International Journal of Public Health Science (IJPHS)
Vol. 13, No. 3, September 2024, pp. 1366~1373
ISSN: 2252-8806, DOI: 10.11591/ijphs.v13i3.24156

Maternal risk factors for stunting in children aged 24-59 months

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Article Info

Article history:

Received Nov 5, 2023
Revised Dec 13, 2023
Accepted Dec 29, 2023

Keywords:

Children under five
Growth disorder
Maternal
Risk factors
Stunting

ABSTRACT

Stunting is a problem of growth and development disorders in children which is related to nutritional problems in the world. In 2022, 21.6% of children aged under five years in Indonesia were stunted. Several factors influence stunting, including environmental (social), household factors, maternal and child factors. The aim of this study was to determine maternal risk factors for stunting in children aged 24 to 59 months. This research, with a case control study design, involved 191 participants (91 stunted children and 100 non-stunting children). The results found that maternal factors associated with stunting in children aged 24-59 months included maternal height (P<0.005, OR 2.025), birth spacing (P<0.005, OR 1.912), gestational age (P<0.005, OR 2.622), history of illness during pregnancy (P<0.005, OR 2.453), and consumption of iron tablets during pregnancy (P<0.001, OR 7.600). In the multivariate analysis, consumption of iron tablets and maternal height were the factors identified as being most related to the incidence of stunting in children aged 24-59 months.

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1. INTRODUCTION

Stunting in childhood is one of the most significant inhibiting factors in human resource development [1]. Stunting is a problem of growth and development disorders in children which is related to the problem of malnutrition in the world, especially in poor and developing countries [2]. Children are classified as stunted if their height for age is more than two standard deviations below the median WHO Child Growth Standards. Moderate stunting if the height-for-age z score (HAZ) is less than two standard deviations (SD) below the reference, while it is said to be severe stunting if the HAZ is less than three standard deviations) [3], [4].

Stunting occurs in the womb and continues for at least the first 2 years of postnatal life. The health and well-being of the baby to some extent depends on the health and well-being of the mother during pregnancy. Therefore, the period from the conception of a two-year-old child, the first thousand days of a child's life, is the most important opportunity for intervention, both for prevention and treatment [5], [6]. The ideal development of children is a human right and is the goal of the health and social security system [7]. Along with stunted growth, children who experience stunting may experience severe, permanent physical and cognitive impairment. Stunting has detrimental effects that can last a lifetime and even affect future generations [8]. The prevalence of stunting in the world in children under 5 years of age in 2022 is 148.1 million people, 22.3% of children under 5 years of age in the world are stunted. Most of these children live in Asia, 52% of the total children in the world, and Africa, 43% of the total children in the world, or it could be said that more than half of children under five who are stunted live in Asia and two out of five children live in Africa. Between 2012 and 2022, the number of countries falling into the very high stunting prevalence category dropped from 46 to 28, a 40% decrease. While there has been a drop in the prevalence of stunting between 2000 and 2022, more concerted efforts are required if the world is to meet its 2030 target of 89 million fewer children suffering from stunting. Between 2012 and 2022, the number of countries falling into the very high stunting prevalence category dropped from 46 to 28, a 40% decrease. While there has been a drop in the prevalence of stunting between 2000 and 2022, more concerted efforts are required if the world is to meet its 2030 target of 89 million fewer children suffering from stunting [8].

Based on the results of the Indonesian Nutritional Status Survey (SSGI) in 2022, the incidence of stunting in children under 5 years of age in Indonesia is 21.6%. The province in Indonesia with the highest incidence of stunting is East Nusa Tenggara (35.3%), followed by West Sulawesi (35.0%) and Papua (34.6%). Lampung Province has a high stunting incidence rate and is above the national target, which is 15.2%. In 2021, Tanggamus Regency took first place in Lampung for the stunting incidence rate with a prevalence of 25%, then in 2022 the stunting rate in Tanggamus was 20.4%. There is a decrease in the prevalence of stunting from 2021 to 2022, but it is still far above Indonesia's national target of 14% [9], [10].

Stunting in children can lead to pathological changes that include physical deterioration, impaired neurological development, impaired cognitive function, and an elevated risk of metabolic disease that persists into adulthood. This impact can certainly burden the economy of the family and the country. Some experts view this condition as 'stunting syndrome'. Stunting is a cyclical process because women who experience stunting as children tend to have offspring who are also stunted, thus creating a cycle of intergenerational poverty and reduced human resources that is difficult to eliminate, although there are still opportunities that have been identified [11]–[13].

