Amerta Nutrition
e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
Dzulkifli et al. | Amerta Nutrition Vol. 8 Issue 3 (September 2024). 496-505

RESEARCH STUDY
English Version
OPEN ACCESS

Breastfeeding on Body Composition in Premature Infants: A Systematic Review

Pemberian ASI terhadap Komposisi Tubuh pada Bayi Prematur: A Systematic Review

Achmad Dzulkifli[1]*, Siti Rahayu Nadhiroh[2], Achidah Nur Syahdana[3]

[1]Program Magister Kesehatan Masyarakat, Fakultas Kesehatan Masyarakat, Universitas Airlangga, Surabaya, Indonesia
[2]Departemen Gizi, Fakultas Kesehatan Masyarakat, Universitas Airlangga, Surabaya, Indonesia
[3]Rumah Sakit Umum Daerah Karsa Husada Batu, Kota Batu, Jawa Timur, Indonesia

ARTICLE INFO

Received: *13-06-2023*
Accepted: *07-05-2024*
Published online: *30-09-2024*

Correspondent:
Achmad Dzulkifli
dzulkifliachmad6@gmail.com

DOI:
10.20473/amnt.v8i3.2024.496-505

Available online at:
https://e-journal.unair.ac.id/AMNT

Keywords:
Breastfeeding, Body composition, Preterm infants

ABSTRACT

Background: Premature newborns have a higher susceptibility to metabolic syndrome and cognitive impairment compared to infants born at full term. Breast-feeding is advised as a natural source of nutrition for premature newborns and as a cost-effective approach to decrease illness and financial strain. Assessing preterm children's growth and body composition upon leaving the hospital is crucial and requires great attention due to its sensitivity and significance in determining future care.
Objectives: This study aimed to compare the body composition of preterm infants who were fed breast milk against formula.
Methods: This study employed a systematic survey approach, which involved the use of fifteen exploratory diaries covering the period from 2013 to 2023. The search terms employed were "breast-feeding", "body composition", OR "preterm infants".
Discussions: Breast-feeding preterm infants has a positive correlation with the deposition of body fat-free mass. This helps maintain healthy body composition, prevent obesity, prevent loss of brain cell development, and promote optimal growth instead of formula feeding. The body composition of premature newborns undergoes alterations during breast-feeding at ages that correspond to their expected due dates, which may contribute to the mitigation of risk factors associated with metabolic syndrome.
Conclusions: Breast-feeding preterm infants results in slower weight gain compared to formula feeding. However, it is more effective in repairing body composition by increasing body fat-free mass, which leads to better metabolic outcomes and neurodevelopment. The care of preterm newborns places a high priority on promoting breastfeeding and providing breastfeeding support.

INTRODUCTION

From the moment of birth, breast milk is the optimal nourishment that mothers can provide to their infants. Breast milk provides sufficient nutrients to fulfil the dietary requirements of infants up to six months old. Furthermore, breast milk is enriched with antibodies that bolster infants' immune systems, aiding them in combatting infections. Exclusive breast-feeding can enhance the bond between mother and child, expedite postpartum weight loss for the mother, and normalize the menstrual cycle. Increasing the number of moms who breastfeed could potentially increase the number of mothers who breastfeed[1].

Preterm birth refers to the delivery of a baby before 37 weeks of gestation and is the primary factor contributing to neonatal mortality[2]. Based on data from the World Health Organization (WHO), roughly 13.4 million babies were born prematurely in 2020, meaning they were delivered before 37 weeks of gestation. Complications from preterm delivery are the leading cause of death for children under the age of 5, resulting in around 900,000 deaths in 2019. The prevalence of preterm births varied between 4% and 16% across different countries in the year 2020[3]. Preterm newborns experience incomplete organ development, known as organogenesis, due to the unnatural conditions they encounter in the neonatal intensive care unit (NICU) during hospitalization. As a result, they face a significant risk of developing multiple health conditions[4,5]. A significant amount of research indicates that breastfeeding breast-feeding substantially impacts the growth and development of body composition in the early postnatal period[6]. There are multiple advantages to breastfeeding premature children, such as decreased sepsis rates, enhanced eating, increased neurodevelopment, decreased rates of metabolic

How to cite: *Dzulkifli, A., Nadhiroh, S. R., & Syahdana, A. N. (2024). Breastfeeding on Body Composition in Premature Infants: A Systematic Review: Pemberian ASI terhadap Komposisi Tubuh pada Bayi Prematur: A Systematic Review. Amerta Nutrition, 8(3), 496–505.*

syndrome, and reduced levels of low-density lipoprotein in adolescence[7].

