

# Determinant Factors of Stunting in Toddlers in South Jakarta City, Indonesia: A Cross-Sectional Study

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## ABSTRACT

**OBJECTIVE:** To identify factors associated with stunting among children aged 0–59 months in South Jakarta, Indonesia

**METHODOLOGY:** This study was conducted in a cross-sectional setting in South Jakarta, including 392 toddlers (aged 0-59 months) randomly selected from 20,210 toddlers. Medical records were collected from community health centres, and mothers/caregivers were interviewed for qualitative data collection alongside a cross-sectional quantitative design. Stunting was defined as a height-for-age z-score of <-2 SD in the WHO standard form. Bivariate analysis was carried out using the Spearman Rank correlation test, while multivariate analysis was performed by binary logistic regression.

**RESULTS:** Fifty percent of 392 participants reported stunting (n = 196). Multivariate analyzes also found that independent factors of stunting were maternal age in Pregnancy ≥35 years (AOR=2.96; 95% CI: 1.24–7.04; p=0.014), not receiving complementary feeding (AOR=2.70; 95% CI: 1.48–4.92; p=0.001), not exclusive breastfeeding (AOR=3.43; 95% CI: 1.87–6.30; p<0.001), ANC visits ≤5 times (AOR=3.40; 95% CI: 1.20–9.66; p=0.022), primary education (AOR=3.84; 95% CI: 1.64–9.01; p=0.002) and male gender (AOR=6.30; 95% CI: 1.90–20.86; p=0.003). Employment status was not associated with immunization. The model fit was good (Hosmer–Lemeshow p=0.72; Nagelkerke R<sup>2</sup>=0.24).

**CONCLUSION:** Exclusive breastfeeding, complementary feeding, ANC visits, maternal education, gestational age and toddler sex are independent determinants of stunting. An urban at-risk population in need of supportive nutritional interventions and social protective measures are a necessity.

**KEYWORDS:** Stunting, toddlers, exclusive breastfeeding, complementary feeding, antenatal care

## INTRODUCTION

Stunting is one of the most severe constraints on human growth worldwide, caused by reduced linear growth due to chronic malnutrition from an early age.<sup>1</sup> In 2020, approximately 149.2 million children, 22 percent of all children, will be stunted, 21.8 percent of whom will be in Asia. South Asia is the largest region in Asia, with a prevalence of 30.7%, followed by Southeast Asia with 27.4%.<sup>2</sup>

At the regional level, Indonesia has one of the highest stunting burdens in Southeast Asia. Indonesia has the third-highest stunting prevalence in Southeast Asia; this figure remains among the highest in Southeast Asia and globally<sup>3</sup>. At the national level, the 2018 Basic Health Survey reported a stunting prevalence of 30.8%<sup>4</sup>, while subsequent nutritional status surveys showed a downward trend: 27.7% (2019), 24.4% (2021), and 21.6% (2022)<sup>4</sup>.

From a conceptual perspective, the reported recurrent determinants include family socioeconomic status and parental education<sup>5</sup>, maternal knowledge regarding stunting/nutrition, maternal health conditions during Pregnancy, including nutritional

status and antenatal care<sup>6</sup>, and infection and childhood illness<sup>6</sup>. In Jakarta, local evidence suggests a significant economic impact. In South Jakarta, studies found that families earning below the regional minimum wage had a significantly higher chance of stunting (around six to seven times) compared to those earning above the minimum wage<sup>7</sup>.

However, most literature on factors influencing stunting in Indonesia remains cross-sectional and/or focuses on areas beyond Jakarta's urban context, which limits understanding of sequential exposure and incidence. Not enough has been studied of stunting and the risk dynamics specific to the urban area. Thus, a study in South Jakarta City is needed to identify the factors that decisively affect stunting incidence over time and to demonstrate the need to strengthen nutritional and social protection interventions for vulnerable urban populations.

The main objective of this study was to determine factors influencing stunting among toddlers in South Jakarta, Indonesia. This study contributes to the literature by mapping the determinants of stunting in a dense urban context (South Jakarta City) using routine health facility data (medical records and Community Health Centre data) and a population-based cross-sectional design. This study not only tests bivariate associations but also presents multivariate modeling with model fit indicators, thus strengthening the inference of independent factors.

