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Does nutritional status influence early child development? Evidance from infants in Bantul, Yogyakarta, Indonesia

Adelia Kholila Putri[1]*, Lia Dian Ayuningrum[2], Farida Aryani[1], Siti Roshaidai Mohd Arifin[2]

[1]Department of Midwifery, Faculty of Health Sciences, Universitas Alma Ata Yogyakarta, Brawijaya street 99, Tamantirto Yogyakarta, Indonesia
[2]Department of Special Care Nursing, Kulliyyah of Nursing, International Islamic University Malaysia, 25200 Kuantan Pahang, Malaysia

Correspondence: liadianayuningrum@almaata.ac.id

ABSTRAK

Latar Belakang: *Perkembangan anak usia 1-24 bulan sangat dipengaruhi oleh status gizi. Kekurangan gizi dapat menghambat pertumbuhan fisik, kognitif, serta meningkatkan risiko stunting. Data WHO pada tahun 2024 mencatat 23,2% anak di bawah 5 tahun mengalami stunting. Sementara itu, laporan Survei Status Gizi Indonesia menunjukkan prevalensi 19,8% pada tahun 2024. Dinas Kesehatan Bantul mencatat 7,01% balita mengalami stunting pada Juni 2024, Puskesmas Srandakan tercatat prevalensi tertinggi yaitu 13,94%.*
Tujuan: *Mengetahui hubungan status gizi terhadap perkembangan anak usia 1-24 bulan.*
Metode: *Penelitian survei analitik dengan desain cross-sectional ini dilakukan di posyandu wilayah kerja Puskesmas Srandakan pada 14 Mei–11 Juni 2025. Sebanyak 104 anak usia 1–24 bulan dipilih melalui cluster random sampling. Status gizi diukur dengan antropometri dan perkembangan anak menggunakan KPSP. Analisis data menggunakan uji korelasi Spearman Rank.*
Hasil: *Mayoritas anak memiliki status gizi baik (83,7%) dan perkembangan yang sesuai (68,3%). Analisis statistik menggunakan uji Spearman Rank menunjukkan tidak terdapat hubungan yang signifikan antara status gizi dan perkembangan anak dengan nilai p = 0,976.*
Kesimpulan: *Penelitian ini menunjukkan tidak terdapat hubungan signifikan antara status gizi dan perkembangan anak usia 1–24 bulan di wilayah kerja Puskesmas Srandakan, Bantul. Meskipun sebagian besar anak bergizi normal, variasi perkembangan tetap ditemukan pada semua kelompok gizi. Temuan ini mengindikasikan bahwa faktor lain—seperti stimulasi, praktik pengasuhan, dan lingkungan psikososial—juga berperan penting. Oleh karena itu, peningkatan perkembangan anak perlu mengintegrasikan intervensi gizi dengan edukasi pengasuhan dan stimulasi yang lebih terarah.*

KATA KUNCI*: baduta; perkembangan anak; status gizi; stunting*

ABSTRACT

Background: *The development of children aged 1-24 months is significantly influenced by nutritional status. Malnutrition can inhibit physical and cognitive growth, and increase the risk of stunting. WHO data in 2024 recorded 23.2% of children under 5 years old experiencing stunting. Meanwhile, the Indonesian Nutritional Status Survey report showed a prevalence of 19.8% in 2024. The Bantul Health Office recorded 7.01% of toddlers experiencing stunting in June 2024, while the Srandakan Community Health Center recorded the highest prevalence at 13.94%.*

Objectives: *To determine the relationship between nutritional status and the development of children aged 1-24 months.*

Methods: *This analytical survey with a cross-sectional design was conducted at the integrated health service post (posyandu) in the working area of the Srandakan Community Health Center. Total of 104 children aged 1-24 months were selected through cluster random sampling. Nutritional status was measured using anthropometry and child development using the KPSP. Data analysis used the Spearman Rank correlation test.*

