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Pneumonia in Toddlers: Association of Characteristics and Nutritional Status

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ABSTRACTS

Pneumonia is one of the health problems that contribute to the mortality of toddlers. Pneumonia cases in children are determined by health history. The purpose of this study was to analyze the relationship between age, gender, birth weight, history of breastfeeding, nutritional status, and immunization status with the incidence of pneumonia in toddlers at the Kudus Aisyiyah Hospital. The design of this study was analytic observational with a cross-sectional approach. A total of 102 patients have participated as research respondents, and sampling was done using the accidental technique. The instrument used in this study is an observation sheet prepared for toddler patients with pneumonia. Data analysis was carried out using chi-square and fisher's exact method. The results showed that 48 patients (47.1%) had pneumonia. There was a significant relationship between the age of children under five (p=0.003) and birth weight (p=0.0001) with the incidence of pneumonia. There was no relationship between gender (p=0.399), exclusive breastfeeding (p=0.495), and nutritional status (p=0.141), with the incidence of pneumonia in children under five. The age variable is associated with the pneumonia incidence in toddlers at Kudus 'Aisyiyah Hospital. Mothers are expected to pay more attention to the health of their toddlers due to their vulnerability to a variety of diseases, particularly infectious diseases. Support and counseling programs from health workers were also expected to help mothers' understanding to improve their child's health quality.

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1. Introduction

Pneumonia is one of the health problems and the biggest contributor to the death of children under five. Pneumonia is the leading cause of mortality in children under the age of five, contributing to about one in every five deaths. Pneumonia also kills more than 2 million children under five every year, mostly in developing countries.[1] Pneumonia in developed countries is referred to be a "neglected disease" or "the forgotten disease" due to the high number of children who die from it, yet little attention is paid to the problem.[2]

The WHO estimates that in developing countries, pneumonia affects 151.8 million toddlers each year. Around 8.7% (13.1 million) of these were severe pneumonia cases that required hospitalization. Annually, it is predicted that 4 million cases occur in developing countries, bringing the global total to 156 million cases of pneumonia in toddlers.[2]

In Indonesia, pneumonia is still the main cause of death for children aged 29 days - 11 months, with a mortality rate of 73.9%.[3] In 2010-2014 the incidence of pneumonia in toddlers from 20-30%. The number of cases continued to increase from 2015 to 2019, where the number reached 35.5%. In 2020, a different trend occurred, with a reduction in cases of 34.8 percent. This reduction is most likely due to the presence of the COVID-19 pandemic, where there is a stigma associated with those who have COVID-19, resulting in a decrease in the number of visits to the health community center by toddlers with coughs or breathing difficulties.[3]

The results of the 2018 Basic Health Research (Riskesdas) stated that 2.1% of children under five in Indonesia and Central Java were diagnosed with pneumonia. Meanwhile, based on the data of the respondents in this study, there were 3.9% who showed pneumonia-like symptoms. These results indicate a higher number of cases in the community. There is a difference in the prevalence of pneumonia cases of 1.13% in 2018.[4]

Several groups are susceptible to pneumonia, including children under the age of two, the elderly over the age of 65, and adults with chronic health conditions (malnutrition, immunological disorders).[5] Various risk factors are contributing to pneumonia-related mortality, including, nutritional status (undernutrition and poor nutrition), breastfeeding (exclusive breastfeeding reduces the risk), low birth-weight babies (increases risk), and vaccination (reduces risk). [6]

A 2012 study conducted at a hospital in Jakarta found that pneumonia in toddlers was influenced by several variables, such as age, breastfeeding history, nutritional status, and vaccination history. Infants under one year of age are at a greater risk of developing pneumonia, due to an immature immune system and relatively narrow airways.[7] Another study conducted in Metro District showed that apart from age, gender is also a risk factor for pneumonia.[8] Additionally, a study undertaken at RSUD Dr. Moewardi indicated that toddlers who contracted pneumonia required a lengthy hospital stay. This is because malnutrition and infection are interrelated, hence deteriorating the patient's health condition.[9]

Another risk factor that causes the high incidence of pneumonia in toddlers is the low birth weight (LBW) and babies who did not get exclusive breastfeeding. According to Ibrahim (2010), the condition of LBW in infants is one of the factors that cause pneumonia, because they will be more susceptible to respiratory tract infections than babies with normal birth weight.[10]

Based on the findings from a preliminary study in early 2021, there are 323 toddlers hospitalized with pneumonia at the Kudus Aisyiyah Hospital. During the previous

three months, there is 22.12 percent of toddlers hospitalized for pneumonia.

