

BREASTFEEDING AND EARLY CHILDHOOD CARIES (ECC) SEVERITY OF CHILDREN UNDER THREE YEARS OLD IN DKI JAKARTA

Febriana Setiawati Sugito^{*)}, Herwati Djoharnas, Risqa Rina Darwita

Department of Community and Preventive Dentistry, Faculty of Dentistry, University of Indonesia, Jakarta 10430, Indonesia
Urban Studies, Directorate of Research and Community Service, University of Indonesia, Depok 16424, Indonesia

^{*)}E-mail: febrianasetiawati@gmail.com

Abstract

The prevalence and severity of caries in children under three years old are constantly increasing. One of the cause is the increase consumption of cariogenic carbohydrate. Breast milk have buffer capacity that eventually able to prevent caries. The aims of this research are to discover the correlation between breastfeeding with the severity of Early Childhood Caries (ECC) in children under three years old, to provide information on prevalence and severity of caries in children under three years, and to explain factors influencing the incidence of ECC. This research designed cross sectionally and conducted upon 565 children aged 12-38 months, selected using multistage cluster random sampling. The ECC prevalence of children under three years in DKI Jakarta is 52.7%, with average score of def-t 2.85. Bivariate analysis showed that, variables which correlate with the level of ECC are; the way to deliver ($p=0,012$), frequency ($p=0,002$), duration ($p=0,002$), salivary buffer capacity ($p=0.013$), habitual consumption of sugary diet ($p=0.005$), child's dental hygiene behavior ($p=0.002$), and mother's education ($p=0.001$). Multivariate analysis showed that ECC can be explained by these variables: age, mother's education, the way to deliver and frequency of breast milk complements/replacement of consumptions, child's brushing habit, plaque pH, and salivary buffer capacity. Resulting determination coefficient 32.1%. There is no significant correlation between breastfeeding and the level of Early Childhood Caries (ECC). The role of protective qualities of breastfeeding are not shown because of bias in obtaining data influence the incidence of caries.

Keywords: breastfeeding, early childhood caries, formula milk, mother's education, plaque, sucrose solution, saliva, socioeconomic status

I. Introduction

Dental caries still holds the highest prevalence and severity among other dental problems. The caries process can develop right away, as soon as the tooth erupted in the oral cavity. The first experience of caries on infants and children under five years old, defined as Early Childhood Caries (ECC). The prevalence and severity of caries on children under five years old in several countries in the world are considerably high. In USA, the prevalence of ECC on children aged 3-5 years old is 90%¹. In Thailand ECC on infants aged 15-19 months is 82.8%². While in Indonesia, the prevalence of caries on children aged 3-5 years old is constantly increasing. In year 1988, the prevalence of caries on preschool children in Jakarta and its surrounding areas is 85.17%³ with rate of severity (def-t) 6.03 tooth per child. In year 2001, The prevalence of caries on children aged 3-5 years old in DKI Jakarta is 81.2%⁴.

ECC is a major community health problem that must be solved with serious measures and controlled with

priority, because to some extent, ECC can cause malfunction of the mastication and digestive system, interfering with growth and development process of the child, disturb the phonetic and articulation, and eventually cause child's low self esteem⁵. In the developing countries, ECC is a significant problem, because it is worsened by the low social economic status and malnutrition^{5,6}. ECC cases were found more often on children from family with low social economic status, single parents, or parents with low education level. It relates with the capability to provide good nutrition for the child⁷.

In Indonesia, with the increase of people live under the poverty line, the amount of parents that could not provide good nutrition for their children (under five years old) is also increasing. On the other hand, the low family income problem makes the mothers of family with low social economic status have to go to work to help the family economic condition. This condition is getting worse by mother's low education level and lack of general health knowledge, breast milk as the best

nutrition for infants was rarely given or given in a short period of time. As a breast milk replacement, or complement, the children were given formula milk or other sweet drinks such as sweetened tea or condensed milk.

