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CONTENT OF SULFUR DIOXIDE (SO_2) IN THE AIR ON THE OCCURRENCE OF UPPER RESPIRATORY INFECTION (URI) IN FARMERS IN IJEN DISTRICT WATERSHED, BONDOWOSO

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ABSTRACT

The objective of this research was to analyze the effect of Sulfur Dioxide (SO2) content on Upper Respiratory Infection through individual factors (age, duration of exposure, length of work, smoking habits, nutritional status, independent efforts to reduce exposure (personal protective equipment) and environment factors (temperature, humidity, ventilation). This is an observational analytic research with a cross sectional approach with a sample of 101 respondents. The data used are primary data obtained from SO2 measurements, Upper Respiratory Infection examination, and questionnaires for 101 farmer respondents. The analysis instrument uses SPSS 22.0. The results of data analysis show that: 1) SO2 source of exposure has a significant effect on the incidence of URI. 2) Individual factors (age, length of work, duration of exposure, smoking habits, independent efforts to reduce exposure) and environment factors (temperature, humidity, ventilation) have a significant effect on the occurrence of URI.

KEYWORDS: Sulfur dioxide, upper respiratory infection, farmer.

INTRODUCTION

The activity of Ijen Crater can produce toxic gases, sulfur sublimation, volcanic dust, and acidity in the crater water and the content of fluoride (F). This crater water flows upstream of Kali Pahit until it flows to Blawan plantation area of Ijen District such as three hamlets, which are Curah Macan, Margahayu and Watu Capil, then it flows across several regions in the eastern Situbondo District (Aminuddin 2014).[1]

The content of S02 toxic gas in river water can pollute the environment in Ijen District watershed area, and it can cause harm to health. WHO states that the ambient air quality has a chemical effect on the health of the respiratory tract. Poor air quality can also cause the possibility of being infected with several respiratory diseasses and one of them is URI (Upper Respiratory Infection). Viruses or bacteria are the causes of human being exposed to acute respiratory infections. This disease lasts for 14 days and can also more than 14 days. The etiology of URI consists of 300 types of bacteria, viruses, and rickets. Common symptoms of this disease are cough, sore throat, difficulty of breathing, runny nose, fever and earache (Ministry of Health of the Republic of Indonesia 2014).[2]

The data obtained from the Community Health Center of Ijen shows that URI disease always becomes the highest disease in the monthly report in Ijen District. Wednesday (3/21/2018) at 19.13 Western Indonesian Time. Kali Pahit Riverflow exposes a very pungent odor of toxic gas, which is then inhaled by residents living in the watershed of Watu Capil River, Margahayu, Kali Bahit, Kalianyar Village, Ijen District, Bondowoso Regency, East Java. Two hundred residents in the area were evacuated. While the number of victims resulting from exposure to poison gas reached 30 people. Twenty four of them were treated at the Community Health Center of Ijen, then four people were treated at the Community Health Center of Tlogosari, and two people were rushed to the Regional Hospital of Koesnadi (Indonesian Regional Board for Disaster Management of Bondowoso 2018).[3]

The research on SO2 content and URI occurrence conducted in Surabaya, based on the level of pollution caused by motorized vehicles with an average SO2

content of 11.6 µg/m3 in Rungkut District, causes URI occurrence of 12.73 per 1,000 population and 25.12 per 1,000 residents in Jambangan District. Therefore, it can be concluded that there is a relation between the occurrence of URI and SO2 content (Firdaus A, 2017).[4] The factors that can affect the risk of someone being exposed to URI can be divided into four broad lines, namely pollution, individual characteristics, working behavior, and environment factors. From some of the problems aforementioned above, the researchers are interested in conducting a study and measurement of air SO2 content in the watershed area of Ijen District, Bondowoso. In addition, the researchers are also willing to know the distribution of farmers who experience symptoms of URI.

