Research Article

Low Birth Weight and Immunizations Status: Risk Factors of Acute Respiratory Infection in Children 2-5 Years

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ABSTRACT

Background: Acute Respiratory Infection (ARI) is one of the most important causes of morbidity and mortality in children under five years old (toddlers) worldwide, especially in developing countries. ARI is an acute upper or lower respiratory tract disease that occurs acutely, usually transmitted with mild to lethal symptoms. Various risk factors cause a high incidence of ARI cases in infants, including low birth weight (LBW) and incomplete immunization. Children aged 2-5 years are expected to have received basic immunizations and complete tests according to age to have a stronger immunity to ARI than children aged less than two years. Objective: To determine the relationship of LBW and immunization history with ARI events in children aged 2-5 years.

Method: This is an analytic observational study with a cross-sectional design using 31 samples of ARI and non-ARI pediatric patients treated at the PKU Muhammadiyah Hospital Surakarta. Samples were determined using a purposive technique - meaning that samples were taken according to specific criteria. The population was pediatric patients aged 2-5 years diagnosed with ARI: common cold, nasopharyngitis, tonsillitis, laryngitis, bronchitis, bronchiolitis, pneumonia, and SARS. This study's study populations are pediatric patients aged 2-5 years who were outpatient at PKU Muhammadiyah Hospital Surakarta in December 2019. Therefore, the number of samples is calculated using the Sample Formula for Study Groups with Different Sample Sizes, and data was taken employing a patient's parent interview.

Results: There were 31 patients with details of 17 ARI and 14 non-ARI. Fisher's test showed there was no relationship between LBW and ARI (p-value = 0.597, p> 0.05 and Prevalence Ratio = 1.286). And there was no significant relationship between the history of immunization with ARI (p-value = 0.287, p> 0.05 and Prevalence Ratio = 2.5).

Conclusion: There is no significant relationship between LBW and immunization history with ARI in children aged 2-5 years.

INTRODUCTION

Acute Respiratory Infection (ARI) is one of the most important causes of morbidity and mortality in children worldwide, especially in developing countries (1). Every year, ARI kills

around 1.4 million children under five (toddlers), accounting for 18% of all deaths of children under five in the world (2). The prevalence of ARI in Central Java Province in 2017 was 9.7% or 10.551 cases of ARI according to the diagnosis of health workers in some healthcare. While the prevalence of ARI in Surakarta in the same year, the highest number was found in the age group under five years (toddlers) (24-35 months) 19.112 cases, followed by 36-47 months, 18.821 cases (3).

Based on previous research, there was a significant correlation between the MR vaccine (p = 0.011) and the DPT vaccine (obtained p = 0.002) to reduce pneumonia in children aged ten months to 5 years. Adequate MR immunization can prevent about 11% of pneumonia deaths under five, and with pertussis immunization (DPT), 6% of pneumonia deaths can be controlled (4). A research study conducted in Stockholm, Sweden in 2014 showed, in a research population of 6.014 single infants born between 35-42 weeks of gestation, low levels of T-cell receptor excision circles (TREC) and K-Deleting Recombination Excision Circles (KREC) more often found in infants with a low birth weight with adequate gestational age (5)

Various risk factors cause high mortality rates of ARI cases in infants, such as low birth weight (LBW), children who do not get complete immunization, do not get adequate breast feed, and exposed to cigarette smoke or pollution (6). Besides, risk factors underlying the course of ARI in children include host factors, disease agents, and the environment, including age, sex, nutritional status, breastfeeding, low birth weight (LBW), immunization, parents' educational status, socio-economic status, air pollution, other diseases, natural disasters, and consideration of antibiotic use (7)(8).

Low birth weight is a risk factor of ARI in infants due to the low number of immune cells in the body of infants with low birth weight, namely T lymphocytes and B lymphocytes (9). When viewed from the immunization schedule, children aged 2-5 years are expected to have received basic immunizations and complete tests according to age to have a stronger immunity to ARI than children aged less than two years (10).

