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The Nutritional Status of Breastfeeding Mothers and Breastfeeding Adequacy in Indonesia: A Systematic Review

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ABSTRACT

Background: One of the basic capitals for the formation of quality human beings is the consumption of breast milk. The amount of breast milk produced is highly dependent on the mother's diet. This study aimed to identify the relationship between the nutritional status of breastfeeding mothers and breast milk adequacy in Indonesia.
Subjects and Method: This was a systematic review using PICO model to formulate the research question. Population= breastfeeding mothers. Intervention= adequate BMI and MUAC. Comparation= poor BMI and MUAC. Outcome= breast milk adequacy. The database used is Google Scholar with keywords "Anthropometry" OR "BMI" OR "Breastfeeding mothers" OR "breast milk adequacy" OR "Indonesia". There were 10 cross-sectional studies and 2 cohort studies published in 2011-2023 that met the inclusion criteria.
Results: There is mostly a relationship between the nutritional status of breastfeeding mothers as measured by BMI and MUAC with the adequacy of breast milk.
Conclusion: The adequacy of breast milk can be influenced by the nutritional status of the mother while breastfeeding. The nutritional status of breastfeeding mothers is no less important than the nutritional status of pregnant women so that risks such as stunting do not occur.

Keywords: anthropometry, body mass index, breastfeeding mothers, milk adequacy.

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BACKGROUND

Breastfeeding is a way of offering food that the mother gives directly to her child, as a process where the baby learns to suck milk effectively from the breast and the mother learns to breastfeed the baby as comfortably as possible (Nugroho et al., 2014). Optimal growth and development of children is part of children's human rights. The basic capital for the formation of quality human beings begins from the baby in the womb, continued with the consumption of breast milk (Prawirohardjo, 2013). Breast milk is sufficient if the position and attachment are correct. The baby will urinate more than six times a day with colorless urine, not thick and odorless. Weight gain of more than 500 grams per month, exceeding birth weight at two weeks

of age. The baby is relaxed and content after feeding and leaves the mother's breast (Roesli and Yohmi, 2008).

The coverage of exclusively breastfed infants in 2021 in Indonesia is 56.9%. This figure has exceeded the 2021 program target of 40%. The highest percentage of exclusive breastfeeding coverage was in West Nusa Tenggara Province (82.4%), while the lowest proportion was in Maluku Province (13.0%) (Kemenkes RI, 2022).

Malnutrition is a common public health problem, especially among lactating mothers in some developing countries (Berhe et al., 2019). Breastfeeding is a major concern in developing countries because of its positive impact on infant health and nutrition. Breastfeeding mothers in developing countries are considered a nutritionally vulnerable group as they have high nutritional requirements during this time. Inadequate maternal nutrition during this period leads to poor excretion of nutrients into breast milk, which can affect the health of the child in the long run (Picciano et al., 2003). In malnourished mothers, the ability to breastfeed is reduced, so the amount of milk produced is highly dependent on the mother's diet. Breastfeeding not only fulfills her own nutritional needs, but also allows her to produce enough milk for her baby (Allen, 2012).

In this case, a study is needed that can comprehensively present facts about the nutritional status of breastfeeding mothers and the adequacy of breast milk, especially in Indonesia. This study aims to identify the relationship between the nutritional status of breastfeeding mothers and breast milk adequacy in Indonesia.

SUBJECTS AND METHOD

1. Study Design

This research was conducted through a systematic review and meta-analysis using primary data, i.e. data from previous similar studies. The database used is Google Scholar with keywords “Anthropometry” OR “BMI” OR “Breastfeeding mothers” OR “breast milk adequacy”. There were 10 cross-sectional studies and 2 cohort studies published in 2011-2023 that met the inclusion criteria.

2. Inclusion Criteria

To be eligible for inclusion, articles must present the data from observational studies in 2010-2023 that include anthropometric measures of breastfeeding/ postpartum mothers' nutritional status and breastmilk adequacy. The study must be conducted in Indonesia even if it is published in a journal outside Indonesia. Anthropometric indices that can be used are Body Mass Index (BMI), Maternal Upper Arm Circumference (MUAC), Body Weight (BW) and Height (H) in breastfeeding mothers. Breast milk adequacy can be seen in the frequency of breastfeeding, changes in infant weight and or the volume of breast milk.