Having a thorough understanding of breastfeeding is crucial for adopting effective methods to enhance the body composition and growth of preterm infants, given their delayed postnatal development and body composition after hospital release[8]. Breastfeeding is a potential strategy to reduce neonatal mortality by promoting the mother's and newborn's well-being, preventing infections and problems, and fostering a strong bond between them. Breast-feeding is crucial for all infants, particularly those born prematurely, during the first six months of life. Premature infants face a higher risk of mortality and have unique challenges compared to full-term infants. Therefore, it is essential for mothers to closely monitor their babies' well-being and any factors that may impact breastfeeding. A lack of information or a mother's perspective in providing care can contribute to their concerns. In the early stages of infancy, newborns are more susceptible to experiencing weight loss and an elevated likelihood of developing disabilities[9].

Understanding the typical age at which most preterm newborns achieve various nursing milestones, along with an individual evaluation, is a crucial resource for assisting mothers in breastfeeding their infants and promoting breastfeeding in preterm infants. Consequently, the authors undertook a systematic review with the objective of acquiring information about the impact of breast-feeding on the body composition and growth of premature newborns.

METHODS

A comprehensive review was conducted to analyze data from observational studies, including cross-sectional, case-control, and cohort designs. The search results of primary research were described using the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) technique. The search was carried out between March and May 2023. The OR/AND/NOT Boolean operators were utilized to identify studies containing the keywords "OR", "AND", "body composition", "preterm infants", or "breast-feeding". The search was limited to studies published in English and Indonesian within the past ten years (2013-2023) and with an observational study design.

The article inclusion criteria were used to examine formula-fed preterm infants and formula-fed hospitalized newborns. Articles that are being examined for elimination should have the exact same content. A total of 8,410 articles pertaining to the specified keywords were discovered through an exhaustive search of electronic databases. A total of 434 publications were collected after excluding duplicate articles spanning a period of 10 years, which did not include full text or research articles. A total of 26 pertinent publications were chosen for the step of selecting titles and abstracts. A total of fifteen papers that satisfied the inclusion and systematic review criteria were deemed acceptable. The subsequent phase was the data extraction procedure, wherein significant information from the articles was gathered. The findings of the systematic review were thereafter displayed in a tabular manner as the outcomes of the data-gathering process. The table contained the researcher's name, study aims, research design, sample characteristics, findings, and conclusions.

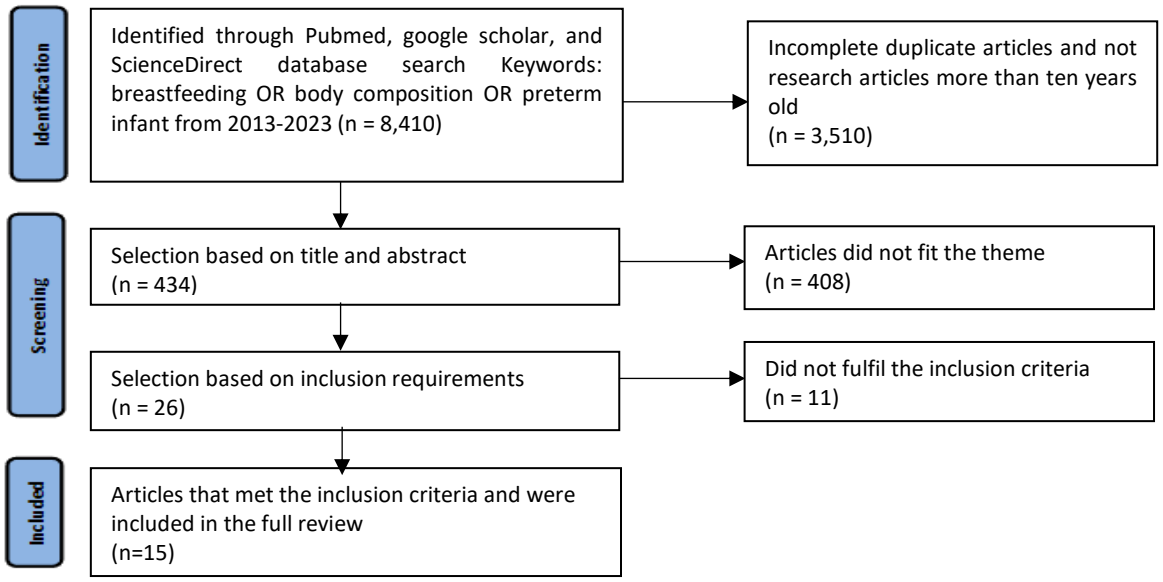

Figure 1. PRISMA flow chart for 2020 to determine a systematic review of breastfeeding on the body composition of prematurely born infants

How to cite: *Dzulkifli, A., Nadhiroh, S. R., & Syahdana, A. N. (2024). Breastfeeding on Body Composition in Premature Infants: A Systematic Review: Pemberian ASI terhadap Komposisi Tubuh pada Bayi Prematur: A Systematic Review. Amerta Nutrition, 8(3), 496–505.*