Results: *The majority of children had good nutritional status (83.7%) and appropriate development (68.3%). Statistical analysis using the Spearman Rank test showed no significant relationship between nutritional status and child development with a p-value of 0.976.*

Conclusions: *This study shows no significant relationship between nutritional status and development in children aged 1–24 months in the Srandakan Community Health Center (Puskesmas) area, Bantul. Although most children had normal nutrition, developmental variations were found across all nutrition groups. These findings indicate that other factors—such as stimulation, parenting practices, and the psychosocial environment—also play a significant role. Therefore, improving child development requires integrating nutritional interventions with more targeted parenting education and stimulation.*

KEYWORDS: *child development; infant; nutritional status; stunting*

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INTRODUCTION

Child development is a gradual process encompassing gross motor, fine motor, speech, socialization, and independence aspects, all of which are interrelated (1). The age range of 0–24 months is recognized as the golden period for growth and development, when the brain and body experience the most rapid changes. During this critical phase, nutritional status plays a fundamental role, as inadequate nutrition can lead to growth faltering and developmental delays (2). The 8,000 Days of Life Program highlights the importance of fulfilling nutritional needs from conception through early childhood to prevent long-term developmental disorders (3). Globally, WHO–UNICEF–World Bank JME data in 2024 reported that 23.2% of children under five experienced stunting, with 12.2 million suffering from severe malnutrition. In Indonesia, developmental disorders such as delays in motor skills, language, and socio-emotional aspects affect 28.7% of children under five, ranking the country third in Southeast Asia for developmental problems (4)(5).

The National Nutritional Status Survey (SSGI) recorded a decline in stunting prevalence from 37.6% 2013 to 19.8% 2024 (6). while the 2018 Basic Health Research (Riskesdas) documented a rate of 30.8% (7). In Yogyakarta Province, undernutrition prevalence rose from 7.94% (2018) to 10.4% (2022), with the highest rates found in Kulon Progo and Yogyakarta City (8). Meanwhile, Bantul Regency experienced a sharp increase in stunting from 14.9% (2022) to 20.05% (2023), exceeding the national target of 14% by 2024 (9). Data from the Bantul District Health Office (2024) reported that the Srandakan Public Health Center had the highest stunting prevalence at 13.94%, notably higher than the

district average of 7.01% (10). Data from the Bantul District Health Office (2024) records the highest stunting prevalence in Srandakan Public Health Center at 13.94%, far above the district average of 7.01% (11).

Nutritional status is widely recognized as one of the biological determinants of child development (12). Poor nutrition increases the risk of infections, impairs physical growth, and negatively affects cognitive and motor development (14). Previous studies including those by Manalu et al. (2024) and Weni & Afifi (2023) have shown a positive association between nutritional status and developmental outcomes, particularly when assessed using weight-for-age or weight-for-length indicators (16)(17)(22). Other research highlights the influence of low birth weight, inadequate breastfeeding, and limited maternal knowledge on both stunting and developmental delays (19). Developmental assessment in Indonesia commonly uses the Kuesioner Pra Skrining Perkembangan (KPSP), which is integrated into routine services at posyandu (20).

Although many studies have examined nutrition and child development, most were conducted in populations with moderate stunting prevalence, used broad age ranges (0–59 months), or did not consider recent fluctuations in local stunting rates. Consequently, there is limited evidence focusing specifically on children aged 1–24 months in areas with consistently high stunting prevalence such as Srandakan. This research provides localized, updated evidence from the region with the highest stunting prevalence in Bantul. By narrowing the focus to children aged 1–24 months the most critical developmental period, and by integrating anthropometric data with Pra Skrining Perkembangan results, this study offers novel, context-specific insight into how nutritional status relates to early childhood development in a high-risk community.

Preliminary data from January 2025 reported 108 stunted toddlers in Trimurti Village and 83 in Poncosari Village within the Srandakan service area, reinforcing the need for a focused investigation. The novelty of this study lies in its specific age focus, high-prevalence setting, and combination of nutritional and developmental assessments, which together strengthen its relevance for local health planning. Therefore, this study aims to examine the association between nutritional status and developmental outcomes among children aged 1–24 months in the Srandakan Public Health Center area, providing essential evidence to support targeted interventions, improve early detection, and strengthen integrated nutrition development strategies at the district level.

