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# Dietary Diversity as a Dominant Factor of Energy Intake Among Breastfeeding Mothers in Depok City, Indonesia

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## Abstract

Maternal nutritional needs increase during lactation. However, the energy intake of breastfeeding mothers usually still falls short of the recommended adequacy levels. This study aimed to identify the dominant factor of energy intake in breastfeeding mothers in Sawangan District, Depok City, Indonesia. This quantitative study used a cross-sectional design from July 2022 to February 2023. Energy intake, dietary diversity, and eating frequency were collected using 24-hour food recall. Other variables were collected through interviews with structured questionnaires. Data were analyzed using the Chi-square test and binary logistic regression. A total of 217 breastfeeding mothers participated in this study. This study found that 78.3% of breastfeeding mothers had inadequate energy intake. Dietary diversity ( $p$ -value = 0.032) was the dominant factor associated with the energy intake of breastfeeding mothers. Breastfeeding mothers with non-diverse food consumption were at a 2.507 times higher risk of inadequate energy intake. Energy intake in breastfeeding mothers is related to the sustainability of breastfeeding. However, most breastfeeding mothers in Sawangan District still have insufficient energy intake. Therefore, it is suggested that food supplementation for breastfeeding mothers should be included in promoting exclusive breastfeeding.

**Keywords:** breastfeeding mothers, dietary diversity, energy intake, Sawangan District

## Introduction

Globally, in 2021, malnutrition in women remains at a high level, including underweight (9.1%), overweight (32.5%), anemia (29.9%), and short stature (7%).<sup>1</sup> The Indonesian Basic Health Research reported 22.7% of adolescents and women of reproductive age suffering from anemia and 17.3% of pregnant women experiencing chronic energy malnutrition.<sup>2</sup> According to the United Nations Children's Fund (UNICEF) conceptual framework on the 2020 Maternal and Child Nutrition, inadequate food consumption was one direct cause of malnutrition.<sup>3</sup> Breastfeeding mothers need 330 kcal of additional energy in the first six months of breastfeeding, which is higher than the recommendation for pregnant women.<sup>4</sup> This is an essential period for breastfeeding mother to replenish their nutritional reserves after childbirth and ensure additional energy needs for breastfeeding are met.<sup>1</sup> Inadequate intake during this period can level up the risks of mother and infant for malnutrition, morbidity, and mortality.<sup>5</sup>

The breastfeeding mother's intake is related to the composition of breast milk. A diverse and adequate energy intake can help mothers to go through lactation without deficiencies.<sup>6</sup> A previous study found that consuming <2,100 kcal per day in breastfeeding mothers can affect the sustainability of breastfeeding.<sup>7</sup> Besides, if breastfeeding mothers do not meet their nutritional needs, they will be at risk of nutrient storage depletion and micronutrient deficiencies, thus worsening malnutrition problems.<sup>8</sup>

However, studies in West Java Province, Indonesia, have found that maternal energy intake still needs to meet Indonesia's Recommended Dietary Allowance/*Angka Kecukupan Gizi* (AKG).<sup>9,10</sup> Breastfeeding mothers' energy intake was lower than when pregnant, even though their nutritional needs were higher during breastfeeding than during pregnancy.<sup>9</sup> Several factors are related to energy intake, such as age, education level, household income, mother's attitude, husband's support, dietary diversity, and eating frequency.<sup>9,11-15</sup>

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Based on a previous study in Depok City, West Java Province, the energy intake of breastfeeding mothers still does not meet the AKG.<sup>9</sup> Infants exclusively breastfed get nutrients only from breast milk. Therefore, breastfeeding mothers' intake must be considered in stunting prevention.<sup>16</sup> However, existing interventions only target female adolescents, pregnant women, and toddlers, but not breastfeeding mothers.<sup>17</sup> Sawangan District has a higher stunting prevalence (5.7%) compared to the whole of Depok City (3.48%).<sup>18</sup> Therefore, this study aimed to identify the dominant factor of energy intake in breastfeeding mothers in Sawangan District, Depok City. This study's results may contribute valuable insight into the urgency of promoting dietary diversity, specifically for breastfeeding mothers, in promoting exclusive breastfeeding for stunting prevention in Indonesia.

