ORIGINAL ARTICLE

# Impact of maternal behavior and history of infectious diseases during pregnancy on the prevalence of stunting among children under five years

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**Received** 2 July 2024 **Revised:** 9 September 2024 **Accepted:** 11 September 2024 **Available online:** January 2025
**DOI:** 10.55131/jphd/2025/230115

## ABSTRACT

The prevalence of stunting in children under 5 years of age is a problem that must be resolved, mothers are people who have an important role in stunting prevention efforts, so prevention efforts are relevant in reducing the prevalence of stunting in Indonesia. A cross sectional design was conducted on 532 participants. Simple random sampling and proportional sampling techniques were used for sampling. Structured questionnaires were used to collect data through interviews and anthropometric measurements. Multiple logistic regression analysis and statistical significance expressed at 95% CI were used. Mothers who had a low knowledge score (OR=4.8, 95% CI=3.1-7.3), low attitude score (OR=2.0, 95% CI=1.3-3.1), low action score (OR=1.8, 95% CI=1.1-2.7), and a history of infectious diseases during pregnancy (OR=2.2, 95% CI=1.4-3.5) were the main causal factors of stunting. Maternal behaviour is a significant determinant of stunting in children under 5 years old. If a mother has low scores in knowledge attitude score, score, along with a history of infectious diseases during pregnancy, the chance of stunting is 85.7%. Therefore, strategies and programmes that focus on mothers are the right choice, and increasing maternal knowledge is necessary to improve maternal attitudes and actions.

**Key words:**
stunting; maternal knowledge; maternal attitude; maternal action; infectious disease

**Citation:**
Dian Mariza Riskiah, Ayu Yuliani Sekriptini, Loso Judijanto, Khariri Khariri, Agung Sutriyawan, Ade Elvina. Impact of maternal behavior and history of infectious diseases during pregnancy on the prevalence of stunting among children under five years. J Public Hlth Dev. 2025;23(1):196-206
(https://doi.org/10.55131/jphd/2025/230115)

# INTRODUCTION

Chronic malnutrition in children under the age of five represents a significant global health concern, affecting communities across the world.[1] Stunting, a form of chronic malnutrition, occurs when children are unable to reach their full growth potential, resulting in significant physical and cognitive impairments.[2] This has a profound impact on the child's future growth and development, with adverse consequences in childhood.[3] Stunting is one of the leading causes of disease-related mortality, accounting for approximately 3.1 million or 45% of child deaths globally each year.[4]

In comparison with the ASEAN nations, Indonesia's stunting rate (24.4%) is lower than that of Myanmar (35%) but higher than that of Vietnam (23%), Malaysia (17%), Thailand (16%), and Singapore (4%).[5,6] The stunting rate in Indonesia is still far from the 14 percent reduction target set for 2024. According to the 2023 Indonesian Health Survey, the national stunting prevalence was 21.5 percent, a decrease of about 0.8 percent compared to the previous year.[7] Bandung, which is one of the largest cities in Indonesia, also still has a burden of this disease. In 2022 the prevalence of stunting reached 6.43% with an absolute number of cases of 6,518 children.[8] The programme to reduce the prevalence of stunting is a priority for the current government. The Indonesian government has made many improvements to reduce the prevalence of stunting and malnutrition in Indonesia. Government policies in Indonesia focused on reducing the prevalence of stunting include several programs, namely ending hunger, achieving food security and improved nutrition, and launching sustainable agriculture, as well as overcoming stunting in children. In addition, the programme accelerates stunting reduction by increasing the effectiveness of specific and sensitive nutrition interventions.[9]

The problem of stunting is complex as several conceptual frameworks have suggested, focussing on child undernutrition, maternal undernutrition, and food and nutrition security. The main causes of stunting are multifactorial, interrelated factors such as biological, social and environmental factors.[10] Several previous studies have assessed risk factors for stunting, such as those conducted in India,[11] Malaysia,[12] China,[13] and Brazil.[14] In order to decrease the occurrence of stunting, it is necessary to implement suitable programs that are tailored to address the specific needs. Furthermore, efforts to prevent stunting should be targeted towards low-income populations. Hence, a crucial aspect of developing a successful program involves recognizing maternal conduct, as mothers play a significant part in the endeavor to avoid stunting. This ensures that prevention efforts are pertinent in diminishing the occurrence of stunting in Indonesia. The objective of this study is to assess the impact of income, maternal behaviour, and infectious diseases on maternal during pregnancy on the prevalence of stunting among children under five years.

