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Breastfeeding Pattern and Its Association with Nutritional Status and Salivary Secretory Immunoglobulin A Level In 3–6 Months Old Infants

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Eleonora Mitaning Christy,[1] Sri Sukmaniah,[1] Rini Sekartini [2]

1. *Department of Clinical Nutrition, Faculty of Medicine, Universitas Indonesia, Cipto Mangunkusumo Hospital, Jakarta, Indonesia*
2. *Department of Child Heath Medicine, Faculty of Medicine, Universitas Indonesia, Cipto Mangunkusumo Hospital, Jakarta, Indonesia*

Abstract

Introduction: Breastfeeding pattern is a form of mother's behavior in giving breast milk to her baby. Breast milk supports the growth and development of the baby. The most common immunoglobulin in breast milk is secretory immunoglobulin A (sIgA) whose levels can be evaluated, one of the ways, from saliva samples examination. The purpose of the research were to determine the breastfeeding pattern and its association with nutritional status and salivary secretory immunoglobulin A level in 3-to 6-month-old infants.

Methods: A research with cross sectional design was conducted in Kiara Social Pediatric-Growth and Developmental Clinic Cipto Mangunkusomo Hospital Jakarta. A total of 54 healthy infants subjects aged 3–6 months old were taken using consecutive sampling method. Descriptive analysis, Chi Square, and Mann-Whitney test were used. P-values <0.05 were considered significant.

Results: Our results showed that subjects with normal nutritional status were 85.2%. The median of subjects' salivary sIgA level was 56.2 (2.5–536.4) µg/ml. We did not find significant difference regarding to subjects' nutritional status between good breastfeeding pattern group and poor breastfeeding pattern group (p>0.145), nor difference regarding to salivary sIgA level between good breastfeeding pattern group and poor breastfeeding pattern group (p>0.34).

Conclusion: Despite the un-significant results, this study showed that normal nutritional status tended to be more prevalent in group with good breastfeeding pattern than in poor breastfeeding pattern. Re-encouragement, socialization, and education to the breastfeeding mothers are needed to improve the good breastfeeding pattern.

Keywords Breast milk, breastfeeding mother, breastfeeding pattern, nutritional status, salivary sIgA

Corresponding author:
Eleonora Mitaning Christy, MD
Department of Clinical Nutrition, Faculty of Medicine, Universitas Indonesia, Cipto Mangunkusumo Hospital, Jakarta, Indonesia
Email address : mitaningchristy@gmail.com

Introduction

Breast milk is a form of natural food given to the importance of infants' growth and development. Breastfeeding is a physiological process to provide optimal nutrition to the infants in an optimal way. According to WHO/UNICEF 2004, breastfeeding is the most appropriate way in providing an ideal food for the achievement of growth and development of a healthy baby, and has biological and psychological influences for the mother and the baby.[1] According to Indonesian Basic Research of Health (RISKESDAS) in 2010, breastfeeding patterns are grouped into three categories: exclusive breastfeeding, predominant breastfeeding, and partial breastfeeding.[2] The good breastfeeding pattern can be defined as exclusive breastfeeding accompanied by good breastfeeding method.

Based on The National Socioeconomic Survey (SUSENAS) in 2013, the coverage of exclusive breastfeeding in 0–6 months infants in all provinces of Indonesia was 45.55%.[3,4] This figure is still far from the coverage target of exclusive breastfeeding by the Indonesian ministry of health per 2014, which was 80%. In 2012, WHO made the Implementation Plan on Maternal, Infant and Young Child Nutrition programme, which contained six points of nutritional targets to be achieved globally by 2025. Points number 5 of the nutrition targets is to increase the success rate of exclusive breastfeeding in the first 6 months of life, at least up to 50%.[5]

One of the components in breast milk that supports the immune system is immunoglobulins. Compared to other immunoglobulins, secretory immunoglobulin A (sIgA) has the highest level in breast milk, particularly in the early phase of breastfeeding. The sIgA is often regarded as body's first line of defense mechanism, because sIgA has an important role in mucosal immunity. These roles including to provide protection to various mucous membranes by neutralizing toxins and viruses found in the mucosa, and preventing adhesion of pathogens at mucosal epithelial cells. Mother transfers sIgA to her baby through breastmilk. In infants and children, salivary sIgA levels are often associated with allergic symptoms as well as upper respiratory tract infections. Research on sIgA level from salivary samples are still rare. A study conducted by Jafarzadeh,[6] found that salivary sIgA level were significantly higher in breast-fed children compared to children who only received formula milk from birth. A study conducted by Ananta et al,[7] found that malnutrition rate in infants who received formula milk were significantly higher than those who were in exclusively breast-fed group. Other studies connecting breastfeeding to nutritional status in Indonesia are still rare to be found.