From a survey conducted by Hellen Keller Worldwide on 4 big cities in Indonesia in year 2002 was found that in Jakarta, breastfeeding activity that given for 1-3 months duration was only 25%, given for 4-5 months was 4% and given for 5-6 months was only 1%⁸. This situation is getting more complex because women nowadays have the opportunity to work outside their homes, and it became difficult for working mothers to breastfeeds their infants. The number of working mothers is increasing, according to SDKI 1997 there is 14.324 millions (49.7%) working woman in Indonesia. It means that one in every two women participate in economic activity, 44.8% of them reside in DKI Jakarta, and 28.7% among them have children (under five years old).

In group with low socioeconomic status more parents had given their children early food for breast milk replacement, bottled milk, and food with high level of sugar ingredient Drinking sweetened drinks along with bad oral hygiene give a very bad effects on children's dental health, particularly those under five years old⁹. Previous pilot study showed that 55% mothers from group with social economic status give the sweetened condensed milk; which contains very high sugar as a replacement or complement for breast milk. This phenomenon happened because the price of formula milk is unaffordable.

With increasing numbers of, and with very little knowledge on how important breast milk is for a child's health, it appears that more and more mothers did not breastfeed their infants. Until now the delivery of formula milk is expected to replace the role of breast milk providing nutrition for infants. But, the low socioeconomic status, the expensive price of formula milk makes it unaffordable. As a result, the sweetened condensed milk was selected to replace or complement breast milk. This type of milk contains very high sugar and low on other nutrition elements, if it's delivered in a wrong way it can caused caries. On the other hand, breast milk contains a lot of high-quality nutrition to enhance the immune system, and also contain other elements that have protective affects against caries process.

Ending the breastfeeding activity totally will enhanced the incidence and severity of ECC on children under three years old. This study try to discover whether consumption of breast milk instead of sweetened condensed milk as a breast milk replacement can reduce the risk of ECC on children under three years old.

General purpose of this study is to know the relationship between breastfeeding with Early Childhood Caries (ECC) on children under three years old, considering all factors influencing the process.

2. Methods

This is an observational study using cross sectional approach. The population in this study is children aged 12-38 months in DKI Jakarta. Sampling method use the multistage stratified cluster random sampling, with total sample 576 children.

The data collecting technique use two type; 1) questionnaires; to collect socio demographic data, type, frequency, and duration of consumption of breast milk's replacement or complement, mother's knowledge on dental health, mother's behavior on maintaining their child's oral hygiene, and habitual consumption of cariogenic carbohydrate; 2) intra oral examination; to gain the severity of caries data (def-t score), to collect small amount of dental plaque and examine its acidity (plaque pH), to collect saliva and examine its acidity (pH) and its buffer capacity. The examination of plaque pH uses the Plaque test, the examination of salivary pH and buffer capacity uses the saliva test made by GC . Data obtained from all this examination were analyzed using univariate, bivariate (linear regresi , anova, t-test) and multivariate analyses (multiple liner regression) through statistical software SPSS verse 13.0. The average reliability in diagnosing dental caries for all the examiners was high, Kappa = 0.80.

3. Results and Discussion

This study conducted in five areas in DKI Jakarta on October 2007 – March 2008

East Jakarta : Kelurahan Cipinang Muara
 South Jakarta : Kelurahan Bukit Duri
 Center Jakarta : Kelurahan Johar Baru
 North Jakarta : Kelurahan Pademangan Tmr
 West Jakarta : Kelurahan Palmerah

Before each child's dental examination, the parents were given explanation about the examination procedure, and after understanding the process and willing to participate, parents sign the informed consent.

Table 1. Prevalence and Severity of ECC (x def-t)

Areas	n	Prevalence of ECC	x def-t	SD
DKI Jakarta	567	52.7%	2.85	3.90
East Jakarta	120	60%	3.49	4.24
South Jakarta	124	50%	2.41	3.35
Center Jakarta	121	54.5%	3.10	4.18
North Jakarta	119	46.2%	2.64	4.00
West Jakarta	83	53%	2.51	3.50

Bivariate analysis showed these variables; age, mother's level of education, type of breast milk's replacement/complement, method of breast milk's replacement/complement delivery (with/without bottle), frequency and duration of breast milk's replacement/complement, frequency of consuming cariogenic carbohydrate, plaque pH, salivary buffer capacity, and tooth brushing habit, that have a significant correlation with the severity of ECC (def-t score) ($p < 0.05$).

