

# Growth Velocity of Infants with Breast - Feeding Patterns, Status and Family Socio - Economic Conditions

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## ABSTRACT

**Background:** The study was conducted with the aim of determining the relationship between the growth of children aged 0-12 months in Pinrang, Indonesia. **Methods:** This study was an observational study with a cross-sectional study design. A total of 61 respondents with the criteria of mothers having babies under one year of age, not twins, not suffering from congenital disabilities, and domiciled in Siwolong Polong was recruited purposively. The breastfeeding patterns measuring with an interview questionnaire, the growth velocity measuring with the Marshal and Swann direction. Children's growth indicators used in this study were weight and length, which was measured bi-monthly, from 2 months to 12 months of age. The family socioeconomic status was measured by education level and family income quintiles. The data were analysed using the ANOVA to assess the relationship of growth velocity in infants with the status of breastfeeding patterns and socio-economic quantiles. **Results:** The results show that the growth velocity weight and length have no association with breastfeeding pattern status. In contrast, length growth velocity significantly reduced at 6 months of age, lowered in the predominant pattern. Meanwhile, the socioeconomic status was lower in the first quintile than in the fifth quintile family concerning the growth rate of weight and height at six months of age. **Conclusions:** The growth velocity in infants aged 0-12 months does not depend on the breastfeeding pattern status and more visible impact of family income status.

**Keywords:** Growth Velocity, Infant, Breastfeeding Pattern, Socioeconomic.

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## Introduction

Nutritional issues are a significant risk factor for death and mortality, and can cause widespread health problems and affect the growth of infants and children up until they enter adulthood [1]. Low infant weight can cause later health problems such as blood pressure and cardiovascular problems in younger adults [2]. Infant weight also plays a role in the neurodevelopment of children [3]. Child development is a predictor of health in the future. As such, infant growth is an important foundation for later health, which needs to be considered.

An element of public health nutrition that is of particular concern is the influence of various factors on the rate of growth and environmental conditions of children. These factors include socio-economic conditions, parenting patterns, and family income [4]. Some growth disorders have been closely linked to eating habits and delays in child development [5]. Several studies have found that there is a relationship between breastfeeding patterns and nutritional status in children [6,7]. This illustrates the possibility that breastfeeding is related to growth velocity. Growth velocity is

palpable in its development as it has no effect other than on nutritional status. Implementing an appropriate intervention to achieve the optimal rate of growth and development, and monitoring the results, will provide an overall picture of the effectiveness of growth and development [3].

The World Health Organization provide several standard velocities that describe the optimal growth potential of infants, which are used to assess growth of children according to their age [7]. Children's growth and development can also be monitored using the standard described in Ashworth *et al* [8].

In the development of this study, we analysed the effect of parenting conditions on infant growth. In this case, we assessed the breastfeeding patterns and socio-economic status of the family, hoping that these two things could be used to identify interventions that would improve the fulfilment of optimal growth and development in infants, through childhood and into adulthood.

## Materials and Methods

This was an observational cross-sectional study conducted in June

2020. The sample size was 61 respondents who were recruited purposively. The inclusion criteria were mothers who had babies under one-year-old, not twins, did not suffer from congenital disabilities, and were domiciled in Siwolong Polong, Pinrang. Measurement of breastfeeding patterns with interview questionnaires includes data on mother’s education, type of work, total family income in a month. The baby’s weight and length were collected by checking the maternal-infant book/card (so-called “KMS book”) obtained from the Primary Health Service. Measurement of the infant growth and development using a standard by the World Health Organization [7]. The growth indicators used was infant’s weight and length which were measured every two months from second month until 12<sup>th</sup> month. Family socioeconomic status is measured by work, education level, and family income quintile. Data were analysed using ANOVA and chi-square test to assess the relationship between infant growth rate, breastfeeding pattern status, and family socioeconomic status.

**Result**

Based on the data obtained from the study of Seulong Polong village, the characteristics of the respondents are described in Table 1. The table shows that most respondents are over 26 years old, have a high school education, and a housewife. Most of their infants was boys, normal birth weight, and received colostrum for infants.

Figure 1 shows the growth rate of body weight and length in infants with different breastfeeding patterns. In general, there is no significant difference in the rate of growth between the two groups. A decreasing growth rate pattern from the beginning of birth to the age of one year was shown in the figure.

