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The Effect of Exclusive Breastfeeding on Infant Growth

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Abstract *Exclusive breastfeeding for the first six months of life is an important nutritional intervention that plays a role in supporting infant growth and preventing growth disorders. Although the coverage of exclusive breastfeeding in Indonesia has increased, differences in infant growth outcomes based on nutritional sources remain an issue that needs to be examined contextually. This study aims to analyze the effect of exclusive breastfeeding on infant growth at the Labuha Community Health Center, South Halmahera Regency. The study uses a quantitative approach with an observational analytical design and a comparative cross-sectional design. The study sample consisted of 30 infants aged 3–9 months selected using total sampling technique. The independent variable was the infant's nutritional source (exclusive breastfeeding and breastfeeding supplemented with formula milk), while the dependent variables included weight gain and length gain. The data were analyzed univariately and bivariately. The normality test was performed using the Shapiro–Wilk test, and the difference analysis was performed using the independent t-test. The results showed that there was no significant difference in infant weight gain based on nutritional source (p = 0.334). However, there was a significant difference in infant length gain, with infants who were exclusively breastfed showing better linear growth than infants who received a combination of breast milk and formula (p = 0.006). The conclusion of this study shows that exclusive breastfeeding has a significant effect on infant length growth, but not on weight gain. These findings emphasize the importance of exclusive breastfeeding in supporting linear growth as a key indicator of healthy infant growth.*

Keywords*: Community Health Center; Exclusive Breastfeeding; Infant Growth; Length; Weight.*

1. INTRODUCTION

Exclusive breastfeeding for the first six months of life is one of the most effective public health interventions in supporting infant growth and reducing morbidity and mortality in early life. The World Health Organization (WHO) recommends exclusive breastfeeding for six months, followed by the introduction of adequate complementary foods while continuing to breastfeed until the age of two years or beyond, as the early life period is a critical phase that determines the trajectory of long-term growth and health (WHO, 2023a; WHO, 2023b). Optimal breastfeeding practices not only contribute to the nutritional status of infants, but also to the prevention of infectious diseases that can interfere with physical growth.

Globally, exclusive breastfeeding rates have not yet reached optimal targets. The WHO and UNICEF report that approximately 44–48% of infants under six months of age are exclusively breastfed, although there has been an upward trend in recent years (UNICEF & WHO, 2023; UNICEF & WHO, 2024). However, more than half of infants worldwide still receive complementary fluids or foods too early, which can potentially increase the risk of infection, nutrient absorption disorders, and suboptimal growth (UNICEF, 2025). This condition shows that infant feeding practices that do not comply with recommendations remain a global challenge that directly impacts the quality of child growth.

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In Indonesia, exclusive breastfeeding coverage has improved, but it is not yet consistent nationally or regionally. The 2023 Indonesian Health Survey (SKI) reported that the proportion of infants aged 0–5 months who were exclusively breastfed reached 68.6%, with considerable variation between provinces (Indonesian Ministry of Health, 2023). Although this figure is relatively higher than the global average, the practice of exclusive breastfeeding for six full months still faces various obstacles, including family support, mothers' working conditions, and the quality of lactation counseling. At the same time, Indonesia still faces the burden of child growth problems, as reflected in the national stunting prevalence of 19.8% based on the 2024 Indonesian Nutrition Status Survey (SSGI) (Indonesian Ministry of Health, 2025). This shows that nutritional interventions in early life, including exclusive breastfeeding, remain a strategic priority.

Theoretically and clinically, the effect of exclusive breastfeeding on infant growth can be explained through several biological and functional mechanisms. Breast milk contains a balanced and bioavailable nutrient composition, which is tailored to the needs of infants according to their age, thereby supporting proportional weight and length gain (WHO, 2023a). In addition, breast milk contains immunological components such as immunoglobulin A, oligosaccharides, and anti-inflammatory factors that protect infants from gastrointestinal and respiratory infections, which are the main causes of growth disorders in infants (Victora et al., 2016). With a decrease in the incidence of infection, energy and nutrients can be optimally utilized for tissue growth.

