

## ORIGINAL RESEARCH

# RISK FACTORS OF STUNTING IN KEDISAN, GIANYAR DISTRICT, BALI, INDONESIA

Faktor Risiko Terjadinya Stunting di Kedisan, Kabupaten Gianyar, Bali, Indonesia

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### ABSTRACT

**Background:** Stunting is a nutritional status based on measurements of the Length-for-Age or Height-for-Age index of the anthropometric standards assessment of nutritional status of children. The report of the Public Health Center (PHC) of Tegallalang I revealed the largest number of stunting cases in Kedisan Village, with 28 toddlers suffering from stunting based on 2017 data. **Purpose:** This study aims to investigate the risk factors associated with stunting at Kedisan Village, Tegallalang Sub-district, Gianyar District. **Methods:** This is an analytic study employing a case-control approach. Sampling was carried out using a total sampling technique; that is, by utilizing all cases of children under five who were declared stunted in the village in question (a total of 28 cases). The case:control ratio used was 1:1; thus, the total sample used in the study was 56 samples from May 2017. Bivariate analysis was conducted using a chi-square test. **Results:** The majority of respondents were employed (i.e., 67.80% in the case group and 53.50% in the control group); in terms of the most recent level of education, 35.70% of respondents in the case group had a junior high school education, while 46.40% in the control group had a senior high school education. The results of the bivariate analysis found that the risk factor that was most significantly related with the incidence of stunting was complementary foods with breast milk ( $p = 0.03$ ; OR: 4.63), while other risk factors were not related to the occurrence of stunting. **Conclusions:** The factor that influenced the occurrence of stunting in Kedisan Village was complementary foods with breast milk.

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## ABSTRAK

**Latar Belakang:** Stunting adalah status gizi yang didasarkan pada indeks PB/U (panjang badan menurut umur) atau TB/U (tinggi badan menurut umur) dimana dalam standar antropometri penilaian status gizi anak. Laporan Pusat kesehatan masyarakat (Puskesmas) Tegallalang I didapatkan kasus stunting terbanyak terdapat di Desa Kedisan dengan jumlah 28 balita menderita stunting berdasarkan data pada tahun 2017. **Tujuan:** Penelitian ini bertujuan untuk mengetahui faktor yang mempengaruhi terjadinya stunting di Desa Kedisan, Kecamatan Tegallalang, Gianyar. **Metode:** Penelitian ini menggunakan jenis analitik dengan pendekatan case-control. Besar sampel diambil menggunakan teknik total sampling yaitu dengan menggunakan semua kasus balita yang dinyatakan stunting di wilayah Desa Kedisan yaitu 28 kasus dengan perbandingan kasus dan kontrol 1:1. Jumlah sampel yang digunakan dalam penelitian ini adalah 56 sampel yang diambil pada Bulan Mei 2017. Analisis bivariat menggunakan uji Chi-Square. **Hasil:** Sebagian besar responden sudah bekerja yaitu 67.80% pada kelompok kasus dan 53.50% pada kelompok kontrol. Dilihat dari tingkat pendidikan terakhir 35.70% responden kelompok kasus berpendidikan sekolah menengah pertama dan 46.40% kelompok kontrol berpendidikan sekolah menengah atas. Hasil analisis bivariat mendapatkan faktor risiko yang memiliki hubungan yang signifikan dengan kejadian stunting adalah makanan pendamping Air Susu Ibu (ASI) ( $p=0,03$ ; OR: 4,63), sedangkan faktor risiko lain tidak berhubungan dengan terjadinya stunting. **Kesimpulan:** Faktor yang mempengaruhi terjadinya stunting di Desa Kedisan adalah pemberian makanan pendamping ASI.

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## INTRODUCTION

Stunting refers to chronic malnutrition status during growth and development starting from the early stages of life. It is represented by a Height-for-Age Z-Score less than -2 standard deviations (SD) based on growth standards. Globally, about one in four children under the age of five is stunted. From a global perspective, childhood stunting is the best overall indicator of children's wellbeing and one of the most accurate reflections of social inequality (de Onis & Branca, 2016).

In addition, on a global scale, in 2011, more than 25% of children aged under five—that is, around 165 million children—were stunted, while at the Asian level, from 2005–2011, Indonesia was ranked fifth in terms of the highest prevalence of stunting. The prevalence of stunted children under five in Indonesia in 2013 was 37.20%, while in Bali Province in 2013, it was 31%. Gianyar is one of the “100 Priority Districts/Cities for Stunting Interventions” promoted by the government, as it

has a stunting prevalence of 40.99%. In 2018, the Indonesian government reported that stunting affects less than 20% of children in Bali (Ministry of Health RI, 2018). In the long run, the negative effects that can be caused by stunting include an increased risk of morbidity and death, along with inhibited growth in motor and mental abilities. Stunted toddlers have a higher risk of reduced intellectual ability, lower productivity, and an increased risk of degenerative diseases in the future (World Health Organization, 2014).