3. Exclusion criteria

Exclusion criteria in this study were articles where the variables and outcomes were not clearly defined. Then if there was no relevant statistical evidence or it was not an original research article, this was also excluded.

4. Operational Definition of Variables

Here, we used PICO to formulate the research problem. The population consists of breastfeeding mothers. The interventions carried out were to determine the relationship between the nutritional status of breastfeeding mothers and the adequacy of breast milk and to compare the nutritional status of good and poor mothers. The outcome of this study was an understanding of the nutrition of breastfeeding mothers and its benefits for the growth and development of their children.

Breastfeeding mothers was a mother who breastfeeds after giving birth.

Breast milk adequacy was the frequency of feeding, changes in infant weight and/or

volume of breast milk that are good and normal.

Body mass index was weight divided by height multiplied by height in meters.

Maternal Upper Arm Circumference was another method besides BMI that is used in measuring the nutritional status of pregnant/ breastfeeding women.

5. Study Instrument

Assessment of paper quality through literature review of selected papers using the Critical Appraisal Skills Program (CASP, 2020).

6. Data Analysis

Articles were selected using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology, which is conducted systematically following the correct research phases or protocols. This systematic review process consists of several steps.

1) Gather background information and objectives.
2) Research question.
3) Literature search.
4) Selection criteria.
5) Practical screening.
6) Quality checklists and procedures.
7) Data extraction strategies.
8) Data synthesis strategies.

RESULTS

A search of 1010 articles was conducted, and in total, 12 articles were included in the final systematic assessment. The articles were published between 2000-2023. Seven articles dealt with BMI, two articles dealt with BMI and MUAC and three articles dealt with BMI and MUAC, three articles dealt with MUAC. The process of search up to selecting to be included in the review is presented in Figure 1.

