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Correlation Air CO Level with HbCo Level, Hemoglobin, and Blood Pressure to Street Vendors in The Gading Fajar Sidoarjo Street Vendor Area

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ABSTRACT Motor vehicles emit exhaust gas emissions that produce pollutants, one of the compounds contained is carbon monoxide (CO). CO may cause intoxication in humans if exposed for a long time especially street vendors because the work area is filled with vehicle fumes containing CO gas. High CO levels in the air indicate HbCO levels to increase. The increased of HbCO levels will cause abnormal hemoglobin levels and induce vasoconstriction which makes blood pressure increase. The purpose of this study was to prove the correlation between CO levels in the air with HbCO, hemoglobin, and blood pressure levels to street vendors in the Gading Fajar Sidoarjo Street Vendor Area. This research uses the Conway diffusion cell method and is an analytic observational study with a cross sectional design implemented at the Surabaya Health Laboratory Center and the Hematology Laboratory of Medical Laboratory Technology Department Poltekkes Kemenkes Surabaya in March 2022. Blood tests was carried out on 25 street vendors using random sampling technique. The results showed that average air CO level was 11.0 ppm and 13.3 ppm; mean HbCO levels 0.87%; mean hemoglobin levels 14.4 g/dL; mean systolic blood pressure levels 128 mmHg; and the mean of diastolic blood pressure levels 80 mmHg. The data were analyzed using SPSS. The outcome of normality test showed that the data was not normally distributed. Statistical tests was performed using Spearman correlation. The conclusion showed there was correlation between air CO level with HbCO level, hemoglobin level, and blood pressure level on street vendors in the Gading Fajar Sidoarjo Street Vendor Area. If CO levels in the air increase, then HbCO levels and blood pressure also increase. Street vendors are expected to always use Personal Protective Equipment (PPE) such as mouth masks when working to reduce the risk of exposure to CO gas and doing a healthy lifestyle as a preventive effort to avoid health problems.

INDEX TERMS Carbon Monoxide, Hemoglobin, Blood Pressure

I. INTRODUCTION

The acceleration of growth in the sector of transportation, especially in motor vehicles, is directly proportional to the development of the times in Indonesia. It can be reviewed and felt its influence on daily life. One of very relevant influence is air pollution which has an unfavorable impact on human health, and can even lead to death if exposed too much [1]. Burning fuel oil in motor vehicles will produce residual gases consisting of almost 60% carbon monoxide and about 15% containing hydrocarbons which can cause air pollution [2].

Burning fuel oil in motor vehicles will produce residual gases obtained from the air and produce pollutants that pollute the environment. Complete combustion reaction

occurs because the oxygen supply is sufficient to produce CO_2 and H_2O gas, while incomplete combustion reaction occurs due to lack of oxygen supply resulting in emissions of SO_2, CO, NO, and lead in gasoline fuel. Among the toxic gases produced, CO gas has a major influence on human health because it can cause intoxication in the blood. Carbon monoxide gas comes from incomplete combustion reactions that can cause intoxication in the human body [3].

In the process of human respiration, gases in the air from the atmosphere will be inhaled into the lungs which then flow into the alveoli and into the bloodstream. CO and O_2 gases that enter the body will diffuse through the alveoli membrane [4]. After the co gas is mixed in the blood, there is competition between CO and O_2 with the same speed to bind to hemoglobin, but CO has an affinity 230-270 times stronger than O_2 so that O_2 easily detaches from hemoglobin [5]. As a result, the position of O_2 which is very important for the human respiratory system is replaced by CO which then binds to Hb reversibly to form Carboxyhemoglobin (HbCO) [6].

CO can lead health problems, including decreased oxygen availability for all body tissues, abnormal hemoglobin levels, and can cause damage to the heart muscle and central nervous system are very closely related to blood pressure [7]. CO poisoning is a common cause of death from poisoning in the United States. CDC Data [8] reports that in the United States there are at least 430 people dead and about 50,000 people in the ER due to accidental CO poisoning.

