Risk Factors of Stunting in Children Aged 6–59 Months: A Case-Control Study in Horticulture Area

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Risk Factors of Stunting in Children Aged 6–59 Months: A Case-Control Study in Horticulture Area

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Abstract

BACKGROUND: Stunting is a critical public health problem in Indonesia because it affects cognitive and physical development and contributes to child mortality.

AIM: This study aims to identify risk factors for stunting in children aged 6–59 in the horticultural area.

METHODS: A casecontrol study was conducted to compare previous exposure between stunted children and non-stunted children. Measurements and interviews were conducted with 160 participants (120 controls and 40 cases), including mothers or caregivers. SPSS was used for χ^2 statistical analysis, multiple logistic regression, and odds ratios.

RESULTS: The study identified four risk factors for stunting: children who were born short (adjusted odds ratio [AOR] = 17.57; 95% confident interval [CI]: 5.02–61.51), LBW (AOR = 4.35; 95% CI: 1.38–13.78), and got a low protein intake (AOR = 4.96; 95% CI: 1.22–20.26). Significantly, a relationship between stunting and access to sanitation was also found (AOR = 6.06; 95% CI: 1.25–29.35).

CONCLUSIONS: The risk factors for stunting in children aged 6–59 are related to nutrition during pregnancy and the child's quality of food. Nutrition interventions should emphasize improving the nutritional status of pregnant women and children and women empowering to affect access to resources and allocations for children's nutrition.

Introduction

Malnutrition is a critical public health problem for children under five in developing countries, including Indonesia. Malnutrition is due to many interrelated factors and has detrimental health effects in the short and long term [1], [2]. Malnutrition will affect children's cognitive and physical development, increase the risk of infection, and significantly contribute to child morbidity and mortality [3], [4], [5], [6]. The high indicators of malnutrition in a country reflect children's low nutritional status and health under five [2], [7]. Three extensively recognized indicators of children's nutritional status are stunting, wasting, and underweight, and stunting indicates chronic malnutrition form [1], [2], [6], [8], [9], [10], [11]. A stunted child if their height for age is over two standard deviations below the median of the World Health Organization (WHO) 2005 [2], [12].

Stunting is the best measure of malnutrition in childhood, a predictor for long-term morbidity and mortality, and long-term societal costs [13]. Children who suffer from stunting will grow into adults at risk of obesity, glucose tolerance, coronary heart disease, hypertension, osteoporosis, decreased performance, and productivity [2], [5], [6], [10], [11], [13], [14].

Globally, in 2025, malnutrition contributes to at least half of all deaths each year in children under five [7], [13], [15]. In 2025, estimating 127 million will be stunted [16]. Prevalence was greater in developing countries, especially in South Asia and Africa [15], [16], [17]. In Indonesia, the stunting prevalence was 30.8%, consisting of 11.5% very short and 19.3% short.

Many factors are associated with stunting. Several studies reported socioeconomic inequality, geographic differences, practices of feeding, food insecurity, education, and childhood morbidity, infection, and environmental [3], [4], [5], [6], [11], [18]. Stunting is also associated with micronutrient deficiencies, such as protein, iron, zinc, calcium, and vitamins D, A, and C [15]. There are limited research reports on risk factors for stunting, especially in horticultural farming areas. In the study area (Liwa City), the risk factors for stunting in children aged 24–59 months have not been studied. It is crucial to identify risk factors for stunting to overcome the problem of stunting and its consequences. The study aimed to identify risk factors for stunting among children under five in the horticultural areas.

Materials and Methods

Study design and setting

A case-control study was conducted in Liwa City, West Lampung Regency, to compare previous exposures between stunted children (cases) and non-stunting children (controls). Seven horticultural farming villages were selected from the twelve villages in the city. This research was conducted after obtaining approval from the Health Research Ethics Committee, Tanjungkarang Health Polytechnic (No.261/KEPK-TJK/V/2020). Permission from the West Lampung District Health Office and the Liwa Community Health Center was obtained. Guided by the Helsinki protocol, informed consent was taken, and data handling was confidential. No risk of harm would be to the participants, and participants have the right to withdraw during the study. All study procedures were described before the interview. Nutrition education for children was given after the interview.

Study period and study participants

The study was conducted from July to August 2020. Children aged 12–59 months with a mother or caregiver who lived for at least 6 months in the study area were included in the study. Children without mothers or caregivers, children who appeared to have physical disabilities, children whose exact age was unknown were excluded from the study. Cases were children with stunting (high z score for age <−2 z score). Controls were children who were not stunting (high z score for age ≥ −2 z score), selected from the case's nearby neighbor who was of the same age. If multiple controls are found, they are randomly selected.

The sample size calculated was following formula:

$$n = \frac{2 \circ \bar{p}^{\infty} \bar{q}^{\infty} (Z_\alpha + Z_\beta)^2}{(p_1 - p_0)^2}$$

where, n=sample size of case; = mean proportion exposed in the case and control group; Z_α = spcifield power; Z_β = specifield significance; p_1= proportion exposed in the case group; p_0 = proportion exposed in the control group.