Multivariate analysis was done to predict the strength of correlation between one set of independent variables simultaneously with the dependent variable, also to discover the best model that can explain the relationship between the dependent variable and one set of independent variables that act as predictor.

After tested with several assumption as conditioned for double regression linier test for correlation of dependent variable (def-t score) with several predictor variables, the result showed end model with $R^2 = 0.321$, which means 32.1% of def-t score variation can be explained

Table 2. Prevalence and Severity of ECC (x def-t) based on Age

Age	n	Prevalence of ECC	x def-t	SD
12-18 months	146 (25.7%)	17.12%	0.63	1.56
19-24 months	131 (23.1%)	50.38%	1.99	2.56
25-30 months	122 (21.5%)	59.02%	3.32	3.81
31-38 months	168 (29.6%)	80.95%	5.10	4.86

Table 3. Prevalence and Severity of ECC (x def-t) based on Gender

Gender	n	Prevalence of ECC	x def-t	SD
Male	285 (50.26%)	57.19%	3.00	3.88
Female	282 (49.74%)	48.23%	2.69	3.91

Table 4. Prevalence and Severity of ECC (x def-t) based on Mother's Level of Education

Education	n	Prevalence of ECC	x def-t	SD
No formal education	2 (0.4%)	100%	4.50	0.7
Elementary School	93 (16.4%)	59.14%	3.55	4.68
Junior High School	147 (25.9%)	53.74%	3.39	4.44
High School	276 (48.7%)	48.55%	2.41	3.41
Academy	31 (5.5%)	58.06%	2.67	2.33
University	14 (2.5%)	57.14%	1.64	1.73
No answer	4 (0.7%)	-	-	-

by independent variables in this model. From the double regression linier analysis obtained this equation:

$$x \text{ def-t} = 4.21 + 0.24 \text{ Age} + 1.03 \text{ Mother's level of education} + 0.98 \text{ Method of breast milk's replacement/complement delivery (with/without bottle)} + 0.69 \text{ Frequency of breast milk's replacement/complement} + 1.13 \text{ Tooth brushing habit} - 1.25 \text{ plaque pH} - 0.32 \text{ salivary buffer capacity}$$

Table 5. Prevalence and Severity of ECC (x def-t) based on Income Level

Income	n	Prevalence of ECC	x def-t	SD
Above UMR	298 (53.02%)	50%	2.66	3.87
Below UMR	264 (46.98%)	55.30%	3.05	3.95

Table 6. Prevalence and Severity of ECC (x def-t) based on Breastfeeding Activity

Breastfeeding	n	Prevalence of ECC	x def-t	SD
No	51 (%)	49.02%	2.88	4.05
Yes	516 (91%)	53.10%	2.84	3.89

Table 7. Prevalence and Severity of ECC (x def-t) based on Type of Complement/Replacement of Breast Milk

Type	n	Prevalence of ECC	x def-t	SD
Breast milk+ formula milk	345 (60.8%)	44.93%	2.09	3.27
Breast milk+ sweetened condensed milk	126 (22.2%)	84.92%	5.55	4.61
Breast milk+ sweetened tea	27 (4.8%)	37.03%	1.59	2.88
Breast milk + biscuit/porridge/rice	15 (2.6%)	40%	2.33	2.33
Formula milk	27 (4.8%)	40.74%	2.41	4.09
Sweetened condensed milk	3 (0.5%)	100%	7	6.25
Sweetened tea	8 (1.4%)	50%	2.37	2.88
Biscuit/porridge/rice	16 (2.8%)	18.75%	0.5	1.21

Table 8. Prevalence and Severity of ECC (x def-t) based on Method of Breast Milk's Replacement/ Complement Delivery

Method of Delivery	n	Prevalence of ECC	x def-t	SD
Without bottle	93 (17.22%)	49.46%	2.01	2.68
Always using bottle	447 (82.77%)	55.25%	3.14	4.14

Caries prevalence of children aged 12-38 months in DKI Jakarta is 52.7% with average def-t score 2.85. The highest caries prevalence (60%) and average def-t score (3.49) was found in East Jakarta. This def-t score is higher than average def-t score of entire Jakarta. The lowest caries prevalence was found in North Jakarta (46.2%), while the lowest average def-t score was found in South Jakarta (2.41). ECC prevalence in Jakarta is higher than caries prevalence in several countries in the world.

