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Maternal Calorie Intake is a Significant Factor Associated with 6 Months of Exclusive Breastfeeding among Lactating Mothers in Depok City, Indonesia

Fikawati S, Syafiq A & Mardatillah

Center for Nutrition and Health Studies, Faculty of Public Health, University of Indonesia, Depok Indonesia

ABSTRACT

Introduction: The target of achieving exclusive breastfeeding for the first 6 months of life in Indonesia remains a challenge. Studies show a relationship between calorie intake of lactating mothers and success in 6 months of exclusive breastfeeding. This study aimed to compare the calories consumed between mothers who succeeded in 6 months of exclusive breastfeeding and those who did not and to investigate the effect of different types of supplementation. **Methods:** Three groups of lactating mothers (n=201) selected from cadres' lists were followed for 6 months between June 2015 – July 2016. The first group was a control, the second group received milk (140 kcal/day), and the third group received milk and eggs (220 kcal/day). All food supplementation were given five days a week for as long as the mother was exclusively breastfeeding the infant. Cadres provided the mother supplements and ensured complete consumption. Each month, all groups were observed and measured on status of breastfeeding, anthropometry, and food consumption. **Results:** For all groups, calorie intake of those who succeeded in exclusive breastfeeding was significantly *(p*-value < 0.05) higher than those who failed. Calorie intake of lactating mothers is the most dominant factor (OR=5.6) for the success of 6 months of exclusive breastfeeding. The milk supplementation group had the highest calorie intake and highest percentage of mothers who were successful in providing 6 months of exclusive breastfeeding. **Conclusion:** Calories supplementation was found to be a significant factor in successfully achieving 6 months of exclusive breastfeeding. In this study, milk supplementation was more effective than milk and egg supplementation.

Key words: Exclusive breastfeeding, Indonesia, maternal calorie intake

INTRODUCTION

The fourth target of the Millenium Development Goals is to reduce child mortality rate indicated by Infant Mortality Rate (IMR). Currently, in comparison to the rest of South-east Asia, IMR in Indonesia is still considered high at 32/1000 live births (Central Bureau Statistics of Indonesia, 2013). Breastfeeding (which includes early initiatives on breastfeeding and 6 months of exclusive breastfeeding) as well as feeding with appropriate, adequate and safe complementary foods are the key for infant survival and serves as the foundation of infant health status. Therefore, successful breastfeeding practice determines the nutritional and health status of infants.

By the end of 2012, the government launched the National Movement of Nutrition Awareness program by focusing on the 1,000 First Days of Life (HPK) Movement. This movement aimed to

Correspondence: Sandra Fikawati; Email: *fikawati@ui.ac.id*

accomplish the global target of Sustainable Development Goals (SDGs) related to ending all forms of malnutrition (UN, 2015). The ultimate aim is to have citizens who are healthy, smart, and productive from an early age. One of the indicators of success of the 1,000 HPK Movement is the increasing percentage of (at least 50%) mothers who provide 6 months of exclusive breastfeeding by 2025.

It is difficult to measure this goal as published data on nutrition intake of lactating mothers is limited. Most studies on lactating mothers only discuss the need for intake of certain nutrition categories, rather than nutritional intake insufficiency and its associated risks (Pratt, Durham & Sherry, 2014). Today, there is a need to pay more attention to the calorie intake of lactating mothers. Various studies report a strong correlation between amount of energy (calorie) intake of lactating mothers and successful exclusive breastfeeding for 6 months (Fikawati, 2013; Ogechi,2014; Ongosi *et al*., 2014).

