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Artikel Penelitian

# ANTROPOMETRI IBU DAN HASIL PERTUMBUHAN BAYI USIA < 6 BULAN: STUDI LINTAS SEKSI

## *MATERNAL ANTHROPOMETRY AND GROWTH OUTCOMES IN INFANTS AGED < 6 MONTHS: A CROSS-SECTIONAL STUDY*

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**A B S T R A K**

Status gizi ibu selama masa menyusui berperan penting dalam mendukung pertumbuhan bayi pada periode awal kehidupan melalui pengaruhnya terhadap kualitas dan komposisi air susu ibu(ASI). Namun, hubungan antara antropometri ibu dan pertumbuhan bayi masih menunjukkan hasil yang beragam pada berbagai populasi. Penelitian ini bertujuan untuk menganalisis hubungan antara status gizi ibu dengan luaran pertumbuhan bayi usia < 6 bulan. Penelitian analitik observasional dengan desain potong lintang dilakukan pada 56 pasangan ibu dan bayi di Kota Medan, Indonesia, selama September-November 2025. Status gizi ibu dinilai menggunakan indeks massa tubuh (IMT), sedangkan pertumbuhan bayi dinilai berdasarkan indikator antropometri menurut standar WHO, yaitu berat badan menurut umur, panjang badan menurut umur, Berat badan menurut Panjang badan, dan IMT menurut umur. Analisis statistik dilakukan menggunakan uji korelasi Spearman. Hasil penelitian menunjukkan adanya hubungan yang bermakna antara status gizi ibu dengan berat badan menurut umur (r=0.301; p=0.0204), Panjang badan menurut umur (r = 0.322; p=0.015), berat badan menurut panjang badan (r=0.319; p= 0.017), serta IMT menurut umur (r=0.319; p= 0.017). Kesimpulan: status gizi ibu memiliki hubungan signifikan dengan indikator pertumbuhan bayi usia 0-6 bulan, sehingga pemantauan dan perbaikan status gizi ibu selama masa menyusui penting untuk mendukung pertumbuhan optimal bayi.

***A B S T R A C T***

*Maternal nutrition status during lactation plays an important role in supporting infant growth in early life through its influence on the quality and composition of breastmilk. However, evidence regarding tha association between maternal anthropometry and infant growth outcomes remains inconsistent across different populations. This study aimed to examine the association between maternal nutritional status and growth outcomes among infants aged <6 months. A cross-sectional analytic study was conducted among 56 mother-infant pairs in Medan,Indonesia, between September and November 2025. Maternal nutritional status was assessed using body mass index (BMI), while infant growth was evaluated using World Health Organization anthropometric indicators, including weight-for-age, length-for-age, weight-for-length, and BMI-for-age. Statistical analysis was performed using Spearman correlation. Significant positive correlation were observed between maternal nutritional status and infant weight-for-age (r=0.301; P=0.024), length-for-age (r=0.322; p= 0.0015), weight-for-lentgh (r=0.319; p=0.017), BMI-for-age (r=0.319; p=0.0017). Conclusion: Maternal nutritional status was significantly associated with infant growth indicators during the first six months of life. These findings highlight the importanace of maintaining optimal maternal nutrition during lactation to support healthy infant growth.*

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## INTRODUCTION

The period encompassing the first 1000 days of life, from conception until two years of age, constitutes a critical developmental window that exert substantial influence on growth patterns, neurodevelopmental processes, immune regulation, and long-term health. Nutritional exposures within this timeframe are central determinants of physiological and metabolic programming, with consequences that may extend across the entire lifespan.[1 2, 3]

Optimal infant nutrition during the first six months of life is primarily achieved through exclusive breastfeeding. Human breast milk provides a biologically tailored source of nutrients that contains not only macronutrients and micronutrients but also a diverse array of bioactive components, including immunoglobulins, enzymes, hormones, and human milk oligosaccharides.[4] These compounds contribute to immune protection, gastrointestinal maturation, and metabolic regulation in early infancy. Consequently, the World Health Organization recommends exclusive breastfeeding for the first six months of life, followed by continued breastfeeding alongside complementary feeding up two years of age or beyond.[5 6]

