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Determinants of Wasting Among Children Under Five in Sragen Regency, Central Java, Indonesia

Lidya Diantika Sigalingging[1)], Selfi Handayani[2)], Revi Gama Hatta Novika[1)], Hari Wahyu Nugroho[3)], Annang Giri Moelyo[3)]

[1)]Master's Program in Public Health, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Central Java, Indonesia
[2)]Department of Anatomy, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Central Java, Indonesia
[3)]Department of Pediatrics, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Central Java, Indonesia

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ABSTRACT

Background: Wasting remains a public health concern in Sragen Regency despite its agricultural potential. This study examined associations with childhood wasting and pathways involving household food insecurity, dietary diversity, and attendance at community-based integrated health posts (*Posyandu*).

Subjects and Method: This cross-sectional study recruited 204 children aged 6–59 months through consecutive sampling at Posyandu from an accessible population of 5,781 in Sragen Regency. Sample size planning considered the anticipated complexity of GSEM. The recruitment target was 200 participants, and 204 were enrolled. Wasting was the dependent variable; independent variables included maternal education, household economic status, household size, number of children, social capital, maternal mental health, food security, dietary diversity, and Posyandu attendance. Data were collected using anthropometry and questionnaires (SRQ-20, HFIAS, DDS) and analyzed using chi-square tests, multivariable logistic regression, and GSEM comprising four structural equations with 16 regression paths.

Results: Low maternal education (aOR=4.21; 95% CI=2.05 to 8.63; p<0.001), low economic status (aOR=6.67; 95% CI=3.09 to 14.40; p<0.001), large household size (aOR=2.83; 95% CI=1.22 to 6.55; p=0.015), low dietary diversity (aOR=3.65; 95% CI=1.73 to 7.72; p=0.001), and irregular Posyandu attendance (aOR=3.08; 95% CI=1.40 to 6.77; p=0.005) were associated with higher odds of wasting. GSEM showed positive associations of large household size (b=0.99; 95% CI=0.21 to 1.77; p=0.013) and more children (b=0.95; 95% CI=0.24 to 1.67; p=0.009) with food insecurity, low maternal education with low dietary diversity (b=0.71; 95% CI=0.14 to 1.28; p=0.015), and maternal psychological distress with irregular attendance (b=0.92; 95% CI=0.31 to 1.53; p=0.003). Other examined intermediate associations were nonsignificant.

Conclusion: Low maternal education, low household economic status, larger household size, inadequate dietary diversity, and irregular Posyandu attendance were associated with higher odds of wasting. GSEM identified additional associations involving household food insecurity, dietary diversity, and Posyandu attendance, although the overall indirect effects were not formally tested.

Keywords: Wasting; children under five; nutritional status; maternal factors

Correspondence:
Selfi Handayani. Department of Anatomy, Faculty of Medicine, Universitas Sebelas Maret. Jl. Ir. Sutami 36A, Surakarta, Central Java 57126, Indonesia. Email: selfihandayani@staff.uns.ac.id.

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BACKGROUND

Wasting is an acute form of child undernutrition characterized by low weight-for-height and remains a major public health concern because it increases vulnerability to illness and mortality. Indonesia continues to face a substantial burden: the 2024 national prevalence of wasting was 7.4%, exceeding the World Health Organization target of below 5%, while Central Java recorded a prevalence of 5.9% (Ministry of Health Republic of Indonesia, 2025). In Sragen Regency, routine nutrition data recorded 2,702 children with wasting in December 2024 and 2,383 children (approximately 5.40%) in September 2025, indicating that acute malnutrition remains locally relevant (Sragen Regency Health Office, 2025).

Sragen is predominantly agrarian and has substantial food-production potential. Nevertheless, persistent wasting indicates that regional food availability does not necessarily translate into adequate household access, dietary quality, or optimal child nutritional status. The UNICEF Conceptual Framework on Maternal and Child Nutrition proposes that child nutrition is shaped by interconnected immediate, underlying, and enabling determinants (UNICEF, 2020). These frameworks support examining wasting as the product of pathways linking socioeconomic conditions, household characteristics, maternal psychosocial factors, food security, dietary intake, and utilization of community health services.

