ORIGINAL ARTICLE

Exclusive Breastfeeding Duration and Allergic Asthma Severity in Children

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ABSTRACT

Introduction: Asthma is a disease marked by bronchial hyperresponsivity. It is commonly seen in children and often affects their quality of life. Many factors affect asthma, including breastfeeding. Bioactive and immunological components of maternal milk have a protective effect on allergic asthma. However, some studies denied this, stating that it had no significant association to asthma. This study aimed to analyze the correlation between breastfeeding duration and the severity of allergic asthma described by the frequency of asthma attacks, sleep disorder, and activity limitation.

Methods: This analytic observational study used a cross sectional approach. The subjects were pediatric outpatients aged 1 – 5 years old with allergic asthma at Pediatric Clinic of Dr. Soetomo General Hospital Surabaya and Private Pediatric Clinic from September 2019 to July 2020. Subjects were assessed based on the history of exclusive breastfeeding duration, frequency of asthma attacks, sleep disorder, and activity limitation through an interview using questionnaire.

Results: Through the data obtained from 62 respondents, duration of exclusive breastfeeding showed no significant relation to the frequency of asthma attack (rs = -0.227, p = 0.076), sleep disorder (rs = -0.214, p = 0.095), and activity limitation (rs = -0.055, p = 0.672).

Conclusion: There was no correlation between the duration of exclusive breastfeeding and the frequency of asthma attack, sleep disorder, and activity limitation.

INTRODUCTION

According to Global Initiative for Asthma (GINA) 2019, asthma is a heterogeneous disease marked by chronic inflammation of the respiratory tract. This disease showed symptoms such as wheezing, shortness of breath, chest tightness, and cough that appears time to time in a various intensity alongside expiratory airflow limitation.[1] These symptoms arise due to episodic and chronic obstruction of the respiratory tract due to bronchial hypersensitivity resulting in bronchoconstriction, mucus hypersecretion, and bronchial mucosa swelling.[2] Various intensity and onset of asthma are triggered by several factors, such as allergen, exercise, weather, and viral infection. Asthma is often found in children, disturbing their daily activities and may restrict their growth. Even though this increasing medical cost due to asthma has a potential to be a socioeconomic burden to the people.[3]

The prevalence of asthma remains high. According to GINA 2011, there are approximately 300 millions asthma patients worldwide and this number is predicted to increase to 400 millions in 2025.[4] The prevalence of asthma in Indonesia is not a small deal either. As reported by 2018 National Health Research, also known as Riset Kesehatan Dasar (Riskesdas) Badan Penelitian dan Pengembangan (Balitbang) by the Ministry of Health of the Republic of Indonesia, the national prevalence of asthma in all ages reached 2.4% of the total population, meaning that approximately 6 millions of Indonesians are asthma patients.[5]

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Allergic asthma is one of the most common chronic disease in children aged 5 years old or younger. This disease may appear as intermittent or persistent. Asthma classification reflects its severity degree. There are 4 classification of asthma, such as intermittent, mild persistent, moderate persistent, and severe persistent.[6] The severity degree of asthma describes the frequency of attacks and its effect on daily activities. Activity limitation and sleep disturbance are common symptoms in asthma. Therefore, asthma in children should not be underestimated. Previous study in the United States reported that asthma is the leading cause of school absence. This concern goes beyond, as asthma not only interferes with growth and development, it also has an impact on children's social activities.[3]

Allergic asthma is affected by many factors, one of them is breastfeeding. Breastfeeding is known to have many useful nutritional components. It serves as natural source of nutritions for babies that is affordable for people from all backgrounds. Not only does it suffice the nutritional needs of a baby, it also plays an important role in the development of immune system.[7] Human maternal milk is known to be rich in bioactive compounds which enables it to protect babies from allergic asthma and decreasing asthma incidence. Previous study reported that exclusive breastfeeding up to 6 months decreased 62% of wheezing episodes.[8] A cohort study also revealed that breastfeeding was associated with reduced incidence of wheezing in children up to 5 years old.[9] On the contrary, other study mentioned that in a risk-adjusted population, breastfeeding did not have major impact to asthma development.[10]

Experts around the world recommend breastfeeding to be initiated in the first hour of life and to be continued given exclusively for 6 months. The term exclusive breastfeeding refers to giving infants only human maternal milk without any addition of any complementary foods nor formula milk.[11]

Many studies have been made to reveal the correlation of breastfeeding and asthma. However, only few described the correlation between breastfeeding duration and allergic asthma severity in children. Moreover, the protective effect of breastfeeding is still controversial. This study aimed to analyze the relation between the two, as well as to add more evidence of the relation of between breastfeeding and allergic asthma severity described through attacks frequency, sleep disorder, and activity limitation, in a hope that this study can be useful both for science and clinical application in the future.