Nutrition authorities recommend a higher calorie intake during lactation (2580 kcal/day) compared to calorie intake during pregnancy (2550kcal/day) (Ministry of Health RI (MoH RI 2013a). However, in Indonesia, a mother's average calorie intake during lactation is low and even lower compared to her intake during pregnancy (Fikawati, 2013; Syafiq, Fikawati & Widiastuti, 2015; Sihite, Syafiq & Fikawati, 2015; Nuradiana, 2016). These studies also show a declining calorie intake of lactating mothers during the 6 months post-partum. Many mothers fail to pay attention to their daily intake after the infants are born, while in fact the daily intake of mothers during lactation is the most important factor for successful breastfeeding (Butte *et al*., 1984; Strode, Dewey & Kinnerdal, 1986; Gonzales *et al*., 1998, Fikawati, 2013; Ogechi, 2014; Ongosi, *et al*., 2014; Mufidah, 2016).

A good nutrition status of the mother is also the main requirement to produce milk and provide 6 months of exclusive breastfeeding to the infant. Without a good pre-breastfeeding nutrition status and sufficient nutritional intake of the mother during breastfeeding, it is difficult to optimally provide 6 months of exclusive breastfeeding. Breast milk production is also dependent on the amount of calorie intake by the mother (Gonzales *et al*., 1998; Ogechi, 2014; Aubuchon-Endsley *et al*., 2015). Nutrition and food consumed by the mother will not only meet her own nutritional need but will also support sufficient breast milk production for her infant. Alam *et al.* (2003) found that in developing countries most mothers begin the lactation period without enough fat reserves thus being at risk of producing insufficient breast milk.

In Indonesia, national data from the Indonesia Basic Health Research (IBHR)(MoH RI, 2007; 2010; 2013b) reveal that a high level of mothers in childbearing age suffer from malnutrition. Recent data from IBHR 2013 (MoH RI, 2013b) show no improvement in the nutrition level of mothers of childbearing age. The risk prevalence of chronic energy deficiency (CED) in pregnant women aged 15-49 years is 24.2% and the risk prevalence of CED in women of childbearing age is 20.8%. Comparing data from IBHR 2007 and IBHR 2010, the risk prevalence of CED was found to increase for almost all age groups and conditions (pregnant and unpregnant). The increasing risk in pregnant women is even higher (MoH RI, 2007; 2010).

A poor nutrition status and insufficient calorie intake of lactating mothers will hinder the achievement of the exclusive breastfeeding program. Studies using secondary data from IBHR (MoH RI, 2013b) showed that exclusive breastfeeding practice increased the risk of stunting in infants younger than 6 months

old (Badriyah, 2016; Daningrat, 2015). As an infant's food intake comes solely from lactating mothers, the incidence of stunting is mostly attributed to inadequate breast milk primarily which in turn is due to low nutritional status of mothers or low calorie intake by mothers during lactation.

Lactating mothers require a high daily calorie intake to support lactation and having sufficient post-partum weight retention (Fikawati, 2013; Prabasiwi, Fikawati & Syafiq, 2015). Adair & Popkin (1992) state that a program should be considered to protect lactating mothers because a long duration of breastfeeding (6 months) is associated with maternal nutritional status and mother's calorie intake. The results of the research conducted by Gonzales *et al*. (1998) and Fikawati (2013) concluded that the production of breast milk from lactating mothers can be increased by providing supplements.

The purpose of this research is to test three hypotheses:

1. There is no difference in the amount of calorie intake between mothers who provide 6 months of exclusive breastfeeding and those who fail to do so;
2. There is no difference in the success rate of 6 months of exclusive breastfeeding between mothers who were provided with calorie supplementation and those who were not given calorie supplementation;
3. There is no difference in the success rate of 6 months of exclusive breastfeeding by the type of calorie supplementation given to mothers.

This research is expected to deliver valuable inputs for government programs especially in terms of calorie supplementation for mothers to increase their calorie intake in support of successfully completing 6 months of exclusive breastfeeding in Indonesia.