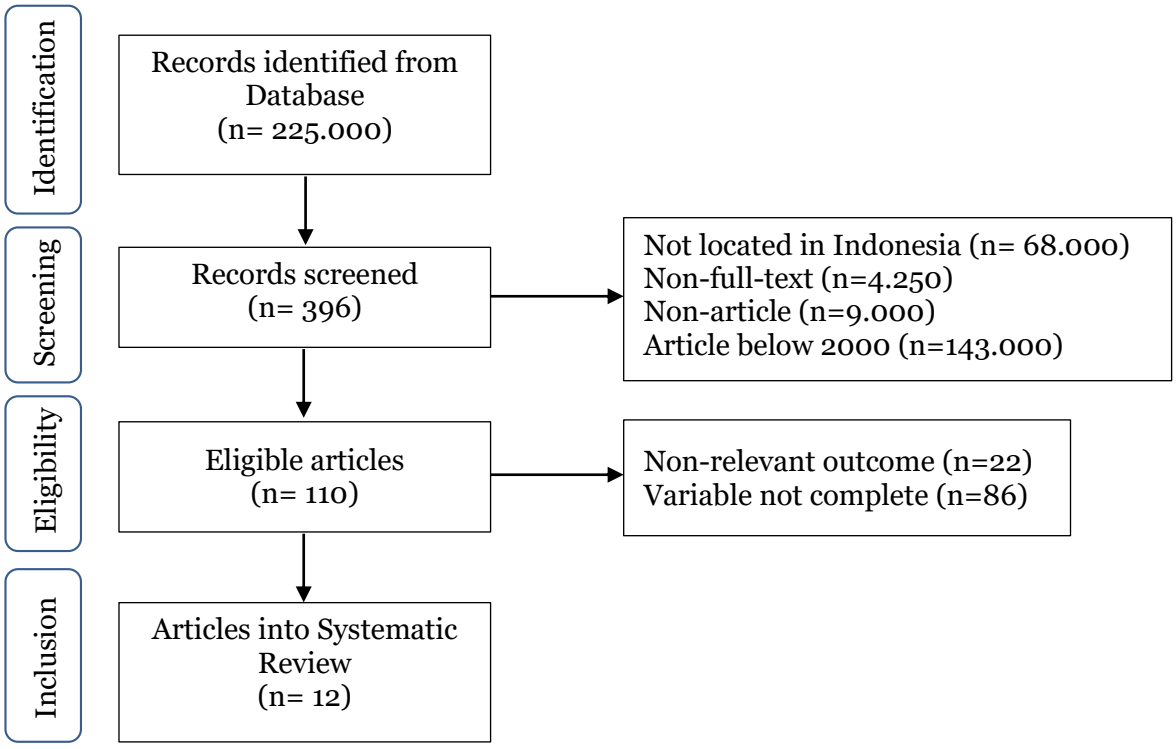

Figure 1. PRISMA flow Digram

BMI of Breastfeeding Mothers with Breast Milk Adequacy

Seven articles examined the relationship between BMI of breastfeeding mothers and breast milk adequacy. In article 1, the underweight BMI of breastfeeding mothers was

2.7% and there was a strong relationship between nutritional status and breast milk adequacy (coefficient of correlation 0.344). Article 4 showed that mothers with good nutritional status had better exclusive breastfeeding than mothers with poor nutritional status (p=0.002). Article 5 also showed a relationship between maternal weight and breast milk production (p= 0.002). Article 7 suggests that there is a relationship between maternal BMI and breastfeeding practices (p=0.002), and the lower the BMI of breastfeeding mothers, the higher the risk of unsuccessful breastfeeding (article 8).

Table 1. Relationship between Nutritional Status of Breastfeeding Mothers (BMI and MUAC) and Breast Milk Adequacy

Author (year)	Method & Location	Subject	Anthropometry	Breast Milk Adequacy	Result
Maqfiro and Tyas (2018)	Cross-sectional (Puskesmas Sukorame, Kediri)	37 breast-feeding mother	BMI	Interview with mother about breastfeeding (current/not current; regular breastfeeding/ not)	Breastfeeding mothers with less BMI amounted to 2.7%. The nutritional status of breastfeeding mothers with breast milk fluency was found to be ρ = 0.043. The correlation coefficient value is 0.334, which means that there is a fairly strong relationship between nutritional status and breast milk fluency.
Pujiastuti and Kasiati (2020)	Cross-sectional (Posyandu Desa Karang Kedawang, Sooko, Mojokerto)	54 breastfeeding mother	BMI, MUAC	Mother fills in the record of the child's weight before and after breastfeeding, weighs the child 1 month later.	Breastfeeding mothers with mild and severe BMI were 40.7% and 2%, respectively. Breastfeeding mothers with at-risk MUAC were 44.4%. MUAC and BMI of breast-feeding mothers with breast milk adequacy showed no significant relationship (p= 0.319; 0.129).
Wardana et al. (2018)	Cross-sectional (Banda-harjo, Semarang)	42 breast-feeding mothers who have infants aged 1-12 months	BMI	Measurement of breast milk content of 100 ml for 1x24 hours at the Pathology Laboratory	BMI in breastfeeding mothers showed 64% were far from the over BMI category. BMI was not associated with the energy, carbohydrate, fat and protein content of breast milk (p = 0.54; 0.74; 0.3; 0.29).
Rohman (2020)	Cross-sectional (Puskesmas Gatak Sukoharjo)	60 mothers with children under six months of age	BMI	Interview with mother about breastfeeding	Nutritional status has a significant relationship with exclusive breastfeeding, where mothers with good nutritional status have better exclusive breastfeeding than mothers with poor nutritional status (p = 0.002).

