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The Relationship between Low Birth Weight and the Incidence of Pneumonia in Toddlers at the Mlati II Health Center

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Low birth weight, pneumonia, toddlers.

ABSTRACT

Pneumonia remains one of the leading causes of morbidity and mortality among children under five years old, particularly in developing countries, and is often associated with various intrinsic risk factors, including low birth weight. Toddlers with a history of low birth weight are considered more vulnerable to infections due to their immature immune and respiratory systems. This study aims to determine the relationship between low birth weight and the incidence of pneumonia in toddlers at the Mlati II Health Center. This research used a quantitative analytical design with a case-control approach. Secondary data were obtained from the medical records of 70 toddlers, consisting of 35 pneumonia cases and 35 controls, selected using total and quota sampling techniques. Data were analyzed using the chi-square test with a 95% confidence level and odds ratio (OR) measurement. The results showed that 68.8% of toddlers with low birth weight experienced pneumonia, compared to 44.4% in the non–low birth weight group. However, statistical analysis indicated no significant relationship between low birth weight and pneumonia incidence ($p = 0.088$), although the OR value of 2.750 suggests a higher risk tendency. In conclusion, low birth weight is not statistically significantly associated with pneumonia incidence, but it may still contribute to increased susceptibility, highlighting the importance of monitoring high-risk toddlers.

INTRODUCTION

Pneumonia in toddlers is one of the health problems that remains a global concern because it contributes significantly to childhood morbidity and mortality. Acute respiratory infections, especially pneumonia, are still the leading cause of death in infants and toddlers, even exceeding the combined burden of AIDS, malaria, and measles (Director General of P2P of the Ministry of Health of the Republic of Indonesia, 2019). Based on WHO data in 2018, of the 6.6 million children under five who died worldwide, around 1.1 million deaths were caused by pneumonia, with 99% of these deaths occurring in developing countries (Director General of P2P of the Ministry of Health of the Republic of Indonesia, 2019). UNICEF also reported that in 2018 pneumonia caused the deaths of more than 800,000 children under five worldwide, and an estimated 19,000 children in Indonesia died from pneumonia (UNICEF, 2019). In the Special Region of Yogyakarta, cases of pneumonia among toddlers remain relatively high, with the number of cases reaching 4,812 in 2023, with the highest proportion occurring in Sleman Regency (Profil Kesehatan DIY, 2023).

Based on a preliminary study conducted on March 22, 2024, at the Mlati II Health Center, it was reported that in 2023 there were 54 cases of pneumonia in children under five. The high incidence rate indicates that pneumonia remains a significant health problem in the working area of the Mlati II Health Center. This condition highlights the need for further studies on the risk factors that contribute to the incidence of pneumonia in toddlers, especially intrinsic

factors originating from the child's condition at birth (Mei et al., 2023; Nguyen et al., 2017; O'Brien et al., 2019; Wonodi et al., 2012).

A literature review shows that pneumonia in toddlers is influenced by various intrinsic and extrinsic factors. Intrinsic factors include age, sex, low birth weight, immunization status, breastfeeding, vitamin A supplementation, and nutritional status (Samuel et al., 2022; Simanjuntak, Haya, Suryani, & Ahmad, 2018; Zimmermann & Curtis, 2019). Meanwhile, extrinsic factors include household crowding, house ventilation, humidity, type of cooking fuel, exposure to cigarette smoke, as well as maternal factors such as education and knowledge (Ratnaningtyas et al., 2020). One of the intrinsic factors that is often associated with an increased risk of pneumonia is low birth weight (BBLR) (Aprilliani & Lestari, 2020). Toddlers with a history of BBLR are known to have a higher risk of developing pneumonia than those with normal birth weight, due to lower immunity to infection (Khairiah & Fitriyeni, 2019).