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doi: 10.22442/jlumhs.2026.01478

Received: 19-03-2026

Revised: 11-05-2026

Accepted: 25-05-2026

Online First: 27-07-2026



## METHODOLOGY

This research was Cross-sectional. This design allows systematic examination of associations and risk prediction models through both bivariate and multivariate analyses.

The research was conducted from May to December 2025, covering the stages of instrument preparation, instrument trials, enumerator training, sampling, health record searches, structured interviews, data processing, and statistical analysis. The study was carried out in South Jakarta, DKI Jakarta, Indonesia. The specific location was determined based on the epidemiology, which demonstrates very high stunting prevalence despite some degree of regional health program implementation.

### Sample

The target population for this study includes mothers with toddlers aged 0-59 months in South Jakarta. We identified a pool of 20,210 toddlers as potential participants, and ultimately selected 392 through simple random sampling. The sample size was determined using the Slovin formula.

$$n = \frac{N}{1 + Ne^2}$$

$$n = 20,210 / (1 + 20,210 (0.05)^2)$$

$$n = 392$$

Information:

n = sample size

N = 20,210

e = 0.05

Simple random sampling gives every subject in the sampling frame (N=20,210) an equal chance of selection, theoretically minimizing selection bias and maximizing external validity.

To maintain internal validity, this study established inclusion criteria comprising: (1) children aged 0–59 months registered at Primary Health Centres within the South Jakarta area, (2) availability of anthropometric data (length/height-for-age) at the health facility, (3) willingness of the mother/ caregiver to participate and provide informed consent, and (4) possession of a Maternal and Child Health book for verification purposes. The exclusion criteria encompassed: (1) children with congenital abnormalities or chronic diseases that independently affect linear growth, (2) incomplete or inaccessible health records precluding stunting classification, (3) mothers/caregivers unable to communicate or respond to structured interviews, and (4) families who relocated outside the study area during the data collection period. The establishment of these criteria ensures sample homogeneity while acknowledging that such exclusions may limit generalizability to the broader population.

### Data collection procedure

Data were collected through two main stages. First, historical data on toddlers were extracted from medical records at Primary Health Centres per village/sub-district and records of the South Jakarta City Health Office, covering health intervention

history, immunization status based on service records, and anthropometric evaluations (length/height and available nutritional status indicators). Extraction was performed using a standardized extraction sheet (pro forma) to ensure consistency among enumerators and minimize transcription errors. Of the total 420 medical records extracted, 285 (67.86%) had complete data on all variables, while 135 (32.14%) had one or more incomplete variables, particularly maternal age during Pregnancy, ANC visit frequency, and breastfeeding history.

Second, for incomplete medical records, we completed and verified data through structured questionnaires administered to mothers/caregivers. Completed variables included maternal age during Pregnancy, ANC visit frequency, breastfeeding history and practices (including exclusive breastfeeding), complementary feeding practices, and immunization status verified using the Maternal and Child Health book. Ten Enumerators were trained in structured questioning techniques, ethical probing, and consistent recording.

Drop-out criteria were established as follows: participants were excluded from analysis if (1) medical records could not be traced at the health facility, (2) the mother/caregiver could not be contacted after 3 (three) contact attempts, or (3) missing data exceeded 30% of the total required variables. A total of 28 participants met the drop-out criteria, resulting in a final sample of 392 toddlers.

Third, instrument trials, standardization procedures, confidentiality training, and quality control were conducted to ensure instrument reliability and internal consistency.

### Operational definition

Stunting is a linear growth failure condition in toddlers, which is defined using height-for-age (H/A) or length-for-age (L/A) metrics. Stunting classification is based on anthropometric standards for children (most often WHO), whereby toddlers are stunted if the H/A or L/A z-score is < -2 SD and not stunted if ≥ -2 SD, according to anthropometric data in nutritional records/nutritional assessments available at health facilities. Antenatal care (ANC) is defined as the number of pregnancy visits. Description categories were ≤5 times and ≥6 times in the descriptive table. We operationalized exclusive breastfeeding as providing only breast milk without other feedings/drinks (except medicines/supplements as indicated) for the first 6 months, coded as yes/no based on the mother/caregiver and/or KIA report, if available. Complementary feeding was defined as the practice of providing complementary feeding after 6 months and was scored as yes/no per the study criteria. Immunization status was measured as received immunization (yes vs no) according to health facility records and/or KIA Handbook Verification. Education among mothers was also operationalized as the most comprehensive level of education (or, in this case, as

ranking in the data sets used in the analyses). Maternal age at Pregnancy was provided in years and used numerically or categorically in the models of interest. Maternal employment was operationalized as working/not working status or relevant employment categories.