Based on preliminary studies, the Public Health Center (PHC) of Tegallalang I, Gianyar, reported that the village found to have the most stunting cases in the area was Kedisan, with the number of sufferers numbering 28 toddlers in 2017. The condition of stunting was the factor underlying the present study. Therefore, this study reveals the underlying factors that affected the incidence of stunting in children under five in Kedisan Village, Tegallalang Sub-district, Gianyar District. The

aims of this study are to investigate the risk factors associated with stunting.

## METHODS

This study is an analytic study employing a case-control approach. The focus of this study is on stunting in Kedisan Village, Tegallalang Sub-district, Gianyar District. The analysis conducted was bivariate analysis using a chi-square test. The case:control ratio was 1:1. Sampling was carried out using a total sampling technique; that is, by utilizing all cases of children under five who were declared stunted in the village in question. There were 28 total cases of stunting; thus, the total sample used in the study was 56 samples in 2017.

The data collected in this study were both primary and secondary. Primary data were collected using an interview guide in the form of a questionnaire, which was given to respondents to discover information about factors that influence the incidence of stunting; these included exclusive breastfeeding, complementary foods, maternal nutritional status during pregnancy, low birth weight, infectious diseases, family income and environmental sanitation. Exclusive breastfeeding is defined as the infant receiving only breast milk, while no other liquids or solids are given. Complementary foods are defined as any food or liquid other than breast milk. Maternal nutritional status during pregnancy is determined according to energy intake less than the requirement for one

month, low birth weight is defined as weight at birth less than 2,500 grams, infectious disease is defined as having ever been infected by serious illness, family income is defined according to gross regular income of the mother and husband over the last three months (< Rp 1.600.000 is low while  $\geq$  Rp 1.600.000 is greater), and environmental sanitation refers to safeguarding the home environment in a safe manner, particularly with regard to sewage systems, which are categorized as with latrines and without latrines.

Secondary data were obtained from the register of the community health center in question. The focus was on data relating to stunted toddlers in Kedisan Village, Tegallalang Sub-district, Gianyar District. This research was certified as ethically cleared by Universitas Udayana Faculty of Medicine Health Research Ethical Clearance Commissions, Number: 369/UN14.2.2/PD/KEP/2017.

## RESULTS

In terms of respondent characteristics, it was first determined that the majority of respondents were employed (i.e., 67.80% in the case group and 53.50% in the control group); in terms of the most recent level of education, 35.70% of respondents in the case group had a junior high school education, while 46.40% in the control group had a senior high school education (Table 1).

**Table 1**  
Respondent Characteristics

Characteristics of Sample	Case		Control	
	n	%	n	%
<b>Toddler's Age (years old)</b>				
2-3	11	39.20	10	35.70
4-5	17	60.70	18	64.20
<b>Gender of children</b>				
Male	18	64.20	15	53.50
Female	10	35.80	13	46.50
<b>Mothers' Job</b>				
Worked	9	32.10	13	46.40
Did not work	19	67.80	15	53.50
<b>Mother's Latest Education</b>				
Elementary school	5	17.80	3	10.70
Junior high school	10	35.70	8	28.50
Senior high school	9	32.10	13	46.40
Bachelor's degree (complete)	4	14.20	4	14.20
<b>Total</b>	<b>28</b>	<b>100.00</b>	<b>28</b>	<b>100.00</b>

Based on the results of bivariate analysis, the risk factor found to have a significant relationship with the incidence of stunting is complementary foods with breast milk ( $p = 0.03$ ; OR: 4.63). On the other hand, risk factors such as exclusive breastfeeding ( $p = 0.04$ ; OR: 5.20), family income ( $p = 0.04$ ; OR: 7.36), maternal nutritional status during pregnancy ( $p = 0.08$ ; OR: 2.12), low birth weight ( $p = 0.31$ ; OR: 2.04), infectious diseases ( $p = 0.74$ ; OR: 1.26) and environmental sanitation ( $p = 0.30$ ; OR: 0.31) were not found to have a relationship with the incidence of stunting (see Table 2).

## DISCUSSION

### Relationship of Exclusive Breast Milk with the Incidence of Stunting

The current study showed no relationship between exclusive breastfeeding and the incidence of stunting in children. Coincidentally, the results of this study are in line with the results of a previous study which showed no relationship between exclusive breastfeeding and the incidence

of stunting in children aged 13–36 months in the working area of the PHC of Sonder ( $p = 0.38$ ) (Pangkong, Rattu, & Malonda, 2017).