Previous research supports a link between BBLR and pneumonia. A study in Bekasi found that toddlers with a history of BBLR were 5.6 times more likely to develop pneumonia compared to those without such a history (Khairiah & Fitriyeni, 2019). Research at Bogor City Hospital also showed a relationship between BBLR and pneumonia, where BBLR was associated with a 3.014-fold increased risk of neonatal pneumonia (Apriliani & Lestari, 2020). In addition, a meta-analysis concluded that there was a significant association between BBLR and the incidence of pneumonia in toddlers (Anjaswanti et al., 2022).

Although many studies have demonstrated a link between BBLR and pneumonia, most have been conducted in hospitals or in areas with different population characteristics (Badriah & Indana, 2022; Chen, Keller, Wang, Lin, & Lin, 2012). Therefore, the scientific novelty of this study lies in examining the relationship between low birth weight and the incidence of pneumonia in toddlers at the Mlati II Health Center, based on medical record data from the working area of the Mlati II Health Center, Sleman, which has not been widely studied. This study also provides a contextual overview of risk factors for pneumonia in toddlers at the primary healthcare level.

The research problem is formulated as follows: "Is there a relationship between low birth weight and the incidence of pneumonia in toddlers at the Mlati II Health Center?" This study aims to determine the relationship between low birth weight and the incidence of pneumonia in toddlers at the Mlati II Health Center.

The results of this study are expected to provide theoretical contributions to the development of public health science, particularly regarding risk factors linking low birth weight to the incidence of pneumonia in toddlers. Practically, this study may serve as evaluation material for healthcare workers and the Mlati II Health Center in improving pneumonia prevention efforts through monitoring toddler health and addressing other risk factors that influence the incidence of pneumonia.

METHODS

This study is a quantitative research with an analytical survey design that aims to analyze the relationship between risk factors and disease incidence in toddlers. The research design used is case control with a retrospective approach, which is a study that compares case groups (subjects with disease) and control groups (subjects without disease) retrospectively (looking back) to find risk factors or exposure to disease causes (Sugiyono, 2019). This study

was conducted to determine the relationship between low birth weight (BBLR) and the incidence of pneumonia in toddlers in the working area of the Mlati II Health Center.

This research framework involves two main variables, namely low birth weight as an independent variable and pneumonia incidence as a bound variable. This study also considered the presence of disruptive variables, both internal factors such as age, immunization status, nutritional status, and vitamin A intake, as well as external factors such as home ventilation, occupancy density, humidity, exposure to cigarette smoke, and family socioeconomic conditions, but these factors were not further analyzed due to limited medical record data.

The data source used in this study is secondary data obtained from the medical records of toddlers at the Mlati II Health Center in 2025. Secondary data is data obtained from previously available sources without direct measurement by researchers (Hardisman, 2021). The data includes the birth weight history of toddlers as well as the diagnosis of pneumonia that has been determined by the doctor.

The population in this study is all toddlers registered at the Mlati II Health Center in 2025, both those who have pneumonia and those who do not have pneumonia, with a total of 2,981 toddlers. The sample of this study amounted to 70 toddlers, consisting of 35 toddlers with pneumonia as a case group and 35 toddlers without pneumonia as a control group, in accordance with the case control design with a 1:1 ratio. The sampling technique for the case group was carried out with total sampling, while the control group was selected using the quota sampling technique, which is a technique of determining samples from populations that have certain characteristics until the desired quota number is met. (Sugiyono, 2019).

The inclusion criteria in this study include toddlers who undergo examinations at the Mlati II Health Center, have complete immunization status, and normal nutritional status. Meanwhile, the exclusion criteria are toddlers with incomplete medical record data. The research instrument used was a respondent data assessment sheet compiled by the researcher based on medical record information. The variable birth weight was categorized into BBLR (<2,500 grams) and not BBLR, while the incidence of pneumonia was categorized based on the doctor's diagnosis in the medical record.