METHODS

This was an analytic observational study with a cross sectional approach. The study population was pediatric outpatients aged 1 – 5 years old with allergic asthma at Pediatric Clinic of Dr. Soetomo General Hospital Surabaya and Private Pediatric Clinic from September 2019 to July 2020. The subjects were 62 respondents acquired through consecutive sampling method. The inclusion criteria included pediatric outpatients aged 1 – 5 years old, patients who previously diagnosed with allergy through skin prick test, patients who had an allergic manifestation in the form of asthma marked by previous episodes of shortness of breath or worsening cough, and patients who were breastfed. Meanwhile the exclusion criterion was interview rejection by patients' guardian. The subjects were assessed based on the history of exclusive breastfeeding duration, frequency of asthma attacks, sleep disorder, and activity limitations through an interview with their guardian using a questionnaire and the data were analized using SPSS. The obtained data were assessed using Kolmogrov-Smirnov Test, if the result was within normal range, the data then went through Pearson Correlation Test. However, if the data was not in the normal range, it should be assessed using Spearman Correlation Test. This study obtained ethical clearance from the Committee of Ethics of Dr. Soetomo General Hospital Surabaya with Ethical Clearance Certificate Number of 1507/KEPK/IX/2019.

RESULTS

Total subjects involved in this study were 62 patients with allergic asthma, consisting of 52 patients from Pediatric Clinic of Dr. Soetomo General Hospital Surabaya and 10 patients from Private Pediatric Clinic. The location difference was due to COVID-19 pandemic which restricted further data collection at Pediatric Clinic of Dr. Soetomo General Hospital Surabaya. All subjects had met all the inclusion criteria and were not in any of the exclusion criteria.

General Characteristics

The questionnaire respondents involved in this study were 62 allergic patients with manifestation in the form of asthma. The characteristics of the respondents are shown in table 1.

Table 1. Characteristics of allergic patients with manifestation in the form of asthma

Characteristics		Total (n)	Percentage (%)
Age	0-1 years old	8	12.90%
	1-2 years old	13	20.96%
	2-3 years old	13	20.96%
	3-4 years old	13	20.96%
	4-5 years old	15	24.19%
Parental history of asthma	Positive history of asthma	30	48.38%
	Negative history of asthma	32	51.61%

Table 2. History of frequency of asthma attacks and exclusive breastfeeding in pediatric patients with allergy and asthma manifestation

Asthma attack frequency	History of exclusive breastfeeding													
	Non-exclusive breastfeeding		1 month		2 months		3 months		4 months		5 months		6 months	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Intermittent asthma	4	6.45%	3	4.83%	1	1.61%	0	0%	1	1.61%	1	1.61%	18	29.03%
Mild persistent asthma	2	3.22%	2	3.22%	1	1.61%	1	1.61%	0	0%	0	0%	6	9.67%
Moderate persistent asthma	1	1.61%	3	4.83%	1	1.61%	2	3.22%	0	0%	0	0%	1	1.61%
Severe persistent asthma	4	6.45%	1	1.61%	1	1.61%	1	1.61%	0	0%	1	1.61%	6	9.67%

The age group with most respondents were those aged 5 years old, accounted for 15 children (24.19%). The average age of the respondents were 3.22 years old with deviation standard of 1.36. Meanwhile, based on the parental history of asthma, the number between the two groups were relatively similar, ignoring both paternal and maternal division.

Correlation between Exclusive Breastfeeding and Frequency of Asthma Attacks

Table 2 mapped the history of frequency of asthma attacks and exclusive breastfeeding in pediatric patients with allergy and asthma manifestation.

According to Table 2, majority of respondents (29.03%) had intermittent asthma and a history of 6 months of exclusive breastfeeding. The second groups with most number of respondents were the group with history of mild persistent and severe persistent asthma which both had previous history of 6 months of exclusive breastfeeding (9.67%). Meanwhile, the rest of the respondents were relatively scattered into the remaining groups.

