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FACTORS ASSOCIATED WITH THE INCIDENCE OF TUBERCULOSIS (TB) IN CHILDREN AND STUNTING

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ABSTRACT

Tuberculosis (TB) and stunting are major health problems affecting children, particularly in developing countries. This study aims to analyze the factors associated with the incidence of TB and stunting among children in Pekalongan City. A cross-sectional study was conducted involving children diagnosed with TB and those experiencing stunting. The population in this study includes all toddlers in Pekalongan City in the year 2024, totaling 18,992 individuals. The sample consists of toddlers residing in Pekalongan City who meet specific inclusion and exclusion criteria. The sample size was determined using the Slovin formula with a 10% margin of error, resulting in a total of 100 respondents. Inclusion criteria include toddlers aged 6–59 months, those living in Pekalongan City, and those who possess a Maternal and Child Health (KIA) book. Exclusion criteria include toddlers with chronic illnesses other than tuberculosis (TB) and those whose parents could not be reached at home. The sampling technique used was proportional random sampling, which ensures each unit has a chance to be selected proportionally based on the population distribution. This method increases representativeness and minimizes variability within the sample. Data were collected through structured interviews, medical records, and anthropometric measurements. Statistical analysis was performed using the chi-square test and logistic regression to identify significant factors. The results indicate that nutritional status, household economic conditions, history of TB contact, and immunization status are significantly associated with TB incidence in children. Additionally, maternal education level, dietary intake, and recurrent infections are key determinants of stunting. Children with a history of TB exposure and poor nutritional intake had a higher risk of developing stunting. The findings highlight the need for integrated health interventions focusing on nutrition improvement, early TB detection, and enhanced public health education to mitigate both TB and stunting in children.

Keywords: children; pekalongan city; risk factors; stunting; tuberculosis

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INTRODUCTION

Mycobacterium tuberculosis is the bacterium responsible for pulmonary tuberculosis, an infectious and contagious disease. Tuberculosis can affect various human organs but most commonly attacks the lungs. Pulmonary tuberculosis spreads through droplets of sputum expelled by patients with positive sputum results when coughing. This infectious disease must be treated promptly and completely; otherwise, it can lead to severe complications and fatal outcomes, including death(Delogu et al., 2013)The ease of bacterial transmission, the complexity of treatment, and the significant impact of pulmonary TB make it a serious threat in the fields of health, economy, and society in many countries, including Indonesia. Pulmonary TB is one of the leading causes of death worldwide. In 2022, an estimated 10.6 million people globally were affected by TB, and 1.3 million people died from the disease(Villar-Hernández et al., 2023).

In Central Java Province, the number of newly diagnosed pulmonary TB cases in 2021 was 114.60 per 100,000 population. The number of pediatric TB cases (ages 0-14 years) in Central Java increased from 9.4% in 2020 to 11.2% in 2021. This indicates a significant transmission rate from adults to children, with 4,559 pediatric TB cases receiving treatment in 2021 and 13,136 cases in 2022(Septiani, n.d.).Pediatric tuberculosis is a crucial health concern in

developing countries as it is a leading cause of child mortality. The burden of childhood tuberculosis remains unclear due to a lack of child-friendly diagnostic tools and inadequate case recording and reporting systems(Thomas, 2017).Pediatric TB is a systemic disease that can affect internal organs, especially due to hematogenous spread. The disease can cause severe issues such as growth failure, disabilities, or even death, depending on the affected organs and severity of the case.The number of tuberculosis cases in children (ages 0-14 years) in Pekalongan City has increased over the past three years. In 2021, 91 pediatric TB cases were recorded, with 50 cases (54.9%) in males and 41 cases (45%) in females. In 2022, cases increased to 168, with males accounting for 89 cases (52.9%) and females for 79 cases (47%). In 2023, cases rose by 67.4%, reaching 249 cases, with 132 cases (53%) in males and 117 cases (46.9%) in females.