The association between breastfeeding patterns and infants' nutritional status which measured by anthropometric measurements, as well as the association between breastfeeding patterns and salivary sIgA levels as indicator of first-line body defense mechanism were investigated to fulfill the aim of this study

Methods:

Subjects and Study Design

This study was conducted using cross sectional design that aimed to investigate the association between breastfeeding patterns with nutritional status, and the relationship between breastfeeding patterns with secretory levels of salivary sIgA in 3–6 months infants. This range of age was chosen due to the highest IgA secretion in baby's saliva which occurred temporarily at 3–6 months of age.[8] Age correction was applied on premature babies. Subjects with gestational age <32 weeks, on going infection, never received breast milk from birth, using medications (anti-cholinergic, anti-histamine, or anti-seizure), had a history of impaired fetal growth as well as abnormalities which affect enteral intake, and had abnormality/disorder affecting salivary production, were excluded from this study. Data was collected on February 23 until March 16, 2017 at Kiara pediatric clinic in Cipto Mangunkusumo Hospital Jakarta. A total of 54 healthy 3–6 months old infant subjects, which were chosen using consecutive sampling method, joined the research until the end of the study.

Data Collection

Data were collected from interview to obtain the characteristics of subjects and subjects' mothers. Interview using questionnaire and direct observation during breastfeeding were conducted to obtain data on breastfeeding categories. The Salimetrics® sIgA Indirect Enzyme Immunoassay kit was used for the quantitative measurement of salivary sIgA. Nutritional status was based on WHO weight for length Z-score 2006. The measurements performed using Seca® digital weight scale, as well as Seca® infantometer to obtain the anthropometric data.

Statistical Analysis

Data were analyzed using *Statistical Package for Social Science* (SPSS) version 20.0. The normality of data distribution was analyzed using Kolmogorov-Smirnov test. The variables that had normal distribution were presented as mean ± standard deviation, while non-normal distribution were presented as median (minimum-maximum). Association between breastfeeding pattern and nutritional status was analyzed using Chi Square test, and the association between breastfeeding pattern and saliva secretory IgA level was analyzed using Mann-Whitney test. Significance set limit was $p<0.05$.

Results

Characteristics of total 54 healthy infant subjects (*i.e.* subjects' gender, birth weight, gestational age, delivery history, and hospitalization history), as well as the characteristics of subjects' mothers *(i.e.* mothers' age, education, occupation, and numbers of labour), are presented in Table 1.

Table 1 Characteristics of subjects and subjects' mother (n=54)

Characteristics	Value
Subjects' gender, n (%)	
Boy	33 (61.1)
Girl	21 (38.9)
Birth weight (g)	2707.83 ± 584.39*
Subjects' gestational age, n (%)	
Term	31 (57.4)
Preterm	23 (42.6)
Delivery history, n (%)	
Spontaneous	26 (48.1)
C-section	28 (51.9)
History of being hospitalized, n (%)	
Never	26 (48.1)
Yes	28 (51.9)
Hospitalized during neonatal period	20 (71.4)
Others	8 (28.6)
Mothers' age	
< 20 years old	1 (1.9)
20–30 years old	35 (64.8)
> 30 years old	18 (33.3)
Mothers' education, n (%)	
Low	12 (22.2)
Moderate	24 (44.5)
High	18 (33.3)
Mothers' occupation, n (%)	
Working	11 (20.4)
Not working	43 (79.6)
Numbers of labour	
Prime-paras	21 (38.9)
Multiparas	30 (55.6)
Grande-multiparas	3 (5.6)

*mean ± SD

Breastfeeding pattern is a formulation of model behavior in giving breast milk to the baby, including: whether breast milk is given exclusively/predominantly/partially, and how breastfeeding is performed (the breastfeeding method). The breastfeeding method was categorized based on 4 points: (1) breastfeeding position, (2) attachment between mother and baby, (3) breastfeeding frequency in a day, and (4) the breast engagement as well as the time that is needed in each cycle of breastfeeding.