There are various factors that can cause stunting, either from the mother's side from the child's side, or even both. Numerous studies have demonstrated that a number of factors, such as parental education, the mother's age at pregnancy, socioeconomic status, the nutritional status of expectant mothers, infectious diseases during pregnancy, and other factors during the prenatal period, are important in the incidence of stunting [14]–[17]. The incidence of stunting was found to be significantly correlated with factors related to the baby's side, including low birth weight, premature birth, non-optimal exclusive breastfeeding, contracting infectious diseases during infancy, and other factors at birth [18]–[20]. The success of efforts to reduce the prevalence of stunting requires seriousness and commitment from the central and regional governments by involving integrated multi-sector cooperation so that a smart generation can be created to create a healthy and advanced Indonesia. The high prevalence of stunting in Tanggamus Regency, Lampung Province must be reduced to reduce the negative impact of stunting in the area. By knowing the risk factors for stunting, it is hoped that we can develop and strengthen more optimal nutritional intervention strategies.

The state of the art of this research is that several factors put forward in this research influence the incidence of stunting. Maternal factors have been shown to have an impact on the incidence of stunting in numerous prior studies investigating the factors that influence its occurrence. Nevertheless, none of these studies have looked into the maternal factors that have the biggest impact on the prevalence of stunting. Aside from that, it has never been conducted this kind of research Tanggamus Regency. In order to enrich and improve upon earlier research, this study intends to examine the maternal risk factors for stunting in children between the ages of 24 and 59 months in Tanggamus Regency, Lampung Province.

2. METHOD

2.1. Research design

This research is a case-control study. The case group is children whose growth is stunted and the control group is children whose growth is normal or not stunted, both groups were identified at the start of the study. Research aims to identify the influence of maternal factors such as maternal height, nutritional status, education level, occupation, age, birth spacing, gestational age, history of illness, status of antenatal care visits, consumption of iron supplements, and low birth weight (LBW) to stunting in children age 24-59 months. This research protocol and procedures have been reviewed and approved by the Research Ethics Committee of Panca Bhakti College of Health Sciences, Lampung Indonesia, with number No.010/UE.STIKes/VI/2023, June 17th 2023.

2.2. Research sample and place

The samples for this study were mothers who had Stunting children and children with normal growth aged 24-59 months, stunting children and children with normal growth aged 24-59 months registered in Tanggamus Regency who met the inclusion criteria and were willing to become participants by signing a consent form (informed consent). The study included 24-59-month-old children who reside in the research area and live with their parents, mothers who have ≥2 children and possess a maternal and child health (MCH) book published by the Ministry of Health, Republic of Indonesia. People with mental illnesses, impairments, or moms who declined to provide their permission were excluded. Determination of sample size is adjusted to the research objectives and type of research data. Lemeshow's case-control study formula was used to determine the sample size based on the difference in the two population proportions and to examine the variation in risk between the two groups [21]. This calculation was based on prior research. The total proportion (P) is 0.52 with a 95% confidence level (Zα=1.96), power tests 90% (Zβ=1.28), the proportion at risk or cases (P1) being 0.64, and the proportion in the control group (P2) whose value is known based on the literature: 0.40 with OR 2.74. Based on the sample size formula calculations, 84 individuals were acquired for each group (cases and controls). After accounting for 10% dropout rate, the sample size was 92 individuals per group, rounded to 100 individuals per group. Stratified random sampling was used in the research subject selection process. The research was conducted from June to August 2023 in Tanggamus District, Lampung Province. Data collection was carried out in the sub-districts of Gisting, Sumber Rejo, Cukuh Balak, Limau, and Klumbayan.

2.3. Variable and research instrument

The independent variables are maternal risk factors in terms of maternal height, nutritional status during pregnancy, education level, occupation, age at birth, birth spacing, gestational age, diseases that occurred in the mother during pregnancy, such as anemia, malaria, worms, HIV/AIDS, depression, hypertension, history of antenatal care (ANC) during pregnancy, consumption of iron supplements during pregnancy and LBW. The dependent variable is the incidence of stunting in children aged 24-59 months.