As the child grows, the caries risk is also increasing. This study discovered positive linier correlation between age and the severity of ECC. There's no significant correlation between socioeconomic status and the severity of ECC. This result maybe due to measurement of socioeconomic status in this study is based on UMR (standard minimum payroll), without concerning number of child and relatives covered on each family, which influence the capability to provide good nutrition to their children. Generally, children from high socioeconomic family shows lower incidence of caries than children from low socioeconomic family. But as soon as the caries process developed, the severity will be similar with children from low socioeconomic family.

Table 9. Prevalence and Severity of ECC (x def-t) based on Habitual Ways to Deliver Breast Milk's Replacement/Complement Delivery

Using bottle until the child asleep	n	Prevalence of ECC	x def-t	SD
Never	99 (21.9%)	59.59%	3.33	4.21
Seldom	106 (23.5%)	54.71%	2.87	3.88
Always	247 (54.6%)	54.25%	3.16	4.19

Table 10. Prevalence and Severity of ECC (x def-t) based on Frequency of Breast Milk's Replacement/ Complement

Frequency	n	Prevalence of ECC	x def-t	SD
1-2 times/day	189 (33.4%)	46.56%	2.14	3.21
>= 3 times/day	377 (66.6%)	55.97%	3.21	4.16

Table 11. Prevalence and Severity of ECC (x def-t) based on Duration of Breast Milk's Replacement/ Complement

Duration	n	Prevalence of ECC	x def-t	SD
0 – 12 months	106 (18.7%)	22.64%	0.70	1.47
>=13 months	461 (81.3%)	59.65%	3.34	4.11

In this study, there's no correlation between breastfeeding with the severity of caries. This finding correspond with previous study by Hirroko I, et al¹⁰ found no correlation between breastfeeding and duration of breastfeeding with ECC. Contrary, this study is not in agreement with previous studies that showed IgA level which is tissue's main local defensive factor upon caries on children drinking formula milk is lower than breastfed children¹¹. Caries incidence is lower on subjects with higher concentration of IgA^{11,12}. A child without breast milk or only breastfed for three months experienced higher caries prevalence than those who breastfed in a longer period^{11,13}.

This study showed that there's no correlation between mother's knowledge on dental health and ECC. This happened because good knowledge on dental health is not always followed by good behavior upon family's dental health care. Mother's level of education showed significant correlation with the severity of ECC. The higher the education, average def-t score decreases. Mother's with low level of education makes them rarely exposed to health care information, such as how to choose healthy and nutritious food. Previous studies also shown significant correlation between mother's level of education with the severity of ECC.

Generally, bivariate analysis showed that there's a significant correlation between types of breast milk's replacement/complement and the severity of ECC. Children whose given breast milk with formula milk showed lower ECC level than children whose given

Table 12. Prevalence and Severity of ECC (x def-t) based on Frequency of Consuming Cariogenic Carbohydrate

Sweet snacking habit	n	Prevalence of ECC	x def-t	SD
Never	75 (13.23%)	30.67	1.61	3.64
Seldom	7 (1.23%)	42.86	1.43	1.99
Sometimes	46 (8.11%)	41.30	2.04	2.97
Often	95 (16.75%)	52.63	2.65	3.60
Everyday (<=3x/day)	290(51.15%)	57.59	3.15	4.08
Everyday (>3x/day)	54 (9.52)	68.52	4.13	4.10

Table 13. Prevalence and Severity of ECC (x def-t) based on Plaque pH

Plaque pH	n	Prevalence of ECC	X def-t	SD
7.00	8 (1.41%)	37.50%	1.75	2.66
6.50	291 (51.32%)	43.30%	2.04	3.20
6.00	193 (34.03%)	61.14%	3.56	4.42
5.5	74 (13.05%)	70.27%	4.31	4.35