The data collection technique was carried out by the documentation method, which was to trace the medical records of toddlers to obtain information about birth weight history and pneumonia status. Before data collection, etichal clearance and research permits are carried out. The data obtained is then processed through the stages of editing, coding, entry, and tabulation to facilitate the analysis process. Data analysis was carried out univariate to describe the frequency distribution of each variable, and bivariate analysis used the Chi-Square test to determine the relationship between low birth weight and the incidence of pneumonia in toddlers. The test was conducted with a confidence level of 95% ($\alpha = 0.05$). The risk measure in this study was also calculated using Odds Ratio (OR) to see the chance of pneumonia in toddlers with a history of BBLR compared to toddlers with normal birth weight.

RESULTS AND DISCUSSION

This research was carried out in the working area of the Mlati II Health Center located in Cabaka Hamlet, Sumberadi Village, Mlati District, Sleman Regency, Special Region of Yogyakarta. The working area of the Mlati II Health Center covers several villages, the majority of which are residential areas and relatively densely populated areas, so basic health

services are very important in efforts to prevent and handle diseases in vulnerable community groups such as toddlers. The Mlati II Health Center is a primary health service facility that plays an important role in monitoring the health of toddlers, including handling pneumonia cases and monitoring child growth and development. This study uses medical record data for toddlers in 2025 with a sample of 70 toddlers consisting of 35 case groups (pneumonia) and 35 control groups (non-pneumonia).

Table 1. Distribution of Birth Weight Frequency in Toddlers

Birth Weight	n	%
BBLR	16	22,9
No BBLR	54	77,1
Total	70	100

Source: Secondary Data of Medical Records of the Mlati II Health Center in 2025

The results of the univariate analysis showed that most of the toddlers had a history of normal birth weight or not BBLR. Of the total 70 toddlers, 54 toddlers (77.1%) were included in the non-BBLR category.

Table 2. Distribution of Frequency of Pneumonia Incidence in Toddlers

Pneumonia Incident	n	%
Pneumonia	35	50,0
No Pneumonia	35	50,0
Total	70	100

Source: Secondary Data of Medical Records of the Mlati II Health Center in 2025

The distribution of pneumonia incidence in the study sample showed a balanced proportion between the case and control groups. Toddlers who experienced pneumonia amounted to 35 (50.0%), while toddlers who did not experience pneumonia also amounted to 35 (50.0%). This is in accordance with the design of the case control study which uses a 1:1 ratio between the case group and the control group.

Table 3. The Relationship of Low Birth Weight to the Incidence of Pneumonia

Birth Weight	Pneumonia n (%)	No Pneumonia n (%)	Total	p-value	Contingency Coefficient	OR
BBLR	11 (68,8)	5 (31,3)	16	0,088	0,200	2,750
No BBLR	24 (44,4)	30 (55,6)	54			
Total	35	35	70			

Source: Secondary Data of Medical Records of the Mlati II Health Center in 2025

Bivariate analysis was conducted to determine the relationship between low birth weight and the incidence of pneumonia in toddlers. The results of cross-tabulation showed that of 16 toddlers with a history of BBLR, as many as 11 toddlers (68.8%) had pneumonia, while 5 toddlers (31.3%) did not have pneumonia. In the group of toddlers with a history of non-BBLR, as many as 24 toddlers (44.4%) had pneumonia and 30 toddlers (55.6%) did not have pneumonia.

The results of the Chi-Square test showed a value of $p = 0.088$ ($p > 0.05$), so it can be concluded that there is no relationship between low birth weight and the incidence of

pneumonia in toddlers at the Mlati II Health Center. An Odds Ratio (OR) value of 2.750 indicates that toddlers with a history of BBLR have a greater chance of developing pneumonia than toddlers with normal birth weight, but the relationship is not statistically significant. In addition, the results of the relationship tightness test showed a Contingency Coefficient value of 0.200 which indicated that the relationship between low birth weight and the incidence of pneumonia in toddlers was relatively weak

The results of this study show that descriptively the incidence of pneumonia is more common in toddlers with a history of low birth weight compared to toddlers born with normal weight. Of the 16 toddlers with a history of BBLR, as many as 68.8% experienced pneumonia, while in the non-BBLR group, the incidence of pneumonia was 44.4%. These findings indicate a tendency that toddlers with a history of BBLR are more susceptible to pneumonia.