METHODS

This longitudinal study, conducted in Beji Sub-district Depok City, West Java, Indonesia, used the quasi experiment design to follow up on three groups of lactating mothers over 6 months. Mothers were allocated to the groups based on geographical division with similar characteristics as suggested by health personnel in Puskesmas. The first group was only given education on nutrition, the second group was given education on nutrition and food supplements in the form of milk powder (additional energy of 140 kkcal), and the third group was given education on nutrition and food supplements in the form of milk powder and cooked chicken eggs (additional calorie of 220 kcal/day). The food supplements were given by the cadres of Integrated Service Post or Pos Pelayanan Terpadu (Posyandu) who also had to ensure that mothers consumed all the supplements given. Food supplementation was given five days a week for as long as the mother was exclusively breastfeeding her infant. Each month, all groups were observed and measured on status of breastfeeding, anthropometry (mothers' weight as well as weight and length of their infants), and mothers' food consumption.

The respondents for this research were mother-infant pairs who met the following inclusion criteria: (1) gave birth at term (gestational age >37 weeks); (2) infant had birth weight of <2500 grams; (3) normal birth (no inborn malformation); (4) single birth, (5) no chronic illness, (6) had intention to breastfeed exclusively for 6 months; and (7) willing to participate in the study for 6 months. The total number of respondents recruited were 207 mothers, but 6 mothers dropped out in the early stage of the research; thus only 201 mothers were followed through.

Calculation of the dosage of the supplement was done based on the assumption that the mothers' average consumption during lactation was around 1960 kcal/day (Fikawati, 2013) and based on the results of the research conducted by Butte *et al.* (1984) and Fikawati (2013) who stated that if the intake was increased to 2100 kcal/day, the risks to exclusive/ predominant breastfeeding would increase significantly. The calorie intake eficiency of lactating mothers in Indonesia is 2100 kcal/day minus 1960 kcal/day, equal to 140 kcal/day. This study adopted a trial of 2 doses (low=140 kcal/day and high=220kcal/day). The doses were not different from the randomised, double blind, supplementation study conducted by Gonzales *et al*. (1998) in Guatemala with a low dose supplement of 120 kcal/ day but quite different from this high dose of 510 kcal/day. For this study, the high dose was limited to 220 kcal considering that the study was conducted in an urban area where mothers have a relatively good nutrition status.

Food consumption data were collected using the 24-h food recall method. Data on calorie and macronutrients were collected monthly. Data on exclusice breastfeeding duration were obtained through cadres each week to ensure that the researcher did not miss the exact date when the mother stopped exclusive breastfeeding. The definition of exclusive breastfeeding adopted for this study is that the infant receives only breast milk without any additional food or drink except some drops of medicine or vitamin during the first six months of life (WHO, 2009).

Data collection for maternal anthropometry (height and weight) and infant anthropometry (weight and length) was started 6 to 7 days after delivery (after mother and infant had already returned home) and stopped when the mother stop providing exclusive breastfeeding. Mother's height was measured using standard microtoise; infant length was measured using locally made wood length board with attached microtoise measuring band with 0.1-cm precision, and weight (for mothers and infants) was measured using a calibrated weighing scale.

Cross-checking of the respondent was conducted monthly. Data were analysed using chi-square test and multiple logistic regressions. Variables on mothers included in the multivariate analysis were nutritional status, calorie intake, age, parity, education, working status, breastfeeding knowledge, expenses for family meals, and supplementation status.

This study was approved by the Commission of Research Expert and Research Ethics of Faculty of Public Health University of Indonesia (Letter of Approval No.180/H2.F10/PPM.00.02/2015 dated 20th April 2015). Written informed consent was obtained from all subjects/ respondents.

RESULTS

A total of 201 mothers successfully completed the study, of which 44 did not receive any supplement, 81 received only milk supplement, and 76 received milk and egg supplements. The characteristics of mothers in all treatment groups were almost similar. There were no significant differences among all treatment groups except for mother's calorie intake (due to supplementation regimes) and mother's breastfeeding knowledge. Mothers who did not receive supplementation had better breastfeeding knowledge compared to the two other groups of mothers who received supplementation. Table 1 shows the characteristics of the three treatment groups.

