PROCEEDING

2nd Banten International Conference on Health Advancement & Research
binar@poltekkesbanten.ac.id
https://binar.poltekkesbanten.ac.id/
Vol. 1 No. 2 (2026)

The Relationship Between Smoking Habits and the Incidence of Tuberculosis in the Service Area of the Ngariboyo Community Health Center

Yoke Aurellian Putri[1]

[1]Bachelor of Public Health, Faculty of Public Health, Universitas Bhakti Hasta Mulia Madiun, East Java, Indonesia, yokeaurellian@gmail.com

ABSTRACT

Pulmonary tuberculosis remains a major public health problem in Indonesia, and smoking habits are recognized as one of the factors that increase the risk of infection by impairing the respiratory defense system. This study aimed to analyze the relationship between smoking habits and the incidence of pulmonary tuberculosis in the working area of Ngariboyo Public Health Center. An analytical observational study with a case-control design was conducted involving 76 respondents, consisting of 38 cases and 38 controls selected through simple random sampling. Data were collected using structured questionnaires and medical record reviews and analyzed using the Chi-square test with a 95% confidence level. The results showed that most respondents in the case group had smoking habits (86.8%). Statistical analysis revealed a significant relationship between smoking habits and the incidence of pulmonary tuberculosis ($p < 0.001$), with an Odds Ratio of 0.070 and a 95% Confidence Interval of 0.022–0.224. The study concludes that smoking habits are significantly associated with the incidence of pulmonary tuberculosis in the working area of Ngariboyo Public Health Center. Therefore, efforts to reduce smoking habits are expected to support tuberculosis control in the community

Keywords: smoking habits, pulmonary tuberculosis, case-control study

INTRODUCTION

Pulmonary tuberculosis remains one of the world's major infectious diseases caused by *Mycobacterium tuberculosis*. The disease is transmitted through airborne droplets released when an infected person coughs, sneezes, or speaks. Despite being a preventable and curable disease, tuberculosis continues to pose a significant public health challenge, particularly in low- and middle-income countries. According to the (World Health Organization, 2025), tuberculosis remains one of the leading causes of death from infectious diseases globally, with Indonesia ranking among the countries with the highest TB burden. This condition indicates that tuberculosis control remains a priority and requires comprehensive efforts to reduce its incidence and transmission. Indonesia continues to face a high burden of tuberculosis.

Data from the Indonesian Health Survey (SKI) 2023 reported that the prevalence of physician-diagnosed pulmonary tuberculosis was 0.30%, reflecting that tuberculosis remains widely distributed throughout the country. In Kabupaten Magetan, tuberculosis also remains an important public health problem. According to the (Dinas Kesehatan Kabupaten Magetan, 2024), here were 903 tuberculosis cases, with a Case Notification Rate (CNR) of 67% per 100,000 population. Although the treatment success rate reached 98.3%, the cure rate was only 52.1%, which was still below the national target. Furthermore, data from Puskesmas Ngariboyo showed that pulmonary tuberculosis cases fluctuated during the last three years, with 51 cases in 2023, 38 cases in 2024, and 54 cases in 2025, indicating that tuberculosis remains a persistent health problem in the area.

The incidence of pulmonary tuberculosis is influenced by various host, environmental, and behavioral factors. Among these, smoking is recognized as one of the most important modifiable behavioral risk factors. Cigarette smoke contains thousands of toxic compounds, including nicotine, tar, and carbon monoxide, which impair the respiratory defense system (Fernandes et al., 2025). Continuous exposure to cigarette smoke damages the ciliary epithelium, disrupts mucociliary clearance, decreases macrophage function, and suppresses both innate and adaptive immune responses. Consequently, the lungs become more susceptible to colonization and infection by *Mycobacterium tuberculosis*. Individuals with smoking habits are therefore more

likely to develop pulmonary tuberculosis than non-smokers (Akbar et al., 2023).