Previous studies have linked child undernutrition with maternal education, socioeconomic conditions, household composition, food insecurity, maternal mental health, dietary diversity, social capital, and access to community-based health services (Khan, 2022; Hossain et al., 2024; Dassie et al., 2024). However, these determinants are often examined separately. Evidence on how these factors operate simultaneously through intermediate pathways remains limited, particularly in an agrarian area with high food-production potential such as Sragen.

The research question was whether socioeconomic, family, maternal psychosocial, household food-security, dietary, and health-service factors were associated with wasting and how these determinants were interconnected through pathways among children under five in Sragen Regency. This study aimed to analyze the determinants of wasting among children under five in Sragen Regency and the pathways among these determinants using Generalized Structural Equation Modeling (GSEM).

SUBJECTS AND METHOD

1. Study Design

This quantitative analytical observational study used a cross-sectional design. The study was conducted from April to June 2026 in the catchment areas of Gondang, Mondokan, and Plupuh II Primary Health Centers in Sragen Regency, Central Java, Indonesia. These areas were purposively selected based on the number of children with wasting, catchment area coverage, and feasibility of data collection. Given the non-probability selection of study sites and participants, the findings should be generalized to the wider population of Sragen Regency with caution. Measurements of child nutritional status and the proposed

determinants were performed during the same study period without intervention.

2. Population and Sample

The target population comprised mothers with children aged 6–59 months registered across 25 primary health centers in Sragen Regency. The accessible population consisted of 5,781 children registered in the Electronic Community-Based Nutrition Recording and Reporting System (e-PPGBM) within the catchment areas of the three selected primary health centers. Three primary health centers were purposively selected based on the reported number of children with wasting, catchment area coverage, and the feasibility of data collection. Two *Posyandu(s)* were subsequently selected within each catchment area.

Eligible participants were children aged 6–59 months attending the selected Posyandu whose mothers or guardians provided informed consent. Children with congenital abnormalities or chronic diseases affecting growth were excluded. Attending children were assessed through anthropometric measurements and classified as wasting or non-wasting according to the WHO 2006 Child Growth Standards.

Sample size planning for GSEM was guided by a parameter-based approach (Kline, 2016), considering the anticipated complexity of the structural model. A recruitment target of 200 participants was established to provide a larger analytical sample and accommodate potential incomplete data. The final GSEM comprised four structural equations with 16 regression paths, including nine direct associations with wasting. The sample size was considered in relation to model complexity, recognizing that parameter-based guidelines provide preliminary planning considerations rather than formal evidence of statistical power.

To ensure balanced representation of the two nutritional status groups, a target of approximately 100 children per group was established. Consecutive recruitment was conducted within each group until the recruitment targets were reached. The final sample comprised 204 children, including 102 with wasting and 102 without wasting, all of whom were included in the analysis. The individual child was the unit of analysis. As recruitment was intentionally balanced by wasting status, the observed proportion of wasting does not represent its prevalence in the general population. Odds ratios were interpreted as measures of association, with consideration of potential selection bias and limited generalizability.

3. Study Variables

The dependent variable was wasting. Independent variables were maternal education, household economic status, household size, number of children, family social capital, maternal mental health, household food security, child dietary intake, and *Posyandu* attendance. In the path model, household food security, dietary intake, and *Posyandu* attendance also functioned as intermediate variables.

4. Operational Definition of Variables

Wasting was defined as weight-for-height/length below -2 SD according to the WHO 2006 Child Growth Standards. Children with Z-scores ≥−2 SD were classified as non-wasting.

Maternal education was categorized as low (junior high school or below) or high (senior high school or above).

Household economic status was determined by the proportion of monthly household expenditure allocated to food and categorized as low when food expenditure accounted for ≥75% of total expenditure and high when it accounted for <75%. This operational cut-off was adapted from the food expenditure share classification

described by Russell et al. (2018), in which a share exceeding 75% indicates substantial economic vulnerability to food insecurity, consistent with Engel's law (Chen, 2022; Russell et al., 2018).

Household size was categorized as small (≤4 members) or large (>4 members).

Number of children was categorized as few (≤2 children) or many (>2 children).