Immunization is one of the effective preventive measures to prevent infectious diseases by providing artificial active immunity (11). The vaccine that affects ARI's case is Pentavalent vaccine immunization, and it was articulated by research in India (12). Pentavalent vaccine (DPT-HB-Hib) and BCG, Polio, and MR vaccines are originally only to prevent nine infectious diseases, namely diphtheria, pertussis, tetanus, hepatitis B, tuberculosis, polio, measles, and rubella have developed into eight diseases contagious. Hib antigens can prevent pneumonia and meningitis, which are inflammatory diseases of the brain, and pneumonia, which account for 17.2 percent of infants' deaths (10).

Based on research conducted by Sari and Vitawati in 2015, there was a significant correlation between MR vaccine administration (p=0.011) and DPT vaccine (p=0.002) in reducing the incidence of pneumonia in children aged ten months to 5 years. Adequate MR immunization can prevent about 11% of pneumonia deaths under five, and with pertussis immunization (DPT), 6% of pneumonia deaths can be controlled (4). A research study conducted in Stockholm, Sweden in 2014 showed, in a study population of 6,014 single infants born between 35-42 weeks of gestation, low levels of T-cell receptor excision circles (TREC) and K-Deleting Recombination Excision Circles (KREC) more often found in infants with a low birth weight with sufficient gestational age (5).

The purpose of this study was to determine the relationship between LBW and history of immunization with ARI in children aged 2-5 years. This research can provide information for clinicians and the community so that prevention can be done early and reduce ARI incidence in children aged 2-5 years.

METHOD

This research is an observational analytic study with a cross-sectional approach conducted at the Children's Polyclinic PKU Muhammadiyah Surakarta Hospital. We retrieve the data using interviews with parents of pediatric patients diagnosed with ARI who underwent outpatient treatment at the Paediatric Clinic PKU Muhammadiyah Surakarta Hospital within November-December 2019 that met the criteria of retention.

This study used 31 samples of ARI and Non-ARI patients following predetermined retention criteria. The age of the study subjects was 2-5 years. The sampling technique is using non-probability purposive sampling.

This study's independent variables were low birth weight (LBW) and immunization history, then the dependent variable of the study was the incidence of acute respiratory infections (ARI). The data were analyzed using a statistical software program, then analyzed bivariate with the Fisher's test with a significance level of $p < 0.05$.

This research has already been ethically approved by a human research ethics committee (HREC).

RESULTS

The data were analysed based on age and gender. Based on gender, this study was dominated by males, with 19 patients (61.3%). Based on age, most of the patients in this study 9 patients (29.0%) were 4 years old, and at least 6 patients (19.4%) were at the 3 years old (Table 1).

Table 1. Characteristics of Subjects

Characteristics	Frequency	Percentage (%)
Gender		
Male	19	61.3
Female	12	38.7
Age (y.o.)		
2	8	25.8
3	6	19.4
4	9	29.0
5	8	25.8

Table 2 shows that children aged 2-5 years who were treated at PKU Muhammadiyah Hospital Surakarta were born above the average body weight of 26 children (83.9%). Most of the children have a history of the complete immunization status of 24 children (77.4%), and most of the ARI diagnosed were 17 children (54.8%) (Table 2).

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Table 2. Univariate Analysis Result

Characteristic	Frequency	Percentage (%)
Low Birth Weight		
LBW	5	16.1
Non-LBW	26	83.9
Immunization Status		
Complete	24	77.4
Incomplete	7	22.6
Diagnosis		
ARI	17	54.8
Not ARI	14	45.1

Statistical analysis to see the relationship of low birth weight (LBW) with ARI using Fisher's Test obtained p = 0.597 (p> 0.05) meaning that there is no significant relationship between low birth weight (LBW) with the incidence of ARI in children aged 2-5 years. The relationship between LBW and ARI in children is presented in Table 3, a prevalence ratio of 1.28 (95% CI: 0.183–9.021) - there is no significant relationship between LBW and ARI in children 2-5 years.

