The Effect of Work Environment and Behavior on Health Complaints in Female Waste Pickers at Terjun Landfill

Agnes Ferusgel[1], Rina Mahyurni Nasution[1], Yenni Gustiani Tarigan[2]
[1]Faculty of Publich Health, Institut Kesehatan Helvetia
[2]Faculty of Pharmacy and Health Sciences, Sari Mutiara Indonesia University
email: agneslppmhelvetia@gmail.com

Abstract

Background: Nowadays, female workers are vulnerable to workplace hazards. One of the groups who are highly vulnerable to the exposure of workplace hazards is female waste pickers. This study focused on breathing problems in female waste collectors. The present study aimed to determine the effect of work behavior and work environment on respiratory complaints in female waste pickers at Terjun Landfill in Medan City. Methods: It was a cross sectional study in which the independent variables were work behavior and work environment, while the dependent variable was health complaints, respiratory complaints in particular. Work behavior was measured by collecting the data of protective mask use, while the data of work environment was collected by exploring the concentration level of CH_4 and H_2S at Terjun Landfill in Medan City. A total of 53 female waste pickers were participated as research sample. The data was analyzed by performing multiple linear regression calculation. Conclusion: It was obtained that there was an effect of work behavior (p=0.047) and concentration level of CH_4 (p= 0.000) on respiratory complaints in female waste pickers at Terjun Landfill. However, it was found that H_2S concentration level did not have an effect on respiratory complaints in female waste pickers at Terjun Landfill in Medan City. This study suggests that Sanitary and Park Office of Medan City can work together with related stakeholders to cultivate methane emissions (CH_4) to become energy source to reduce air pollution at waste landfill, whereas to female waste collectors, this study suggests that they can regularly use protective mask to minimize the risk of hazardous gas at workplace.

Keywords : work environment, health complaints, female waste collectors

e-ISSN: 2656-1123 (media online)

url: http://prociding.sari-mutiara.ac.id/index.php/samicoh

article submit: Augustus 2018

article revise: September 2018

article publish: November 2018

Introduction

As of today, the number of woman workforce is increasing due to the necessity to fulfill household daily needs. The increase also triggers various occupational health and safety problems among woman laborers. This makes female laborers vulnerable to workplace hazards. Based on data from International Labour Organization (ILO) in 2013, 1 worker died every 15 minutes due to work-related accidents, while 160 workers reported to have work-related health problems. Ministry of Health of the Republic of Indonesia reported that the total number of 97.144 cases of work-related health problems, which was relatively high, were accounted, but this number decreased to 40.694 cases in 2014 (Kemenkes, 2015).

Woman laborers at waste landfill have high risks to suffer from various health problems at their workplace. It is because waste collection workers get exposure to diseases by the garbage (Rimantho, 2015). Diseases caused by garbage exposure can be either communicable or noncommunicable. One of the common diseases found among waste pickers at a landfill is respiratory problem due to hydrogen sulfide and methane emissions from garbage decay.

There have been several studies about hazardous gasses such as hydrogen sulfide and methane gases produced at a landfill. Meirinda (2008) found that the concentration of hydrogen sulfide and methane gasses at zero meter of Terjun Landfill exceeded the regulatory standard. Sianipar (2009) also found that the average ambient air hydrogen sulfide concentration was 0.0290 mg/m^3, exceeding the regulatory standard. In addition, Andhika (2016) found the effect of methane gases (CH_4) on respiratory problem complaints in waste pickers at Mrican Landfill in Ponorogo Regency with *p* value = 0.015 and the probability of the waste pickers to get exposure to methane gas above the normal level was 9.2% (Sianipar, 2009).

Besides environmental factors, work behavior of waste pickers also play role in increasing the risk of workplace health hazards. Mostly, waste collectors are still unaware of the use of personal protective equipment (PPE) and personal hygiene. Based on the pilot observation at Terjun Landfill, it was still found many waste pickers who did not use complete PPE, particularly protective face mask at their worksite. Lack of awareness on personal hygiene also increases risk of diseases such as diarrhea and worms. Lisnawati (2014) found that adherence in using personal protective equipment (PPE) was correlated with health status in household waste collectors in Tasikmalaya.