Sidoarjo is one of the metropolitan areas in East Java province. The volume of heavy traffic causes the level of air pollution to be quite high along with the increase in the number of motor vehicles in accordance with BPS data Sidoarjo year 2015-2017 that there is an increase in motor vehicles up to 5.7% per year [9]. One area that often causes congestion in Sidoarjo is Gading Fajar street vendors. Based on a preliminary survey in the field in November 2021, Gading Fajar is one of the areas used as a center for street vendors for buying and selling transactions. The Gading Fajar causes traffic jams due to the large number of motorists passing by to see or buy goods, food, and drinks along the road with the vehicle's engine still running. With the large volume of motorized vehicles, the Gading Fajar area allows street vendors who sell to be exposed to CO gas for a longer time. This is also supported by the results of interviews with several street vendors who experienced health complaints in the form of dizziness while working.

According to research [10], the average ambient air quality of CO parameters on Gedangan Street Sidoarjo is 11456.04 µg/Nm3. This amount still meets the quality standard in accordance with East Java Governor Regulation number 10 of 2009 concerning Ambient Air Quality Standards and Immovable Source Emissions of 22,600 µg/Nm3. However, in the examination of HbCO levels, most of the respondents exceeded the normal limit with a minimum level of 4.14% and a maximum level of 14.56%. The high HbCO levels make respondents experience complaints such as dizziness and impaired vision. On research [11], there was a significant correlation between HbCO levels in street vendors around the Gajah Mada and Basuki Rahmat Jember traffic lights with the highest HbCO levels coming from non-smokers aged 41-50 years with an average of 44.45%. Exposure to CO gas in the air at street vendors at risk of increasing HbCO levels due to frequent inhalation of vehicle fumes containing CO gas for more than 6 hours/day. With increasing levels of CO gas in the air, street vendors are at risk of health problems, especially in HbCO levels, hemoglobin, and blood pressure. Therefore, it is necessary to conduct this study, which aims to analyze the correlation of CO levels in the air with HbCO levels, hemoglobin, and blood pressure.

II. METHODOLOGY

This research is an analytic observational study with a cross sectional approach which was carried out in March 2022. Data collection used a questionnaire as an interview medium containing questions referring to the selection of respondents. Measurements of CO air and blood pressure were carried out in Gading Fajar Sidoarjo. Examination of HbCO levels using the Conway diffusion cell method using 5 N H_2SO_4 reagent which will react with 0.005 N $PdCl_2$ and 5% KI solution for absorbance readings carried out at the Surabaya Central Health Laboratory. The hemoglobin level examination using the Fluorescence Flow Cytometry method was carried out at the Hematology Laboratory, Medical Technology Laboratory, Health Polytechnic of the Ministry of Health, Surabaya. The respondents of this study were 25 street vendors in Gading Fajar Sidoarjo who met the requirements, namely: having worked for at least 1 year, aged 35-45 years, male, not sick, and willing to be research respondents. The sampling technique used is random sampling.

A. SAMPLING TECHNIQUE

The blood taken was whole blood in the median cubital vein using a tourniquet and a 3 mL syringe. After that, it was placed in tubes containing 0.5 mL of CO_2-free aquadest and tubes containing 2.5 mL of EDTA anticoagulant, then labeled with the patient's identity on each tube.Furthermore, the specimen is put into a cool box which is kept at a temperature according to the temperature of the refrigerator and given an ice pack. The test material is then brought to the laboratory for examination [12].

B. AIR SAMPLING PROCEDURE

Air CO sampling using CO analyzer “Smart Sensor AS8700A". Smart Sensor Carbon monoxide gas detector is a portable detector for detecting carbon monoxide (CO) gas made in China. It can continuously monitor the CO gas concentration in the surrounding environment, once the gas concentration reaches the level of the alarm, the alarm will

sound, light and vibration. High precision portable CO gas tester with compact size and light weight is easy to carry and operate. It is widely used in petroleum, chemical, and other industries. The appliance is activated until a "beep" sounds and placed at the environment with clean air and then waits until purging initialization for 120 seconds. Then the instrument is moved to the point of location to be tested and the tool will automatically take measurements.