# METHOD

### *Research Design*

An observational study with a cross-sectional design was used in this study to analyse the influence of behaviour and infectious diseases on the prevalence of stunting in children under 5 years old. Bandung City, which is one of the areas with a high prevalence of stunting, was chosen as the research location. This study has been approved by the health research ethics committee of Bhakti Kencana University with Number 083/09.KEPK/

UBK/VII/2023. All respondents have agreed to participate in the research voluntarily. Consent was written and signed by all participants before starting the interview.

***Sampling Technique***

The population of this study was all children aged 24-59 months. The sample size was taken using the A-priori Sample Size for Structural Equation Models Formula (power test = 80% and probability level = 5%). Thus, the sample size was 532 respondents. From a total of 30 sub-districts in Bandung City, 10 sub-districts were selected using random sampling techniques. A census of the 10 sub-districts was conducted to generate a list of randomly selected houses to count all children aged 24-59 months. All children aged 24-59 months living more than 2 years in Bandung City and meeting the eligibility criteria were strictly sampled. Only homes that met the inclusion criteria were considered for the sample. To determine the number of samples from each sub-district, proportional sampling was used. Eventually, mothers and children from each sub-district were selected and enrolled using the simple random sampling method. Households were selected using the lottery method. If there was more than one eligible child in a household, only one child was selected using the lottery method.

***Research Instrument***

The measurement procedure uses standard child anthropometry. This measurement is carried out in a standing position. The child will be asked to stand upright on a height measuring device, barefoot, with their head positioned at eye level. The classification of nutritional status assessment based on the Anthropometric Index is in accordance with the nutritional status categories in the WHO Child Growth Standards for children aged 0-5 years.[15,16] If the anthropometric measurement results fall within a Z score < -2 SD, the child is categorised in the stunting toddler group. If the results of measurements fall within a Z score of ≥ -2SD, the children are categorised as the normal group (toddlers are not stunted). In the income variable, family income is calculated as the total income earned (husband + wife) in 1 month. The cut off point used is the regional minimum wage of Bandung City in 2024, which is IDR 4,200,000,-. Low income was categorised as total income < less than the Bandung City regional minimum wage, and high income was categorised as total income ≥ Bandung City regional minimum wage.

The researcher utilized a questionnaire that was developed for the study. The knowledge questionnaire used in this study pertains to the subject of nutrition. The knowledge questionnaire employs a Guttman scale with 20 items. Participants are given the option to select from three answer categories, namely "yes", "no", and "don't know", for each statement. Participants were assigned a score of 1 for a correct response and 0 for an incorrect response or if they indicated that they did not know the answer, for the purpose of analysis. The potential ratings varied between 0 and 20. Higher scores corresponded to a higher level of understanding of the occurrence of stunting. The cut-off points for knowledge were classified as follows: a low knowledge level was assigned if the respondent's answer score was between 0 and 14 (with a percentage answer score < 70%), while a high knowledge level was assigned if the respondent's answer score was between 15 and 20 (with a percentage answer score ≥ 70%).

The questionnaire on maternal attitudes consisted of 15 questions on nutritional intake for children. The questionnaire used a Likert scale with answer options of 0 for "strongly disagree", 1 for "disagree", 2 for " doubt", 3 for "agree", and 4 for "strongly agree". Some negatively worded items were reversed and recoded during the data analysis process. Possible scores ranged from 0 to 60. *Cut off*

points for maternal attitudes were categorised into low scores if the respondent's answer score was between 0-36 (percentage answer score < 60%), and high scores if the respondent's answer score was between 37-60 (percentage answer score ≥ 60%). The action questionnaire consisted of 12 statement items. The questionnaire used a Likert scale with answer options of 0 for "never", 1 for "rarely", 2 for sometimes", 3 for "often", and 4 for "always". Some negatively worded items were reversed and recoded during the data analysis process. Possible scores ranged from 0 to 48. *Cut off points* for the measures were categorised into low score if the respondent's answer score was between 0-28 (percentage answer score < 60%), high score if the respondent's answer score was between 29-48 (percentage answer score ≥ 60%). Meanwhile, in the infectious disease question item, the researchers examined the history of infectious diseases during pregnancy (history of dengue disease during pregnancy and history of diarrheal disease during pregnancy).[17,18] History of infectious disease was measured based on whether or not the mother had dengue disease or diarrhea during pregnancy. This questionnaire has been declared valid using Pearson product moment correlation (n=20 and r table=0.444) and all question items have a t value greater than the t table value. Reliability measurement used Cronbach's alpha coefficient. Knowledge (0.869), attitude (0.825), and action (0.831) variables showed high internal consistency.