Correlation between exclusive breastfeeding duration and asthma attacks frequency was analyzed using Spearman Correlation. The result showed correlation coefficient (rs) of -0.227 and significance (p) of 0.076. It means that there was no correlation between exclusive breastfeeding duration and frequency of asthma attacks.

Table 3. Spearman correlation between asthma attacks frequency and breastfeeding duration

	Duration of breastfeeding	Frequency of asthma attacks
Duration of breastfeeding	1,000	-.227
Frequency of asthma attacks	-.227	1,000

Correlation between Exclusive Breastfeeding and Sleep Disorder

According to Table 4, the group that did not experience sleep disorder with history of 6 months of exclusive breastfeeding had the most number of respondents (35.48%). Meanwhile, the second group with most number of respondents was the group that did not experience sleep disorder with no history of exclusive breastfeeding (9.67%). The rest of the respondents were distributed randomly into the remaining groups.

The data of history of exclusive breastfeeding duration and the frequency of sleep disorder were tested using Kolmogrov-Smirnov test for normality. The obtained significance value of Asiymp. Sig (2-tailed) was lower than 0.05, meaning that the data distribution was not normal, thus data correlation should be assessed using Spearman Correlation. Further analysis on the data revealed correlation coefficient (rs) of -0.214 and significance (p) of 0.095. This result demonstrated that there was no significant correlation between exclusive breastfeeding duration and frequency of sleep disorder due to allergic asthma.

Table 4. History of sleep disorder and exclusive breastfeeding in pediatric patients with allergy and asthma manifestation

Frequency of sleep disorder	History of exclusive breastfeeding													
	Non-exclusive breastfeeding		1 month		2 months		3 months		4 months		5 months		6 months	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
No sleep disorder	6	9.67%	4	6.45%	0	0%	3	4.83%	0	0%	1	1.61%	22	35.48%
1 time	2	3.22%	1	1.61%	3	4.83%	0	0%	0	0%	0	0%	4	6.45%
2 times	0	0%	0	0%	1	1.61%	0	0%	1	1.61%	0	0%	1	1.61%
3 times	1	1.61%	2	3.22%	0	0%	0	0%	0	0%	0	0%	1	1.61%
4 times	0	0%	1	1.61%	0	0%	0	0%	0	0%	0	0%	1	1.61%
5 times	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
6 times	1	1.61%	1	1.61%	0	0%	0	0%	0	0%	0	0%	0	0%
7 times	1	1.61%	0	0%	0	0%	1	1.61%	0	0%	1	1.61%	2	3.22%

Table 6. History of activity limitation and exclusive breastfeeding in pediatric patients with allergy and asthma manifestation

Frequency of activity limitation	History of exclusive breastfeeding													
	Non-exclusive breastfeeding		1 month		2 months		3 months		4 months		5 months		6 months	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
No activity limitation	10	16.12%	5	8.06%	3	4.83%	2	3.22%	1	1.61%	1	1.61%	25	40.32%
1 time	0	0%	0	0%	1	1.61%	0	0%	0	0%	0	0%	2	3.22%
2 times	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	2	3.22%
3 times	0	0%	1	1.61%	0	0%	1	1.61%	0	0%	0	0%	0	0%
4 times	0	0%	0	0%	0	0%	1	1.61%	0	0%	0	0%	0	0%
5 times	0	0%	1	1.61%	0	0%	0	0%	0	0%	0	0%	0	0%
6 times	0	0%	1	1.61%	0	0%	0	0%	0	0%	0	0%	0	0%
7 times	1	1.61%	1	1.61%	0	0%	0	0%	0	0%	1	1.61%	2	3.22%

Table 5. Spearman correlation between frequency of sleep disorder and breastfeeding duration

	Duration of breastfeeding	Frequency of sleep disorder
Duration of breastfeeding	1,000	-.214
Frequency of sleep disorder	-.214	1,000

Table 7. Spearman correlation between frequency of activity limitation and breastfeeding duration

	Duration of breastfeeding	Activity limitation
Duration of breastfeeding	1,000	-.055
Activity limitation	-.055	1,000

Correlation between Exclusive Breastfeeding and Activity Limitation

As shown in Table 6, the group that did not experience any activity limitation and had 6 months history of exclusive breastfeeding showed the most number of respondents (40.32%). The second group with the most respondents was those who did not experience any activity limitation and had no history of exclusive breastfeeding (16.21%). The rest of the respondents were distributed randomly into the remaining groups.