## Method

This quantitative study used a cross-sectional design conducted from July 2022 to February 2023 in Sawangan District, Depok City, West Java Province, Indonesia. The respondents for this study were breastfeeding mothers who met the following inclusion criteria: aged 15-49 years, living in the area of study, and willing to participate in the study process. The exclusion criteria were breastfeeding mothers with twin infants. This study used the total sampling method; hence, all the breastfeeding mothers who met the criteria were included. A total of 217 breastfeeding mothers participated in this study, with infants ranging in age from two days to three months. All the respondents in this study had signed an informed consent prior to data collection.

Energy intake was categorized as inadequate (if the intake was <90% AKG) and adequate (if the intake was ≥90% AKG). The AKG used in this study refers to Regulation of the Indonesian Minister of Health Number 28 of 2019.<sup>4</sup> Variables of energy intake, dietary diversity, and eating frequency were collected using 24-hour food recall. Dietary diversity was assessed using Minimum Dietary Diversity for Women (MDD-W) with 10 food groups: (1) grains, white roots and tubers, and plantains, (2) pulses, (3) nuts and seeds, (4) milk and milk products, (5) meat, poultry, and fish, (6) eggs, (7) dark green leafy vegetables, (8) other vitamin A-rich fruits and vegetables, (9) other vegetables, and (10) other fruits. Dietary diversity was calculated by summing the number of food groups an individual consumed ≥15 grams in a 24-hour recall period.<sup>19</sup> Eating frequency was assessed by counting the meal times an individual consumed food or beverages ≥50 kcal, separated from the previous meal time during the 24-hour recall period.<sup>20</sup>

Other variables such as age, maternal education level, household monthly income, attitude to breastfeeding mother's meal portion, and husband's support according to the mother's perception were collected through interviews with structured questionnaires. The questionnaire was validated using Cronbach's alpha of 0.611, considered acceptable. Age was categorized using the median. The attitude was analyzed based on "agree" or "disagree" responses to the statement, "A breastfeeding mother still wants to eat more according to the breastfeeding mother's portion, even though she feels full." The breastfeeding mother had a positive attitude if she agreed with this statement. Similarly, the husband's support was analyzed based on the breastfeeding mother's response to the statement, "My husband reminds me to eat nutritious food to increase breastmilk production." Data was then analyzed using the Chi-square test and binary logistic regression.

## Results

A total of 217 breastfeeding mothers participated in this study. Table 1 shows the characteristics of the breastfeeding mother in this study. Respondents were mostly aged ≥29 years (53.5%), graduated from senior high school or higher (66.8%), having a high household income (50.7%), having a positive attitude to the breastfeeding mother's meal portion (73.7%), and receiving support from their husband (94.9%). Most breastfeeding mothers' food consumption was diverse (66.4%) and met the minimum eating frequency or ate ≥4 times a day (87.6%). The prevalence of inadequate energy intake in this study was 78.3%.

Table 2 shows the distribution of energy intake in breastfeeding mothers, ranging between 1788.17 kcal to 1948.01 kcal, which fulfills 70.64% to 76.98% AKG. This study found that the median energy intake in breastfeeding mothers was 1803.72 kcal and only met 70.49% AKG. Table 3 shows the bivariate analysis result. This study found that two variables were significantly associated with breastfeeding mothers' energy intake: dietary diversity (p-value = 0.006, OR: 3.018) and eating frequency (p-value = 0.005, OR: 8.306). Other variables such as age, maternal education level, household monthly income, attitude, and husband's support were not significantly associated with energy intake in breastfeeding mothers. Table 4 shows that higher energy intake is found in breastfeeding mothers with diverse food consumption and met the minimum eating frequency.

**Table 1. Characteristics of the Breastfeeding Mother**

Variable	n	%
Energy intake		
Inadequate (<90% AKG)	170	78.3
Adequate (≥90% AKG)	47	21.7
Age		
<29 years	101	46.5
≥29 years	116	53.5
Maternal education level		
Low (Junior high school or lower)	72	33.2
High (Senior high school or higher)	145	66.8
Household monthly income		
Low (<IDR3,000,000 or \$191.05)	107	49.3
High (≥IDR3,000,000 or \$191.05)	110	50.7
Attitude to breastfeeding mother's meal portion		
Negative	57	26.3
Positive	160	73.7
Husband's support according to the mother's perception		
No	11	5.1
Yes	206	94.9
Dietary diversity		
Not diverse (<5 food groups)	73	33.6
Diverse (≥5 food groups)	144	66.4
Eating frequency		
Not met (<4 times)	27	12.4
Met (≥4 times)	190	87.6

Notes: AKG = Angka Kecukupan Gizi/Indonesia's Recommended Dietary Allowances, IDR = Indonesian Rupiah

