



Original Research

## Exclusive Breastfeeding Associated with the Reduction of Acute Respiratory Tract Infections in Toddlers with High-Risk Factors

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### ABSTRACT

**Introduction:** Acute respiratory tract infections (ARI) is a disease that is the primary cause of death, especially in children. Toddlers can be prevented from developing ARI with increased immunity. Giving breast milk can increase children's immunity, but there are still children who experience ARI. This study aimed to explain the differences in Acute Respiratory Tract Infections (ARI) events in toddlers who are exclusively and non-exclusively breastfed.

**Methods:** The research design used was descriptive-comparative with a retrospective design. The population in this study were all children one to three years of age. A sample of 158 toddlers was recruited by a purposive sampling technique. Data retrieval was done with the criteria that the child had visited a public health centre (puskesmas) or integrated health care service post (posyandu), and does not suffer from a disease such as asthma or have any allergies. The variables were measured using a questionnaire and observation sheet. Data analysis was done by a chi-square test and binary logistic regression.

**Results:** The results showed that there were differences in ARI incidence in toddlers (one to three years) who were exclusively and non-exclusively breastfed with a value of  $p = 0.003$ . The air pollution factor proved to be significant, dominantly affecting the incidence of ARI.

**Conclusion:** Differences in ARI incidence in toddlers who are exclusively and non-exclusively breastfed is possible due to air pollution factors. Key implications for nursing practice from this research are improving services, and prevent the occurrence of ARI.

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### INTRODUCTION

Acute Respiratory Tract Infection (ARI) is an infection that attacks the throat, nose, and lungs which occurs around fourteen days (Kemenkes RI, 2012) and becomes the main cause of death, especially in children around the world (Fillatre et al., 2018). Around 18-33% of the death of children under five years is estimated to be caused by ARI (Khan & Islam, 2017). In addition, 6.6 million children under five years old died in the world annually. As many as 95% occurred in developing countries, and one-third of which were caused by ARI (Tazinya et al., 2018).

Risk factors of ARI include the provision of breastmilk, the nutritional status of infants, birth weight, air pollution, immunization status, and

population density (Kemenkes RI, 2012). Incomplete exclusive breastfeeding is one of the risk factors for ARI, especially in toddlers who are very susceptible to the infection. In other words, toddlers who are not exclusively breastfed have a high risk of ARI (Arifeen et al., 2001), while the risk can be reduced in those who are exclusively breastfed (Hanieh et al., 2015). In addition, patients with mild ARI (not pneumonia) can be worsened into severe if not treated properly (Qazi et al., 2015). Furthermore, ARI can be experienced several times by children as many as three to six times per year on average (Riskseddas, 2013).

The existence of a stimulus, in this case, the provision of breastmilk, will lead to the emergence of coping mechanisms in individuals. The regulator subsystem is part of a coping mechanism that has

several adaptive modes. Breast milk contains anti-bacterial factors including secretory Ig A, IgG, epithelial cell receptor analogues, casein, alpha-lactalbumin, lipids, and phosphorylated beta-casein (Andreas, Kampmann, & Mehring Le-Doare, 2015) which will help the children to response viruses or bacteria inhaled. The presence of these substances will result in a high content of anti-bacterial factors and will prevent the entry of viruses or bacteria entering the body, and subsequently, prevent the occurrence of ARI.

Previous research in Indonesia indicated that there was a relationship between the history of exclusive breastfeeding and the incidence of ARI in one-year-old children (Anggraeni & Warsiti, 2010). Another study was that the incidence of ARI was lower at the age of seven to twenty-four months who were given exclusive breastfeeding than those who were fed with formula milk (Dewi, 2017). Previous research conducted abroad showed that risk factors for age, sex, immunization status, breastfeeding, nutritional status, and population density were not significantly associated with ARI events (Tazinya et al., 2018). The results of previous studies in Indonesia showed that there was no research subjects toddler.

Based on previous research that does not have a toddler's age, a study will be conducted on the differences in ARI incidence in toddlers who are given exclusive and non-exclusive breastfeeding. The results of previous studies abroad showed that ARI risk factors were not significantly associated with ARI events. Based on those results, re-research needs to be done, especially in Indonesia due to differences in characteristics and culture.

