INDONESIAN HEALTH JOURNAL

Volume 5 Number 3, November 2026
pp. 940-957
E-ISSN: 2963-3036
DOI: 10.58344/ihj.v5i3.997

# The Influence of Family Income and Parenting Styles of Toddlers on Stunting Incidence at Binjai City Health Center in 2025

**Angelika Praticia Sinaga*, Masdalena Nasution, Adi Soekardi**
PUI Phyto Degenerative dan Lifestyle Medicine, Universitas Prima Indonesia, Indonesia
Email: angelpraticia1009@gmail.com*

**Keywords:**
stunting, family income, parenting patterns, toddlers, maternal knowledge

This is an open access article under the CC BY-SA license.

Copyright © 2026 by Author. Published by
Riviera Publishing

**Abstract**

Stunting remains a persistent public health concern in Indonesia, particularly in areas with disadvantaged socioeconomic conditions. Binjai City reported a stunting prevalence of 25.6%, exceeding the national prevalence of 19.8%. This study aimed to examine the associations of family income and parenting styles with stunting among children under five years of age at selected community health centers in Binjai City in 2025. An observational analytical study with a case-control design was conducted involving 80 children aged 0–59 months, comprising 40 stunted cases and 40 non-stunted controls selected through purposive sampling and matched at a 1:1 ratio based on age and village of residence. Data were analyzed using chi-square tests and binary logistic regression. Bivariate analysis revealed significant associations between stunting and anthropometric characteristics ($p = 0.003$; OR = 3.96), democratic parenting ($p = 0.034$; OR = 4.11), authoritarian parenting ($p = 0.022$; OR = 3.40), permissive parenting ($p = 0.007$; OR = 11.32), and maternal knowledge ($p = 0.003$; OR = 13.00). In contrast, family income, low birth weight, and maternal education were not significantly associated with stunting. Multivariable analysis identified maternal knowledge as the strongest associated factor ($p = 0.005$; OR = 43.054), followed by democratic parenting, which was identified as a protective factor ($p = 0.005$; OR = 17.467), whereas authoritarian and permissive parenting were associated with increased odds of stunting. The regression model yielded a Nagelkerke $R^2$ of 0.624 and an overall classification accuracy of 80%. The findings suggested that maternal knowledge and parenting styles were significantly associated with stunting, whereas family income showed no statistically significant association. Strengthening maternal nutrition education and providing targeted parenting support are therefore recommended to support stunting prevention efforts.

## INTRODUCTION

Early childhood represents a critical period in human development, characterized by rapid physical growth and cognitive maturation (Alex et al., 2024; Ramesh, 2022; Volkow et al., 2024). Adequate nutritional intake and appropriate parenting practices are essential for supporting optimal child growth and development (Femidio & Muniroh, 2020). However, stunting remains a persistent public health challenge in Indonesia, particularly in regions experiencing socioeconomic disadvantages (Alao et al., 2021; Ernawati et al., 2021; Mulyaningsih et al., 2021; UNICEF, 2020).

Stunting is defined as impaired linear growth, indicated by a height-for-age or length-for-age z-score below −2 standard deviations from the median of the World Health Organization (WHO) Child Growth Standards (World Health Organization, 2006). It is commonly associated with chronic or recurrent undernutrition, particularly during the first 1,000 days of life, from conception to a child's second birthday (Badan Kependudukan dan Keluarga Berencana Nasional, 2022; Kementerian Kesehatan Republik Indonesia, 2024). The consequences of stunting extend beyond impaired physical growth and may include delayed cognitive development, compromised immune function, reduced productivity, and an increased risk of metabolic and noncommunicable diseases later in life (Global Nutrition Report, 2020; Handryastuti et al., 2022; Mustakim et al., 2022).

Beyond socioeconomic conditions, parenting practices play an important role in determining children's nutritional status and vulnerability to stunting. These practices encompass feeding behaviors, personal and environmental hygiene, and access to essential health care services. Appropriate parenting practices, including adequate nutritional provision, developmental stimulation, and timely utilization of health services, contribute to stunting prevention. Saleh et al. (2021) emphasized that maternal involvement and the quality of caregiving during the first 1,000 days of life were important protective factors against childhood stunting. Similarly, Saadong et al. (2021) highlighted the importance of exclusive breastfeeding during the first six months of life, followed by the timely introduction of nutritionally adequate complementary foods while breastfeeding continues (Hadi et al., 2021). Furthermore, inadequate environmental sanitation and recurrent infectious diseases may impair children's growth and nutritional status. Improved sanitation, access to essential health services, and effective infectious disease prevention measures can help reduce the risk of stunting (Dewi et al., 2024).

Low birth weight (LBW) is another important factor associated with childhood stunting. Infants born weighing less than 2,500 grams are more vulnerable to impaired growth and infectious diseases, potentially increasing their risk of stunting. LBW may also indicate adverse intrauterine conditions, including fetal growth restriction or preterm birth, that can affect subsequent growth trajectories. Previous studies conducted in Indonesia have reported significant associations between LBW and stunting among children under five years of age (Chandra & One, 2021; Cholifatus, 2023).

According to the 2024 Indonesian Nutritional Status Survey (Survei Status Gizi Indonesia, SSGI), the national prevalence of stunting declined from 21.5% to 19.8%. However, the reported prevalence in Binjai City remained higher at 25.6%, indicating persistent local challenges in childhood nutrition and growth (Kementerian Kesehatan Republik Indonesia, 2025; Suratri et al., 2023). These disparities highlight the importance of examining socioeconomic and caregiving factors associated with stunting at the local level, particularly family income and parenting practices among households with children under five years of age.

Although previous studies have identified multiple determinants of childhood stunting, the relative contributions of family income, parenting styles, maternal education, and maternal nutritional knowledge may differ across socioeconomic and geographical contexts. Family income may influence household food security and access to health services, whereas parenting styles and maternal knowledge may shape feeding practices, hygiene behaviors, and health care

utilization. However, the relationships among these factors and stunting in Binjai City require further investigation (Mutiara et al., 2021). Accordingly, this study sought to address this research gap by examining the associations between family income, parenting styles, and stunting among children under five years of age attending selected community health centers in Binjai City in 2025.