C. HbCO EXAMINATION PROCEDURE

HbCO examination using conway diffusion cell method with UV-Visible Spectrophotometer. Pipetted 1.5 mL of CO_2-free aquadest into the right side of conway, 0.2 mL of H2SO4 pipetted into the left side of conway, then 1 mL of $PdCl_2$ pipetted into the middle side of conway, then added 0.5 mL of blood into the right partition containing CO_2-free aquadest. The conway is covered and homogenized then incubated for 1 hour.

Next, prepared 25 mL measuring flask and filled with 10 mL of CO_2-free aquadest, 1 mL of 5% KI solution, and 0.25 mL of $PdCl_2$ mixture in the center of the conway plate, then added aquadest to the miniscus line and read on UV-Visible spetrofotometer with a maximum wavelength of 420 nm [13]. Before measuring the absorbance of the sample, the standard solution with concentration variation is first measured and the absorbance value of the standard solution is used to create a calibration curve. For the blank contains 10 mL of aquadest and 1 mL of 5% KI solution [14].

D. HEMOGLOBIN EXAMINATION PROCEDURE

Hemoglobin examination using Hematology Analyzer Mindray BC-5000. Before checking, the appliance must be turned on and warmed up for 30 minutes. Blood with EDTA anticoagulants is homogenized first before the examination. On the device screen, the identity of the sample is entered (name, age, and address) then the blood sample is inserted into the suction device and the knob is pressed once by holding the sample tube until the suction device comes out of the sample tube (a "beep" sound). The tool will process the sample automatically for one minute then the results will appear on the screen and can be printed. Figure 1 shows the procedure.

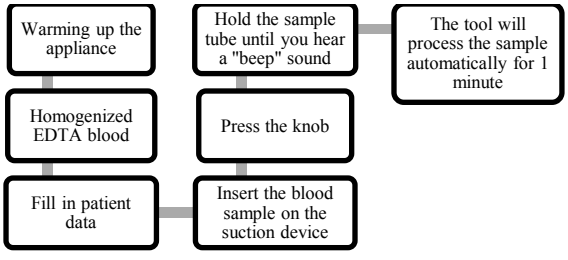

FIGURE 1. Flow chart of Hemoglobin Examination Procedure. System flow chart to detect hemoglobin level readings using the Mindray BC-5000 Hematology Analyzer.

E. BLOOD PRESSURE PROCEDURE

Examination of blood pressure using an aneroid sphygmomanometer and stethoscope. Before the blood pressure check, respondents were instructed to take a break from physical activity for 5-15 minutes. Then the cuff is placed 1-2 cm above the elbow on the respondent's arm, then the stethoscope is placed on the pulse that is felt to be strong. Make sure the valve on the balloon is closed and then pump the balloon until the cuff can hold blood flow and is no longer heard while listening to the heart rate through the stethoscope. Then the pressure is read on the scale indicated on the gauge [15]. Figure 2 Shows the procedure.

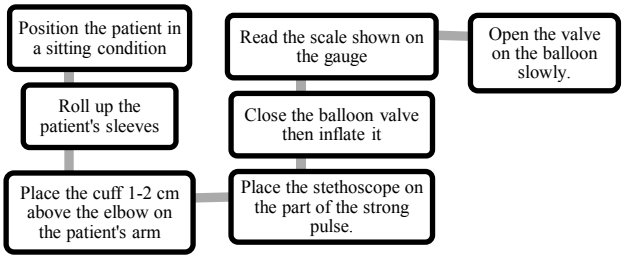

FIGURE 2. Flow chart of Blood Pressure Examination Procedure. System flow chart to detect blood pressure using a Spygmomanometer aneroid and stethoscope

F. DATA ANALYSIS PROCEDURE

The data obtained were carried out by the Shapiro-Wilk normality test. Then the Spearman correlation statistical test (r-Spearman) was conducted to determine the correlation between CO levels in the air with HbCO levels, hemoglobin, and blood pressure on street vendors in the Gading Fajar Sidoarjo Street Vendor Area. Figure 3 shows the procedure.

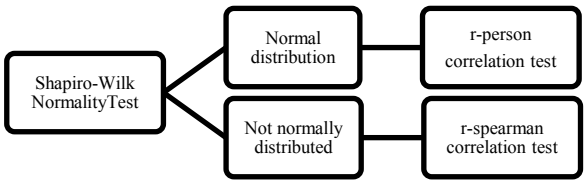

FIGURE 3. Data Analysis Procedure. The data analysis technique uses the Shapiro Wilk test, if the data is normally distributed then it is continued with the r-person test and vice versa.