DISCUSSIONS

Effect of Breastfeeding on Body Composition of Premature Infants

Premature babies have a higher likelihood of experiencing poor neurodevelopmental outcomes. The long-term outcomes are greatly impacted by proper growth and nourishment. During the initial months after birth and in the prenatal stage, the development of the brain is influenced by the consumption of ideal nutrition. Over the past decade, there has been a growing fascination with dietary interventions aimed at promoting growth and development in preterm newborns[11]. Gianni et al.[6] conducted a study to examine the influence of nursing on the accumulation of fat and fat mass in preterm newborns. A favorable link was discovered between the consumption of breast milk and the deposition of adipose tissue mass, which was further enhanced after adjusting for the age of premature infants. The study conducted by Piemontese et al.[12] examined the correlation between diet type and body composition in preterm children with very low birth weight (VLBW). The age correction study of VLBW preterm infants revealed that infants who consumed ≥50% of their total milk volume through breastfeeding exhibited greater lean mass deposition in comparison to VLBW infants who were breastfed less than 50%.

In a more focused manner, Morlacchi et al.[13] conducted a study to examine the impact of breast milk protein on the body composition of preterm newborns with very low birth weight (VLBW). Although breast-fed infants and formula-fed infants were given similar amounts of nutrients, breast-fed infants had a greater nitrogen balance upon leaving the hospital and a larger proportion of lean body mass at the age when preterm infants reached their expected developmental stage. Mól et al.[14] conducted a comparative study between preterm newborns who were fed their mother's milk or formula and a control group consisting of full-term newborns. The study revealed a decrease in muscle mass and an increase in fat mass in preterm infants with very low birth weight (VLBW). However, when considering the gestational age-adjusted for the term, the group of very low birth weight (VLBW) children who were nursed had a body composition that was similar to that of newborns born at full term.

Beliaeva et al.[15] focused their attention on the growth and development of the body, specifically studying preterm neonates who were categorized into three groups based on the sort of treatment they received. The study findings indicated that exclusively breast-fed preterm newborns had reduced weight, length, head circumference, and chest circumference compared to infants who were given specialized formulas for preterm infants upon being discharged from the clinic. Similarly, research was conducted on preterm children who were exclusively breast-fed, comparing them to newborns who got a combination of breastmilk and formula. Nevertheless, breast-fed newborns had a favorable correlation between physical growth and lean body mass. Nonetheless, examination of the body composition of premature children who received a specialized formula for premature infants revealed a higher adipose tissue mass than solely breast-fed infants.

On the other hand, a study conducted by Li et al.[16] using a randomized controlled trial found that most premature infants who were given specialized formula were heavier than exclusively breast-fed at the end of the study. This difference in weight was accompanied by significant changes in body weight z-score, indicating an increase in non-fat tissue mass accumulation. No correlation was observed between using formula feeding and increased adiposity at term. Beginning at 24 weeks of gestation, almost 90% of the fetal body composition comprises extracellular space-occupying fluid. The three phases of postpartum diuresis function are the diuresis phase, which occurs 24-48 hours after delivery; the diuresis phase, which occurs 2-4 days after delivery; and the post-diuresis phase, which can last up to the second week after delivery. During the diuresis phase, there is a disruption in the balance of fluids and electrolytes. Additionally, in the post-diuresis phase, there is a loss of 5-10% of body weight due to alterations in the amount of extracellular fluid and an increase in intracellular volume[17].

Effect of Breastfeeding on Premature Infant Growth

Breast milk is suggested for premature newborns as it provides essential nourishment and immuno-protective advantages. It also helps develop digestive functions and supports neurodevelopment through its bioactive components. While nursing has proven beneficial for both short-term and long-term health outcomes in low birth weight (LBW) children, it may not always meet the nutritional requirements of preterm infants[11]. In a study conducted by Wibowo et al.[18], the researchers examined the relationship between the timing of introducing formula milk and the duration of breast-feeding. For extended durations, the formula should be administered in a single dose.

The cohort of neonates who were provided >75% breast milk exhibited a greater degree of z-score weight reduction from birth to discharge from the Neonatal Intensive Care Unit (NICU) compared to neonates who received less than 75% breast milk. Upon analyzing the type of breastmilk given to infants (maternal, donor, or a combination of maternal and donor breastmilk), a pattern became apparent. It was observed that growth inhibitory factors were more abundant in infants who received <75% donor breastmilk, as opposed to those who were fed <75% maternal and donor breastmilk. It is worth noting that donor breastmilk is a secondary choice when maternal breastmilk is not accessible. Laws and regulations dictate the procedures for administering, storing, and preparing donor breastmilk[1,2]. In order to minimize the risk of toxic contamination (such as drugs, narcotics, alcohol, and cigarettes) as well as diseases (such as human immunodeficiency virus (HIV), cytomegalovirus (CMV), hepatitis, and syphilis), donors are required to undergo screening[16]. Donor breast milk is subjected to pasteurization and microbiological testing to prevent the presence of germs or viruses[19].

