The Relationship Between Smoking Habits and CO Levels of Adolescents in Middle Schools in Cinere District, Depok City, West Java, 2023

Silmy Kaaffah✉[1), Raden Putri Annisya Affriany Praasetyo[1)

[1] UPTD Puskesmas Cinere, Kota Depok, Dinas Kesehatan Kota Depok, Jl. Cinere Raya no.30, Cinere, Kota Depok, 16514
✉Email: silmykffh@gmail.com

ABSTRACT

Background: Smoking is one of the highest risk factors for non-communicable diseases. Cigarettes Contain various dangerous substances, one of which is Carbon Monoxide (CO) which can cause multiple diseases of the lungs, heart, and other organs. The number of adolescent smokers has increased from 2014 to 2019. Riskesdas data in 2018 also shows that smokers start smoking at the age of 15-19 years. Aims: This study examines the relationship between smoking habits in adolescents aged 12-19 years in 16 secondary schools in the Cinere District, Depok City, West Java. Method: This is a cross-sectional study of 486 samples using a random sampling method. Data on smoking habits were analyzed descriptively and its relationship with CO levels was analyzed using the Kruskal-Wall Test. Result: Studies show that 51.9% of teenagers have never smoked, 18.6% of teenagers have tried smoking, 14.9% of teenagers smoke occasionally and 14.7% of teenagers smoke every day. 69.81% of teenage smokers smoke using conventional cigarettes, 14.1% use electronic cigarettes, and 16.1% use both. The average number of cigarettes smoked was 19 cigarettes per week. The average teenage smoker starts smoking at the age of 13 years and has been smoking for 31 months. The reason teenagers smoke is because of curiosity at 50.8% and being invited by friends at 46.6%. The presence of family members at home who smoke reaches 71.9% and there is a significant relationship between the presence of family members at home smoking and smoking habits among students. The Kruskal-Wall Test between smoking habits and CO levels produces a P-value of 0.001. Conclusion: It can be concluded that there is a significant relationship between smoking habits and CO levels in teenagers in secondary schools in the Cinere District area in 2023.

Keywords: Smoking habits, CO Levels, adolescent, student, electronic cigarette.

INTRODUCTION

Smoking can cause diseases and disabilities and harm almost every organ in the human body. According to the 2018 Riskesdas data, smoking is the second highest contributing factor to non-communicable diseases. Smoking can lead to various diseases such as heart disease, chronic obstructive pulmonary disease, and even cancer (CDC, 2023).

WHO data from 2023 indicates that at least 38 million adolescents aged 13-15 are tobacco users, with the Southeast Asia region having the highest number of adolescent smokers, accounting for 48% of the total adolescent smokers. The 2023 Indonesian Health Survey reported that the percentage of smokers aged 10-18 in Indonesia reached 27.02% of the

population. Meanwhile, the number of adolescent smokers in West Java increased from 10.62% in 2018 (Riskesdas, 2018) to 11.1% in 2023 (Indonesian Health Survey, 2023). The 2019 Global Youth Tobacco Survey stated that 19.2% of students in Indonesia used tobacco products. Additionally, the 2023 Riskesdas data indicated that 74.9% of smokers in Indonesia started smoking between the ages of 10-19.

Adolescence is a transitional phase from childhood to adulthood. During this period, adolescents undergo mental and social growth and development, from thinking patterns to decision-making. In the middle adolescence stage, individuals reach the peak of puberty, where they

begin to distance themselves from their parents and strive for independence to achieve autonomy. Peers play a central role in the developmental process toward adulthood (Park, 2011). Peer influence is related to smoking behavior among adolescents; those influenced by their peers are 88.17% more likely to smoke compared to those not influenced by their peers' smoking behavior (Azzahra, 2022). Therefore, smoking prevention efforts for adolescents need to be initiated early.

Cigarettes contain many harmful substances, one of which is Carbon Monoxide (CO). When someone inhales cigarette smoke, the body absorbs carbon monoxide through the lungs. The level of CO present during exhalation can be measured to determine a person's smoking status. Many researchers use CO measurements to assess tobacco exposure among smokers because it is a simple method to perform. The exhaled air CO levels in smokers are higher compared to non-smokers (Inayatillah, 2014). By measuring CO levels, an adolescent smoker can become aware of the CO exposure in their body, which may influence their future smoking behavior decisions.