The exposure considered was parenting (32.9%). Assuming 95% CI, 90% power, control to case ratio 3:1, the total sample size is 160 (120 controls dan 40 cases).

Data collection and procedures

Data were collected from measurements and interviews using a questionnaire. All samples of children under five were measured in height with WHO standard measurements. The standard reclining board is used to measure the children aged <24 months in the supine position. The children aged 24–59 months are measured in a standing position. History of birth length, birth weight, immunization are asked for and validated with records from the official at KMS (Health Toward Book). All mothers or caregivers were asked for their education and occupation. Parenting is a mother's behavior in caring for her child. The 24-h diet recall method was used to assess children's diets using a checklist adapted from WHO guidelines.

Data analysis

Data were entered into SPSS (24.0) after being checked for completeness, edited, coded. Code outcomes were given, 1 for cases and 0 for controls. Data entered for analysis were mother's education, mother's labor status, birth length, birth weight, immunization, protein intake, parenting, and sanitation access. The bivariate analysis used the χ^2 statistic to measure the variables associated with outcome (stunted). The calculation of Crude OR and CI = 95% was also carried out. Variables with a $p < 0.25$ were transferred to a multivariate analysis to identify risk factors. To determine the relationship between risk factors and stunting, we used multiple logistic regression analysis. For all statistical tests, $p \leq 0.05$ was considered significant. The Hosmer and Lemeshow test was applied to test the fit model of the multiple logistic regression.

Results

Sociodemographic and economic characteristics of participants

A total of 160 (120 controls and 40 cases) children aged 6–59 months and their mothers or caregivers participated in the study. Nobody dropped out during the study period, so the participation rate was 100%. The number of samples was boys and girls almost equal (Table 1), but most were in the 6–23 month age group (73.13%). The majority of mothers or

Table 1: Socio-demographic characteristics

Variables	Case (%) (n = 40)	Control (%) (n = 120)	p-value
Sex of child			
Female	22 (55.0)	54 (45.0)	0.361
Male	18 (45.0)	66 (55.0)	
Age of children (months)			
6–23	29 (73.5)	88 (73.3)	1.000
24–59	11 (27.5)	32 (26.7)	
Family's income			
Low	35 (87.5)	95 (79.2)	0.350
Medium to high	5 (12.5)	25 (20.8)	
Mother's level education			
Low	18 (45.0)	28 (23.3)	0.02
High	22 (55.0)	92 (76.7)	
Mother's labor status			
Work	17 (42.5)	47 (39.2)	0.85
Not work	23 (57.5)	73 (60.8)	

caregivers have completed junior high school (71.25%), but they do not work (60.0%), and the family income is low (81.25%).

Health and child feeding-related characteristics of participants

Although the majority was normal (Table 2), about 19 (47.5%) of children in the case group and 4 (3.3%) in the control group were born stunted. There were also 13 (32.5%) children in the case group and 9 (7.5%) in the control group born with low birth weight. Complete immunization was obtained by about 36 (90.0%) children in the case group and 92 (76.7%) in the control group. Almost all (90.63%) children in the case and control groups received adequate protein intake. However, around 24 (60%) in the case group and 59 (49.2%) lacked parenting.

Table 2: Health and child feeding characteristics

Variables	Case (n = 40)	Control (n = 120)	p-value
	Number (%)	Number (%)	
Birth length			
Low	19 (47,5)	4 (3.3)	<0.01
Normal	21 (52.5)	116 (96.7)	
Birth weight			
Low	13 (32.5)	9 (7.5)	<0.01
Normal	27 (67.5)	111 (92.5)	
Immunization			
Incomplete	4 (10.0)	28 (23.3)	0.110
Complete	36 (90.0)	92 (76.7)	
Protein intake			
Low	10 (25.0)	5 (4.2)	<0.01
Adequate	30 (75.0)	115 (95.8)	
Parenting			
Lack	24 (60.0)	59 (49.2)	0.315
Normal	16 (40.0)	61 (50.8)	

Environmental related characteristics of participants

Almost all children in the case group (95.0%) and the control group (97.5%) were found in homes with access to safe drinking water. However, about 7 (17.5%) children in the case group and 4 (3.3%) in the control group were found in homes without access to healthy sanitation, as Table 3.

Table 3: Environmental characteristic

Variables	Case (n = 40)	Control (n = 120)	p-value
	Number (%)	Number (%)	
Access to drinking water			
No-access	2 (5.0)	3 (2.5)	0.793
Access	38 (95.0)	117 (97.5)	
Access to sanitation			
No-access	7 (17.5)	4 (3.3)	0.007
Access	33 (82.5)	116 (96.7)	

Risk factors of stunting

Only 4 of the 12 variables associated with stunting ($p < 0.05$) were shown from multiple logistic regression analysis (Table 4). The fit model is shown by the Homers and Lemeshow test obtained ($p = 0.253$). All variables with a $p < 0.25$ from the bivariate analysis were entered into the model in this work. They are the mother's education, birth length, birth weight, immunization, protein intake, parenting, and sanitation access. Then they are issued one by one following the largest p-value. Interaction tests were also carried out, but none of them showed interactions between variables.