A study conducted by Brownell et al.[20] found that comparing breast-feeding (using both mother's milk and donated breast milk) to mixed formula feeding (breast-

How to cite: *Dzulkifli, A., Nadhiroh, S. R., & Syahdana, A. N. (2024). Breastfeeding on Body Composition in Premature Infants: A Systematic Review: Pemberian ASI terhadap Komposisi Tubuh pada Bayi Prematur: A Systematic Review. Amerta Nutrition, 8(3), 496–505.*

feeding combined with special formula milk for infants) showed no significant difference in weight, length, or head circumference z-score between infants exclusively fed breast milk and those fed mixed formula from birth until they were discharged from the hospital. Brownell et al.[20] also investigated the correlation between mother breastmilk, donor breastmilk, and formula concerning preterm birth and growth rates. The data indicated a decrease in weight-adjusted mean growth velocity with each 10% increase in intake of donor breast milk. Moreover, the average change in body weight z-score declined as the quantity of donor breast milk increased but rose as the fraction of formula milk intake grew. Ultimately, an inverse relationship was observed between the consumption of donated human milk and the average growth rate in head circumference.

This systematic study examines the relationship between breast-feeding and preterm newborns' body composition and growth. However, Belyeva[15] stated that breastfeeding in premature newborns is linked to the deposition of fat-free mass, which helps to shape their body composition beneficially. Furthermore, this study revealed that premature infants discharged from the hospital following treatment did not show any correlation between growth and the accumulation of fat mass. However, it is essential to exercise caution when interpreting these results because the research included in the analysis only used prospective or retrospective study designs, except for one case. Therefore, the degree of evidence provided is restricted.

Furthermore, the majority of these studies encompassed diverse groups of preterm children, which included both moderately preterm and late preterm infants, who have particularly elevated demands for nutritional intake. Preterm newborns may exhibit distinct patterns of body composition development within the first month of their corrected age. Measurements of head circumference, body length, and body weight are commonly conducted. Regular monitoring of weight velocity enables early identification and management. When assessing growth, increases in body length and head circumference are considered. Based on the general agreement, a weight increase of 15 grams per kilogram per day is regarded as a healthy limit. If the infant's measurements show a higher weight rise, it is called an unstable weight[24].

Amalia[21] conducted a study on the primary determinant of the duration of hospitalization for premature infants: their weight. Newborns fed more than 75% breast milk have reduced weight gain while hospitalized compared to newborns who received less than 75% breast milk. Nevertheless, the authors omitted evaluating body length or head circumference, which could offer supplementary insights into growth quality and body composition. In their study, Brownell et al.[20] conducted a retrospective analysis of anthropometric measurements of preterm infants with a birth weight of less than 1800 g (1.8 Kg). They found a negative correlation between weight and head circumference growth and the quantity of donor breastmilk consumed in addition to breastmilk, from birth until hospital discharge.

Consistent with these findings, Beliaeva et al.[15] observed that solely breastfed newborns experienced poor growth in terms of weight, length, and head circumference during their hospital stay, compared to infants fed with formula. Nevertheless, it is essential to acknowledge that this study was purely observational and focused solely on a limited sample of infants born between 26 and 36 weeks of gestation. Consequently, the study encompassed not only preterm infants but also late preterm infants who have distinct nutritional requirements based on their degree of prematurity. These findings emphasize the significance of constantly monitoring the growth of preterm newborns, particularly when they are breast-fed and supplemented with donor breastmilk.

The suboptimal growth observed in breastfed, breastfed preterm infants may be partially attributed to the standardized approach used for fortifying breastmilk. This approach has been found to potentially cause nutritional deficiencies, particularly in terms of protein. Therefore, the safety of the nutritional value of donor breastmilk should also be taken into consideration. Furthermore, donor breast milk often consists of fully developed milk obtained from moms who have delivered their babies at the end of the normal gestation period. Consequently, the macronutrient composition of this milk, particularly in terms of protein, is lower than that of breast milk for preterm babies and does not fulfil the elevated nutritional requirements of preterm infants[25].

During the critical phase of caring for premature infants, breast milk is the optimal option for initiating enteral feeding. The enteral nutrition provided throughout the growth period is tailored to meet the specific demands of each preterm infant[22]. Furthermore, Visuthranukul et al.[23] found that breast-feeding promotes sufficient growth following discharge from the neonatal critical care unit. In their study, Mol et al.[14] found that when examining the impact of breast-feeding on the development of body composition, most of the studies analyzed in this review showed that breast-fed preterm infants had higher levels of fat-free mass deposition compared to formula-fed infants. The researchers also suggested that this fat-free mass deposition in preterm infants may have a protective effect against obesity and help prevent losses in neuronal cell development.