The data used in this research are primary and secondary data. Research data was obtained directly from research subjects by measuring the child's height. Secondary data was obtained from the MCH book and then filled into a questionnaire containing the characteristics of mothers of children aged 24-59 months including height, maternal nutritional status during pregnancy, education level, occupation, mother's age at birth, birth interval, gestational age, illnesses during pregnancy, frequency of antenatal check-ups, consumption of iron supplements during pregnancy and baby's weight at birth, then confirm with the mother if there is data that is not in the MCH book. If this is not possible, data is obtained from the maternal cohort list at the community health center (*Puskesmas*). These sections' questions were taken from an earlier study [22]. The Stunting variable is obtained from the results of measurements using a stadiometer. To obtain the value of nutritional status or stunting by calculating body height/age and then adjusting it to WHO 2015 anthropometric standards.

3. RESULTS AND DISCUSSION

3.1. Characteristics of participants

The number of participants in this study was 191 people who were divided into two groups, including the case group and the control group. Some of the participant characteristics collected from the research results were height, nutritional status, education level, occupation, age at birth, birth spacing, gestational age, history of illness during pregnancy, history of antenatal care, and LBW. The characteristics of the data obtained from the results of univariate analysis can be seen in Table 1.

Table 1. Univariate analysis

Variables		Total	
		n	%
Stunting	Stunting	91	47.65
	Normal	100	52.35
Maternal height	Short (<150 cm)	46	24.1
	Normal (≥150 cm)	145	75.9
Maternal nutritional status	CED (MUAC <23,5 cm)	5	2.6
	Normal (MUAC ≥23,5 cm)	186	97.4
Education level	Low (under junior high school)	23	12
	High (high school and above)	168	88
Occupation	Work as a housewife	160	83.8
	Work not housewife	31	16.2
Maternal age at birth	High risk (<20 years or >35 years)	31	16.2
	Low risk (20-35 years)	160	83.8
Birth spacing	Near (<2 years)	124	64.9
	Far (≥2 years)	67	35.1
Gestational age	Preterm (<37 weeks)	22	11.5
	Aterm and Postterm (≥37 weeks)	169	88.5
History of Illness during Pregnancy	Any	24	12.6
	Not	167	87.4
Antenatal history	Incomplete (<4x)	16	8.4
	Complete (≥4x)	175	91.6
Consumption of iron tablets	Incomplete (<90 tablets)	31	16.2
	Complete (90 tablets)	160	83.8
Low birth weight	LBW (<2500 gram)	7	3.7
	Normal (≥2500 gram)	184	96.3

Table 1 shows that most participants had normal height (≥150 cm), with 145 participants (75.9%), nutritional status without CED (Chronic Energy Deficiency) was 186 participants (97.4%), a higher education level (high school and above) was 168 participants (88%), not working 160 participants (83.8), age at birth at a low-risk age 160 participants (83.8%), close birth distance 124 participants (64.9%), term and postterm gestational age 169 participants (88.5%), had no history of illness during pregnancy 167 participants (87.4%), complete antenatal care history 175 participants (91.6%), complete consumption of iron tablets 160 participants (83.8%), body weight 184 participants (96.3%) were born normal.

3.2. Maternal risk factors for stunting in children

To identify the association between maternal risk factors and the incidence of stunting in children between the ages of 24 and 59 months, the analysis used was the Chi-Square test by considering the P value and odds ratio (OR). Research data includes nominal and ordinal categories, with a significance Chi-Square test result of P<0.05. The bivariate test results listed in Table 2 show that there is a significant relationship between height (P=0.039), birth interval (P=0.036), gestational age (P=0.040), the history of illness during pregnancy (P=0.046), and completeness of consumption the iron tablets during pregnancy (P=0.000) with the incidence of stunting in children aged 24-59 months.

