Maternal factors contributed as important risk factors of stunting among children under 5 years old in East Java, Indonesia

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ABSTRACT

Roughly, three out of ten toddlers in Indonesia are stunted. Stunted children are spread throughout some provinces in Indonesia, including East Java. In East Java Province, ten cities and regencies exhibit a higher stunting prevalence rate than the national average. This study aimed to determine the factors affecting stunting among families with children under five years old. The study is population-based using census data. The dependent variable is stunting. The independent variables are young maternal age (<20 years old), older maternal age (>35 years old), and frequent pregnancies (> 2 children). The data were collected from the National Population and Family Planning Board which included 6,373,612 families, with children under five years old, from 38 districts/cities around East Java, Indonesia. The data were analysed using univariate, bivariate, and multivariate analysis with multiple linear regression. The results showed a relationship between young maternal age (B=11.37; $p < 0.001$; 95% CI= 7.35 to 15.40), old maternal age (B=1.02; $p < 0.001$; 95% CI= 0.84 to 1.20), and frequent pregnancies (B=1.01; p=0.007; 95% CI= 0.30 to 1.73) and the incidence of stunting. Maternal factors significantly contributed to stunting. The research identified young maternal age, old maternal age, and frequent pregnancies as variables that predicted and contributed to stunting. Based on the findings, an intervention can be proposed to stakeholders to arrange stunting prevention programs related to maternal issues.

INTRODUCTION

Childhood stunting is one of the most serious barriers to human growth, impacting roughly 162 million children under the age of five worldwide. Stunting is one of the global public health problems in several developing countries, including Indonesia.[1] The World Health Organization stated that the maximum tolerance limit for stunting in a country is 20 percent. According to this, Indonesia is the third country with the highest prevalence of stunting in the Southeast Asian region.[2] There are 3 out of 10 toddlers in Indonesia who are stunted, with a prevalence rate of 24,4.[3] Several provinces in Indonesia had a higher stunting prevalence rate than the national prevalence, which were provinces of East Nusa Tenggara (37,8), West Sulawesi (33,8), Aceh (33,2), West Nusa Tenggara (31,4), Southeast Sulawesi (30,2), South Kalimantan (30), West Kalimantan (29,8), Middle Sulawesi (29,7), Papua (29,5), and Gorontalo (29). All these provinces are located outside the island of Java, which is the center of government and development. However, it turns out that on the island of Java, there is a province where the stunting prevalence rate is quite high, namely the province of East Java. In East Java Province, ten cities and regencies have a higher stunting prevalence rate than the national prevalence, some of which are Bangkalan (38.9%), Pamekasan (38.7%), Bondowoso (37.0%), Lumajang (30.1%), Sumenep (29.0%), Mojokerto (27.4%), Surabaya (28.9%), Malang (25.7%), and Nganjuk (25.1%).[4] Therefore, stunting cases in this province need to be immediately addressed.

Stunting is a condition in which a child has a minimum height compared to other children of similar age, which is indicated if the Z-score is below -2 standard deviations (-2 SD) compared to the average standard of child growth in general.[5] Stunting may occur due to chronic malnutrition during the first 1000 days of the child's life. The first 1000 days is the golden period for a child's growth and development, which begins from the time of pregnancy or the formation of a fetus until two years old.[6,7] Stunting is also triggered by several factors, such as maternal health, home environment, breastfeeding practice, economy, socioculture, child feeding practices, poor parenting, and psychosocial stimulation, family structure, and limited access to maternal and child health services.[8–13]

Maternal factors contribute significantly to the incidence of stunting in children. It belongs to the mother and the pregnancy with a direct transgenerational effect on child growth and development during the first 1000 days of life. [11–14] Prevention of stunting can start with targeting interventions at maternal factors. This makes maternal factors important and critical in the context of stunting interventions. By generating interventions on maternal factors, the principle of stunting prevention can be applied from the very beginning. Stunting prevention interventions need to be carried out during pregnancy because it is the period of formation and development of the brain and fetal organs that exert an irreversible effect.[15]

Maternal factors include adequate mother's nutrition before and during pregnancy, age, pregnancy conditions, mental condition, and general health condition. For example, young maternal age, it was revealed that the prevalence of stunting in children of teenage mothers was consistently higher than in children of adult mothers and the risk of stunting among these children was at least three times higher than that of children of adult mothers. The main causes of stunting in children are inadequate dietary intake and infections so more children of young mothers might have been exposed to these. Undernourished children have significantly inadequate intake of diversified foods and a low rate of hand washing at critical times.

Inadequate dietary intake and infections usually result from household food insecurity, inappropriate childcare practices as well as poor health care.[8,15–19] Of these several maternal factors, certain conditions pose a risk to both the mother and the fetus because these conditions can bring about stunting in children. These conditions include mothers who experience pregnancy at a young age, old age, and frequent pregnancy.