Social capital was assessed using a locally adapted 16-item questionnaire informed by the World Bank's Integrated Questionnaire for the Measurement of Social Capital (SC-IQ), originally developed by Grootaert et al. (2003). The instrument has also been used in subsequent studies to assess various dimensions of social capital (Craig et al., 2023). The Indonesian-language questionnaire was contextually adapted to assess social trust, neighborhood relationships, cooperation, and community support relevant to child caregiving. Each item was scored on a five-point Likert scale (1= strongly disagree to 5= strongly agree), yielding total scores ranging from 16 to 80. Pilot testing among 44 mothers outside the main study sample demonstrated corrected item-total correlations ranging from 0.632 to 0.887 and a Cronbach's alpha of 0.967. Social capital was classified as high (≥66) or low (<66) using the sample median of 66 as a study-specific cut-off, consistent with previous studies employing median-based categorization of social capital (Bai et al., 2022). This study-specific threshold was used because no established cut-off was available for the adapted questionnaire.

Maternal mental health was assessed using the Self-Reporting Questionnaire-20 (SRQ-20) and classified as impaired (score ≥6) or not impaired (score <6), following the Indonesian Ministry of Health (2023) guidelines. This threshold indicates potential psychological distress requiring further assessment rather than a clinical diagnosis (Ministry of Health Republic of Indonesia, 2023).

Household food insecurity was assessed using the nine-item Household Food Insecurity Access Scale (HFIAS), with total scores ranging from 0 to 27. The instrument has been validated in Indonesian households (Mahmudiono et al., 2018). Households were classified as food secure (score 0–1) or food insecure (score >1), following a previously published operational classification (Maulida et al., 2023).

Dietary intake was assessed using a seven-food-group Dietary Diversity Score (DDS) based on maternal reports of foods consumed by the child during the preceding 24 hours. The seven groups and ≥4 cut-off were adapted from the WHO dietary diversity indicator (WHO, 2008). Each food group consumed contributed one point, yielding scores ranging from 0 to 7. Children were categorized as having adequate (≥4 groups) or inadequate (<4 groups) dietary diversity using a study-specific operational classification applied to children aged 6–59 months, consistent with previous Indonesian research (Maulida et al., 2023). Breast milk was not included in the seven food groups, while exclusive breastfeeding history was recorded separately. Food consumed outside the home was not assessed separately.

Posyandu attendance was classified as regular (≥2 visits) or irregular (<2 visits) during the preceding three months. This study-specific threshold was informed by the Indonesian Ministry of Health's minimum standard of eight child growth-monitoring visits annually (Ministry of Health Republic of Indonesia, 2024). A threshold of ≥2 visits within three months was selected to reflect attendance at most expected monthly sessions.

5. Study Instruments

Child weight and height/length were measured using appropriate anthropometric equipment and assessed according to the WHO 2006 Child Growth Standards. Social capital was measured using a locally adapted 16-item questionnaire based on the World Bank's social capital measurement framework. The questionnaire was developed in Indonesian and adapted to reflect local social relationships, trust, and community support relevant to child caregiving.

Maternal mental health was assessed using the 20-item Self-Reporting Questionnaire (SRQ-20), household food insecurity using the nine-item Household Food Insecurity Access Scale (HFIAS), and child dietary diversity using a seven-food-group Dietary Diversity Score (DDS). Posyandu attendance was assessed through maternal interviews and/or verification of child growth-monitoring records.

A pilot study was conducted by the authors among 44 mothers at Miri Primary Health Center, who were not included in the main study, to assess questionnaire clarity, comprehensibility, and internal consistency. The adapted social capital questionnaire underwent item validity testing using corrected item-total correlations, with all 16 items exceeding the criterion of 0.297 (range: 0.632–0.887). Internal consistency was assessed using Cronbach's alpha, yielding values of 0.967 for social capital, 0.835 for SRQ-20, and 0.935 for HFIAS. As SRQ-20 and HFIAS were established instruments supported by existing guidelines and validation studies, item validity was not reassessed in this study (Prasetio et al., 2022; Mahmudiono et al., 2018). DDS was not subjected to psychometric reliability testing because it represents a count of food groups consumed rather than a multi-item psychological scale.

6. Data Analysis

Baseline characteristics were summarized as frequencies and percentages. Bivariate associations with wasting status were assessed using the Chi-square test or Fisher's exact test, as appropriate. Variables with $p<0.250$ in bivariate analysis were entered into a multivariable binary logistic regression model. Associations are reported as odds ratios (OR) with 95% confidence intervals (CI), with $p<0.050$ considered statistically significant. Generalized Structural Equation Modeling (GSEM) was additionally performed to examine the relationships among the study variables using four structural equations comprising 16 regression paths. Binary endogenous variables were modeled using a logit link function. No missing data were identified among the variables.