At the beginning of the study, in the first week, 15.4% of mothers stopped exclusive breastfeeding (Table 2). The reasons mentioned were no breast milk (51.6%) and insufficient breast milk

Table 1. Respondent's characteristics in different supplementation groups

Variables	*Control*		*Milk suplementation*		*Milk and egg suplementation*		*p value*
	n = 44		*n = 81*		*n = 76*		
	n	*%*	*n*	*%*	*n*	*%*	
Mother's nutritional status (kg/m2)							
<18,5	4	9,1	8	9,9	10	13,2	0,729
>18,5	40	90,9	73	90,1	66	86,8	
Mother's calorie intake							
< 80% AKG	39	88,6	47	58,0	60	78,9	0,001*
≥ 80% AKG	5	11,4	34	42,0	16	21,1	
Mother's age (years)							
<30	24	54,5	45	55,6	55	72,4	0,052
>30	20	45,5	36	44,4	21	27,6	
Mother's parity							
Primipara	11	25,5	19	23,5	20	26,3	0,918
Multipara	33	75,0	62	76,5	56	73,7	
Mother's education							
Low	13	29,5	18	22,2	21	27,6	0,608
High	31	70,5	63	77,8	55	72,4	
Mother's working status							
Employed	5	11,4	4	4,9	10	13,2	0,189
Unemployed	39	88,6	77	95,1	66	86,8	
Mother's breastfeeding knowledge							
Less	16	36,4	42	51,9	49	64,5	0,011*
Good	28	63,6	39	48,1	27	35,5	
Family meal expenses							
Low	18	40.9	25	30,9	25	32,9	0,514
High	26	59,1	56	69,1	51	67,1	

* *p*-value <0,05

Table 2. Success of exclusive breastfeedingbased at post-partum age

Post-partum age (months)	*Exclusive breastfeeding for 6 months*					
	Failed		*Succeeded*		*Total*	
	n	*%*	*n*	*%*	*n*	*%*
1	31	15,4	170	84,6	201	100
2	2	1,2	168	98,8	170	100
3	3	1,8	165	98,2	168	100
4	1	0,6	164	99,4	165	100
5	6	3,7	158	96,3	164	100
6	3	1,9	155	98,1	158	100

production (48.4%). In the sixth month of observation, it was discovered that 22.9% mothers had failed to provide exclusive breastfeeding for 6 months. The reasons mentioned were no breast milk during the first 7 days (34.8%), insufficient breast milk (63.0%), and mothers had to go back to work (2.2%). The data also showd that the fifth month was a critical month because many mothers failed to provide exclusive breastfeeding in that month (Table 2).

The calorie intake of mothers who successfully completed 6 months of exclusive breastfeeding was significantly (p-value < 0.05) higher (2004.7 ±304.0 kcal/day) compared to those who failed (1502.6 ± 434.1 kcal/day). Furthermore, in all groups, mothers who suceeded in providing 6 months of exclusive breastfeeding had a significantly (p-value < 0.05) higher level of calorie intake compared to the group that failed (Table 3). The no treatment (control) group had the highest percentage of failure (40.9%), while for the supplementation groups, failure was below 20%. The control group had the highest percentage (88.6%) of mothers whose calorie intake was less than 80% RDA, compared to the milk supplement group (58%) and milk and egg supplement group (78.9%).

The model first began with nine independent variables of the mother, but finally it only consisted of six independent variables namely calorie intake, nutritional status, age, parity, expense for family meals, and supplementation status. Mother's calorie intake was the most dominant variable with OR 5.6 (CI 1.7-18.2) which means that mothers with higher calorie intake had 5.6 times greater chance of successfully providing 6 months of exclusive breastfeeding. Data on the final model is shown in Table 4.

