



# Gender, Birth Length and Low Birth Weight as Determinants of Stunting: A Study in Kebon Kalapa Village, Indonesia

Yusias Hikmat Diani <sup>a\*</sup>

<sup>a</sup> Department of Community Medicine, Faculty of Medicine, Universitas Kristen Indonesia, Jakarta, Indonesia.

## Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

## Article Information

DOI: <https://doi.org/10.9734/ajpr/2025/v15i4439>

## Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://pr.sdiarticle5.com/review-history/133592>

Original Research Article

Received: 01/02/2025

Accepted: 03/04/2025

Published: 04/04/2025

## ABSTRACT

**Aims:** to reveal the relationship between Gender, Birth Length and Low Birth Weight with Stunting in Kebon Kalapa Village Sumedang in 2021.

**Methods:** using simple cross sectional approach, all primary data obtained from children age between 2-5 years old in Kebon Kalapa Village, Sumedang west Java which eligible for the inclusion criteria.

**Results:** Simple analysis conducted on 130 respondents obtained using the total sampling technique revealed that the incidence of stunting in children aged 2-5 years in Kebon Kalapa Mekarsari Village, Sumedang was found to be 24.6% (n=32) and non-stunting was 75.4% (n=98). The gender distribution of respondents with female compared to male was 51.5% (n=67) vs 48.5%,(n=63) respectively. Respondent with history of short birth length (length of birth less than 48

\*Corresponding author: Email: [yusias.diani@uki.ac.id](mailto:yusias.diani@uki.ac.id);

cm) was found to be 19.2% and normal ( $\geq 48$  cm) was 80.2%, while low birth weight was found to be 4.6% and normal birth weight was 95.4%.

**Conclusion:** stunting formation in children associated with their gender, short birth length and low birth weight. The birth condition of the baby solely depend on the mother's nutritional status and anemia condition. This implies that it is crucial to prevent anemia since very early, e.g., in adolescent girls and in women before and during pregnancy, with the regular monitoring of nutritional status of pregnant women, as a part of programs to eliminate stunting in children.

**Keywords:** Nutrition; anemia; pregnant women; toddler; newborn; government; policy.

## 1. INTRODUCTION

Stunting is the impaired growth and development that any children may experience from multifaceted condition (Soliman et al., 2024) such as chronic poor nutrition intake (De Sanctis et al., 2021), persistent and recurrent infection or even severe co-infection, (Mutasa et al., 2022; Siagian, 2023) and combined with complex inappropriate psychosocial stimulation (Walker et al., 2007). Childhood stunting is the best overall indicator of children's well-being and an accurate reflection of social inequalities (de Onis & Branca, 2016). Children are defined as stunted or impaired linear growth-for-age, if their height-for-age is more than two standard deviations below the WHO Child Growth Standards median (Quamme & Iversen, 2022).

Stunting occurs due to the progressive escalation of irreversible physical and cognitive damage caused by chronic undernutrition (Diani, 2024), repeated infections (Mutasa et al., 2022) and poor or inadequate feeding behavior (Mandara et al., 2024). Stunting has a wide range of adverse long-term sequels (De Sanctis et al., 2021), including poor cognition (Handryastuti et al., 2022), deprived school performance and outcome (Amusa et al., 2022), irretrievable productivity and an increased risk of nutrition-related diseases, such as diabetes and obesity (Diani 2024), which all of those previously mentioned conditions specifically add the economic burdens of childhood stunting to the private sector in low- and middle-income countries (Akseer et al., 2022). It is also a recognized risk factor for obstetric complications during labor, potentially resulting in injury or death for mothers and their newborns (De Sanctis et al., 2021).

Globally, stunting in children under 5 years old has been decreasing (Vaivada et al., 2020), but unfortunately, there are still regional and within-country discrepancies (Karlsson et al., 2023). Its global prevalence in 2022, 148.1 million

(estimated 22.3%) children under 5 years of age were too short for their age (stunting) (UNICEF, WHO, WORLD BANK, 2021). Regionally, the prevalence of stunting in Southeast Asia is high, estimated 27.4% (UNICEF, WHO, WORLD BANK, 2021) and is linked to poverty (Arhut et al., 2024), poor access to healthcare especially in urban vs rural (Siramaneerat et al., 2024), and policy related conflicts (Meher et al., 2023).