The primary research question was whether family income and parenting styles were significantly associated with stunting among children under five years of age at selected community health centers in Binjai City in 2025. The main objective was to examine these associations while considering additional maternal and child characteristics, including maternal education, maternal knowledge, and low birth weight. Specifically, the study investigated whether maternal educational attainment and nutritional knowledge were associated with children's growth status and whether different parenting styles were associated with variations in the likelihood of stunting.

Theoretically, this study aimed to contribute empirical evidence to the understanding of childhood stunting as a multifactorial public health problem influenced by socioeconomic, behavioral, and maternal characteristics. By examining family income and parenting styles alongside maternal education and knowledge, the study sought to provide a more comprehensive understanding of factors associated with childhood stunting in the local context. The findings were expected to contribute to the existing literature on maternal and child nutrition and inform future investigations into the social and behavioral determinants of stunting.

Practically, the findings were intended to support the development of targeted stunting prevention strategies by local health authorities and community health centers. The results could inform maternal nutrition education, parenting support programs, and interventions promoting age-appropriate feeding practices, balanced nutrition, and household hygiene. Strengthening caregivers' understanding of nutritious food selection, hygienic food preparation, and appropriate child-feeding practices may contribute to improved child health and nutritional outcomes. Furthermore, the study was expected to provide evidence to support collaboration among families, health care professionals, and local policymakers in reducing stunting and promoting optimal early childhood growth and development.

## METHOD

### Research Type and Design

This study employed an analytical observational design with a case-control approach to examine the associations between family income, parenting styles, and stunting among children under five years of age. The study compared children with stunting (cases) and those without stunting (controls) based on family income, anthropometric characteristics, parenting styles, birth weight, maternal knowledge, and maternal education.

### Research Location and Time

The research was carried out in several health centers in Binjai City from May 27 to June 27, 2026.

**Population and Sample**

The study population was all toddlers aged 0–59 months who lived for at least six months in the work area of the health center where the study was located, totaling 80 toddlers. This domicile criterion was determined so that the data obtained reflected toddlers who were consistently in the environment and scope of local health services, so that the results of the study described the factors that affect the nutritional status of toddlers in the area more accurately.

The case group was toddlers with TB/U less than −2 elementary school based on posyandu data or medical records of the health center. All 40 cases that met the criteria were included by purposive sampling technique. The control group was toddlers with TB/U ≥ −2 elementary school who came from the same basic population, selected through matching based on age similarity (tolerance ±3 months) and residential village with a ratio of 1:1, so that 40 controls were obtained. The total sample was 80 toddlers

**Inclusion and Exclusion Criteria**

The inclusion criteria in this study are as follows.

1) Toddlers aged 0–59 months who lived for at least six months in the study area, so that the subjects truly reflected the toddler who lived and received exposure to the local environment and health services.
2) Complete anthropometric data (height or length and age) during screening, so that stunting status can be accurately determined according to WHO standards: cases when TB/U is < −2 SD and control when TB/U is ≥ −2 SD.
3) Parents or guardians are willing to give written consent (informed consent) and be interviewed about family income, parenting practices, and other relevant variables; this willingness is the basis for research ethics.
4) Specifically for the control group, subjects were selected from the same baseline population as the case through age matching (±3 months) and village, to minimize selection bias.

The exclusion criteria in this study are as follows.

1) Toddlers with a history of chronic diseases or congenital disorders that directly affect growth, because they have the potential to be the main confounding variable that obscures the influence of family income and parenting.
2) Toddlers who are in severe acute pain (e.g., high fever or sepsis) or have been hospitalized for a long time. Toddlers who are twin or multiple births can also be excluded to maintain the homogeneity of the sample because their growth patterns tend to be different from single children.
3) Toddlers whose parents or guardians refuse to participate or cannot be contacted, as well as toddlers whose anthropometric data or medical records are incomplete or cannot be verified for accuracy.

**Operational Definition**

The operational definition of the research variables is presented in Table 1.

**Table 1.** Operational Definition of Research Variables

| Variable | Operational definition | Measuring instruments | Categories |
|---|---|---|---|
| Stunting | Height or body length by age (TB/U) below −2 SD WHO standard | WHO height/length measurements and curves | 0 = Stunting<br>1 = Not stunted |
| Family income | Total income of father, mother, or other family members in the past month for household needs | Interviews with parents | 1 = Low (< IDR 1,500,000)<br>2 = Medium (IDR 1,500,000–2,500,000)<br>3 = High (IDR 2,500,000–3,500,000)<br>4 = Very high (> IDR 3,500,000) |
| Parenting (eating) | How parents feed toddlers: frequency, type of food, food diversity, and breastfeeding/milk practices | Parenting questionnaire (24-hour recall or FFQ) | Democratic: 0 = Undemocratic (score ≤ 5), 1 = Democratic (score > 5) |
| Nutritional status (anthropometry) | Skinny/obese condition of toddlers based on weight ratio by height (Z-score) | Microtoise and digital scales | 0 = Malnutrition<br>1 = Good nutrition |
| BBLR | Weight of the baby weighed in the first 1 hour after birth, less than 2,500 grams regardless of the period of pregnancy | Questionnaire and medical record record/KIA | 0 = Low (< 2,500 g)<br>1 = Normal (≥ 2,500 g) |
| Mother's knowledge | Results of the assessment of mothers' understanding of stunting | Interviews with questionnaires | 0 = Less (score ≤ 5)<br>1 = Good (score > 5) |
| Mother's education | The last level of formal education achieved by the mother | Interviews with questionnaires | 1 = SD<br>2 = SMP<br>3 = SMA |
| Age | Age group of toddlers by date of birth | Date of birth record and official documents (birth certificate) | 1 = 20–30 months<br>2 = 31–40 months<br>3 = 41–50 months<br>4 = 51–59 months |
| Gender | Biological differences from birth | Observation or identity card | 1 = Male<br>2 = Female |

Description: SD = standard deviation; FFQ = food frequency questionnaire; KIA = Maternal and Child Health.

## Ethical Aspects

The ethical aspect is maintained by requesting written consent (informed consent) from parents or guardians before the interview and data collection, so that the respondent's involvement is voluntary and based on understanding. The confidentiality of the respondent's identity is maintained by not including the full name and replacing it with an initials or code in all data processing.