Previous studies have consistently demonstrated an association between smoking and pulmonary tuberculosis. Several studies have reported that smokers are at a significantly higher risk of developing active pulmonary tuberculosis than non-smokers because prolonged exposure to cigarette smoke impairs pulmonar

defense mechanisms and weakens immune function (Hidayat et al., 2023). Furthermore, smoking has been associated with delayed sputum conversion, poor treatment outcomes, and an increased risk of tuberculosis recurrence (Akbar et al., 2023). These findings suggest that smoking not only contributes to the development of pulmonary tuberculosis but may also aggravate disease progression and hinder recovery (Rhomadhon et al., 2026).

Although several studies have reported an association between smoking habits and pulmonary tuberculosis, most of these studies were conducted in hospitals or other healthcare settings with different population characteristics. Evidence regarding this association at the primary healthcare level, particularly in the working area of Puskesmas Ngariboyo, is still limited. Meanwhile, tuberculosis cases in the working area of Puskesmas Ngariboyo have continued to fluctuate over the past three years, indicating that tuberculosis remains a public health concern in the area. Therefore, local epidemiological evidence is needed to better understand the contribution of smoking habits to pulmonary tuberculosis and to support the development of appropriate tuberculosis control strategies based on community characteristics.

MATERIALS AND METHODS

This study employed an analytical observational design with a case-control approach to examine the relationship between smoking habits and the incidence of pulmonary tuberculosis in the working area of Puskesmas Ngariboyo, Magetan Regency, East Java, Indonesia. The study was conducted from April to May 2025. The study population consisted of pulmonary tuberculosis patients registered at Puskesmas Ngariboyo as the case group and community members without pulmonary tuberculosis as the control group. A total of 76 respondents were selected using simple random sampling, comprising 38 respondents in the case group and 38 respondents in the control group with a 1:1 ratio. The inclusion and exclusion criteria were determined before sampling to ensure the eligibility of study participants.

Data were collected through face-to-face interviews using a structured questionnaire to assess respondents' smoking habits and through medical record reviews to determine pulmonary tuberculosis status. In this study, smoking habits were categorized into smokers and non-smokers according to the operational definition established by the researchers. Descriptive (univariate) analysis was performed to describe the characteristics of respondents and the distribution of smoking habits. The association between smoking habits and pulmonary tuberculosis was analyzed using the Chi-square test with a 95% confidence level ($\alpha = 0.05$). The strength of the association was determined using the Odds Ratio (OR) and its 95% Confidence Interval (CI). Ethical approval was obtained from the Health Research Ethics Committee of STIKES Bhakti Husada Mulia Madiun before the study was conducted.

RESULTS AND DISCUSSION

1. Characteristics of Respondents

A total of 76 respondents participated in this study, consisting of 38 respondents in the case group and 38 respondents in the control group. The characteristics of respondents based on age and sex are presented in Table 1.

Table 1. Characteristics of Respondents

Age Group	Cases n (%)	Control n (%)
1-16	2 (5,3)	2 (5,3)
17-25	1 (2,6)	1 (2,6)
36-45	6 (15,8)	6 (15,8)
46-55	6 (15,8)	6 (15,8)
56-65	9 (23,7)	9 (23,7)
66-100	14 (36,8)	14 (36,8)

Source : Primary Data, 2026

Sex	Cases n (%)	Control n (%)
Male	33 (86,8)	31 (81,6)
Female	5 (13,2)	7 (18,4)

Source : Primary Data, 2026

The results showed that the largest proportion of respondents in both the case and control groups was

aged 66–100 years, accounting for 36.8% of each group. In addition, most respondents were male, comprising

33 respondents (86.8%) in the case group and 31 respondents (81.6%) in the control group. These findings indicate that pulmonary tuberculosis cases in this study were predominantly found among older adults and male respondents.