MATERIALS AND METHODS

This research is a quantitative analytic study with a cross-sectional design. This design was chosen to investigate the relationship between variables at a single point in time. The sampling technique used is probability sampling with the type of cluster random sampling. This method was selected to obtain a representative sample from a large and geographically dispersed population. The study was conducted at posyandu (integrated health service posts) within the working area of Srandakan primary health care, which includes Poncosari and Trimurti Villages. The location was chosen due to its documented high stunting prevalence. The population in this study consisted of 1,492 children aged 1st–24th months, The total sample of 104 children was determined through a sample size calculation using the Slovin approach. The initial minimum sample obtained from the calculation was 94 children, after which an additional 10% was added to anticipate potential drop-out during data collection, resulting in a final required sample of 104 children. The final distribution consisted of 66 children from Poncosari Village and 38 children from Trimurti Village, according to the number of eligible children available in the selected clusters. Cluster random sampling was implemented because the population was spread across 44 posyandu (24 in Poncosari and 20 in Trimurti). A total of 14 posyandu were selected proportionally as clusters 9 from Poncosari and 5 from Trimurti based on the proportion of posyandu in each village. Cluster selection was conducted through random drawing. All children aged 1st–24th months within the selected posyandu who met the inclusion and exclusion criteria were included in the sample, leading to variations in sample numbers across clusters depending on the number of eligible children. The inclusion criteria were: children aged

1st–24th months, actively participating in posyandu activities within the past three months, and having parents or caregivers willing to be respondents. The exclusion criteria included children who were absent during posyandu activities, currently ill, or uncooperative during the data collection process. Ethical clearance for this study was obtained from the Ethics Committee of Universitas Alma Ata Yogyakarta with the reference number KE/AA/V/10112483/EC/2025. Nutritional status was measured using anthropometric assessments, specifically body weight and body length measurements. These values were then analyzed using the WHO growth standard to obtain Z-scores for weight for length (W/L), which were categorized into six nutritional categories: severely undernourished, underweight, normal, at risk of overweight, overweight, and obese. Child development was measured using the Kuesioner Pra-Skrining Perkembangan, a standardized early developmental screening questionnaire. This instrument evaluates four developmental domains: gross motor skills, fine motor skills, personal-social skills, and language. The instruments used in this study were anthropometric measurements (weight and length) and the KPSP questionnaire. Bivariate analysis was performed using the Spearman Rank (Rho) correlation test to determine the relationship between nutritional status and the development of children aged 1st–24th months. The Spearman Rank test was chosen because the variables were ordinal.

RESULTS AND DISCUSSIONS

This study used a sample of 104 toddlers from posyandu (integrated health service posts) within the working area of Srandakan Primary Health Care, Bantul..