Table 14. Prevalence and Severity of ECC (x def-t) based on Salivary pH

pH saliva	n	Prevalence of ECC	x def-t	SD
6.8-7.8	227 (40.03%)	51.98%	2.55	3.70
6.0-6.6	261 (46.03%)	55.55%	3.20	4.06
5-5.8	79 (13.93%)	45.46%	2.52	3.84

Table 15. Prevalence and Severity of ECC (x def-t) based on Salivary Buffer Capacity

Salivary Buffer Capacity	n	Prevalence of ECC	x def-t	SD
10-12	26 (4.58%)	65.38%	2.23	2.16
6-9	187 (32.98%)	51.34%	2.60	3.58
0-5	354 (62.43%)	52.54%	3.03	4.15

Table 16. Prevalence and Severity of ECC (x def-t) based on Tooth Brushing Habit

Tooth brushing Habit	n	Prevalence of ECC	x def-t	SD
Everyday	392(9.1%)	50%	2.51	3.69
Not Everyday	174(30.7%)	59.20%	3.63	4.25

breast milk with sweetened condensed milk. Sweetened condensed milk contain sucrose, which is the most cariogenic form of sugar. While, formula milk contains lactose, less cariogenic form. Formula milk which contain sucrose is more cariogenic¹⁴. In this study, sweetened condensed milk that contain highly cariogenic sucrose was given using bottle, the child were very fond with the taste, the parents believed that it contain good nutrition for the child, and most of all it is affordable. ECC prevalence on this group is the highest among others (84.9%). Only 124 subjects (22.06%) from all subjects consuming combination of breast milk and sweetened condensed milk. 3 subject (0.05%) consuming only sweetened condensed milk. Those who consumed combination of breast milk and formula milk are 342 subjects (60.85%), and formula milk only 27 subjects (4.8%). Among 124 who consumed combination of breast milk and sweetened condensed milk, 73 of them (58.9%) comes from low socioeconomic family, 41.1% comes from high socioeconomic family. Among 342 who consumed combination of breast milk and formula milk, 141 subjects (41.2%) comes from low socioeconomic family. These facts showed that many subjects from high socioeconomic family do not know good nutrition that's best for a child. On the contrary, several parents from low socioeconomic family struggle to keep providing their kids with formula milk as a replacement/complement for breast milk, although the price of formula milk is high. Nevertheless, cross sectional study using interview to collect data is very prone to bias,

especially in determining socioeconomic status of the family and types of breast milks replacement/complement .

A research on children aged 3-5 years old, concluded that breastfeeding can prevent ECC^{11,15}. In this study, the severity of ECC on children whose given formula milk, sweetened condensed milk, and sweetened tea, without breast milk, are higher compare to those with breast milk. But the difference is not significant. This is because the method of breast milks replacement/complement delivery using bottle, is not the only important factor that influencing the incidence of ECC on children. Antibacterial quality on breast milk can interfere with microorganism activity that caused caries¹⁴.

The study also showed that there's a significant average def-t difference between those who use bottle to deliver breast milks replacement/complement, and those who were not. Children using bottle have an average def-t score higher than those who were not. But, using bottle until the child falls asleep did not caused any different on average def-t score. Correlation between breastfeeding frequency and using bottle until the child fall asleep with the severity of ECC is steel a controversy¹⁰.

Habitual consumption of cariogenic carbohydrate snacks on breastfed children, or those whose given formula milk, can not be ignored as factor influencing the severity of ECC¹⁴. This study showed that there's a significant correlation between habitual consumption of cariogenic carbohydrate snacks on daily basis with the severity of ECC. Previous study had shown that sugar consumption is the main diet factor that influenced prevalence and progressivism of ECC. Sucrose is the most cariogenic form of sugar. Increased consumption of sugar enhanced the acid production of cariogenic bacteria. This acid caused demineralization of tooth structure, depends on absolute pH decline, and how long it remains lower than the critical pH¹⁴. This study showed significant correlation between plaque pH and the severity of ECC. If the plaque pH decreases, the def-t scores increases. There's also significant correlation between daily tooth brushing habit and the severity of ECC. If plaque is not regularly removed thoroughly, not only will cause new caries, but also extend the severity of it. Caries is a multifactorial disease, caused by interaction between host, agent, environment, and time. Caries risks can be reduced by eliminating casual agents, improving host, and controlling the oral cavity environment. Microorganism inside tooth plaque can be minimized by maximum plaque removal from the tooth surface (regular tooth brushing).