Data on breastfeeding patterns were obtained by applying interview and observation to the subject's mother while breastfeeding. Interviews were conducted to determine: whether breast milk was given exclusively/partially/ predominantly, the frequency of breastfeeding, and how the breast engagement and the time needed in each cycle of breastfeeding. Meanwhile, observations were made to assess the position of breastfeeding and attachment between infants and mothers. Good breastfeeding pattern was

concluded if breastfeeding was performed exclusively with good breastfeeding method. Meanwhile, it is categorized into poor breastfeeding pattern if: (1) exclusive breastfeeding but poor breastfeeding method, (2) predominant breastfeeding accompanied by either good or poor breastfeeding method, or (3) partial breastfeeding accompanied by either good or poor breastfeeding method. The subjects' breastfeeding (BF) pattern characteristic is presented in Table 2.

Table 2 Subjects' Breastfeeding Pattern Characteristic (n=54)

Breastfeeding pattern	Value
Good (Exclusive BF with Good Breastfeeding Method), n (%)	19 (35.2)
Poor, n (%)	35 (64,8)
Exclusive BF with Poor Breastfeeding Method	0
Predominant BF with Good Breastfeeding Method	3 (8.6)
Predominant BF with Poor Breastfeeding Method	3 (8.6)
Partial BF with Good Breastfeeding Method	6 (17.1)
Partial BF with Poor Breastfeeding Method	23 (65.7)

Table 3 showed the nutritional status for subjects, which was made based on the weight-for-length Z-score interpretation on the WHO 2006 growth chart, with the determination of its category based on the Indonesian Pediatric Nutrition Care (Pediatric Nutrition Care) Recommendation Guideline 2011.[9]

Table 3 Subjects' nutritional status (n=54)

Nutritional Status	Value
Abnormal, n(%)	8 (14.9)
Obesity, n(%)	0
Overweight, n(%)	0
Undernourished, n(%)	5 (9.3)
Severely malnourished, n(%)	3 (5.6)
Normal, n(%)	46 (85.1)

The association between breastfeeding pattern and nutritional status of the subjects showed no significant difference in nutritional status between the good breastfeeding pattern group and poor breastfeeding pattern group (Table 4).

Table 4 Association between breastfeeding pattern and nutritional status (n=54)

Breastfeeding pattern	Abnormal nutritional status n (%)	Normal Nutritional Status n(%)	p Value*
Good (n = 19)	1 (5.3%)	18 (94.%)	0.145[CS]
Poor (n = 35)	7 (20%)	28 (80%)	

[CS]: Chi Square test; p*: statistically significant if p<0,05

The association between breastfeeding patterns and salivary sIgA levels was observed. Salivary sIgA levels have abnormal data distribution, for which non-parametric statistical tests Mann-Whitney was used. The non-parametric test results showed no significant difference in salivary sIgA level between good breastfeeding pattern group and poor breastfeeding pattern group (Table 5).

Table 5 Association between breastfeeding pattern and salivary secretory IgA level (n=54)

Breastfeeding pattern (n)	Salivary IgA levels (μg/ml)	p value
Good (19)	52.8 (2.5–536.4)	0.34 [MW]
Poor (35)	46.6 (2.5–449.8)	

[MW] : Mann-Whitney U; p*: statistically significant if p<0,05

Discussion

In this study, there was no significant difference in nutritional status between the subjects with good breastfeeding patterns and those with poor breastfeeding patterns (p=0.145). However, normal nutritional status tended to be more prevalent in subjects with a good maternal breastfeeding pattern, which is 94.7% compared to 80% from the poor breastfeeding pattern group. Underweight and severe malnutrition were also more likely to be found in infants with poor breastfeeding patterns. This was similar to the study by Ananta et al.[7] which described that nutritional status was significantly found less in non-exclusively breastfed infants (p=0.01). A retrospective study by Mandic et al,[12] found that breast-fed infants gained

less weight than those who were not breastfed, however those who were breast-fed remained within normal growth curves for weight and age.