**Table 1: Characteristics of Respondent.**

Variable	n	%
<b>Mom Aged</b>		
< 26 yo	20	32.8
≥ 26 yo	41	67.2
<b>Sex</b>		
Boys	34	55.7
Girls	27	44.3
<b>Birth weight</b>		
Normal	56	91.8
Low birth weight	5	8.2
<b>Baby Length</b>		
≥ 48 cm	49	80.3
< 48 cm	12	19.7
<b>Having Colostrum</b>		
Yes	46	75.4
No	15	24.6
<b>Educational Level of Mom</b>		
Elementary School	7	11.5
Junior High School	21	34.4
Senior High School	29	47.5
University	4	6.6
<b>Mother occupation</b>		
Housewife	54	88.5
Others	7	11.5
<b>Monthly Family Income (Rp)</b>		
Rp. 1.000.000	7	11.5
≥ Rp. 1.000.000	54	88.5

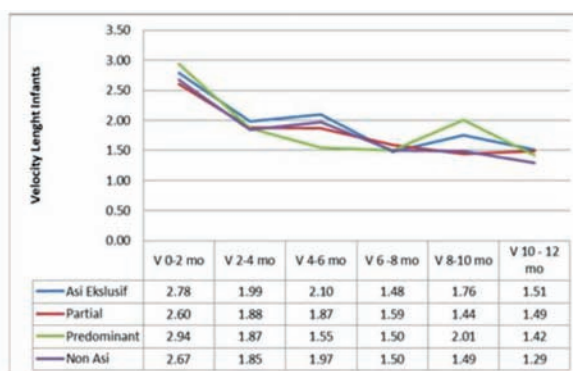
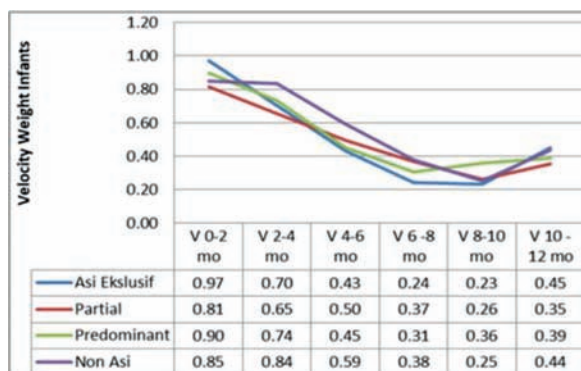


Figure 1: Growth velocity weight and length of infants aged 0 - 12 months by breastfeeding patterns.

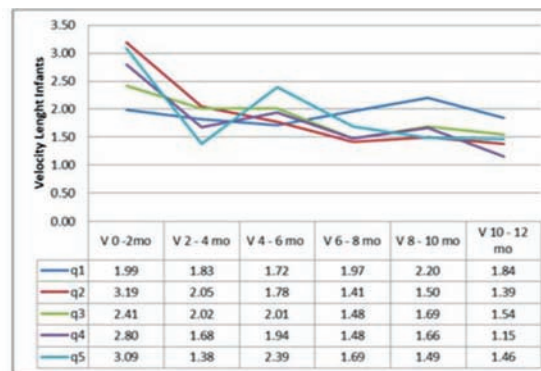
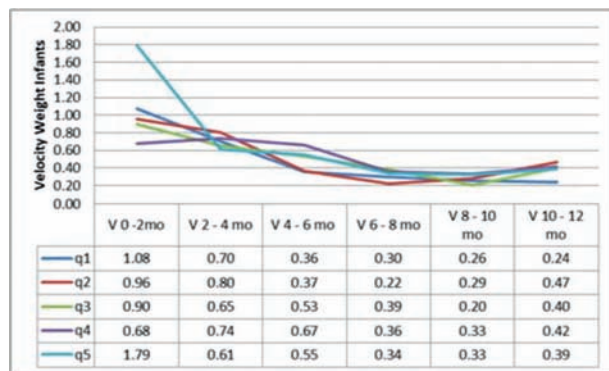


Figure 2: Growth velocity length of infants aged 0 - 12 months by Family Income Quintiles.

Figure 2 shows the pattern of the growth rate of infants aged 0-12 months by socio-economic quintiles. There is a significant difference ( $p < 0.05$ ) in changes in the growth rate of children among quintiles groups.

Table 2 shows the effect of the growth rate of the baby's weight in the first two months of birth, where quintile one and quintile 5 have significant differences. This finding shows the growth rate of babies in families with higher incomes positively influences the high rate of weight gain of babies in the first two months of birth. The rate of body length showed a significant effect on quintile four and quintile two at the eighth month.

