Applied Nursing Journal of Indonesia
Vol. 3, No. 1, April 2025
https://e-journal.aipviki.org/

THE RELATIONSHIP BETWEEN SMOKING AND SPO_2 EXAMINATION RESULTS AMONG MANUAL LABORERS AT PT X, KEDIRI

Yitno[1*], Aesthetica Islamy[2], Lasman[3]

1,2,3 Bachelor Degree of Nursing in STIKES Hutama Abdi Husada Tulungagung

Article History
Received : January 2025
Revised :
Published : April 2025

Contact
yitno@stikestulungagung.ac.id

Keywords
Smoking Behavior, Oxygen Saturation, SpO_2, Manual Labor Workers

ABSTRACT

Introduction
Smoking is a major public health problem that can affect oxygen transport in the body due to carbon monoxide exposure, which reduces hemoglobin's ability to bind oxygen. This condition may lead to decreased oxygen saturation (SpO_2), especially in workers who rely on physical strength such as manual laborers. This study aimed to determine the relationship between smoking behavior and SpO_2 levels among manual labor workers at PT X Kediri.

Method
This study used a quantitative approach with a cross-sectional design. A total of 44 respondents were selected using quota sampling. Data were collected using questionnaires for smoking behavior and pulse oximetry for measuring SpO_2 levels. Data analysis was performed using the Independent t-test.

Result
The average SpO_2 level in non-smokers was 98.23%, while in smokers it was 97.27%. Most smokers (90.9%) had normal SpO_2 levels, although some (9.1%) showed decreased values. Statistical analysis showed a significant relationship between smoking behavior and SpO_2 levels ($p = 0.035$; $p < 0.05$).

Conclusion
There is a significant relationship between smoking and oxygen saturation levels. Smoking behavior can decrease SpO_2 levels among manual labor workers. It is recommended that workers reduce or stop smoking to maintain optimal health and work performance.

INTRODUCTION

Smoking is a major public health problem at both national and global levels that continues to increase within society due to the difficulty of controlling it, given the many interrelated contributing factors. Cigarettes include clove cigarettes, white cigarettes, cigars, and other forms derived from *Nicotiana tabacum*, *Nicotiana rustica*, other species, or their synthetic products. Each cigarette contains various harmful chemical substances, such as carbon monoxide (CO), carbon dioxide (CO_2), hydrogen cyanide, ammonia, nitrogen oxides, hydrocarbon compounds, tar, nicotine, benzo[a]pyrene, phenol, and cadmium (Almaududy, 2017) .

Despite the wide-ranging negative effects of smoking-including addiction, health problems, and even death and the many warnings that have been promoted, public awareness to quit smoking remains low. Therefore, May 31 is commemorated as World No Tobacco Day (WNTD) as a form of opposition to tobacco use as the main ingredient in cigarettes, while also encouraging smokers to abstain from smoking for 24 hours simultaneously.

The Global Adult Tobacco Survey (GATS) estimates that there are currently approximately 7.9 billion adult active smokers worldwide, with an additional 3.5 billion individuals exposed to secondhand smoke in the workplace . Indonesia ranks second globally in smoking prevalence at 33%, following Russia at 35% (WHO, 2012). According to The ASEAN Tobacco Control Report, Indonesia holds the highest position in Southeast Asia, with a smoking prevalence of 51.11%, far exceeding neighboring countries, which generally do not exceed 13%. This indicates the high prevalence of smoking in Indonesia (Kementrian Kesehatan RI, 2018).

Data from the National Socioeconomic Survey (Susenas), the Household Health Survey (SKRT), and the Basic Health Research (Riskesdas) show an increase in smoking prevalence among males and females aged ≥15 years, from 27% in 1995 to 36.3% in 2013. Among females, there was a significant fivefold increase, from 1.7% to 6.7% over the same period. Meanwhile, the Global Youth Tobacco Survey (GYTS) 2012 reported a smoking prevalence of 34.7% in Indonesia, consisting of 65.9% males and 4.2% females. Regionally, the highest proportion of daily smokers was found in the Riau Islands Province (27.2%), followed by East Java (23.9%), and the lowest in Papua (16.2%) (Kementrian Kesehatan RI, 2018).