Observations on 10 medical record data also found 60% of pneumonia patients were underweight. Another fact discovered during the preliminary study was that seven out of 10 were male (70%) and most of them were aged 1-2 years (60%). Nine out of ten (90%) toddlers did not receive exclusive breastfeeding, two of them were not immunized against measles (20%), and there was one person who was LBW (10%). This study aims to analyze the relationship between the characteristics and nutritional status of children under five with the incidence of pneumonia in children under five at Kudus Aisyiyah Hospital.

2. Materials and Methods

This research is an observational study with a cross-sectional approach. The population in this study was all toddlers (0-59 months) who were hospitalized at the Kudus 'Aisyiyah Hospital during the last three months, namely 135, 158, and 114 patients. From these data, it was found that the average visit of toddlers undergoing hospitalization was 136 patients per month.

Sampling in this study was done by consecutive sampling technique. Each patient who met the criteria was included in the study for a certain period until the required number of patients was met. A total of 102 patients under five were taken as samples in this study.

Data collection was carried out using a series of questionnaires. Questions in the questionnaire included patient data, age, gender, weight, height, history of birth/ weight, history of exclusive breastfeeding, and nutritional status. The research data were then analyzed further using the chi-square test.

3. Results and Discussion

The following table summarizes the characteristics of the respondents in this study:

Table 1. Respondent Characteristic

Variable	Frequency Distribution (N =78)
Age	
- < 1 year	15(14,7%)
- 1-3 year	56(54,9%)
- 3-5 year	31(30,4%)
Sex	
- Male	47(46,1%)
- Female	55(53,9%)
Pneumonia	
- Yes	48(47,1%)
- No	54(52,9%)
Nutritional status	
- Underweight	3(2,9%)
- Normal	71(69,6%)
- Overweight	28(27,5%)
Parent’s education	
- Junior Highschool	11 (10,8%)
- Senior Highschool	61 (59,8%)
- Diploma	27 (26,5%)
- Bachelor	3 (2,9%)
Parent’s occupation	
- Unemployed	1 (1%)

Variable	Frequency Distribution (N =78)
- Labor	16 (15,7%)
- Merchant	7 (6,9%)
- Entrepreneur	32 (31,4%)
- Private employee	32 (31,4%)
- Civil servant	14 (13,7%)
Birth weight	
- 2500-3499 gram	87 (85.3%)
- 3500-4000 gram	15 (14.7%)
Breastfeeding	
- Non-exclusive	93 (91.2%)
- Exclusive	9 (8.8%)

Univariate analysis revealed that most toddlers were male (53.9%), and aged 1-3 years (54.9 percent). Many infants under the age of five were born weighing between 2500-3499 grams (85.3 percent) and were not having exclusive breastfeeding (91.2 percent).

Table 2. The association between the characteristics and nutritional status of toddlers with pneumonia

Variable	Pneumonia		Total	p-value
	Yes	No		
Age				
- < 1 year	10 (66.7)	5 (66.7)	15 (100)	0.003
- 1-3 year	31 (55.4)	25 (44.6)	56 (100)	
- 3-5 year	7 (47.1)	24 (52.9)	31 (100)	
Sex				
- Male	28 (50.9)	27 (49.1)	55 (100)	0.399
- Female	20 (42.6)	27 (57.4)	47 (100)	
Birth weight				
- 2500-3499 gram	48 (55.2)	39 (44.8)	87 (100)	0.001
- 3500-4000 gram	0	15 (100)	15 (100)	
Breastfeeding				
- Non-exclusive	45 (48.4)	48 (51.6)	93 (100)	0.495
- Exclusive	3 (33.3)	6 (66.7)	9 (100)	
Nutritional status				
- Underweight	0	15 (100)	15 (100)	0.141
- Normal	32 (45.1)	39 (54.9)	71 (100)	
- Overweight	16 (57.1)	12 (42.9)	28 (100)	

There were 47.1% cases of pneumonia in children under five or as many as 48 of the total 102 respondents who had pneumonia in this study. Infants are more susceptible to pneumonia than toddlers. Data shows that children aged less than one year have a 30% higher risk of developing a cough and cold than children aged between 2-3 years old. This is due to the immature immune system of infants and the relatively narrow size of the respiratory tract.[10]

The results of the univariate analysis showed that most of the respondents were 1-3 years old (56.9%). In this study, children aged less than one year were more likely to suffer from pneumonia (66.7%). Children with older age (4-5 years) showed the opposite result, where the number that did not suffer from pneumonia was 52.9%.