***Data collection***

The researcher acquired the data firsthand with the help of four skilled midwives. Prior to commencing data collection on anthropometric measures, interviews utilizing questionnaires, sample selection criteria, and approaches to respondents, a one-day training session was conducted. Data were gathered by door-to-door visits. The data were obtained through anthropometric measurements of child height and face-to-face interviews with eligible respondents using a pre-tested structured questionnaire. The survey consisted of inquiries regarding the attributes of children under the age of five, parental attributes, behavior, and contagious illnesses.

***Data Analysis***

The data obtained in the study were processed and analysed using computer software. In addition to descriptive analysis, data were tested for influence between variables using the chi-square test, where $P < 0.05$. The prevalence of stunting in children under 5 years was associated with income, knowledge score, attitude score, action score, and infectious diseases using crosstab and chi-square analyses to examine how the variables were related. Multiple logistic regression models were used to assess the independent effect of each variable on the dependent variable. Associations were expressed by odds ratios adjusted to 95% confidence intervals for each variable entered into the logistic regression model. Furthermore, a multiple logistic regression equation model was developed to determine the probability of the dependent variable from the independent variables, using the multiple logistic regression equation formula.

## RESULTS

**Figure 1** shows an explanation of the percentage of children under 5 years old by age and gender from a total of 532 respondents. In Figure 1(a), which presents the percentage by age, children aged 24 - 36 months were 36.3% (n=193), and children aged 37 - 59 months were 63.7% (n=339). In Figure 1(b), which presents the

percentage by gender, boys were 52.6% (n=280) and girls were 47.4% (n=252).

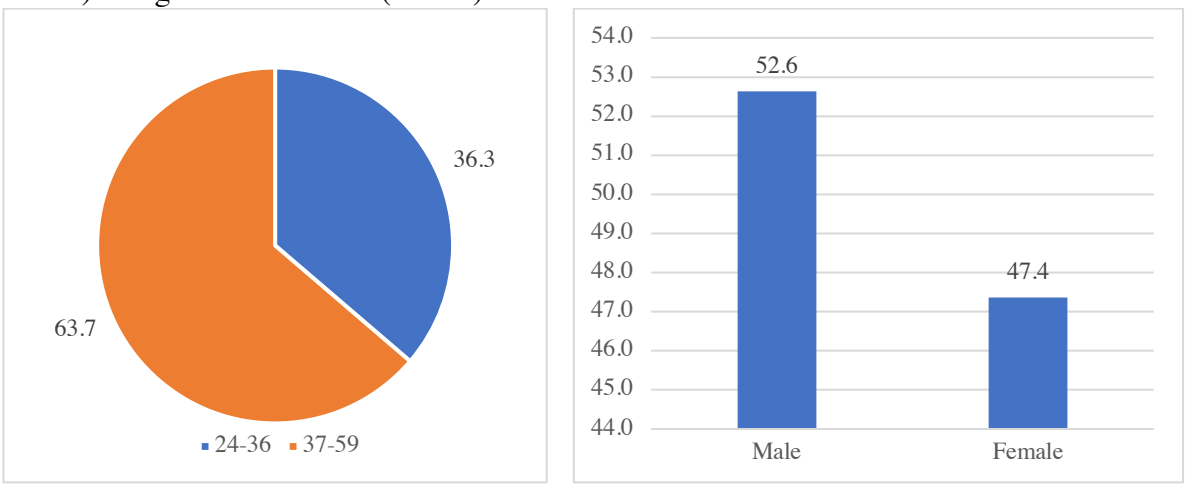


**Figure 1. (a)** Percentage of Age of Children under 5 years old (b) Percentage of Gender of Children under 5 years old

**Table 1** shows the distribution of parental characteristics. Mothers who participated in this study consisted of (n=154, 28.9%) those with low levels of education and (n=387, 71.1%) high levels of education. About (142, 26.7%) of fathers had a low level of education. More than half of the mothers were 31-40 years old (n=279, 52.4%) and most of the fathers were 31-40 years old (n=357, 67.1%). Most mothers were employed (n=430, 80.8%) and almost all fathers were employed (n=503, 94.5%) in this study.