DISCUSSION

Characteristics of the Respondents

Respondents included in this study were children aged up to 5 years old. Except for those who are aged under 1 year old, the rest of the age groups were pretty much equally distributed. Recruitment of children aged up to 5 years old was made due to our consideration regarding the effect of breast milk. Several previous studies stated that protective effect of breast milk against asthma was mainly seen in early childhood.[12,13] Other characteristic included in this study was parental history of asthma. This characteristic had only a slight difference in terms of number of respondents (48.38%

and 51.61%). Previous studies had different statements regarding the protective effect of breast milk against asthma. One stated that the protective effect was shown in those without parental history of allergy, while the other one stated that parental history of asthma did not interfere with the correlation of breast milk and its protective effect on asthma.[13]

Correlation between Exclusive Breastfeeding and Frequency of Asthma Attacks

This study explained that there was no significant correlation between the duration of exclusive breastfeeding and the frequency of asthma attacks. This result differed from the study of Nagel, *et al*. (2009) which stated that breastfeeding reduced the incidence of asthma.[14] Azad, *et al*. (2017) also stated that breastfeeding was associated with reduced frequency of asthma symptoms such as wheezing.[8] On the other hand, the results of this study was in accordance with the study of Kramer (2011) which stated that the protective effect of breast milk against asthma was not statistically significant.[15] Study by Bion, *et al*. (2016) also mentioned the same result, stating that 0 – 4 months exclusive breastfeeding compared to those of more than 4 months of duration did not have any significant difference in the term of asthma or allergic diseases development.[12] The dose-response relationship of breastfeeding duration was seen in wheezing with early onset, whereas no clear association was seen in late onset and persistent wheezing.[9] Exclusive breastfeeding was reported to have protective effect against asthma at 10 years of age. However, it did not possess any major effect on asthma in a population with adjusted confounding variables, such as gender, smoking history, age, body mass index, and birth weight.[10] This study suggested that these contrasting results might arise due to differences in study population, adjustments to confounding variables, and further analysis regarding breast milk composition.

It is undeniable that many studies had explained the protective effect of breast milk against allergic asthma and wheezing in children.[8,9,13] Compared to the previous study conducted by Azad, *et al*. (2017) which performed statistical analysis of the confounding variables, this study did not perform those analysis which might have led to differences in results.[8] In addition, this study observation was limited to children aged up to 5 years old. According to Quigley, *et al*. (2018), breast milk provided protective effect from early transient wheeze, but the same effect was not found in persistent wheeze. Early transient wheeze was determined by an episode of wheezing that occurred at least once until 5 years of age but did not occur further above 7 years of age. Meanwhile, persistent wheeze was determined by an episode of wheezing that occurred at least once at the age of 9 months old, 3 years old, or 5 years old and recurred at least once at the age of 7 years old.[9] Different from Rothenbacher, *et al*. (2005) who analyzed sCD14 content in breast milk, this study did not analyze any contents of breast milk given to the subjects. Rothenbacher, *et al*. (2005) reported that breast milk with higher levels of sCD14 had tendency to have immunomodulating effect, thereby reducing the risk of developing allergic diseases in children.[13] Previous studies had also reported that the protective effect of breast milk against asthma was mainly seen in early childhood, but this effect did not persist later in childhood.[12,13] It was also previously found that the protective effect of breast milk was more significant in children without maternal history of asthma.[13]

Correlation between Exclusive Breastfeeding and Sleep Disorder

Sleep disorder was defined as symptoms related to difficulty of starting or maintaining sleep, excessive drowsiness, disrupted sleep schedule, and other dysfunction related to sleep, sleep stages, and parasomnia.[16] Sleep disorder was assessed qualitatively in this study, in accordance to a previous study which also assessed qualitative sleep disorder through counting the number of days in a week in which sleep disorder occurred.[17]

These results also showed that there was no correlation between duration of exclusive breastfeeding and sleep disorder due to asthma. However, in contrast to the results, another previous study stated that breastfeeding for more than one month was associated with reduced incidence of sleep-related breathing disorder in children.[18] Another study also stated that breastfeeding had inversed relationship with frequency of sleep disorder in children with asthma which was assessed through the frequency of snoring and apnea

occurrences.[19] This relationship was thought to be related to immunological protection provided by breast milk.[20] The difference between previous study and this study might have occurred because previous study by Montgomery-Downs, *et al.* (2007) analyzed the association of breastfeeding with sleep-related breathing problems in general and did not differentiate allergic and viral infections-related asthma.