### **Instrument**

The research tools used were (1) a structured questionnaire for mothers/caregivers and (2) a health record extraction form. The items within the questionnaire include maternal demographic characteristics (i.e., maternal age at pregnancy, level of education, and occupation), maternal service utilization history (ANC frequency), infant and child feeding practices (exclusive breastfeeding, breastfeeding pattern, timing and practices of the introduction and provision of complementary feeding) and immunization information for supplementation/verification. Pilot testing was conducted to assess the quality of measurement. The reliability of the internal consistency of the questionnaire was high (Cronbach's  $\alpha = 0.85$ ). At the same time, the stability over time was evaluated by a one-week test-retest ( $r = 0.78$ ), which indicated good stability. We extracted documented historical and clinical data (subject pseudonym codes, summaries of health interventions, immunization status from service records, and anthropometric/nutritional status assessment scores for stunting classification) using an extraction sheet. Variables included stunting incidence outcomes (dichotomous), predominant exposures (complementary breastfeeding practices, exclusive breastfeeding, frequency of ANC), covariates (education, age at pregnancy, occupation, and immunization), and model quality (Nagelkerke pseudo- $R^2$ , Hosmer–Lemeshow test, and VIF).

The validity of the research instrument was evaluated through two main approaches. A panel of nutritionists, midwives, and epidemiologists assessed content validity through expert judgment of ensure each item suited the construct being measured. The Content Validity Index (CVI) was calculated based on the proportion of inter-rater agreement, with a CVI value of 0.89. Construct validity was tested through a pilot test of the instrument on a pilot sample, where each question item was analyzed using corrected item-total correlation. Items with a correlation value of  $r \geq 0.38$  were considered. The medical record data extraction form was validated through cross-checking between the extracted data by two independent data collectors to ensure consistency and accuracy of recording. The entire validation process was conducted before the main data collection to ensure measurement quality.

### **Data Analysis**

Statistical analyses were carried out in steps (descriptive, bivariate and multivariate analyses). At the descriptive stage, we presented all categorical variables as frequencies (n) and percentages (%) to describe the distribution of sample characteristics (n=392), including coverage of nutritional services/

practices such as ANC, exclusive breastfeeding, complementary feeding, and immunization. For bivariate analysis, we tested the correlation between each independent variable and the incidence of stunting and used a Spearman Rank Correlation Test because it suits ordinal/dichotomous data and detects monotonic relationships without requiring parametric assumptions. Significance was set at  $p < 0.05$ . For multivariate analysis, binary logistic regression was performed to assess the simultaneous effects of MP-ASI, breastfeeding, ANC, and education on the odds of stunting, reported as OR (Exp(B)) with 95% CI, and verified using model diagnostics (Nagelkerke  $R^2$ , Hosmer–Lemeshow test, and VIF).

## **RESULTS**

**Table I** displays the characteristics of 392 participants (mothers of toddlers) from the examination of factors that influence toddler stunting in South Jakarta City. The total sample included 196 stunted cases (50.00%) and 196 controls (50.00%). The mean maternal age at Pregnancy was 30.23 years. A notable percentage (65.82%) fell within the 20-35 age group (mean = 26.72 years); 4.08% of mothers were under 20 years (mean = 18.84 years), and 30.10% were over 35 years old (mean = 39.45 years). Regarding education, almost all subjects had basic (38.01%), intermediate (35.20%), and tertiary (26.79%) levels. For work, 57.40% were employed, and 42.60% were unemployed. Toddlers had an almost equal gender distribution of 51.02% female and 48.98% male.