How to cite: *Dzulkifli, A., Nadhiroh, S. R., & Syahdana, A. N. (2024). Breastfeeding on Body Composition in Premature Infants: A Systematic Review: Pemberian ASI terhadap Komposisi Tubuh pada Bayi Prematur: A Systematic Review. Amerta Nutrition, 8(3), 496–505.*

Table 1. Summary of systematic review research results

Researcher	Research Purpose	Research Design	Sample Characteristic	Findings and Conclusion
Zahra, Dwiyani[1]	At the Kebayoran Baru sub-district health center in South Jakarta to evaluate the results of developmental screening and determine whether there is a difference in the development of infants aged 0-6 months who are breast-fed or formula-fed.	Desain cross-sectional	According to the calculation, a total of 20 samples from each meeting were collected for each meeting, so the total number of tests expected for this review was 44 samples.	Exclusive breastfeeding has many advantages such as reducing the risk of childhood infections, improving children's motor skills and intelligence, and reducing the risk of childhood obesity and overweight. Besides helping mothers lose weight faster after childbirth and lowering the risk of breast and ovarian cancer, breastfeeding also has many benefits for mothers.
Nanik Zulaikha, Fika Minata[2]	To determine the relationship of maternal age, parity, history of preterm birth, short interval between 2 pregnancies to the incidence of preterm birth.	Analytical survey method using a cross-sectional approach	Population 1,011 mothers attending RSIA Rika Amelia Palembang. Samples were taken with simple random sampling technique as many as 254 samples.	- Short interval between two pregnancies (p=0.001) showed a significant association with the incidence of preterm birth. - From the results of multivariate analysis, the most dominant factor in the incidence of preterm birth is maternal age with OR=3.382; p-value=0.000 (95% CI: 1.810 - 6.320). - The most dominant factor in the incidence of preterm birth is maternal age.
Gianni[6]	To investigate whether early life breastfeeding modulates the development of body composition in preterm infants.	Observational cohort study	Neonatal, anthropometric and feeding data of 284 preterm infants were collected. Body composition was evaluated at term age using air displacement plethysmography.	According to multiple regression analysis, breastfeeding at discharge and at term and exclusive breastfeeding at term were positively associated with fat-free mass.
Amalia and Herawati[8]	To determine how the implementation of kangaroo method care is related to the knowledge and attitude of mothers of LBW infants.	Descriptive correlation	This study tracked all mothers who delivered LBW infants.	- Less than half had sufficient knowledge, more than half were supportive, and more than half were interested in kangaroo care. - Chi Square test results showed that there was an association between maternal knowledge and attitude towards the implementation of kangaroo method care.
Murakami et al.[10]	To analyze the post-menstrual age at breastfeeding milestones in different preterm gestational age groups, to describe the level of breastfeeding duration at predetermined times, and to analyze the factors associated with post-menstrual age at exclusive breastfeeding establishment.	This study was part of a prospective survey of a Danish national cohort of preterm infants based on questionnaires and structured telephone interviews.	1,221 mothers and their 1,488 preterm infants with a gestational age of 24-36 weeks.	- Of the preterm babies, 99% initiated breastfeeding and 68% were discharged with exclusive breastfeeding. - Preterm infants can start breastfeeding at an earlier time, with some delay in infants less than 32 weeks gestation. - Very preterm infants have the lowest mean post-menstrual period (35 weeks) at first

How to cite: *Dzulkifli, A., Nadhiroh, S. R., & Syahdana, A. N. (2024). Breastfeeding on Body Composition in Premature Infants: A Systematic Review: Pemberian ASI terhadap Komposisi Tubuh pada Bayi Prematur: A Systematic Review. Amerta Nutrition, 8(3), 496–505.*

Researcher	Research Purpose	Research Design	Sample Characteristic	Findings and Conclusion
				complete breastfeeding, and moderately preterm infants have the lowest mean post-menstrual period at the start of exclusive breastfeeding (36 weeks). - Small infants were associated with a 5–6-day delay in exclusive breastfeeding.
Pasqua Piemontese et al.[12]	the effect of breast milk on the body composition of preterm infants.	Longitudinal observational study	LBW whose birth weight was <1,500 g with gestational age between 26 and 34 weeks were included.	- Maternal breastfeeding can modulate growth and improve growth quality in vulnerable preterm infants. - Donor breastfeeding should be encouraged when maternal milk is insufficient or unavailable.
Laura Morlacchi et al.[13]	To investigate the protein balance according to feeding mode and the relationship between breastfeeding and age-corrected fat-free mass content in very low birth weight preterm infants.	Prospective observational study	A sample size of 32 very low birth weight infants whose birth weight was <1,500 g with gestational age ≤32 weeks was included.	These findings suggest that breastfeeding is associated with early fat-free mass deposition in healthy and stable preterm infants.
Nina Mo´l[14]	To compare the body composition of preterm infants who were breastfed or fed special formula for preterm infants with a control group of full-term newborns, this study examined the body composition of both groups of infants.	Prospective cohort study	The criterion was infants with a birth weight of 1,000-1,500 g (VLBW) with a sample size of 53 preterm infants	Breast-fed VLBW infants had a similar body composition to term infants, while formula-fed VLBW developed a higher amount of adipose tissue and a lower amount of fat-free mass.
Belyaeva[15]	To examine the research and practice issues of optimizing the feeding of preterm infants.	Observational cohort study	80 samples of preterm infants with gestational age 28-36 weeks.	The results showed that the physical development of premature infants who received mother's breast milk was significantly worse at discharge from hospital inpatients than children on mixed or artificial feeding.
Yangmei Li[16]	To investigate the impact of breastmilk (BM) intake on body composition in very preterm term infants.	Preplanned secondary analysis of the Nutritional Evaluation and Optimization in Neonates (NEON) trial	n = 133, GA <31 weeks	The slower weight gain of preterm infants fed maternal breast milk appears to be due to a non-mass deficit of adipose tissue and may reflect lower protein intake.
Wibowo et al.[18]	To identify barriers that will affect the success of breastfeeding in term infants.	The study design was cross-sectional.	The study included 79-under-month infants who were eligible for inclusion and exclusion.	- The mean duration of breastfeeding in infants less than one month was 10.8-8.1 months with a median of 7 months.