7. Research Ethics

Ethical approval was obtained from the Health Research Ethics Committee of Dr. Moewardi Regional General Hospital before study initiation. Informed consent was obtained from the participants' parents or guardians, and participant confidentiality was maintained. The ethical clearance approval number was 918/IV/HREC/2025.

RESULTS

1. Sample Characteristics

The study included 204 children aged 6–59 months. Most mothers had high education (56.37%), while 52.45% of households were classified as having low economic status. Large households accounted for 55.39% of participants, and 38.24% of mothers had more than two children. High social capital was reported by 51.47% of families, impaired maternal mental health by 33.33%, and household food insecurity by 30.88%. Adequate dietary intake was found in 46.08% of children and regular *Posyandu* attendance in 64.22%. The

analytical sample contained 102 children with wasting and 102 without wasting.

Table 1. Sample characteristics and distribution of study variables

Variable	Category	n	%
Maternal education	Low	89	43.63
	High	115	56.37
Household economic status	Low	107	52.45
	High	97	47.55
Household size	Small	91	44.61
	Large	113	55.39
Number of children	Few	126	61.76
	Many	78	38.24
Social capital	Low	99	48.53
	High	105	51.47
Maternal mental health	Not impaired	136	66.67
	Impaired	68	33.33
Household food security	Secure	141	69.12
	Food insecure	63	30.88
Dietary intake	Inadequate	110	53.92
	Adequate	94	46.08
Posyandu attendance	Not regular	73	35.78
	Regular	131	64.22
Wasting	No	102	50.00
	Yes	102	50.00

2. Bivariate Analysis

Crude associations with wasting were significant for low maternal education, low economic status, large household size, more than two children, food insecurity, low dietary diversity, and irregular attendance. Low social capital (p=0.069) and maternal psychological distress (p=0.370) were not significantly associated with wasting in the crude analysis (Table 2).

Table 2. Bivariate associations between study variables and wasting status

Independent Variables	Nutritional Status				OR	p
	Normal		Wasting			
	N	%	N	%		
Maternal education						
High	75	65.22	40	34.78	4.30	<0.001
Low	27	30.34	62	69.66		
Household economic status						
High	64	65.98	33	34.02	3.52	<0.001
Low	38	35.51	69	64.49		
Household size						
Small	58	63.74	33	36.26	2.75	<0.001
Large	44	38.94	69	61.06		
Number of children						
Few	76	60.32	50	39.68	3.01	<0.001
Many	26	33.33	52	66.67		

Independent Variables	Nutritional Status				OR	p
	Normal		Wasting			
	N	%	N	%		
Social capital						
High	59	56.19	46	43.81	1.67	0.069
Low	43	43.43	56	56.57		
Maternal mental health						
No distress	71	52.21	65	47.79	1.30	0.370
Distress	31	45.59	37	54.41		
Household food security						
Secure	81	57.45	60	42.55	2.70	0.002
Insecure	21	33.33	42	66.67		
Dietary intake						
Adequate	59	62.77	35	37.23	2.62	0.001
Inadequate	43	39.09	67	60.91		
Posyandu attendance						
Regular	76	58.02	55	41.98	2.49	0.002
Irregular	26	35.62	47	64.38		

** Note: Percentages are calculated within each category of the independent variables (row percentages).*

3. Multivariate Analysis

After adjustment for all nine predictors, low maternal education (aOR=4.21; 95% CI= 2.05 to 8.63; p<0.001), low economic status (aOR=6.67; 95% CI=3.09 to 14.40; p <0.001), large household size (aOR=2.83; 95% CI=1.22 to 6.55; p=0.015), low dietary diversity (aOR=3.65; 95% CI=1.73 to 7.72; p= 0.001), and irregular attendance (aOR= 3.08; 95% CI=1.40 to 6.77; p=0.005) were associated with higher odds of wasting (Table 3).