Children with stunting experience several adverse effects related to their growth and development. Stunting causes children to experience impairment in physical growth with height below the average. Stunting also causes children to have lower cognitive abilities. They tend to find difficulty in concentration and have poor school performance. Besides, they are prone to disease exposure. They can also experience limited learning capacity and function, show low immunity, and face the risk of obesity, risk of heart disease, stroke, and diabetes in their adulthood.[20,21]

Those adverse effects of stunting on children need to be prevented so that they do not bring long-term impacts that can affect the overall quality of human resources.[22,23,24] Therefore, stakeholders need to identify and assess in advance the factors that can predict stunting in children. By understanding the factors, prevention, and treatment can be actualised based on interventions around related factors. Prevention and treatment of stunting can be effective if the interventions are properly targeted. This research will examine further the maternal factors that contribute to the incidence of stunting in children.

METHODS

This study is population-based using census data. The dependent variable of this research is stunting. The independent variables are young maternal age (<20 years old), old maternal age (>35 years old), and frequent pregnancies (> 2 children). The data in this research was obtained from a survey by The National Population and Family Planning Board (Badan Kependudukan dan Keluarga Berencana Nasional/BKKBN, in Bahasa). It is a national family survey conducted every 5 years in Indonesia. The latest survey was conducted in 2021, the 2021 Family Data Survey of the National Population and Family Planning Board. The data was collected from 6,373,612 families with children under five years old. This survey was carried out by data collection officers of BKKBN and the survey area was spread around East Java Regency/City. It involved families in 38 districts/cities. This survey involved several elements of data collection officers: government (formal) and communities (informal) sectors, such as family planning field officers from BKKBN and family planning cadres. It adopted the census method for all targeted families in the relevant certain areas. The surveyors visited them door to door in each region.

The criteria for the targeted families are a unit in the society, consisting of a father, a mother, and children of 0- 5 years old, or a mother and children of 0- 5 years old. It excludes families that do not meet the normative definition of family, for example, those with only a husband and children without a mother, and/or children only, or children with an age over 5 years.

The data was analyzed using univariate analysis to describe the frequency distribution and percentage of each variable. It also employed bivariate analysis using Pearson Correlation to examine the correlation coefficient, which measured the strength and direction of linear relationships between pairs of continuous variables. The Pearson correlation coefficient (r) is the most common way of measuring a linear correlation. It is a number between -1 and 1

that measures the strength and direction of the relationship between two variables. An r of −1 indicates a perfect negative linear relationship between variables, an r of 0 indicates no linear relationship between variables, and an r of 1 indicates a perfect positive linear relationship between variables. This study had an r closer to 1, which indicates a perfect positive linear relationship. Multivariate analysis was conducted using multiple linear regression to study the linear relationship between the dependent and independent variables in this research. Ethical approval was obtained from the Research Ethics Committee Wilujeng Hospital with the approval number 022/VII/HREC/2023.

To erase missing data, we used the list-wise deletion procedure. If even a single value in a record was missing, the whole record was skipped in this approach. After excluding the individuals with missing data, the remaining 6,373,612 families with children under five years old were included.

RESULTS

The characteristics of the research respondents are displayed in Table 1. According to Table 1, most respondents (99.3%) are mothers who get married after turning 20, and 83.4% of them have 1-2 two children. Most of them (88.1%) come from wealthy families. Most of them live in fine conditions (87% have clean latrines, 93% have access to clean water, and 73% have livable residences).

Table 1. Characteristics of respondents

Characteristic		N	%
Age of maternal first marriage	<20 years old	47372	1
	>20 years old	6326240	99
Economic Status	Pre-prosperous	759058	12
	Prosperous	5614554	88
Maternal education	Lower than Junior High School	2101712	33
	Higher than Junior High School	4271900	67
Total number of children	≤ 2 children	5312929	83
	> 2 children	1060683	17
Sanitation availability	Clean water	5966738	94
	Clean latrines	5460302	86
	Livable house	4692054	74
Maternal status of pregnancy	Pregnant	187189	3
	Not pregnant	6186423	97
Nutritional fulfilment	Fulfilled (twice per day)	6248172	98
	Not fulfilled (less than twice per day)	125440	2
Maternal condition	Young maternal age (pregnancies<20 years old)	47372	7
	old maternal age (pregnancies >35 years old)	3526942	55
	frequent pregnancies (> 2 children)	1060683	38

Table 1 provides information on the 3% of research participants who were pregnant during the study. Most research participants (67%) have completed at least junior high school and 98% can meet their daily nutritional needs. A breakdown of the

respondents' maternal conditions is also provided in the table, 1% of the participants were under 20 during the pregnancy, 55% were over 35, and 17% had more than two children.