Preliminary observations conducted by the researcher at PT X Kediri on November 2025, showed that out of 10 manual labor workers aged ≥20 years, 8 individuals (80%) were smokers and 2 individuals (20%) were non-smokers.

According to Billy Boseke (2019), individuals who consume more than one pack of cigarettes per day tend to have larger red blood cells compared to non-smokers. This condition represents the body's response to oxygen deficiency caused by carbon monoxide (CO) exposure, which reduces hemoglobin's affinity for oxygen. As a result, oxygen saturation levels in the blood may be impaired. Carbon monoxide is a toxic gas with a stronger binding affinity to hemoglobin than oxygen, thereby reducing the blood's ability to transport oxygen and leading to decreased SpO_2 levels.

Oxygen saturation is an indicator of the percentage of hemoglobin bound to oxygen (CDC, 2020). Normal oxygen saturation ranges from 96% to 100%, corresponding to a partial pressure of oxygen (PaO_2) of approximately 80–100 mmHg (Kiswanto & Chayati, 2022).

Chronic exposure to carbon monoxide through inhalation can affect blood oxygen levels. The gas enters the lungs, binds to hemoglobin, and is distributed throughout the body. In smokers, the average red blood cell mass is generally higher than in non-smokers as a compensatory mechanism. The resulting effects include decreased physical capacity, fatigue, irregular breathing patterns, and increased heart rate (Tri, 2015). In addition, the addictive substances in cigarettes can lead to various health disorders, including cardiovascular diseases, cancer, respiratory disorders, pregnancy complications, peptic ulcers, and osteoporosis (Sukesi, 2019).

These effects can significantly impact the activities of manual labor workers who rely on physical strength. Physical activity refers to any body movement produced by skeletal muscles that requires energy. The body maintains a

homeostatic mechanism, whereby increased energy demand requires a greater supply of oxygen (Bahroni, I., & Pratama, 2018) (Islamy, Aesthetica 2018).

Therefore, the smoking problem in Indonesia must be addressed comprehensively by all parties, including the government, communities, and families. Efforts can begin at the individual level, such as building motivation to quit smoking, avoiding smoking-related triggers, distancing from smoking environments, engaging in regular exercise, and substituting smoking urges with healthy foods or candies.

Efforts to control smoking aim to create a healthy and productive young generation. In national development, a workforce that is physically and mentally healthy, as well as competent, is essential. Optimal health conditions support the ability to think and work effectively.

Based on this background, the researcher is interested in further examining smoking habits and their impact on health, particularly the relationship between cigarette consumption and oxygen saturation (SpO_2) levels among manual labor workers. The objective of this study is to determine the relationship between smoking behavior and SpO_2 levels among manual labor workers at PT X Kediri in 2026.

METHOD

The research design serves as a general guideline for conducting a study, including the planning of data collection and analysis as well as the control of factors that may influence the results (Nursalam, 2019). This study employed a quantitative approach with a cross-sectional design, in which the independent and dependent variables were measured at the same point in time.

This study used primary data to analyze the relationship between smoking behavior and oxygen saturation (SpO_2) levels among manual labor workers at PT X Kediri in January 2026. A total of 44 samples were selected using a quota sampling technique. The data were processed and analyzed using the Independent t-test.

In this study, the independent variable was cigarette consumption, while the dependent variable was the SpO_2 measurement results, both collected simultaneously. Measurements were conducted using a pulse oximetry device. The objective of this study was to determine the relationship between smoking behavior and SpO_2 levels among manual labor workers at PT X Kediri in 2026.

RESULT

A. General data

1. Respondent Characteristics Based on Age

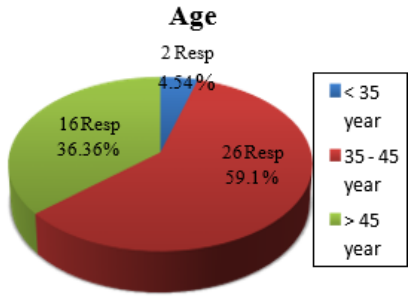

Diagram 1. Frequency distribution of respondents based on age at PT X Kediri, January 2026

Diagram 1 above shows that out of a total of 44 respondents, the majority were aged 35–45 years, totaling 26 individuals (59.10%).