On the other hand, the results of the current study stand in contrast with the results of a study conducted in Malawian infants showing an association between exclusive breastfeeding and length-for-age Z-score  $< -2SD$ , wasting, and underweight (Kuchenbecker et al., 2015). Another study also found that in children aged 2–5 years, histories of non-exclusive breastfeeding and low birth weight are significantly correlated with stunting, with a 10-fold increase observed (Lestari, Hasanah, & Nugroho, 2018).

Childhood stunting is affected by many different factors. Moreover, breastfeeding factors can be combined with other factors to create the condition of stunting in children. Cetthakrikul et al (2018) found that prolonged breastfeeding beyond 12 months, when interacting with poor economic status of a household, caused a 1.8-fold increase in stunting. Terati, Yuniarti, & Susanto (2018)'s study also found that the duration of breastfeeding and mother's diet correlate with stunting.

**Table 2**  
Risk Factors of Stunting

Risk Factor of Stunting	Case		Control		OR	95% CI	p
	n	%	n	%			
<b>Exclusive Breastfeeding</b>							
No	8	28.58	2	7.14	5.20	0.99–27.23	0.38
Yes	20	71.42	26	92.86			
<b>Complementary Foods with Breast Milk</b>							
No	10	35.70	3	10.72	4.63	1.11–19.26	0.01*
Yes	18	64.30	25	89.28			
<b>Maternal Nutritional Status during Pregnancy</b>							
Less Chronic Energy	3	10.72	0	0.00	2.12**	1.59–2.82	0.07*
Normal	25	89.28	28	100.00			
<b>Low Birth Weight</b>							
Low Birth Weight	1	3.58	0	0.00	2.04**	1.56–2.67	0.325
Normal	27	96.42	28	100.00			
<b>Infectious Diseases</b>							
Ever	6	21.44	4	14.28	1.26	0.33–4.71	0.310
Never	22	78.54	24	85.74			
<b>Family Income</b>							
Low	6	21.42	1	3.58	7.36	0.83–65.83	0.04*
Greater	22	78.58	27	96.42			
<b>Environmental Sanitation</b>							
With latrine	1	3.56	3	10.72	0.31	0.03–3.17	0.410
Without latrine	27	96.44	25	89.28			
<b>Total</b>	<b>28</b>	<b>100.00</b>	<b>28</b>	<b>100.00</b>			

(\*) Indicate statistically significant ( $p \leq 0.05$ ); \*\*Haldane correction used

Breastfeeding is nourishment designed naturally by the human body for newborns and infants. Breastfeeding is also a protective factor against infections that can cause stunting. There are many benefits of breast-milk: for example, increasing children's immunity against diseases and ear infections, reducing the frequency of diarrhea, and so on. Lack of breastfeeding increases the risk of stunting, especially in early life, and stunting was found to occur in relation to long chronic infections due to low immune system (Brahm & Valdés, 2017).

### **Relationship between Complementary Foods with Breast Milk and Stunting Incidence**

The present study showed that there was a significant relationship between complementary foods with breast milk and the incidence of stunting in children. These results confirm the findings of previous studies regarding the relationship between supplementary feeding in addition to breastfeeding and the incidence of stunting in children aged 6–23 months in Sedayu Sub-district. In the results of this study, it was revealed that a relationship existed between complementary feeding in addition to breast milk and the incidence of stunting ( $p = 0.01$ ; OR: 2.87) (Khasanah, Hadi, & Paramashanti, 2016).

Inappropriate feeding practices were often determinant factors of inadequate nutrition intakes in households. Feeding practices such as complementary feeding behavior very often provoked the incidence of stunting in children. Complementary feeding covers the period from six to 18–24 months of age; this is a vulnerable period for nutritional needs, when breast milk is no longer enough for an infant, and is typically the time when malnutrition starts. Complementary feeding should be timely, meaning that all infants should begin to receive foods in addition to breast milk from six months onwards. These complementary foods should be given in adequate amounts, with adequate quality, quantity, frequency and consistency to cover the nutritional needs of the growing child (Zhao et al., 2016). A study by Awaliyah, Rachmawati, & Rahmah (2019) proved that breastfeeding practices are influenced by breastfeeding self-efficacy, which in turns influences the mother's satisfaction with breastfeeding; inappropriate feeding practices can reduce this satisfaction. Low satisfaction with breastfeeding is associated with low rates of breastfeeding and complementary food practice for children under five years old.

de Onis & Branca (2016) also proved that disorders in growth in the early stage of a baby's life are caused by several factors, including malnutrition since infancy, complementary feeding besides breastfeeding that is too early or too late, supplementary feeding of breast milk that lacks nutrition and does not meet the baby's nutritional needs, inaccurate breastfeeding patterns and complementary feeding by age. In fact, after the age of six months, children under five must be given foods complementary to breast milk in sufficient quantity and frequency; this is because, at this stage, breast milk is no longer able to meet the child's micro-nutritional needs (such as zinc and iron), meaning that appropriate complementary feeding can reduce the risk of stunting incidence (Abeshu, Lelisa, & Geleta, 2016).

