, at least 1 time/year to detect early perceived health problems.

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