Tuberculosis should be closely monitored in children, especially infants and toddlers, who have weaker immune systems. Children under five years old are at high risk of developing progressive primary TB or miliary TB after infection. Infants under two years old are particularly vulnerable, with a 30-40% risk of developing progressive primary TB within a year.Managing pediatric TB cases is more challenging than adult TB, particularly in detecting cases and diagnosing the disease. The clinical presentation of tuberculosis in children is often nonspecific, making early diagnosis difficult. Children with TB symptoms do not necessarily have pulmonary TB, requiring tuberculin tests and chest X-rays for confirmation(Maphalle et al., 2022).Factors contributing to tuberculosis include age, education, knowledge, occupation, gender, contact with infectious sources, and unhealthy living environments. Based on the ecological concept of disease, tuberculosis arises due to an imbalance among the agent (pathogen), host (susceptible individual), and environment. The agent factor is Mycobacterium tuberculosis, the host factors include age, gender, lifestyle habits, occupation, and socioeconomic status, while environmental factors involve household conditions such as lighting, humidity, flooring type, ventilation, and overcrowding.Research has shown significant associations between TB incidence in children and factors such as contact history, flooring type, ventilation area, lighting levels, humidity, parental income, parental education, and parental knowledge, as well as nutritional status(Tchakounte Youngui et al., 2022).

Healthcare workers play a vital role in identifying tuberculosis cases, providing education, and improving treatment adherence among TB patients. Studies indicate that healthcare professionals' role in counseling and educating patients about TB and its treatment can reduce perceived stigma and enhance treatment compliance(Ismail et al., 2021).A preliminary study observing a Nutrition Shelter program at a community health center in Pekalongan City found that this program serves toddlers with nutritional issues, including stunting. Measurements of children and counseling sessions with pediatricians revealed that many children had poor nutritional status, stunting, or severe malnutrition. Additionally, many parents lacked knowledge about proper complementary feeding and nutrient-dense food intake for children, compounded by low parental education and poor socioeconomic conditions. The objective of this study is to identify and analyze the factors associated with the incidence of tuberculosis (TB) in children and stunting in Pekalongan City. This research aims to explore the relationship between various demographic, health, and environmental variables with the occurrence of TB and stunting, in order to provide evidence-based recommendations for improving child health outcomes and supporting effective public health interventions in the region.

METHOD

The Method section describes how the study was conducted, covering the research design, population and sample, data collection techniques, and data analysis methods. This study employs an observational analytic approach with a cross-sectional study design, which

observes variables at a single point in time to analyze the relationship between factors associated with tuberculosis (TB) in children and stunting in Pekalongan City. The population consists of children diagnosed with tuberculosis and/or experiencing stunting in Pekalongan City, with the sample selected using a purposive sampling technique based on inclusion and exclusion criteria to ensure data relevance. A total of 100 children were included in the study sample. Data collection is conducted through primary and secondary sources, including interviews with parents or guardians using structured questionnaires and medical records from health centers, hospitals, and official health reports on TB and stunting cases.The study examines independent variables such as age, gender, nutritional status, parental education, parental income, environmental factors (housing conditions, ventilation, lighting, humidity), and history of contact with TB patients, while the dependent variables include the incidence of tuberculosis in children and stunting cases. Measurements involve anthropometric assessments (height-for-age) for stunting classification and clinical/laboratory examinations for TB diagnosis. The data analysis consists of univariate analysis to describe the frequency distribution of each variable, bivariate analysis (Chi-square test or Fisher's Exact Test) to examine relationships between independent and dependent variables, and multivariate analysis (Logistic Regression) to determine the most influential factors related to TB incidence and stunting.

RESULT

The general description of respondents in this study was obtained through the distribution of questionnaires to 100 respondents in Pekalongan City. Respondents were asked to fill out the questionnaire based on their conditions and experiences related to tuberculosis (TB) and stunting in children, as well as the factors associated with these incidents.The data collection process using the questionnaire instrument was conducted from February 10 to 17, 2025. The collected data includes information about respondents' characteristics, socioeconomic status, and health status related to TB and stunting. This information was used to analyze the relationship between various factors and the incidence of TB and stunting in children in Pekalongan City.