**Table 2. Distribution of Energy Intake in Breastfeeding Mother**

Variable	N	Min-Max	Median	SD	95% CI
Energy intake (kcal)	217	631.60-4,185.64	1,803.72	597.29	1,788.17 – 1,948.01
% AKG	217	24.48-168.78	70.49	23.71	70.64 – 76.98

Notes: AKG = Angka Kecukupan Gizi/Indonesia's Recommended Dietary Allowances, SD = standard deviation, CI = confidence interval

**Table 3. Factors Associated with Energy Intake in Breastfeeding Mother**

Variable	Energy Intake				p-value	OR (95% CI)
	Inadequate		Adequate			
	n	%	n	%		
Age						
<29 years	83	82.2	18	17.8	0.2	1.537
≥29 years	87	75.0	29	25.0		(0.794-2.975)
Maternal education level						
Low	61	84.7	11	15.3	0.108	1.832
High	109	75.2	36	24.8		(0.870-3.856)
Household monthly income						
Low	88	82.2	19	17.8	0.169	1.582
High	82	74.5	28	25.5		(0.821-3.047)
Attitude to breastfeeding mother's meal portion						
Negative	45	78.9	12	21.1	0.897	1.050
Positive	125	78.1	35	21.9		(0.502-2.198)
Husband's support according to the mother's perception						
No	9	81.8	2	18.2	1.0	1.258
Yes	161	78.2	45	21.8		(0.262-6.030)
Dietary diversity						
Not diverse	65	89.0	8	11.0	0.006*	3.018
Diverse	105	72.9	39	27.1		(1.328-6.860)
Eating frequency						
Not met	26	96.3	1	3.7	0.015*	8.306
Met	144	75.8	46	24.2		(1.097-62.905)

Notes: OR = odds ratio, CI = confidence interval, \*p-value <0.05

**Table 4. Energy Intake Based on Dietary Diversity and Eating Frequency**

Variable	n	Min-Max	Median	SD	95% CI
Dietary diversity					
Not diverse	73	631.60-3,167.76	1,577.88	537.91	1,452.93 – 1,703.94
Diverse	144	800.04-4,185.64	1,939.84	573.28	1,920.50 – 2,109.37
Eating frequency					
Not met	27	631.60-2,967.66	1,041.73	505.74	1,024.98 – 1,425.11
Met	190	802.07-4,185.64	1,863.51	552.34	1,880.43 – 2,038.52

Notes: SD = standard deviation, CI = confidence interval

This study also analyzed the dominant factor of energy intake in breastfeeding mothers (Table 5). Variables with a p-value of <0.25 were included in multivariate analysis using binary logistic regression. Based on the results of the bivariate selection, five of seven independent variables in this study with a p-value of <0.25 were age (p-value = 0.2), maternal education level (p-value = 0.108), household monthly income (p-value = 0.169), dietary diversity (p-value = 0.006), and eating frequency (p-value = 0.015). These five variables would be included in the initial multivariate modeling. Two independent variables that were not candidates in the multivariate model were attitude to the breastfeeding mother's meal portion (p-value = 0.897) and husband's support according to the mother's perception (p-value = 1.0). The multivariate analysis showed that dietary diversity (p-value = 0.032) was the dominant factor of energy intake. Breastfeeding mothers with non-diverse food consumption had a 2.507 times higher risk of consuming inadequate energy than breastfeeding mothers with diverse food consumption after controlling for variables such as age, maternal education level, household monthly income, and eating frequency. No interaction was found between dietary diversity and other variables.

**Table 5. Dominant Factor of Energy Intake in Breastfeeding Mother**

Variable	p-value	OR	95% CI
Age	0.228	1.526	0.767–3.035
Maternal education level	0.288	1.556	0.688–3.521
Household monthly income	0.497	1.282	0.626–2.626
Dietary diversity	0.032*	2.507	1.084–5.800
Eating frequency	0.087	5.990	0.774–46.383

Notes: OR = odds ratio, CI = confidence interval, \*p-value <0.05

## Discussion

This study found that most breastfeeding mothers in Sawangan District had inadequate energy intake (78.3%). Meanwhile, only 21.7% of breastfeeding mothers had adequate energy intake. Breastfeeding mothers were estimated to consume around 1,803.72 kcal or 70.49% AKG. According to the mother's age, this intake was much lower than the daily recommended intake of 2,380 kcal to 2,580 kcal. In line with this result, a study in Cipayung District, Depok City, also found that the energy intake of breastfeeding mothers was lower than the recommended, with only 2,273 kcal.<sup>9</sup> A systematic review also found that the intake of breastfeeding mothers in Indonesia does not meet the recommended nutritional adequacy.<sup>21</sup>