**Table 1.** Distribution of parental characteristics among children under 5 years old

| Charactertistics | Frequency | Percentage |
|---|---|---|
| **Mother's Education** | | |
| Low Education | 154 | 28.9 |
| High Education | 378 | 71.1 |
| **Father's Education** | | |
| Low Education | 142 | 26.7 |
| High Education | 390 | 73.3 |
| **Mother's age (years)** | | |
| 20-30 | 143 | 26.9 |
| 31-40 | 279 | 52.4 |
| 41-50 | 110 | 20.7 |
| **Father's age (years)** | | |
| 20-30 | 126 | 23.7 |
| 31-40 | 357 | 67.1 |
| 41-50 | 49 | 9.2 |
| **Mother's Occupation** | | |
| Employed | 430 | 80.8 |
| Unemployed | 102 | 19.2 |
| **Father's Occupation** | | |
| Employed | 503 | 94.5 |
| Unemployed | 29 | 5.5 |
| **Total** | **532** | **100** |

**Table 2** shows that mothers who have low income are more likely (OR=3.624, 95% CI 2.487-5.279, P=0.0001) to contribute to the prevalence of stunting in children. Mothers with low knowledge scores were more likely (OR=7.419, 95% CI 5.032-10.938, P=0.0001) to increase the prevalence of child stunting. Mothers with low attitude scores were more likely (OR=2.946, 95% CI 2.059-4.214, P=0.0001) to increase the prevalence of child stunting. Mothers with a low action score were more likely (OR=3.975, 95% CI 2.759-5.727, P=0.0001) to increase the prevalence of child stunting. Mothers who had an infectious disease during pregnancy were more likely (OR=4.642, 95% CI 3.189-6.758, P=0.0001) to have children with stunted growth.

**Table 2.** Influence of Income, Maternal Behaviour, and Infectious Diseases on the Prevalence of Stunting

| Variable | Prevalence of stunting | | | p-value | OR 95% CI |
|---|---|---|---|---|---|
| | Stunting n (%) | Normal n (%) | Total n (%) | | |
| **Income** | | | | | |
| Low | 112 (62.2) | 68 (37.8) | 180 (100) | 0.0001 | 3.624 (2.487-5.279) |
| High | 110 (31.3) | 242 (68.8) | 352 (100) | | |
| **Knowledge** | | | | | |
| Low Score | 160 (66.7) | 80 (33.3) | 240 (100) | 0.0001 | 7.419 (5.032-10.938) |
| High Score | 62 (21.2) | 230 (78.8) | 292 (100) | | |
| **Behaviour** | | | | | |
| Low Score | 128 (56.6) | 98 (43.4) | 226 (100) | 0.0001 | 2.946 (2.059-4.214) |
| High Score | 94 (30.7) | 212 (69.3) | 306 (100) | | |
| **Action** | | | | | |
| Low Score | 146 (59.1) | 101 (40.9) | 247 (100) | 0.0001 | 3.975 (2.759-5.727) |
| High Score | 76 (26.7) | 209 (73.3) | 285 (100) | | |
| **Infectious Disease** | | | | | |
| Infected | 162 (58.7) | 114 (41.3) | 276 (100) | 0.0001 | 4.642 (3.189-6.758) |
| Not Infected | 60 (23.4) | 196 (76.6) | 256 (100) | | |
| **Total** | **222 (41.7)** | **310 (58.3)** | **532 (100)** | | |

The multiple logistic regression model (**Table 3**) shows that maternal knowledge (OR=4.808), maternal attitude (OR=2.057), maternal action (OR=1.807), and infectious diseases (OR=2.275) are factors that cause stunting. Maternal knowledge is the variable that has the strongest influence on the prevalence of stunting (OR=4.808), which means that the chances of mothers who have low knowledge have four times greater odds of having children who experience stunting.

**Table 3.** Multiple Logistic Regression Model of the Prevalence of Stunting in Children Under 5 Years of Age

| Variable | B | Sig. | Exp(B) | 95% C.I.for EXP(B) | |
|---|---|---|---|---|---|
| | | | | Lower | Upper |
| Knowledge | 1.570 | 0.001 | 4.808 | 3.137 | 7.369 |
| Mother's Behaviour | 0.721 | 0.001 | 2.057 | 1.348 | 3.140 |
| Mother's Action | 0.592 | 0.007 | 1.807 | 1.174 | 2.781 |
| Infectious Disease | 0.822 | 0.001 | 2.275 | 1.478 | 3.503 |
| Constant | -5.245 | 0.001 | 0.005 | | |

The final model was then entered into a multiple logistic regression equation model to determine the probability of stunting from behaviour and infectious diseases as follows:

$$P = \frac{1}{1+2{,}718^{-(-5.245 + (1.570x1+0.721x1+0.592x1+0.822x1)}}$$

$$P = \frac{1}{1+0{,}166}$$

$$P = \frac{1}{1{,}166}$$

$$P = 0{,}857 = 85{,}7\%$$

The results of the logistic regression equation obtained a probability value of stunting prevalence of 85.7%, meaning that if the mother has a low knowledge score, low attitude score, and low action score, and her child has a history of infectious disease during pregnancy, the chance of stunting is 85.7% and 14.3% is due to other variables.