MATERIALS AND METHODS

Quantitative approach is the method used in this research. The research used is analytic observational study with cross sectional approach. The population in this study was all farmers around Watucapil watershed of 101 people. The sample used in this study was all farmers who were around Watucapil watershed (total sampling).

This research has passed the ethics test in the research ethics commission at the Faculty of Dentistry, University of Jember with number 540/UN25.8/KEPK/DL/2019. Data collection is done by interview, documentation, observation and measurement. Measurement is made to measure content of SO2 in collaboration with Technical Implementing Unit of Occupational Health and Safety of Surabaya by using minipump and implinger. Then, the URI examination is carried out by a doctor from the local health center. The analysis used is logistic regression using SPSS 22.0.

RESULT AND DISCUSSION

1.1 Univariate Analysis

Table 1: Source of SO2 Exposure.

Variable	Category	SO_2 Content	Information
Source of SO_2	Kali Pahit	33,6	Above Threshold Value
	Watu Capil	6,9	Above Threshold Value
	Farming	4,7	Above Threshold Value
	Residents' House	9,27	Above Threshold Value

Table 1 The highest SO2 measurement (Table 1) in Kali Pahit watershed is 33.65 (mg/m3) above the Threshold Value (NAV). The lowest measurement result (SO2) is in the watershed are (plantation) that is 4.7 (mg/m3) below the Threshold Value (NAV).

Individual Factors

Table 2: The distribution of Individual Factors.

Variable	Category	N	%
Age	36 – 45 y.o	25	24,7
	46 – 55 y.o	42	41,6
	>56 y.o	34	33,7
	Total	101	100
Duration of Exposure	<4 hrs	54	53,5
	>4 hrs	47	46,5
	Total	101	100
Length of Work	6-10 yrs	43	42,6
	>10 yrs	58	57,4
	Total	101	100
Smoking Habit	Not smoking	47	46,5
	Light Smoker	54	53,5
	Total	101	100
Nutritional Status	Thin	15	15
	Normal	78	77
	Fat	8	8
	Total	101	100
Independent Efforts to Reduce Exposure	Frequent	26	25,7
	Sometimes	65	64,3
	Never	10	10
	Total	101	100

The age group of 46-55 years (Table 2) has a greater percentage among other categories of groups with 41.6% or as many as 42 respondents; farmers exposed to < 4 hours per day ie as many as 54 people or about 53.5%; then as many 58 or around 57.4% of respondents in Ijen District have more than 10 years of work, 54 smokers or 53.4%, 78 people or 77% of farmers have normal nutritional status, 65 people or around 64.3% of farmers sometimes make independent efforts to reduce exposure to pollutants.

Environment Factors

Table 3: Temperature, Humidity, Ventilation.

Variable	Category	N	%
Temperature	Qualified	47	46,6
	Not qualified	54	53,4
	Total	101	100
Humidity	Qualified	47	46,6
	Not qualified	54	53,4
	Total	101	100
Ventilation	Qualified	90	89,1
	Not qualified	11	10,9
	Total	101	100

Environment factors (Table 3) as many as 54 houses or around 53.4% have temperatures that do not meet the requirements; as many as 54 or 53.4% of houses do not meet the humidity requirements and as many as 90 houses or 89.1% have ventilation of farmer houses that meet the requirements. Almost all houses in this study have the same model in terms of size and shape; there are only a few houses which are different

Bivariate Analysis

Table 4: Result of Logistic Regression.

Variable	Chi Square	Sig
SO_2	61,559	0,000
Age	7,141	0,028
Length of Work	20,532	0,000
Smoking Habit	27,466	0,000
Duration of Exposure	47,096	0,000
Independent Efforts to Reduce Exposure	31,466	0,000
Nutritional Status	0,777	0,678
Temperature	65,044	0,000
Humidity	74,889	0,000
Ventilation	9,152	0,002

*it is regarded as significant if the p value < α (0.05)

The results of the analysis (Table 4) reveal that almost all variables are at the value of p value <α (0.05) so that it can be interpreted that they have a significant effect, except for nutritional status with a significance of 0.678> α (0.05) so that it does not significantly affect the occurrence of URI in farmers in the watershed of Ijen District, Bondowoso.