Author (year)	Method & Location	Subject	Anthro pometry	Breast Milk Adequacy	Result
Nur and Dulambuti (2019)	Cross-sectional (Puskesmas Jongaya Makassar)	40 postpartum mothers at Jongaya Makassar Health Center	BMI	Interview with mother about milk production (sufficient/not)	The most respondents were mothers with ideal weight (BMI 20-24.9) with adequate breast milk production as many as 12 people (30%). Statistical test (chi-square test, p=0.002) showed that there was a relationship between maternal weight and breast milk production.
Zahro et al. (2016)	Cross-sectional (Puskesmas Kedungmundu)	34 breastfeeding mothers	BMI, MUAC	Interview with mothers about breastfeeding patterns	Non-exclusively breastfeeding mothers were more likely to have abnormal BMI. Non-exclusively breastfeeding mothers tended to have abnormal MUAC size (17.6%, at risk of chronic energy deficiency CED)). Statistical test results showed no relationship between breastfeeding patterns and the nutritional status of MUAC and BMI of breastfeeding mothers (p=0.452; 0.132).
Puspo-rini (2021)	Cross-sectional (Desa Banyu-kuning, Kecamatan Bandungan, Semarang)	27 breast-feeding mothers who have infants aged 0-6 months	BMI	Exclusive breastfeeding practices were categorized into two; 1) no (infants were given food other than breast milk at 0-6 months of age, 2) yes (infants were given breast milk alone at 0-6 months of age).	Breastfeeding mothers with abnormal BMI were 74.1%. There is a relationship between maternal BMI and exclusive breastfeeding practices (p=0.026).

Author (year)	Method & Location	Subject	Anthro pometry	Breast Milk Adequacy	Result
Irawati (2003)	Cohort Retrospecti ve (enam desa di Kecamatan Sukaraja Kabupaten Bogor)	234 pregnant mothers with 12 weeks gestation	BMI	Measurable measure according to energy consumption from breast milk	Maternal BMI values during breastfeeding in the successful breastfeeding group and the unsuccessful breastfeeding group were significantly different ($p<0.05$). Before breast-feeding, the mean BMI of mothers in the two groups was the same, but the longer breastfeeding, the lower the BMI. Low BMI mothers had a risk of unsuccessful breastfeeding of 2.26-2.56 times that of normal BMI breastfeeding mothers.
Iskandar (2022)	Cross-sectional (Puskesmas Kasssi-Kassi Makassar)	39 multiparous breastfeedi ng mothers	BMI	Assessment of milk production using a questionnaire	Mothers with thin BMI with breastfeeding (breast milk only) were 3 respondents (7.7%), normal BMI were 17 respondents (43.6%), overweight BMI were 5 respondents (12.8%), obese BMI no one gave breast milk (only). There is no relationship between BMI and breastfeeding ($p=0.322$).
Rahmaw ati and Saidah (2021)	Cross-sectional (Wilayah Kerja Puskesmas Cipanas Kabupaten Garut)	31 postpartum women on days 3-7 who breastfed	MUAC	Interview with mother about breastfeeding	Breastfeeding mothers with MUAC were at risk by 54.8%. There is a rela-tionship between nutritional status and the smooth production of breast milk in postpartum mothers. The strength of the relationship value gets (r) 0.502 which means that the strength of the relationship between the nutritional status of breast-feeding mothers is moderate with a positive relationship direction ($p=0.004$).

Author (year)	Method & Location	Subject	Anthro pometry	Breast Milk Adequacy	Result
Soi et al. (2006)	Cohort retro-spective (Ruang Rawat Gabung di RSUD Prof. Dr. WZ Johanes Kupang)	80 mothers at any time after giving birth	MUAC	Breast milk exclusivity data was observed from the pattern of breast milk initiation in the hospital which continued once a month for 4 months	Breastfeeding mothers with MUAC were at risk by 24.4%. There was no difference in 50% median survival between the two groups by Log Rank Test (p=0.53). T-test results showed no significant difference between the CED and non CED groups.
Handaya ni and Fatmawa ti (2017)	Cross-sectional (Puskesmas Gunung Sari)	45 mothers at any time after giving birth	MUAC	Measurement of breast milk on days 4 and 10 in the morning (06.00-12.00) and before the baby feeds or 2-3 hours after the baby feeds	Breastfeeding mothers with MUAC were at risk by 24.4%. MUAC and breastmilk production on day 4 and 10 showed no significant association (p=0.579; 0.375).

