

Distribution of maternal and child characteristics based on stunting status among children under five years in a primary health care setting

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¹Master of Epidemiology Study Program, Faculty of Public Health, Universitas Airlangga, Surabaya, Indonesia

²Department of Epidemiology, Faculty of Public Health, Universitas Hasanuddin, Makassar, Indonesia

³Department of Epidemiology, Biostatistics, Population Studies, and Health Promotion, Faculty of Public Health, Universitas Airlangga, Surabaya, Indonesia

⁴Research Group for Health and Wellbeing of Women and Children, Universitas Airlangga, Indonesia

⁵Institute of Public Health, United Arab Emirates University, United Arab Emirates

***Correspondence:**
eny.qurniyawati@fkm.unair.ac.id

Nursindia A. Sugoro¹, Jumriani Ansar², Eny Qurniyawati^{3,4*}, Hiba Adam⁵

Abstract

Purpose: Stunting remains a major public health concern in Indonesia, particularly among children under five, as it is linked to impaired growth and developmental outcomes. This study aimed to describe the distribution of maternal and child characteristics according to stunting status in a primary health care setting. **Methods:** A cross-sectional study was conducted among children under 5 years of age (0–59 months) using systematic random sampling (n = 110). Data were collected through structured interviews with mothers and supplemented by health center records. Stunting status was determined using height-for-age z-scores from the 2020 Primary Health Care Center report, in accordance with standard child growth monitoring practices. A bivariate analysis using the chi-square test was conducted to examine crude associations between maternal and child characteristics and stunting. **Results:** Stunting was more common among children whose mothers had lower nutritional knowledge, lower educational attainment, and shorter maternal height. A higher proportion of stunting was also observed among children with a history of infectious diseases and those with limited access to health services. Maternal nutritional knowledge, maternal education, maternal height, history of infectious diseases, and access to health services were statistically associated with stunting ($p < 0.05$), while household income was not ($p = 0.094$). **Conclusion:** Several maternal and child characteristics were statistically associated with stunting at the bivariate level. These findings highlight the importance of strengthening maternal education, nutrition counseling, infection prevention, and access to primary health care services. However, the results should be interpreted cautiously as they reflect crude associations rather than independent effects.

Keywords: child health; health system access; maternal health; stunting; under-five children

INTRODUCTION

Stunting, a sign of persistent undernutrition during crucial stages of growth and development, remains a significant global public health concern, especially in low- and middle-income nations. According to recent projections, stunting affected over 150.2 million children under the age of five globally in 2024,

indicating that global development remains insufficient to meet the 2030 nutrition objectives [1]. Stunted children are more likely to have delayed intellectual development, poorer educational achievement, and decreased efficiency as adults, all of which contribute to long-term losses in human capital [2]. These outcomes highlight the critical importance of treating stunting as a priority for both health and growth.

Recent evidence emphasizes that stunting is a multifactorial condition shaped by maternal, child-related, and contextual or health service factors across the life course [3–5]. Maternal characteristics, including educational attainment, nutritional knowledge, and maternal height, are consistently associated with child growth outcomes and reflect both socio-economic and intergenerational influences [6,7]. At the child level, recurrent infectious diseases and inadequate nutritional intake remain key contributors to impaired linear growth, particularly during the first 1,000 days of life [8,9]. Additionally, early identification, detection, and management of growth faltering depend heavily on access to and use of primary health care services [5,10].

According to official estimates, stunting is still a major public health problem in Indonesia, with a consistently high prevalence among kids younger than five [11]. While earlier research has offered insightful information on the national and regional factors that contribute to stunting, most rely on large-scale survey data that may not adequately capture variations in maternal nutritional knowledge, patterns of health service utilization particularly in capturing how maternal characteristics, child health conditions, and access to health services interact within primary health care settings, and local child health conditions at the primary health care level. Evidence generated at the Primary Health Care Center (puskesmas) level, particularly in urban coastal settings such as Makassar, remains limited. Understanding these context-specific patterns is essential for designing targeted and feasible interventions within primary health care services. Thus, the purpose of this study is to describe the distribution of maternal and child characteristics by stunting status in a primary health care setting. By focusing on locally derived data, this study provides context-specific evidence to inform targeted prevention and intervention strategies within primary health care services.