## Data Processing and Analysis

Before being analyzed, the data was processed through three stages (Hermawan, 2019).

a) Editing, which is checking questionnaires and observation sheets to ensure that all data is filled in completely and no parts are missed.
b) Coding, which is the provision of codes on each variable to facilitate processing; the respondent's name is replaced with initials to maintain identity confidentiality.

c) Tabulating, which is the entry of data that has been coded into a frequency table accompanied by percentages so that the data is more structured and easy to understand.

Data analysis was carried out with the Statistical Package for the Social Sciences (SPSS) program in stages. Univariate analysis describes the frequency and percentage distribution of each variable. Bivariate analysis tested the relationship between each independent variable and stunting incidence using the Chi-Square test according to the fulfillment of the test requirements, with the strength of the relationship seen from the Odds Ratio (OR).

Multivariate analysis used binary logistic regression to determine the relationship of several independent variables simultaneously with stunting events. Variables with $p < 0.25$ in bivariate analysis were considered to enter the model while still paying attention to the theoretical foundation and conceptual framework. The level of statistical significance was set at $p < 0.05$.

## RESULTS AND DISCUSSION

### Sample Characteristics

Univariate analysis was used to describe the characteristics of the sample in the form of frequency distribution as an initial description before testing the influence between variables. This study involved 80 toddlers, consisting of 40 stunted toddlers and 40 non-stunted toddlers. The sample characteristics are presented in Table 2.

**Table 2.** Characteristics of the Research Sample (N = 80)

| Variable | Categories | n | % |
|---|---|---|---|
| Stunting incidence | Stunting | 40 | 50,0 |
| | Not stunted | 40 | 50,0 |
| Gender | Male | 42 | 52,5 |
| | Women | 38 | 47,5 |
| Age | 20–30 months | 19 | 23,8 |
| | 31–40 months | 19 | 23,8 |
| | 41–50 months | 26 | 32,5 |
| | 51–59 months | 16 | 20,0 |
| Nutritional status (anthropometry) | Malnutrition | 35 | 43,8 |
| | Good nutrition | 45 | 56,3 |
| Birth weight | Low (BBLR) | 10 | 12,5 |
| | Normal | 70 | 87,5 |
| Democratic parenting | Democratic | 67 | 83,8 |
| | Undemocratic | 13 | 16,3 |
| Authoritarian parenting | Authoritarian | 21 | 26,3 |
| | Non-authoritarian | 59 | 73,8 |
| Permissive parenting | Permissive | 10 | 12,5 |
| | Not permissive | 70 | 87,5 |
| Mother's education | SD | 10 | 12,5 |
| | Junior High School | 31 | 38,8 |
| | High School | 39 | 48,8 |
| Mother's knowledge | Less | 11 | 13,8 |
| | Good | 69 | 86,3 |
| Parents' income | Low | 13 | 16,3 |
| | Medium | 36 | 45,0 |
| | Height | 19 | 23,8 |
| | Very high | 12 | 15,0 |

Source: primary data of the study.

By gender, there were slightly more boys under five (42 toddlers; 52.5%) than girls (38 toddlers; 47.5%). The most age group was 41–50 months (26 toddlers; 32.5%), followed by the 20–30 months and 31–40 months groups with 19 toddlers (23.8%), and the least 51–59 months group (16 toddlers; 20.0%). The balanced composition of stunting, namely 40 stunted toddlers (50.0%) and 40 toddlers (50.0%) not stunted, is a consequence of the control case design with a 1:1 ratio that supports the accuracy of the analysis at the next stage. This proportion of 50.0% is not a reflection of the prevalence of stunting in Binjai City, so it cannot be directly compared with the national prevalence of 21.5% and North Sumatra of 18.9% (Badan Kebijakan Pembangunan Kesehatan, 2023).

Of the three types of parenting, democratic parenting is the most dominant, namely 67 toddlers (83.8%), while 59 toddlers (73.8%) are not taken care of authoritatively and 70 toddlers (87.5%) are not taken care of in a permissive manner. Authoritarian parenting is found in 21 toddlers (26.3%) and permissive in 10 toddlers (12.5%). Democratic parenting is

characterized by two-way communication, directed freedom, and active involvement of parents in meeting children's needs. According to Khoiriyah et al. (2024), good parenting optimizes the growth and development of toddlers so that it helps reduce stunting. The discovery of authoritarian and permissive parenting emphasizes the importance of implementing the right parenting style in the research area.

A total of 70 toddlers (87.5%) were born with normal weight and 10 toddlers (12.5%) had a history of BBLR. Although the proportion is small, BBLR still needs special attention because BBLR babies generally have been malnourished since the womb so that catch up growth is difficult to achieve optimally (Chandra & One, 2021), and their digestive system is not fully functioning so that the absorption of nutrients from food is disrupted (Cholifatus, 2023). Thus, BBLR is not just a serious problem at birth, but has long-term consequences for growth and development if it is not accompanied by early monitoring and nutritional interventions.

Most mothers have a high school education (39 people; 48.8%), followed by junior high school (31 people; 38.8%) and elementary school (10 people; 12.5%), as well as well-informed (69 people; 86.3%) with 11 people (13.8%) having low knowledge. This high level of knowledge is likely related to the dominance of high school education and routine counseling by health center officers. Mothers with higher education tend to have easier access to nutrition information sources and implement stunting prevention in daily care (Salsabila et al., 2022). However, formal education is not the only determinant because exposure to information from health workers, media, and personal experiences also shape mothers' behavior, so good knowledge and attitudes continue to contribute positively regardless of their educational background (Arnita et al., 2020). Mothers who understand nutrition also tend to pay more attention to meeting the nutritional needs of their children (Aghadiati et al., 2023; Hamdin et al., 2023). Further education is still needed, especially for lower-educated mothers, so that understanding is evenly distributed.

The majority of parents are middle-income (36 toddlers; 45.0%), followed by high income (19 toddlers; 23.8%), low income (13 toddlers; 16.3%), and very high (12 toddlers; 15.0%). Income is a socioeconomic factor that plays a role in meeting children's basic needs, including nutrition, because families with adequate income generally have better access to nutritious food, health services, and sanitation. Low-income families tend to have limited food purchasing power and consume food with limited nutritional content. However, sufficient income does not automatically guarantee good nutritional status, because mother's knowledge in managing food, parenting, and family health behavior is also decisive.

