

## Preterm Infants' Weight Gain and Nutrition: Retrospective Study in a Top Indonesian Referral Hospital

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### ABSTRACT

**Background:** Impairment of nutritional fulfillment is one of the problems that is often encountered in premature infants.

**Purpose:** This study aimed to determine the effect of the type of nutrition on the weight increase of premature babies.

**Methods:** A retrospective study was conducted through a medical record review in a top national referral hospital, Indonesia. Total of 75 preterm infants divided into groups of 15 infants by nutrition type (100% BM, 75% BM, 50% BM, 25% BM, and 0% BM). Weight gain was assessed for 12 days through the patients' medical records. Weighing observation was divided into four times: birth weight in day-1, day-4, day-8, and day-12. Subjects were recruited using consecutive sampling with the following criteria: preterm infants with chronological age > 7 days and weight > 1000 grams. Meanwhile, the exclusion criteria were preterm infants treated in the neonatal intensive care unit (NICU), preterm infants with medical diagnosis of hydrocephalus, sepsis, and congenital anomalies, conjoined twin babies. The general linear model-repeated measure was used to quantify the contrast of increases in infants' body weight among groups for days 1-4; 4-8; and 8-12.

**Results:** There were no significant differences between the five types of nutrients in terms of increase in the infants' body weight in day 1-4 ( $p > 0,68$ ); day 4-8 ( $p > 0,65$ ); day 8-12 ( $p > 0,12$ ).

**Conclusion:** Although it not likely to accelerate the infant's weight, mother's own milk is still the first recommendation due to its immunity components, nutritional elements, and safety.

**Keywords:** Weight Gain, Preterm Infants, Breast Milk, Type Of Nutrition.

Received January, 23, 2021; Revised February 28, 2021; Accepted March 12, 2021

DOI: <https://doi.org/10.30994/jnp.v4i2.125>



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**BACKGROUND**

About 36% of preterm infants were reported as having digestive problems. Such condition was caused by sepsis, respiratory distress syndrome, phototherapy, and mothers who suffer from diabetes mellitus ([Ahammad, Begum, and Nasrin, 2018](#)). Health problems related to digestion in preterm infants could affect their weight gain ([Namiro, Mugalu, McAdams, Ndeezi, 2012](#)).

Breast milk is the essential nutrition for preterm infants and has numerous benefits, such as protecting against infection; improving cognitive skills; reducing short-term and long-term morbidity risk; shortening the hospitalization period; increasing the mother-baby bond; preventing necrotizing enterocolitis (NEC), gastrointestinal infection, respiratory tract infection, otitis media, obesity, and sudden infant death syndrome; lowering the risk of breast and ovarian cancer, osteoporosis, type II diabetes, cardiovascular diseases, and rheumatoid arthritis ([Meier, Engstom, Patel, Jegier & Bruns, 2010](#)). However, some clinicians propose infant formula as the main substitution to reach expected weight gain regardless of its other impacts on preterm infants.

A study conducted by [Wojkowska-Mach, Rozanska, Borszewska-Kornacka et al. \(2014\)](#) stated that formula feeding for preterm infants could increase the risk of NEC and sepsis. NEC can cause ischemia or toxicosis, which might damage the gastrointestinal mucosa, cause loss of mucosa integrity, and trigger bacteria proliferation in the mucosa. Such condition could allow bacteria to easily invade the digestive tract. This process could lead to intestinal necrosis and cause sepsis. NEC is one of the causes of preterm infant death. This study aims to compare breastfeeding and formula feeding in preterm infant weight gain. We hypothesized that preterm newborn weight gain is associated with the kind of nutritional intake.

**OBJECTIVE**

This study aimed to determine the effect of the type of nutrition on the weight increase of premature babies

**METHODS****Design and samples**

A retrospective study was conducted through a medical record review.

The subjects were to be divided into five groups. Using Winpepi 11.65 with the power of 0.80 for an  $\alpha$  value of 0.05, the standard deviation of the groups was respectively 71 and 60, with a minimal significant difference of 70. Therefore, a minimum of 70 total subjects was needed. Seventy-five subjects were recruited using consecutive sampling with the following criteria: preterm infants with chronological age > 7 days and weight > 1000 grams. Meanwhile, the exclusion criteria were preterm infants treated in the neonatal intensive care unit (NICU), preterm infants with medical diagnosis of hydrocephalus, sepsis, and congenital anomalies, conjoined twin babies, and preterm infants who were breastfed with human milk fortifier (HMF) and formula fed with nutrient dense formula containing 30kcal/oz. The investigation was conducted in a top national referral hospital in Jakarta, Indonesia.