Table 4: Risk factor for stunting

Variables	Case (n = 40)	Control (n = 120)	Crude OR (95%CI)	Adjusted OR (95%CI)
	Number (%)	Number (%)		
Birth length				
Low	19 (47.5)	4 (3.3)	26.24 (8.11–84.89)	17.57 (5.02–61.51)
Normal	21 (52.5)	116 (96.7)	1	1
Birth weight				
Low	13 (32.5)	9 (7.5)	5.94 (2.30–15.33)	4.35 (1.38–13.78)
Normal	27 (67.5)	111 (92.5)	1	1
Protein intake				
Low	10 (25.0)	5 (4.2)	7.67 (2.43–24.12)	4.96 (1.22–20.26)
Adequate	30 (75.0)	115 (95.8)	1	1
Access to sanitation				
No-access	7 (17.5)	4 (3.3)	6.15 (1.69–22.3)	6.06 (1.25–29.35)
Access	33 (82.5)	116 (96.7)	1	1

The proportion of children born shortly was significantly higher in the case group than in the control group. Low birth length (boys <46.1 cm, and girls <45.6 cm) was found to be a risk factor for stunting (adjusted odds ratio [AOR] = 17.57; 95% confident interval [CI]: 5.02–61.51). Birth weight <2500 grams was also a risk factor for stunting (AOR = 4.35; 95% CI: 1.38–13.78). The proportion of children with low protein intake was higher in the case group than in the control group (AOR = 4.96; 95% CI: 1.22–20.26). We also found a statistically significant relationship between house access to sanitation and stunting (AOR = 6.06; 95% CI: 1.25–29.35). This study found that the dominant variable related to stunting was the low birth length.

Discussion

Of all the factors studied, the length of birth showed the dominant risk factor for stunting in horticulture farming areas. The results confirm Islam, that low birth length and low birth weight are relationships with stunting [17]. Birth length is associated with low maternal nutritional intake during pregnancy, which is influenced by low family economic status [2], [15], and food insecurity in the family [19].

Food insecurity in the family results in a decrease in the variety and the nutritional value of food consumed. It will sustainably affect the family's nutritional status, including child development. In pregnant women, which affect stunted babies' birth [20], [21]. Access and availability of food for the poor combine poverty problems, lack of permanent jobs, low and irregular cash income, and limited purchasing power [19], [21], and are closely related to low education levels [22].

Besides impaired motor and verbal development, an increase in degenerative diseases, morbidity, and mortality, a further concern of stunting is the disruption of cognitive development [2], [5], [6]. Most children with early malnutrition did not finish high school and work as manual laborers [20]. Impaired cognitive development and learning achievement will reduce work productivity to hinder economic growth, increase poverty, and widen inequality in a country [20], [23].

Multivariate analysis showed that four variables were significantly associated with the incidence of stunting. If related to the child's life span, it has caused the mother's nutritional status during pregnancy. These results explain the concept of stunting in the first 1000 days of life [15], [16], [17], [24]. The role of mothers is critical in facilitating interventions through strengthening their nutritional status during pregnancy and breastfeeding [24].

Malnutrition in pregnancy results from a low average intake of protein, fat, total energy, and often insufficient micronutrients such as folate, Fe, Ca, and Zn. Malnutrition in pregnant women affects disruption of intra-uterine growth [24] due to LBW, stuntedness, perinatal mortality [4], [7], [22], [25]. Linear growth failure is mostly caused in the intra-uterine period due to an inadequate diet [13].

Malnutrition in pregnancy is detected from anemia [15]. Anemia is a condition characterized by an abnormal decrease in the total mass of red blood cells caused by blood loss due to acute or chronic bleeding, destruction of red blood cells, and insufficient red blood cell production. Anemia is a risk for pregnant women in agricultural areas due to the chronic impact of pesticide exposure [26]. Sanitation access is associated with increased exposure to microbes and infectious diseases, especially diarrhea [1], [9]. Fecal-oral pathways are water, food, vectors, and vectors [27].

Control with a nutrition approach for the first 1,000 days by promoting healthy behaviors, breastfeeding, nutrition during pregnancy includes micronutrient supplementation, breastfeeding, and disease prevention will reduce child malnutrition, especially chronic malnutrition in the form of stunting [15], [24]. Nutrition-sensitive interventions must also highlight a fundamentally important factor that indirectly impacts mothers' and children's nutrition, namely women's empowerment. Women's empowerment is a process of improving women's institutions and status. It will affect household access to resources, including allocations for children's health and nutrition.

Conclusions

This study found four factors associated with stunting among children aged 6–59 months in horticulture farming areas, length at birth, LBW, protein intake, and access sanitation. Of the four variables, it indicates malnutrition during pregnancy. Therefore, it needs intervention and nutrition programs for pregnant women, including micronutrient supplementation. It also empowers women in the family to affect household access to resources, including allocations for children's health and nutrition.

Author Contributions

All the authors contributed equally to the preparation, development, and completion of this manuscript.

Ethics

This article is original and contains unpublished material. The corresponding author confirms that the other authors have read and approved the manuscript and that there were no ethical issues involved.

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