Based on East Java's 2016 health profile data, the number of babies in the East Java region was 509,874 toddlers, 74.3% of these were exclusively breastfed. Whereas in the Lamongan area the number of toddlers was 18,542 with 73.3% of that number having been exclusively breastfed (Riskasdas, 2013). The results of a preliminary study of ten mothers who had toddlers found five children were exclusively breastfed and five children were non-exclusively breastfed. From the five children who were exclusively breastfed, four children rarely experienced ARI and one child often developed ARI (Rohma, 2018). Meanwhile, three out of five children who were non-exclusively breastfed often experienced the incidence of ARI and two children rarely experienced ARI events. The frequency category of ARI events in children is said to be rare if it occurs once in the last two months and often if it occurs twice or more than three times in the last two months (Kemenkes RI, 2012).

Based on data obtained from the 2016 East Java health profile, there were 102,712 cases of ARI in infants were found and treated. Preliminary study results at the health profile of Lamongan Regency 2016 recorded 5,372 toddlers of ARI cases that were found and handled. Lamongan was the highest of five regencies or cities that have ARI cases in East Java.

According to the Public Health Office of Lamongan, in 2017, as many as 3,479 toddlers suffered from ARI and 223 toddlers suffered from severe pneumonia. In a district community health centre in Lamongan, from January to April 2018, there were 44 infants who suffered ARI pneumonia and severe pneumonia.

Therefore, based on the description above, researchers are interested to conduct investigations that can determine the difference in the incidence of ARI in toddlers who are exclusively and non-exclusively breastfed. Knowing these differences will eventually encourage mothers to exclusively breastfeed children to reduce the incidence of ARI. This research aimed to explain the differences in ARI events in toddlers (one to three years) who are exclusively and non-exclusively breastfed.

## MATERIALS AND METHODS

The research design was descriptive-comparative with a retrospective approach looking at ARI events that had occurred in the past, namely toddler age.

The population of this study was all children one to three years old (toddlers) in Lamongan, Indonesia. The data was collected in a district which had a primary public health centre (*puskesmas*), and six health service posts (*posyandu*) as program implementers. The *puskesmas* noted that the number of children under five in April 2018 was 301 toddlers. A sample of 158 toddlers was recruited by purposive sampling technique. The technique was done by determining the sample based on predetermined criteria, namely toddlers who had visited a public health centre, and did not suffer from a disease such as asthma or have any allergies. The study was conducted from June 22 to July 9, 2018.

The procedure for data collection was carried out for the first time at a *puskesmas* in one of Lamongan's districts by assessing medical records of the toddlers who met the inclusion criteria for some information such as address, demographical characteristics, and incidence of ARI over the past two months. The ARI incidence data were used to determine categories.

Toddlers who met the criteria were visited at their home in which the researchers asked for permission to the children's parents to be involved as research subjects. The parents were explained with the purpose and procedure of the study and then asked for a signature as evidence of agreeing or disagreeing as for the subject of the study. Respondents who agreed to be the subjects were accompanied to fill out questionnaires about self-identity, exclusive breastfeeding, and air pollution. Room occupancy density data was taken by measuring the respondent's room area directly. Nutritional status data and immunization history were obtained from *kartu menuju sehat* (growth chart). The collected data were then analyzed and explained.

Research variables were breastfeeding, ARI incidence in toddlers and ARI risk factors. Variables

of ARI risk factors consisted of low birth weight (LBW), nutritional factors, air pollution, occupancy density, and complete immunization. The research instruments used were the ARI and ARI risk questionnaire which was modified from the research of Agungnisa (2017) and Simarmata (2017). In addition to questionnaires, there were variables measured by observation techniques, namely nutritional status by looking at the growth chart data, ARI occurrences were determined by assessing the medical records, and the occupancy density of the room was measured using a meter. The category of ARI events in children was divided into "rare", less than once in the last two months; and "often", more than twice in the last two months) (Kemenkes RI, 2012). Occupancy density categories were grouped into crowded, eight square meters for more than two people or less than four square meters for one person; and worthy, eight square meters for two people or more than four square meters for one person (Agungnisa, 2019).

This study used a Chi-square test with a significance of  $\alpha \leq 0.05$  for the analysis of the hypothesis of the relationship between the incidence of ARI and breastfeeding. The relationship between ARI and the risk factors were analyzed using a binary logistic regression test.

The research procedure had been tested and declared ethical by the Health Research Ethics Committee of the Faculty of Nursing, Universitas Airlangga, on July 2nd, 2018 with an ethical approval number of 982-KEPK. The ethical principles applied in this study included participants who were given information and provided informed consent before the data collection. They had the right to confidentiality of data by using initials.

## RESULTS

Out of 158 respondents, there were 76 toddlers who were not exclusively breastfed (Table 1). The majority of toddlers who are non-exclusively breastfed, often experience ARI (59.2%). In addition, the majority of toddlers who were exclusively breastfed rarely experienced ARI (64.6%), which means that an incidence of rare ARI was found.