**Research instrument and data collection**

The samples were 75 preterm infants and consisted of 15 infants who were 100% breastfed, 15 infants who were 75% breastfed, 15 infants who were 50% breastfed, 15 infants who were 25% breastfed, and 15 infants who were 0% breastfed. Infant weight was assessed within 12 days based on the infants' medical records. The observation was divided into four

parts: body weight day 1 (BW1), body weight day 4 (BW4), body weight day 8 (BW8), and body weight day 12 (BW12). Instrument are Completed forms from medical records were used to obtain data from 2017 to 2018.

**Data analysis**

This investigation was conducted through secondary data resource (medical record). Homogeneity among groups was examined using one-way Anova. Whereas the general linear model-repeated measure was used to quantify the contrast of increases in infants' body weight with normal data distribution among groups for days 4, 8, and 12.

**Ethical considerations**

Since this was a retrospective study using medical records and no human contact, it did not need to comply with the Research Ethics Committee.

**RESULTS**

The characteristics of respondents in this study included gestational age, chronological age, birth weight, current weight, type of delivery, and sex.

**Table 1**  
Respondents' demographic characteristics (n=75)

Variabel	BM 0%		BM 25%		BM 50%		BM 75%		BM 100%		P value
	Mean (n)	SD (%)	Mean (n)	SD (%)	Mean (n)	SD (%)	Mean (n)	SD (%)	Mean (n)	SD (%)	
Gestational age (wk)	32,8	1,89	33,6	1,55	32,3	2,46	32,8	1,61	33,5	1,46	0,62
Chronological age (day)	18,87	1,04	20,9	1,58	14,53	8,42	11,8	4,88	11,33	8,22	0,005
Birth weight (gr)	1683	453,97	1742	356,20	1818	417,28	1731	392,94	1882	418,2	0,243
Actual weight (gr)	2301	420,71	2288	383,49	2179	256,59	2079	281,39	2117	374,3	0,043
Type of delivery											
SC	11	73,3	11	73,3	9	60	10	66,7	11	73,3	0,862
Normal	4	26,7	4	26,7	6	40	5	33,3	4	26,7	
Sex											
Male	10	66,7	5	33,3	7	45,7	6	40	8	53,3	0,629
Female	5	33,3	10	66,7	8	53,3	9	60	7	46,7	

= BM: Breast Milk

**Table 2**  
General linear model with post-hoc analysis was used for predicting the association between the amount of breast milk consumption and preterm infants' body weight (n=75)

Increase in body weight	BM 0%	BM 25%	BM 50%	BM 75%	BM 100%	P value
	(n=15) Mean (SD)	(n=15) Mean (SD)	(n=15) Mean (SD)	(n=15) Mean (SD)	(n=15) Mean (SD)	
Increase: BW4-BW1	77,4 (71,284)	47,80 (91,806)	108,80 (248,135)	13,47 (104,695)	56,27 (108,493)	0,68
Increase: BW8-BW4	115,67 (83,364)	66,80 (102,364)	46,67 (202,764)	144,33 (99,071)	136,80 (129,267)	0,65

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Increase: BW12-BW8	163,33 (76,827)	109,40 (73,473)	128,60 (134,187)	78,20 (132,770)	43,33 (145,353)	0,12
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## DISCUSSION

Statistical analysis using the general linear model shows that there is no significant difference among the five nutritional intake types in regard to preterm infants' weight. The calorie content of breastfeeding is almost equal to formula feeding; thus, this indicates no difference regarding weight gain among preterm infants in the various nutritional intake groups. The calorie content of breast milk until two weeks chronological age is equal to formula milk for preterm infants ([Padovani, Duarte, Martinez & Linhares, 2011](#)). In this study, the chronological age of preterm infants varied until 62 days. This condition could affect the calorie content of breast milk, and thus, it could have less calorie content than formula milk.

However, previous studies have shown the negative impact of formula on preterm infants ([Shulhan, Dicken, Hartling & Larsen, 2017](#)). [Kosmont \(2011\)](#) stated that preterm infants who were formula fed have higher risk of NEC compared to preterm infants who were breastfed or received donated breast milk and breast milk with HMF. Breast milk has immunological, psychological, and economic benefits and enhances neurobehavioral and cognitive growth, gastrointestinal system maturity, and emotional bonding between mother and baby ([Shulhan, Dicken, Hartling & Larsen, 2011](#)).