Nutritional status (anthropometry) was found in 35 toddlers (43.8%), while 45 toddlers (56.3%) were in good status. This proportion shows that nutritional problems of toddlers in the study area are still worrying and related to the lack of food intake, both in terms of quality and quantity. Nutritional status is influenced by feeding practices, family socioeconomic conditions, and mothers' understanding of nutrition; if not treated immediately, this condition can inhibit linear growth and lead to stunting. This finding is in line with Karisma et al. (2022) who emphasized the importance of routine anthropometric monitoring for early detection of stunting.

The impact of stunting is long-term, including barriers to cognitive development, decreased learning ability, and increased susceptibility to non-communicable diseases in adulthood, so its occurrence at an early age needs to be seriously monitored. According to researchers, this condition reflects that nutritional problems are multifactorial, involving direct factors such as lack of nutritional intake and infectious diseases, as well as indirect factors such as family income, maternal knowledge, and inappropriate parenting. Therefore, the interrelated causes of stunting in Indonesia (Aurima et al., 2021) require integrated and sustainable interventions from various parties, not partial treatment.

**Bivariate Analysis**

Bivariate analysis is an analysis of two variables to examine whether there is a relationship between the two. In this study, the analysis was used to identify independent variables that are meaningfully related to stunting as the basis for determining dominant risk factors. The results are presented in Table 3: anthropometry, parenting (democratic, authoritarian, permissive), and maternal knowledge are meaningfully related to stunting, while BBLR, maternal education, and parental income are not.

**Table 3.** Results of Bivariate Analysis of Factors Related to Stunting Incidence

| Variables and categories | Stunting n (%) | Not stunted n (%) | OR | p |
|---|---|---|---|---|
| **Anthropometry** | | | | |
| Malnutrition | 24 (60,0) | 11 (27,5) | 3,955 | 0,003 |
| Good nutrition | 16 (40,0) | 29 (72,5) | | |
| **Democratic parenting** | | | | |
| Undemocratic | 10 (25,0) | 3 (7,5) | 4,111 | 0,034 |
| Democratic | 30 (75,0) | 37 (92,5) | | |
| **Authoritarian parenting** | | | | |
| Authoritarian | 15 (37,5) | 6 (15,0) | 3,400 | 0,022 |
| Non-authoritarian | 25 (62,5) | 34 (85,0) | | |
| **Permissive parenting** | | | | |
| Permissive | 9 (22,5) | 1 (2,5) | 11,32 | 0,007 |
| Not permissive | 31 (77,5) | 39 (97,5) | | |
| **BBLR** | | | | |
| Low | 6 (15,0) | 4 (10,0) | 1,59 | 0,499 |
| Normal | 34 (85,0) | 36 (90,0) | | |
| **Mother's education** | | | | |
| SD | 4 (10,0) | 6 (15,0) | – | 0,118 |
| Junior High School | 20 (50,0) | 11 (27,5) | | |
| High School | 16 (40,0) | 23 (57,5) | | |
| **Mother's knowledge** | | | | |
| Less | 10 (25,0) | 1 (2,5) | 13,000 | 0,003 |
| Good | 30 (75,0) | 39 (97,5) | | |
| **Parents' income** | | | | |
| Low | 9 (22,5) | 4 (10,0) | – | 0,120 |
| Medium | 20 (50,0) | 16 (40,0) | | |
| Height | 8 (20,0) | 11 (27,5) | | |
| Very high | 3 (7,5) | 9 (22,5) | | |

Remarks: Chi-Square test; OR is calculated for table 2×2 by comparing the risk category (undernourished, undemocratic, authoritarian, permissive, BBLR, lack of knowledge) against other categories; the "–" sign means that OR is not calculated because the table is not 2×2.

Anthropometry. Of the 40 stunted toddlers, 24 toddlers (60.0%) were malnourished and 16 toddlers (40.0%) were normal, while of the 40 non-stunted toddlers, 11 toddlers (27.5%) were malnourished and 29 toddlers (72.5%) were normal. A p-value of 0.003 and an OR of 3.96 indicated that toddlers with undernourished status were about 4 times more likely to experience stunting. Undernutrition status basically reflects malnutrition that has lasted for a certain period of time and, if not treated immediately, can develop into chronic malnutrition characterized by linear growth retardation. These findings are in line with Karisma et al. (2022) and Aurima et al. (2021) who place malnutrition as a direct factor with a major contribution to stunting. According to researchers, toddlers with poor nutritional status are suspected of not getting sufficient energy and protein intake from the beginning of life, so exclusive

breastfeeding, timely and nutritious and balanced MP-ASI, and routine growth monitoring at posyandu need to be improved.

Democratic parenting. Undemocratic parenting was found in 10 toddlers (25.0%) in the stunting group and 3 toddlers (7.5%) in the non-stunting group (p = 0.034; OR = 4.11), so that not implementing democratic parenting was meaningfully related to stunting. These results are in line with Rosyida and Setyawati (2024) who found a meaningful relationship between parental parenting and stunting in toddlers aged 24–59 months (p = 0.000). Because the number of toddlers in certain cells is small, these findings need to be interpreted carefully and tested on a larger sample.

Authoritarian parenting. Authoritarian parenting was found in 15 toddlers (37.5%) of the stunting group and 6 toddlers (15.0%) of the non-stunted group (p = 0.022), with an OR of 3.40 for toddlers who were raised authoritarianly. Authoritarian parenting that emphasizes parental will can affect children's eating habits, for example, forcing children to eat without paying attention to hunger and satiety signals or limiting intake based on personal beliefs without considering nutritional needs. These findings are consistent with Rosyida and Setyawati (2024) and Christiana et al. (2022), and emphasize that the psychosocial aspects of parenting need to be considered, not only nutritional fulfillment, because an overly rigid approach can affect children's overall growth and development. Parents need to be accompanied to implement parenting that is responsive to children's needs.