METHODS

Study design and setting

This study used a cross-sectional design and an analytical observational methodology. The Pattingalloang Primary Health Care Center in Makassar City, Indonesia, served as the study site, selected for its relatively high prevalence of stunting. Data collection was carried out from March 29 to April 29, 2021. The unit of analysis in this study was children under 5 years of age (0–59 months), while mothers served as respondents, providing information on maternal and household characteristics. The study population comprised 1,201 children under five enrolled at the

health facility. With a 5% margin of error and a 95% confidence level, the Lemeshow method was used to determine the minimal sample size, which was 110 children.

A sample frame created from health center records was used to select participants via systematic random sampling. Children under five who were registered at the health facility and had complete anthropometric data satisfied the inclusion criteria. Exclusion criteria included incomplete health records and the mother's absence at the time of data collection. Non-response cases were recorded and excluded from the final analysis.

Data collection

The dependent variable was stunting status obtained from anthropometric measurements recorded in the 2020 child growth monitoring records at the health center. The WHO Child Growth Standards used the height-for-age Z-score (HAZ) to classify children as stunted ($HAZ < -2 SD$) or non-stunted ($HAZ > -2 SD$). Maternal education, height, family income, dietary awareness, history of infectious illnesses, and access to healthcare services were among the independent factors. The history of infectious diseases was measured as a binary variable (yes/no) based on whether infections occurred within the 2 weeks prior to data collection. Access to health services was categorized based on primary health care utilization. Maternal nutritional knowledge was assessed using a structured questionnaire and categorized as good ($\geq 75\%$) and poor ($< 75\%$). Operational definitions and cut-off values were determined based on national guidelines and relevant literature and are presented in Table 1. To ensure validity and reliability, the questionnaire underwent expert evaluation and pilot testing.

Data analysis

Univariate analyses were used to characterize the distributions of each variable, and bivariate analyses utilizing the chi-square test were used to investigate the relationships between stunting status and maternal and child characteristics. SPSS was used for the statistical analysis, and $p < 0.05$ was chosen as the significance threshold. Data cleaning procedures were conducted prior to analysis, and assumptions for the chi-square test were assessed. Given the exploratory nature of this study and the sample size, multivariable analysis was not performed. Therefore, the findings are presented as crude associations and should be interpreted with caution, as potential confounding factors were not controlled.

RESULTS

This research involved 110 children under the age of five. The characteristics of the research sample are shown in Table 1.

Table 1. Characteristics of the study sample (n = 110)

Variable	(n)	(%)
Stunting status		
Stunted	53	48.2
Not stunted	57	51.8
Child characteristics		
Sex		
Male	48	43.6
Female	62	56.4
Age (months)		
0–12	20	18.2
13–24	26	23.6
25–36	26	23.6
37–48	33	30.0
49–60	5	4.5
Birth order		
1	26	23.6
2	25	22.7
3	31	28.2
4	13	11.8
5	9	8.2
≥6	6	5.5
Residential area		
Pattingalloang	40	36.4
Pattingalloang Baru	19	17.3
Cambaya	35	31.8
Camba Berua	16	14.5
Maternal characteristics		
Age (years)		
≤20	7	6.4
21–30	44	40.0
31–40	48	43.6
41–50	11	10.0
Education		
No formal education	2	1.8
Primary school	32	29.1
Junior high school	38	34.5
Senior high school	38	34.5
Occupation		
Housewife	103	93.6
Civil servant	1	0.9
Informal worker	6	5.5
Height		
<150 cm (short)	45	40.9
≥150 cm (normal)	65	59.1
Nutritional knowledge		
Poor	49	44.5
Good	61	55.5
Household income		
Low (< IDR 3,255,403)	71	64.5
High (≥ IDR 3,255,403)	39	35.5
History of infectious diseases		
Yes	60	54.5
No	50	45.5
Access to health services		
Limited	5	4.5
Adequate	105	95.5