Breast milk for preterm infants contains more glycosaminoglycan, which aims to prevent enterocyte death. The bioactive molecule in breast milk could strengthen the baby's immune system and prevent NEC, which infant formula cannot do ([Chowning, Radmacher, Lewis, Serke, Pettit & Adamkin, 2015](#); [Siggers, Thymann, Boye & Sanglid, 2011](#)). Colostrum given after birth contains growth factor and lactoferrin ([Underwood, 2013](#)). [Dutta, Singh, Chessell, Wilson, Janes et al. \(2015\)](#) stated that mother's own milk is the very first option for preterm infants. The second best alternative is donor milk, although some nutritional elements are inactivated by the pasteurization process ([Bertino, Nicola, Giuliani, et al., 2012](#); [Kumar, Singhal, Vaidya, Banerjee, Anwar et al, 2017](#); [McGuire and Anthony, 2003](#)). The last option is formula milk, for which the risks and benefits associated with NEC remain debatable ([Walsh, Brown, Askie, Embleton, & McGuire, 2019](#)).

The normal increase of preterm infant weight is 15 grams/kg BW/day after age 8-10 days. Bronchopulmonary dysplasia, patent ductus arteriosus, and respiratory distress could cause weight loss and increase morbidity and mortality in preterm infants ([Caner, Tekgunduz, Temuroglu, Demirelli & Kara, 2015](#)). Weight gain could also be promoted by the Kangaroo Mother Care (KMC) method. KMC helps babies gain more weight, strengthens the emotional bond between mother and baby, controls body temperature, provides feelings of security and safety, has an analgesic effect, provides physiological function stability, calms the baby, boosts the blood flow to the brain, and shortens the hospitalization stay ([Korraa, Nagger, Mohamed & Helmy, 2014](#); [Sarparast and Farhadi, 2015](#)).

Too little or too much stimuli could affect the nervous synchronization system, and could damage their development and growth ([Als and McAnulty, 2011](#)). At the beginning of a preterm infant's life, there are several physiological functions that need stabilization and integration from medical equipment to help their survival, such as breathing, heart rate, temperature control, digestive function, and elimination. The best treatment to overcome environmental stress is developmental care ([Hockenberry and Wilson, 2013](#)).

However, the implementation of developmental care in Indonesia is still not optimal. Constraints related to human resources, policies, and facilities are one of the obstacles to the perfect application of developmental care ([Efendi and Rustina, 2013](#)). Several developmental care standards that are generally implemented by hospitals include sound management in the treatment room, but developmental care such as sleep protection by providing nesting, minimal handling, reducing lighting, and kangaroo mother care have been implemented. Programs to improve bonding for mothers and babies have been carried out in several hospitals, for example through Mother Therapeutic Touch (MTT) for babies undergoing minor invasive procedures ([Efendi et al., 2018](#)), the use of breast feeding pillows for mothers with premature babies, and discharge planning programs. in the neonatology unit ([Julianti, Rustina and Efendi, 2019](#)).

## **CONCLUSION**

This study concluded that there is no significant difference among the five nutritional intake types in terms of preterm infants' weight gain. Though the increase in preterm infants' weight were equal, consumption of mother's own milk is still more recommended over others due to its immunity components, nutritional elements, and safety. Nurses have a pivotal role as advocates for preterm infant formula use with rigorous considerations.

## **Relevance to clinical practice**

This study provide evidence of the similarity of weight gain associated with the tipe of enteral nutrition in preterm infants in the first two weeks. Although breast milk does not accelerate the infants weight gain, aspect in safety, cost effectiveness, and imonological support make breastmilk remains superior to the other. The use of preterm formula should be accompanied by strong consideration. Nurses must provide support, as well as assistance to mothers who are experiencing problems in the production of breast milk. Collaboration with lactation councelor and peer support group might be needed to improve lactation coverage of the preterm infant in special care nursery.

## **ACKNOWLEDGMENTS**

The authors are indebted to all of the neonatal nurses in Cipto Mangunkusumo national top referral hospital Jakarta, Indonesia.

## **CONFLICTS OF INTEREST**

We declare there is no conflict of interest in this study

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