## DISCUSSION

In this study, mothers who had low knowledge scores, low attitude scores, low action scores, and children with a history of infectious diseases were risk factors for stunting at 95% CI, and an odds ratio of 85.7%. Children born to mothers with low knowledge were 4.8 times more likely to be stunted. Low maternal knowledge about nutrition is caused by various factors, such as education, and attitudes that are less concerned with nutrition, which can negatively impact child growth. A study in Nigeria concluded that mothers with higher education levels had better knowledge about nutrition.[19] Another study in Indonesia concluded that parents who have a high level of education will increase their knowledge about nutrition, so as to prevent the prevalence of stunting in children.[20] Educated mothers can receive information from various sources and improve their understanding and knowledge about childcare. Therefore, education is related to mothers' knowledge of how to implement effective parenting patterns and improve children's nutritional status.[6,21]

Optimizing the role of mothers can be achieved by strengthening their knowledge and skills. This aspect is reinforced by research that proves that attitude scores and a better understanding of nutrition are positively associated with the prevalence of stunting. Mothers who have good nutritional knowledge prefer to prepare food for their families instead of buying ready-made food that cannot be ascertained for its nutritional content and hygiene.[22] This makes a significant contribution to efforts to prevent stunting in children through the fulfillment of optimal nutrition. This effort is in line with what is previously stated that many mothers who have higher levels of nutritional practices tend to have children with average body weight.[23]

Children born to mothers with low attitude scores are twice as likely to be stunted. This is in line with research

conducted in Indonesia, which states that maternal attitudes regarding nutritional intake for children significantly affect the prevalence of stunting.[24,25] Negative attitudes about nutritional intake can lead to stunting, given that nutritional intake is very important for child growth. The better the mother's attitude, the better the nutritional status of the resulting toddlers. A person's attitude can be influenced by several factors including age, occupation, education and parity.[26] This study also proves that maternal actions can be a determining factor in the prevalence of stunting in children. Mothers who have negative attitudes about parenting and nutritional intake of children are 1.8 times more likely to have their children stunted. Other findings state that most mothers' feeding practices are less responsive, they do not pay attention to the signs of their hungry children, and inappropriate feeding, along with limiting children's food portions are the causes of child malnutrition.[27] A study in Zambia concluded that only a small proportion of mothers tried to provide alternative foods for their children in an effort to fulfill their nutritional needs.[28] The researchers found that the majority of mothers persuaded their children to eat in various ways without paying attention to the signs of hunger and satiety, in addition to restricting their children's food cravings. Restriction of food intake affects the amount of nutrients the child can receive and is related to the child's nutritional status.[29]

Infectious diseases during pregnancy are also a significant cause of stunting in children. Mothers who have experienced infectious diseases during pregnancy have a 2.2 times greater chance that their children will be stunted. In line with other studies that state that mothers who have experienced infectious diseases during pregnancy can cause premature birth and this increases the risk of children experiencing stunting.[30] The frequency of infection during pregnancy is one of the main determinants of child growth in the first 2 years.[25,31] Bacterial, viral, and parasitic infections in the womb will affect foetal development, leading to outcomes such as premature birth and low birth weight.[32,33] Infants born prematurely due to intrauterine bacterial infections often experience severe morbidity and long-term effects such as chronic lung disease, asthma, cerebral palsy, and neurodevelopmental problems.[34,35]

## CONCLUSION AND RECOMMENDATIONS

Maternal behaviour is a determining factor in the prevalence of stunting among children under 5 years old. Maternal knowledge, attitudes, and actions are significantly associated with the prevalence of stunting. In addition, a history of infectious disease during pregnancy is also significant with the prevalence of stunting. If the mother has a low knowledge score, low attitude score, low action score, and a history of infectious disease during pregnancy, the chance of stunting is 85.7%. Therefore, strategies and programmes that focus on mothers are the right choice, and increasing maternal knowledge is necessary to improve maternal attitudes, and actions.

## ACKNOWLEDGMENTS

The authors would like to thank all participants who provided the information needed for this study.

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