Table 3 shows the growth rate of the baby's weight and length based on WHO standards with breastfeeding patterns. Based on the table, there is no difference in each rate on the pattern of breastfeeding.

Table 4 shows that socioeconomic status does not have a significant difference both on the mother's educational status and on the family's total income in a month. Significant results were only found when testing the rate of these quintiles in the ANOVA test.

## Discussion

The results showed that any relationship between the baby's growth rate and breastfeeding patterns was not significant. In contrast, the growth rate of body length was significantly reduced in the sixth

lunar phase, lower in the dominant pattern. Meanwhile, in the sixth month phase, socio-economic status was lower in quintile 1 compared to quintile 5, in relation to weight and height growth rate.

The results showed that any relationship between the pattern of body weight growth rate and breastfeeding patterns was not significant. This finding was in line with research in Pontianak, which stated that there was no relationship between breastfeeding practices and nutritional status. In this research, breastfeeding practices were studied in subjects and controls where most were breastfeeding. This partial breastfeeding was due to each baby's different duration of breastfeeding and according to the baby's sucking pattern [9]. There was no significant difference in the growth of babies who were exclusively breastfed with babies who were not exclusively breastfed, which means that the growth of exclusively breastfed babies is not better than those who are not exclusively breastfed [10]. According to WHO, there are several breastfeeding patterns, namely, exclusive, exclusive, predominant and partial breastfeeding. The period of growth and development of infants requires nutritional intake to be obtained through exclusive breastfeeding. In this study, most of the respondents exclusively breastfed. At the age of 6-12 months, in the normal category of exclusive breastfeeding, there were no low weight babies. Breast milk contains the ideal nutrients to support the optimal growth and development of babies.

**Table 2: Growth Velocity of Baby's Weight and Length According to Family Income Quintiles.**

Family Income	Growth Velocity (months)					
	0 – 2	2 – 4	4 – 6	6 – 8	8 – 10	10 – 12
<b>Weight</b>						
q1	1.08* <sup>q5</sup>	0.70	0.36	0.30	0.26	0.24
q2	0.96	0.80	0.37	0.22	0.29* <sup>q3</sup> * <sup>q4</sup>	0.47
q3	0.90	0.65	0.53	0.39* <sup>q4</sup>	0.20* <sup>q3</sup>	0.40
q4	0.68	0.74	0.67	0.36* <sup>q3</sup>	0.33* <sup>q2</sup>	0.42
q5	1.79* <sup>q1</sup>	0.61	0.55	0.34	0.33	0.39
<b>Length</b>						
q1	1.99	1.83	1.72	1.97	2.20	1.84
q2	3.19	2.05	1.78* <sup>q4</sup>	1.41	1.50	1.39
q3	2.41	2.02	2.01	1.48	1.69	1.54
q4	2.80	1.68	1.94* <sup>q2</sup>	1.48	1.66	1.15
q5	3.09	1.38	2.39	1.69	1.49	1.46

ANOVA test (p); \*<sup>q</sup> = p value < 0.05.

**Table 3: Growth Velocity of Infant's Weight and Length According to WHO Standards with Breastfeeding Patterns.**

Breastfeeding Pattern Status	Growth Velocity							
	Weight Increment				Length Increment			
	0 – 6 months		6 – 12 months		0 – 6 months		6 – 12 months	
	Normal	Low	Normal	Low	Normal	Low	Normal	Low
Exclusive Breastfeeding (n = 22)	10 (35.7%)	12 (36.4%)	22 (36.1%)	0	22 (37.9%)	0	22 (36.7%)	0
Partial (n = 18)	8 (54.5%)	20 (30.3%)	18 (29.5%)	0	10 (27.6%)	2 (66.7%)	17 (28.3%)	1 (100%)
Predominant (n = 10)	4 (14.3%)	6 (18.2%)	10 (16.4%)	0	9 (15.5%)	1 (33.3%)	10 (16.7%)	0
Non-Breastfeeding	6 (18.2%)	5 (15.2%)	11 (18%)	0	11 (19%)	0	11 (18.3%)	0
Total	28	33	61	0	58	3	60	1
P*	0.973		**		0.213		0.69	

\*Chi-square Test; \*\*Constant Data.

