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The Relationship of Environmental Factors and Nutritional Status and The Incidence of ARI of Toddlers in the Working Area of Donggala Public Health Center

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Abstract

Acute Respiratory Tract Infection (ARI) is one of the contributors to the high morbidity and mortality rates of a toddler. ARIs are mostly suffered by the toddler in developing countries such as Indonesia, where the incidence is always high every year. The purpose of this study was to analyze the relationship between environmental factors and nutritional status with the incidence of ARI in children under five in the Donggala Community Health Center working area. This type of research is quantitative with a cross-sectional approach. The population in this research was 32,694 toddlers using the Slovin formula and obtained a sample of 100 toddlers. The sampling used was the Probability Sampling technique. The analysis used was Chi-Square. The variables that are significantly related to the incidence of ARI are nutritional status, smoking behavior, house ventilation, and residential density with a p-value < 0.05. Most of the respondents were malnourished, namely, 58%, had a high risk of exposure to cigarette smoke, which was 64%, and the house ventilation area which was included in the not good category was 57% and the residential density was included in the not eligible category at 59%. Prevention efforts to reduce the incidence of ARI in toddlers are by consuming nutritious food, education about house ventilation, and residential density, and increasing awareness of smoking behavior among parents.

Keywords*:* Acute Respiratory Infection (ARI), Malnutrition, Residential Density, House Ventilation, Smoking Behavior of Parents

Key Messages:

- There is a significant relationship between the nutritional status of children under five, the parents' smoking behavior, house ventilation, and residential density with the incidence of ARI in children under five at the Donggala Health Center

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1. Introduction

Infectious diseases are still a major public health problem in Indonesia, in addition to the increasing problem of non-communicable diseases. There are no administrative boundaries in Infectious diseases, so eradicating these diseases requires cooperation between regions (1). One of the infectious diseases is Acute

Respiratory Tract Infection (ARI); the most common disease worldwide and leads to significant morbidity and mortality. Viruses often cause ARIs; many causative agents are easily transmitted from human to human and thus often cause epidemics. ARI is the largest cause of death in children worldwide (2).

WHO data revealed that the prevalence of children under 5 years hospitalized with ARI is estimated at 20%, and 90% are pneumonia. Patients with ARI, especially pneumonia, accounted for 15% of all deaths in children under 5 years and caused the death of 808,694 children in 2017 (3).

The prevalence of the incidence of ARI in Indonesia in 2019 was 3.55%. The description of the most ARI cases based on age was found at the age of 1-4 years, as many as 313,749 cases, while the death rate caused by the most ARI incidence occurred in the 1-4 years old group with 300 cases (4). Based on data from the Ministry of Health of the Republic of Indonesia in 2019, the prevalence of ARI in Central Sulawesi reached 5.19% (4). Data from 16 Public Health Centers in Donggala Regency showed that Donggala Health Center has the highest prevalence at 47.18%, Lembasada Health Center at 54.24%, and Tompe Health Center at 47.68% (5). The provision of complete basic immunization can provide an important role in preventing the incidence of ARI. At the same time, one of the factors causing the high number of ARI cases in Donggala Regency is the nutritional status of children under five and environmental factors. Good nutrition will generally increase the body's resistance to infectious diseases. The nutritional status of toddlers is an important thing that every parent must know. Inadequate nutritional intake is a risk for the incidence and mortality of children under five with respiratory infections (6).

Besides the nutritional status of children under five, ARI is closely related to the physical environment of the house. The physical environment of the house that does not meet the requirements is a big risk for the incidence of ARI. Toddlers are the group most at risk of ARI infection because toddlers spend more time at home, and toddlers' immune systems are still weak compared to adults (7). The physical environment of the house where the family gathers and takes refuge is not healthy, so there is a great risk of causing various diseases in toddlers, one of which is ARI. This is because an unhealthy home environment will become a place for bacteria and viruses to grow and develop, which will be exposed to toddlers. Physical environmental factors that affect the incidence of ARI include floor conditions, walls, ventilation, humidity, temperature, lighting, and occupancy of bedrooms that do not meet the requirements are risk factors for ARI (8). One of the house's neglected parts is the bedroom's ventilation. Insufficient ventilation will also cause humidity to rise due to the evaporation of liquid from the skin. This moisture is a good medium for disease-causing bacteria (6).

The room occupancy can cause humidity due to water vapor from breathing and followed by an increase in carbon dioxide (CO2); decreased oxygen levels can have an impact on decreasing air quality in the house so that the resistance of the occupants is reduced and bacterial contamination occurs easily which then causes respiratory tract diseases such as ARI (9). The floor of a house made of rough plaster may produce dust and is not waterproof, so it becomes damp (10). The type of house floor can affect ARI disease because floors that do not meet health standards are a good medium for the proliferation of bacteria or viruses that cause ARI. The general risk factors that can cause ARI are socioeconomic conditions, air pollution, and cigarette smoke. In families who smoke, statistically, children under five have the possibility of getting ARI 2 times compared to toddlers from families who do not smoke (11).