III. RESULT

The study was conducted in Gading Fajar Sidoarjo with 25 respondents as street vendor workers. Respondents were selected in accordance with the criteria of the sample, which has been working for at least 1 year, aged 35-45 years, male gender, not in a state of illness, and willing to be respondents to the study. Respondents' characteristics will be grouped according to the length of working hours in a day, smoking habits, health complaints, and the use of masks.

TABLE 1
Characteristics of Respondents by Hour of Work. Of the 25 respondents, there are 19 people who have working hours in accordance with the provisions, namely working for 6-8 hours/day.

Hour of Work (hour/day)	Frequency	Percentage (%)
6-8	19	76
>8	6	24
Total	25	100

Table 1 shows the highest percentage of working hours (76%) obtained from the group of traders who have a working time of 6-8 hours/day. While the lowest percentage of Working Time (24%) from the group of traders who have a working period of more than 8 hours/day.

TABLE 2
Characteristics of Respondents by Smoking Habits. All respondents of this study is male and categorized as active and passive smokers.

Smoking Habits	Frequency	Percentage (%)
Yes	15	60
No	10	40
Total	25	100

Based on the results of the questionnaire, in table 2 it can be seen that the distribution of smoking habits of the most respondents with a total of 15 traders (60%). While the other 10 traders (40%) do not have a smoking habit.

Based on the results in table 3 shows (52%) respondents do not have health complaints at work. While the rest experienced health complaints in the form of dizziness and headaches, weakness, and dizzy eyes.

TABLE 3
Characteristics of Respondents by Health Complaint. Health complaints experienced by 12 respondents while working include Dizzy, Weak, and Dizzy eyes

Health Complaints	Frequency	Percentage (%)
Dizzy	4	16
Weak	5	20
Dizzy eyes	3	12
No health complaints	13	52
Total	25	100

TABLE 4
Characteristics of Respondents by Use of Masks. Masks are one of the protections when on the road, as many as 15 traders wear masks.

Use of Mask	Frequency	Percentage (%)
Yes	15	60
No	10	40
Total	25	100

TABLE 5
Results of Air CO Level

Day	Location	Air CO level (ppm)	Temperature (°C)	Description
Monday	**Point 1**	18.00	38.0	Normal
	Point 2	12.00	38.1	Normal
	Point 3	10.00	38.1	Normal
Average		13.33	38.0	Normal
Wednesday	**Point 1**	16.00	38.1	Normal
	Point 2	9.00	38.1	Normal
	Point 3	8.00	38.1	Normal
Average		11.00	38.1	Normal

Notes:
Point 1 : coffee shop intersection **Point 3** : in front of State High School 2 Sidoarjo
Point 2 : fountain circle

Table 4 shows that (60%) street vendors use masks while working. The remaining (40%) do not wear masks at work. Air CO sampling in the Gading Fajar Sidoarjo PKL Center Area using a CO Analyzer. This measurement is carried out continuously from time to time at 3 points for 2 times (Monday and Wednesday) in a week. The results of air measurements of carbon monoxide parameters carried out in the Gading Fajar Sidoarjo Street Vendor Area can be seen in Table 5. Examination of Air CO samples was carried out in 3 sectors representing a dense area of street vendors who sell so often resulting in congestion. Air CO measurements were carried out in the morning until noon in cloudy sunny weather conditions with an average air temperature of 38,1°C. The highest level was obtained on Monday at Point 1 is 18.00 ppm and the lowest result was obtained on Wednesday at Point 3 is 8.00 ppm. Then the results of all laboratory tests can be seen in table 6.