Despite these recommendations, nutritional challenges among infants remain a significant global public health concern. Recent estimates indicate that a substantial proportion of children worldwide continue to experience growth faltering, particularly in low-and middle-income countries. Stunting, which reflects chronic undernutrition during early development, affects millions of children and remains closely linked to maternal health, nutritional status, and early infants feeding practice.[7] In Indonesia, national health surveys have consistently reported that child undernutrition remains prevalent, highlighting the importance of strengthening maternal and infant nutrition strategies during early life.[8]

Maternal nutritional status plays a fundamental role in supporting optimal infant growth during the breastfeeding period. Anthropometric indicators such as maternal Body Mass Index (BMI), Body Composition, and nutritional reserves may influence both the production and biochemical composition of breastmilk. Accumulating evidence suggest that maternal nutritional status exerts measurable effects on the biochemical characteristics of human milk, including its lipid profile, fatty acid composition, and the concentration of metabolic hormones. These alterations may subsequently influence infant appetite regulation, metabolic programming, and growth trajectories during early infancy.[9,10]

Epidemiological studies consistently report that maternal nutritional status is a determinant of infant growth outcomes. Maternal undernutrition has been linked to growth impairment and an increased incidence of underweight and stunting, while maternal overweight and obesity have been associated with atypical growth trajectories and a possible predisposition to childhood overweight and metabolic pathologies.[11] Additionally, maternal micronutrient deficiencies particularly iron deficiency anaemia in pregnancy and early lactation may affect infant haemoglobin levels and overall nutritional status during infancy.[12]

The linkage between maternal anthropometric characteristics and infant growth outcomes remains intricate and insufficiently defined. Evidence from prior studies is mixed, with some reporting significant association between maternal anthropometric indicators and infant growth parameters, while others document negligible or inconsistent relationship, particularly in contexts marked by variability in breastfeeding practices, maternal dietary intake, and socioeconomic status.[13] These divergent findings imply that infant growth outcomes are likely determined by the interplay of multiple factors, including maternal nutritional status, infant feeding modalities, environmental exposures, and healthcare availability.[14]

In Indonesia, studies examining the relationship between maternal nutritional status during lactation and infant growth outcomes remain relatively limited. Urban populations, including those in cities such as Medan, increasingly face the double burden of malnutrition, characterized by the coexistence of undernutrition and overweight within the same community. This situation poses additional challenges for maternal and child health, as both maternal undernutrition and excess adiposity may alter breast milk composition and influence infant growth patterns.[10]

Epidemiological investigations at the local level that explore the relationship between maternal anthropometry and infant nutritional status in the context of exclusive breastfeeding are scarce. Most existing studies have focused on infant feeding practices or child growth outcomes independently, rather than evaluating maternal anthropometry as a potential determinant of infant growth during the exclusive breastfeeding period. Generating local evidence in this area is essential to better understand maternal-infant nutritional dynamic and to inform targeted maternal nutrition interventions.[5]

Therefore, this study aimed to analyse the association between maternal anthropometric status and growth outcomes among infants aged <6 months in Medan, Indonesia. Understanding this relationship may contribute to strengthening maternal nutrition programs, improving breastfeeding support strategies, and providing evidence-based guidance for early childhood nutrition interventions within the framework of the first 1000 days of life.

## METHODS

This analytic cross-sectional study was conducted in selected districts in Medan, Indonesia, involving mothers and infants who attended community health centers in kecamatan Medan Sunggal, Medan Tembung, Medan Helvetia, and Medan Tuntungan during the study period from September to November 2025 to examine the relationship between maternal anthropometric status and growth outcomes among infants aged < 6 months. Ethical approval for the study was obtained from the Health Research Ethical Committee of Universitas Sumatera Utara (No. 1235/KEPK/USU/2025). Mothers with infants aged <6 months who had live in the selected districts for six months were eligible to participate. Only singleton infants who received either exclusive breastfeeding or breastfeeding combined with formula feeding

were included. Participants were excluded if the mother or infant had severe acute or chronic illness, congenital conditions that could influence growth, or if anthropometric measurements could not be obtained accurately. The required sample size was estimated using a formula for comparing proportions with a 5% significance level and 80% statistical power. The calculation indicated a minimum of approximately 50 participants; therefore, an additional 10% was added to account for incomplete data, resulting in a final minimum sample size 55 mother-infant pairs. Participants were recruited using consecutive sampling, in which all eligible mother-infant pairs were included sequentially until the target sample size was reached.[15]