Previous studies have examined the relationship between exclusive breastfeeding and infant growth, with results generally supporting the benefits of exclusive breastfeeding. The Lancet series on breastfeeding confirms that breastfed infants have healthy and physiological growth patterns and a lower risk of disease compared to non-breastfed infants (Victora et al., 2016). Longitudinal studies and systematic reviews also show that exclusive breastfeeding is associated with adequate weight and length gain in the first six months of life, although in some contexts infants who receive formula may have higher weight without consistent linear growth benefits (Van Neste et al., 2025; Leth-Møller et al., 2025). These findings confirm that healthy growth indicators are not assessed solely by weight, but by balanced and age-appropriate growth.

In addition, breastfeeding success factors also play a role in determining the impact of breast milk on infant growth. Research shows that maternal self-efficacy in breastfeeding, breastfeeding frequency, and proper latching techniques are associated with better infant

weight gain (Güneş et al., 2023). This indicates that the quality of exclusive breastfeeding practices is as important as the duration of breastfeeding itself in influencing infant growth.

Although scientific evidence on the benefits of exclusive breastfeeding is quite extensive, there are still relevant research gaps, particularly in the Indonesian context. First, some studies use different growth indicators, such as weight-for-age, length-for-age, or z-score index, making it difficult to directly compare results. Second, many studies have not fully controlled for important confounding factors, such as birth weight, maternal nutritional status, history of infection, and socioeconomic conditions, which can affect infant growth. Third, national surveillance data showing relatively high exclusive breastfeeding coverage has not always been directly linked to measurable infant growth outcomes at the health service level (Indonesian Ministry of Health, 2023; UNICEF Indonesia, 2025).

In the context of the still significant burden of stunting in Indonesia, research on the effect of exclusive breastfeeding on infant growth is becoming increasingly urgent. Strong contextual evidence is needed to reinforce breastfeeding counseling messages, optimize lactation interventions, and ensure that the promotion of exclusive breastfeeding truly contributes to improving child growth. Therefore, this research is urgent both clinically and programmatically.

Based on this background, the purpose of this study was to analyze the effect of exclusive breastfeeding on infant growth, as measured by anthropometric indicators, so that the results of the study could serve as a scientific basis for strengthening breastfeeding practices and monitoring infant growth in Indonesia

2. RESEARCH METHOD

This study used a quantitative approach with an observational analytical design and a comparative cross-sectional design. This design was chosen because the study aimed to analyze the effect of exclusive breastfeeding on infant growth by comparing the growth conditions of infants who received exclusive breastfeeding and infants who did not receive exclusive breastfeeding at a specific measurement time, without providing direct intervention to respondents. This approach was considered appropriate for examining the statistical cause-and-effect relationship based on data available in health services.

The study was conducted at the Labuha Community Health Center, South Halmahera District, which is a primary health care facility with a wide range of maternal and child health services, including monitoring infant growth through integrated health service posts (posyandu) and maternal and child health services. The location was chosen based on the

availability of infant data, diversity of breastfeeding status, and completeness of infant growth records.

The population in this study consisted of all infants aged 0–12 months who were registered and received health services at the Labuha Community Health Center during the study period. This population included infants who were exclusively breastfed and infants who were not exclusively breastfed.

The research sample consisted of infants who met the inclusion criteria, namely infants aged 0–12 months who had complete data on breastfeeding history and anthropometric data (weight and/or length), and were actively registered with the Labuha Community Health Center. Exclusion criteria included infants with a history of chronic disease, congenital abnormalities, or incomplete growth data. The sample size was determined using total sampling, meaning that all infants who met the inclusion criteria were taken as research samples, so that the research results were expected to be more representative of the actual conditions in the Labuha Community Health Center working area. If the population size was limited, the minimum sample size was still adjusted to the rules of analytical research, namely ≥30 respondents.

The sampling technique used was total sampling, because all data on infants who met the inclusion criteria were available and could be analyzed. This technique was chosen to minimize selection bias and maximize the power of statistical analysis, especially in studies with limited populations.

The independent variable in this study was exclusive breastfeeding, which was categorized as exclusive breastfeeding and non-exclusive breastfeeding based on breastfeeding history during the first six months of the baby's life. The dependent variable is infant growth, which is measured using anthropometric indicators, namely weight for age (WFA) and/or length for age (LFA) according to WHO standards. Infant growth is then categorized as normal and abnormal based on z-score values.