TABLE 6
Examination results of HbCO, Hemoglobin, and Blood Pressure Level

No.	SC	HbCO level (%)	Hb level (g/dL)	BP (mmHg)	
				S	D
1.	016	0.00	17.4	110	70
2.	021	0.00	15.1	120	80
3.	023	0.00	14.8	110	70
4.	024	0.00	14.4	170	90
5.	007	0.22	14.0	110	70
6.	002	0.32	13.2	120	80
7.	011	0.36	15.1	130	80
8.	020	0.46	13.9	105	70
9.	014	0.52	15.1	160	90
10.	017	0.55	14.3	170	90
11.	006	0.57	13.8	130	80
12.	025	0.59	12.9	140	90
13.	001	0.68	13.7	130	80
14.	012	0.74	14.4	110	70
15.	008	0.75	14.2	120	80
16.	019	0.75	14.7	120	80

17.	015	0.93	15.5	110	70
18.	022	1.18	13.6	140	80
19.	018	1.38	15.2	120	80
20.	003	1.42	14.6	125	80
21.	010	1.42	13.4	130	80
22.	005	1.72	15.9	150	90
23.	006	1.86	13.8	110	70
24.	004	2.53	13.1	130	80
25.	009	2.93	14.5	140	90

Notes:
SC = Sample code **S** = Systolic
Hb = Hemoglobin **D** = Diastolic
BP = Blood Pressure

The outcome of the examination in table 6 show that the highest levels of HbCO obtained results of 2.93% in the sample code 009, while the lowest levels occurred in 4 respondents in the sample code 016, 021 023, 024 with the results of 0.00%. On examination of hemoglobin found 1 respondent with the highest levels of 17.4 g/dL with sample code 016, while the lowest levels obtained the results of 12.9 g/dL with sample code 025. The results of blood pressure checks found high blood pressure values as many as 7 respondents in the sample code 005, 009, 014, 017, 022, 024, 025 with a value that exceeds the normal limit, which is >139/80 mmHg, while the lowest levels obtained results of 105/70 in the sample code 020.

All examination data followed normality test using Shapiro-Wilk and obtained the results of the data is not normally distributed. Then do spearman correlation test which aims to determine the level of strength of the relationship between variables by looking at the value of correlation coefficient (r) and the direction of the linear relationship. If the correlation coefficient value is positive, it means that the relationship between the two variables is unidirectional, but if the correlation coefficient value is negative, the relationship between the two variables is opposite.

TABLE 7
Correlation Coefficient Value of air CO levels with HbCO levels, Hemoglobin, and Blood Pressure

Variabel	Air CO Level		Correlation Rate
	Value of Sig. (2-tailed)	*Correlation Coefficient* (r)	
HbCO	0.034	0.426	Moderate positive
Hemoglobin	0.021	-0.142	Weak negative
Systolic blood pressure	0.003	0.178	Weak positive
Diastolic blood pressure	0.002	0.141	Weak positive

Table 7 shows spearman correlation test between CO levels in the air with HbCO levels obtained Sig values. (2-tailed) of 0.034 (α <0.05) and the correlation coefficient of 0.426. The value indicates the strength of moderate positive correlation between air CO levels with HbCO levels, which means that the higher the air CO levels the higher the HbCO levels in the blood.

The correlation test between air CO levels with hemoglobin obtained Sig values. (2-tailed) of 0.021 (α<0.05) and the correlation coefficient of -0.142. The value indicates that there is a significant correlation between air CO levels with hemoglobin levels with a weak negative correlation direction.

Correlation test between air CO levels with blood pressure obtained Sig value. (2-tailed) of 0.003 (α<0.05) and the correlation coefficient of 0.178. Correlation of air CO levels with systolic blood pressure while the correlation between Air CO with diastolic blood pressure obtained Sig values. (2-tailed) of 0.002 (α<0.05) and the correlation coefficient of 0.141.

IV. DISCUSSION

In this research, the respondents were 25 street vendors in the Gading Fajar PKL Center Area who were willing to have their blood drawn for examination of HbCO, hemoglobin, and blood pressure levels with a range of 35-45 years of age. The selection of respondents of the same sex, namely men, is intended to obtain the characteristics of the same respondents. This is due to differences in hemoglobin levels and blood pressure in men and women. While the air CO sample examination was carried out in the Gading Fajar Sidoarjo from morning to noon in cloudy sunny conditions with an average air temperature of 38.1°C.