More specifically in Indonesia, Taufiqurokhman that cited the Indonesian Ministry of Health's Nutritional Status Study report, the prevalence of stunting in Indonesia fell from 27.7 percent in 2019, 24.4 percent in 2021, to 21.6 percent in 2022, with the majority occurring in children aged 3–4 years (Taufiqurokhman, 2023). However, this figure is still above the WHO standards (World Health Organization, 2014), which has a global target to reduce stunting in children under five by 40% by 2025 (or less than 20%). For this reason, the government is trying to reduce the stunting rate to 17 percent in 2023 and 14 percent in 2024 (Arieffiani & Ekowanti, 2024). In the year of 2018, almost one out of every three children under five in Indonesia, or 31%, were stunted, with substantial variations across provinces (Kustanto, 2021).

The prevalence of stunting differs across 38 provinces in Indonesia. The eastern part of the country has the highest prevalence of stunting (Wardani et al, 2022). The prevalence of stunting in infants was measured in several regions of Indonesia, including DKI Jakarta (11.9%), West Java (16.3%), Central Java (13.2%), DI Yogyakarta (12.1%), East Java (15.9%), and Banten (14.6%) (Paramita, et al., 2024). More specifically, in 2022, the stunting prevalence in West Java was 20.2%, slightly reduced from 24.5% in 2021 (Yusup et al., 2024). The West Java Provincial Government has a target to reduce stunting to 14-15% by 2024.

Faculty of Medicine, Universitas Kristen Indonesia, in Jakarta Indonesia has actually

pioneered a stunting intervention program since early 2018, with the initiation of establishing and collecting baseline data related to toddlers in 10 villages namely (1) Kebonkalapa-Cisarua, (2) Ungkal-Conggeang, (3) Mekarbhakti-Pamulihan, (4) Mekarsari-Sukasari, (5) Cimarga-Cisitu, (6) Cilembu-Pamulihan, (7) Malaka-Situraja, (8) Cijeruk-Pamulihan, (9) Sukahayu-Rancakalong and (10) Margamukti-Sumedang Utara in Sumedang Regency, West Java. In 2019, our faculty officially became one of the universities appointed by the Indonesian Ministry of Health to provide assistance in preventing and overcoming stunting in Sumedang. The important role of universities in this academic assistance is to assist local governments in planning and implementing programs through integrated nutritional interventions as well as providing scientific evidence on the implementation of local government programs through collaborative research and publications (Mayangsari et al., 2024). The aim of this study was to study the relationship between Birth Length and Low Birth Weight with Stunting in Kebon Kalapa Village, Sumedang in 2019.

## 2. METHODOLOGY

This simple cross sectional study purposively use all data of children aged 2-5 years in Kebon Kalapa Village, Sumedang. The data used are secondary data which are the results of a primary survey conducted by the Stunting Center FK UKI in September 2018. The dependent variable in this study is stunting which is obtained using the height index according to age (height/age), while the independent variables are gender, birth length, and birth weight. The collected data were then analyzed using univariate analysis to provide an overview of the frequency of each

variable studied and bivariate analysis using the chi-square test to determine the relationship between gender, birth length, and birth weight to stunting.

## 3. RESULTS AND DISCUSSION

Analysis conducted on 130 respondents obtained using the total sampling technique revealed that the incidence of stunting in children aged 2-5 years in Kebon Kelapa Mekarsari Village, Sumedang was found to be 24.6% and non-stunting was 75.4%. The gender distribution of respondents with female vs male was 51.5% vs 48.5%, respectively. Respondent with history of short birth length (<48 cm) was found to be 19.2% and normal ( $\geq 48$  cm) was 80.2%, while low birth weight was found to be 4.6% and normal birth weight was 95.4%.