The aim of this study is to describe smoking habits, including frequency of smoking, reasons for smoking, the number of cigarettes smoked, the types of cigarettes used, family members who smoke, and the age at which smoking began. Additionally, the study seeks to examine the relationship between smoking habits and CO levels in adolescents at 16 secondary schools in the Cinere District in 2023. The benefits of this research are expected to provide a data foundation for the Smoking Cessation Program in the Cinere District.

METHODS

This research is a cross-sectional study conducted from July to September 2023 on 486 students from 16 secondary schools, consisting of 8 high schools and 8 junior high schools. The sampling technique used was simple random sampling, targeting students from grades 7 to 12 who were in good health. Primary data collection was carried out through interviews about students' smoking habits and by measuring CO levels using a CO Analyzer device, specifically the Micro Smokerlyzer from Bedfont. Students measured for CO levels were instructed to inhale for 10 seconds and then exhale into the device, which then displayed their CO levels.

The questionnaire used in the study is the School-Aged Children's Smoking Behavior Screening Questionnaire, sourced from the Ministry of Health of the Republic of Indonesia in 2023. The questionnaire consists of six sections: screening location information, respondent identity, knowledge about smoking, sources of exposure to smoking behavior, CO level measurement, and a description of smoking habits. The smoking habits section includes questions on how often they smoke, the number of cigarettes smoked, types of cigarettes used, age of smoking initiation, reasons for smoking, duration of smoking, and whether there is a desire to quit smoking.

Analysis was conducted using IBM SPSS Statistics 27 software to examine the description of smoking habits and their relationship with CO levels in students' bodies. The relationship between smoking habits and CO levels was analyzed using the Kruskal-Wallis test. This non-parametric test is suitable for analyzing relationships between categorical variables (such as smoking habits) and continuous variables (such as CO levels) when the assumptions of parametric tests are not met. The Kruskal-Wallis test assesses whether there are statistically significant differences in CO levels across different categories of smoking habits.

RESULTS AND DISCUSSION

Table 1. Characteristic Sample

Characteristic	N	%
Sex		
Man	446	90.3 %
Woman	38	7.7 %
Educational Level		
Senior High School	253	51.2 %
Junior High School	231	46.8 %
Family Member smoke		
Yes	348	71.9 %
No	136	28.1 %
Knowledge about the dangers of smoking		
Yes	482	99.6 %
No	4	0.4%
Smoking Habit		
Never	251	51.9 %
Have tried	90	18.6 %
Occasionally	72	14.9 %
Everyday	71	14.7 %

Type of Cigarette		
Conventional	91	63.6 %
Electric	21	14.7 %
Both of them	31	21.7 %
Reason of Smoking		
Curious	76	53.1 %
Peef influence	63	44.1 %
Family influence	4	2.8 %
Plan to Quit Smoking		
Yes	128	89.5 %
No	15	10.5 %

Table 1 shows that the respondents were predominantly male, accounting for 90.3%. In terms of educational levels, there is a balance between students from junior high school and senior high school, with 51.2% and 46.8%, respectively.

The family members of the respondents who smoke reached 71.9%, and there is a significant relationship between having family members who smoke and smoking habits among students (P-value <0.001). This aligns with research conducted by Vrinten in 2022, which stated that adolescents whose caregivers smoked when they were 14 years old were more than twice as likely to smoke compared to those whose caregivers did not smoke.

Out of 486 respondents, the smoking habits are as follows: 251 respondents (51.9%) have never tried smoking, 90 respondents (18.6%) have tried smoking before, 72 respondents (14.9%) smoke occasionally, and 71 respondents (14.7%) smoke every day.

Out of 143 respondents who smoke, 63.6% of them smoke conventional cigarettes, 14.7% smoke electronic cigarettes, and 21.7% use both. The National Youth Tobacco Survey in 2018 depicted an increase in the use of electronic cigarettes among adolescents in the United States. The prevalence of electronic cigarette use in Indonesia has also significantly increased from 0.2% in 2011 to 3% in 2021 (Global Adult Tobacco Survey, 2011 and 2021). A study by the Indonesian Youth Council for Tobacco Control in 2022 stated that most young people use electronic cigarettes to follow trends and appear cool in social circles.

The reason respondents start smoking is predominantly due to curiosity and peer influence, which aligns with a study by Anjum in 2016 stating that 75-94% of adolescents agree that smoking habits are caused by curiosity, and 84% of adolescents agree that smoking habits start due to peer influence. Another study by Almaidah in 2021 in Surabaya also stated that the highest reason adolescents smoke is curiosity. Adolescents have a high level of curiosity, so they want to try new things even though they are aware that smoking has dangerous health consequences.