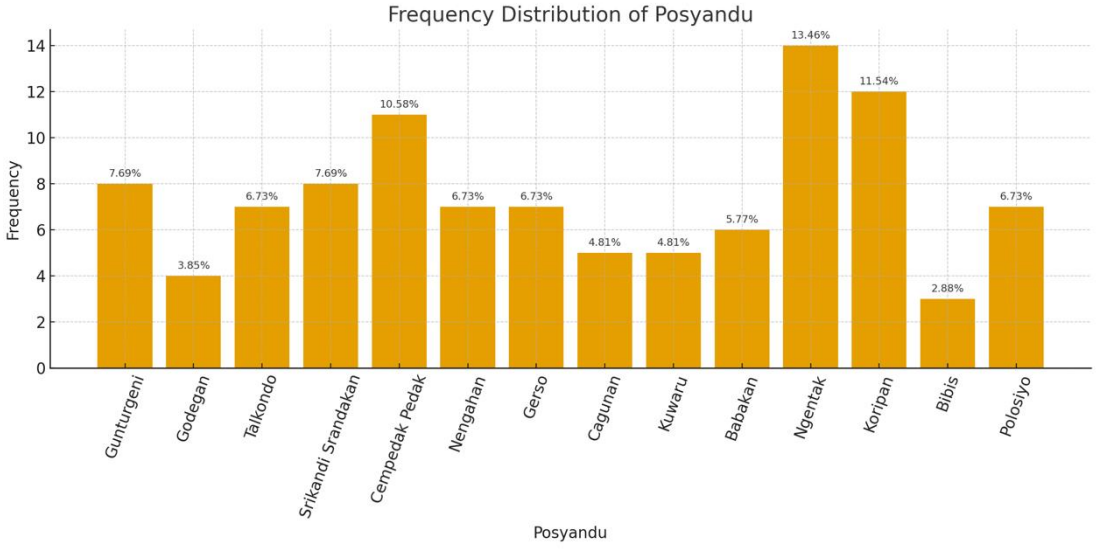

Figure 1: Frequency Distribution of Posyandu

Based on **Figure 1**, the frequency distribution of Posyandu indicates that Ngentak had the highest number of respondents (13.46%), followed by Koripan and Cempedak Pedak. In contrast, Bibis Posyandu had the lowest number of respondents (2.88%). This pattern suggests that the participation rate of toddlers varies across different Posyandu, which may reflect differences in population density, accessibility, or community engagement in each area. Overall, the distribution appears relatively balanced, with most Posyandu contributing a similar proportion of respondents, except for the few with notably higher or lower participation rates.

Table 1. Frequency Distribution of Characteristics

Characteristics	Frequency (n=104)	Percentage (%)
Mother's Characteristics		
Mother's Age		
<18 Years	1	1.0
18-35 Years	81	77.9
>35 Years	22	21.2
Last Education Level		
Primary	0	0
Secondary	70	67.3
Higher Education	34	32.7
Occupation		
Housewife	46	44.2
Private Employee	18	17.3
Entrepreneur	15	14.4
Civil Servant	12	11.5
Laborer	13	12.5
Income		
< Regional Minimum Wage	49	47.1
Regional Minimum Wage	40	38.5
> Regional Minimum Wage	15	14.4
Child's Characteristics		
Child's Age		
1-6 months	27	26.0
7-12 months	28	26.9
13-18 months	22	21.2
19-24 months	27	26.0
Sex		
Male	62	59.6
Female	42	40.4
Birth Order		
First	47	45.2
Second	38	36.5
More than second	19	18.3
Caregiver		
Parents	94	90.4
Grandparents	8	7.7
Others	2	1.9
Nutritional Status (Weight for Length)		
Severely malnourished (<-3 SD)	1	1.0
Underweight (-3 to <-2 SD)	7	6.7
Normal (-2 to 1 SD)	87	83.7
At risk of overweight (>1 to 2 SD)	6	5.8
Overweight (>2 to 3 SD)	2	1.9
Obese (>3 SD)	1	1.0
Current Weight		
Minimum 3.610		
Median 8.240		
Maximum 13.650		
Decelopment		
Normal	71	68.3
Suspect	27	26.0
Deviation	6	5.8

Based on **Figure 1**, the toddlers who participated as respondents were distributed across 14 posyandu (integrated health posts) within the working area of Puskesmas Srandakan.

The posyandu with the highest number of respondents was Ngentak, with 14 children (13.46%), followed by Koripan with 12 children (11.54%), and Cempedak Pedak with 11 children (10.58%). The lowest number of respondents was recorded at Bibis posyandu, with only 3 children (2.88%). The remaining posyandu showed relatively even distribution, such as Gunturgeni and Srikandi Srandakan with 8 children each (7.69%), Talkondo, Nengahan, Gerso, and Polosiyo with 7 children each (6.73%), Babakan and Ngentak with 5.77%, Cagunan and Kuwaru with 4.81%, and Godegan with 3.85%. This distribution pattern indicates that participation was relatively well represented across various posyandu, reflecting the broad coverage of the Srandakan Public Health Center's service area. However, the uneven distribution particularly the low number of respondents at Bibis may reflect population density differences,variable community engagement, or accessibility challenges in certain locations. These factors are important to consider, as disparities in participation may indirectly represent variations in health awareness, parental involvement, and the effectiveness of local health promotion activities.

