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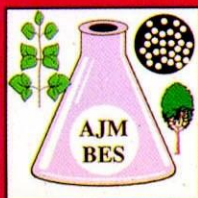
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CORRELATION OF PARTICULATE MATTER TO CORONARY HEART DISEASE IN PALEMBANG

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Abstracts – The short-term particulate exposures stimulate the heart attacks in the risk-population and increase the mortality. The study aims to prove the correlation of particulate exposure to the coronary heart disease in Palembang. The particulate data ($PM_{2.5}$ – PM_{10}) are obtained from the measurements on the parking zone of 39 puskesmas (primary health care) in Palembang in which the data of coronary heart diseases are obtained from the data of new outpatient who visit at the puskesmas reported at health office department of Palembang. The data is formed in the forms of average, standard deviation, minimum and maximum, and analyzed statistically with Spearman correlation method. The results present that there is no correlation between the particulate exposure ($PM_{2.5}$ and PM_{10}) against coronary heart disease in Palembang.

INTRODUCTION

The recent research suggests that the short-term exposure could trigger the heart attacks in the risk-population and increase the mortality (Brook *et al.*, 2010). Chen *et al.* (2016a) conducted a study on the effect of $PM_{2.5}$ exposure on the population causing death in China and found that the reducing of the mean annual concentration of $PM_{2.5}$ by 35 mg.m^{-3} could decrease the annual death rate for cardiovascular, lung cancer, and respiratory diseases of 89.000, 47.000, and 32.000, respectively. Furthermore, Chen *et al.* (2016b) assessed the risk of ambient PM_{10} causing the death and the results showed that PM_{10} effects in the years of life lost in men and parents

The WHO database compiles $PM_{2.5}$ and PM_{10} from the measurements for approximately 3000 cities around the world and estimates only one in ten people breathing with the clean air (WHO, 2016). The particle pollutants could form the small solid or liquid particles in the air (Dockery, 2009; Brook *et al.*, 2010; WHO, 2016). The ambient particulates have a devastating impact on the

human health (Katsouyanni, 2003; Pope III and Dockery, 2009; Brook *et al.*, 2010; Du *et al.*, 2016; Chen *et al.*, 2016a; Bourdrel *et al.*, 2017). These small particles pose a health risk because the particles can be inhaled, passing through the throat and entering the lungs (Brook and Rajagopalan, 2010; Brook *et al.*, 2010).

The most dangerous particles are the particles that are classified as fine particles, smaller in diameter than 2.5 microns (about 30 times smaller than the diameter of a human hair) (WHO, 2016). These microscopic particles, known as $PM_{2.5}$ that inhale to the lungs, generate the health problems and in the long-term exposure exacerbate the respiratory problems. The high concentrations of $PM_{2.5}$ initiate the coughing, irritation of the eyes, nose, throat (WHO, 2016), lung irritation, and shortness of breath (Brunekreef *et al.*, 2009), cardiovascular (Freitas *et al.*, 2010; Brook *et al.*, 2010; Du *et al.*, 2016; Stockfelt *et al.*, 2017), atherosclerosis (Brook and Rajagopalan, 2010). Some groups are very sensitive to $PM_{2.5}$ including children, the elderly, and people with existing respiratory problems including asthma and respiratory organ

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problems and liver. The long-term $PM_{2.5}$ exposure is associated with the increase of mortality (Brook *et al.*, 2010; Du *et al.*, 2016), especially in coronary heart disease (Gill *et al.*, 2011; Ye *et al.*, 2016; Pena and Rollins, 2017). The study aims to prove the correlation of particulate exposure to the coronary heart disease in Palembang

MATERIALS AND METHODS

The data of $PM_{2.5}$ and PM_{10} were obtained from the measurements using mini particle counter DT-96 (CEM, Shenzhen-China) at 39 puskesmas (primary health care) in Palembang in the fourth week of January 2018. The data of patients with the coronary heart disease in 2017 was obtained from the reports of outpatient visitation at 39 puskesmas to health service department in Palembang. All the data was processed in the forms of average data, standard deviation, minimum and maximum and analyzed by Spearman method.