2. Respondent Characteristics Based on Education

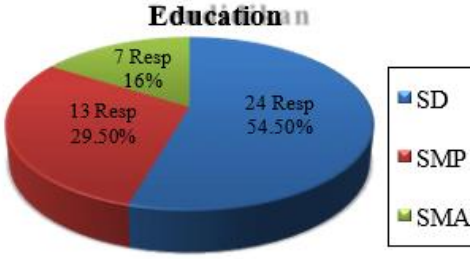

Diagram 2. Frequency distribution of respondents based on education at PT X Kediri, January 2026

Diagram 2 above shows that out of a total of 44 respondents, the majority had an elementary school (SD) education, totaling 24 individuals (54.50%).

B. Specific data

Table 1. Frequency distribution of SpO_2 measurement results among non-smoking manual labor workers at PT X Kediri 2026.

Smoking Activity	n	Min	Max	Mean	Sd
Non-Smoking	22	95	99	98,23	1,152

Based on Table 1, it can be interpreted that the respondents had an average SpO_2 value of 98.23. This average is slightly below the maximum score (the highest value recorded among respondents), which was 99. Based on the SpO_2 results, all 22 non-smoking manual labor workers (100%) had normal SpO_2 levels.

Table 2. Frequency distribution of SpO_2 measurement results among smoking manual labor workers at PT X Kediri in 2026.

Smoking Activity	n	Min	Max	Mean	Sd
Smoking	22	92	99	97,27	1,695

Based on Table 2, the respondents had an average SpO_2 value of 97.27. This average is notably below the maximum score recorded among respondents, which was 99. From the SpO_2 results, among 22 smoking manual labor workers, 20 respondents (90.9%) had normal SpO_2 levels, while 2 respondents (9.9%) had abnormal oxygen saturation levels.

Table 3. Distribution of respondents based on duration of smoking among manual labor workers at PT X Kediri in 2026.

	n	Min	Max	Mean	Sd
Duration of smoking	22	20	49	32,23	7,244

Based on Table 3, it can be concluded that the average duration of smoking among respondents was 32.23 years. This mean value is still considerably lower than the maximum value recorded among respondents, which was 49 years. All respondents in this study were smokers, totaling 22 individuals (100%), whose SpO_2 levels were subsequently analyzed.

Table 4. Distribution of respondents based on the number of cigarettes consumed per day

	n	Min	Max	Mean
Number of Cigarettes Consumed	22	6	12	11,64

Based on Table 4, it can be interpreted that the average number of cigarettes consumed per day was 11.64 sticks. This mean value is slightly below the maximum value recorded among respondents, which was 12 cigarettes, indicating a relatively small range. All manual labor workers in this study, totaling 22 respondents (100%), were assessed for their daily cigarette consumption.

Table 5. Results of the independent t-test on cigarette consumption and SpO_2 levels among manual labor workers at PT X Kediri in 2026

Smoking Activity	n	Mean	Sd	*T*	*P*
Non-Smoking	22	98,23	1,152	2,184	0,035
Smoking	22	97.27	1.695		

Based on the results presented in Table 5, the mean SpO_2 levels differed between non-smoking and smoking manual labor workers, with a significantly higher mean observed in the non-smoking group.

From the quantitative data analysis using the Independent t-test with SPSS, the statistical test at a significance level of 0.05 yielded a *p-value* of 0.035, which is smaller than $\alpha = 0.05$ ($0.035 < 0.05$). Therefore, H_0 is rejected and H_1 is accepted, indicating that there is a significant relationship between cigarette consumption and SpO_2 levels among manual labor workers at PT X Kediri in 2026.

DISCUSSION

a. SpO_2 measurement results among non-smoking manual labor workers at PT X Kediri

Based on Table 1, all 22 respondents had an average SpO_2 value of 98.23%, with a maximum of 99% and a minimum of 95%. This indicates that all non-smoking manual labor workers at PT X Kediri had normal oxygen saturation levels (100%).

Oxygen saturation refers to the percentage of oxygen bound to hemoglobin in the blood (O'Driscoll et al., 2017). SpO_2 is measured using pulse oximetry, a non-invasive device typically attached to the fingertip or earlobe, which can detect hypoxemia early before clinical signs and

symptoms appear. Normal SpO_2 values range from ≥95% to 100%, corresponding to a partial pressure of oxygen (PaO_2) of approximately 80–100 mmHg (Tri, 2015). Oxygen saturation can be influenced by several factors, including physical activity, hemoglobin levels, circulation, body temperature, hypoxemia, and smoking habits.