In multivariate analysis, only these variables; age, mother's level of education, method of delivery and

frequency of breast milk's replacement/complement, tooth brushing habit, plaque pH, and salivary buffer capacity are included, resulting determination coefficient 32.1%. The most influencing variable to predict the severity of ECC (def-t score) is age, followed by salivary buffer capacity, tooth brushing frequency, mother's level of education, plaque pH, method of delivery and frequency of breast milk's replacement/complement.

4. Conclusion

Infants aged 12-18 months already experienced caries and constantly increasing as they grow up. In this study there is no correlation between breastfeeding and the severity of ECC. In this study, the role of protective qualities of breastfeeding is not shown. Relationship between breastfeeding and ECC is very complex, and influenced by many variables. This study showed different level of ECC severity on children that was given breast milk+formula milk and children that was given breast milk+sweetened condensed milk. The most influencing variable to the severity of ECC (def-t score) is age, followed by salivary buffer capacity, tooth brushing frequency. Mother's level of education, plaque pH, method of delivery and frequency of breast milk's replacement/complement, resulting determination coefficient 32.1%

Reference

1. Tinanoff N, O'Sullivan DM. Early childhood caries: overview and recent findings. *American Academy of Pediatric Dentistry* 1997; 19: 12-15.
2. Vachirarojpisan T, et al. Early childhood caries aged 6-19 month. *Community Dentistry and Oral Epidemiology* 2004; 32: 133.
3. Suwelo IS. *Karies Gigi Pada Anak Dengan Pelbagai Faktor Etiologi. Kajian Pada Anak Usia Prasekolah, Edisi I*. Jakarta: Penerbit Buku Kedokteran EGC, 1992.
4. Setiawati F. *Faktor-faktor Yang Berhubungan Dengan Derajat Keparahan Karies Pada Anak usia 3-5 tahun dan Program Pencegahannya di DKI Jakarta*. Jakarta: Penerbitan FKGUI, 2001.
5. Ramos-Gomez FJ, Weintraub JA, Gansky SA, Hoover CI, Featherstone JD. Bacterial, behavioral and environmental factors associated with early childhood caries. *The Journal of Clinical Pediatric Dentistry* 2002; 26: 165-173.
6. Ismail AI. Determinants of health in children and the problem of early childhood caries. *Pediatric Dentistry* 2003; 25: 328-333.
7. Huntington NL, Kim IJ, Hughes CV. Caries-risk factors for Hispanic children affected by early childhood caries. *Pediatric Dentistry* 2002; 24: 536-542.
8. Weinstein P. Public health issues in early childhood caries. *Community Dentistry and Oral Epidemiology* 1998; 26: 84-90.
9. Ribeiro-Nilza ME. Breastfeeding and early childhood caries: a critical review. *J Pediatr. (Rio de J.)* 2004; 80: 5.
10. Seow KW. Biological mechanism of early childhood caries. *Community Dent Oral Epidemiology* 1998; 26:8-27.
11. Newbrun E. *Cariology*. 3rd ed. Chicago, London, Berlin, Sao Paulo, Tokyo and Hongkong: Quintessence publishing Co Inc., 1989: 257-268.
12. Moynihan PJ. The Role of diet and nutrition in the etiology and prevention of oral diseases. *Bull World Health Organ* 2005; 83: 77-85.
13. Berkowitz RJ. Cause, treatment and prevention of early childhood caries. *J Can Dent Assoc.* 2003; 69: 304-307.
14. Thylstrup A, Fejerskov O. *Textbook of Cariology*. 1st ed. Copenhagen: Munksgaard Co., 1986.
15. Nizel AE. *Nutrition in Preventive Dentistry*. 2nd ed. London: W.B. Saunders Co., 1981: 55, 262-282, 375-388.