

THE RELATIONSHIP BETWEEN ANTHOPOMETRIC STATUS AND ENVIRONMENTAL FACTORS ON THE INCIDENCE OF ACUTE RESPIRATORY TRACT INFECTION

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ABSTRACT

Acute respiratory tract infection (ARI) is a form of infection in the respiratory tract that can interfere with respiratory function. Based on the high incidence, morbidity and mortality due to acute respiratory infections, it is necessary to control risk factors to prevent the incidence of ARI. This study will assess the relationship between anthropometric status and home environmental factors on ARI in Palembang City. This research is an observational analytic study with cross sectional design. The research was conducted by distributing using a questionnaire. From 123 respondents, it was found that most of the respondents were 25-59 months old (59.3%) and male (51.2%). There were 14.6% of children under five years old with abnormal anthropometric status and 65.0% of respondents had a good home environment score. 70.7% of all respondents suffer from ARI. From 70% of respondents who suffered from ARI, it was found that 71.4% were male under five years old, 88.9% were under-five years old with abnormal anthropometric status which was divided into under nutrition and over nutrition anthropometric status, and 71.3% had a score good home environment. From the results of the chi-square test, the p value of ARI incidence was 0.048 with OR 3.8 (95% CI: 0.8-17.6) which indicated that there was a significant relationship ($p < 0, 05$) anthropometric status and the incidence of ARI in children under five years old. The Kruskal Wallis test results showed that the p value of ARI incidence was 0.978 which indicated that there was no significant relationship ($p > 0.05$) the home environment score and the incidence of ARI in children under five years old. This study found a significant relationship between anthropometric status and the incidence of ARI and did not find a significant relationship between home environmental scores and the incidence of ARI.

Keywords: ARI, anthropometric, home environment

1. INTRODUCTION

Globally, air pollution is estimated to cause about 4.2 million premature deaths per year (7.6% of deaths) and morbidity in 103.1 million people which makes up 4.2% of the global disease burden.¹ Epidemiological studies show that air pollution is associated with various diseases, such

as cardiovascular disease (stroke and ischemic heart disease), cancer and diseases of the respiratory system. Respiratory system diseases associated with air pollution include acute respiratory tract infections (ARI), chronic obstructive pulmonary disease (COPD) and bronchial asthma.^{2,3} In

2015, in Indonesia based on data from the Ministry of Health, there were 562,605 people suffering from ARI in six provinces, of which 21.4% (120,404 cases) occurred in South Sumatra Province in the period of July-October 2015.⁴ The latest data in Palembang city shows that until mid-September 2019, the incidence of ARIs reached 76,232 people.⁵ This shows the importance of controlling environmental factors in preventing the incidence of ARI. This environmental factor also includes the environmental factor of the house. Inadequate housing conditions are associated with poverty or low socioeconomic conditions in a household. This situation is one of the risk factors for the incidence of ARI.⁶

Acute respiratory infections are not only influenced by environmental factors. Host factors such as density of residence, malnutrition, incomplete immunization and economic status are other important determinants in the course of ARD disease.⁷ This is mainly related to the immune system (body defense) against microorganisms that cause ARI. There are several ways to assess nutritional status, namely anthropometric, clinical, biochemical, and biophysical measurements called direct nutritional status assessments. Measurement of children's nutritional status based on anthropometric criteria is the simplest and most practical type of measurement, because it is easy to do and can be done in a large number of samples.⁸ The combination of several parameters is called the anthropometric index.⁹

Based on the high incidence, morbidity and mortality due to acute respiratory infections, it is necessary to control risk factors to prevent the incidence of ARI. Control of nutritional and environmental factors is a form of intervals that can be done. This study

will assess the relationship between anthropometric status and home environmental factors on ARI in Palembang City.

2. METHOD

This research is an analytic observational study with a cross sectional design. The population in this study were all toddlers in Palembang who filled out an questionnaire. The minimum sample size was calculated based on previous research data and the minimum sample size was 79 toddlers.¹⁰ The sampling technique used in this study was total sampling. Data collection was carried out in October 2020. The online questionnaire was made into three parts, the identity of mothers and toddlers, the ARI incidence section, and the home environment assessment section.