How to cite: *Dzulkifli, A., Nadhiroh, S. R., & Syahdana, A. N. (2024). Breastfeeding on Body Composition in Premature Infants: A Systematic Review: Pemberian ASI terhadap Komposisi Tubuh pada Bayi Prematur: A Systematic Review. Amerta Nutrition, 8(3), 496–505.*

Researcher	Research Purpose	Research Design	Sample Characteristic	Findings and Conclusion
				- Infants who were breastfed until two months of age were 96.2%, 89.9% at four months, 81% at six months, 45.6% at eight months and 34.2% at ten months. - Multiple linear regression analyses showed that the age at which the infant was first formula-fed was an independently significant variable affecting breastfeeding duration.
Brownell et al.[20]	Dose-response relationship between the proportion of donor breast milk intake and newborn intensive care unit in NICU growth rate. The objective was to evaluate the relationship between the percentage proportion of donor breast milk intake, mother's own milk, and mixed formula intake i.e. breastfeeding and specialized formula feeding for preterm infants and neonatal growth parameters at 36 weeks post term.	Single-center retrospective study	Eligible infants for this single-center retrospective study was born at 32 weeks' gestation or 1,800 g, stayed in the NICU for 7 days for 24 samples.	When the intake of donor breastmilk and mother's breastmilk were alternately fortified, preterm infants who received additional amounts of donor breastmilk intake were at increased risk of postnatal growth arrest.
Maya Amalia[21]	To analyze the risk factors affecting the length of stay of preterm infants in RSKIA Bandung.	Quantitative research with retrospective design	All preterm infants admitted to the NICU room of RSKIA Bandung in April-July 2022.	- The average length of hospitalization for preterm infants was 70.97% in the range of 1-10 days. - The results of multiple regression tests showed that only the weight variable had a significant relationship with length of stay. - The order of the strength of the causal relationship of the independent variables to the dependent variable, can be sorted from the strongest to the weakest, namely weight, gestational age, Apgar Score, mode of delivery, gender and breast milk.
Toto[22]	Have knowledge of how PEUT occurs in relation to nutrient intake	Preterm newborns admitted to Bunda Harapan Kita Children's Hospital between July 2018 and July 2019 were the subject of a retrospective descriptive	321 preterm babies	- 55 premature newborns (about 43%) had PEUT. Compared with formula milk and breast milk fortified with HMF, there was a risk of PEUT of 1.08 and 1.78 for breast milk. - The PEUT group that received breast milk fortified with HMF experienced the largest growth acceleration (14 grams/kgBW/day),

How to cite: *Dzulkifli, A., Nadhiroh, S. R., & Syahdana, A. N. (2024). Breastfeeding on Body Composition in Premature Infants: A Systematic Review: Pemberian ASI terhadap Komposisi Tubuh pada Bayi Prematur: A Systematic Review. Amerta Nutrition, 8(3), 496–505.*

Researcher	Research Purpose	Research Design	Sample Characteristic	Findings and Conclusion
		study from medical records.		while the group that received premature formula milk experienced the smallest growth acceleration (4.6 grams/kgBW/day). - Weight gain acceleration of the normal growth group ranged from 11.5 to 13.7 grams/kgBW/day in all preterm infants.
Chonnikant Visuthranukul[23]	To compare post-discharge growth, adiposity and metabolic outcomes in preterm infants fed maternal breast milk and diet-based diets in a neonatal intensive care unit.	Single-center longitudinal cohort study	Total is 51 samples	A diet based on exclusive maternal breastfeeding can improve the long-term body composition and metabolic outcomes of preterm infants with birth weight ≤1,250 g.