Table 2. Descriptive statistics of variables that contribute to stunting among children under 5 years old

	N	Minimum	Maximum	Mean	SD
Young maternal age	6.373.612	24	4687	1246.63	1284.24
Old maternal age	6.373.612	10450	246547	92814.26	57321.66
Frequent pregnancies	6.373.612	3739	76608	27912.71	19347.89
Stunting	6.373.612	12828	358147	133291.47	81970.23

Table 2 shows the statistics summary of variables that contribute to stunting among children under 5 years old by providing an overview or description of the data from the research variables seen from the average (mean), standard deviation, maximum, and minimum. The mean (standard deviation) for young maternal age, old maternal age, frequent pregnancies, and stunting were 1246.63 (1284.24), 92814.26 (57321.66), 27912.71 (19347.89), and 133291.47 (81970.23) respectively.

Table 3. Correlation analysis determining the relationship between stunting and all the input variables

Independent variable	Stunting		P
	N	r	
Young maternal age	6.373.612	0.73	<0.001
Old maternal age	6.373.612	0.98	<0.001
Frequent pregnancies	6.373.612	0.95	<0.001

*P from pearson correlation

The bivariate analysis employs the Pearson correlation study to examine the relationship between the independent variables (young maternal age, old maternal age, and pregnancy frequency) and the dependent variable (stunting). Table 3 shows a relationship between young maternal age and stunting (p<0.001), old maternal age and stunting (p<0.001), and pregnancy frequency and stunting (p<0.001).

Table 4. Multiple linear regression analysis result

Independent Variable	B	SE	95 % CI for B	p-Value
Young maternal age	11.37	1.98	7.35-15.40	<0.001
Old maternal age	1.02	0.09	0.84-1.20	<0.001
Frequent pregnancies	1.01	0.35	0.30-1.73	0.007

n observation = 6.373.612

*p-Value from pearson correlation

Table 4 shows that the regression coefficient (b value) for the variable of young pregnancy is 11.37, which means that if the young age value increases by one unit, the stunting case advances by 11.37 units. The b value of 1.02 for the variable old pregnancy means that if the old age value increases by one unit, the stunting case increases by 1.02 units. The b value of 1.01 for the variable pregnancy frequency indicates that if the frequency value increases by one unit, the case of stunting increases by 1.01 units
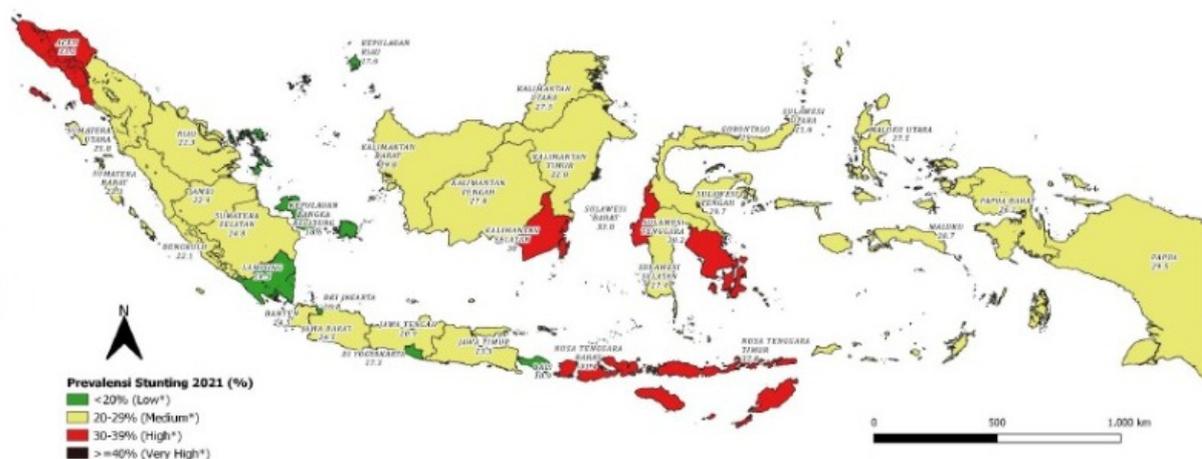

Figure 1. Prevalence of stunting among toddlers in Indonesia

Based on Figure 1, the prevalence of stunted children remains above 20% (24.4% in 2021). The target is to reduce the prevalence of stunted children to 14 percent.