DISCUSSION

The most vulnerable time for breastfeeding failure is the first month, and particularly in the first week post-partum. In the early stage of breastfeeding, there were 31 mothers (15.4%) who intended to provide exclusive breastfeeding but ended with providing formula milk. Previously this delayed onset of lactation was merely viewed as a consequence of post-partum hormonal change. However, this study provides new evidence that mothers who failed in the early stages of exclusive breastfeeding had a significantly lower calorie intake (1,403.52±402.71 kcal/day) compared to mothers who continued to provide exclusive breastfeeding (2,036.2 ± 462.0 kcal/day). Almost all mothers who failed in providing exclusive breastfeeding had a calorie consumption of less than 80% RDA.

A qualitative study conducted by Fikawati *et al.* (2014a) in Depok showed that in the early stage of breastfeeding, mothers ate less because of limited time to cook and eat (mother's efforts were mostly devoted to taking care of their infants). Looking after the infant and preparing food made some women exhausted leading to low appetite. They thus preferred to rest rather than eat. Ukegbu & Anyika-Elekeh (2013) reported that mothers with a larger household size were more likely to practise exclusive breastfeeding because they had more help available to assist the nursing mothers. During the beginning of the lactation period, mothers need help to do chores such as cooking, washing, cleaning, etc. This will help the mothers to use their free time between breastfeeding to take a rest or take a bath.

Another critical time for breastfeeding failure was in the fifth month of the post-partum period. This might relate to weanling dilemma. At that time, mothers had no more fat reserves brought on by pregnancy and thus solely depended on fat accumulated from mother's calorie intake during the previous periods to produce breast milk. Alam *et al.* (2003) noted that in developing countries, most mothers began their lactation period without sufficient

Table 3. Calorie intake(kcal/day) among different supplementation groups and the success of 6 months of exclusive breastfeeding

*Status**	*Control*			*Milk supplement*			*Milk + egg supplement*			*Total*			*p-value*
	Kcal /day	*n*	*%*	*Kcal /day*	*n*	*%*	*Kcal /day*	*n*	*%*	*Kcal /day*	*n*	*%*	*p-value*
Failed	1482,3 ±486,4	18	40,9	1643,3 ±393,8	14	17,3	1388,1 ±389,7	14	18,4	1502.6 ±434.1	46	22.8	0.001**
Succeeded	1887,3 ±306,6	26	59,1	2120,9 ±321,0	67	82,7	1928,4 ± 238,0	62	81,6	2004.7 ±304.0	155	77.1	
p-value		0,002**			0,001**			0,001**					
Total	1721,6 ±434,5	44	100	2038,3 ±378,5	81	100	1828,9 ±341,8	76	100				
	%			%			%						
RDA< 80%	88,6			58,0			78,9						

* status =successful exclusive breastfeeding for 6 months
** *p*-value <0,05

Table 4. Final model of multivariate analysis

Variables	*p-Value*	*OR (CI)*
Mother's calorie intake	0,004*	5,6** (1,7 - 18,2)
Mother's age	0,349	
Parity	0,005*	3,8 (1,5 - 9,6)
Family meal expenses	0,001*	4,4 (2,1 - 9,4)
Mother's nutritional status	0,103	
Mother's supplementation status	0,024*	2,5 (1,1 - 5,7)

* *p*-value< 0,05
** highest OR

fat reserves and thus faced the risk of producing insufficient breast milk. Picciano (2001) and Jones, Berkley & Warner (2010) state that inadequacy of maternal intake will affect milk production and influence the infant's health. According to Fikawati (2014b) low calorie intake of vegetarian mothers during the first 6 months of lactation causes significant decline in mother's post-partum weight. For this reason, calorie intake during lactation is an important factor for successful breastfeeding.