URI examination conducted by doctors on farmers found that as many as 57.4% or 58 people were affected by light URI, while as many as 42.6% or 43 people were not affected by URI. The results of statistical test (Table 4) obtained a chi square value of SO2 content of 61.559 which was greater than the value of chi square table 3.84 and p-value of 0.000 which was less than α (error level 0.05). These results indicate that SO2 affects the occurrence of URI in farmers in Ijen District.

The individual factors (age, length of working, smoking habits, duration of exposure, independent efforts to reduce exposure) and environmental factors (temperature, humidity, ventilation) have a chi square value greater than 3.84 and a p-value less than α (0, 05) are regarded to affect the occurrence of URI in farmers in Ijen District. The nutritional status variable was regarded not to affect the occurrence of URI disease in farmers in Ijen District because it had a p value of 0.678 greater than α (error level of 0.05) so that it did not meet the assumption of affecting the URI disease occurrence.

The average age of the farmer, specifically 51 years old, can be stated that it has come to the early elderly period. Decreased respiratory muscles and tissue elasticity will occur in line with age, then when breathing oxygen, the strength of the respiratory muscles will decrease, and it can make a person vulnerable to have URI exposure. At the age of 30 years, the lung function value will usually decrease slowly.[5] The farmers exposed to SO2 pollutant for more than 4 hours every day experience more light URI than the farmers who work less than 4 hours every

day. The duration of exposure is closely related to the length of time a farmer works in a day. Someone works usually 4 - 8 hours a day, if the working hours are longer, then it will have a negative impact on workers due to the exposure to these pollutants.[6]

The average length of work of farmers affected by URI is > 10 years. The longer someone works, the more possible that person be contaminated with more pollutants.[7] The accumulation of pollutants in the lungs has an effect on the narrowing of the respiratory tract, then the accumulation of accumulated dust causes the elasticity of the respiratory tissue to decrease so that the lung capacity also decreases.[8] Smoking habit has a bad impact on the function and the structure of tissues in the respiratory tract. It has a close relation with the increased risk of respiratory disorders. Cigarette smoke causes the ability of vibrating hair in capturing foreign objects decreased which result in dust easily entering the lungs.[9]

Independent efforts to reduce exposure (personal protective equipment) used by farmers are cuff, shoes, head coverings and cloth. However, not all farmers wear complete personal protective equipment, because they are less comfortable and it can interfere with their work productivity. Personal protective equipment is worn when the smell of SO2 gas is extremely strong by using a wet cloth. There is no guarantee that someone using personal protective equipment will avoid the possibility of humans affected by respiratory disorders.[10] The analysis results on the nutritional status of URI occurrence showed that there was no significant effect. There was no significant effect between nutritional status and respiratory disorders in textile industry workers X in Semarang Regency.[11]

The research results found that the temperature condition of house that did not meet the requirements was at temperature less than 18oC. The condition of residential density in the house also affected the temperature in the room. Low temperature can cause an increase in relative humidity, so that it can increase the corrosive effects of pollutants in places where the air is polluted when in cold temperatures; the air condition becomes dense so that the pollution concentration in the air is higher.[12] The average housing model is the same as the area that can be regarded as small and is habited of 3 or 4 people in one house in average. The more people in a room that has high humidity, the higher concentration of microorganism will be. Everyone has the possibility of containing microorganisms that has the risk of transmitting the disease to fellow residents of the room.