Breast Milk = Mother's Milk
NICU = Neonatal Intensive Care Unit
LBW = Low Birth Weight
VLBW = Very Low Birth Weight
LBW = Very Low Birth Weight
GA = Gestational Age
PEUT = Extrauterine Growth Retarded
HMF = Human Milk Fortifier

How to cite: *Dzulkifli, A., Nadhiroh, S. R., & Syahdana, A. N. (2024). Breastfeeding on Body Composition in Premature Infants: A Systematic Review: Pemberian ASI terhadap Komposisi Tubuh pada Bayi Prematur: A Systematic Review. Amerta Nutrition, 8(3), 496–505.*

Mol et al.[14] conducted prospective cohort research to evaluate body composition in a small sample of very preterm newborns at term-corrected age. The study focused on the mode of feeding during the infant's hospital stay. The scientists found that preterm newborns who were fed formula had a lower amount of fat-free mass compared to term infants. In contrast, newborns that were breast-fed had body compositions that were similar to those of full-term infants. Piemontese et al.[12] observed that the body composition of neonates who were fed breast milk, whether from their biological mother or a donor, seemed to vary depending on the amount of milk received. When examining term-tested infants with very low birth weight, the researchers discovered that breastfeeding contributed to almost 50% of their overall intake through the digestive system and was linked to an increase in fat-free mass. The authors implemented a targeted method to fortify breastmilk, which has been proven to ensure adequate caloric and protein consumption by considering the variations in the macronutrient composition of breastmilk[25].

According to the same research group, breast-feeding was linked to the accumulation of fat-free mass among infants born slightly before their due date. The correlation between the duration of breast-feeding and the exposure of preterm infants to breast-feeding alone became more pronounced. Consistent with these results, Morlacchi et al.[13] reported that a small group of preterm children who were breast-fed had a stronger nitrogen balance and more protein storage compared to preterm infants who were formula-fed. These findings indicate that when enough energy is supplied, the mother's own breast milk proteins can be used for anabolic functions. Li et al.[16] conducted a secondary analysis of randomized controlled trials and discovered that there was no difference in the quantity of fat mass between breast-fed and formula-fed preterm infants who had similar body weight and fat-free mass deposits.

Furthermore, the body composition of premature newborns undergoes alterations while being breast-fed at the appropriate age, which could potentially reduce the likelihood of developing metabolic syndrome in early adulthood. Infants born with extremely low birth weight (ELBW) or extremely low birth weight (SLBW) have minimal fat reserves and, therefore, rely heavily on enteral and parenteral feedings. The presence of fat throughout infancy can have an impact on several outcomes that follow, such as physical development and brain growth[26]. In order to gain a deeper understanding of the function and effects of breastmilk on the early development, body composition, and long-term outcomes of preterm infants, it is necessary to undertake additional research using bigger groups of participants, longer periods of follow-up, and consistent evaluation methods.

CONCLUSIONS

Preterm infants who are breast-fed experience slower weight gain compared to those who are fed formula milk. However, breast-feeding is more effective in correcting body composition by increasing body fat-free mass deposition. This can potentially result in better metabolic outcomes and neurodevelopment. The care of preterm newborns places a high priority on promoting and providing assistance for breast-feeding.

ACKNOWLEDGEMENT

The authors would like to extend their gratitude to all the instructors of the Nutritional Anthropometry course at the Faculty of Public Health, Universitas Airlangga, for their valuable assistance and support.

CONFLICT OF INTEREST AND FUNDING DISCLOSURE

The authors declare no conflict of interest in this study and have not received any money from any source.

AUTHOR CONTRIBUTIONS

REFERENCES

1. Diwani, E. I. Z. *Perbandingan Antara Perkembangan Bayi Usia 0-6 Bulan*. (2022).
2. Zulaikha, N. & Minata, F. Analysis of Determinants of The Incidence of Premature Birth at RSIA Rika Amelia Palembang. *JKSP* 4, 24–30 (2021).
3. WHO, UNICEF & UNFPA. *Born too soon Decade of action on preterm birth*. (2023).
4. Msall, M. E., Sobotka, S. A., Dmowska, A., Hogan, D. & Sullivan, M. Life Course Health Development Outcomes After Prematurity: Developing a Community, Clinical, and Translational Research Agenda to Optimize Health, Behavior, and Functioning. in *Handbook of Life Course Health Development* 321–348 (Springer International Publishing, 2018). doi:10.1007/978-3-319-47143-3_14.
5. Vogel, J. P. *et al.* The global epidemiology of preterm birth. *Best Pract Res Clin Obstet Gynaecol* **52,** 3–12 (2018).
6. Giannì, M. L. *et al.* Does human milk modulate body composition in late preterm infants at term-corrected age? *Nutrients* 8, (2016).
7. Amissah, E. A., Brown, J. & Harding, J. E. Protein supplementation of human milk for promoting growth in preterm infants. *Cochrane Database of Systematic Reviews* vol. 2018 Preprint at https://doi.org/10.1002/14651858.CD000433.pub2 (2018).
8. Amalia, L. & Herawati, E. Hubungan Pengetahuan dan Sikap Dalam Pelaksanaan Perawatan Metode Kangguru. *Jurnal Pendidikan Keperawatan Indonesia* **4,** (2018).
9. Dwi Yitna Putri, M., Studi, P. S., Fakultas Ilmu Kesehatan Universitas, K. & Yogyakarta, A. PEMBERIAN ASI PADA BAYI DENGAN KELAHIRAN PREMATUR (Breast Milk in Babies with Prematur Birth). **5,** (2022).
10. Murakami, E., Shionoya, T., Komenoi, S., Suzuki, Y. & Sakane, F. Cloning and characterization of novel testis-Specific diacylglycerol kinase ɳ splice variants 3 and 4. *PLoS One* **11**, (2016).
11. Ikatan Dokter Anak Indonesia. *KONSENSU : Asuhan Gizi pada Bayi Prematur*. (2016).