Based on a pilot survey to 5 waste pickers at Terjun Landfill, it was found that some of them complained of having health problems, such as dizziness, breathing difficulty, burning skin sensation and sore eyes. It was also found that 2 out of 5 female respondents complained to be tired easily and felt dizzy at the workplace after they married. Based on this background, the researcher was motivated to study the effect of work environment and work behavior on health complaints in female waste collectors at Terjun Landfill in year 2017.

Method

This study was an analytical observational survey using cross sectional design. The population and samples of this study were all female waste pickers at Terjun Landfill, with the total number of participants were 53 people. The measuring parameters were concentration level of hydrogen sulfide (H_2S) and methane (CH_4) through laboratory tests, while the personal hygiene, PPE using habits and health complaints were collected through questionnaire administration. Data of hydrogen sulfide and methane concentration were collected in 4 different spots. They were 25 meters from gas spot I, 50 meters from gas spot I, 25 meters from gas spot II, and 50 meters from gas spot II. Techniques of the present data collection were primary and secondary data. Then, the collected data was analyzed by using univariate analysis as well as multivariate analysis through multiple linear regression.

Results and Discussion

The illustrations of respondent characteristics in this study are presented in the following tables:

Table 1. Age Frequency Distribution of Female Waste Pickers at Terjun Landfill

Age Group	N	%
≤ 36 years old	18	34,0
>36 years old	35	66,0
Total	**53**	**100.0**

Table 1 shows that the majority of the respondents was older than 36 years of age with the total number of respondents was 35 (66.0%), while the number of respondents whose age was ≤ 36 years old was 1 (34.0%).

Table 2. Education Frequency Distribution of Female Waste Pickers at Terjun Landfill

Education	n	%
Uneducated	3	5,7
Primary School Graduate	22	41,5
Junior High School Graduate	24	45,3
Senior High School Graduate	4	7,5
Total	53	100.0

Data shown in Table 2. illustrates the distribution of female waste pickers based on their education background. It is seen that 24 respondents are junior high school graduates (45.3%), 22 respondents are primary school graduates (41.5%), 4 respondents are senior high school graduates (7.5%) and 3 respondents are poorly educated (5.7%).

Table 3. Frequency Distribution of Female Waste Pickers at Terjun Landfill Based on Marital Status

Status	**n**	**%**
Married	52	98,1
Single	1	1,9
Total	**53**	**100.0**

Based on data in Table 3, in can be seen that most of female waste pickers at Terjun Landfill are married, with the total number is 52 (98.1%). On the other hand, there is only 1 respondent who is still single (1.9%).

Table 4. The illustrations of Hydrogen Sulfide (H_2S) and Methane (CH_4) Concentration at Terjun Landfill

Location	**H_2S**	**CH_4**
Spot 1	0.0190	12.24
Spot 2	0.0345	19.14
Spot 3	0.0095	10.78
Spot 4	0.0176	16.04

The results of H_2S measurement obtained that the concentration of H_2S at site 1 was 0.00190, at site 2 was 0.0345, at site 3 was 0.0095, and at site 4 was 0.0176. On the other, the concentration of CH_4 at site 1 was 12.24, at site 2 was 19.14, at site 3 was 10.78, and at site 4 was 16.04.

Respiratory complaints reported by respondents in this study are illustrated in the following table.

Table 5. Frequency Distribution of Female Waste Pickers at Terjun Landfill Based on Respiratory Complaints

Complaints	Yes		No	
	n	%	%	n
Cough	41	77.4	12	22.6
Chest pain	25	47.2	28	52.8
Breathing Difficulty	53	100.0	0	0.0

Based on data in Table 5, it is obtained that 41 female waste pickers at Terjun Landfill complain of having cough (77%), 25 respondents complain of suffering from chest pain (47.2%) and all female waste pickers at Terjun Landfill report to have ever experienced breathing difficulty (100%).