The data were analyzed using univariate and bivariate Chi Square distribution analysis techniques. The relationship between the home environment and the incidence of ARI was analyzed by Kruskal Wallis because the data were not normally distributed. This analysis technique was used to determine the distribution of respondent characteristics, the distribution of ARI incidence, distribution of anthropometric status, distribution of home environmental scores, and the relationship between nutritional status and home environmental score with the incidence of ARI.

3. RESULT

Of the 123 respondents, it is known that the average age of the respondents is 28.45 ± 16.14 months. The majority of respondents were male (51.25%).

Table 1. Distribution of Respondent Characteristics

Characteristics	Amount (n)	Percentage (%)
Age	123	100
2-24 months	50	40.7
25-59 months	73	59.3
Gender		
Male	63	51.2
Women	60	48.8

In table 2 it can be seen that 9 children with under nutritional status, 105 children with good nutritional status, and 9 children with over nutritional status. From this, it shows that the number of children under five with nutritional status is far less than under five with normal nutritional status. As many as 85.4% of all toddlers who were respondents in this study were toddlers with normal anthropometric status. From a total of 123 respondents, 70.7% of them experienced Upper Respiratory Tract

Infection (ISPA) while the remaining 36 under five did not suffer from ARI. The average score of the respondent's home environment was 15.91 ± 2.21 . From this data, the results of respondents with a bad home environment score were 3 people, respondents with a good home environment score were 40 people, and respondents with a good home environment score were 80 people. No data were found for respondents with very bad home environmental scores.

Table 2. Distribution of Anthropometry Status, ARI Incidence and Home Environment Score Respondents

Characteristics	Amount (n)	Percentage (%)
Anthropometric Status		
Malnutrition	0	0
Malnutrition	9	7.3
Good Nutrition	105	85.4
More Nutrition	9	7.3
ARD incidence		
ARI	87	70.7
Not ARI	36	29.3
Home Environment Score		
Very bad	0	0
Bad	3	2.4
Enough	40	32.5
Well	80	65.0

Based on data on the distribution of ARI incidence based on gender, it was found that there was a significant difference between boys and girls. The

percentage of ARI in boys was 71.4% and for girls was 70.0%. toddlers with less nutrition and more nutrition are more prone to suffer from ARI than

toddlers with normal nutrition. Of all children under five with less and more nutrition, as much as 88.9% suffer from

ARI compared to normal nutrition as much as 67.6%.

Table 3. Distribution of ARI incidence based on Gender, Anthropometric Status, and Home Environment Score

	ARI		Not ARI	
	n	%	n	%
Gender	45	71.4	18	28.6
Male				
Women	42	70.0	18	30.0
Anthropometric Status	8	88.9	1	11.1
Malnutrition	71	67.6	34	32.4
Good Nutrition	8	88.9	1	11.1
More Nutrition				
Home Environment				
Bad	2	66.7	1	33.3
Enough	28	70.0	12	30.0
Good	57	71.3	23	28.7

Table 4 shows the relationship between anthropometric status and the incidence of ARI in children under five. From the results of the chi-square test, it was found that the p value of ARI incidence was 0.048 with OR 3.8 (95% CI: 0.8-17.6) which indicated that there was a significant relationship ($p < 0.05$)

between anthropometric status and the incidence of ARI. in toddlers. Toddlers with abnormal anthropometric status can increase the risk of ARI events 3.8 times compared to toddlers with normal anthropometric status.

Table 4. Relationship between Anthropometric Status and the incidence of ARI

Anthropometric Status	ARI		Not ARI		Total		P Value	Odds Ratio	Confidants Interval 95%
	n	%	n	%	n	%			
Abnormal	16	13.0	2	1.6	18	14.6			
Normal	71	57.7	34	27.6	105	85.4	0.048	3.8	0.8-17.6
amount	87	70.7	36	29.3	123	100			

Table 5 shows the relationship between home environmental scores and the incidence of ARI among children under five. From the Kruskal Wallis test results, the p value of ARI

incidence was 0.978 which indicated that there was no significant relationship ($p > 0.05$) between the home environment score and the incidence of ARI in children under five.