**Table 4: Growth Velocity of Infant’s Weight and Length According to WHO Standards with Social-economic Status.**

Social-Economic Status		Growth Velocity							
		Weight Increment				Length Increment			
		0 – 6 months		6 – 12 months		0 – 6 months		6 – 12 months	
		Normal	Low	Normal	Low	Normal	Low	Normal	Low
Mother's education	Elementary School	3 (0.70%)	5 (15.5%)	7 (11.5%)	0	7 (12.1%)	0	7 (11.7%)	0
	Junior High School	12 (42.9%)	12 (34.9%)	21 (34.4%)	0	20 (34.5%)	1 (33.3%)	21 (35%)	0
	Senior High School	12 (42.9%)	14 (42.4%)	29 (47.5%)	0	27 (46.6%)	2 (66.7%)	28 (46.7%)	1 (100%)
	University	1 (3.6%)	1 (3%)	4 (6.6%)	0	4 (6.9%)	0	4 (6.7%)	0
P*		0.969		**		**		**	
Family Income	q1	1 (9.6%)	5 (15.2%)	6	0	6 (10.3%)	0	6 (10%)	0
	q2	12 (42.9%)	8 (24.2%)	20	0	20 (34.5%)	0	20 (33.3%)	0
	q3	8 (28.6%)	13 (39.4%)	24	0	20 (34.5%)	1 (33.3%)	20 (33.3%)	1 (100%)
	q4	5 (17.9%)	5 (15.2%)	40	0	8 (13.8%)	2 (66.7%)	10 (16.7%)	0
	q5	2 (7.1%)	2 (6.1%)	4	0	4 (6.4%)	0	4 (6.7%)	0
P*		0.389		**		**		**	

\*Chi-square Test; \*\*Constant Data.

The results differed to those of several other studies, which stated that exclusively breastfed babies had a higher average weight gain than babies who were not breastfed [11]. There appears to be a relationship between a low level of exclusive breastfeeding and a lack of good complementary feeding, and the number of children who do not grow normally [12]. Research in Medan in 2017 also stated that most infants who were exclusively breastfed experienced weight gain, whereas most infants who were not exclusively breastfed did not gain weight [13].

The growth rate of body length was significantly reduced in the sixth month phase, lower in the predominant breastfeeding pattern. Children with exclusive breastfeeding were more likely to be short than children with non-exclusive breastfeeding patterns [14]. In other studies, however, it was found that babies who were given feeds (not exclusively breastfed) were higher than the body length of babies who were breastfed exclusively [15].

This difference may be caused by other factors that affect exclusive breastfeeding, namely the amount of breast milk given and the nutritional intake of breastfeeding mothers [14]. Nutritional needs can have a profound effect on growth and weight gain. Children who get good nutrition (protein and energy) tend to have strong disease resistance, meaning that their risk of disease is smaller and their growth can progress normally [16]. Body weight is an indicator of infant growth and development, whereas breastfeeding technique, frequency and energy intake are significantly related to body weight [17]. The frequency of breastfeeding is the factor that triggers increased weight. The higher the breastfeeding frequency, the more optimal the nutrition, which leads to an increase in the infant’s weight [18]. A mother’s age and parity are related to breast milk production, which will also affect the baby’s weight gain [19].

Mutiara, in 2019, found that the adequacy of energy and protein from breast milk and complementary feeding affects the growth of infants aged 6 -11 months [16].

Based on the study results, the effect of socio-economic status, specifically family income, on the baby’s growth rate can be seen. The composition of breast milk can be influenced by breastfeeding mothers’ food consumption, which is influenced by socio-economic factors including education, income, and employment. The protein and fat components of breast milk have been found to affect the baby’s body weight and length [20].

Infants who are exclusively breastfed, on average, have a good or normal nutritional status, which is in line with previous research that found a relationship between family income levels, low birth weight, and exclusive breastfeeding with stunting [21]. Exclusive breastfeeding can be impacted by the mother’s intention to breastfeed, the duration of the mother wanting to breastfeed, the mother’s perception of breastfeeding, the mother’s job, the length of time the mother works, the experience of breastfeeding, the baby’s birth weight, family income, antenatal care, and husband and family support [22]. There is also a relationship between breastfeeding mothers and anaemia, and poor nutritional intake with infant weight [23].