The chi-square test resulted in a p-value of 0.003 ($p<0.05$), indicating that there is a

correlation between age and pneumonia incidence in toddlers at the Kudus 'Aisyiyah Hospital. The data in table 4.8 shows that the number of children under five with pneumonia decreased with age. Pneumonia cases in children aged less than one year were 66.7%; age 1-3 years by 55.4%; and at the age of 4-5 years, the number decreased by 47.1%. In the group of children who did not have pneumonia, the opposite results were obtained. The absence of pneumonia cases was increasing along with a child's age. Pneumonia cases were 33.3 percent in children under one year, 44.6 percent in children aged 1-3 years, and 52.9 percent in children aged 4-5 years. The findings of this study support the assumption that as children grow older, their risk of suffering pneumonia decreases. Thus, it can be concluded that the age of children affects the frequency of pneumonia among toddlers at the Kudus 'Aisyiyah Hospital.

The results of this study are in line with research conducted by Hartati, et al (2012) which stated that age was associated with the incidence of pneumonia in children in Jakarta (p= 0.0002). Infants and toddlers have a less developed immune system than adults. Due to immature immunity and smaller airways, younger children (0-24 months) are more susceptible to pneumonia than older children.[7] Another study by Regina, et al (2013) stated that there was a relationship between toddler's age and the incidence of pneumonia in Miroto Semarang in the year 2013.[12]

As many as 50.9% of male toddlers suffer from pneumonia, while the remaining 49.1% of male toddlers did not have it. In the female group, 42.6% of children under five suffered from pneumonia, while others (57.4%) did not. From this data, male toddlers have a higher proportion of 50.9% compared to female toddlers which are only 42.6%. Men have been identified as a high-risk category for pneumonia. This phenomenon is related to the lower immune system of males than females, besides that males have smaller respiratory tract diameters.[13] Although boys under the age of five are more likely to develop pneumonia than girls, bivariate analysis using the chi-square test revealed a p-value of 0.399 (p>0.05). This result suggests that there is no relationship between the gender of children under the age of five and the incidence of pneumonia in toddlers at the Kudus 'Aisyiah Hospital.

Gender was not observed to relate to the pneumonia incidence in this study since the numbers were comparable. There are 28 boys and 20 girls diagnosed with pneumonia in this study. The number of toddlers who did not have pneumonia in this research was also the same, comprising 27 males and 27 girls. Thus, both male and female toddlers have an equal chance of having pneumonia. However, the estimated risk (odds ratio) indicates that males have a 1.4-times greater probability of catching pneumonia than women. Research by Hartati, et al (2012) shows a similar result, where gender is not a factor associated with the incidence of pneumonia in children.[7] Furthermore, Regina's research (2013) also states that gender is not a factor associated with the incidence of pneumonia in toddlers.[12]

It was found in this study that birth weight was associated with the incidence of pneumonia in toddlers. According to bivariate analysis, 55.2 % of newborns within 2500-3499 grams had pneumonia, whereas the remaining 44.8 % did not. In toddlers with birth weights between 3500-4000 grams, all of them suffer from non-pneumonia diseases. This shows that the greater the BBL value for children under five, the lower the probability of suffering from pneumonia. So, in other words, it can be stated that the birth weight of the baby is related to the incidence of pneumonia in toddlers.