Table 9. The Relationship between Home Environment Score and the incidence of ARI

Home environment	ARI		Not ARI		Total		P Value
	n	%	n	%	n	%	
Bad	2	1.6	1	0.8	3	2,4	0.978
Enough	28	22.8	12	9.8	40	32.5	
Well	57	46.3	23	18.7	80	65.0	

4. DISCUSSION

The ages in this study were divided into two groups, namely toddlers aged 2-24 months and toddlers aged 25-59 months. As a result, most children aged 25-59 months were 59.3%, while the percentage of children aged 2-24 months was 40.7%. Previous research by Lorensa also showed the same results. In this study, the percentage of toddlers who were more than 24 months old was 55.7%.¹¹ The results obtained in this study were in accordance with the data from the South Sumatra Provincial Health Office which showed the percentage of boys in South Sumatra was 50, 9% and the percentage of girls under five in South Sumatra was 49.1%.¹²

This study shows the data for under-nutrition children is 7.3% which is slightly lower when compared to data from the South Sumatra Provincial Health Office which shows the percentage of under-nutrition children in 2018 is 10.2%.¹³ Base on Oktavia and friends's research, there are several factors that are proven to have a relationship and affect the nutritional status of toddlers. These factors include: the amount of energy consumed, the amount of protein consumed, a history of infectious diseases, the mother's knowledge of nutrition, and the socioeconomic status of the family.¹⁴

According to data on the distribution of ARI incidence among respondents, it was found that most of

the respondents suffered from ARI with a percentage of 70.7%. Recent research conducted in one of the districts in South Sumatra, namely OganKomeriungUlu District, shows that the percentage of ARIs is almost the same. The study, which was conducted in one of the health centers working areas, showed that 77.6% of respondents experienced ARI.¹⁵ Immunization status, breastfeeding pattern, and birth weight had a significant relationship with the incidence of ARI.¹⁶ In addition, the incidence of ARI was also influenced by environmental and socio-economic factors of the family.¹⁷

According to the data on the distribution of the respondents' home environment scores, most of the respondents had a good home environmental score, which was 65.0%. Other similar studies conducted previously also showed that the percentage of a good home environment was higher than that of an unfavorable home environment. This research shows the percentage of lighting, humidity, floor type, house wall, roof, and occupancy density that meet the requirements of 56.2%, 57.5%, 57.5%, 95.9%, 84.9, respectively. %, and 76.7%.¹⁸ The Ministry of Health of the Republic of Indonesia defines a livable house with seven related indicators, namely: access to safe water, access to proper sanitation, sufficient living area (floor area per capita > 7.2 m², type of floor, type of wall, type of roof, and

electric lighting Based on these data, the percentage of livable houses in South Sumatra in 2018 was 94.54% .¹⁹

Of all children under five with abnormal anthropometric status, which includes the anthropometric status of under nutrition and over nutrition, it was found that 88.9% suffered from ARI. The results of this study are in line with the research conducted by Febrianto and colleagues which showed a significant relationship between nutritional status and the incidence of ARI ($P = 0.000$).²⁰ Undernutrition during childhood is closely related to recurrent infections, which worsen through repeated cycles. Inadequate nutrition in children will negatively impact the child's defense against infection. Nutritional status is an important risk factor for upper respiratory tract infection. Malnourished children tended to be diagnosed as ARI more frequently than children with normal nutritional status.^{21,22}

Malnutrition affects the prevalence of severe ARI. ARI in malnourished children had a 3 times higher risk of developing pneumonia than well-nourished children. Malnutrition has been shown to influence the development of cellular, innate and humoral immunity. Nutrition is a component that supports the immune system to work optimally. Several vitamins, including vitamins A, B6, B12, C, D, E, and folate; and other elements, such as zinc, iron, selenium, magnesium, and copper, play an important and complementary role in supporting the innate and adaptive immune systems.^{23,24}

This study did not show that there was a significant relationship ($p > 0.05$) between home environment scores and the incidence of ARI in children under five. This is not in line with previous studies which found a significant

relationship between home conditions and the incidence of ARI. This study found a significant relationship between occupancy density and the incidence of ARI ($P = 0.017$).²⁵