Data collection was conducted using secondary data obtained from MCH books, posyandu registers, and MCH service records at the Labuha Community Health Center, and supplemented with primary data through tracing the history of breastfeeding by the mothers of infants, when necessary. The data collection process was carried out in accordance with research ethics principles, including maintaining the confidentiality of respondents' identities.

Data analysis was conducted in stages. Univariate analysis was used to describe the frequency distribution and percentage of infant characteristics, breastfeeding status, and infant growth categories. Next, bivariate analysis was performed to determine the effect of exclusive

breastfeeding on infant growth. If the growth data was categorized (normal and abnormal), the statistical test used was the Chi-Square or Fisher Exact Test if there were cells with an expected value of less than five. If growth data is analyzed numerically (z-score or average weight), an independent t-test is used if the data is normally distributed, or a Mann–Whitney test if the data is not normally distributed. The statistical significance level is set at $\alpha = 0.05$, where a p-value < 0.05 indicates that exclusive breastfeeding has an effect on infant growth.

If necessary, the analysis can be continued with multivariate analysis using logistic regression to control for confounding factors such as infant age, gender, and birth weight. However, the main focus of this study is bivariate analysis in accordance with the research objectives.

With this research method, it is hoped that a clear and comprehensive picture of the effect of exclusive breastfeeding on infant growth at the Labuha Community Health Center can be obtained, so that the results of the study can be used as a basis for strengthening the promotion of exclusive breastfeeding and monitoring infant growth at the primary health care level.

3. RESULTS AND DISCUSSION

Table 1. Demographic data.

Var		n	F (%)
Age	< 20 years old	0	0
	20-35 years old	27	90.0
	>35 years old	3	10.0
Education	Elementary school	6	20
	Junior high school	2	6.7
	High School	16	53.3
	College/university	6	20
Employment	Housewife	23	76.7
	Farmer	0	0
	Private employee	2	6.7
	Government employee	5	16.7
Infant gender	Male	12	40
	Female	18	60.0
Nutrition source	Breastfeed only	18	60.0
	Breastfeed and infant formula	12	40.0
Total		30	100

Source: primary data, 2025.

Based on the results of a study of 30 respondents, the majority of mothers were in the 20–35 age group, namely 27 people (90.0%). This age group is considered the safe reproductive age, which is biologically and psychologically optimal for pregnancy, breastfeeding, and childcare. There were 3 mothers (10.0%) aged over 35 years, while there were no respondents aged under 20 years. This age distribution shows that most mothers are in a relatively mature age group in terms of decision-making related to infant care and nutrition.

In terms of education level, most respondents had a high school education or equivalent, namely 16 people (53.3%). Respondents with elementary school and college education numbered 6 people (20.0%) each, while 2 people (6.7%) had a junior high school education. This composition shows that the majority of mothers have a secondary education level, which could potentially influence their understanding of the importance of exclusive breastfeeding and monitoring infant growth.

Based on employment status, the majority of respondents were housewives, totaling 23 people (76.7%). There were 5 respondents (16.7%) who worked as civil servants, while 2 respondents (6.7%) worked as private employees. There were no respondents who worked as farmers. The dominance of housewives indicates that most mothers have greater opportunities to be with their babies, which can influence breastfeeding practices and daily parenting patterns.

The characteristics of the infants show that more than half of them are female, namely 18 infants (60.0%), while there are 12 male infants (40.0%). This difference in gender proportions does not indicate a particular trend, but it remains an important variable in growth analysis because energy requirements and growth patterns may differ slightly between male and female infants.

Based on nutritional sources, most infants were exclusively breastfed, namely 18 infants (60.0%), while 12 infants (40.0%) received a combination of breast milk and formula milk. These findings indicate that exclusive breastfeeding is quite dominant among respondents, although there is still a proportion of infants who receive additional formula milk. This condition provides an important initial picture for analyzing the effect of exclusive breastfeeding on infant growth.