Permissive parenting. Permissive parenting was found in 9 toddlers (22.5%) of the stunting group and only 1 toddler (2.5%) of the non-stunting group (p = 0.007; OR = 11.32). Among the three types of parenting, permissive contributes the greatest risk. The lack of parental restrictions and supervision of eating habits makes the fulfillment of children's nutrition and basic health practices less consistent, as reported by Hidayat (2023). Parents need to understand that the provision of nutritious food regularly and in sufficient quantities cannot be completely handed over to children, especially at an early age who still needs full guidance.

BBLR. The history of BBLR was found in 6 toddlers (15.0%) in the stunting group and 4 toddlers (10.0%) in the non-stunting group (p = 0.499; OR = 1.59), so there was no meaningful relationship, even though the direction of the relationship was in the same direction as the increased risk. This is likely influenced by the limited sample, especially since only 10 toddlers had a history of BBLR. These results differ from Chandra and One (2021) who found an association between BBLR and stunting in children aged 1–5 years, which may be due to differences in sample counts, location, and confounding variables. Toddlers with a history of BBLR still need to receive more intensive growth monitoring during the first 1,000 days of life for optimal growth recovery.

Maternal education. In the stunting group, 16 mothers (40.0%) had a high school education, 20 mothers (50.0%) were in junior high school, and 4 mothers (10.0%) were in elementary school, while in the non-stunting group, 23 mothers (57.5%) had a high school education, 11 mothers (27.5%) were in junior high school, and 6 mothers (15.0%) were in elementary school. This difference was not significant (p = 0.118). OR was not calculated because the variables consisted of three categories and were not table 2×2. Nutritional knowledge can be obtained from informal sources such as counseling, media, and parenting experience, and other factors such as income or parenting may be more dominant than formal

education levels. In addition, the relatively uniform distribution of respondents' education (48.8% and junior high school 38.8%) reduced the ability of statistical tests to detect differences between groups. This finding is in line with Salsabila et al. (2022) that the influence of maternal education does not stand alone, but is influenced by other contextual factors.

Mother's knowledge. Mothers with knowledge are less found in 10 toddlers (25.0%) in the stunting group and only 1 toddler (2.5%) in the non-stunting group ($p = 0.003$; OR = 13.00), so that knowledgeable mothers are 13 times more likely to have stunted children. Mother's knowledge is the variable with the greatest strength of relationship in bivariate analysis, beyond anthropometry and parenting. Well-informed mothers tend to be more sensitive to recognize the early symptoms of growth disorders, are able to provide nutritious food according to the child's age, and routinely use posyandu to monitor growth and development, while low knowledge can have an impact on less precise daily decisions related to child nutrition. These findings are in line with Aghadiati et al. (2023; $p = 0.001$) and Hamdin et al. (2023; $p = 0.006$), who also reported a much larger proportion of stunted children in mothers with less knowledge (52.5% compared to 12.5%). Theoretically, knowledge is an important domain in behavior formation, so that mothers who understand stunting are more encouraged to provide exclusive breastfeeding for six months, nutritious and timely MP-breastfeeding, complete immunization, and regular visits to posyandu.

Parents' income. In the stunting group, 20 toddlers (50.0%) came from middle-income families, 9 (22.5%) were low, 8 (20.0%) were high, and 3 (7.5%) were very high, while in the non-stunting group, 16 toddlers (40.0%) were middle-income, 4 (10.0%) were low, 11 (27.5%) were high, and 9 (22.5%) were very high. This difference was not significant ($p = 0.120$), and OR was not calculated because the table was not 2×2. This non-significant result may be related to regional characteristics, the number of samples, and the way income is grouped. Low-income families can still meet the nutritional needs of toddlers if they are able to manage resources well, while according to researchers, some middle- to high-income families may not allocate their economic resources optimally for child nutrition due to limited nutritional knowledge or parental busyness that affects parenting. Increasing income therefore needs to be accompanied by nutrition education and parenting assistance.

In summary, five variables were significantly related to stunting in the bivariate analysis, namely maternal knowledge (OR = 13.00), permissive parenting (OR = 11.32), undemocratic parenting (OR = 4.11), anthropometry (OR = 3.96), and authoritarian parenting (OR = 3.40). The other three variables, namely parental income, BBLR, and mother's education, were not meaningfully related. All variables except BBLR met the requirement of $p < 0.25$ so they were continued to multivariate analysis to see the simultaneous effect.

**Multivariate Analysis**

Multivariate analysis was conducted to identify variables that had a simultaneous effect on stunting incidence after controlling for the influence of other variables. The method used was binary logistic regression because the dependent variables consisted of two categories. The variables included in the model were income, anthropometry, knowledge, education, and democratic, authoritarian, and permissive parenting. The BBLR variable was not included because the bivariate p exceeded 0.25. The results are presented in Table 4.

**Table 4.** Results of Binary Logistics Regression Factors Affecting Stunting Incidence

| Variable | B | S.E. | Wald | df | Sig. | Exp(B) | 95% CI Exp(B) |
|---|---|---|---|---|---|---|---|
| Revenue (overall) | | | 5,860 | 3 | 0,119 | | |
| Medium | −1,588 | 1,122 | 2,003 | 1 | 0,157 | 0,204 | 0,023–1,842 |
| Height | −1,723 | 1,237 | 1,940 | 1 | 0,164 | 0,179 | 0,016–2,017 |
| Very high | −3,499 | 1,454 | 5,795 | 1 | 0,016 | 0,030 | 0,002–0,522 |
| Anthropometry | 1,065 | 0,695 | 2,344 | 1 | 0,126 | 2,900 | 0,742–11,337 |
| Knowledge | 3,762 | 1,340 | 7,890 | 1 | 0,005 | 43,054 | 3,118–594,571 |
| Education (overall) | | | 6,980 | 2 | 0,030 | | |
| Junior High School | −2,282 | 1,253 | 3,319 | 1 | 0,069 | 0,102 | 0,009–1,189 |
| High School | −0.063 | 1,119 | 0,003 | 1 | 0,955 | 0,939 | 0,105–8,412 |
| Democratic parenting | 2,860 | 1,009 | 8,309 | 1 | 0,005 | 17,467 | 2,418–126,166 |
| Authoritarian parenting | −2,978 | 0,914 | 10,607 | 1 | 0,001 | 0,051 | 0,008–0,306 |
| Permissive parenting | −2,697 | 1,320 | 4,173 | 1 | 0,041 | 0,067 | 0,005–0,896 |

Remarks: the reference category of education is elementary and the reference category of income is low; Exp(B) = odds ratio; CI = confidence interval. Nagelkerke R Square = 0.624; accuracy of classification = 80%.