Data collection was conducted through structured face to face interviews and anthropometric measurements performed by the principal investigators. A standardized questionnaire was used to collect information on maternal sociodemographic characteristic, including age, education level, occupation, household income, breastfeeding practices, medical history, and medication use. Maternal anthropometric measurements included body weight and height, measured using calibrated instruments, and body mass index (BMI) was calculated as weight in kilograms divided by height in meters in meters squared. Infant anthropometric data included body weight and recumbent length measured using a digital infant scale and an infantometer. Each measurement was performed twice, and the average value was used for analysis. Infant nutritional status was evaluated according to the World Health Organization (WHO) Child Growth Standards using weight for age, Length for Age, Weight for Length, and BMI for Age indicators.

Data were processed and analysed using SPSS version 22. Descriptive statistics were applied to summarize participant characteristics, while bivariate analysis was performed using Spearman correlation to assess the relationship between maternal anthropometric indicators and infant growth parameters. as several variables did not meet the assumption of normality based on preliminary normality testing. In addition, the Kruskal-Wallis's test was used to compare infants' nutritional status across categorical maternal characteristics. Statistical significance was defined as $p < 0.05$.

## RESULT

A total of 56 mother-infant pairs were included in this study. The mean maternal age was 30.01±3.9 years. Most mothers had completed senior high school education (60.7%), followed by diploma (32.1%), while a smaller proportion had completed secondary education (1.8%) or held bachelor's and master's degrees (3.6% and 1.8%, respectively).

Based on maternal nutritional status, the majority of mothers were classified as having normal nutritional status (37.5%), followed by obesity class I (33.9%), overweight (21.4%), and obesity class II (5.4%). Only a small proportion of mothers were underweighted (1.8%). Regarding medical history, most mothers had no anaemia (98.2%), while anaemia was reported in only one participant (1.8%).

Among infants, the mean age was 3.01± 1.63 months. Most infants had normal nutritional

status based on weight for age (85.7%), while 12.5% were classified as at risk of overweight and 1.8% were underweight. Most infants also had normal length for age (83.9%), while 7.1% were classified as tall and 5.4% as stunted. Based on weight for length and BMI for age indicators, most infants were categorized as having normal nutritional status (83.9%), with smaller proportions classified as at risk of overweight (7.1%), overweight (5.4%), or wasted (1.8%).

**Table 1. Characteristics of research subjects**

| Variabel | n=56 | p-value |
|---|---|---|
| **Maternal Characteristic** | | |
| **Age, years** | 30.01 ± 3.9 | 0.20 |
| **Education Level, n (%)** | | |
| ≤ Secondary High School | 1 (1,8) | |
| Senior High School | 34 (60,7) | |
| Diploma | 18 (32.1) | |
| Bachelor's Degree | 2 (3.6) | |
| Master's Degree | 1 (1.8) | |
| **Maternal Nutritional Status** | | |
| Underweight | 1(1.8) | |
| Normoweight | 21 (37.5) | |
| Overweight | 12 (21.4) | |
| Obesity class 1 | 19 (33.9) | |
| Obesity class 2 | 3(5.4) | |
| **Medical History** | | |
| No Medical History | 55(98.2) | |
| Anemia | 1 (1.8) | |
| **Infant Characteristic** | | |
| **Age, month** | 3.0(16.4-34.5) | 0.006 |
| **Body Weight/Age** | | |
| < -3SD (Severly Underweight) | 0 (0) | |
| -3 SD s.d -2SD (Underweight) | 1 (1.8) | |
| -2SD s.d +2SD (Normoweight) | 48 (85.7) | |
| >+2SD (Risk Of Overweight) | 7 (12.5) | |
| **Body Length/Age** | | |
| < -3SD (Severly Stunted) | 2 (3.6) | |
| -3 SD s.d < -2SD (Stunted) | 3 (5.4) | |
| -2 SD s.d +3SD (Normal) | 47(83.9) | |
| > +3SD (Tall) | 4 (7.1) | |
| **Body Weight/Body Length** | | |
| <-3SD (Severly Wasted) | 0 (0.0) | |
| -3SD s.d <-2SD (Wasted) | 1 (1.8) | |
| -2SD s.d +1SD (Normal) | 47 (83.9) | |
| > + 1SD s.d +2SD (Possible risk of overweight) | 1(1.8) | |
| > +2SD s.d +3SD (Overweight) | 4 (7.1) | |
| >+3SD (Obese) | 3 (5.4) | |
| **Body Mass Index / Age** | | |
| <-3SD (severly wasted) | 0 (0.0) | |
| -3 SD s.d < -2SD (wasted) | 1 (1.8) | |
| -2SD s.d +1SD (Normal) | 47 (83.9) | |
| > +1SD s.d +2SD (Possible risk of Overweight) | 1 (1.8) | |
| > +2SD s.d +3SD (Overweight) | 4 (7.1) | |
| > +3SD (Obese) | 3 (5.4) | |
| **Infant Feeding Status** | | |
| Exclusive Breastfeeding | 46(82.1) | |
| Mixed Feeding | 3(5.4) | |
| Exclusive Formula Feeding | 7(12.5) | |
| **Gestational Age at Birth** | | |
| Term (37w - 41w) | 51(91.1) | |
| Premature (<37w) | 2(3.6) | |
| Post Term (≥42w) | 3(5.4) | |