**Table II** presents the frequency distribution and bivariate analysis using Spearman's rank correlation for factors associated with stunting. Variables significantly associated with stunting include maternal age during pregnancy ( $p = 0.001$ ), complementary feeding ( $p < 0.001$ ), exclusive breastfeeding ( $p < 0.001$ ), antenatal care visits ( $p < 0.001$ ), maternal education ( $p < 0.001$ ), and toddler gender ( $p = 0.004$ ). Exclusive breastfeeding showed the strongest correlation ( $r = 0.453$ ). Conversely, maternal occupation ( $p = 0.611$ ) and immunization status ( $p = 0.301$ ) showed no statistically significant association with stunting.

Results of multivariate logistic regression (**Table III**) indicate a good model fit (Hosmer–Lemeshow  $\chi^2 = 5.98$ ;  $p = 0.72$ ) and moderate explanatory power (Nagelkerke's pseudo  $R^2 = 0.24$ ). VIF values ranged from 1.02 to 1.83, suggesting no multicollinearity. Independent, and significant associations between variables and stunting, were: maternal age  $\geq 35$  years at Pregnancy (AOR = 2.96; 95% CI: 1.24–7.04;  $p = 0.014$ ), not receiving complementary feeding (AOR = 2.70; 95% CI: 1.48–4.92;  $p = 0.001$ ), not receiving exclusive breastfeeding (AOR = 3.43; 95% CI: 1.87–6.30;  $p < 0.001$ ), fewer than five ANC visits (AOR = 3.40; 95% CI: 1.20–9.66;  $p = 0.022$ ), basic education (AOR = 3.84; 95% CI: 1.64–9.01;  $p = 0.002$ ), and male gender (AOR = 6.30; 95% CI: 1.90–20.86;  $p = 0.003$ ). In contrast, employment status (AOR = 1.02;

95% CI: 0.78–1.34;  $p = 0.871$ ) and immunization status (AOR = 1.05; 95% CI: 0.83–1.32;  $p = 0.709$ ) were not significantly associated with stunting.

**Table I: Respondent Characteristics**

| Characteristic                        | Frequency | Mean         | Percentage |
|---------------------------------------|-----------|--------------|------------|
| <b>Age During Pregnancy (Years)</b>   |           | <b>30.23</b> |            |
| 20 to 35                              | 258       | 26.72        | 65.82      |
| ≤ 20                                  | 16        | 18.84        | 4.08       |
| ≥ 35                                  | 118       | 39.45        | 30.10      |
| Total                                 | 392       |              | 100.00     |
| <b>Stunting Status (The Toddlers)</b> |           |              |            |
| Stunted                               | 196       |              | 50.00      |
| Non-Stunted                           | 196       |              | 50.00      |
| Total                                 | 392       |              | 100.00     |
| <b>Education (Mothers)</b>            |           |              |            |
| Basic (Elementary)                    | 149       |              | 38.01      |
| Middle (Junior-Senior)                | 138       |              | 35.20      |
| High (University)                     | 105       |              | 26.79      |
| Total                                 | 392       |              | 100.00     |
| <b>Occupation (Mothers)</b>           |           |              |            |
| Not Working                           | 167       |              | 42.60      |
| Working                               | 225       |              | 57.40      |
| Total                                 | 392       |              | 100.00     |
| <b>Gender of Toddlers</b>             |           |              |            |
| Male                                  | 192       |              | 48.98      |
| Female                                | 200       |              | 51.02      |
| Total                                 | 392       |              | 100.00     |

**Table II: Frequency Distribution and Bivariate Analysis (Spearman's Rank Correlation) of Factors Associated with Stunting**