Overall, the characteristics of the respondents show that the majority of mothers are of safe reproductive age, have a secondary education, and are housewives, while most babies receive breast milk as their main source of nutrition. This description provides an important context for understanding breastfeeding practices and their relationship to infant growth in the Labuha Community Health Center working area..

Table 2. Variable Data.

Var	N	min	max	Mean	SD
Infant age	30	3.0	9.0	6.03	1.65
Body weight gained (%)	30	69.00	213.3	128.30	36.88
Body length gained (%)	30	19.0	43.00	30.06	6.55

Source: primary data, 2025.

Descriptive analysis of 30 infants showed that their ages ranged from 3 to 9 months, with an average age of 6.03 months and a standard deviation (SD) of 1.65. This age range indicates that most infants were in the early stages of life, which is a critical phase of growth and is greatly influenced by nutritional adequacy, particularly breastfeeding.

Based on the weight gain parameter (%), the minimum value obtained was 69.0% and the maximum was 213.3%, with an average weight gain of 128.30% and SD 36.88. This wide variation in values indicates differences in weight gain responses among infants. In general, the relatively high average weight gain reflects relatively good growth in most infants during the observation period.

Meanwhile, the increase in infant length (%) ranged from 19.0% to 43.0%, with an average of 30.06% and a standard deviation of 6.55. These values indicate that, in general, infants experienced consistent length gains in line with the normal growth phase at that age. The relatively small standard deviation compared to weight gain indicates that the variation in body length growth between infants is more homogeneous.

Overall, these descriptive results indicate that the infants in the study experienced fairly good growth, both in terms of weight and length. However, the considerable variation in weight gain indicates that factors such as nutritional sources, infant age, and breastfeeding patterns may potentially affect the rate of growth, so further analysis is needed at the bivariate analysis stage to determine the effect of exclusive breastfeeding on infant growth.

Table 3. Statistical Analysis.

Independent variable	n	P Value	
Body weight gained (%)	30	0.485*	
Body length gained (%)	30	0.617*	
Shapiro-Wilk			
Independent variable	N	P Value	Dependent variable
Body weight gained (%)	30	0.334	Nutrition source
Body length gained (%)	30	0.006	Nutrition source
Independent t-test			

*significant Source: primary data, 2025.

Data normality was tested using the Shapiro–Wilk test to determine the appropriate statistical test for bivariate analysis. The normality test results showed that infant weight gain (%) data had a p-value of 0.485 ($p > 0.05$), indicating that the data were normally distributed. Similarly, infant length gain (%) data also showed a normal distribution with a p-value of 0.617 ($p > 0.05$). Based on these results, analysis of infant growth differences based on nutritional sources can be continued using a parametric test, namely the independent t-test.

The results of bivariate analysis using an independent t-test showed that there was no significant difference in infant weight gain (%) based on nutritional source. The p-value obtained was 0.334 ($p > 0.05$), indicating that the weight gain of infants who were exclusively breastfed was not significantly different from that of infants who were fed breast milk and formula.

Conversely, the results of the independent t-test on the variable of infant length gain (%) showed a significant difference based on the source of nutrition. The p-value obtained was 0.006 ($p < 0.05$), indicating that the source of nutrition has a significant effect on infant length gain. These findings show that infants who are exclusively breastfed have a significantly different length gain compared to infants who receive a combination of breast milk and formula.

Interpretation of Results

Overall, the results of the analysis show that exclusive breastfeeding has no significant effect on infant weight gain, but has a significant effect on infant length gain. This indicates that the effect of exclusive breastfeeding on infant growth is more apparent in terms of linear growth (length) than weight gain.

These findings reinforce the understanding that infant weight gain can be influenced by various short-term factors, such as daily energy intake and breastfeeding frequency, while length gain better reflects the infant's overall nutritional status and health in the medium to long term.

Discussion

This study aims to analyze the effect of exclusive breastfeeding on infant growth at the Labuha Community Health Center, South Halmahera, focusing on two growth indicators, namely weight gain and length gain. The results of the study indicate that exclusive breastfeeding does not have a significant effect on infant weight gain, but it does have a significant effect on infant length gain. These findings suggest that the impact of exclusive breastfeeding on infant growth is not uniform across all indicators, but is more pronounced in terms of linear growth.