Previous studies have found no relationship between the level of family income and exclusive breastfeeding for infants aged 0-6 months in the *Dadok Tunggal Hitam* Health Center Work Area, Koto Tengah District, Padang City [24]. Previous research studied the relationship between infant nutrition and maternal education level and family economic status, in infants aged 4-6 months who were exclusively breastfed in North Denpasar. This study found that mothers from low socioeconomic backgrounds mostly chose

exclusive breastfeeding as the price of formula milk was too high. Exclusive breastfeeding meant that other family needs could be met [25]. On the other hand, there was no statistically significant relationship between the mother's education level and the infant's nutritional status. There was also no statistically significant relationship between the family's economic status and the infant's nutritional status.

Infant growth and development are closely related to the nutritional status of the baby. Exclusive breastfeeding is the most dominant variable affecting infant growth and development. Babies who do not receive exclusive breastfeeding are 1.8 times more likely to experience developmental disorders than their counterparts [23,26]. An inappropriate maternal diet can cause insufficient quantity and quality of breast milk, which can also affect the growth and development of the baby [27,28].

The availability of nutrients, in sufficient quantities and at the right time, largely determines nutritional status and the ability of cells to develop and function normally. Nutritional status is influenced by the nutrients needed by the body and the factors that determine the amount of absorption and use of substances. In infants aged 0-12 months, rapid growth and physical changes are accompanied by significant nutritional needs [29]. Nutrients are required for growth and development, activity, health maintenance and healing. Nutritional status will play a role in disease prevention, especially infectious diseases that inhibit optimal growth rates. As such, infants and toddlers are an age group that is susceptible to malnutrition. The nutritional status of infants and toddlers is one of the indicators that can be used to measure the nutritional status of the community [30]. Nutritional problems will become more complex if they occur in early childhood. At an early age, malnutrition has been shown to impact growth and development severely, causing a potential loss of IQ up to 22 points [31].

Growth disorders are characterised by a baby or child's body size being much smaller than it should be. In children, this can be identified through a child's weight being less than the fifth percentile for their age [32]. Body weight is a parameter that describes body mass. Body mass is very sensitive to sudden changes, such as infection [33]. Growth disorders in children can be characterised by inappropriate growth curves and may be caused by malnutrition [34].

The development of non-communicable diseases can occur due to an accumulation of risk from infancy to adulthood. The risk of non-communicable diseases can increase due to low growth rate in infancy. Poor nutritional status causing a low growth has the potential to lead to degenerative diseases, and mental or cognitive disorders. Short height is often not considered to be a problem, but this condition can lead to pathological changes later in life. Stunting in Indonesia often occurs during the period of complementary feeding where breast milk is considered unable to meet the baby's needs [35].

The quality of children's health and development can reflect the good health of a country. Children's growth should be monitored as this reflects their health and development. The government launched a program to monitor the growth of children under five at the Posyandu to increase community participation [36,37]. This program was implemented as Indonesia is currently facing high levels of growth and development problems in infants and toddlers. One of the factors that affects infant growth and development is monitoring the growth rate. Knowing the nutritional status of infants and toddlers can allow for optimal health care for infants, which can reduce their risk of contracting infectious diseases. Infectious diseases in infants and toddlers can interfere with the baby's growth

and development process through impaired food intake and increased loss of essential nutrients [38]. Developing a medical history can also contribute to the health of infants and toddlers.

## Conclusion

The growth velocity and development, in terms of body weight and length, of infants aged 0-12 months does not depend on breastfeeding patterns. Based on the data, the impact of socio-economic status, specifically family income, on infant growth and development is more visible.

## What is known about the subject?

Growth Velocity in infants shows the development of body mass in infants based on increasing age, providing a longitudinal sight of subsequent development.

## What does the study performed add to the literature?

Growth Velocity in infants is not influenced by breastfeeding patterns but by the family's financial condition.

## What are the implications of the results obtained?

For stakeholders in the program to improve the infants' health, it is important to pay attention to the family's financial condition.

## Author contribution

N.U. Mahmud and R.Q. Arief conceived of the presented idea. E.N. Andyarini, N. Lusiana, and Yuliati developed the theory and performed the computations. Yuliati, S. Alam, Hastuti, and S. Avnalurini Shariff verified the analytical methods. N. U. Mahmud encouraged R.Q. Arief to investigate the growth infants growth velocity and supervised this work's findings. All authors discussed the results and contributed to the final manuscript.

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<b>Ethics:</b>	There is no ethical violation as it is based on voluntary anonymous interviews
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<b>Guarantor:</b>	Dr. Ria Qadariah Arief will act as guarantor of this article on behalf of all co-authors.

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