Regarding feeding practices, most infants received exclusive breastfeeding (82.1%), while 5.4% received mixed feeding and 12.5% received exclusive formula feeding. In terms of gestational age, many infants were born at term (91.1%), whereas 3.6% were preterm and 5.4% were post-term. Detailed characteristics of the study participants are presented in Table 1.

Spearman correlation analysis was conducted to evaluate the association between maternal anthropometric indicators and infant growth outcomes. The results showed a significant positive correlation between maternal nutritional status and infant weight for age (r=0.301, p=0.024), length for age (r=0.322, p=0.015), weight for length (r=0.319, p=0.0017), and BMI for age (r=0.319, p = 0.017). The correlation coefficients indicate a weak to moderate positive relationship, suggesting that better maternal nutritional status is associated with improved infant growth outcomes. (Table 2).

**Table 2. Correlation between Maternal nutritional status with dengan Infant Nutritional Status**

| Variable | Mother's Nutritional Status | | |
|---|---|---|---|
| | n | r | p |
| Infant Nutritional Status | | | |
| Body Weight / Age | 56 | 0,301 | 0,024* |
| Body Length/ Age | | 0,322 | 0,015* |
| Body Weight/ Body Length | | 0,319 | 0,017* |
| BMI / Age | | 0,319 | 0,017* |

*) Korelasi Spearman Rho signifikan dengan nilai p<0,05

## DISCUSSION

The findings of this study indicate that maternal nutrition status is significantly associated with infant growth outcomes during the first six month of life. In the present study, maternal anthropometric status showed a positive correlation with several infant growth indicators, including weight for age (r = 0.301), length for age (r = 0.322), weight for length (r = 0.319), and BMI for age (r = 0.319). Although the strength of these correlations was modest, the direction of association was consistent across all growth parameters, indicating that better maternal nutritional status is associated with improved infant growth. These results suggest that maternal anthropometry may contribute to early infant growth patterns during this period.[16]

These findings are in line with previous studies. Liang et al reported that maternal dietary factors and health status were significantly associated with infant anthropometric outcomes, with correlation coefficients ranging from r = 0.21 – 0.35 for weight for age and BMI for age among exclusively breastfed infants aged 0-6 month. Similarly, a systemic review by Gonzales Fernandez et al [14] found that maternal nutritional status was positively associated with infant growth indicators, although the reported effect sizes were generally small to moderate, which is comparable to the magnitude observed in the present study. [9,17,18]

The link between maternal nutritional status and infant growth is mediated through diverse biological mechanisms. Maternal

nutrient reserves and dietary intake during lactation are key determinants of human milk composition, influencing its macronutrient profile, lipid constituent, and bioactive elements. This finding is in line with studies by Favara et al, which demonstrated that maternal dietary patterns and BMI can alter the fatty acid profile of breast milk.[19] Similarly, Montana et al reported that maternal overweight and obesity are associated with changes in milk composition, including higher saturated fatty acid levels and altered omega-6 to omega-3 ratios, which may influence infant growth trajectories. These findings support the biological plausibility of the association observed in the present study. Variations in maternal body mass index and dietary behaviours have been shown to alter the fatty acid spectrum of breastmilk, with potential downstream effects on infant growth and metabolic development. Evidence further indicated that breastmilk produced by mothers with overweight or obesity often contains higher proportions of saturated fatty acids and exhibits imbalance in omega-6 to omega-3 ratios, factors that may contribute to differences in infant growth trajectories.[9]