This research intends to analyze the relationship between environmental factors and nutritional status with the incidence of ARI in toddlers in the working area of Donggala Public Health Center.

2. Methods

This type of research was a quantitative research with an analytical survey approach with a Cross-Sectional Study design, which would be conducted from November 2021 to January 2022; the research location was in the work area of the Donggala Health Center. The population of this study was children under 5 years old in the Donggala Health Center working area, as many as 32,694 persons. This study used the Probability Sampling Technique, with the independent variables being nutritional status, parents' smoking behavior, house ventilation, occupancy density, and type of floor, while the dependent variable was ARI. The data analysis used was the Che Square test with a $p < 0.05$.

3. Results

Table 1 shows that the variables that are significantly related to the incidence of ARI are nutritional status, smoking behavior, house ventilation, residential density with p value < 0.05. Most of the respondents were malnourished, namely 58%, had a high risk of exposure to cigarette smoke, which was 64%, and the house ventilation area which was included in the not good category was 57% and the residential density was included in the not eligible category at 59%.

Table 1. Nutritional and Environmental Status Factors with the Incidence of ARI in Toddlers in the Donggala Health Center Work Area

Variable	Incidence of ARI in Toddlers				Total		*p value*
	Yes		No				
	n	%	n	%	n	%	
Nutritional status							
Malnutrition Status	48	68.6	10	33.3	58	58.0	
Normal	22	31.4	20	66.7	42	42.0	*0.001*
Smoking Behavior							
High Risk	54	77.1	10	33.3	64	64.0	*0.000*
Low Risk	16	22.9	20	66.7	36	36.0	
House Floor Type							
Not eligible	38	55.4	11	36.7	47	47.0	0.175
Eligible	34	48.6	19	63.3	53	53.0	
Home Ventilation Area							
Not good	45	64.3	12	40.0	57	57.0	0.025
Good	25	35.7	18	43.3	43	43.0	
Residential density							
Not eligible	48	68.6	11	36.7	59	59.0	0.003
Eligible	22	31.4	19	63.3	41	41.0	
Total	**70**	**100**	**30**	**100**	**100**	**100**	

4. Discussion

The Relationship between Nutritional Status and the Incidence of ARI in Toddlers

Table 1 shows that among 58 toddlers with poor nutritional status, 48 toddlers experienced ARI (68.6%). This is due to the parents' low economic status, which can affect the fulfillment of household foodstuffs. The income level can determine the type of food to be purchased with additional income, so economic status or family income is an important factor in the quantity and quality of food (12). These factors can affect the lack of nutritional intake that enters the body, resulting in an imbalance between food intake and the needs of the toddler's body. Under-fives with poor nutrition are more susceptible to infectious diseases than well-nourished children, and this is due to their weak immune systems against pathogen invasion. Lack of nutrients can also affect the metabolism of vitamins and minerals that act as antioxidants and cannot function optimally; as a result, both normal flora and external bacteria can quickly develop, and their virulence increases, causing disease symptoms, including acute respiratory infections (ARI) (13).

The Relationship of Parents' Smoking Behavior with the Incidence of ARI in Toddlers

The habit of parents smoking in the house can harm family members and children, especially toddlers (14). Smoking in parents is often influenced by the lack of awareness in maintaining their children's health. They smoke freely, inside and outside the home, because they ignore the dangers of smoking to the health of others. Smoking habits are also at risk of increasing the susceptibility of the respiratory tract to disease agents because the toxins in cigarettes damage the respiratory defense mechanisms. Cigarette smoke from parents or residents on the same roof as toddlers is a serious pollutant in the living space and will increase the risk of illness from toxic substances in children (15). The harmful gases in cigarette smoke stimulate the formation of mucus, dust, and

bacteria, which the accumulation cannot be expelled, causing chronic bronchitis, paralysis of elastic fibers in lung tissue, and resulting in the rupture of air pockets.

The Relationship between House Floor Type and ARI Incidence in Toddlers

The floor is a building component that holds ground water or animals from the ground, and vice versa as a load-bearing, commonly called a space divider at the bottom (16). The type of floor in this study was categorized into 2: the type of floor that meets the requirements.

According to the results of the research conducted, it was found that there was no significant relationship between the type of floor of the house and the incidence of ARI in children under five in the Donggala Health Center work area. Based on Table 1, 19 children under five (63.3%) did not experience ARI, and the type of floor of the house had met the requirements; this was because some of the respondent's houses had water-resistant types of floors and were made of ceramics and tiles, so it was easy to clean from dust. A suitable type of house floor is made of materials that are not flammable and not easily moistened because materials that contain high humidity can become a place for germs to breed, thereby increasing the risk of ARI, coupled with no sunlight entering the house (17).