The WHO states that pneumonia is a disease formed from an acute infection of the lower respiratory tract area that specifically affects the lungs. Pneumonia is also defined as one of the acute respiratory tract infections that affects the alveolus tissue of the lungs (Fajar et al., 2024). Pneumonia is still one of the leading causes of morbidity and mortality in children under five, especially in developing countries (WHO, 2023).

In theory, toddlers with low birth weight have an immune system that has not been optimally developed, making them more susceptible to infections, including respiratory tract infections such as pneumonia. Babies with BBLR generally have immaturity of organs, including the lungs, as well as an immune system that has not been optimally developed, making them more susceptible to infections, including lower respiratory tract infections such as pneumonia. The results of the study showed that low birth weight was associated with and also increased the risk of pneumonia (Hadisuwarno et al., 2020). This is in line with previous research which stated that toddlers with a history of BBLR have a higher risk of developing pneumonia than toddlers with normal birth weight (Khairiah & Fitriyeni, 2019). Another study also found that neonatal pneumonia was more common in babies with BBLR compared to babies with normal birth weight (Apriliani & Lestari, 2020). A meta-analysis conducted by Anjaswanti et al. (2022) also showed a meaningful relationship between BBLR and the incidence of pneumonia in toddlers.

However, the results of the statistical test in this study showed a value of $p = 0.088$ which means that there was no statistical relationship. The absence of a relationship can be caused by the number of samples under five with a relatively small history of BBLR, so the power of statistical tests is limited. In addition, pneumonia is a multifactorial disease that is influenced by various other factors, both intrinsic and extrinsic, such as nutritional status, complete immunization, exclusive breastfeeding, exposure to cigarette smoke, and home environmental conditions (Ratnaningtyas et al., 2020). In this study, these factors were not analyzed further because they had been controlled through inclusion and exclusion criteria.

An Odds Ratio of 2,750 shows that clinically toddlers with a history of BBLR have a greater chance of developing pneumonia than non-BBLR toddlers. However, because the p-value is greater than 0.05, the increased risk is not statistically significant. This is in line with the Contingency Coefficient value of 0.200 which shows that the relationship between low birth weight and the incidence of pneumonia is relatively weak. Although the results of this study did not show a statistical correlation, the tendency to increase the risk of pneumonia in toddlers with a history of BBLR still has clinical significance. Toddlers with a history of BBLR

are known to have lower immunity so they are more susceptible to infections, including respiratory tract infections such as pneumonia. Therefore, the results of this study still emphasize the importance of monitoring and preventing the incidence of pneumonia in toddlers with a history of BBLR in the work area of the Mlati II Health Center.

CONCLUSION

This case-control study involving 70 toddlers in the Mlati II Health Center working area examined the relationship between low birth weight (BBLR) and pneumonia incidence. Most toddlers had normal birth weight (77.1%), while 22.9% had a history of BBLR, and the distribution of pneumonia and non-pneumonia cases was equal (50.0% each). Although pneumonia was more common among toddlers with BBLR (68.8%) compared to those without (44.4%), statistical analysis using the Chi-square test showed no significant association ($p = 0.088$). However, the Odds Ratio of 2.750 suggests a tendency for higher pneumonia risk among toddlers with BBLR, despite the lack of statistical significance. Future research is recommended to involve larger sample sizes, longitudinal designs, and additional variables—such as environmental and maternal factors—to better clarify the relationship and potential causal pathways between BBLR and pneumonia in toddlers.

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