| Variables                           | Stunted n (%) | Non-Stunted n (%) | Correlation Coefficient | p-value |
|-------------------------------------|---------------|-------------------|-------------------------|---------|
| <b>Age During Pregnancy (Years)</b> |               |                   | 0.198                   | 0.001   |
| 20–35 (ref)                         | 110 (56.12)   | 148 (75.51)       |                         |         |
| ≤ 20                                | 10 (5.10)     | 6 (3.06)          |                         |         |
| ≥ 35                                | 76 (38.78)    | 42 (21.43)        |                         |         |
| <b>Complementary Feeding</b>        |               |                   | 0.372                   | < 0.001 |
| Yes                                 | 58 (29.59)    | 131 (66.84)       |                         |         |
| No                                  | 138 (70.41)   | 65 (33.16)        |                         |         |
| <b>Exclusive Breastfeeding</b>      |               |                   | 0.453                   | < 0.001 |
| Yes                                 | 49 (25.00)    | 138 (70.41)       |                         |         |
| No                                  | 147 (75.00)   | 58 (29.59)        |                         |         |
| <b>Antenatal Care</b>               |               |                   | 0.367                   | < 0.001 |
| ≤ 5 visits                          | 138 (70.41)   | 66 (33.67)        |                         |         |
| ≥ 6 visits                          | 58 (29.59)    | 130 (66.33)       |                         |         |
| <b>Education (Mothers)</b>          |               |                   | 0.224                   | < 0.001 |
| Basic (Elementary)                  | 91 (46.43)    | 58 (29.59)        |                         |         |
| Middle (Junior–Senior)              | 70 (35.71)    | 68 (34.69)        |                         |         |
| High (University)                   | 35 (17.86)    | 70 (35.71)        |                         |         |
| <b>Gender of Toddlers</b>           |               |                   | 0.143                   | 0.004   |
| Male                                | 110 (56.12)   | 82 (41.84)        |                         |         |
| Female                              | 86 (43.88)    | 114 (58.16)       |                         |         |
| <b>Occupation (Mothers)</b>         |               |                   | 0.026                   | 0.611   |
| Not Working                         | 86 (43.88)    | 81 (41.33)        |                         |         |
| Working                             | 110 (56.12)   | 115 (58.67)       |                         |         |
| <b>Immunization (Toddlers)</b>      |               |                   | –0.053                  | 0.301   |
| Yes                                 | 142 (72.45)   | 132 (67.35)       |                         |         |
| No                                  | 54 (27.55)    | 64 (32.65)        |                         |         |

**Table III: Multivariate Analysis Results Using Multiple Logistic Regression**

| Variables                           | B     | SE    | Wald $\chi^2$ | AOR  | df | Sig.   | VIF  | 95% CI Lower | 95% CI Upper |
|-------------------------------------|-------|-------|---------------|------|----|--------|------|--------------|--------------|
| (Constant)                          | –     | –     | –             | –    | –  | –      | –    | –            | –            |
| Age During Pregnancy (≥35 vs 20-35) | 1.086 | 0.442 | 6.03          | 2.96 | 1  | 0.014  | 1.25 | 1.24         | 7.04         |
| Complementary Feeding (No vs Yes)   | 0.993 | 0.306 | 10.53         | 2.70 | 1  | 0.001  | 1.78 | 1.48         | 4.92         |
| Exclusive Breastfeeding (No vs Yes) | 1.232 | 0.310 | 15.80         | 3.43 | 1  | <0.001 | 1.83 | 1.87         | 6.30         |
| Antenatal Care (≤5 vs. ≥6 visits)   | 1.223 | 0.533 | 5.26          | 3.40 | 1  | 0.022  | 1.54 | 1.20         | 9.66         |
| Education (Basic vs High)           | 1.345 | 0.435 | 9.57          | 3.84 | 1  | 0.002  | 1.82 | 1.64         | 9.01         |
| Gender of Toddlers (Male vs Female) | 1.840 | 0.611 | 9.07          | 6.30 | 1  | 0.003  | 1.81 | 1.90         | 20.86        |
| Immunization (Yes vs No)            | 0.044 | 0.118 | 0.14          | 1.05 | 1  | 0.709  | 1.17 | 0.83         | 1.32         |

**Diagnostic Test:**

\* Pseudo  $R^2$  (Nagelkerke) = 0.24

\*Hosmer–Lemeshow test:  $\chi^2 = 5.98$ ,  $p = 0.72$

**DISCUSSION**

The findings revealed that maternal age during pregnancy, provision of complementary foods, exclusive breastfeeding, antenatal care (ANC) visits,

maternal education, and toddler gender were significant predictors of stunting in the study. These findings are in line with the common consensus that stunting is a persistent growth retardation outcome, influenced by multilevel determinants including

maternal variables, feeding practices of infants and young children and use of health services, as well as child-level measures<sup>8</sup>. Conceptually, the study's emphasis on breastfeeding and complementary feeding is consistent with evidence that poor child feeding practices are a major driver of stunting and require targeted behavior change communication and nutrition<sup>9</sup>.