Table 2. Bivariate analysis of maternal characteristics related to the prevalence of stunting in children between the ages of 24 and 59 months

Variables		Case (stunting)		Control (normal)		OR	*P value*	CI
		n	%	n	%		n	%
Maternal height	Short (<150 cm)	28	30.77	18	18	2.025	0.039	1.029-3.985
	Normal (≥150 cm)	63	69.23	82	82			
Maternal nutritional status	CED (MUAC <23,5 cm)	4	4.4	1	1	4.522	0.142	0.499-41.499
	Normal (MUAC ≥23,5 cm)	87	95.6	99	99			
Education level	Low (under junior high school)	13	14.3	10	10	1.500	0.363	0.623-3.611
	High (high school and above)	78	85.7	90	90			
Occupation	Work as a housewife	77	84.6	83	83	1.172	0.762	0.520-2.349
	Work not housewife	14	15.4	17	17			
Maternal age at birth	High risk (<20 years or >35 years)	17	18.7	14	14	1.411	0.381	0.652-3.056
	Low risk (20-35 years)	74	81.3	86	86			
Birth spacing	Close (<2 years)	66	72.5	58	58	1.912	0.036	1.041-3.511
	Far (≥2 years)	25	27.5	42	42			
Gestational age	Preterm (<37 weeks)	15	16.5	7	7	2.622	0.040	1.017-6.760
	Aterm and postterm (≥37 weeks)	76	83.5	93	93			
The history of illness during pregnancy	Any	15	16.5	7	7	2.453	0.046	0.996-6.045
	Not	76	83.5	93	93			
Antenatal history	Incomplete (<4x)	9	9.9	7	7	1.458	0.471	0.520-4.090
	Complete (≥4x)	82	90.1	93	93			
Consumption of iron tablets	Incomplete (<90 tablets)	26	28.6	5	5	7.600	0.000	2.774-20.820
	Complete (90 tablets)	65	71.4	95	95			
Low birth weight	LBW (<2500 gram)	5	5.5	2	2	2.849	0.199	0.539-15.061
	Normal (≥2500 gram)	86	94.5	98	98			

CI=confidence interval, OR=odds ratio. Using the logistic regression test, bivariate analysis data with p<0.05 was included in the multivariate analysis

A total of 30.77% of children born to mothers with short stature are stunted, while 18% of normal children. Stunted children in mothers who gave birth at close range were 72.5%, while in normal children it was 58%. Stunted children from mothers who gave birth at premature gestational age were 16.5%, while normal children were 7%. Stunted children from mothers who had a history of illness during pregnancy were 16.5, while the number of normal children was 7%. Stunted children from mothers who took incomplete iron tablets during pregnancy were 28.6% and 5% were normal children.

The multivariate analysis test listed in Table 3 shows that there were five variables with a P value <0.05 that were tested, including maternal height, birth spacing, gestational age, history of illness during pregnancy, and consumption of iron tablets. The results of logistic regression analysis tests show that the consumption of iron tablets (P=0.000) and maternal height (0.026) are the factors most related to the incidence of stunting. Babies whose mothers consumed <90 iron tablets during pregnancy had an 8 times higher risk of stunting compared to babies whose mothers consumed ≥90 iron tablets during pregnancy. Babies whose mothers are short (<150 cm) are twice as likely to be stunted as babies whose mothers are ≥150 cm tall.

Table 3. Multivariate analysis of maternal characteristics related to the prevalence of stunting in children between the ages of 24 and 59 months

Variables		OR	Sig.	CI
Maternal height	Short (<150 cm)	2.230	0.026	1.098-4.520
	Normal (≥150 cm)			
Birth spacing	Close (<2 years)	1.376	0.342	0.713-2.657
	Far (≥2 years)			
Gestational age	Preterm (<37 weeks)	1.960	0.202	0.697-5.514
	Aterm and Postterm (≥37 weeks)			
The history of illness during pregnancy	Any	1.924	0.194	0.717-5.157
	Not			
Consumption of iron tablets	Incomplete (<90 tablets)	8.052	0.000	2.910-22.277
	Complete (90 tablets)			

3.2.1. Maternal height

This study identified a significant association between maternal height and the prevalence of stunting in children between the ages of 24-59 months, both bivariate and multivariate tests show that children born to mothers with short height (<150 cm) are twice as likely to be stunted. Compared to children with normal maternal height (≥150 cm). This finding is in accordance with other research which shows that tall mothers are less likely to have stunted children than short mothers. Children of mothers with a height of less than 150 cm have a 2.5 times higher chance of stunting compared to mothers whose height is 150 cm and above and increasing maternal height by 1 cm reduces the likelihood of stunting by 1% [23]. Research in Tanzania showed that reducing maternal height by 1 cm increased the likelihood of stunting by 12% [24]. These findings indicate the existence of intergenerational transmission of stunting, where short mothers tend to have children who are also stunted.