This research shows that there is a significant difference between the amount of calorie intake by mothers who succeed in providing 6 months of exclusive breastfeeding and those who fail. Mothers who succeed in providing 6 months of exclusive breastfeeding consumed more calories (2004.7 ±304.0 kcal/day) compared to those who did not (1502.6 ± 434.1 kcal/day). Further analysis showed that mothers with higher calorie intake had almost a 6-fold greater chance of being successful in providing 6 months of exclusive breastfeeding. These results are in line with the findings of Demissie, Mekonen & Haider (2003), Allen (2012), Fikawati (2013), and Ogechi (2014) who report that successful breastfeeding is influenced by calorie intake of lactating mothers.

In all treatment groups, it was observed that calorie intake of those who were successful in providing 6 months of exclusive breastfeeding was higher than those who failed. This result is in line with studies which reported that mother's calorie consumption during the lactation period is an important factor for successful breastfeeding (Gonzales *et al.,* 1998; Demissie *et al.*,2003; Allen, 2012). A study by Syafiq *et al.* (2015) reports that mothers with low calorie intakes are not able to provide 6 months of exclusive breastfeeding.

In developing countries, lack of calorie intake among lactating mothers is not only caused by insufficient meals but also mother's inability to purchase nutritious and energy-dense foods. This research also shows that the expense of family meals, as a proxy indicator of mother's socio-economic status, is the second dominant factor (after mother's calorie intake) which influences the success of exclusive breastfeeding for 6 months. Adair & Popkin (1992) state that there is a need to consider protecting mothers who intend to provide 6 months of exclusive breastfeeding because six months is a relatively long period in which the mother should continuously maintain a high calorie intake. Gonzales *et al.* (1998) concluded that the production of breast milk from women with poor nutrition status could be increased by providing food supplements.

Calorie supplement appears to be important for lactating mothers. In this

study it is observed that the two groups of mothers that received food supplements have a higher calorie intake compared to the group that did not get supplements. The percentage of mothers who succeeded in exclusive breastfeeding for 6 months from the supplement group was higher (more than 80%) compared to the control group (less than 60%). The two groups that received suplementation group consumed more calories and had a higher prevalence of 6 months of exclusive breastfeeding (82,7% and 81,6%) compared to the control group (51,9%). The results show that providing supplements to lactating mothers helps increase the prevalence of 6 months of exclusive breastfeeding. Therefore the target of 6 months of exclusive breastfeeding (50%) is not impossible to achieve.

Theoretically, the milk and egg group should have the highest additional calories intake, but in reality the total calorie intake in the milk and egg group was lower than that of the milk group. So in this study, the highest consumption of calories was in the milk group and the highest prevalence of 6 months of exclusive breastfeeding was also in the milk group.

Several explanations can be given for the higher calorie intake of mothers in the milk group than that in the milk and egg group: (i) the milk and egg treatment group perhaps was under the impression that they need not consume other foods because they had already consumed two types of supplements (milk and eggs); (ii), eggs contain high protein so mothers who received egg supplement experienced a longer period of satiety leading to less consumption of other food; third, the milk and egg treatment group by chance had significantly lower knowledge of breastfeeding compared to the other groups which limited their knowledge on the importance of increasing mother's calorie intake during lactation; and (iv), the milk and egg treatment group by chance consumed less calorie compared to the milk group.

Several conclusions can be drawn from this study. First, mothers who succeeded in providing 6 months of exclusive breastfeeding had significantly higher calorie intake compared to those who failed. Second, increasing a lactating mother's calorie intake through supplementation improved the success of 6 months of exclusive breastfeeding. Third, the milk supplementation group had the highest calorie intake and highest percentage of mothers who were successful in providing 6 months of exclusive breastfeeding. In this study, just milk supplementation was more effective than milk and egg supplementation.

It is suggested that calorie supplementation intervention for lactating mothers should be included in public health programs so as to increase the target set for 6 months of exclusive breastfeeding. The intervention could be implemented through multisectoral cooperation programs involving industry, academics, and government (health sectors).

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Conflict of interest

The authors declare that they have no conflict of interest.

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