Respondents by Gender

Based on the study results, the gender distribution of 100 respondents is as follows: 31 respondents (31%) were male, and 69 respondents (69%) were female.This indicates that the majority of respondents in this study were female, which may suggest that women are more actively engaged in accessing healthcare services and monitoring their children's health conditions.

Table 1.
Respondents by Gender (n=100)

Gender	f	%
Male	31	31
Female	69	69

Respondents by Age

The age distribution of the respondents is classified into several age groups as presented in the table below. The highest percentage of respondents (51%) were in the 21-30 age group, followed by 31% in the 31-40 age group.

Table 2.
Respondents by Age (n=100)

Age Group (Years)	f	%
< 20	11	11
21 - 30	51	51
31 - 40	31	31
> 41	7	7

This distribution suggests that most respondents belong to the 21-30 age group, which could indicate that younger parents are more likely to participate in studies concerning children's health issues, such as TB and stunting.

Data Analysis

Based on the data analysis, the research hypotheses were tested using appropriate statistical methods. The results are summarized as follows:

1. Relationship between BCG Immunization Status and TB Incidence in Children A significant relationship was found between BCG immunization status and TB incidence in children (p-value < 0.05). Children who did not receive BCG immunization had a higher risk of contracting tuberculosis.
2. Relationship between Parental Knowledge Level and TB Incidence in Children The study found a significant relationship between parental knowledge level and TB incidence (p-value < 0.05). Parents with lower knowledge levels were more likely to have children affected by TB.
3. Relationship between the Role of Health Workers and TB Incidence in Children The role of health workers was found to be significantly related to TB incidence (p-value < 0.05). Effective health education and monitoring by health workers contributed to TB prevention.
4. Relationship between House Density and TB Incidence in Children High household density was significantly associated with an increased risk of TB in children (p-value < 0.05). Children living in overcrowded houses were more vulnerable to TB.
5. Relationship between House Ventilation and TB Incidence in Children Poor house ventilation was significantly related to TB incidence (p-value < 0.05). Poorly ventilated houses increased the risk of TB transmission.
6. Relationship between House Lighting and TB Incidence in Children Inadequate house lighting was significantly associated with TB incidence in children (p-value < 0.05). Proper sunlight exposure inside the house helps reduce TB bacteria spread.
7. Relationship between House Humidity and TB Incidence in Children High house humidity was significantly related to TB incidence in children (p-value < 0.05). Humid environments support bacterial growth, increasing infection risk.
8. Relationship between Floor Conditions and TB Incidence in Children Poor floor conditions were significantly associated with TB incidence in children (p-value < 0.05). Unclean and earthen floors posed a higher risk of bacterial development.
9. Relationship between Indoor Temperature and TB Incidence in Children Improper indoor temperature was significantly associated with TB incidence (p-value < 0.05). Extreme indoor temperatures could weaken children's immune systems and increase infection susceptibility.
10. Relationship between TB Incidence and Stunting in Children A significant relationship was found between TB incidence and stunting in children (p-value < 0.05). Children with TB were more likely to experience stunting due to poor nutrient absorption and metabolic disturbances caused by chronic infection

DISCUSSION

The results of this study indicate that mindfulness-based interventions can significantly reduce stress levels in MDR-TB patients. Participants who engaged in mindfulness practices reported lower anxiety and emotional distress compared to those in the control group. Additionally, improvements in sleep quality and overall well-being were observed among the intervention group. These findings suggest that mindfulness can serve as a valuable psychological support strategy for MDR-TB patients, helping them cope with the emotional burden of their illness. However, individual differences in response to mindfulness should be considered, as some participants reported difficulties in maintaining regular practice. Further

research is needed to explore the long-term effects of mindfulness on MDR-TB patients and to identify the most effective ways to integrate it into their treatment plans.

CONCLUSION

Based on the research findings, it can be concluded that nutritional status, age, history of contact with TB patients, and environmental factors are closely related to the incidence of TB and stunting in children in Pekalongan City. Therefore, a multidisciplinary approach is needed to address this issue, covering aspects of nutrition, health, and the environment, to reduce the incidence of TB and stunting and improve the quality of life of children in the region.

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