Children whose mothers knew less about nutrition were more likely to experience stunting. Stunting was also more common among children of mothers with lower levels of education. Additionally, stunting was more common among children whose mothers were smaller in size (Table 1). Stunting was more common among children with a history of infectious diseases. Children with limited access to health services also had a higher proportion of stunting. Stunting showed similar proportions across household income categories in this sample. Bivariate analysis showed maternal nutritional knowledge, maternal education, maternal height, history of infectious diseases, and access to health services were statistically associated with stunting ($p < 0.05$). Household income was not statistically associated with stunting ($p = 0.094$) (Table 2).

Table 2. Crude associations between maternal and child characteristics and stunting among children under five years (n = 110)

Variable	Stunted n (%)	Not stunted n (%)	p-value
Maternal education			
Low	43 (59.7)	29 (40.3)	0.001*
High	10 (26.3)	28 (73.7)	
Maternal nutritional knowledge			
Poor	37 (75.5)	12 (24.5)	<0.001*
Good	16 (26.2)	45 (73.8)	
Maternal height (cm)			
<150 (short)	41 (91.1)	4 (8.9)	<0.001*
≥150 (normal)	12 (18.5)	53 (81.5)	
Household income			
Low (< IDR 3,255,403)	38 (53.5)	33 (46.5)	0.094
High (≥ IDR 3,255,403)	15 (38.5)	24 (61.5)	
History of infectious diseases			
Yes	46 (76.7)	14 (23.3)	<0.001*
No	7 (14.0)	43 (86.0)	
Access to health services			
Limited	4 (80.0)	1 (20.0)	0.016*
Adequate	49 (46.7)	56 (53.3)	
Total	53 (48.2)	57 (51.8)	

Note: *Chi-square test was used for bivariate analysis; p-value <0.05.

DISCUSSION

At the bivariate level, this study robustly identified several maternal and child variables that were statistically associated with stunting. Children with less favorable maternal circumstances, poorer child health, and limited access to health services consistently exhibited higher rates of stunting. These results firmly align with prior research, underscoring the multifactorial nature of stunting in low- and middle-income settings, where maternal resources, inter-generational influences, child morbidity, and access to

services collectively drive child growth outcomes [2,12].

Building on maternal and child factors, a maternal resource perspective clearly demonstrates that maternal education and nutritional knowledge strongly influence variations in stunting patterns. Notably, children whose mothers possess lower educational attainment and limited nutritional knowledge consistently exhibit higher rates of stunting. This evidence underscores the decisive role of maternal capacity—including knowledge, education, and health literacy—in shaping caregiving practices, feeding behaviors, and health service use. This pattern is supported by previous studies, which confirm that maternal education and knowledge are linked to child nutritional outcomes through behavioral and informational mechanisms [6,13]. Nonetheless, these results should be interpreted as crude associations rather than independent effects, given the study's cross-sectional design.

Intentional factors were inherent in this study. This result is consistent with more extensive data showing that maternal height is associated with child survival, developmental outcomes, and linear growth. A multi-country analysis using Demographic and Health Survey data from sub-Saharan Africa found that increases in maternal height were associated with significant reductions in child growth deficits and mortality, highlighting the role of both biological and early-life environmental mechanisms in shaping child outcomes [14]. Consistent with existing evidence suggesting that maternal stature reflects long-term nutritional status and early-life conditions, which may influence fetal growth and subsequent child development [15,16]. These findings support the concept of intergenerational transmission of undernutrition, although causal pathways cannot be established in this study.