89.5% of smoker respondents express a desire to quit smoking. In previous research, Sulastri in 2018 also stated that most smokers want to quit smoking but face difficulties due to addiction to cigarettes. The majority (99.6%) of respondents are aware of the negative health impacts of smoking, yet they still struggle to quit. Therefore, it is necessary to provide professional assistance to smokers, especially adolescent smokers, to access smoking cessation counseling at the nearest healthcare facilities.

Table 2. Overview of Smoking Habits

No	Variable	Mean	Min	Max	Sd
1	Age	15.11	12	19	1.362
2	Age of Starting Smoking	12.85	7	16	1.989
3	Number of cigarette (Per Week)	19.13	1	252	29.096
4	During smoking (in Month)	31.56	1	108	22.546
5	Co Level (ppm)	0.8	0	17	2.078

Table 2 presents an overview of smoking habits among respondent students, with a mean age of respondents being 15.11 years old. The average age of smoking initiation among smoker respondents is 12.85 years or 13 years old, with the youngest age of smoking initiation being 7 years old and the oldest being 16 years old.

The CO level test was conducted on 383 respondents who were willing to undergo the CO test, both smokers and non-smokers, with an average result of 0.8 ppm, a minimum value of 0 ppm, and a maximum value of 17 ppm. Respondents who obtained a value of 17 ppm admitted to having smoked in the morning just before the CO level test was conducted. This finding is consistent with research by Zhang in 2013, where the average CO levels substantially increased with the

number of cigarettes smoked in the previous hour or day. The closer the time of measurement to the time of smoking, the higher the CO levels in an individual.

The study conducted by Sitorus in 2018 also found that the longer the CO levels are measured in the lungs of smokers, the lower their CO levels. Therefore, even if someone smokes, if the CO check is performed after a long period without smoking, the CO levels will be lower. Another study by Hilyah in 2021 states that the longer someone smokes, the longer they are exposed to CO from cigarette smoke, and the amount of cigarette smoke inhaled increases, leading to higher CO levels.

Table 3. Relationship Between Habitual Smoking with Co Level

	CO Analyzer
Kruskal-Wallis H	18.059
Df	3
Aaymp.Sig	0.001

Table 3 depicts the results of the Kruskal-Wallis Test between Smoking Habits and CO Level test, resulting in a P-value of 0.001. Thus, it can be concluded that there is a significant relationship between Smoking Habits and CO Levels among adolescents in Secondary Schools in the Cinere District in 2023. Research by Julie Amaliah in 2023 also shows the same, indicating a relationship between smoking, CO levels, and PEFR Value. High CO levels are influenced by the duration of smoking. Environmental factors also affect an individual's CO levels, as they may be exposed to CO gas from smoking parents or family members.

Furthermore, research by Putri in 2018 provides similar results, indicating a correlation between the amount of cigarette consumption and CO levels among adolescent smokers in Vocational High Schools in Jambi City. This finding could serve as a recommendation to strengthen the implementation of smoking cessation efforts targeting adolescent students, especially at the senior high school level. By actively reaching out to them, it is hoped that the implementation of smoking cessation efforts will increase.

This study has several limitations. Firstly, it is a cross-sectional study, where CO levels were observed and measured only at one point in time, thus not capturing changes in CO levels before and after smoking. Additionally, environmental factors such as living conditions or exposure to vehicle exhaust were not considered, which could contribute to high CO levels.

CONCLUSION

Based on research, it was found that 29.6% of high school respondents in Cinere are smokers, either occasionally or daily. The average CO level among respondents is 0.8 ppm, and according to the Kruskal-Wallis analysis, there is a relationship between smoking habits and CO levels among adolescents in the Cinere District with a p-value < 0.001. This research result is also consistent with previous studies that state CO levels in smokers are higher compared to non-smokers, indicating that CO levels are related to an individual's smoking habits.

The results of this study can be part of advocacy efforts at the cross-sectoral level to enhance the monitoring of smoke-free areas in educational settings. Additionally, efforts to encourage smoking cessation can be carried out by partnering with high schools in the Cinere area to conduct regular CO-level checks on high school students to identify those who wish to quit smoking.

REFERENCES

Almaidah, Fitri dkk. 2021. *Survey Faktor Penyebab Perokok Remaja Mempertahankan Perilaku Merokok.* Jurnal Farmasi Komunitas Vol. 8, No: 1, (2021) 20-26.