To identify the relationship between the variable risk factors for ARI events and the main variable, namely the incidence of ARI, a series of initial analyses were carried out (Table 2). The proportion of underweight birth weight is in accordance with the standard, the majority of which was 135 (85.4%) of normal birth weight. Also, most of the nutritional status and immunization status are good (96.2% and 79.1% respectively), which means that toddlers' nutrition was fulfilled and the immunization was complete. Moreover, air pollution around the homes of toddlers with poor or unhealthy air pollution was 35.4%, while moderate air pollution was 45.6% and only 19% were healthy. In accordance with the standards imposed by the Indonesian government, more than half of toddlers (56.3%) experienced

inadequate housing. LBW toddlers who are non-exclusively breastfed (47.8%) often experience ARI. Toddlers with good nutritional status and exclusive breastfeeding (32.9%) rarely experience ARI.

Toddlers with complete immunization status and exclusive breastfeeding (32.8%) rarely experience ARI. Toddlers who lived in unhealthy air pollution areas and were non-exclusively breastfed (66.1%) often experience ARI. Toddlers who lived in homes with worthy room and obtained exclusive breastfeeding (37.7%) rarely experience ARI. In particular, air pollution had the most dominant relationship to the incidence of ARI in toddler children. This is indicated by p-value = 0.000.

The results of this study indicate that there were differences in the incidence of ARI in toddlers who were exclusively and non-exclusively breastfed. The results of the Chi-square statistical test obtained a p-value of 0.003 which means that the first hypothesis (H1) is accepted if  $p < 0.05$  (Table 1).

## DISCUSSION

ARI events in the category are often lower for toddlers who are exclusively breastfed than for non-exclusive children. This is evidenced by the results of the data that most toddler who exclusively breastfed experienced ARI in the rare category; whereas most toddlers who were non-exclusively breastfed experienced ARI in the frequent category. The incidence of ARI is said to be rare if it occurs once in the last two months and often if it occurs twice or more than three times in the last two months (Kemenkes RI, 2012).

The results of this study were in line with previous studies which stated that there was a significant difference in the incidence of ARI between children who were exclusively breastfed and those who were given complimentary food for breast milk at the age of 7-24 months (Dewi, 2017). The difference in ARI incidence in children who were exclusively and non-exclusively breastfed is because breast milk contains anti-bacterial and anti-viral factors (Andreas et al., 2015). Breast milk also contains anti-inflammatory substances and anti-infective substances. The presence of these ingredients can prevent infectious diseases caused by bacteria, viruses, and parasites (Riksani, 2012).

Some studies also prove that breast milk can reduce the incidence of infections in infancy and toddlers such as gastroenteritis, respiratory infections, otitis media, neonatal sepsis and urinary tract (Aldy, Krupnick, Newell, Parry, & Pizer, 2009). Most toddlers who were exclusively breastfed experienced ARI in the rare category. It is evident that exclusive breastfeeding can reduce the risk of ARI in infants (Hanieh et al., 2015). As for toddlers who were given non-exclusive breastfeeding, most experienced ARI in the frequent category. It proves that ARI has a high risk in children who are not exclusively breastfed (Arifeen et al., 2001).

Table 1. The comparison of ARI occurrence in toddlers who were given exclusive and non-exclusive breastfeeding (N=158)

Breastfeeding	ARI		Total n (%)	Chi-Square Test p-value
	Often n (%)	Rare n (%)		
Non-exclusive	45 (59.2)	31 (40.8)	76 (100)	0.003
Exclusive	29 (35.4)	53 (64.6)	82 (100)	

Table 2. Risk factors of ARI in non-exclusively and exclusively breastfed toddlers (N=158)

Risk Factors	ARI Frequency	Non-exclusive breastfeeding		Exclusive breastfeeding		Total		P-value
		n	%	n	%	n	%	
<b>Birth weight</b>								
Low	Often	11	68.8	2	28.6	23	14.6	0.829
	Rarely	5	31.3	5	71.4			
Not Low	Often	34	56.7	27	36.0	135	85.4	
	Rarely	26	43.3	48	64.0			
<b>Nutritional status</b>								
Poor	Rarely	3	100.0	3	100.0	6	3.8	1.000
Good	Often	45	61.6	29	36.7	152	96.2	
	Rarely	28	38.4	50	63.3			
<b>Immunization</b>								
Less	Often	9	56.3	5	29.4	33	20.9	0.619
	Rarely	7	43.8	12	70.6			
Complete	Often	36	60.0	24	36.9	125	79.1	
	Rarely	24	40.0	41	63.1			
<b>Air condition</b>								
Poor	Often	37	97.4	16	88.9	56	35.4	0.000
	Rarely	1	2.6	2	11.1			
Fair	Often	5	20.0	11	23.4	72	45.6	
	Rarely	20	80.0	36	76.6			
Good	Often	3	23.1	2	11.8	30	19.0	
	Rarely	10	76.9	15	88.2			
<b>Occupancy</b>								
Crowded	Often	30	68.2	18	40.0	89	56.3	0.799
	Rarely	14	31.8	27	60.0			
Worthy	Often	15	46.9	11	29.7	69	43.7	
	Rarely	17	53.1	26	70.3			