In 2018, the prevalence of stunting in Indonesia was still 30.8%, slightly reduced from 37.2% in 2013. However, this was still higher than the World Health Organization's (WHO) target of less than 20%. Our findings regarding stunting in toddlers in Kebon Kelapa Mekarsari Village remains a problem in the health sector, although the incidence is slightly lower than the whole Sumedang residence (30.1%), West Java (29.2%) and even lower than the national data obtained through Riskesdas (30.8%) A study regarding stunting incidents in toddlers in East Java Province is the parenting style provided by mothers. The level of maternal knowledge regarding Exclusive Breastfeeding (ASI), provision of Complementary Feeding (MPASI), and the intake of foods consumed by toddlers has a significant correlation with the occurrence of stunting and the developmental progress of children (Pertwi & Hendrati, 2023).

**Table 1. Univariate analysis of 130 children in Kebon Kelapa Mekarsari Village, Sumedang**

	Variable	N	%
<b>1</b>	<b>Stunting</b>		
	Yes	32	24.6
	No	98	75.4
<b>2</b>	<b>Gender</b>		
	Boys	63	48.5
	Girls	67	51.5
<b>3</b>	<b>Birth length</b>		
	Short	25	19.2
	Normal	105	80.8
<b>4</b>	<b>Low Birth Weight Baby</b>		
	Yes	6	4.6
	No	124	95.4

In this study, the number of girls with stunting is slightly higher than the number of boys (51.5% vs 48.5%). Some studies suggest that boys are more likely to be stunted than girls, while others suggest that gender is not a significant factor. One interesting aspect of this gender differences was revealed by a study on sex differences in infant and young child feeding practices which found that differences in energy needs may contribute to sex differences in feeding practices (Thompson, 2021). According to Rosenfeld and Roberts, Boys grow faster and are larger than girls before and after birth, which may make it more energetically costly for them and their mothers (Rosenfeld & Roberts RM, 2004). Several baby's gender internal factor which thought to contribute to stunting were as follows (1) difference in growth rate where male fetuses grow briskier compared to female fetuses which already commencing in the second trimester of pregnancy (Melamed et al., 2013); (2) size of the infant where male infants are larger than female infants at birth and throughout childhood (Alur, 2019); (3) specific body configuration difference where male infants have lesser body fat for their size (Davis et al., 2019); (4) vulnerability to illness where the more fragile male infants are more likely to get sick (Kraemer, 2000); and last but not least (5) energy cost needed where the faster growth and larger size of male infants makes them require more energetically costly for both the infants and also their mothers at the same time (Thompson, 2021).

According to the birth length, 19.2% of children in Kebon Kelapa village were born with a short body length. Short stature at birth is defined as a birth length that is less than 48 centimeters (cm). A short birth length can be a risk factor for stunting in toddlers (Judiono et al., 2023). Causes of short stature including several history of (1) maternal short stature (Khatun et al., 2019) where mothers with short stature are more likely to have newborns with short birth lengths; (2) Intrauterine growth restriction (IUGR) (Sania et al., 2015) where restricted growth which happened to the uterus during pregnancy can result in a newborn baby being born smaller than normal and (3) Genetic causes where short stature can be caused by genetic conditions such as Down syndrome (Akhtar & Bokhari, 2023), Ullrich-Turner syndrome or Turner syndrome (Trovó de Marqui, 2015), and Lerí-Weill dyschondrosteosis (Lemire & Weibe, 2009).

Other aspect obtained from this simple study was regarding the low birth weight baby (LBWB)

where the incidence was 4.6%. Low birth weight (LBW) is a major risk factor for stunting in children (Aryastami, et al., 2017). LBW is highly prevalent in particularly south Asian countries such as Bangladesh, India and Pakistan and (Abbas, et al. 2021).

Table 2 revealed that 22 out of 32 stunted children were boys (68.75%) and 10 (31.25%) were girls ( $p=0.015$ ) whereas the p value as a probability, provides a continuous measure of the evidence against  $H_0$  (Dorey, 2010). This finding suggests that there is significance gender difference in stunting formation. Boys are generally more likely to experience stunting than girls (Thompson 2021; Samuel, et al., 2022). This is true in many developing countries, including Indonesia (Yasmine & Widjaja, 2024). Many tropical parasitic diseases, including malaria (Onyango and Maguire, 2022), visceral leishmaniasis (Cloots et al., 2020), Chagas' disease (Triana et al, 2016), amebiasis (Acuna-Soto, et al., 2000), and certain helminth infections (Wesolowska, 2022), display a certain one-sidedness towards the male gender, whereas a female bias exists in cysticercosis (Escobedo et al., 2010). Selected murine models accurately mirror the male predominance in human parasitosis, including the modulation by sex hormones, and can thus be used as tools for the study of sex differences in infection (Sellau, et al., 2024) and furthermore, persistent intestinal parasitic infection (IPI) induce the host's chronic immune activation and systemic inflammation that contributes to stunting (Siagian, 2023).