At the same time, the directionality of maternal age effects can vary across contexts. Evidence suggests that increasing maternal age may reduce the probability of stunting, potentially through accumulated maternal knowledge and experience regarding childcare and health-seeking<sup>10</sup>.

The strongest associations in the present study were for feeding variables: absence of complementary feeding and lack of exclusive breastfeeding were both strongly associated with higher odds of stunting in bivariate analysis and remained independently associated in multivariate analysis. This pattern aligns with the broader evidence base emphasizing IYCF as a critical proximal determinant of linear growth<sup>11</sup>, and with Indonesian findings that feeding practices and caregiving patterns are strongly related to stunting outcomes<sup>12</sup>.

In the present analysis, ANC visit frequency was strongly associated with stunting, with fewer visits linked to increased odds of stunting in bivariate analysis and remaining significant after adjustment in the multivariate model. This association aligns with broader maternal and antenatal care pathways linked to stunting risk, where maternal and antenatal factors are frequently identified as contributors to child growth outcomes<sup>13</sup>. More generally, conceptual models of stunting highlight maternal nutrition and infection during Pregnancy and related maternal factors as key upstream determinants of fetal growth and subsequent child growth trajectories<sup>14</sup>.

The present findings therefore support an interpretation that ANC may serve as a platform for prevention through maternal nutrition monitoring, health education, and early identification of pregnancy-related risks that can influence fetal and infant growth<sup>15</sup>. This interpretation aligns with the broader literature emphasizing that monitoring maternal nutritional status during Pregnancy is recommended given its links to child growth outcomes<sup>16</sup>.

In the present study, maternal education was significantly associated with stunting, with lower education linked to higher odds of stunting in bivariate analysis and remaining independently associated in multivariate analysis. This is consistent with evidence from Indonesia demonstrating the importance of maternal education in relation to stunting among young children<sup>17</sup>, as well as with broader cross-context evidence indicating that parents' (including mothers') education contributes to child growth differences and stunting risk<sup>18</sup>. Additionally, studies synthesizing determinants of

maternal knowledge and nurturing care emphasize that maternal education is consistently associated with child stunting and functions as a major predictor across settings<sup>19</sup>.

The present study found that male toddlers had higher odds of stunting than female toddlers, and this association remained significant in multivariate analysis. This aligns with evidence reported in population analyses where male children often have a higher chance of being stunted compared with female children<sup>20</sup>.

Research on low-income Indonesian families has directly examined whether mothers' employment is a risk factor, highlighting the relevance of contextual socioeconomic stratification when interpreting employment effects<sup>21</sup>. Thus, the present study's lack of association may reflect local conditions in South Jakarta where employment could be offset by improved household resources or alternative caregiving arrangements, consistent with the observation that stunting is shaped by multiple intersecting determinants rather than any single socioeconomic indicator<sup>22</sup>.

Although the present model showed acceptable calibration (Hosmer–Lemeshow p-value indicating good fit) and moderate explained variance, the broader literature suggests that many determinants of stunting extend beyond maternal-child characteristics, particularly environmental conditions such as water, sanitation, and hygiene (WASH). Evidence from multiple settings shows that improved access to drinking water and sanitation is associated with reduced odds of stunting, and these relationships can persist after adjusting for sociodemographic confounders<sup>23–27</sup>.

The primary novelty of this study lies in providing context-specific evidence on stunting predictors in urban South Jakarta, where maternal employment was not significantly associated with stunting, unlike findings from other Indonesian studies. This suggests that stunting determinants depend on context. Additionally, the study simultaneously integrated maternal, feeding, and child-level variables within a single multivariate model. Overall, the contribution is confirmatory and contextual, informing locally relevant intervention strategies.

## CONCLUSION

This case-control study of 392 mothers with toddlers in South Jakarta City demonstrates that six independent factors significantly influence stunting. Multivariate logistic regression identified that lack of exclusive breastfeeding (AOR = 3.43), lack of complementary feeding (AOR = 2.70), fewer than five antenatal care visits (AOR = 3.40), maternal age  $\geq 35$  years at Pregnancy (AOR = 2.96), basic education level (AOR = 3.84), and male gender (AOR = 6.30) were significant predictors of stunting. Conversely, maternal employment status and immunization status were not significantly associated with stunting. These

findings underscore the need for targeted interventions focusing on promoting exclusive breastfeeding and appropriate complementary feeding, enhancing antenatal care access, and providing nutritional education particularly for mothers with lower educational attainment and advanced maternal age.