Table 1 shows that of the 53 types of the floor of under-five children's houses that meet the requirements, 34 under-five children experienced ARI (48.6%). This was because the respondent's house had a carpeted floor and was rarely cleaned, so dust accumulates on the surface of the carpet, causing toddlers to inhale the dust when playing/laying on the carpet, in addition to factors that make toddlers experience ARI but the type of floor meets the requirements was most toddlers have bad nutritional status (47.2%).

However, our study's results found that the type of floor of the respondent's house did not meet the requirements, but 38 of their toddlers had ARI (55.4%). This is because there were still houses with floors made of coarse plaster (21.0%) and wood (17.0%), so they were still dusty when cleaned, which can cause ARI. Exposure to dust can irritate the upper respiratory tract, such as the nose and throat. Long-term exposure to dust can later damage the tissues around the nose and throat, and this condition can increase production in the upper respiratory tract (18).

The Relationship between the Area of Home Ventilation and the Incidence of ARI in Toddlers

One of the physical environmental factors assessed in this study was the ventilation area of the house. Home ventilation provides air or exchanges air from outside into the house or vice versa, either naturally or mechanically (19); this study was grouped into two categories: good ventilation and poor ventilation. Based on the results obtained, 45 toddlers had ARI (64.3%), and the ventilation of the house they lived in did not meet the requirements. This was because the houses in the Donggala Health Center working area had ventilation but did not comply with the terms and conditions of a healthy house because the ventilation was only small, some had ventilation but used cloth/plastic covers, and some had ventilation only in the living room. However, there was no ventilation in the family room and bedroom, which would cause health problems.

The size of the house ventilation significantly affects the incidence of ARI in toddlers. Where the size of the ventilation according to a healthy home and not using a cover made of glass/plastic is better because the air circulation will alternate; on the contrary, the size of small ventilation or ventilation using a cover made of glass/plastic is more likely to create air circulation that does not alternate in inside the house. Another factor that causes the ventilation area to be related to the incidence of ARI is the ventilation area of the house <10% of the floor area. This can cause a lack of oxygen in the house. Besides that, natural lighting from sunlight that does not enter the house can cause the humidity in the house to rise and is also a suitable medium for the growth of bacteria/viruses/parasites. It may cause health problems, especially in the respiratory system.

A house whose ventilation area does not meet health requirements will affect the health of the occupants of the house (6). This is because the process of exchanging air flow from outside to inside the house is not smooth, so the bacteria that cause ARI disease in the house cannot get out. Ventilation also causes an increase in room humidity due to the evaporation of liquid from the skin. Therefore, a high room humidity will be a good medium for the proliferation of bacteria that cause ARI.

Based on the study results, there were houses whose ventilation did not meet the requirements/not good, but there were children who did not experience ARI, as many as 12 toddlers (40.0%). This is because the room air

is still possible through the main door because of the wide door gap; the habit of opening the door found in some respondents' homes supports the provision of fresh air and good circulation in the house; it is not easy to breed sources of infectious diseases.

Relationship of Occupancy Density with ARI Incidence in Toddlers

Based on the results of the study, it was found that there was a significant relationship between residential density and the incidence of ARI in children under five in the Donggala Community Health Center working area. It was due to 48 children under five (68.0%) who experienced ARI residing with residential densities that did not meet the requirements. The residential density value was obtained from the calculation between the floor area of the house and the number of family members living in the house. The results obtained that most of the houses had a high residential density. Some of these toddler houses were inhabited by 5-8 family members, of which 2 toddlers were living in them. When the density of housing does not meet the requirements, it will harm health, especially for toddlers, lack of oxygen and facilitate the transmission of diseases through the air, causing toddlers to be vulnerable to the incidence of ARI.

The ratio of occupants must be adjusted to the area of the house if the area is narrow, while the number of family members will be unbalanced. Crowded housing conditions trigger the emergence of bacteria and viruses that can be transmitted through the respiratory tract. Underage children are susceptible to contracting these bacteria and viruses (20). The house area that is not proportional to the number of residents will cause it to be overcrowded. This is unhealthy since it causes a lack of oxygen consumption; if one of the family members suffers from an infectious disease, especially ARI, it will easily spread to other family members because an average patient can infect two to three people in his house (6).

The density of residential homes will increase the room temperature caused by the release of body heat, which will increase the humidity due to water vapor from the breath (21). So that the more occupants of the house, the faster the air in the room experiences gas or bacterial contamination. The more occupants, the oxygen level will decrease, followed by an increase in CO2 in the room; the impact of the increase in CO2 in the room is a decrease in air quality in the house.

5. Conclusion

There is a significant relationship between the nutritional status of children under five, the parents' smoking behavior, house ventilation, and residential density with the incidence of ARI in children under five at the Donggala Health Center. However, there is no significant relationship between the type of floor of the house with the incidence of ARI in children under five at the Donggala Health Center. Prevention efforts to reduce the incidence of ARI in toddlers are through increasing the consumption of nutritious food, education and meeting the requirements of a healthy home, as well as improving awareness of good smoking behavior for parents.

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