Amaliah, Julie, 2023. *Correlation of Smoking with Carbon Monoxide Level and Peak Respiratory Flow Rate in High School Students Banda Aceh.* Jurnal Respirol Indonesia Vol 3 No.3: 204-9.

Anjum, Misshakeel etc. 2016. *Reason for Smoking among the teenagers of age 14-17 years in Vikarabad town: A Cross-sectional Study.*

Aryanti, Puspita Ayu, 2019.Perbedaan Kadar CO Udara Ekspirasi pada Pelajar Perokok Aktif dan Pasif. Skripsi Thesis Universitas Airlangga.

Azzahra, Karimah. 2022. *Factors Related to Smoking Behavior in High School*

Adolescents in Al Hasra in 2022. Proceeding the Second Muhammadyah Internasional Public Health and Medicine Conference. Volume II Number I, 2022.

Center for Disease Control and Prevention, 2023. *Smoking & Tobacco Use.*

Hilyah, Risa Apriyani, 2021. *Hubungan Antara Kebiasaan Merokok dengan Kadar Karbon Monoksida (CO) Perokok.* Jurnal Ilmiah Farmasi Farmasyifa 4(1):1-5.

Iin Rahmania Inayatillah. 2014, *Kadar Karbon Monoksida Udara Ekspirasi pada Perokok dan Bukan Perokok Serta Faktor-Faktor yang Mempengaruhi.* Fakultas Kedokteran Universitas Indonesia.

Indonesian Youth Council for Tobacco Control, 2022. *Full Report Rokok Elektronik: Baju Baru Bisnis Adiktif.*

Kementrian Kesehatan Republik Indonesia, Riset Kesehatan Dasar Tahun 2018.

Kementrian Kesehatan Republik Indoensia. 2023. *Survey Kesehatan Indonesia tahun 2023.*

Lestari, Sari Arie etc. 2021. *Carbon Content in Home with Carboxyhemoglobin (COHb) in Active Smoking in III Environment, Keramaya, Kendari City.* Indonesian Journal of Health Science Research and Development Vol.3 No.1 March 2021. DOI: 10.36566/ijhsrd/Vol3.Iss1/69

Merianos, Ashley L etc. Screening, *Counseling and Health Care Utilization Among National Sample of Adolescent Semokers.* 2020. Clin Pediatr (Phila) 2020 May;59(4-5):467-475. doi: 10.1177/0009922820905875.

Muharry, Andy dkk. 2021. *Perilaku Merokok dan Keberadaan Perokok di Lingkungan dengan Kadar Karbon Monoksida pada Pelajar di Kabupaten Indramayu.* Jurnal Ilmu Kesehatan Bakti Husada Science Journal Vol.12 No. 02, Desember 2021. DOI: 10.34305/JIKBH.V12I2.326

Park, Sang-hee, 2011. *Smoking and Adolescent Health.* Korean J Pediatri 2011;54(10):401-404.

Putri, Miko Eka. 2018. *Korelasi Jumlah Batang Rokok dengan Kadar CO pada Remaja Perokok di SMK Kota Jambi.* Jurnal; Akademika Baiturrahim, Jambi Vol.7 No.2, September 2018.

Sitorus, Rico Januar. 2021, The *Effect of Smoking on Carbon Monoxide Respiration among Active Smokers in Palembang City, Indonesia.* Jurnal Kesehatan Masyarakat Nasional, 2021: 16 (2): 108-112.

Sulastri, dkk. 2018. *Keinginan Berhenti Merokok pada Pelajar Perokok Berdasarkan Global Youth Tobacco Survey di SMK Negeri Kota Padang.* Jurnal Kesehatan Andalas, 2018; 7(2).

Vancelik, Serhat. 2009, *Interactions between exhaled CO, smoking status and nicotine dependency in a sample of Turkish adolescents. The Turkish Journal of Pediatrics 2009; 51: 56-64.*

Vrinten, Charlotte etc. 2022. *Risk Factor for Adolescent Smoking Uptake: Analysis of Prospective Data from the UK Millenium Cohort Study.* Tobacco Inducted Disease, 2022;20(October):83.

World Health Organization, Global Adult Tobacco Survey, 2021. *Indonesia Comparison Information Sheet 2011 & 2021.*

World Health Organization. 2023. *Global Report on Trends in Prevalence of Tobacco Use* 2000-2025 Fourth edition.

Zang, Quili, etc. 2013. *Exhale carbon monoxide and its associations with smoking, indoor household air pollution and chronic respiratory diseases among 512,000 Chinese Adults.* International Journal of Epidemiology 2013: 42:1464–1475.