Table 3. Multivariate Analysis

	ARI Incidence		Total	*p-value*	RP	95% CI
	ARI	Non-ARI				
LBW History						
LBW	3	2	5	0.597	1.286	0.183-9.021
Non-LBW	14	12	26			
Immunization Status						
Complete	5	2	7	0.287	2.5	0.403-15.501
Incomplete	12	12	24			

We found that here was no relationship between the history of immunization with ARI in children aged 2-5 years in this study. Statistical analysis to see the relationship between the history of immunization status and the incidence of ARI using Fisher's Test, obtained the value of p = 0.287 (p> 0.05), it can be concluded that H0 is accepted and H1 is denied or there is no significant relationship between the history of immunization status with ARI in children aged 2-5 years old (Table 3).

DISCUSSION

Low birth weight is a risk factor of ARI in infants. Based on the theory, birth weight determines physical growth and development in infancy. Children with a history of low birth weight (LBW) have a greater risk of death than children with a history of adequate birth weight (BBLC), especially in the first months of birth, due to imperfect immune formation making it more susceptible to infectious diseases especially pneumonia and other respiratory infections.

Babies with LBW often experience respiratory problems. This is caused by the growth and development of imperfect lungs and weak respiratory muscles (13)

However, in this study, no relationship was found between LBW and ARI in children aged 2-5. This study was dominated by the number of children born with average birth weight compared to children who had a history of low birth weight, thereby affecting the unrelated outcome between LBW and ARI in children aged 2-5 years. This result is in line with research conducted (Lestari, 2017), which states that there is no significant relationship (p = 0.467) between LBW and ARI (14)

Based on table 3, the relationship between the history of immunization status with ARI in children, a prevalence ratio of 2.5 with Confidence Interval (95% CI: 0.403–15,501), it can be concluded that there is no meaningful relationship between historical status immunization with ARI in children aged 2-5 years. This is different from research conducted by Imelda (2017), which states that toddlers with incomplete immunization history have 8.6 times the chance of suffering from ARI than toddlers who have a complete immunization history (15). However, other studies conducted also showed the same thing with this study: the absence of a relationship (p = 0.363) between immunization status and the incidence of ARI in infants (14). Following the results of research conducted by (Tazinya, 2018) which states that age, sex, immunization status, breastfeeding, parental (father) education status, parental age, absenteeism in attendance, and population density are not significant factors related to ARI in toddlers (6)

The sample in this study was dominated by children who have a complete history of immunizations, that is, complete basic immunizations and tests according to the child's age because most of the patients follow the government's immunization program regularly by the government. However, based on interviews with parents of children, they often stated late or not given to children aged 2-5 years are measles / MR vaccine and pentavalent (DPT-HB-HIB) tests experiences illness or parents are busy at the time of the immunization schedule.

Besides, some parents of children also doubted the vaccine's halalness, so that they chose not to give or continue giving the vaccine to their children. ARI that occurs in children can also be influenced by several other factors such as history of breastfeeding, nutritional status, environmental conditions, the child's immune condition when sick, and children's food / beverage habits that irritate the pharyngeal epithelium, thereby triggering the occurrence of pharyngitis and other ARIs (10). To reduce the factors that increase the ARI mortality, complete immunization is essential, including full primary immunization and repetition. Toddlers with an entire history of vaccination can be expected that the disease will not become more severe. The method that has proven to be the most effective is the administration of measles and pertussis immunization (DPT) aimed to reduce infant mortality (16).

CONCLUSION

There was no relationship between low birth weight (LBW) and history of immunization in the incidence of acute respiratory infections (ARI) in children aged 2-5 years.

Authors' contribution

QR was responsible for the design, data collection, analysis, and drafting of the manuscript. ED, LM, and SR were responsible for design and analysis, and manuscript review.

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Conflict of interest

There is no conflict of interest in this research.

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