Inadequate maternal energy intake during breastfeeding may impact the production of breast milk. A previous study found that breastfeeding mothers who failed to provide exclusive breastfeeding only consumed 1,502.6±434.1 kcal daily. In contrast, breastfeeding mothers providing exclusive breastfeeding had a higher energy intake of 2,004.7±304 kcal per day.<sup>22</sup> Another study stated the same findings, that breastfeeding mothers with energy intake <2,100 kcal per day are at higher risk of being unable to provide exclusive breastfeeding for up to six months.<sup>7</sup> These results showed that breastfeeding mothers in Sawangan District had a higher risk of being unable to provide exclusive breastfeeding for up to six months.

Six-month exclusive breastfeeding is a specific intervention program for accelerating stunting reduction in Indonesia. Unfortunately, the program has no intervention on breastfeeding mothers' food intake.<sup>17</sup> Several studies have found that inadequate intake in breastfeeding mothers could affect breastmilk composition and threaten the sustainability of exclusive breastfeeding.<sup>6,22</sup> Another study found that the energy intake of mothers in the sixth month of breastfeeding was even lower than in the first month, even though their nutritional needs increased as the months progressed.<sup>23</sup> In this study, breastfeeding mothers' food intake in several weeks to three months of breastfeeding was still deficient compared to the recommended nutritional adequacy, and they were at risk of becoming lower as the months progressed. This study further strengthens that the dietary intake of breastfeeding mothers still does not meet the recommended value and is essential to pay attention to in promoting exclusive breastfeeding.

This study found a significant relationship between dietary diversity and energy intake in breastfeeding mothers (p-value = 0.006). This result was in line with another study on Japanese adults.<sup>14</sup> The OR value was 3.018; thus, breastfeeding mothers with non-diverse food consumption will have a greater likelihood of inadequate energy intake than those with diverse food consumption. In this study, the median value of energy intake in breastfeeding mothers with various food consumption was 1,939.84 kcal. Meanwhile, energy intake in breastfeeding mothers with non-diverse food consumption was much lower at only 1,577.88 kcal. Improved food consumption diversity is associated with increased intake in nutrient-dense food groups, such as meat, fish, and fruit.<sup>14</sup>



Another variable significantly related to breastfeeding mothers' energy intake was eating frequency (p-value = 0.015). Breastfeeding mothers eating <4 times per day were 8.306 times more likely to have inadequate energy intake than breastfeeding mothers eating  $\geq 4$  times daily. The median value of energy intake in breastfeeding mothers with  $\geq 4$  times eating frequency was 1,863.51 kcal. This intake was much higher than breastfeeding mothers with a <4 time-eating frequency at only 1,041.73 kcal. In line with this result, a previous study stated that the higher the eating frequency of breastfeeding mothers, the more likely breastfeeding mothers can fulfill their increasing nutritional needs.<sup>15</sup> When the eating frequency increases once, the energy intake will increase by 301 kcal and 243.3 kcal.<sup>20,24</sup>

Although there was no significant relationship, inadequate energy intake was more prevalent in the age group <29 years (82.2%) compared to the older age group (75%). This result aligned with a previous study finding that inadequate energy intake is more common in younger breastfeeding mothers.<sup>10</sup> This may be related to the mother's experiences. Younger mothers, especially those who just had children, tend to be unaccustomed to taking off their children and paying little attention to themselves.<sup>9</sup>

Other than age, this study also found inadequate energy intake was more often found in breastfeeding mothers with low levels of education (84.7%) and household monthly income (82.2%) than their counterparts. Education is associated with the mother's ability to make better decisions for herself and her infant. Educated mothers, compared to uneducated ones, tend to be more careful in selecting the foods they consume.<sup>25</sup> Moreover, increased income is associated with the increased ability to purchase food. Low-income mothers may experience barriers to purchasing groceries.<sup>26,27</sup>

In this study, inadequate energy intake was more prevalent in breastfeeding mothers with negative attitudes to breastfeeding mother's meal portions (78.9%) than those with positive attitudes (78.1%). This finding might be related to the mother's assumption of the infant's nutritional needs. A study in Jakarta and Depok found that more than half of breastfeeding mothers disagreed that the nutritional needs of mothers increased during the breastfeeding period.<sup>28</sup> This finding is related to a mother's assumption that her infant needs more nutrients for its development while in the womb than after birth.<sup>28</sup>