The findings show that all non-smoking respondents had normal SpO_2 values, indicating no impairment in oxygen saturation. This condition is likely because they are not exposed to carbon monoxide from cigarette smoke.

Furthermore, the physically demanding activities performed by manual labor workers can increase lung capacity, thereby improving oxygen uptake and exchange. Adequate oxygen supply to the muscles ensures that energy requirements for physical activity can be met more efficiently and effectively.

b. SpO_2 measurement results among smoking manual labor workers at PT X Kediri

Based on Table 2, among the 22 smoking respondents at PT X Kediri, the mean SpO_2 value was 97.27%, with a minimum of 92% and a maximum of 99%. The majority of respondents, 20 individuals (90.9%), had normal SpO_2 levels, while 2 respondents (9.1%) showed below-normal oxygen saturation.

Smoking involves inhaling smoke produced from the combustion of tobacco, which contains numerous harmful substances. Approximately 60% of cigarette smoke consists of gases and vapors, including carbon monoxide, hydrogen cyanide, nitrogen dioxide, acetone, and ammonia, many of which are toxic to the respiratory system (Rusdani, & Esmiralda, 2019). Among these, carbon monoxide plays a critical role due to its high affinity for hemoglobin, which interferes with the transport of oxygen in the blood.

The findings of this study revealed that some smoking respondents had SpO_2 levels below the normal threshold (<95%). This is consistent with the theory that increased levels of carbon monoxide in the reduce the oxygen-carrying capacity of hemoglobin, thereby lowering SpO_2 levels (Tri, 2015). This condition was observed in 2 out of 22 smoking respondents who had SpO_2 values below 95%.

Decreased SpO_2 levels can lead to reduced physical capacity, increased fatigue, unstable breathing patterns, and elevated heart rate (Tri, 2015). These effects are particularly important for manual labor workers, whose performance heavily depends on physical endurance and adequate oxygen supply.

c. The relationship between cigarette consumption and SpO_2 measurement results among manual labor workers at PT X Kediri in 2026

Based on Table 3, all non-smoking respondents at PT X Kediri (22 individuals) demonstrated normal SpO_2 levels (100%). In contrast, among the smoking group, the majority also had normal SpO_2 values, with 20 out of 22 respondents (90.9%) falling within the normal range.

The results of the Independent t-test analysis using SPSS at a significance level of 0.05 showed a p-value of 0.035 ($p < 0.05$), leading to the rejection of H_0 and acceptance of H_1. This indicates a statistically significant relationship between smoking behavior and SpO_2 levels among manual labor workers at PT X Kediri in 2026.

Long-term smoking has detrimental effects on health, particularly on the cardiovascular system, largely due to carbon monoxide (CO) exposure (Sundari, R., Widjaya, D. S., & Nugraha, 2015). Smoking is also associated with an increased risk of various diseases, including heart disease, vascular disorders, cancer, respiratory diseases, and other health complications (Meirina Anwar, Najiah, 2021). Elevated CO levels in smokers can impair hemoglobin's ability to bind oxygen, resulting in reduced oxygen saturation in the blood.

The observed differences in oxygen saturation between smokers and non-smokers in this study may be influenced by several factors, such as smoking intensity, type of cigarette, duration of smoking, and levels of physical activity. Higher exposure to carbon

monoxide increases the likelihood of decreased blood oxygen levels, which may be reflected in SpO_2 values below the normal threshold (<95%).

These findings are consistent with previous studies indicating that higher smoking intensity is associated with lower oxygen saturation levels. Therefore, it is recommended that manual labor workers reduce or cease smoking to maintain optimal health, particularly adequate oxygen saturation. Additionally, the company is encouraged to provide education on the health risks of smoking to support workers in maintaining their productivity and well-being.