Table 2. Distribution of Pulmonary Tuberculosis Incidence

Pulmonary Tuberculosis Status	Frequency (n)	Percentage (%)
Cases	38	50
Controls	38	50
Total	76	100

Source : Secondary Data, 2026

Table 2 shows that the study involved 76 respondents, consisting of 38 respondents (50.0%) in the pulmonary tuberculosis case group and 38 respondents (50.0%) in the control group. The equal proportion between the two groups reflects the use of a 1:1 case-control ratio, which was determined during the sampling process to facilitate comparison between respondents with and without pulmonary tuberculosis.

2. Relationship between Smoking Habits and the Incidence of Pulmonary Tuberculosis

Table 3. Relationship between Smoking Habits and Pulmonary Tuberculosis

Smoking Habits	**Cases n (%)**	**Control n (%)**	**OR (95% CI)**	**p-value**
Smoker	33 (86,8)	12 (31,6)	0,070 (0,022-0,224)	**<0,001**
Non-smoker	5 (13,2)	26 (68,4)		

Source : Primary Data, 2026

Table 2 shows that 33 respondents (86.8%) in the case group had smoking habits, whereas only 12 respondents (31.6%) in the control group were smokers. Meanwhile, 5 respondents (13.2%) in the case group and 26 respondents (68.4%) in the control group were non-smokers. Statistical analysis using the Chi-square test showed a significant relationship between smoking habits and the incidence of pulmonary tuberculosis ($p < 0.001$). The Odds Ratio (OR) was 0.070 with a 95% Confidence Interval (0.022–0.224), indicating that smoking habits were significantly associated with the incidence of pulmonary tuberculosis in the working area of Puskesmas Ngariboyo.

These findings are consistent with the theory that smoking contributes to the development of pulmonary tuberculosis by impairing the respiratory defense system. Cigarette smoke contains toxic substances such as nicotine, tar, and carbon monoxide that damage the ciliary epithelium, disrupt mucociliary clearance, reduce alveolar macrophage activity, and suppress both innate and adaptive immune responses. As a result, *Mycobacterium tuberculosis* can more easily colonize and proliferate in the lungs, increasing the risk of pulmonary tuberculosis (Fernandes et al., 2025)

The present findings are also in agreement with previous studies that reported a significant association between smoking habits and pulmonary tuberculosis. Long-term exposure to cigarette smoke weakens pulmonary immune function and decreases the body's ability to eliminate inhaled pathogens, thereby increasing susceptibility to *Mycobacterium tuberculosis* infection. These studies emphasize that smoking is one of the most important modifiable behavioral risk factors for pulmonary tuberculosis (Hidayat et al., 2023)

From an immunological perspective, cigarette smoke suppresses both innate and adaptive immune responses. Exposure to cigarette smoke decreases the phagocytic capacity of alveolar macrophages, alters dendritic cell function, impairs neutrophil activity, and reduces T-cell-mediated immune responses that are essential for controlling *Mycobacterium tuberculosis*. Consequently, infected individuals may have a reduced ability to eliminate the bacteria, allowing bacterial survival and multiplication within the lungs. These biological mechanisms provide a plausible explanation for the observed association between smoking habits and pulmonary tuberculosis (Mathofani & Febriyanti, 2020).

The findings of this study are consistent with previous studies reporting that smokers have a significantly higher risk of developing pulmonary tuberculosis than non-smokers. Previous epidemiological studies have shown that prolonged exposure to cigarette smoke increases the likelihood of active tuberculosis and is associated with poorer clinical outcomes, including delayed recovery and a greater risk of disease progression. Furthermore, a systematic review and meta-analysis concluded that tobacco smoking is consistently associated with an increased risk of tuberculosis infection, active disease, and tuberculosis-related mortalit (Ade Ismayanti et al., 2024).

Although several respondents in the control group also reported smoking habits, they did not develop pulmonary tuberculosis. This finding suggests that smoking alone is not sufficient to cause pulmonary tuberculosis because the disease is influenced by multiple factors, including exposure to *Mycobacterium tuberculosis*, nutritional status, environmental conditions, immune status, and individual susceptibility. Nevertheless, the substantially higher proportion of smokers in the case group compared with the control group indicates that smoking habits remain an important factor associated with pulmonary tuberculosis.