DISCUSSION

The results of the data analysis confirmed the objectives of this study, which predicted that young maternal age, old maternal age, and frequent pregnancies were variables that contributed to stunting. The findings indicated that stunting is predictable through several maternal factors. Mothers who experience some of these conditions pose a risk of triggering stunting in children. Risky pregnancies experienced by mothers could predict the occurrence of stunting. [25-27]

The current study results stated that mothers who become pregnant at a young age, under 21 years old, are more likely to bear children with stunting. It corresponds to the research conducted by Santosa.[27] This is a case-control study of 132 stunted and 132 non-stunted children. It concluded that a mother who is pregnant at a young age is one of the maternal factors that have a direct effect on stunting. They experience several conditions that negatively affect the children's growth. These young mothers are mostly unready for pregnancy.[26] They also have limited knowledge and skills required for pregnancy and parenting. They tend to be less sensitive to their own and their children's nutritional needs.[27] Nutritional competition usually happens in young mothers and their babies. This is due to young mothers' need for nutrition to support their growth and development to reach the adulthood phase. However, when they were pregnant and had children, there would be an overlap in the fulfillment of these nutrients. Besides, they are in an adolescent developmental phase characterized by psychological and mental instability. Adolescent mothers could experience psychological unpreparedness in the process of giving breast milk to their

babies. They are also prone to experiencing personal stress due to changes in life events.[28,29]

Maternal conditions, which are also known to be related to stunting cases, are the conditions of mothers who become pregnant at older ages.[30] Several conditions can trigger the risk of stunting in children.[31] The results of the study stated that mothers who are pregnant at old age are likely to cause stunting in their children. Mothers who got pregnant at an older age were mothers who experienced pregnancy when they were over 35 years old.[32] The results in this study are in accordance with the research conducted by Sari and colleagues, who analysed secondary data from the national cross-sectional Indonesian Basic Health Survey 2018 conducted across 34 provinces and 514 districts in Indonesia.[30] This study stated that children born to mothers over 35 years old have a 2.37 times greater risk of stunting. The mothers tend to have decreased stamina and focus on caring for their pregnancy and children.[33] They also experience a decrease in nutrient absorption due to the aging process, which triggers an imbalance in nutritional intake.[34] Mothers who are pregnant and have children at older age have a high risk of experiencing preterm delivery, severe preeclampsia, and hypertension during pregnancy due to hormonal or chemical changes in their bodies.[30] Later, it leads to several conditions that trigger the risk of stunting in children.

This study stated that mothers who have a high pregnancy frequency can also predict the occurrence of stunting in children. They are the mothers who have more than 2 children.[35] This result is in accordance with analytical survey study with a case control design conducted by Lewa which predicted risk factors for stunting in the age group 6-23 months in the Biromaru Public Health Center, Sigi Biromaru Sub-District, Sigi District. It

stated that mothers who experienced too many pregnancies and had too many children tended to have children who had a high risk of experiencing stunting.[36] They tend to have physical and psychological burdens of nurturing and caring for their children.[37] The author has not found any related literature or studies on the physical condition of women who have been pregnant multiple times and its potential effect on the risk of stunting in children.

They also tend to experience difficulty in fulfilling the required nutrition for their children's growth and development. Besides, they also provide inadequate attention, focus, and stimulation to their children, which are crucial for the optimal growth and development.[38] They can experience various challenges in fulfilling nutrition for their children to ensure optimum growth and development. Children who do not get adequate nutrition can encounter malnutrition. Some of these conditions could expose children to the risk of stunting.[39] These conditions can also be exacerbated if the mother and child are economically unstable. In families with low socioeconomic status, there is a tendency that the last child will be most significantly affected due to the lack of nutritional fulfilment. The child will have inadequate food intake, which could bring about weight loss or stunted growth. Families with too many children are also vulnerable to health risks.[40,41] Families with too many children have a high risk of exposure to infections, which could harm their children's health.[42,43]

LIMITATION

The limitation of this study lies in the fact that the collected data is secondary and does not delve extensively into the underlying factors. The data gathered is historical, requiring a long-term recall. Not all factors affecting stunting, such as

genetics, hormones, illness history, and parenting are considered.

CONCLUSION

Maternal factors related to mothers' pregnancies have a significant contribution to stunting among children under 5 years old. This research identified young maternal age, old maternal age, and pregnancy frequency as variables that predict and contribute to stunting. Mothers who are pregnant at a young age or old age, and have a high pregnancy frequency throughout their reproductive age span will have higher risks of bearing stunted children. Further research on stunting status among the different demographic groups or regions of mothers is recommended. Besides, examining the risk factors of stunting in a longitudinal study is also highly suggested. Furthermore, future studies may use mixed methods for a deeper exploration.

RECOMMENDATIONS

Based on the research findings, an intervention can be proposed to the stakeholders to arrange a stunting prevention program that addresses significant maternal factors. The program should target mothers of children under 5 years old and other relevant family members. Interventions could be made to prevent the occurrence of risky pregnancies among mothers, which are prevention of pregnancies at young maternal age, old maternal age, and high pregnancy frequency.

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