Maternal knowledge was the variable with the greatest influence (p = 0.005; OR = 43.054; 95% CI 3.118–594.571). With stunted coding = 0 and non-stunted = 1, an Exp(B) value of more than 1 means a greater chance of not stunting, so that toddlers of well-informed mothers have about 43 times greater chances of not being stunting than toddlers of poor-informed mothers. Very wide confidence intervals suggest that the magnitude of this influence cannot be precisely estimated, but the direction is consistent with bivariate outcomes.

All three types of parenting had a significant effect after controlling for other variables. Democratic parenting was protective (p = 0.005; OR = 17.467), while authoritarian (p = 0.001; OR = 0.051) and permissive (p = 0.041; OR = 0.067) were risk factors, with the chance of stunting being around 19.6 times and 14.9 times greater than that of toddlers who were not cared for with this pattern, respectively. These results confirm that parenting styles, especially in feeding, play a role in stunting prevention.

Maternal education as a whole was meaningful (p = 0.030), but no category (junior high school or high school) was significantly different from elementary school (p = 0.069 and p = 0.955), so the influence of formal education needs to be interpreted carefully. Overall income was meaningless (p = 0.119). The very high income category was indeed partially meaningful (p = 0.016), but the direction was not in line with the bivariate data distribution and the confidence interval was very wide (0.002–0.522), so these findings cannot be used as a basis for strong conclusions. Meaningful anthropometry in bivariate analysis was no longer meaningful after control (p = 0.126; OR = 2.900), which suggests that the effect is partly explained by maternal knowledge and parenting. Even so, anthropometric monitoring remains important for early detection of growth disorders.

The model has a Nagelkerke R Square of 0.624, meaning that the variables in the model explain about 62.4% variation in stunting incidence, with a classification accuracy of 80%. Overall, the zero hypothesis is rejected for the parenting variable, while for family income the zero hypothesis cannot be rejected. Maternal knowledge and parenting are the most important factors, which confirm that stunting is a multifactorial problem. This pattern also explains why

income has not been shown to have an impact: new economic resources have an impact on children's nutrition when managed by mothers who understand nutritional needs and implement appropriate parenting.

If bivariate and multivariate results are compared, maternal knowledge and parenting are consistently influential at both stages of the analysis, so both can be seen as the most powerful factors. On the other hand, anthropometry loses its meaning after other variables are controlled, while maternal education becomes meaningful as a whole, although it is not meaningful in bivariate analysis, without any distinctly different categories from elementary school. This pattern shows that the influence of one factor on stunting does not stand alone, but is interrelated with other factors, so the interpretation of each variable needs to consider other variables.

The results of this study need to be read by paying attention to their limitations. The wide confidence interval in most variables shows that the estimate is still influenced by a limited number of samples (80 toddlers) relative to the number of variables in the model. In addition, the categories of democratic, authoritarian, and permissive parenting are not separate from each other because they are analyzed as separate variables, so the contribution of each parenting style in the model can overlap.

**Discussion of Research Objectives**

The results of this study answer the formulation of the problem and the four specific objectives are as follows. First, family income has not been shown to have an effect on stunting incidence, both in bivariate ($p = 0.120$) and multivariate ($p = 0.119$) analyses after controlling for other variables). This does not mean that economics is not important, but it shows that the amount of income is not the only determinant of a child's nutritional status, because the use of family resources for nutritional fulfillment depends on the mother's knowledge and parenting.

Second, parenting had a significant effect on stunting at both stages of analysis. Democratic parenting was protective, while authoritarian and permissive parenting were risk factors, with permissive parenting contributing the greatest risk to bivariate analysis. Third, BBLR history was not proven to be effective ($p = 0.499$), but these results need to be read carefully because only 10 toddlers (12.5%) had a history of BBLR, so BBLR still needs to be watched out for as a potential risk factor.

Fourth, maternal knowledge is the factor with the greatest influence, both in bivariate (OR = 13.00) and multivariate (OR = 43.054) analyses, while maternal education is not significantly related to bivariate analysis and is only meaningful overall in multivariate analysis with no real differences between categories. Thus, maternal knowledge of nutrition and stunting seems to be more decisive than formal education. All of these findings need to be interpreted by considering the limited number of samples and control case designs that cannot prove a definite cause-and-effect relationship.

**Implications of Research Results**

The findings of this study show that stunting prevention in Binjai City does not rely enough on economic improvement. Increasing maternal knowledge is a top priority, including through pregnant women's classes, counseling at posyandu, and home visits by health cadres, which effectively increase maternal understanding so that it has a positive impact on children's nutritional status. Parenting assistance also needs to be strengthened so that parents implement

democratic parenting accompanied by two-way communication, attention, and consistent supervision, as well as avoiding parenting that is too rigid and has minimal restrictions, especially in feeding.

For health workers, anthropometric monitoring of toddlers needs to be carried out regularly so that growth disorders are detected and treated as early as possible. For health offices and health centers, prevention programs should be sustainable, contain nutrition education and parenting assistance, and reach all income groups and education levels, because the risk of stunting is found in various levels of the family.

For parents, these findings encourage increased knowledge about stunting, balanced nutrition, and child growth monitoring, for example by actively participating in counseling and posyandu activities. Parents are also expected to make feeding an activity that is supervised consistently and responsive to the needs of children, not as a matter that is completely released to children or carried out by force.

For further studies, a larger sample count and wider coverage of a wider area are needed to make the estimates in the multivariate analysis more stable and the confidence intervals narrower, with the number of variables in the model adjusted for the number of samples and parenting being analyzed as one categorical variable. Subsequent studies can also add potentially influential variables, such as nutritional intake, history of infectious diseases, exclusive breastfeeding, MP-breastfeeding, sanitation, and environmental factors, and use stronger designs in describing cause-and-effect relationships, such as cohort studies, with instruments of measurement of parenting and more in-depth knowledge.