3.2.2. Birth spacing

Children born to mothers whose births are closely spaced (<2 years) have twice the risk of experiencing stunting compared to children whose births are far apart (≥2 years). This result is consistent with other research that showed a significant reduction in the risk of stunting and wasting has been associated with birth spacing of ≥24 months as opposed to <24 months. The reason behind this is that a longer time between pregnancies lowers the likelihood of malnutrition in the subsequent pregnancy by giving the mother enough time to recover from the nutritional strain of the previous pregnancy [25]. Short birth intervals (<24 months) were significantly related to childhood malnutrition and a 57% higher risk of infant mortality, per a recent study done in 34 sub-Saharan countries [26]. In general, short birth spacing has a significant impact on pregnancy outcomes, especially for mothers with financial difficulties, low nutritional status, or limited access to high-quality health services [27]. The optimal birth spacing to prevent stunting is 36 months [28].

3.2.3. Gestational age

Our findings show that children born at <37 weeks' gestation (premature) have a 2.6 times higher risk of stunting than children born at ≥37 weeks' gestation. In research conducted in Sambath Indonesia, it was found that children born prematurely, without LBW, had a 5 times higher chance of stunting compared to children born at term (≥37 weeks) [29]. Other studies also showed that, when compared with full-term babies, preterm babies have twice the risk of stunting [30]. Premature babies often experience problems with their digestive absorption system, this situation causes nutritional intake not to be fully absorbed by the baby's body. In addition, premature babies have not been in the womb long enough to store the nutrients they need, so this increases the risk of stunting in the future [17], [31]. A study found that premature babies had higher plasma levels of insulin-like growth factor binding protein 2 (IGFBP-2), which acts as an endocrine growth regulator and is thought to cause children to have shorter stature. Differences in IGFBP-2 levels may be caused by nutritional abnormalities in the perinatal period [32].

3.2.4. History of illness during pregnancy

Our findings show that a history of illnesses suffered by the mother during pregnancy, such as anemia, malaria, worms, HIV/AIDS, depression, and hypertension, shows a significant association with stunting in children aged 24-49 months. Children whose mothers had a history of disease during pregnancy had a 2.4 times higher risk of experiencing stunting compared to children whose mothers had no history of disease during pregnancy. This finding is supported by other research which found that a history of diseases such as anemia during pregnancy was one of the factors that most influenced the incidence of stunting in toddlers (OR 18.41; P<0.001) [33]. Research finds that infectious diseases during pregnancy are also a significant maternal factor in causing stunting in toddlers. The frequency of infections during pregnancy can be one of the main determinants of a child's growth and development process in the first 2 years of age [34], [35]. Intrauterine infections caused by viruses, bacteria, and parasites have a high risk of affecting the development of the fetus in the womb, complications that can occur are premature birth and LBW [35], [36]. Premature births brought on by intrauterine bacterial infections frequently result in significant morbidity and long-term effects such as cerebral palsy, asthma, chronic lung disease, and neurodevelopmental issues [37], [38].

3.2.5. Consumption of the iron tablets

Stunting is eight times more common in children whose mothers take less than 90 iron tablets during pregnancy than in children whose mothers take more than 90 iron tablets. These outcomes are in line with previous studies showing that iron supplementation reduces stunting incidence in children under two by 8% [39]. Children of mothers who consumed 120 iron supplements during pregnancy had a higher average length for age (LAZ) than children of mothers who consumed less than 120 iron supplement tablets during pregnancy [40]. Providing iron supplementation to pregnant women plays a very important role in preventing anemia (including malaria endemic areas), postpartum sepsis, LBW, and premature birth [41].

4. CONCLUSION

Our research found factors such as short maternal height, close birth spacing, premature gestational age, history of illness during pregnancy, and lack of consumption of iron tablets during pregnancy. The mother's height and inadequate use of iron supplements during pregnancy are the primary factors that contribute to the development of maternal variables that cause stunting in children between the ages of 24-59 months. It is important to improve nutritional status during childhood and adolescence because adequate nutritional intake during this period can help achieve optimal height in adulthood. Additionally, an important contributor to a decrease in stunting rates in developing countries is the improvement of maternal healthcare generally.

ACKNOWLEDGEMENTS

The author would like to thank KEMENDIKBUDRISTEK for financial support and the Independent Practice of Midwife Kasih Ibu Soesrini as a partner in this research. Research grant number 0536/E5/PG.02.00/2023.

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