The data also revealed that in the short birth length group, 13 out of 25 babies (52%) then became stunted while in the normal birth length group, only 19 out of 105 babies (18.1%) underwent stunting ( $p=0.001$ ). According to Krebs et al, Birth length is the strongest predictor of linear growth status and stunting in the first 2 years of life (Krebs, et al., 2022) Other study conducted by Lukman et al, 2021 found out that children with a birth length of below 48 cm (short) have a 15.0 times higher risk of experiencing stunting ( $p<0.05$ ; 95% CI: 2.58– 87.9) compared to children born with a body length  $\geq 48$  cm (normal). The length of a child's body is inseparable from the growth and development of the fetus during the neonatal period (Lukman, et al., 2021). Furthermore, Children from mothers with short statures (height  $<145.0$  cm) and fathers with short statures (height  $<161.9$  cm) had an almost 6 times higher likelihood of being stunted at birth (adjusted odds ratio, 5.93; 95%

**Table 2. Bivariate analysis of 130 children in Kebon Kelapa Mekarsari Village, Sumedang**

Independent variable	Stunting		Total	P value	OR (CI 95%)
	Yes n (%)	No n (%)			
Gender					
Boys	22 (34.9)	41 (65.1)	63 (100)	0.015	3.059 (1.309 – 7.145)
Girls	10 (14.9)	57 (85.1)	67 (100)		
Birth length					
Short	13 (52)	12 (48)	25 (100)	0,001	4.904 (1.937 – 12.412)
Normal	19 (18.1)	86 (81.9)	105 (100)		
LBWB					
Yes	3 (50)	3 (50)	6 (100)	0,159	3.276 (0.627 -17.116)
No	29 (23.4)	95 (76.6)	124 (100)		

confidence interval, 5.53 to 6.36) (Sari, et al., 2021). That is why it is so important to have robust and tailor made programs to support pregnant females and monitor children's heights from birth will help prevent intergenerational stunting.

In the LBWB, three out of six LBWB (50%) then became stunted. Beside birth length, birth weight also important in the formation of stunting. LBW is associated with a higher risk of stunting in children under 60 months of age (Putri et al, 2021). Other study conducted in Indonesia revealed that toddlers with a birth weight less than 2,500 grams are 2,730 times more likely to be stunted than toddlers with an average birth weight (Rahmadiani et al., 2024). If traced further, maternal malnutrition and anemia can cause low birth weight and stunting in children. This relationship is bidirectional, meaning that stunting can also lead to anemia later in life. A community-based survey study design conducted by Nainggolan and Siagian in 2019, regarding the prevalence of anemia in pregnant women in the 10 priority villages for stunting control in Sumedang district, West Java (the same area with this stunting study), they found out that 18.9% of pregnant women surveyed suffer from anemia (Nainggolan & Siagian, 2019).

Further study need to be conducted in order to explore the exact mechanism of how maternal anemia and also maternal nutritional status, especially during pregnancy, may cause their babies to become short in birth height and low birth weight and then further become stunted.

#### 4. CONCLUSION

The current simple cross sectional retrospective study emphasizes that stunting in children may be associated with their gender, short birth length

and low birth weight. The birth condition of the baby solely depend on the mother's nutritional status and anemia condition. This implies that it is crucial to prevent anemia since very early, e.g., in adolescent girls and in women before and during pregnancy, with the regular monitoring of nutritional status of pregnant women, as a part of programs to eliminate stunting in children.

#### DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that no generative AI technologies such as large language models (ChatGPT, COPILOT, etc.) And text-to-image generators have been used during writing or editing of this manuscript.

#### CONSENT

As per international standards, parental written consent has been collected and preserved by the author(s).

#### ETHICAL APPROVAL

It is not applicable.

#### COMPETING INTERESTS

Author has declared that no competing interests exist.

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