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Correlation Between Carbon Monoxide Level in Exhaled Air and Pulmonary Function on Grill Street-Vendors in Medan City

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ABSTRACT

Background. Air pollution is the result of household waste responsible for 3.8 million death and 7.7% of all mortality over the world. One air pollutant which tends to increase year by year is carbon monoxide (CO). CO is produced as the result of the imperfect combustion of machines and the combustion of charcoal. The purpose of this study is to assess the correlation between CO level in exhaled air and pulmonary function on grill street-vendors in Medan city.

Method: This study is an observational analytic with a cross-sectional approach. The subjects were grill in Medan city who fulfilled certain inclusion and exclusion criteria with the consecutive sampling method. This study data is primary data which is collected using a questionnaire, smokerlyzer, and spirometry.

Result: The subjects of this study are 25 grill street-vendors. Most subjects in this study have red (40%) and green (32%) zone in CO exhaled test and as in pulmonary function test, restrictive (56%) and mixed-type (40%) are the most. The Spearman correlation result between CO level in exhaled air and pulmonary function FEV1 and FVC are not significant (p=0.068 and p=0.251).

Conclusion: There is no significant correlation between CO levels in exhaled air and pulmonary function

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ABSTRAK

Latar belakang*. Polusi udara sebagai akibat dari limbah rumah tangga yang bertanggung jawab atas kematian 3,8 juta orang dan kematian 7,7% orang di seluruh dunia. Salah satu polutan udara yang memiliki kecenderungan meningkat dari tahun ke tahun adalah karbonmonoksida (CO). CO diproduksi sebagai hasil dari pembakaran arang yang tidak sempurna. Tujuan dari penelitian ini adalah untuk menilai korelasi antara tingkat CO dalam udara yang dihembuskan dan fungsi paru-paru pada penjual panggangan pinggir jalan di Kota Medan.*

Metode: *Penelitian ini adalah analitik observasional dengan pendekatan potong lintang. Subjeknya adalah pedagang panggangan pinggir jalan di Kota Medan yang memenuhi kriteria inklusi dan ekslusi dengan metode sampling secara berturut-turut. Data penelitian ini adalah data utama yang dikumpulkan menggunakan kuesioner, perokok dan spirometri.*

Hasil: *Subjek penelitian ini adalah 25 pedagang panggangan pinggir jalan. Sebagian besar subjek dalam penelitian ini memiliki zona merah (40%) dan hijau (32%) dalam tes CO yang dihembuskan dan dalam tes fungsi paru,* restriktif *(56%) dan tipe campuran (40%) adalah yang paling banyak. Hasil korelasi Spearman antara tingkat CO di udara* yang dihembuskan dan fungsi paru FEV1 dan FVC tidak signifikan (p= 0.068 dan p = 0.251).

Kesimpulan: Tidak ada korelasi yang signifikan antara tingkat CO dalam udara yang dihembuskan dan fungsi paru-paru

Kata kunci: Polusi udara, tes CO yang dihembuskan, Fungsi paru-paru, pedagang panggangan pinggir jalan, Restriktif, tipe campuran

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1 Introduction

Air pollution is still a considerable problem these days.[1] World Air Quality Report states that particulate matter 2.5 was 45.3 µg/m3 in Jakarta on 2018, which is fourfold higher than WHO recommendation of tolerated air pollution (10 µg/m3) [2]. Air pollution in Medan city is an incautious condition which makes Medan becomes the fourth most polluted city in the world.[3] Carbon monoxide (CO) is one of many breaths of air pollutes that tends to increase year by year. CO gas affects the human body in that it competes with oxygen to bind to hemoglobin (Hb). CO has 400 folds higher affinity to bind Hb than oxygen and the result is carboxyhemoglobin (COHb) complex. High COHb complex in blood circulation could affect human body function, for example, headache, blurred vision, nausea, lassitude, and vertigo.[4,5] Air pollution such as CO gas could be produced by combustion of vehicles or combustion on charcoal, as in grill street-vendors. High exposure to pollutants will also affect human airways and lung function, which act as oxidative stress that results in inflammation of the respiratory tract and possibly airflow

limitation.[6,7] There is no significant correlation between CO level in exhaled air and pulmonary function (FEV1, FVC, FEV1/FVC, FEF) in smokers, non-smokers, and former smokers.[8]

The study by Premana and Griadhi,[9] the prevalence of pulmonary function abnormalities among satay griller in Denpasar, that among 50 samples, 41 of which have restrictive abnormalities, 2 of which have obstructive abnormalities, 1 of which has mixed-type abnormalities, and 6 of which have normal pulmonary function test.

The study aims to assess the correlation between CO level in exhaled air and pulmonary function on grill street-vendors in Medan city.