Air CO sampling using the CO Analyzer Smart Sensor tool. Measurements were carried out continuously from time to time to see variations in concentration on different days. The average results of air CO levels on Monday are 13.33 ppm and on Wednesday are 11.00 ppm. The measurement of the highest air CO levels is carried out in sectors that represent densely populated areas of street vendors who sell so that it often results in congestion due to the increasing volume of motorized vehicles in the area with narrow road width conditions. From the 3 measurement points, all the results obtained meet the quality standard according to Permenakertrans Number 13 of 2011 [16], which is <25 ppm. The low level of CO in the air in the Gading Fajar Sidoarjo can be caused by the measurement time during the day where the number of vehicles decreases, resulting in low vehicle exhaust gas and a large area of land. The factor of sunny cloudy weather at the time of sampling can also result in high air temperatures and air volume/particles being more tenuous, causing the concentration of CO in the air to be lower [17].

HbCO examination using an UV-Visible Spectrofotometer. UV-Vis spectrophotometry is a measurement of the intensity of ultraviolet light and visible

light absorbed by sample measured at a certain wavelength [18]. HbCO examination divided into 2 stages, namely the stage pre-incubation and post-incubation. Pre-incubation, this stage is filling the solution with 3 different reagents on each Conway partition. Partition A contains CO_2-free aquadest and blood, partition B contains H_2SO_4 5 N, and partition C contains $PdCl_2$ 0.005 N which is then homogenized and incubated for 1 hour. The reagent H_2SO_4 5 N will release CO from the blood and reacted with $PdCl_2$ (CO gas will be reduced to CO_2 and Pd_2^+ oxidized to Pd metal) [19]. Then the stage post-incubation, this stage is absorbance readings with $PdCl_2$ solution results are reacted with 5% KI solution to produce color I_2 and form a color which is then measured by the intensity of the UV-Visible Spectrophotometer at a maximum wavelength of 420 nm. By using a standard solution can be known I_2 concentration equivalent to $PdCl_2$ and CO [20].

HbCO is a biological marker when humans are exposed to carbon monoxide. When carbon monoxide is inhaled, in the human body the position of O_2 will be replaced by CO and increases, where CO is easier to bind to hemoglobin than O_2 [21]. Based on table 7, the value indicates the strength of moderate positive correlation between air CO levels with HbCO levels. These results are in line with the research [22], which states there is a significant correlation between exposure to CO gas with blood COHb levels in automotive repair mechanics in Malang with a strong positive correlation amount of 0.593. From table 6 the highest HbCO levels of 2.93% sample code 009, the levels are still within the limits of normal HbCO levels according to Permenkes 2016 [23], <3.5%. The lowest level of 0.00% with sample code 016, 021, 023, 024. A 0.00% level indicates in the respondent's body contains CO gas but with very low levels. Based on the results of the questionnaire, factors that can affect the results are passive smoking habits, the use of mouth masks while working according to the procedure and the respondents did not experience symptoms due to exposure to CO gas. From the interview, 2 of the respondents also apply a healthy lifestyle by exercising.

Hemoglobin is a protein compound that plays an important role in transporting oxygen throughout the body [24]. Hemoglobin examination in this study using a hematology analyzer uses a blood sample with an EDTA anticoagulant. The function of EDTA anticoagulants is intended to prevent blood clots and hemolysis from occurring [25]. The pre-analytical stage that needs to be considered in hemoglobin examination is to homogenize the blood with anticoagulants first so that it is mixed and accurate results are obtained. In table 7 the value indicates that there is a significant correlation between air CO levels with hemoglobin levels with a weak negative correlation direction. This is inversely proportional to the research of [26], which states that there is a correlation with a strong positive correlation between carboxyhemoglobin (HbCO) levels to hemoglobin and hematocrit levels in active smokers with a correlation value of 0.783. Negative correlation means that the correlation runs in the opposite direction which indicates if the air CO levels are high then the hemoglobin level decreases. Decreased hemoglobin levels can be caused due to the influence of HbCO levels in the body resulting in an increase in the hormone Erythropoietin [27]. Erythropoietin hormone is a glycoprotein that functions to regulate the production of erythrocyte cells as an erythropoetic reaction due to decreased tissue oxygenase or hypoxia [28]. One of the symptoms when inhaling CO gas is to experience a decrease in oxygen availability throughout the body tissues or hypoxia, hypoxia can cause hemoglobin levels to decrease. In the results of the questionnaire, several respondents experienced health complaints in the form of dizziness and weakness. These complaints can be a contributing factor because one of the symptoms when the hemoglobin level is low is easily tired, the body feels weak, and the head is dizzy [29].