The estimates for more than two children (aOR=1.89; 95% CI=0.79 to 4.49; p= 0.150), low social capital (aOR=1.87; 95% CI=0.89 to 3.90; p=0.094), maternal psychological distress (aOR=1.02; 95% CI= 0.47 to 2.20; p=0.942), and food insecurity (aOR=1.27; 95% CI=0.56 to 2.85; p= 0.553) were positive but not statistically significant. The reported logistic-model likelihood-ratio statistic was $\chi^2(9)=88.57$ (p <0.001), and the Hosmer–Lemeshow statistic was $\chi^2(8)=5.50$ (p=0.703). The area under the receiver operating characteristic curve was 0.854. These are within-sample measures, not external validation.

Table 3. Multivariable logistic regression of determinants of wasting

Independent variable	aOR	95% CI		p
		Lower limit	Upper limit	
Maternal education (low)	4.21	2.05	8.63	<0.001
Household economic status (low)	6.67	3.09	14.40	<0.001
Household size (large)	2.83	1.22	6.55	0.015
Number of children (many)	1.89	0.79	4.49	0.150
Social capital (low)	1.87	0.89	3.90	0.094
Maternal mental health (impaired)	1.02	0.47	2.20	0.942
Household food insecurity	1.27	0.56	2.85	0.553
Dietary intake (Inadequate)	3.65	1.73	7.72	0.001
Posyandu attendance (irregular)	3.08	1.40	6.77	0.005

4. Multivariate Analysis

The GSEM comprised four structural equations with 16 estimated pathways. The first equation examined associations of household economic status, household size, and number of children with household food insecurity. The second assessed associations of maternal education and food insecurity with inadequate dietary diversity. The third evaluated associations of maternal mental health and social capital with irregular *Posyandu* attendance. The fourth estimated the direct associations of all nine explanatory variables with wasting. The structural model is illustrated in Figure 1, and the corresponding pathway estimates are presented in Table 4.

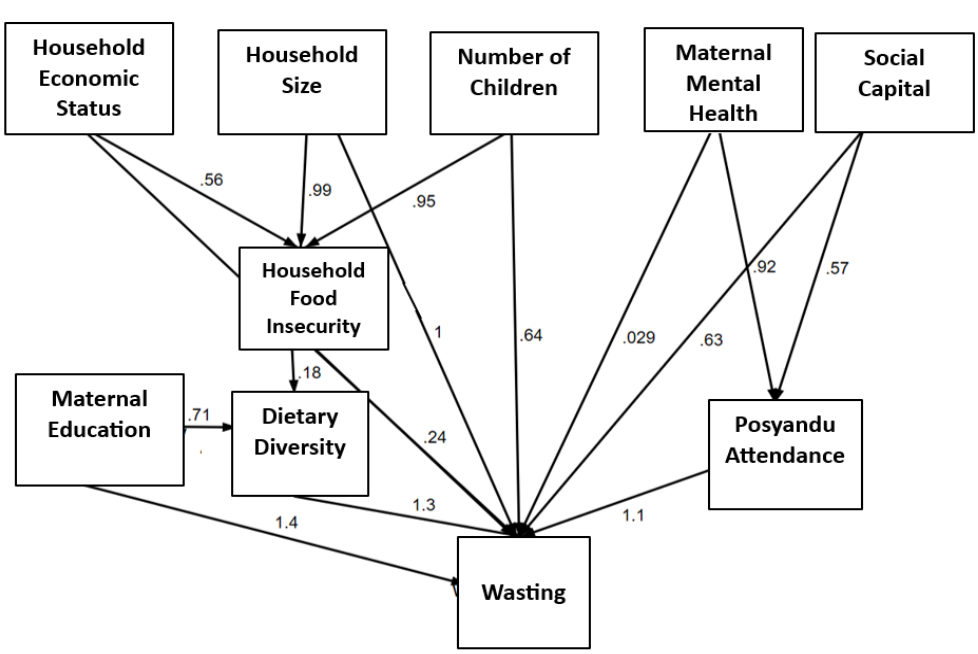


Figure 1. Generalized Structural Equation Model of Determinants Associated with Childhood Wasting

Large household size (b=0.99; p= 0.013) and having more than two children (b= 0.95; p=0.009) were significantly associated with household food insecurity, whereas low economic status showed a non-significant association (b=0.56; p= 0.091). Low maternal education was significantly associated with inadequate dietary diversity (b=0.71; p=0.015), while food insecurity was not (b=0.18; p=0.560). Maternal psychological distress (SRQ-20 score ≥6) screening was significantly associated with irregular *Posyandu* attendance (b= 0.92; p=0.003), whereas low social capital showed a nonsignificant association (b= 0.57; p=0.058).