Based on the majority of mothers in this study were aged 18–35 years 77.9%, which is considered the fertile and productive reproductive age. In terms of education, most mothers had secondary-level education (junior or senior high school), with 67.3%, while the rest had higher education 32.7%. Regarding occupation, the largest group consisted of housewives 44.2%, followed by private employees 17.3%, entrepreneurs 14.4%, civil servants 11.5%, and laborers 12.5%. In terms of income, most mothers earned below the regional minimum wage (UMR) 47.1%, followed by those earning equal to UMR 38.5%, and only 14.4% earned above the UMR.

Most of the children in this study were aged 7–12 months (26.9%), followed by 1–6 months and 19–24 months (both 26.0%), and 13–18 months (21.2%). The majority of children were male (59.6%) and were firstborns (45.2%). For current weight, the minimum recorded was 3,610 grams, the median was 8,240 grams, and the maximum was 13,650 grams. In terms of nutritional status (weight-for-length (W/L), most children had normal nutritional status (-2 SD to 1 SD), totaling 87 children (83.7%).

Table 4. Analysis of the relationship between nutritional status and child development aged 1–24 months in the working area of Srandakan Bantul Community Health Center

Nutritional Status	Normal		Suspect		Deviation		Total N (%)	*p-value*
	n	%	n	%	n	%		
Severely malnourished	1	1.0	0	0.0	0	0.0	1 (1.0)	
Underweight	6	5.8	1	1.0	0	0.0	7 (6.7)	
Normal	60	57.7	23	22.1	4	3.8	87 (83.7)	0.976
At risk of overweight	3	2.9	2	1.9	1	1.0	6 (5.8)	
Overweigh	1	1.0	1	1.0	0	0.0	2 (1.9)	
Obese	0	0.0	0	0.0	1	1.0	1 (1.0)	

Source: Primary Data 2025

Additionally, 6 children (5.8%) were at risk of being overweight (>1 to 2 SD), 7 children (6.7%) were underweight (-3 to <-2 SD), 2 children (1.9%) were overweight (>2 to 3 SD), and 1 child each (1.0%) was categorized as severely undernourished (<-3 SD) and obese (>3 SD). In terms of caregiving, most children were cared for directly by their parents (90.4%), followed by grandparents (7.7%), and other caregivers (1.9%). The majority of children in this study had good nutritional status, totaling 87 children (83.7%). A total of 7 children (6.7%) were categorized as underweight, and 1 child (1.0%) was classified as severely undernourished. In addition, 6 children (5.8%) were at risk of being overweight, 2 children (1.9%) were overweight, and 1 child (1.0%) was categorized as obese. According to Table 3, most children demonstrated appropriate developmental status, accounting for 71 children (68.3%). A total of 27 children (26.0%) showed questionable

development, while 6 children (5.8%) exhibited developmental delays. The study findings showed that among the 87 children with good nutritional status, 60 children (57.7%) had appropriate development, 23 children (22.1%) had questionable development, and 4 children (3.8%) experienced developmental delays. Among the 7 undernourished children, 6 (5.8%) had appropriate development and only 1 (1.0%) was in the questionable category. For the 6 children at risk of being overweight, 3 (2.9%) had appropriate development, 2 (1.9%) were questionable, and 1 (1.0%) had developmental delays. Among the 2 overweight children, 1 child showed appropriate development, and 1 had questionable development. The 1 obese child exhibited developmental delay.