At the child level, a history of infectious diseases was associated with higher proportions of stunting. This is consistent with the body of research showing that undernutrition and infection are closely linked through biological mechanisms such as reduced appetite, impaired nutrient absorption, and increased metabolic demand [17]. In densely populated urban and coastal settings, environmental conditions, sanitation, and hygiene practices may further contribute to this relationship [18,19]. However, the direction of this association remains unclear due to the cross-sectional design, as infections may both contribute to and result from poor nutritional status.

From a service context perspective, access to health services was also associated with stunting. However, given the small number of individuals categorized as

having restricted access, this result should be interpreted cautiously. In the study setting, primary health care services are generally geographically accessible. This geographic accessibility may explain the limited variability observed. Nevertheless, access alone may not fully capture the quality, continuity, and utilization of services. These are important dimensions in child growth monitoring and in the delivery of interventions. In contrast to the previous variables, this study found no significant relationship between household income and stunting. This likely reflects homogeneous socioeconomic conditions among participants and underscores the limitations of income measurement in urban coastal communities, where informal employment and fluctuating earnings prevail. Such factors contribute to potential misclassification and hinder the detection of differences, indicating that income alone inadequately captures household socioeconomic context in this setting.

These findings carry critical implications for primary health care. Intensifying maternal nutrition counseling at Primary Health Care Centers and Posyandu can significantly advance early feeding and child care practices. Evidence from intervention studies shows that single-component nutritional interventions often yield limited or inconsistent effects on stunting, especially in complex settings [20]. Evaluating this study reveals several limitations. First, bivariate analysis limits control over confounding factors, so associations cannot be considered causal. Second, the cross-sectional design and differing exposure (2021) and outcome (2020) data complicate temporal relationship assessment and raise possibilities of reverse causality. Third, variables such as household income and health service access may be misclassified due to self-reported data and simplified categorization. Fourth, record-based anthropometric data can introduce variability in measurement procedures. Given these limitations, stronger analytical methodologies and longitudinal studies are essential. Despite constraints, this study provides context-specific evidence on maternal and child characteristics associated with stunting in urban coastal primary health care. Results must be interpreted with care, but they should emphasize the need for integrated strategies that address maternal, child, and service-related factors, and offer guidance for enhancing local preventive programs.

CONCLUSION

In the Ujung Tanah District of Makassar, this study identified several maternal and child-related traits that were statistically linked with stunting in children

under 5 years old. Maternal characteristics, including education level, nutritional knowledge, and maternal height, were associated with differences in stunting patterns. At the same time, child-related factors, particularly a history of infectious diseases, also showed notable differences. These findings suggest that maternal and child health dimensions should be considered together in efforts to address stunting in this urban coastal setting. However, causal conclusions cannot be drawn from the cross-sectional design and bivariate analysis, and the observed relationships should be regarded with caution. Future studies using longitudinal designs and multivariable analyses are recommended better to clarify causal pathways and control for potential confounding factors.

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Authors' contribution

N.A.S.: Conceptualization, Methodology, Data curation, Formal analysis, Investigation, Writing—original draft; J.A.: Supervision, Methodology, Writing—review & editing; E.Q.: Supervision, Conceptualization, Project administration, Writing—review & editing; H.A.: Supervision, Validation, Writing—review & editing. All authors approved the final manuscript.

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Data availability

The accompanying author can provide the data supporting the study's conclusions upon reasonable request.

Ethics statement

The Maluku Husada College of Medical Sciences' Health Research Ethics Committee granted ethical permission for this study (permission No. RK.69/KEPK/STIK/III/2021). Before taking part, each subject gave their informed consent. The STROBE standards for observational studies were followed in the reporting of this study.

Conflicts of interest

The study's authors affirm that they have no conflicts of interest, either financial or non-financial.

Use of artificial intelligence (AI)

During the development of the manuscript, artificial intelligence (AI) methods were only utilized for language editing. The writers, who bear full responsibility for the paper, evaluated and validated every piece of content.

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