RESULTS

Fig. 1 showed the location of puskesmas in Palembang. The data of particulate measurement and data collection of coronary heart disease at 39

puskesmas in Palembang were shown in table 1. Table 1 and Fig. 2 showed that the ambient of $PM_{2.5}$ had an average value of $10.77 \mu\text{g}\cdot\text{m}^{-3}$ with a standard deviation of 5.59. The minimum and maximum value of $PM_{2.5}$ were $4 \mu\text{g}\cdot\text{m}^{-3}$ and $33 \mu\text{g}\cdot\text{m}^{-3}$ located in the puskesmas of Multi Wahana and Plaju. For the ambient of PM_{10} , the average value was measured as $19.46 \mu\text{g}\cdot\text{m}^{-3}$ with a standard deviation of 9.37 the obtained minimum and maximum value of PM_{10} were $9 \mu\text{g}\cdot\text{m}^{-3}$ and $44 \mu\text{g}\cdot\text{m}^{-3}$, respectively which located in the puskesmas of Multi Wahana and Boom Baru.

Table 1. Data of PM Ambient and CHD of Puskesmas in Palembang.

| Variables | Mean | SD | Min | Max |
|--|------|-------|-----|-----|
| $PM_{2.5}$ ($\mu\text{g}\cdot\text{m}^{-3}$) | 10.8 | 5.59 | 4 | 33 |
| PM_{10} ($\mu\text{g}\cdot\text{m}^{-3}$) | 19.5 | 9.37 | 9 | 44 |
| CHD (n) | 24.5 | 51.09 | 0 | 218 |

According to the threshold limit value (TLV) by WHO in which the TLV for $PM_{2.5}$ was $25 \mu\text{g}\cdot\text{m}^{-3}$ and PM_{10} was $50 \mu\text{g}\cdot\text{m}^{-3}$, there was only one puskesmas that exceeded the TLV of $PM_{2.5}$ where is the puskesmas of Plaju with the level of concentration equal to $33 \mu\text{g}\cdot\text{m}^{-3}$. For PM_{10} there no

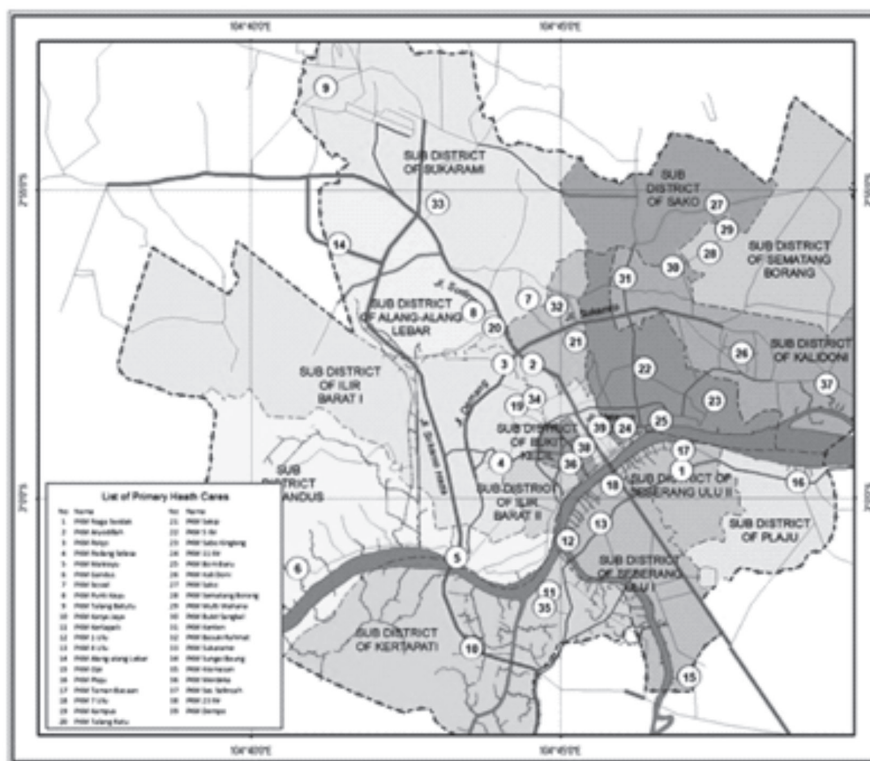


Fig. 1. Map location of Puskesmas in Palembang

puskesmas exceed the TLV.

Table 1 and Fig. 2 represented that the patient of coronary heart disease had an average value of 24.5 patients with a standard deviation of 51.09. The minimum and maximum value of the patient of coronary heart disease were 0 patient (in the puskesmas of Makrayu, Gandus, 1 Ulu, 4 Ulu, Kertapati, Nagaswidak, Taman Bacaan, Kampus, 11 Ilir, 23 Ilir, Talang Ratu, Sekip, Sabokingking, Sei Selincah, Multi Wahana, Talang Betutu and Karya Jaya) and 218 patients (Sukarami).