Higher normal nutritional status in infants with good breastfeeding pattern was possible because good breastfeeding pattern ensured breast milk to be obtained by infants more effectively. Breast milk greatly supports infant growth because, in addition to nutrient content, breast milk contains hormones and growth factors. The growth factors, as we know, are bioactive proteins. In particular, the function of these components is to improve the ability of gastrointestinal adaptation after the baby was born by stimulating the growth of gastrointestinal cells, the maturation of the gastrointestinal system, the formation of non-pathogenic bacterial colonies, and the development of gastrointestinal lymphoid tissue.[13] Thus, the more effective breast milk obtained by infants the better they will grow, which are reflected in the normal nutritional status.

There was no significant difference in salivary sIgA levels between the subjects with good maternal breastfeeding patterns and the subjects with poor breastfeeding patterns ($p=0.234$). The difference between these results with previous studies was possible because in the previous study, sIgA levels were compared only between group of subjects who received breast milk and who did not get breast milk. Meanwhile in this study, the comparison between the good and poor breastfeeding pattern were determined with criteria composed by various aspects other than exclusive breastfeeding itself (*i.e.* breastfeeding position, attachment between mother and baby, breastfeeding frequency in a day, and the breast engagement as well as the time needed in each cycle of breastfeeding). The combination of more complex aspects in defining good and poor breastfeeding patterns may allowed the different result of salivary sIgA level. The finding of non-significant association between breastfeeding pattern and salivary sIgA levels might be affected by the absence of psychological effects on the study subjects. Rhein et al.[14] found that emotions (stress, anger, sadness) had an effect on salivary sIgA levels ($z=-2.02$, $p<0.05$). In a meta-analysis study conducted by Herbert et al.[15] and Van Rodd et al.[16] concluded that psychological stress could affect T lymphocytes and B lymphocytes, *i.e*. the suppression of the number and function of the immune cell. Stress hormones, cortisol, and catecholamines, could be responsible for impacting the lymphocyte cells. B lymphocyte cells in the process will be stimulated to produce immunoglobulins, especially sIgA.[17,18] The decrease in B lymphocyte cells will also reduce the amount of sIgA produced. In an adult study, further observation and interviews on aspects of emotion and psychological stress can be done more easily. Research on saliva sIgA levels in infants and children often overlooks these aspects because the psychological aspects in children and infants are more difficult to be explored than in adults.

Another factor which may contributed to the significant results between breastfeeding pattern and salivary sIgA levels was the under-assessment of "oral care treatment" history using breast milk for non-oral feeding infants treated in inpatient room for neonates in RSCM. Oral care treatment was done by using colostrum or mature breast milk that dripped into the oral mucosa (especially to the inside part of buccal mucosa) for infants who did not receive food intake per oral (including not being breastfed). Oral care treatment using colostrum or mature breast milk, is believed to be a potential factor that can improve the immune system in infants. The process of absorption of immune factors contained in the milk through the oral mucosa, can stimulate the development of the infants' immune system.[19] Lee et al,[20] in their study of premature babies, found that giving colostrum to the oropharyngeal mucosa could significantly increase concentrations of salivary sIgA, prevent secretion of pro-inflammatory cytokines, and decrease the incidence of sepsis. Neonatal inpatient unit has implemented oral care methods since mid 2016. The oral care method is recommended to be applied everyday when the patients have been dicharged, in order to maintain infants' oral immune system. The finding of non-significant breastfeeding pattern-salivary sIga levels relation in this study may be caused by the under-assessment of subjects' oral care treatment history, considering that the method of oral care application could increase the salivary sIga level, eventhough the infants in the neonatal inpatient unit could not be breastfed.

It can be concluded that there is no significant relationship between breastfeeding patterns and nutritional status, and there was also no significant relationship between breastfeeding patterns and salivary sIgA levels of 3 to 6 months old infants. Despite the un-significant results, this study showed that normal nutritional status tended to be more prevalent in group with good breastfeeding pattern than in poor breastfeeding pattern. Re-encouragement, socialization, and education to the breastfeeding mothers are needed to improve the good breastfeeding pattern. Other factors that may affect salivary sIgA levels (*i.e.* "oral care treatment" history using breast milk, physical activity, emotions, and psychological stress) and other factors that may affect breastfeeding patterns (*i.e.* history of mothers' antenatal care), are needed to be assessed for the next research.

Conflict of Interest

The authors of this paper declare there is no conflict of interest regarding this research.

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