In the wasting equation, low maternal education (b=1.44; p<0.001), low economic status (b=1.90; p<0.001), large household size (b=1.04; p=0.015), inadequate dietary diversity (b=1.30; p=0.001), and irregular *Posyandu* attendance (b=1.13; p=0.003) demonstrated significant direct associations. The direct associations of having more than two children, low social capital, positive maternal SRQ-20 screening, and household food insecurity were not statistically significant (Table 4).

The structural model also identified potential indirect pathways linking maternal education to wasting through dietary diversity and maternal psychological

distress to wasting through *Posyandu* attendance. Additional hypothesized pathways involved household socioeconomic characteristics, food insecurity, and dietary diversity. However, formal indirect-effect estimates and their statistical significance were not calculated. Therefore, these pathways should be interpreted as hypothesized associations rather than confirmed mediation effects.

Table 4. Path analysis of determinants associated with wasting

Dependent variable	Independent variable	b	95% CI		p
			Lower limit	Upper limit	
Paths to Intermediate Variables					
Food insecurity	← Economic status (low)	0.56	-0.09	1.21	0.091
Food insecurity	← Household size (large)	0.99	0.21	1.77	0.013
Food insecurity	← Number of children (many)	0.95	0.24	1.67	0.009
Irregular *Posyandu*	← Social capital (low)	0.57	-0.02	1.16	0.058
Irregular *Posyandu*	← Maternal mental health (impaired)	0.92	0.31	1.53	0.003
Inadequate dietary intake	← Food insecurity	0.18	-0.43	0.80	0.560
Inadequate dietary intake	← Maternal education (low)	0.71	0.14	1.28	0.015
Direct Pathways to Wasting					
Wasting	← Maternal education (low)	1.44	0.72	2.16	<0.001
Wasting	← Economic status (low)	1.90	1.13	2.67	<0.001
Wasting	← Household size (large)	1.04	0.20	1.88	0.015
Wasting	← Number of children (many)	0.64	-0.23	1.50	0.150
Wasting	← Social capital (low)	0.63	-0.11	1.36	0.094
Wasting	← Food insecurity	0.24	-0.56	1.05	0.553
Wasting	← Maternal mental health (impaired)	0.03	-0.74	0.79	0.942
Wasting	← Dietary intake (inadequate)	1.30	0.55	2.04	0.001
Wasting	← *Posyandu* attendance (irregular)	1.13	0.34	1.91	0.003

** Note: b represents the estimated regression coefficient on the log-odds scale. Paths to intermediate variables represent components of potential indirect pathways rather than estimated indirect effects. Formal indirect effects and their statistical significance were not calculated. CI = confidence interval; GSEM = Generalized Structural Equation Modeling.*

DISCUSSION

This study identified five determinants significantly associated with childhood wasting after adjustment: low maternal education, low household economic status, large household size, inadequate dietary diversity, and irregular *Posyandu* attendance. The GSEM analysis further identified associations between maternal education and dietary diversity, household composition and food insecurity, and maternal psychological distress and *Posyandu* attendance. These findings illustrate the interconnected nature of socioeconomic, household, nutritional, and health-service factors associated with childhood wasting, consistent with the UNICEF Conceptual Framework on Maternal and Child Nutrition (UNICEF, 2020). By integrating these factors associated with childhood wasting within a single analytical framework, this study provides additional evidence on the multidimensional characteristics of childhood wasting in an agrarian region of Indonesia.

Maternal education was significantly associated with childhood wasting, consistent with Nahar and Zahangir (2024), who

reported that children of mothers with lower educational attainment were more vulnerable to wasting in urban Bangladesh. Maternal education may facilitate the understanding of nutritional recommendations, appropriate food selection, recognition of childhood illness, and timely healthcare seeking. Furthermore, the GSEM analysis demonstrated a significant association between low maternal education and inadequate dietary diversity, suggesting that maternal educational background is relevant to children's feeding practices. These findings emphasize the importance of strengthening maternal nutrition knowledge and practical feeding skills as components of childhood wasting prevention (Nahar and Zahangir, 2024).