The results of the house ventilation found that in average it met the requirements, but this was not followed by people's behavior to open the window in the morning and also in the afternoon. It is because in the morning, SO2 gas had started to cause a pungent odor so that the average respondent did not open the window. It is feared that the pungent odor will become severe until it enters the house.[13] explained that the concentration of germs is more in the un-exchanged air. It is closely related to the limited ventilation that functions to guarantee the quality and the adequacy of air circulation in and out of the room so that it is safe for breathing.

This is the first research conducted on exposure to natural SO2 pollutants on farmers in Ijen Crater watershed, because the previous studies focus more on SO2 exposure from industry. Then, this research combines two methods, namely SO2 measurement and URI examination. The limitation of this study is that the URI examination is only done in a short time.

CONCLUSION

The sources of SO2 exposure affect the occurrence of URI in farmers in Ijen District watershed. Individual factors (age, duration of exposure, length of work, smoking habits and independent efforts to reduce exposure) and environment factors (temperature, humidity, and ventilation) affect the occurrence of ARI in Ijen District watershed, Bondowoso. Besides, nutritional status does not affect the occurrence of URI. As a suggestion for this research, it is needed to conduct a research related to chronic respiratory disorder.

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REFERENCES

1. Aminuddin. Perekayasa di Pusat Sumber Daya Air Tanah dan Geologi Lingkungan, Badan Geologi, 2014.
2. Kementrian Kesehatan Republik Indonesia. Profil Kesehatan Indonesia. Jakarta Kementrian Kesehatan Republik Indonesia, 2014.
3. Badan Penanggulangan Bencana Daerah (BPBD). Bondowoso, 2018.
4. Firdaus, A P dan Sulistyorini L. Hubungan Antara SO2 Dengan Kejadian ISPA Di Kota Surabaya 2013-2015. Jurnal.Fakultas Kesehatan Masyarakat Universitas Airlangga, 2017; 9(1).
5. Rahmatullah, P. Pneumonitis Dan Penyakit Paru Lingkungan. Edisi 5. Jakarta: Pusat Penerbitan Ilmu Penyakit Dalam, 2009.
6. Mengkidi, D N S. Gangguan Fungsi Paru dan Faktor-Faktor yang Mempengaruhinya pada Karyawan PT. Semen Tonasa Pangkep Sulawesi Selatan. Jurnal Kesehatan Lingkungan Masyarakat, 2009; 5(2).
7. Astorina N. Hubungan Masa Kerja terhadap Gangguan Fungsi Paru pada Petugas Penyapu Jalan di Protokol 3, 4 dan 6 Kota Semarang. Jurnal Kesehatan Lingkungan. Fakultas Kesehatan Masyarakat Universitas Diponegoro. 2015; 3(3).

8. Yusnabeti, Ririn, Ruth. PM10 dan Infeksi Saluran pernapasan Akut pada Pekerja Industri Mebel. Skripsi. Jakarta: Universitas Indonesia, 2011.
9. Suma'mur, P. K. Higiene Perusahaan Dan Kesehatan Kerja (Hiperkes). Jakarta: Sagung Seto, 2013.
10. Afiani E E. Faktor – Faktor yang Berhubungan dengan Gangguan Fungsi Paru pada Pekerja di Unit Boiler Industri Tekstil X Kabupaten Semarang. Jurnal. Fakultas Kesehatan Masyarakat Universitas Diponegoro, 2016; 4(3).
11. Siregar. Hubungan Tingkat Konsentrasi Sulfur Dioksida (SO2), Total Suspended Particle (TSP) dan Lingkungan Fisik Dendan Jumlah Kejadian Infeksi Saluran Pernapasan (ISPA) Pada Penduduk DI Kotamadya Jakarta Timur. Skripsi. Universitas Indonesia, 2011.
12. Prajapati, B., Talsania, N., Sonaliya, K.N." A Study on Prevalence of Acute Respiratory Infections (ARI) in Under Five Children in Urban and Rural Communities of Ahmedabad District, Gujarat". National Journal of Community Medicine, 2011; 2(2).