However, there are some articles that have different respondents and results. In article 2, breastfeeding mothers with mild and severe BMI were 40.7% and 2% and there was no relationship between BMI and breast milk adequacy (p=0.129). In article 3, BMI was not associated with breast milk content (carbohydrate, fat, protein). In article 6, mothers with normal BMI gave non-exclusive breastfeeding, so there was no relationship between maternal BMI and breastfeeding (p=0.132). Article 9 showed no association between maternal BMI and breastfeeding (p=0.322).

MUAC of Breastfeeding Mothers with Adequate Milk Supply

Five articles studied the relationship between MUAC of breastfeeding mothers and breast milk adequacy. In article 2, breastfeeding mothers with MUAC had a risk of 44.4% and there was no association between MUAC and breast milk production (p= 0.319). In article 6, breastfeeding mothers with MUAC were at risk by 17.6% and there was no relationship between MUAC and breastfeeding pattern (p=0.456). Whereas in article 10, breastfeeding mothers with MUAC were at risk by 54.8% and there was a relationship between MUAC of breast-feeding mothers and breast milk production (p=0.004; r=0.502, positive relationship).

Other articles showed no significant association. In article 12, breastfeeding mothers with MUAC at risk were 24.4% and there was no significant difference between the CED and non CED groups. In article 11, breastfeeding mothers with MUAC at risk of 24.4% showed no significant association (p=0.579; 0.375) with breast milk pro-duction on day 4 and 10.

DISCUSSION

The nutritional status of breastfeeding mothers can be measured by anthropo-metric indices which are a combination of several parameters such as weight, height, arm circumference and body mass index body mass which is body weight divided by height squared. To measure nutritional status, it can be done biochemically with a

hemoglobin test. During breastfeeding, a mother produces about 800-1000 cc of breast milk (Paath, 2005). The amount of milk secreted depends on the amount of fat stored during pregnancy and within certain limits. The average milk volume of a woman with good nutritional status is about 700-800 ml. While those with poor nutritional status only range from 500 to 600 ml (Arisman, 2007).

Several articles on this systematic completion say that there is a relationship between the BMI of breastfeeding mothers and the fluidity of breast milk. Having a good nutritional status will prevent the occurrence of nutritional status problems because nutritional status will also affect the milk supply properly. If the milk flow is not smooth, it will not meet the nutritional needs of the baby Maqfiro and Tyas (2018) According to Damayanti et al. (2020) the most mothers who disagree to provide exclusive breastfeeding are mothers who have a thin nutritional status. The results of this study are in accordance with previous research which showed a relationship between BMI of breastfeeding mothers and exclusive breastfeeding where mothers with poor nutritional status have a 3.638 times greater risk of not providing exclusive breastfeeding compared to mothers who have good nutritional status (Rohman, 2020).

The nutritional needs of breastfeeding mothers are greater than during pregnancy. When breastfeeding, the body needs additional energy to restore health after childbirth, for daily activities and to form breast milk (Paath, 2005). Mothers with adequate nutritional status will store nutritious nutrients in the body that will be used to balance the needs during breastfeeding. This is important to condition the baby for the anatomical and physical changes that occur during the first month (Arisman, 2007). The nutritional status of breastfeeding mothers is one of the factors that influence the quantity and quality of breast milk. Therefore, babies who get enough breast milk are expected to achieve optimal nutritional status. The nutritional status of breastfeeding mothers reflects the nutritional status and health of the mother during breastfeeding, which can be measured by anthropometry of the mother's body using BMI (Ardiny and Rahayuni, 2013).

The amount of milk production depends on the amount of fat stores accumulated during pregnancy in a given period and the diet during lactation. On the first day only 50 ml of secret volume is collected, then it increases to 500, 650 and 750 ml on the fifth day, in the first and third months. If the nutritional status of the breastfeeding mother is normal and the nutrients absorbed are of good quality and quantity, the breastfeeding mother will be optimally healthy and productive with sufficient milk supply and the baby/ child will be optimally healthy and intelligent (Banudi, 2018).

The lower the nutritional status of breastfeeding mothers, the lower the lactation performance, which will result in an increased risk of child mortality (Demissie et al., 2003). The better the BMI of breastfeeding mothers, the more aware of the importance of a good and nutritious diet for their babies, and the lower the BMI of breastfeeding mothers, the lower the awareness of breastfeeding mothers (Anggraeni and Nirmala, 2019).