Table 6. Result of Determination Analysis

R^2	F	p
0.363	14.234	0.000

Table 6 shows that the value of regression determination coefficient is 0.36. This value indicates that variables of mask use and concentration of H_2S and CH_4 are able to explain the variety of breathing complaints in female waste pickers at Terjun Landfill, i.e. 36.3%

Table 7. The Effect of Protective Face Mask, Concentration of H_2S and CH_4 on Respiratory Complaints in Female Waste Pickers at Terjun Landfill

Work Behavior	B	p.
Constanta	-1.555	
Protective Face Mask	0.716	0.047
CH_4 Level	0.451	0.000

Discussion

The data analysis obtained that 41 respondents (77.4%) experienced cough, while all respondents (100%) reported to have ever experienced chest pain. Then, 35 respondents complained of having chest pain problem while working. These results are in line with the results by Siprianus Singga (2014) which found that the most frequent health complaints in waste collectors at a landfill were cough (98%) and chest pain (55%) (Singga, 2016).

Respiratory complaints such as cough, chest pain, and breathing difficulty in female waste pickers at Terjun Landfill was a result of methane exposure from garbage decay which generally occured in dry season. The cough and chest pain complaints were occurred in the noon and seemingly interrupted them from their work activities. Occasionally, the waste collectors needed relatively longer time to rest and check the condition of the smoke from the garbage burning. As the result of this long rest, they had to work in the evening or night.

Regarding to the work behavior of female waste pickers at Terjun Landfill, it was found that the majority of the respondents, i.e 25 respondents (45.3%) rarely used face mask while working. This study also found that 14 respondents (26.4%) always used face mask, while 15 respondents (28.3%) never used face mask in their workplace. These results are in line with the study by Fani (2016) which found that the behavior of waste collectors in Muktiharjo Village in using personal protective equipment was relatively low, i.e. 35.9%.

Through an interview, there were several reasons why some respondents did not put on protective face masks when they worked at the landfill. Some of the respondents reported that they felt uncomfortable if they wore mask when working. Some others reported that the mask was too tight and made them difficult to breathe. The tight masks made their face sweaty. They also reported that they were not used to using mask while working. Another reason was due to lack of knowledge about the occupational health and safety, workplace risks and work-related health problems.

Hydrogen Sulfide (H_2S) or hydrosulfuric acid is also known as swamp gas or sour gas (Plaza, Xu, Townsend, Bitton, & Booth, 2007). It is flammable, poisonous, and colorless gas with the characteristic foul odor of rotten eggs. Hydrogen sulfide is easily absorbed by lungs so that it brings hazardous effect to human body. Among the 4 spots of H_2S and CH_4 concentration measurement at Terjun Landfill, there was only 1 site in which the concentration of H_2S exceeded the National Ambient Air Quality Standard (0.02 pppm), i.e. site 2 with the concentration was 0.03 pppm. On the other hand, the concentration of H_2S at spot 1, 2, and 4 was 0.019 pppm, 0.0095 and 0.00176 respectively.

Garbage management at Terjun Landfill employs open dumping system. Open dumping is the simplest waste disposal method in which all the waste is disposed at a certain open area. Waste decomposition at an open dumpsite is done by anaerobic bacteria which produce methane as the final result. There is yet any regulation about concentration standard of CH_4 at a landfill.

However, according to NIOSH, the standard level of CH_4 concentration in ambient air is 0.1%. Surprisingly, this study found that the concentrations of CH_4 in all 4 spots were higher than the concentration standard of NIOSH, i.e. spot 1 was 0.12%, spot 3 was 0.11%, spot 4 was 0.16%, and the highest concentration was found at spot 2 (0.2%).

This study also found that there was an effect of protective mask use on respiratory complaints in female waste pickers at Terjun Landfill with p = 0.047. Laborers who always put on clean masks will minimize the amount of air pollutant particle coming in to their body. The result of this study is also in line with the result found by Fathurrahman (2014) who found that there was a correlation between personal protective equipment (PPE) use and lung function disorders (Fathurrahman & Jayanti, 2014). Lisnawati (2014) also found that the adherence of house waste collectors on PEE was also correlated with their health status. (Liswanti, 2015)

One of the functions of PPE is to protect respiratory organs towards gas, smoke, ash or air pollutant particles at workplace which can harm human body (Ostrowski, Marczak, Strzelec, & Barcikowski, 2007). Therefore, using face mask when working would protect female waste pickers from inhaling hazardous gases such as H_2S and CH_4.