Blood pressure checks were carried out before blood sampling, respondent were instructed to stop physical activity for 5 minutes before the examination was carried out. The purpose of stopping physical activity is for the body to relax so that it does not affect the measurement results. Based on the results of the study, there are 7 respondents (28%) have blood pressure above normal values. From the interview results, (48%) respondents felt health complaints such as dizziness, yellowing of the eyes, and feeling weak during and after work. It is possible that the complaints experienced by respondents is one of the symptoms of hypertension in the form of headaches, vertigo, fatigue, and blurred vision. Pathophysiology of carbon monoxide gas poisoning is when inhaled CO gas will enter the lungs, then flow into the alveoli, and into the bloodstream. Increased concentration of HbCO in the blood leads to increased blood viscosity which promotes blood clotting and vasoconstriction or narrowing of blood vessels [30]. Vasoconstriction of blood vessels causes the blood can not function properly to transport oxygen to the tissues of the body, causing hypoxia [31]. Hypoxia risks increasing heart rate, systolic blood pressure, and cardiac output.

Based on the results of the study, the levels of air CO, HbCO, hemoglobin, and blood pressure are within normal limits and have a correlation on each other. This can be viewed from the characteristics of respondents such as factors of time work, smoking habits, health complaints, and the use of masks. The factor of long work or operating hours of traders selling is one of the most important factors to determine how long the street vendors are on the highway that can cause exposure to CO gas in a longer period of time. A total of (76%) street vendors sell for 6-8 hours/day with a working duration of 5-6 days a week. The Working time is in accordance with Law of the Republic of Indonesia No. 11 of 2020 on Job Creation [32]. Then the factor of smoking habits, as many as 14 traders (56%) are active smokers. CO gas not only comes from the exhaust emissions of motor vehicles but also comes from cigarettes and cigarette smoke. In active smokers, HbCO levels can increase by 4-15%

because cigarettes contain CO gas. In terms of health complaint factors, (52%) street vendors do not experience symptoms of being exposed to CO gas while working. Furthermore, the factor of using masks, (60%) traders use mouth masks while working. Most traders use masks the right way. Mouth masks as a preventive effort to ward off air pollution from motor vehicle fumes, cigarette smoke, and dust so that not many toxic gases enter the human body.So that the discussion does not deviate from the research objectives, this research has problem limitations including; the examination was carried out on street vendors with inclusion criteria, the sample used was the blood of street vendors, and the examination of air CO levels was carried out on Gading Fajar Street. High CO levels in the air can affect the results of HbCO levels in the blood. In the results of the research, CO levels in the air had normal results as well as HbCO, hemoglobin, and blood pressure levels also tended to be normal. If the CO level in the air is high, the HbCO level and blood pressure are also high, but the hemoglobin level is low.

V. CONCLUSION

This research aims to analyze the relationship between CO levels in the air and HbCO, hemoglobin, and blood pressure levels in street vendors in the Gading Fajar Sidoarjo street vendor area. Based on the results of research and discussion on the examination of levels of Air CO, HbCO, hemoglobin, and blood pressure on street vendors in the Gading Fajar Sidoarjo street vendors area can be drawn some conclusions as follows: The values of the range of CO levels in the air were 11.00 ppm and 13.3 ppm with the highest values occurring at measurement point 1; The value of the range of HbCO levels in the blood of street vendors was 0.87%; It was found that the hemoglobin level in the blood of street vendors was 14.4 g/dL; The value of the range of systolic blood pressure levels at street vendors is 128 mmHg and the average diastolic blood pressure level is 80 mmHg; There is a significant relationship between air CO levels with HbCO, hemoglobin, and blood pressure levels in street vendors in the Gading Fajar Sidoarjo street vendors area. There are suggestions for further researchers, which are expected to further develop this research by linking factors that affect HbCO levels, hemoglobin and blood pressure such as gender, disease history, incidence of anemia, hypertension, and cardiovascular disorders.

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