In Sri Lanka, the prevalence of underweight breastfeeding mothers was seen in younger women, family members less than 3 and more than 7, iron consumption, duration of breastfeeding, maternal and paternal education, income, region of residence (village/ city). Mostly, mothers with pregnancy weight gain <10 kg were found to be underweight breastfeeding mothers (Jayatissa et al., 2017).

Pujiastuti found no correlation between BMI and breast milk adequacy. Respondents in Sooko, Mojokerto mostly had a low BMI (40.7%) but they had had children before, so they had experience during breastfeeding Pujiastuti et al. (2020). These mothers have a habit of eating vegetables that can increase breast milk production such as katuk leaves, and nuts. Breastfeeding mothers who are thin, normal or obese can still produce sufficient breast milk volume for their babies because factors that affect nutritional status are food consumption and health levels. Food consumption is influenced by income and food availability. It is also influenced by internal (genetic, obstetric) and external factors (food, medicine, environment) (Supariasa, 2002).

The MUAC measurement in women of childbearing age (WUS) is an easy and publicly available early consent method to identify groups at risk of CED. The MUAC measurement is one of the options for determining nutritional status because it is easy to do and does not require inexpensive and hard-to-find equipment (Supariasa, I.D.N., 2002). In breastfeeding mothers who have a risk of MUAC (<23 cm) can be influenced by the mother's diet during pregnancy so that the mother's weight gain during pregnancy is also reduced. This is in accordance with research conducted by Rahmawati (2021), where there is a relationship between nutritional status and the smooth production of breast milk in postpartum mothers. Fat reserves in women with CED do not meet the calorie needs of 110/cal/kg/day, or less than the 560 kcal nutritional adequacy allowance (AKG) recommended by the Indonesian government, especially for infants < 5 months of age (Rahmawati and Saidah, 2021).

The MUAC for breastfeeding mothers who are not at risk of Protein Energy Malnutrition (PEM) can be caused by several things, namely a good diet, adequate nutrition and a balanced diet. The result of Protein Energy Malnutrition (PEM) is that the mother can suffer from Chronic Energy Deficiency (CED) which ends in the risk of infectious diseases. The MUAC of breastfeeding mothers is still relatively good, probably because they get a lot of information from health workers, mass media and others (Anggraeni and Nirmala, 2019).

Soi in his study mentioned that in both CED and non CED mother groups, there was a tendency for babies who were exclusively breastfed to weigh more on average than those who were not exclusive (Soi et al., (2006). Pujiastuti's research also showed a non-meaningful relationship between MUAC and breast milk adequacy. This can be influenced by the mother's work, for example: doing household chores, pounding rice in the fields so that generally mothers in the Mojokerto area have MUAC > 23 cm Pujiastuti et al. (2020). This is supported by Triatmaja that CED in breastfeeding mothers in Kediri City mostly occurs in working mothers, mothers with age ≥ 29 years, mothers with low economic status and the frequency of consumption carbohydrate and protein is less (Triatmaja et al., 2018)

The limitations of this review are articles with a small number of samples and locations that are only in Indonesia. This systematic review emphasizes that breastmilk adequacy can be influenced by the nutritional status of breastfeeding mothers. The nutritional status of breastfeeding mothers is no less important than the nutritional status of pregnant women so that risks such as stunting do not occur.

This systematic review implies that it is very important, especially for breastfeeding mothers, to pay attention to food intake patterns and health, especially family support. With the support from the family to help the mother to be ready to have a good

nutritional status and diet, one child growth will be reduced at the population level. Support from health workers and the government is also needed regarding education on the food intake needed by breastfeeding mothers. Expect efforts to facilitate exclusive breastfeeding by applying persuasive communication when providing medical services.

AUTHOR CONTRIBUTION

Ainindya Pasca Rachmadiani and Siti Rahayu Nadhiroh as the main researcher chooses topics, searches, collects study data, and processes data, analyzed the data and reviewed study documents and articles.

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CONFLICT OF INTEREST

The authors declare that the study was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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