CONCLUSION

Based on the results of the study conducted at PT X Kediri 2026, it can be concluded that all non-smoking respondents (22 individuals) had an average SpO_2 value of 98.23%, with a maximum value of 99%. Meanwhile, among the smoking group, which also consisted of 22 respondents, the average SpO_2 value was 97.27%, still below the maximum value of 99%. Statistical analysis using the Independent t-test showed a p-value of 0.035, which is lower than $\alpha = 0.05$, leading to the rejection of H_0 and acceptance of H_1. This indicates a significant relationship between smoking behavior and SpO_2 levels, suggesting that smoking activity affects oxygen saturation among manual labor workers at PT X Kediri.

BIBLIOGRAPHY

Islamy, Aesthetica. (2018). Pengaruh Penyuluhan Menggunakan Media Dan Alat Peraga Terhadap Pengetahuan Dan Sikap Remaja Tentang Deteksi Dini Kanker Payudara (Penelitian Eksperimental Pada Siswa Sma Negeri 1 Ngunut, Tulungagung). Warta Bhakti Husada Mulia, 5(1), 97–103. http://jurnal.bhmm.ac.id/index.php/jurkes/article/view/97

Almaududy. (2017). Peringatan Bagi Penikmat Rokok. Bhuana Ilmu Populer.

Bahroni, I., & Pratama, A. (2018). Pengenalan Jenis-Jenis Racun Pada Rokok Menggunakan Augmented Reality Berbasis 3 Dimensi Pada Os Android (Studi Kasus) Di Dinas Kesehatan Kabupaten Cilacap. Seminar Nasional Teknologi Informasi Dan Komunikasi Sti&K, 2(2), 2581–2327.

Billy Boseke, M. et al. (2019). Determinan Perilaku Merokok Kepala Keluarga Di Kelurahan Woloan 1 Utara Kecamatan Tomohon Barat Kota Tomohon. Jurnal KESMAS, 8(7), 319–327.

CDC. (2020). Smoking and tobacco use: Health effect.

Kementrian Kesehatan RI. (2018). Hasil Utama Riskesdas 2018. Humas Kementrian Kesehatan RI. https://www.litbang.kemkes.go.id/hasil-utama-riskesdas-2018/

Kiswanto, L., & Chayati, N. (2022). Effect of Head Elevation 30 on GCS Value, and Oxygen Saturation in Stroke Patients. JOSING: Journal of Nursing and Health, 3(1), 54–66.

Meirina Anwar, Najiah, E. a. (2021). Risiko Terkait Perilaku Merokok di Dalam Rumah Selama Masa Pandemi. Jurnal Pengabdian Kesehatan Masyarakat: Pengmaskesmas, 1(2), 7–16. https://doi.org/doi.org/10.31849/pengmaskesmas.v1i2/5745

Nursalam. (2019). Metodologi Penelitian Ilmu Keperawatan: Pendekatan Praktis. Salemba Medika.

O'Driscoll, B. R., Howard, L., Earis, J., Mak, V., Bajwah, S., Beasley, R., Curtis, C., Davison, A., Dorward, A., Dyer, C., Evans, A., Falconer, L., Fitzpatrick, C., Gibbs, S., Hinshaw, K., Howard, R., Kane, B., Keep, J., Kelly, C., … Wijesinghe, M. (2017). Bts Guideline For Oxygen Use In Adults In Healthcare And Emergency Settings. An International Journal Of Respiratory Medicine, 72. https://doi.org/10.1136

Rusdani, & Esmiralda, N. (2019). Hubungan Tingkat Pendidikan dengan Perilaku Merokok pada Karyawan Laki-Laki Universitas Batam. Zona Kedokteran, 9(3), 142–148.

Sukesi, T. W. (2019). Promosi Kesehatan Dalam Pencegahan Hipertensi Dan Perilaku Merokok Di Dusun Combongan

Yogyakarta. Jurnal Pengabdian Kepada Masyarakat, 24(4), 879. https://doi.org/10.24114/jpkm.v24i4.12411

Sundari, R., Widjaya, D. S., & Nugraha, A. (2015). Lama Merokok dan Jumlah Konsumsi Rokok terhadap Trombosit pada Laki-laki Perokok Aktif. Kesmas: National Public Health Journal, 9(3), 257.

Tri, W. (2015). Hubungan Derajat Merokok Aktif, Ringan, Sedang dan Berat Dengan Kadar Saturasi Oksigen Dalam Darah (SpO2). Universitas Muhammadiyah Surakarta.

WHO. (2012). Indonesian's Tobacco Profile (Tobacco free Initiative).