This study also found that inadequate energy intake was more often found in breastfeeding mothers with unsupportive husbands (81.8%) than in mothers with supportive husbands (78.2%). The support of families, specifically from the husband, can be an intermediary to collect and convey information to the mother from close people, health workers, or other media.<sup>29</sup> A study in Bangladesh also found that husbands' participation in programs related to maternal nutrition can help increase maternal food intake.<sup>27</sup> The involvement of husbands can significantly increase awareness, knowledge, self-efficacy, and support to wives, which then affects the mother's food intake.<sup>30</sup>

A multivariate analysis was conducted in this study to analyze the dominant factor of energy intake in breastfeeding mothers. The multivariate analysis showed that dietary diversity was a dominant factor of energy intake in breastfeeding mothers (p-value = 0.032). After controlling for confounding variables (age, maternal education level, household monthly income, and eating frequency), breastfeeding mothers with non-diverse food consumption had a 2.507 times more significant risk for inadequate energy intake. Several studies have found a relationship between age and education level,<sup>31</sup> household income,<sup>32</sup> and eating frequency,<sup>33</sup> with dietary diversity. This showed that variables expressed as confounding could become confounding since they were related to dietary diversity or energy intake.

Breastfeeding mothers in this study were estimated to consume only 70.49% AKG. Further studies are still needed to investigate the impact of this inadequate intake on breastfeeding duration and the development of breastfeeding mothers' intake during breastfeeding. The source of nutrition for exclusively breastfed infants comes from breast milk, thus serving an urgency of breastfeeding mothers' intake for stunting prevention.<sup>16</sup> However, the existing interventions only target female adolescents, pregnant women, and toddlers.<sup>17</sup> This study's results suggested that the government needs to pay attention to breastfeeding mothers' intake when promoting exclusive breastfeeding for stunting prevention, such as food supplementation programs for breastfeeding mothers.

The limitation of this study is the implementation of a 24-hour food recall, which might not be sufficient to describe the individual's daily intake. However, the method is approved by the Food and Agriculture Organization (FAO) to assess food intake at the population level. Another limitation is the application of a cross-sectional study design. Therefore, it cannot determine causal effect relationships. The strengths of this study include the food intake obtained from quantitative data and the implementation of the FAO's advice for minimum intake requirements. The advice was not to include the food consumed <15 grams in the calculation of dietary diversity. In addition, the enumerators are trained so that fewer limitations related to food intake data are expected.

## Conclusion

Energy intake in breastfeeding mothers is related to the sustainability of breastfeeding. However, most breastfeeding mothers in Sawangan District still have inadequate energy intake. Dietary diversity is found to be the dominant factor in breastfeeding mothers' energy intake after controlling for variables such as age, maternal education level, household monthly income, and eating frequency. It is suggested that food supplementation for breastfeeding mothers should be included in promoting exclusive breastfeeding. This intervention could be implemented with the help of multisectoral cooperation, including industry, the government, academics, and the community.

## Abbreviations

AKG: *Angka Kecukupan Gizi*/Indonesia's Recommended Dietary Allowance; OR: odds ratio; SD: standard deviation; CI: confidence interval; IDR: Indonesian Rupiah; FAO: Food and Agriculture Organization.

## Ethics Approval and Consent to Participate

This study was approved by the Research and Community Engagement Ethical Committee Faculty of Public Health, Universitas Indonesia (Letter of Approval No. 440/UN2.F10.D11/PPM.00.02/2023). All the respondents in this study had signed informed consent forms before the data was collected.

## Competing Interest

The authors declare that they have no conflict of interest.

## Availability of Data and Materials

This study's data can be provided upon reasonable request.

## Authors' Contribution

CLS, the principal investigator, conceptualized and designed the study, conducted the data analysis and interpretation, prepared the draft of the manuscript, and reviewed the manuscript; RADS conducted the study, led the data collection, advised on the data analysis and interpretation, and reviewed the manuscript; SF, advised on the data analysis and interpretation, and reviewed the manuscript; FW, advised on the data analysis and interpretation, and reviewed the manuscript; PNP, led the data collection and reviewed the manuscript; and NHMS, advised on the data analysis and interpretation, and reviewed the manuscript.

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