## CONCLUSION

Based on findings from 80 children under five years of age attending community health centers in Binjai City, bivariate analysis revealed significant associations between stunting and anthropometric characteristics, parenting styles, and maternal knowledge. Multivariable analysis identified maternal knowledge as the strongest factor associated with stunting ($p = 0.005$; OR = 43.054), while democratic parenting was identified as a protective factor. In contrast, authoritarian and permissive parenting styles were associated with increased odds of stunting. Family income, history of low birth weight (LBW), and anthropometric characteristics were not significantly associated with stunting after adjustment for other variables. The regression model yielded a Nagelkerke $R^2$ of 0.624 and an overall classification accuracy of 80%. These findings highlighted the importance of maternal knowledge and parenting practices in stunting prevention, although the relatively small sample size warranted cautious interpretation.

Parents are encouraged to improve their understanding of childhood stunting and balanced nutrition while adopting supportive and responsive parenting practices. Health care professionals and community health centers should strengthen maternal nutrition education, parenting support, and routine child growth monitoring. Local health authorities and relevant stakeholders should develop sustainable and inclusive stunting prevention programs. Future research should involve larger samples, broader geographical coverage, and additional variables, including dietary intake, history of infectious diseases, exclusive breastfeeding, complementary feeding practices (Makanan Pendamping Air Susu Ibu, MP-ASI), sanitation,

and environmental conditions, to provide a more comprehensive understanding of factors associated with childhood stunting.

**FUNDING**

This research does not receive special funding from government, private, or other organizations.

**CONFLICT OF INTEREST**

The authors state that there is no conflict of interest in the research, writing, or publication of this article.

**AUTHOR CONTRIBUTION**

All authors contributed to the preparation of this article. Author 1 (Angelika Praticia Sinaga) played a role in the conceptualization of the research, played a role in the collection and analysis of data, played a role in the interpretation of the results and the preparation of the manuscript, while the other authors contributed to the review, editing, and final approval of the manuscript.

**GENERATIVE ARTIFICIAL INTELLIGENCE USAGE STATEMENT**

The author states that no generative artificial intelligence was used in the preparation of this article.

**REFERENCES**

Aghadiati, F., Ardianto, O., & Wati, S. R. (2023). Hubungan Pengetahuan Ibu Terhadap Kejadian Stunting di Wilayah Kerja Puskesmas Suhaid. *Journal of Healthcare Technology and Medicine, 9*(1), 130. https://doi.org/10.33143/jhtm.v9i1.2793

Alao, R., Nur, H., Fivian, E., Shankar, B., Kadiyala, S., & Harris-Fry, H. (2021). Economic inequality in malnutrition: A global systematic review and meta-analysis. *BMJ Global Health, 6*(12), 1–12. https://doi.org/10.1136/bmjgh-2021-006906

Alex, A. M., Aguate, F., Botteron, K., Buss, C., Chong, Y.-S., Dager, S. R., Donald, K. A., Entringer, S., Fair, D. A., & Fortier, M. V. (2024). A global multicohort study to map subcortical brain development and cognition in infancy and early childhood. *Nature Neuroscience*, *27*(1), 176–186.

Arnita, S., Rahmadhani, D. Y., & Sari, M. T. (2020). Hubungan Pengetahuan dan Sikap Ibu dengan Upaya Pencegahan Stunting pada Balita di Wilayah Kerja Puskesmas Simpang Kawat Kota Jambi. *Jurnal Akademika Baiturrahim Jambi, 9*(1), 6–14. https://doi.org/10.36565/jab.v9i1.149

Aurima, J., Susaldi, S., Agustina, N., Masturoh, A., Rahmawati, R., & Tresiana Monika Madhe, M. (2021). Faktor-Faktor yang Berhubungan dengan Kejadian Stunting pada Balita di Indonesia. *Open Access Jakarta Journal of Health Sciences, 1*(2), 43–48. https://doi.org/10.53801/oajjhs.v1i3.23

Badan Kebijakan Pembangunan Kesehatan. (2023). *Survei Kesehatan Indonesia (SKI) 2023 dalam angka*. Kementerian Kesehatan Republik Indonesia.

Badan Kependudukan dan Keluarga Berencana Nasional. (2022). *Strategi penanggulangan stunting nasional*. BKKBN Press.

Chandra, P., & One, M. (2021). Hubungan berat badan lahir rendah (BBLR) dengan kejadian stunting pada anak usia 1-5 tahun. *Journal Health of Education, 3*(1), 30-36.

Cholifatus, S. (2023). Hubungan berat badan lahir rendah (BBLR) terhadap kejadian stunting di wilayah kerja Puskesmas Dradah. *Jurnal Fakultas Kesehatan Masyarakat, 7*(1), 135-140.

Christiana, I., Nazmi, A. N., & Anisa, F. H. (2022). Hubungan Pola Asuh Ibu dengan Kejadian Stunting pada Balita di Desa Kertosari Wilayah Kerja Puskesmas Kertosari Bayuwangi. *Jurnal Ilmiah Keperawatan (Scientific Journal of Nursing), 8*(2), 398–409.