This study also obtained that there was an effect of CH_4 concentration on respiratory complaints, with p=0.000. High concentration on methane will reduce the concentration of oxygen in the atmosphere which eventually could cause lack of oxygen in the body. The low concentration of oxygen causes female waste pickers to have respiratory complaints such as cough and breathing difficulty. The result found in the study is in line to the result found by Ratih Andhika which found that there was an effect of exposure to methane on respiratory complaints with p value= 0.015 ($p<0.05$) (Akbar, 2016).

Methane (CH_4) gas from the untreated garbage could contribute in speeding up global warming. The existence and movement of methane is somehow dangerous, particularly at a landfill without gas management facilities. It is because the concentration of methane at the minimum level of 5-15% can cause explosion if it is mixed with air or get thunder strike (EPA, 2010).

Conclusion

1. There was an effect of protective mask use (p= 0.047) on respiratory complaints in female waste pickers at Terjun Landfill.

2. There was an effect of methane gas (CH_4) concentration on respiratory complaints in female waste pickers at Terjun Landfill.
3. There was no effect of hydrogen sulfide concentration (H_2S) on respiratory complaints in female waste pickers at Terjun Landfill

Acknowledgement

This study was funded by the Ministry of Technology, Research and Higher Education of the Republic of Indonesia. Author would also like to thank Sanitary and Park Office of Medan City.

References

Akbar, R. A. (2016). Pengaruh Paparan Ch4 Dan H2s Terhadap Keluhan Gangguan Pernapasan Pemulung Di Tpa Mrican Kabupaten Ponorogo. *Journal Of Industrial Hygiene And Occupational Health*, *1*(1), 1–14. Jour.

Epa, U. S. (2010). Regulation Of Fuels And Fuel Addiatives: Changes To Renewable Fuel Standard Program; Final Rule. *Fed Regist*, *75*(58), 14790. Jour.

Fathurrahman, C., & Jayanti, S. (2014). Faktor-Faktor Yang Berhubungan Dengan Gangguan Fungsi Paru Pada Pekerja Yang Terpapar Potassium Permanganate Dan Phosphoric Acid Di Industri Garmen. *Jurnal Kesehatan Masyarakat (E-Journal)*, *2*(1), 42–49. Jour.

Kemenkes, R. (2015). Situasi Kesehatan Kerja. *Jakarta: Kemenkes Ri*. Jour.

Liswanti, Y. (2015). Faktor-Faktor Yang Berhubungan Dengan Kepatuhan Penggunaan Alat Pelindung Diri (Apd) Serta Kaitannya Terhadap Status Kesehatan Pada Petugas Pengumpul Sampah Rumah Tangga Di Kota Tasikmalaya Tahun 2014. *Jurnal Kesehatan Bakti Tunas Husada*, *13*(1). Jour.

Ostrowski, R., Marczak, J., Strzelec, M., & Barcikowski, S. (2007). Nano And Microparticles Emission During Laser Cleaning Of Stone. In *Laser Technology Viii: Applications Of Lasers* (Vol. 6598, P. 65980v). Conf, International Society For Optics And Photonics.

Plaza, C., Xu, Q., Townsend, T., Bitton, G., & Booth, M. (2007). Evaluation Of Alternative Landfill Cover Soils For Attenuating Hydrogen Sulfide From Construction And Demolition (C&D) Debris Landfills. *Journal Of Environmental Management*, *84*(3), 314–322. Jour.

Rimantho, D. (2015). Identifikasi Risiko Kesehatan Dan Keselamatan Kerja Pada Pekerja Pengumpul Sampah Manual Di Jakarta Selatan. *Jurnal Optimasi Sistem Industri*, *14*(1), 1–

15. Jour.

Sianipar, R. H. (2009). Analisis Risiko Paparan Hidrogen Sulfida Pada Masyarakat Sekitar Tpa Sampah Terjun Kecamatan Medan Marelantahun 2009. Diss.

Singga, S. (2016). Gangguan Kesehatan Pada Pemulung Di Tpa Alak Kota Kupang. *Media Kesehatan Masyarakat Indonesia*, *10*(1), 30–35. Jour.