The relationship between nutritional status and developmental outcomes in children aged 1–24 months was analyzed using the Spearman Rank correlation test, yielding a correlation coefficient (ρ) of –0.003 with a significance value of $p = 0.976$ ($p > 0.05$). These findings indicate no significant association between nutritional status and child development in the working area of Puskesmas Srandakan. Although 83.7% of children were classified as having normal nutritional status, their developmental outcomes varied widely. This variation highlights that adequate nutrition alone does not ensure optimal child development. Some undernourished children did not show developmental delays, whereas certain well-nourished children still displayed suboptimal progress. This pattern indicates that factors beyond nutritional adequacy such as parenting style, stimulation quality, and psychosocial environment play a crucial role. This interpretation is strongly supported by international evidence. The WHO Nurturing Care Framework (2020) emphasizes that child development depends not only on nutrition but also on early stimulation, responsive caregiving, and emotional and social protection. Multi-country cohort studies (Roberts et al., 2022; Onyango et al., 2023; Hamid et al., 2023) similarly report that nutrition-only interventions have limited impact on cognitive or motor outcomes unless they are integrated with structured stimulation and parental support. Findings from Southeast Asia (Nguyen et al., 2024; Lee & Choi, 2024) further reinforce this view showing that integrated parenting programs can improve developmental scores even in children with mild stunting. These studies suggest that nurturing care environments can buffer the negative effects of borderline nutritional status. (29).

The results of the analysis in Table 4 show that there is no significant relationship between nutritional status and the development of children aged 1–24 months ($p = 0.976$). The majority of children are in the normal nutrition category, but variations in development still appear in this group, indicating that nutritional status is not the only determinant of development. The low proportion of children in extreme nutritional categories, such as severely malnourished or obese, has the potential to reduce the sensitivity of the analysis in detecting developmental differences between groups. In addition, child development is influenced by various other factors, including the quality of stimulation, the caregiving environment, parental education, and health conditions, which were not explicitly analyzed in this study. These findings are in line with previous studies reporting that the relationship between nutritional status and development is more evident in populations with greater nutritional variation. Thus, further research with more heterogeneous samples and multivariate analysis is needed to gain a more comprehensive understanding of the relationship between nutrition and child development (11,22).

Field interviews from the present study provide further explanation. While most mothers reported engaging in stimulation activities, many could not describe age-appropriate forms of play or learning. Several children were primarily cared for by grandparents or other relatives while mothers worked, leading to inconsistent and non-targeted stimulation. Such irregularities likely contribute to the wide variation in developmental outcomes, even among children with good nutrition (21). These findings are consistent with recent Indonesian studies (Wahyuni et al., 2023; Ayuningtyas & Sunarsih, 2024; Ardani, 2023), which demonstrate that socioeconomic and caregiving factors have a stronger influence on development than nutrition alone. In the rural Javanese context, extended family caregiving and limited parental knowledge about developmental

milestones may reduce the effectiveness of home-based stimulation (23). Taken together, these results underscore that early childhood intervention programs must integrate nutrition services with parental education, responsive caregiving, and structured play activities to promote optimal development.

LIMITATION

Some children were shy with unfamiliar examiners, so a few developmental checks could not be completed in full, and several participants were accompanied by grandparents or other relatives who might not have provided completely accurate daily-care information. In addition, the predominance of children with good nutritional status limited data variation, slightly reducing the power to detect subtle associations. Future research with larger, more heterogeneous populations and longitudinal follow-up is recommended to clarify causal pathways between nutrition, stimulation, and developmental outcomes.

CONCLUSION AND RECOMMENDATION

Based on the research findings, it can be concluded that there is no significant relationship between nutritional status and the development of children aged 1–24 months, as indicated by the Spearman Rank test (p = 0.976). This suggests that child development is a multifactorial process that cannot be explained by nutritional status alone. Other contributing factors such as early stimulation, parenting style, and the quality of the home environment play an essential role in shaping developmental outcomes. Future studies are recommended to include these additional variables and to expand the sample coverage to obtain more comprehensive and representative results. Furthermore, longitudinal research designs could provide deeper insights into how nutritional status interacts with psychosocial and environmental factors over time in influencing child development.

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