The absence of a significant difference in weight gain between infants who received exclusive breastfeeding and those who received a combination of breastfeeding and formula milk indicates that infant weight is greatly influenced by various short-term factors, particularly total energy intake. Infants who receive additional formula milk can still experience relatively rapid weight gain due to the high energy content, even though the nutritional quality differs from breast milk. These findings are consistent with studies stating that weight gain in infancy can increase in groups receiving formula milk, without always reflecting optimal growth quality (Dewey et al., 2019).

Conversely, significant results in body length gain indicate that exclusive breastfeeding plays an important role in supporting linear growth in infants. Body length growth is a more stable indicator of medium to long-term growth and reflects the overall nutritional status and health of infants. Breast milk contains bioactive substances such as growth hormones, insulin-like growth factor (IGF), and micronutrients that play a role in bone formation and linear growth (Larnkjær et al., 2020). Therefore, infants who are exclusively breastfed tend to have better body length growth patterns than infants who receive mixed nutrition.

The results of this study are in line with cohort studies showing that exclusively breastfed infants have more optimal length growth and a lower risk of stunted growth compared to infants who are not exclusively breastfed (Horta et al., 2018). Other studies have also reported that linear growth is more sensitive to nutritional quality than weight, so the benefits of exclusive breastfeeding are more apparent in height indicators (Ong et al., 2020). Thus, the results of this study reinforce the evidence that exclusive breastfeeding plays an important role in preventing chronic growth disorders in infants.

From a clinical theory perspective, these findings can be explained through the concept of early life nutrition programming, which states that nutritional intake in early life has a long-term effect on children's growth and health. Exclusive breastfeeding provides nutrition that meets the physiological needs of infants and protects them from infection, so that energy and nutrients can be optimally used for the growth of body tissues, especially bones (Koletzko et al., 2019). Conversely, inappropriate supplementary feeding can increase the risk of minor infections and nutrient absorption disorders, which in the long term can affect linear growth.

The insignificant effect of exclusive breastfeeding on weight gain can also be understood through the concept of catch-up weight gain, whereby infants who receive formula milk tend to experience faster weight gain. However, rapid weight gain does not always reflect healthy growth and in some contexts is associated with the risk of overweight later in life

(Patro-Gołąb et al., 2019). Therefore, focusing on weight alone without considering height can provide an incomplete picture of growth.

The clinical implications of this study are quite important for midwifery practice and maternal and child health services. The results of the study confirm that the promotion of exclusive breastfeeding is not only aimed at increasing infant weight, but primarily at supporting optimal linear growth, which is an important foundation for the prevention of stunting. Health workers, especially midwives, need to emphasize to mothers that healthy growth is not only about babies "gaining weight quickly," but about proportional and age-appropriate growth.

In addition, these findings highlight the importance of comprehensive monitoring of infant growth using more than one anthropometric indicator. Routine monitoring of height needs to be strengthened at the primary care level, as this indicator is more sensitive in detecting long-term growth disorders. Breastfeeding counseling should also be accompanied by education on the benefits of exclusive breastfeeding for bone growth and the prevention of chronic growth problems.

Overall, this study shows that exclusive breastfeeding has a stronger effect on linear growth than on weight gain in infants. These findings reinforce the importance of exclusive breastfeeding as a strategic early nutrition intervention and provide a scientific basis for strengthening breastfeeding promotion programs and infant growth monitoring at the Labuha Community Health Center.

4. CONCLUSION

This study shows that exclusive breastfeeding has no significant effect on infant weight gain, but has a significant effect on infant length gain at the Labuha Community Health Center in South Halmahera. These findings indicate that the main benefits of exclusive breastfeeding on infant growth are more apparent in terms of linear growth than weight gain. Body length growth reflects the nutritional status and health of infants in the medium to long term, so exclusive breastfeeding plays an important role in supporting proportional and optimal growth. Therefore, the promotion of exclusive breastfeeding needs to be strengthened not only by emphasizing weight gain, but also by highlighting the importance of body length growth as a key indicator of infant health. The results of this study are expected to serve as a basis for strengthening midwifery practices and infant growth monitoring at the primary health care level.

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