### **Practical Implication**

These findings have several concrete implications for health programs in South Jakarta. First, strengthen IYCF (Infant and Young Child Feeding) counselling at existing posyandu (integrated health posts) and community health centres, with targeted behaviour change communication emphasizing timely introduction of complementary foods and exclusive breastfeeding for the first six months. Second, ANC (Antenatal Care) coverage should be increased beyond the minimum visit threshold by integrating maternal nutrition screening and growth monitoring protocols to identify at-risk pregnancies early. Third, community-based nutrition education programs should specifically target mothers with lower educational levels, using culturally appropriate messages and peer support models to improve feeding knowledge and practices. Fourth, given the higher odds of stunting among male toddlers, growth monitoring programs should incorporate sex-disaggregated surveillance to enable early detection and intervention. Finally, intersectoral collaboration that integrates WASH (Water, Sanitation, and Hygiene) improvements with nutrition-specific interventions is needed, given that unmeasured environmental determinants likely contribute substantial unexplained variance in current models.

### **Strength and Limitations**

This study used a cross-sectional design, so the associations found are associative and cannot confirm causality or the temporal sequence of exposure to stunting events. However, the study's strength lies in the use of a multivariate prediction model with a goodness-of-fit test (Hosmer–Lemeshow  $p=0.72$ ) and indications of low multicollinearity ( $VIF=0.98-1.83$ ), resulting in relatively stable association estimates. This study also demonstrated standardized extraction sheets, enumerator training, and good instrument reliability ( $\alpha=0.85$ ; test–retest  $r=0.78$ ). Nagelkerke's pseudo  $R^2$  value of 0.24 indicates that the model is only able to explain 24% of the variation in stunting incidence, so that the other 76% of the variation is influenced by factors that were not measured in this study, such as micronutrient intake, genetic factors, environmental sanitation conditions, and maternal health status during Pregnancy.

### **RECCOMENDATION**

Future stunting prevention programs in South Jakarta should strengthen IYCF counselling at posyandu by emphasizing exclusive breastfeeding and timely complementary feeding; increase ANC visit frequency with integrated maternal nutrition screening,

particularly for mothers aged  $\geq 35$  years; and implement community-based nutrition education targeting mothers with lower educational attainment. Sex-disaggregated growth monitoring should be adopted for early detection among male toddlers, and future research should employ longitudinal designs incorporating WASH and micronutrient variables.

### **ACKNOWLEDGEMENT**

We express our deepest gratitude to all individuals and institutions that contributed to the implementation of this research. First, we thank Poltekkes Kemenkes Denpasar for their support and guidance throughout the research process. We also thank the parents and caregivers who participated in the study, enabling us to collect relevant data to understand the factors influencing stunting among toddlers in South Jakarta. We also thank the local health team for providing data and logistical support throughout the research. Finally, we thank our fellow researchers and academics for their valuable input and encouragement throughout the preparation of this thesis.

**Ethical Permission:** The Health Research Ethics Committee of the Denpasar Health Polytechnic, Ministry of Health, approved this study in May 2025 (approval number: IRB.02.03/EA/KEPK/0351/2025).

**Conflict of interest:** There is no conflict of interest between the authors.

**Financial Disclosure / Grant Approval:** The Ministry of Health of Indonesia funded this research, No. LK.fund/1125/2025.

**Data Sharing Statement:** The corresponding author can provide the data supporting the findings of this study upon request. Privacy or ethical restrictions bound us from sharing the data publicly.

### **AUTHOR CONTRIBUTION**

Achjar KAH: Substantial contributions to the conception or design of the work or the acquisition, analysis, or interpretation of data for the work and drafting the work or revising it critically for important intellectual content; AND Final approval

Alamsyah D: Substantial contributions to the conception or design of the work or the acquisition, analysis, or interpretation of data for the work, drafting the work or revising it critically for important intellectual content; AND Final approval

Gama IK: Substantial contributions to the conception or design of the work or the acquisition, analysis, or interpretation of data for the work, drafting the work or revising it critically for important intellectual content; AND Final approval

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