Low household economic status was associated with significantly higher odds of wasting. Household economic status was assessed using the proportion of total household expenditure allocated to food, consistent with Engel's law, which suggests that economically disadvantaged households tend to allocate a larger proportion of their expenditure to food. This finding is supported by Purwanti et al. (2024), who reported significant differences in family income, food expenditure, and food security between children with and without concurrent wasting and stunting in Semarang, Indonesia. Although their study examined concurrent wasting and stunting rather than wasting alone, the findings highlight the relevance of household economic conditions to childhood undernutrition (Purwanti et al., 2024).

Economic constraints may influence children's nutritional status through household purchasing power, dietary quality and quantity, access to healthcare, and environmental living conditions. In addition, infectious diseases may contribute to nutritional deterioration through reduced dietary intake, impaired nutrient absorption, and increased metabolic requirements. Although the association between household economic status and food insecurity was not statistically significant in the present GSEM analysis, the significant association with wasting underscores the importance of considering broader socioeconomic conditions in child nutrition interventions (Katoch, 2022).

Large household size was significantly associated with higher odds of wasting in both bivariate analysis (cOR= 2.75; p <0.001) and multivariable logistic regression (aOR= 2.83; 95% CI=1.22–6.55; p= 0.015). GSEM also demonstrated a significant positive association between larger household size and household food insecurity (b=0.99; p=0.013). These findings are consistent with Habtamu et al. (2022) and Kassaw et al. (2024), who reported associations between larger household size and childhood wasting.

In contrast, having more than two children was significantly associated with wasting in bivariate analysis (cOR=3.01; p<0.001), but the association was no longer statistically significant after adjustment (aOR= 1.89; p=0.150). However, GSEM identified a significant association between having more than two children and household food insecurity (b=0.95; p=0.009). These findings suggest that household size and number of children may reflect different aspects of family composition and nutritional vulnerability. Nevertheless, the cross-sectional design precludes causal interpretation.

Household food insecurity was significantly associated with wasting in crude analysis but not after adjustment, and its association with inadequate dietary diversity was also nonsignificant. This finding is broadly consistent with the initial pooled analysis by Sutrisno et al. (2026), which

found no statistically significant association between household food insecurity and wasting, although the association became significant in sensitivity analysis. Differences in population characteristics, food-security measurement, and adjustment for other determinants may contribute to variations in findings across studies. Similarly, Ismail et al. (2025) reported no significant association between household food insecurity and children's dietary diversity in Malaysia. Household food security and child dietary diversity represent complementary aspects of nutritional vulnerability. Yadav et al. (2024), in a narrative review, highlighted the potential independent and joint relationships of household food insecurity and dietary diversity with childhood undernutrition. In the present study, the GSEM analysis found no statistically significant association between food insecurity and inadequate dietary diversity. These findings suggest that the relationships among household food security, dietary diversity, and childhood wasting may vary across populations and study settings (Ismail et al., 2025; Sutrisno et al., 2026; Yadav et al., 2024).

Inadequate dietary diversity was significantly associated with higher odds of wasting, consistent with findings by Habtamu et al. (2022). Dietary diversity reflects the variety of food groups consumed and is an important dimension of dietary quality, as different food groups provide complementary nutrients essential for child growth and development. Limited dietary diversity may reduce opportunities for children to obtain sufficient nutrients, potentially increasing their vulnerability to acute malnutrition, particularly when accompanied by inadequate food intake or recurrent infections (Habtamu et al., 2022). Furthermore, GSEM analysis showed that low maternal education was significantly associated with inadequate dietary diversity, suggesting that maternal educational background may be relevant to children's feeding practices. These findings highlight the importance of promoting diverse, age-appropriate complementary and family foods as part of community-based strategies to prevent childhood wasting.

Irregular Posyandu attendance was associated with wasting. Regular participation in community-based health services may facilitate growth monitoring, early identification of nutritional problems, caregiver counseling, and timely referral when nutritional problems are detected. Becquey et al. (2023) highlighted the importance of integrating wasting prevention, screening, referral, and treatment through community-based volunteers in Chad. Similarly, Jokhu and Syauqy (2024) found an association between nonuse of Posyandu and concurrent wasting and stunting in Indonesian children aged 6–23 months. Their outcome and age range differ from this study, so the findings are relevant contextual evidence rather than an identical comparison. The present association does not show that attendance alone prevents wasting (Jokhu and Syauqy, 2024; Becquey et al., 2023).