### **Relationship between Maternal Nutrition Status during Pregnancy and Low Birth Weight with Stunting Incidence**

The findings of this study indicate that, in the case group, there were three respondents (5.36%) who had poor nutritional status during pregnancy, while in the control group, there were no respondents who were undernourished. The current study showed no significant relationship between nutritional status and the incidence of stunting in children.

The results of this study differ from the results of Uliyanti, Tamtomo, & Anantanyu (2017), who found a relationship between the mother's nutritional status during pregnancy and the incidence of stunting in the Sub-district of Matan Hilir. In this study, the indicator used to measure the nutritional state of the mother was a standardized mid-upper arm circumference (MUAC) of  $< 23.50$  cm during pregnancy. Chronic energy deficiency (CED) of children with or without recurrent pain will cause stunting or a short body shape in infancy.

In terms of the test results regarding the relationship between low birth weight and stunting incidence, the findings of the current study revealed that there was one respondent in the case group (1.70%) who had a history of low birth weight, while there was no history of low birth weight in the control group. The current study showed no significant relationship between low birth weight and the incidence of stunting. These results are in line with Rahmadi (2016) study, which stated that there was no significant relationship between birth weight and the incidence of stunting in infants; however, such

results differ from the findings of Aryastami et al (2017) in Medan, which suggested that toddlers born with low birth weight were associated with the incidence of stunting in toddlers. This study found that infants born with low birth weight are 1.74 times more likely to be stunted. The study concluded that low birth weight is significantly associated with stunting, while the incidence is more likely in boys. This study drew similar conclusions to other studies holding that boys who were born prematurely have a significantly higher risk of stunting at 24 years old compared to girls born prematurely (Prawirohartono, Nurdiati, & Hakimi, 2016).

These findings are still being debated. One study Rahmadi (2016) found no significant relationship between low birth weight and stunting. This study noted that low birth weight is not directly related to stunting, but should be combined together with other risk factors to diagnose stunting. This finding is supported by another study that found no relationship between low birth weight and stunting (Aramico & Husna, 2017). Not only do the results of the current study also reject the concept of the theory highlighting that low birth weight has a relationship with the incidence of stunting, but many factors could also cause this to occur. Infants born with low birth weight in general affect a family's ability to provide a healthy environment. Low birth weight is related to poor maternal education and low socio-economic status. Children who have low birth weight but who subsequently receive good nutritional intake through good parenting in the next stages of their life can avoid stunting entirely, while another study also proved that maternal nutrition counseling is associated with reduced stunting prevalence (Mistry, Hossain, & Arora, 2019).

### **Relationship between Infectious Disease and Stunting Incidence**

The results of this study found that there were six respondents in the case group (10.70%) who had suffered from an infectious disease, whereas only four respondents in the control group (7.10%) had suffered from the same disease. The current study further showed that there was no significant relationship between infectious disease history and the incidence of stunting.

These results differ from those of Vonaesch et al (2017) study, which found that the variable of infectious disease history affected the incidence of stunting. This study was restricted to a history of diarrheal disease and acute respiratory infections.

The study assessed entero-pathogen carriage in stool samples using microbiological assays. It found that recurrent gastrointestinal infection increased the risk of stunting. Such infections increase enteric dysfunction, leading to mal-absorption, nutritional/metabolic dysregulation, inflammation and bacterial translocation and under-nutrition status, creating a vicious cycle that leads to growth defects and delayed growth. These findings are based on Kusumawati, Rahardjo, & Sari (2015) study, which showed that there are three factors that together affect stunting in children aged six to 36 months: infectious diseases, food availability and environmental sanitation. The most dominant of these are the most commonly experienced infectious diseases, namely acute respiratory infections and diarrhea (OR 8.84). Another study also showed that children with stunting are more likely to present at least one of the danger signs for bacterial pathogens identified as a potential causative agent of diarrhea relative to non-malnourished children (Walson & Berkley, 2018).