Based on these findings, the authors assume that smoking habits play an important role in increasing the risk of pulmonary tuberculosis. Therefore, reducing smoking behavior through education, smoking cessation counseling, and community awareness programs should be strengthened as part of tuberculosis control efforts, particularly among populations at high risk of infection.

CONCLUSION

This study demonstrated a significant relationship between smoking habits and the incidence of pulmonary tuberculosis in the working area of Puskesmas Ngariboyo. Individuals with smoking habits were more likely to experience pulmonary tuberculosis than non-smokers, indicating that smoking is an important behavioral factor associated with the disease. These findings highlight the importance of strengthening smoking control efforts through health education and smoking cessation interventions as part of tuberculosis prevention and control programs. In addition, the results provide scientific evidence that can support the development of community-based tuberculosis control strategies, particularly at the primary healthcare level.

REFERENCES

Ade Ismayanti, S., Auliavika Khabibah, S., Annisa Haq, T., Salsabilla, S., Athilla Rahman, R., Vanessa Hartono, T., Salzabilla, T., Wachidah, N., Yuastita Tangnalloi, T., & Yuda, A. (2024). Perilaku dan Pengetahuan Remaja Indonesia tentang Merokok. *Jurnal Farmasi Komunitas*, *11*(1), 79–85. https://doi.org/10.20473/jfk.v11i1.42580

Akbar, A., Fahdhienie, F., & Andria, D. (2023). *HUBUNGAN KEBIASAAN MEROKOK DENGAN KEJADIAN TB PARU DI WILAYAH KERJA PUSKESMAS KUTA ALAM BANDA ACEH*. *10*(11), 3202–3210.

Dinas Kesehatan Kabupaten Magetan. (2024). *PROFIL KESEHATAN KABUPATEN MAGETAN* (Issue 4).

Fernandes, B., Handayani, T. S., & Aprianti, D. (2025). Hubungan Kebiasaan Merokok Dengan Kejadian Tuberculosis Paru Pada Pasien Dewasa Di Wilayah Kerja Puskesmas Telaga Dewa Dan Puskesmas Sawah Lebar Kota Bengkulu Tahun 2024 A Correlation Between Smoking Habits And The Incidence Of Pulmonary Tuberculosis Amon. *Jurnal Multidisiplin*, *2*(1), 11–20.

Hidayat, L. A., Sommeng, F., Putri, R., Abdullah, I., & Pandu, E. (2023). *Pengaruh Kebiasaan Merokok dengan Kejadian Tuberkulosis Ekstra Paru Pada Pasien Tuberkulosis Di Rumah Sakit Ibnu Sina Makassar Tahun 2021-2023*. *3*, 7220–7230.

Mathofani, P. E., & Febriyanti, R. (2020). Faktor-Faktor Yang Berhubungan Dengan Kejadian Penyakit Tuberkulosis (TB) Paru di Wilayah Kerja Puskesmas Serang Kota Tahun 2019. *JURNAL ILMIAH KESEHATAN MASYARAKAT : Media Komunikasi Komunitas Kesehatan Masyarakat*, *12*(1), 1–10. https://doi.org/10.52022/jikm.v12i1.53

Rhomadhon, U., Pambudi, S., Handayani, T. S., & Marlianto, N. (2026). *Hubungan Perilaku Merokok Dengan Kejadian TB Paru pada Perokok Aktif di Puskesmas Telaga Dewa Kota Bengkulu Tahun 2026*. *5*(2), 987–996. https://doi.org/https://doi.org/10.37676/mude.v5i2.10805

World Health Organization. (2025). Global Tuberculosis Report. In *Blood* (Issue September). https://doi.org/978 92 4 156450 2