How to cite: *Dzulkifli, A., Nadhiroh, S. R., & Syahdana, A. N. (2024). Breastfeeding on Body Composition in Premature Infants: A Systematic Review: Pemberian ASI terhadap Komposisi Tubuh pada Bayi Prematur: A Systematic Review. Amerta Nutrition, 8(3), 496–505.*

12. Piemontese, P. *et al.* The effect of human milk on modulating the quality of growth in preterm infants. *Front Pediatr* 6, (2018).
13. Morlacchi, L. *et al.* Protein use and weight-gain quality in very-low-birth-weight preterm infants fed human milk or formula. *American Journal of Clinical Nutrition* **107,** 195–200 (2018).
14. Mól, N., Zasada, M. & Kwinta, P. Does type of feeding affect body composition in *very low birth weight infants*? – A prospective cohort study. *Pediatr Neonatol* **60,** 135–140 (2019).
15. Belyaeva, I. A., Namazova-Baranova, L. S., Tarzyan, E. O., Skvortsova, V. A. & Boldakova, I. A. *Peculiarities of Physical Growth and Body Composition of Preterm Infants, Received Different Types of Feeding, at the discharge from hospital [2 nd developmental care stage]*. (2014).
16. Yangmei Li, X. L. N. M. S. U. Impact of breast milk intake on body composition at term in very preterm babies: secondary analysis of the Nutritional Evaluation and Optimisation in Neonates randomised controlled trial. *ADC Fetal & Neonatal* **104,** 306–312 (2019).
17. Uauy, R. & Koletzko, B. Defining the nutritional needs of preterm infants. *World Rev Nutr Diet* **110,** 4–10 (2014).
18. Wibowo, T., Anggraini, A., Safrida, E. N., Wandita, S. & Haksari, E. L. Lama Pemberian Air Susu Ibu pada Bayi Kurang Bulan dan Faktor yang Memengaruhi. *Sari Pediatri* **24,** 294 (2023).
19. Underwood, M. A. Human Milk for the Prematur Infant. *Pediatric Clinics of North America* vol. 60 189–207 Preprint at https://doi.org/10.1016/j.pcl.2012.09.008 (2013).
20. Brownell, E. A. *et al.* Dose-response Relationship between Donor Human Milk, Mother's Own Milk, Preterm Formula, and *Neonatal* Growth Outcomes. *J Pediatr Gastroenterol Nutr* **67,** 90–96 (2018).
21. Amalia, M. *Faktor-Faktor Yang Mempengaruhi Lama Rawat Inap Hospitalisasi Bayi Prematur*. vol. 9 (2022).
22. Wisnu Hendrarto, T. & Ayu Nurahma, W. *Pengaruh Asupan Gizi pada Bayi Prematur dengan Pertumbuhan Ekstrauteri Terhambat di Rumah Sakit Anak Bunda Harapan Kita*. vol. 22 (2020).
23. Visuthranukul, C., Abrams, S. A., Hawthorne, K. M., Hagan, J. L. & Hair, A. B. Prematur small for gestational age infants fed an exclusive human milk-based diet achieve catch-up growth without metabolic consequences at 2 years of age. *Arch Dis Child Fetal Neonatal Ed* **104,** F242–F247 (2019).
24. Gates, A., Marin, T., Leo, G. De & Stansfield, B. K. Review of Preterm Human-Milk Nutrient Composition. *Nutrition in Clinical Practice* vol. 36 1163–1172 Preprint at https://doi.org/10.1002/ncp.10570 (2021).
25. Arslanoglu, S. *et al.* Fortification of human milk for preterm infants: Update and recommendations of the European milk bank association (EMBA) working group on human milk fortification. *Frontiers in Pediatrics* vol. 7 Preprint at https://doi.org/10.3389/fped.2019.00076 (2019).
26. Fenton, T. R. *et al.* Validating the weight gain of preterm infants between the reference growth curve of the fetus and the term infant. *BMC Pediatr* **13,** (2013).

How to cite: *Dzulkifli, A., Nadhiroh, S. R., & Syahdana, A. N. (2024). Breastfeeding on Body Composition in Premature Infants: A Systematic Review: Pemberian ASI terhadap Komposisi Tubuh pada Bayi Prematur: A Systematic Review. Amerta Nutrition, 8(3), 496–505.*