The high prevalence of infections among children living in developing countries, including acute, invasive and chronic infection, impair linear population growth by affecting nutritional status. Infection may decrease food intake, food absorption and direct nutrient loss, increase metabolic requirements, cause catabolic loss of nutrients, impair nutrient transport to targeted tissues, imbalance bone remodeling, and impair linear growth (Millward, 2017).

### **Relationship between Family Income and Stunting Incidence**

Family income has an indirect impact on child nutrition. In urban areas, children with low family income have a higher risk of being stunted compared to those with high family income status. Low family income is related to poor living conditions, food insecurity, poor access to health care, unhealthy environment, and high risk of infection. One such as income distribution for family in country is important and needed to solve this problem Addressing income distribution for families in these countries is therefore necessary if this problem is to be solved (Jonah, Sambu, & May, 2018).

The results of the current study uncovered that there were six respondents in the case group (10.70%) who had low incomes, while in the control group, only one respondent (1.70%) had a low income. The results of statistical tests found no relationship between family income and the

incidence of stunting. This result contrasts with Al-Mansoob & Masood (2018) research, which found that family income is a significant influencing factor of the incidence of stunting in children and adolescence (OR 1.73). Another study Bommer, Vollmer, & Subramanian (2019) also found that family income is an important moderating factor for age-specific stunting rates in children. The different findings of this study were caused by the minimum data, as only one respondent had a low income.

### **Relationship between Environmental Sanitation and Stunting Incidence**

The results of the current study showed that, in terms of the relationship between environmental sanitation and stunting, there was only one respondent in the case group (1.70%) who did not have a toilet in their house, while three respondents in the control group (5.30%) did not have indoor latrines. The statistical test results showed no relationship between the availability of latrines and the incidence of stunting.

These results are not in accordance with the results of an earlier study, which revealed that poor quality of sanitation or poor availability of latrines can lead to repeated fecal cross-contamination in the house; this, in turn, can increase bacteria and vermin levels, which can lead to environmental enteropathy, increase the permeability of the small intestine towards pathogens, decrease nutritional absorption and trigger digestive disorders, resulting in the energy needed for growth being diverted and used to increase the body's resistance to infection and causing stunting (Dearden et al., 2017).

The WHO reported that a lack of access to toilets is endangering millions of the poorest children. UNICEF pointed to emerging evidence linking inadequate sanitation and malnutrition. Diarrhea is one of the fecal-oral diseases that can lead to malnutrition in children. Intestinal parasites such as roundworm, whipworm, and hookworm are transmitted through contaminated soil in areas where open defecation is practiced. Hookworm is also one of the major causes of anemia in pregnant women, which can lead to stunting indirectly (Kaminsky, Castillo, & Flores, 2015).

The differences between the results of this study and those of previous studies arise because the environmental sanitation variable focuses only on the waste disposal system (categorized as “with a latrine” and “without a latrine”), and does not consider respondent behavioral factors such as hand-washing or other habits that might affect the

incidence of infection and thus impact the incidence of stunting. This is shown in research conducted by Badriyah & Syafiq (2017), which showed that appropriate sanitation and hygiene had a significant impact on stunting amongst children under two years of age in Indonesia, with waste management being one of the most important indicators.

### **Research Limitations**

We recognize a number of limitations in this study. First, the research was conducted over a short period of time, which affected the credibility of our study results. Second, the case-control design used in our study had a short follow-up period and caused a lack of detail in the recording of some variables. These limitations indicate the need for further study.

### **CONCLUSION**

The key factor affecting the incidence of stunting in Kedisan Village, Tegallalang Sub-district, and Gianyar District is complementary foods with breast milk. Conversely, other factors, such as exclusive breastfeeding, maternal nutritional status during pregnancy, low birth weight, infectious diseases, family income and environmental sanitation have no effect on the incidence of stunting. In order to improve the health of the community, officials of the relevant Public Health Center should provide counseling to mothers regarding exclusive breastfeeding and foods to complement breast milk in order to meet the nutritional needs of infants. Furthermore, they should inform mothers regarding the adverse effects arising from inappropriate patterns of feeding, especially regarding the incidence of stunting. In addition, assistance should be provided to mothers and families in order to encourage them to always monitor the growth and development of babies from the womb onwards; this will help them to grow optimally and can prevent the incidence of stunting.

### **CONFLICT OF INTEREST**

The authors declare that there was no conflict of interest in this study.

### **AUTHOR CONTRIBUTIONS**

LGP was in charge of monitoring and coordinating research activities in journal-making and data analysis. DAPRJ was tasked with

preparing research activities, acting as team secretary, and collecting research data. NR was assigned to deepening references and analyzing data.

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