Maternal psychological distress was significantly associated with irregular *Posyandu* attendance in the GSEM, although its direct association with wasting was not statistically significant. Maternal psychological well-being may be relevant to daily caregiving responsibilities, including planning healthcare visits, maintaining child-feeding routines, and responding to children's health needs. Khan (2022), using the Self-Reporting Questionnaire-20 (SRQ-20) in Bangladesh, reported a significant association between maternal common mental disorders and poorer preventive healthcare utilization, including growth

monitoring and immunization. This finding is consistent with the significant association between maternal psychological distress and irregular Posyandu attendance observed in the present study. However, unlike the present findings, Khan (2022) also reported a significant association between maternal common mental disorders and childhood wasting. Differences in study populations, SRQ-20 cut-off values, and adjustment for potential confounders may contribute to these contrasting results. These findings highlight the relevance of maternal psychological well-being to children's healthcare utilization and support consideration of maternal mental health within community-based maternal and child health services (Khan, 2022).

Low social capital showed positive but nonsignificant associations with irregular attendance and wasting. Information exchange, practical assistance, and trust may support service use, while the relevance of these resources depends on their content and context. Regarding health-service utilization, Mengesha et al. (2021), in a mixed-methods systematic review, highlighted the role of social capital in maternal and child health-service utilization through informational, emotional, and practical support within social networks. In relation to child nutritional status, Kudu et al. (2021) reported a significant association between higher social capital and better nutritional status among children under five in Indonesia. However, their study assessed nutritional status using weight-for-age rather than weight-for-height, limiting direct comparability with wasting in the present study. Differences in population characteristics, social capital measurement, and nutritional indicators may contribute to variations in findings across studies. Although neither association reached statistical significance in the present study, social capital may remain relevant to community participation, caregiver support, and child nutritional well-being. Further research examining specific dimensions of social capital is needed to clarify their relationships with *Posyandu* attendance and childhood wasting (Kudu et al., 2021).

From a public health perspective, the findings emphasize the value of integrating household-level risk identification with nutritional counseling and community-based health services. Maternal education, economic status, and family composition may help identify households requiring additional attention, while dietary diversity and Posyandu attendance represent practical considerations for nutritional assessment and service planning. The significant associations involving maternal psychological distress and Posyandu attendance also highlight the relevance of caregiver well-being within community health programs. These findings support coordinated strategies involving Puskesmas, *Posyandu* cadres, and relevant social-support services to strengthen early identification and nutritional support for vulnerable children.

This study has several limitations. Its cross-sectional design does not establish temporal sequence or causality, and several variables were based on maternal reports, creating potential recall and information bias. The model did not include all possible determinants of wasting, such as sanitation and water access, birth weight, detailed breastfeeding and complementary-feeding histories, and broader caregiving practices. The purposive selection of primary health centers and Posyandu may have introduced selection bias and limited the generalizability of the findings. Furthermore, dichotomization of questionnaire scores may have resulted in information loss and potential misclassification, particularly around the

selected cut-off points. The intentionally balanced distribution of wasting and non-wasting children (102 in each group) did not reflect the underlying population distribution and may have introduced additional selection-related bias.

Within this non-probability sample of 204 children, low maternal education, low household economic status, large household size, inadequate dietary diversity, and irregular Posyandu attendance were significantly associated with higher adjusted odds of wasting. GSEM further identified associations linking household composition, maternal education, and positive maternal SRQ-20 screening with food insecurity, dietary diversity, and Posyandu attendance, respectively, although indirect effects were not formally tested. The cross-sectional design, non-probability sampling, and intentionally balanced wasting and non-wasting groups limit causal interpretation and generalizability and preclude estimation of population wasting prevalence. These findings may inform locally tailored nutrition programs that integrate dietary assessment, growth monitoring, socioeconomic considerations, and attention to maternal well-being within existing *Posyandu* services. However, the effectiveness of such interventions requires further evaluation.

AUTHOR CONTRIBUTIONS

LDS contributed to the study conceptualization, research design, data collection, data analysis, and manuscript preparation. SH and RGHN contributed to the study conceptualization, research design, methodological guidance, interpretation of results, and critical revision of the manuscript. HWN and AGM contributed to the interpretation of findings, critical evaluation of the research, and substantive revision of the manuscript. All authors contributed to the intellectual development of the study, reviewed the manuscript, and approved the final version for publication.

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CONFLICT OF INTEREST

The authors declare that the study was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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