2 Method

This study method is observational analytic with a cross-sectional approach on grill street-vendors. In cross-sectional studies, the independent variables/ risk factors and the dependent variables were assessed simultaneously at one time.[10] This study was conducted in the Medan city area. The period of this study was July-December 2019. The sampling method is consecutive sampling by the criteria of inclusion and exclusion, where the samples are taken in the order of coming to meet the number of samples from this study is 25 peoples. The data for this study were gathered using a questionnaire to screen the samples, a smokerlyzer to measure CO level in exhaled air, and spirometry to measure pulmonary function.

Statistical analysis

The data obtained is entered into SPSS (Statistical Package for the Social Sciences) and distributed using frequency distribution tables and carried out discussions using existing libraries. Next, do a bivariate analysis to see whether there is a correlation between the independent variable and the dependent variable. The statistical test used is the Pearson Correlation Test which is a parametric hypothesis test if both variables are normally distributed or the Spearman Correlation Test is used if one or both variables are not normally distributed.

3 Result

Table 1, shows the characteristic of all samples in this study. Most of the samples were in the 20 – 29 age category (72%). For the working experience, the category of >4 years had most of the samples (40%). In Brinkman Index, most samples had a mild Brinkman index (68%). CO level in exhaled air was distributed to the green, orange and red zone. Most of the samples CO levels were in the red zone (40%) and green zone (32%). In the measurements of pulmonary function, overall samples had restrictive abnormalities (56%) and mixed-type abnormalities (40%).

Table 1 Samples Characteristic

Variable	Category	Frequency	(%)
Age, year	20 – 29	18	72
	30 – 39	4	16
	40 – 59	3	12
Working Experience, year	1 – 2	9	36
	3 – 4	6	24
	>4	10	40
Brinkman Index	Mild	17	68
	Moderate	7	28
	Severe	1	4
CO level in exhaled air	Green	8	32
	Orange	7	28
	Red	10	40
Pulmonary Function	Normal	1	4
	Obstructive	0	0
	Restrictive	14	56
	Mixed-type	10	40
Total		25	100

In table 2, Spearman correlation is used to assess the correlation between CO level in exhaled air and pulmonary function (FEV1 and FVC). There is no significant correlation between CO levels in exhaled air with either FEV1 ($p=0.068$) or FVC ($p=0.251$). The type of correlation in these studies is a negative correlation, which meant if the value of one variable (CO level in exhaled air) increases and the other variable (FEV1 and FVC) will decreases.

Table 2 Correlation between CO level in exhaled air and pulmonary function (FEV1 and FVC)

Spearman Correlation	r	p-value
CO level in exhaled air – FEV_1	-0.371	0.068
CO level in exhaled air - FVC	-0.238	0.251

4 Discussion

Air pollution, especially in this study which is produced by charcoal combustion, contributes to a decrease of pulmonary function and capacity due to lung parenchymal damages.[11] The substances produce as the result of charcoal combustion are such as sulfur dioxide (SOx), carbon monoxide (CO), nitrogen oxide (NOx), hydrocarbons (HC), and dust particles.[12] Air pollutants such as dust-containing particles of solid substances can cause various kinds of respiratory diseases. Dust will enter human lungs, especially 1 – 3 microns in size, which will stick in

alveoli.[13] The study of Sihombing, (2013) shows that inhaled dust, are having restrictive abnormalities in pulmonary function testing on press-packing workers in Usaha Penampungan Butut in Kelurahan Tanjung Muara Hilir Medan.[14]

In this study, there is no significant correlation between the two variables. The same study but different groups of samples also show no significant correlation between CO level in exhaled air and pulmonary function. Both studies have relatively young subjects as samples.[8] The factor that could contribute to pulmonary function in workers is age, working experiences, nutritional status, smoking habit and history of respiratory disease. As humans age, the pulmonary function will decrease gradually. Aging also affects lung function by decreasing lung elasticity.[15] Working experiences affect lung by long-term exposure to dust in a working environment that could induce lung disease.[16] The nutritional status could affect lung function as the result of lower antibodies and weaker immune system in under-nourished human which will make someone becomes more susceptible to infection especially lung infection.[17]

CO level in exhaled air could increase either from outdoor exposure, in this case, is charcoal combustion, or endogenous production. Endogenous production of CO results from the hemolysis process.[18] Smoking could also increase the CO level testing because CO is one of many substances contained in tobacco.[19] All of the samples in this study are smokers, which will reduce the bias of CO level testing.

5 Conclusion

There is no significant correlation between the CO level of exhaled air and pulmonary function (either FEV1 or FVC). Further research should take into other factors that could affect lung function, such as account age, nutritional status, smoking habits dan history of respiratory disease.

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