Correlation between Exclusive Breastfeeding and Activity Limitation

Activity limitation was defined as any restriction to body movement produced by skeletal muscles that requires energy expenditure. Previous study reported that children with higher frequency of asthma were more likely to experience fatigue during the day. One in three children who suffered from asthma experienced fatigue at least once a week.[21] This study tried to find correlation between exclusive breastfeeding duration and activity limitation measured by its frequency in a week.

The duration of exclusive breastfeeding also did not correlate significantly with frequency of activity limitation due to asthma. This result differed with the results of previous studies. It was previously reported that children with higher frequency of asthma experienced more activity limitation due to fatigue during the day.[21] Fatigue, which was common in asthma patients, had an impact on quality of life. Yeatts and Shy (2001) also stated that children with asthma were 20.5 times more likely to experience activity limitation and 2.6 times more likely to be absent from school due to asthma symptoms.[22] According to previous studies, breastfeeding should be able to reduce activity limitation due to asthma. However, this study had different result.

Confounding Variables of the Study

One of the limitations of this study was the unadjusted confounding variables. Asthma was a disease known to be highly influenced by many factors. These factors included sex, age, race, maternal age, childbirth delivery method, history of atopy, environment, smoking, air pollution, respiratory infections, body mass index, birth weight, and socioeconomic conditions.[3,8,10,23] Formula milk which contains probiotic can also affect allergic asthma through environmental improvement of the gut.[24] In addition, the factor that might have a lot of influence on the results of this study was the immunotherapy underwent by the respondents. This study did not differentiate respondents based on the duration of immunotherapy. Allergy immunotherapy could modify allergic diseases including asthma. Allergen-specific bronchial hyperresponsiveness—one of the main manifestations of asthma—was found to be significantly reduced after one year of allergic immunotherapy.[25,26] Thus, duration of allergy immunotherapy might play a significant role in disguising the frequency of asthma attacks that occurred in the respondents. It was reported that in a period of months to years, immunotherapy reduced Immunoglobulin E (IgE) which played an important part in allergic manifestations. Immunoglobulin E would increase initially but then decrease along with the gradual increase of immunoglobulin G4 (IgG4). Immunoglobulin G4 would eventually block the binding of allergens with IgE-bound effector cells, resulting in no activation of basophils and mast cells.[26]

Breast milk in mothers with history of allergy contain interleukin-4 (IL-4), interleukin-8 (IL-8), Regulated upon Activation, Normal T Cell Expressed and Presumably Secreted (RANTES), IgE, and n6/n3 (omega-6/omega-3) polyunsaturated fatty acid (PUFA) which cause early sensitization in infants. Interleukin-4 was the cytokine involved in the formation of IgE and eosinophils which were closely linked to allergic diseases.[27,28] Conforming with that was Sears, *et al*. (2002) who stated that high IgE levels in breast milk would be followed by high IgE levels in infants which further might explain why breastfeeding might not reduce the risk of asthma.[9,29] Although this study did investigate the presence of parental history of asthma, further statistical analysis was not performed. Knowing that it was also proposed that there might be differences of breastfeeding impact in allergic children with and without parental history of asthma, this could explain why no significant correlation was found between the duration of exclusive breastfeeding and the severity of allergic asthma in this study.

Future Recommendation

Future research on the correlation between breastfeeding and allergic diseases should be focused not only on its effect, but also on the exact protective

mechanism on asthma. Reflecting on the limitation of this study, further study should also include adjustment to the confounding variables. However, despite all the debate over its effect on allergic asthma in children, breast milk remain as the recommendation for infant intake from birth up to 6 months of age exclusively, then continued with complementary foods up to 2 years of age.

CONCLUSION

Exclusive breastfeeding duration in this study did correlate with severity of asthma. The severity of asthma was described through the frequency of asthma attacks, sleep disorder, and activity limitation. Neither of them were affected by duration of breastfeeding.

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