Ceria's research (2016) stated that children under five with LBW had a greater chance of experiencing pneumonia. Toddlers born with LBW are at risk of developing pneumonia by 8.90 times compared to those with normal birth weight. Babies born with low body weight

have immature immunity, so they are susceptible to infectious diseases such as pneumonia and have a greater risk of death. Results of this study indicate that maternal care during pregnancy for their health supports babies born with normal birth weight. [14]

Breastfeeding toddlers were also observed in this study. Since almost all the mothers in this study were working mothers, the data showed that exclusive breastfeeding was low (8.8%). Childcare is provided by other family members (grandmother), home assistants, or daycare during working hours. Low coverage of exclusive breastfeeding is also due to the ease of formula milk and the rising assumption that newborns that solely consume breast milk will become hungry faster. Exclusive breastfeeding is known to affect the number of pneumonia in toddlers. The incidence of pneumonia in toddlers who received exclusive breastfeeding was lower (33.3%) than those who were not exclusively breastfed (48.4%).

The Fisher exact test resulted in a p-value of 0.495 ($p>0.05$), indicating that there is no association between breastfeeding history and the prevalence of pneumonia in children under the age of five at Kudus 'Aisyiyah Hospital. This could be because most toddlers did not accept exclusive breastfeeding (91.2 %).

In toddlers who were not exclusively breastfed, the number of those who had pneumonia or not was the same. Although the exclusive breastfeeding variable was not statistically significant, the number of children who did not get pneumonia was double that (66.7%) than those who did (33.1%). The calculated risk also shows an OR value of 1.875, which indicates that those who are not exclusively breastfed have a 1.875 higher risk of pneumonia than newborns who have had a history of exclusive breastfeeding.

A similar study in 2016 revealed that there was no correlation between exclusive breastfeeding and the incidence of pneumonia in Air Tawar Barat Village, Padang ($p=0.735$).[15] Children under the age of five who did not get exclusive breastfed have a 3.13 times higher risk of pneumonia than those who received it. They are more susceptible to disease because they do not receive the benefits of exclusive breastfeeding, which aids in the development of antibodies, which serve as a type of disease defense. Protective compounds, anti-streptococci, antibodies, cellular immunity, and anti-allergic substances are all found in breast milk and serve a vital role in protecting the child's body.[14]

The results of the univariate analysis of the nutritional status of toddlers showed that 69.6% were normal, 27.5% were overweight, and the remaining 2.9% were underweight. Further analysis showed that toddlers with normal nutritional status had a lower percentage of pneumonia cases (45.1%) than those without pneumonia (54.9%). Different results were found in overweight toddlers where the percentage of pneumonia sufferers was greater (57.1%) compared to those who did not (42.9%).

In this study, nutritional status was not associated with the prevalence of pneumonia in toddlers since there are only 2.9% of them developed pneumonia. Furthermore, none of the three underweight children under the age of five in this study suffered from pneumonia, suggesting that nutritional status was unrelated to pneumonia. The estimated risk value (OR) cannot be determined because the OR value can only be analyzed in a 2x2 table.

The results of this study are in line with Regina's research (2013) which states that nutritional status is not related to the incidence of pneumonia in children under five in the working area of the Miroto Health Center Semarang. The categorization of nutritional status in this study was carried out based on the Red Line Boundary (BGM) in Child Report Card.[12] On the other hand, research by Ratnasari, et al (2015) stated that there was a significant relationship between nutritional status and the incidence of pneumonia in children aged 1-5 years at Candi Lama Health Center, Candisari District, Semarang City.[16]

The association of nutritional status with pneumonia is reciprocal, as revealed by Mading and Adyana (2014) in their research, which states that pneumonia is more commonly found in undernutrition children and those with poor nutrition status. On the other hand, nutritional status is also a predisposing factor that can exacerbate infectious diseases directly and can cause individual health problems. Poor nutritional conditions are often accompanied by deficiencies of micro and macronutrients that are mandatory for the body to grow and develop.[17] Children are more vulnerable to infection because of poor dietary conditions, which impair the body's defense system against microbes.[18]

The limitation in this study is the category of respondents, where the study did not distinguish between new or recurrent pneumonia cases. In addition, this study only examined the intrinsic factor of toddlers. Other variables related to pneumonia in toddlers need to be investigated further to produce comprehensive data and analysis.

4. Conclusions

In Kudus Aisyiah Hospital, the prevalence of pneumonia was associated with the toddler's age and weight of birth. Fetal health must be considered during pregnancy for the baby to be born at a normal weight. Hospitals should focus not only on curative and rehabilitative treatments but also on health promotion and disease prevention. To lower the incidence of pneumonia in toddlers, increased collaboration with the health office and Puskesmas can be done.

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