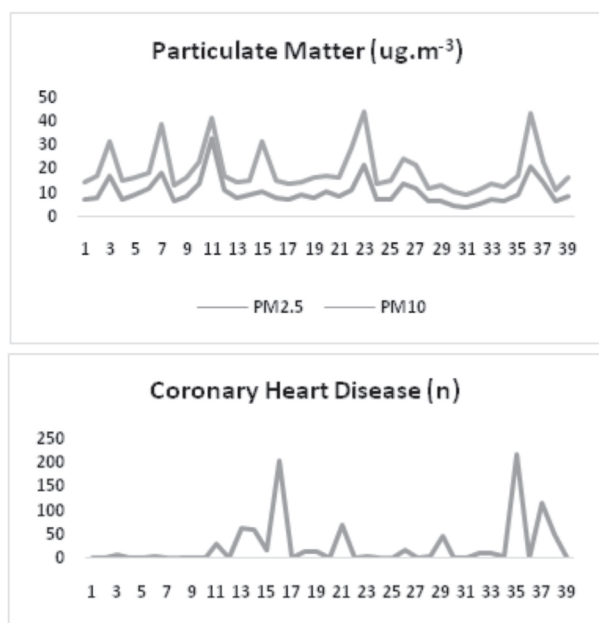


Fig. 2. The results of PM Measurements and CHD outpatients of 39 Puskesmas in Palembang.

Table 2 provided the data of correlation test results between the particulate matters ($PM_{2.5}$ and PM_{10}) and coronary heart disease in Palembang. There was a significantly correlation between $PM_{2.5}$ and PM_{10} ($r = 0.952$; $p = 0.001$). In the other hand, there was an in significantly correlation between $PM_{2.5}$ with coronary heart disease ($r=0.010$; $p=0.954$), and PM_{10} with coronary heart disease ($r = -0.065$; $p = 0.693$).

Table 2. Results of Correlation test with the Spearman method.

| Variables | | PM_{10} | CHD |
|------------|------------------|-----------|--------|
| $PM_{2.5}$ | Cor. Coefficient | 0.952 | 0.010 |
| | Sig. (2 tailed) | 0.001 | 0.954 |
| PM_{10} | Cor. Coefficient | | -0.065 |
| | Sig. (2 tailed) | | 0.693 |

From the annual report of patients visiting at puskesmas in Palembang, in 2017, the highest patient visiting occurred at the puskesmas of Sukarame (218 patients) but had the low particulate exposure ($PM_{2.5}$ and PM_{10}) level (10 ug.m^{-3} ; 17 ug.m^{-3}) whereas in some puskesmas such as Talang Betutu and Boom Baru, no coronary heart disease patients visit even showing the high level of particulate exposure (22 ug.m^{-3} ; 44 ug.m^{-3}). This showed that the occurrences of coronary heart disease in Palembang was not caused by the particulate exposure but caused by the other factor.

DISCUSSION

The results found that there was no correlation between the particulate exposure with the coronary heart disease because the level of particulate exposure was below the permitted TLV. The most possibilities reason was that the measurement was conducted in the rainy season (wet season) caused the particulate fall faster to the ground. The result was supported by Owoade *et al.* (2012) and Jallad *et al.* (2013) mentioned that the level of particulates varied based on the season in which the dry season had the high concentration and the wet season had a low concentration.

Some factors generating the coronary heart disease could be initiated by several things such as hypertension, dietary patterns, exercise, and emotional stress (Institute of Medicine. 2010; Brook *et al.*, 2010; Gill *et al.*, 2011; Cosselman *et al.*, 2015; WHO, 2016; Stockfelt *et al.* 2017). The coronary heart disease became the center of the world attention because of the number of the patient continuously growing up in some developing country (Gresh *et al.*, 2010; Institute of Medicine, 2010), especially in Indonesia (WHO, 2011).

Cassee *et al.* (2013) obtained the results that most evidence of carbon accumulation generated by the traffic has the bad effect on the human health. Traffic that produced dust coming from roads, brakes, and tires, contributed to adverse the health effects. The duration of particulate exposure had been associated with adverse effects of exposure to the coronary heart disease. The results was supported by Pope III and Dockery (2009); Brook *et al.* (2010), Cosselman *et al.* (2015), and Du *et al.* (2016) that found that the particulate effects related to cardiovascular health and increased the knowledge of the common pathophysiology pathway that connected the particulate exposure

with the cardiopulmonary resulting in the morbidity and mortality.

CONCLUSION

The exposures of PM_{2.5} and PM₁₀ in Palembang was below the threshold limit value arranged by WHO. The results obtained that there was no correlation between the particulate (PM_{2.5} and PM₁₀) against the coronary heart disease in Palembang.

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