Beyond breast milk composition, maternal metabolic status and dietary intake during lactation may influence infant growth through mechanisms related to nutrient transfer and metabolic signalling. Evidence from observational studies suggest that maternal dietary patterns, energy intake, and gestational weight gain are associated with infant anthropometric outcomes during early life. For instance, a study involving mother-infant pairs found that maternal dietary fat intake and maternal health conditions during lactation were significantly associated with infant anthropometric Z-score among exclusively breastfed infants aged <6 months.[20]

The results of the present study are consistent with findings from previous systematic reviews that have highlighted the influenced of maternal nutritional status on infant growth outcomes.[21] Maternal BMI and nutritional status during pregnancy and lactation have been reported to influence infant growth through changes in breast milk composition, hormonal signalling, and nutrient availability.[21] Although the strength of the association may vary across populations, maternal anthropometric indicators remain an important determinant of early infant growth and development.[18]

Breastfeeding practices may further modify the relationship between maternal nutritional status and infant growth. Human milk provides a complex combination of nutrients and bioactive components that support infant development. Previous studies, including those by Victoria et al and Qureshi et al, have shown that optimal breastfeeding combined with adequate maternal nutrition is associated with improved growth outcomes and reduced risk of growth faltering. These findings strengthen the interpretation of the present study, highlighting the importance of both maternal nutrition and feeding practice in early infancy.[10, 22]

Despite the significant correlations observed in this study, infant growth is influenced by a complex interaction of multiple factors beyond maternal anthropometry alone. Environmental conditions, maternal education

level, household socioeconomic status, infant health status, and feeding practices may all contribute to variability in infant growth outcomes. Previous studies have also reported that maternal diet intake, sleep quality during lactation, and breastfeeding related complications such as mastitis may affect infant anthropometric indicators during early life. These findings are consistent with the multifactorial nature of infant growth and support the need to interpret the result of this study within a broader context.[10, 20, 23]

The results of this study underscore the critical role of maintaining optimal maternal nutritional status throughout lactation as part of comprehensive strategies to enhance infant growth outcomes. Nutritional counselling for breastfeeding women, together with interventions aimed at improving maternal diet quality may contribute to healthier infant growth trajectories during the first six months of life. Strengthening maternal nutrition initiatives within the framework of the first 1000 days of life is therefore essential to preventing early growth faltering and promoting optimal child development.[2, 24]

This study offers several notable strengths. First, the analysis concentrated specifically on infants within the first six months of life, a critical developmental window during which breastfeeding serves as the predominant source of nutrition.[23] Second, infant growth was assessed using standardized anthropometric measurements aligned with internationally recognized WHO growth standards. Nonetheless, certain limitations must be acknowledged. The cross-sectional design precludes causal inference, and the reliance on bivariate analysis without multivariable adjustment may allow residual confounding from factors such as maternal diet, socioeconomic status, and feeding practices. Therefore, future longitudinal studies with larger samples and multivariable approaches are needed to better elucidate the independent effect of maternal nutritional status on infant growth outcomes.

## CONCLUSION

This study demonstrated a significant association between maternal nutritional status and infant growth indicators among infants aged <6 months. Maternal anthropometric status was positively correlated with several infant growth parameters, including weight-for-age, length-for-age, weight-for-length, and BMI-for-age. These findings suggest that maternal nutritional status during the lactation period may influence early infant growth. Ensuring adequate maternal nutrition during breastfeeding may therefore contribute to optimal infant growth and development in early life.

These finding highlight the importance of integrating maternal nutrition interventions into public health programs, particularly during the lactation period. Routine nutritional screening and counselling for breastfeeding mothers should be strengthened at the primary healthcare level, such as through community health centres and maternal-child health services. In addition, targeted interventions, including maternal dietary improvement programs, nutrition education, and supplementation where needed, may contribute

to optimizing infant growth during the first six month of life.

Further longitudinal studies are needed to explore the causal relationship between maternal nutritional status, breastmilk composition, and infant growth outcomes.

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