Ventilation that does not meet the requirements will cause the change of air circulation to be bad, the floor of the house that is not plastered or from the ground will be more susceptible to causing the house to become dusty, the roof of the house and the walls of the house that do not meet the requirements also tend to easily leak or have holes, making it easier for dust to enter into the house. These conditions cause the home environment to influence the incidence of ARI. In addition, the smoking habit, the density of occupancy humidity, and air quality are also the causes of ARI.^{18,26,27,28}

In this study, the researcher did not conduct research directly and directly examined the condition of the respondent's house. The research was conducted with a questionnaire so that it was possible for the respondent to make mistakes in perceiving questions and answering questions. This is the possibility of differences in the results of this study when compared with previous studies

5. CONCLUSION

Most of the respondents were toddlers aged 25-59 months with the largest gender being male. Most of the respondents suffer from ARI, have a good normal nutritional anthropometric status, and have a good home environment score. This study found a significant relationship between anthropometric status and the incidence of ARI and did not find a significant relationship between home environmental scores and the incidence of ARI.

REFERENCES

- [1]. Cohen, AJ, Brauer, M., Burnett, R., Anderson, HR, Frostad, J., Estep, K., Balakrishnan, K., Brunekreef, B., Dandona, L., Dandona, R., Feigin, V., Freedman, G., Hubbell, B., Jobling, A., Kan, H., Knibbs, L., Liu, Y., Martin, R., Morawska, L., Arden Pope, I., Shin, H., Straif, K., Shaddick, G., Thomas, M., Dingenen, R. van, Donkelaar, A. van, Vos, T., Murray, CJL and Forouzanfar, MH, 2017. Estimates and 25- year trends of the global burden of disease attributable to ambient air pollution: an analysis of data from the Global Burden of Diseases Study 2015. *Lancet*, 389 (10082), pp. 1907–1918.
- [2]. Landrigan, PJ, 2016. Air pollution and health. *Lancet Public Health*, 2 (1), pp. PE4-E5.
- [3]. Mishra, V., 2003. Indoor air pollution from biomass combustion and acute respiratory illness in preschool age children in Zimbabwe. *International Journal of Epidemiology*, 32, pp. 847–853.
- [4]. Disaster Management and Information Data Center for National Disaster Management Agency, 2019. The area of burned land throughout Indonesia reaches 857 thousand hectares. [online] Available at: <<https://bnpb.go.id/Expand-lahan-terbakar-seluruh-indonesia-capai-857-ribu-ha>> [Accessed 21 Nov 2020].
- [5]. Andrianto, N., 2019. Seriousness in Preventing Karhutla. *BPP Media*, 4 (5), pp. 54–55.
- [6]. Annamalay A and Peter Le Souef. 2017. Viral-Bacterial Interaction in Childhood Respiratory Tract Infection. *Viral Infections in Children*, Vol 1: 193-214.
- [7]. Alexandrino, AS, Santos, R., Melo, C. and Bastos, JM, 2016. Risk factors for respiratory infections among children attending day care centers. *Family Practice*, 33 (2), pp. 161–166.
- [8]. Supariasa, Bahcyar Bakri, Ibnu Fajar. 2013. *Assessment of Nutritional Status (Revised Edition)*. Jakarta: Book Medical Publishers EGC.
- [9]. Soekirman, 2000. *Nutrition Science and Its Applications*. Jakarta: Directorate General of Higher Education, Ministry of National Education.
- [10]. Halim Y, Pambudi W. 2019. The Relationship between Nutritional Status and the Prevalence of ARI in Children aged 6-24 months at the Regional Health Center of the City of West Jakarta Administration for the period January-April 2017. *Tarumanegara Medical Journal*, 1 (2), pp. 428-433
- [11]. Lorensa, Permana, Mia, Nindya Leiden, Nurul Lestari, Pribawa, Trisia, M. Imun, Lestari. 2017. The Relationship of Nutritional Status (Weight for Age) on the Incidence of Acute Respiratory Tract Infection (ISPA) in Toddlers. *Periodic Journal of Health*, Vol. 3, No. 1, May 2017: 32-38
- [12]. South Sumatra Provincial Health Office. 2019. *Health Profile of South Sumatra Province in 2019*.
- [13]. South Sumatra Provincial Health Office. 2019. *Annual Performance Plan for Deconcentration of Health Services for 2019*.
- [14]. S. Oktavia, L. Widajanti, and R. Aruben, 2017. Factors Associated with Malnutrition Status in