According to the results of previous studies, the lack of breastfeeding could increase the likelihood of ARI and diarrhoea (Khan & Islam, 2017). These results were supported by previous findings, where children who have been formula milk-fed since babies had experienced severe respiratory diseases and required more than three hospitalizations compared to infants who were exclusively breastfed (Bachrach, Schwarz, & Bachrach, 2003). Moreover, Mahrshahi et al. (2007) stated that the increase in exclusive breastfeeding can reduce child morbidity and mortality and is essential to increase the survival rate of children. These results are similar to other studies which also confirm that exclusive and prolonged breastfeeding has the large protective benefit of morbidity (Quigley, Kelly, & Sacker, 2007).

This study also analyzed five risk factors for the occurrence of other ARIs which according to the Indonesian Ministry of Health was an essential element to control ARI (Kemenkes RI, 2012). The five risk factors include low birth weight, nutritional

status, immunization status, air pollution, and occupancy density. The five factors had been tested using binary regression analysis and show that air pollution had a significantly associated with the incidence of ARI. This result was in line with a study of Kumar, Roy, & Suguna (2014) stating that there is a significant relationship between meeting clean air needs and the incidence of ARI in infants. It indicates that children who live in a good environment of low air pollution have a lower chance of suffering ARI compared to those who live with unhealthy air pollution.

Based on the Ministry of Health of the Republic of Indonesia, intensification carried out in the context of prevention and control of ARI includes a family approach (Kemenkes RI, 2012). The family approach that can be undertaken is through promotive and preventative methods. Promotive efforts include exclusive breastfeeding, balanced nutrition, reducing air pollution, coughing behaviour, and early detection. Preventive efforts include immunization

which comprises diphtheria pertussis tetanus (DPT), measles, Hepatitis, and tuberculosis (Kemenkes RI, 2012). Based on the results of previous studies, prevention of ARI can be accomplished by improving maternal self-efficacy including educating mothers about the concept of ARI, ARI conventional treatment, environmental modification, the benefits of using masks, clean and healthy behavior, proper hand washing, nutrition, the provision of exclusive breast milk, stress management, making peer support groups for mothers of toddlers, and optimizing the role of health workers and family support (Zatihulwani, Sukartini, & Krisnana, 2017).

The air pollution observed in the study was due to the presence of family members smoking, the use of fuelwood stoves, burning garbage, the use of mosquito repellent, houses closed to animal pens and the type of floor of the house. The researcher found that most children lived with families who had smoking behaviour. In these environments, most ARI events often occurred. These results were in line with a study which stated that secondhand smoke is a significant risk factor for ARI (Tazinya et al., 2018). Cigarette smoke is also strongly associated with the incidence of ARI in infants (Kumar et al., 2014). Exposure to cigarette smoke, especially at home and from family members, will increase the likelihood of ARI cases. This result was consistent with the study of Efni, Machmud, & Pertiwi (2016) explaining that the exposure to cigarette smoke in the home has a relationship with the incidence of pneumonia in infants.

LBW, immunization status, nutritional status, and room occupancy density were factors that did not significantly influence the incidence of ARI in toddlers who were exclusively and non-exclusively breastfed. This result was in line with previous research which stated that immunization status and nutritional status did not affect exclusive breastfeeding with the incidence of ARI (Prameswari, 2009). Another study also stated that nutritional status was not significantly associated with ARI events (Tazinya et al., 2018). It can, therefore, be concluded that from some confounding factors, air pollution is an element that significantly influences the incidence of ARI in an exclusive and non-exclusive toddler who were breastfed.

## CONCLUSION

There are differences in ARI events in toddlers who are exclusively and non-exclusively breastfed. Toddlers who are given exclusively breastfed rarely experience ARI than toddlers who are non-exclusively breastfed. ARI occurrences in toddlers are also influenced by air pollution factor, especially in those who are not exclusively breastfed. The recommendation for further research is the relationship between the habits of parents of smokers and ARI in infants who are exclusively and non-exclusively breastfed.

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