https://doi.org/10.33023/jikep.v8i2.1161
Dewi, P., Khomsan, A., & Dwiriani, C. M. (2024). The Household Food Security and Stunting of Under Five Childrenin Indonesia: A Systematic Review. *Media Gizi Indonesia, 19*(1), 17–27. https://doi.org/10.20473/mgi.v19i1.17-27
Ernawati, F., Syauqy, A., Arifin, A. Y., Soekatri, M. Y. E., & Sandjaja, S. (2021). Micronutrient Deficiencies and Stunting were Associated with Socioeconomic Status in Indonesian Children Aged 6–59 Months. *Nutrients, 13*(6), 1–9. https://doi.org/10.3390/nu13061802
Femidio, M., & Muniroh, L. (2020). Perbedaan pola asuh dan tingkat kecukupan zat gizi pada balita stunting dan non-stunting di wilayah pesisir Kabupaten Probolinggo. *Amerta Nutrition, 4*(1), 49–57. https://doi.org/10.20473/amnt.v4i1.2020.49-57
Global Nutrition Report. (2020). *2020 Global Nutrition Report: Action on equity to end malnutrition*. Development Initiatives.
Hadi, H., Fatimatasari, F., Irwanti, W., Kusuma, C., Alfiana, R. D., Ischaq Nabil Asshiddiqi, M., Nugroho, S., Lewis, E. C., & Gittelsohn, J. (2021). Exclusive breastfeeding protects young children from stunting in a low-income population: A study from eastern indonesia. *Nutrients, 13*(12), 1–14. https://doi.org/10.3390/nu13124264
Hamdin, Hamid, A., & Nurhayati. (2023). Hubungan Pengetahuan Ibu tentang Stunting pada Balita di Wilayah Kerja Puskesmas Moyo Hilir 2022. *Jurnal Kesehatan Masyarakat, 7*(1), 865–870. https://doi.org/10.31004/prepotif.v7i1.12859
Handryastuti, S., Pusponegoro, H. D., Nurdadi, S., Chandra, A., Pramita, F. A., Soebadi, A., Widjaja, I. R., & Rafli, A. (2022). Comparison of Cognitive Function in Children with Stunting and Children with Undernutrition with Normal Stature. *Journal of Nutrition and Metabolism, 2022*, 1–5. https://doi.org/10.1155/2022/9775727
Hermawan. (2019). *Metodologi Penelitian Pendidikan Kuantitatif, Kualitatif dan Mixed Methode*. Hidayatul Quran Kuningan: Kuningan.
Hidayat, A. N. (2023). Hubungan Pola Asuh Ibu Dengan Kejadian Stunting Pada Anak Usia 24-60 Bulan di Kelurahan Teritih Wilayah Kerja Puskesmas Kalodran Kota Serang Provinsi Banten Tahun 2022. *Jurnal Anestesi: Jurnal Ilmu Kesehatan Dan Kedokteran, 1*(2), 103–114. https://doi.org/10.55606/anestesi.v1i2.395
Karisma, G. D., Fauziyah, S., & Herlina, S. (2022). Pengaruh Antropometri Bayi Baru Lahir dan Prematuritas dengan Kejadian Stunting pada Balita di Desa Baturetno. *Jurnal Kedokteran Komunitas, 10*(2), 1–0.
Kementerian Kesehatan Republik Indonesia. (2024). *Pencegahan stunting melalui intervensi gizi 1000 hari pertama kehidupan*. Kemenkes RI Press.
Kementerian Kesehatan Republik Indonesia. (2025). *Survei status gizi Indonesia (SSGI) 2024: Prevalensi stunting nasional turun menjadi 19,8%*. https://kemkes.go.id
Khoiriyah, H., Ismarwati, & Wantonoro. (2024). Analisis Hubungan Pola Asuh Orang Tua dengan Kejadian Stunting pada Balita. *Jurnal Kebidanan Indonesia, 15*(1), 106–120. https://doi.org/10.36419/jki.v15i1.994
Mulyaningsih, T., Mohanty, I., Widyaningsih, V., Gebremedhin, T. A., Miranti, R., & Wiyono, V. H. (2021). Beyond personal factors: Multilevel determinants of childhood stunting in Indonesia. *PLOS ONE, 16*(11), 1–19. https://doi.org/10.1371/journal.pone.0260265
Mustakim, M. R. D., Irwanto, Irawan, R., Irmawati, M., & Setyoboedi, B. (2022). Impact of Stunting on Development of Children between 1-3 Years of Age. *Ethiop J Health Sci, 32*(3), 569–578. https://doi.org/10.4314/ejhs.v32i3
Mutiara, D., Suroyo, R. B., & Hanum, R. (2021). Faktor Risiko Kejadian Stunting pada Balita di Wilayah Kerja Puskesmas Desa Binjai Kota Medan Tahun 2020. *Journal of Healthcare Technology and Medicine, 7*(2), 933–944. https://doi.org/10.33143/jhtm.v7i2.1598

Ramesh, S. (2022). Cognitive development and childhood learning. In *The political economy of human behaviour and economic development: Psychology and economic development* (pp. 181–219). Springer.

Rosyida, Q., & Setyawati, A. (2024). Hubungan Pola Asuh Orang Tua dengan Kejadian Stunting pada Balita Usia 24-59 Bulan di Wilayah Kerja Puskesmas Wonotunggal. *JIKA, 8*(2), 7–13. https://doi.org/10.36409/jika.v8i2.217

Saadong, D., Suriani, Nurjaya, & Subriah. (2021). BBLR, Pemberian Asi Eksklusif, Pendapatan Keluarga, dan Penyakit Infeksi Berhubungan dengan Kejadian Stunting. *Jurnal Kesehatan Manarang, 7*, 52–58. http://jurnal.poltekkesmamuju.ac.id/index.php/m

Saleh, A., Syahrul, S., Hadju, V., Andriani, I., & Restika, I. (2021). Role of Maternal in Preventing Stunting: a Systematic Review. *Gaceta Sanitaria, 35*(2), 576–582. https://doi.org/10.1016/j.gaceta.2021.10.087

Salsabila, S., Noviyanti, R. D., & Kusudaryati, D. P. D. (2022). Hubungan Tingkat Pendidikan Ibu dan Pola Asuh Orang Tua dengan Kejadian Stunting pada Balita Usia 12-36 Bulan di Wilayah Puskesmas Sangkrah. *PROFESI (Profesional Islam): Media Publikasi Penelitian, 19*(2), 143–151.

Suratri, M. A. L., Putro, G., Rachmat, B., Nurhayati, Ristrini, Pracoyo, N. E., Yulianto, A., Suryatma, A., Samsudin, M., & Raharni. (2023). Risk Factors for Stunting among Children under Five Years in the Province of East Nusa Tenggara (NTT), Indonesia. *International Journal of Environmental Research and Public Health, 20*, 1–13. https://doi.org/10.3390/ijerph20021640

UNICEF. (2020). *Stunting in a nutshell*. United Nations Children's Fund.

Volkow, N. D., Gordon, J. A., Bianchi, D. W., Chiang, M. F., Clayton, J. A., Klein, W. M., Koob, G. F., Koroshetz, W. J., Pérez-Stable, E. J., & Simoni, J. M. (2024). The HEALthy Brain and Child Development Study (HBCD): NIH collaboration to understand the impacts of prenatal and early life experiences on brain development. *Developmental Cognitive Neuroscience*, *69*, 101423.

World Health Organization. (2006). *WHO child growth standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: Methods and development*. World Health Organization.