- Toddlers in Semarang City in 2017 (Study at the Banyumanik Nutrition Restoration Home, Semarang City). *Journal of Public Health*, Vol%, No. 3.
- [15]. Septiani, Eichi. 2020. The Relationship between Nutritional Status and the Incidence of ARI in Toddlers in the Work Area of the TanjungAgungCommunity Health Center, OganKemerling Ulu Regency, 2019. *Journal of Medika Masks*, Vol 8, No 1.
- [16]. Santoso, Eko Budi and Hairil Akbar. 2018. Factors Associated with the Incidence of ARI in Toddlers in the Juntinyuat Health Center Work Area. *Hibualamo Journal Series Natural and Health Sciences*, Vol 2, No 2.
- [17]. Thomas M, Koutsothanasis GA, Bomar PA. Upper Respiratory Tract Infection. [Updated 2020 Jun 30]. [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan-. Available in:<https://www.ncbi.nlm.nih.gov/books/NBK532961/>
- [18]. Irma Suharno, Rahayu H. Akili, Harvani B. Boky 2019. The Relationship between the Physical Conditions of the House and the Incidence of ARI in Toddlers in the Wawonasa Community Health Center, Manado City. *KESMAS Journal*, Vol 8, No 4.
- [19]. Ministry of Health of the Republic of Indonesia. 2019. *Indonesia Health Profile 2018*.
- [20]. Wahyu Febriyanto, Ircham Mahfoedz, Mulyanti 2015. Nutritional status is related to the incidence of ARI among children under five in the Working Area of Puskesmas Wonosari I, Gunungkidul Regency 2014. *Journal of Nutrition and Dietetic Indonesia*, Vol. 3, No. 2, May 2015: 113-118.
- [21]. Ghosh, Kishore, Shaikh, Satyavrat, Kumar, Shah, Pote, Shinde, Berde, Low, Tan, Hyunh. 2018. Effect of Oral Nutritional Supplementation on Growth and Recurrent Upper Respiratory Tract Infections in Picky Eating Children at Nutritional Risk: A Randomized, Controlled Trial. *Journal of International Medical Research*, Vol 46 (6).
- [22]. Elsanita, Kurniadi, Wulandari, Setiadi. 2015. Undernutrition Affects the Occurrence of Acute Respiratory Infections in Children Under Five Years Old in Cipacing, Jatinangor Subdistrict, West Java From October to November 2012. *Althea Medical Journal*, Vol 2 (3).
- [23]. Ujunwa FA and CT Ezeonu. 2014. Risk Factors for Acute Respiratory Tract Infections in Under-five Children in Enugu Southeast Nigeria. *Annals of Medical and Health Sciences research*, Vol 4 (1).
- [24]. Calder, Carr, Gombart, Eggerdorfer. 2020. Optimal Nutritional Status for A Well-Functioning Immune System Is An Important Factor to Protect Against Viral Infections. *Nutrients*, Vol 12 (4): 1181.
- [25]. Dongky, Patmawati and Kadrianti. 2016. Risk Factors for the Physical Environment of the House with the Incidence of ARI under Toddler in Kelurahan Takatidung Polewalimandar. *Unnes Journal of Public Health*, Vol 5 (4).
- [26]. Safrizal SA. 2017. The Relationship between Ventilation, Floor, Wall, and Roof with the Incidence of ARI in Toddlers in

- BlangMuko. Proceedings of the National Seminar on IKAKESMADA "The Role of Health Workers in the Implementation of SDGs".
- [27]. Makatita Bazrul. 2019. RelationshipsRelationship between Home Environment Risk and Acute Respiratory Infection in Toddlers in the Regional Technical Implementation Unit of the Fiditan Community Health Center, Tual City. *Pasapua Health Journal*, Vol 1 No 2.
- [28]. Adesanya and Chi Chiao. 2017. Environmental Risks Associated with Symptoms of Acute Respiratory Infection among Preschool Children in North-Western and South-Southern Nigeria Communities. *International Journal of Environmental Research and Public Health*, Vol 14 (11): 1396.