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MATERNAL AND ENVIRONMENTAL HEALTH FACTORS AS PREDICTORS OF STUNTING IN FAMILIES AT RISK OF STUNTING IN INDONESIA

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ABSTRACT

Background: *Stunting is a chronic nutritional problem that affects children's physical and cognitive development, especially in children aged 6-23 months who come from families at risk of stunting. In Indonesia, the prevalence of stunting in 2023 reached 21.5%, which is still far from the 14% target set by the government. Stunting can affect children's long-term health and increase susceptibility to non-communicable diseases in adulthood.*
Objectives: *This study aims to analyze factors that act as predictors of stunting incidence in families at risk of stunting in Indonesia, using data from the 2023 Indonesian Health Survey (IHS).*
Methods: *The research design was an analytic study with a cross-sectional approach. This study used total sampling involving 4,766 mothers with children aged 6-23 months. The variables analyzed included maternal factors (birth spacing, number of births, maternal age, family planning participation) and environmental factors (latrine ownership).*
Results: *The analysis showed that too close birth spacing (OR 1.422), too many births (OR 1.323), and improper latrine ownership (OR 1.327) significantly affected the incidence of stunting in families at risk of stunting.*
Conclusion: *This study shows that birth spacing, number of births, and latrine ownership are predictors of stunting in families at risk of stunting. Maternal and environmental factors play an important role in the incidence of stunting in families at risk of stunting in Indonesia. These findings suggest that the need for a holistic approach that includes good family planning and improved sanitation and maternal nutrition should be the main focus of stunting prevention efforts in Indonesia.*

Keywords*: stunting, families at risk of stunting, maternal factors, sanitation*

INTRODUCTION

Stunting is a chronic malnutrition problem caused by a lack of nutritional intake due to feeding that does not meet basic nutritional needs. Stunting is a condition in which children under the age of 5 years fail to grow due to chronic nutritional deficiencies, causing to be smaller than their peers[1]. Malnutrition can begin in the womb and in the first days after birth, but does not appear until 2 years of age, even though the nutritional status of both mother and child is an important factor in child development[2]. Stunting affects intelligence levels, susceptibility to disease, reduced productivity and slowed economic growth, and also increases poverty and inequality. The government has established policies to address the problem of stunting through cross-ministerial/institutional cooperation[3].

The World Health Organization (WHO) says that 22.3% of all children under five will be stunted by 2022. This shows that the 20% target set by WHO has not yet been achieved[4]. Meanwhile, the stunting rate in Southeast Asia reached 30.1% in 2022[5]. Indonesia has the second highest prevalence of stunting in Southeast Asia after Timor Leste. According to data from the Indonesian Health Survey in 2023 the prevalence of stunting in Indonesia was 21.5 percent[6]. This figure is still less than the

target set by the government which is 14% by 2024[5]. Meanwhile, the prevalence of stunting increased significantly by age group, especially between the ages of 6 to 23 months. In the 6-11 month age group, the prevalence of stunting was 13.7% and increased sharply by 1.6 times to 22.4% in the 12 to 23 month age group in 2022[7].

The government established the National Strategy for Accelerating Stunting Reduction through a family approach at risk of stunting in Presidential Regulation No. 72 of 2021 to achieve the target of sustainable development goals by 2030 and also prepared a national action plan on Accelerating Stunting Reduction in order to accelerate stunting reduction [8].

According to BKKBN, Families at risk of stunting target families who have risk factors for giving birth to stunted children, with target families including: PUS, pregnant women, families with children 0 to 23 months, and families with children 24 to 59 months, as well as screening for risk factors that are easy to see and meet the requirements for significance in influencing the occurrence of stunting, namely sanitation, access to drinking water, as well as 4T conditions (too young, too old, too close, too many) and modern family planning participation"[9]. Based on the results of updating the Family Data Collection in 2023, the number of families at risk of stunting in Indonesia is 11.3 million families at risk of stunting. [10]

In an effort to reduce stunting, infants with families at risk of stunting need specific attention from all parties to reduce the risk of stunting because the age of infants is mainly 6 to 23 months. The age from 6 to 23 months is an important period in the development of a child's brain and body. Malnutrition during this period can inhibit brain development, which can lead to cognitive impairment and long-lasting delays in motor development[11]. Children who are stunted at an early age are more susceptible to non-communicable diseases such as hypertension, type 2 diabetes, and obesity in adulthood[12]. Therefore, early treatment of stunting is very important in preventing more serious health problems in the future. According to research, children who are stunted at this age are at higher risk of developing irreversible developmental disorders[13].

Interventions in the form of assistance provided to families at risk of stunting have also been carried out but have not succeeded in significantly reducing the incidence of stunting [14]. Several factors that can influence the incidence of stunting and families at risk of stunting are maternal factors consisting of birth spacing that is too close, the age of the mother at risk, which is too old and too young, as well as the number of births of too many children and family planning participation.

Based on previous research conducted, there is a correlation between maternal factors too young, too old, too close and too many with families at risk of stunting ($p = 0.000$). Family planning participation is also an indirect causal factor for stunting cases. The reason is due to the lack of proper pregnancy planning, so that the birth spacing becomes too close.[15] In addition, environmental factors such as latrine ownership can also affect the incidence of stunting and families at risk of stunting. Wahyudi's research (2024) found that not having a proper toilet was at risk of stunting with an OR = 6.289. [16]

Therefore, it is necessary to explore the determinant factors that cause the incidence of stunted infants in family groups at risk of stunting [17]. The goal is that intervention and mentoring programs carried out by BKKBN and the Health Office for families at risk of stunting can be implemented to significantly reduce stunting rates. The assistance program carried out so far has not been able to significantly reduce the stunting rate, so it is necessary to explore the determinants that determine the incidence of stunting in families at risk of stunting [17].

This study aims to analyze the factors that act as predictors of stunting incidence in families at risk of stunting in Indonesia using

the 2023 Indonesian Health Survey (IHS) data. This research will focus on maternal and environmental health factors which are indicator variables for families at risk of stunting. This research is important because it looks at the influence of stunting risk factors on the incidence of stunting in families at risk of stunting, which has never been done before. There are previous studies examining risk factors in families at risk of stunting and risk factors for stunting incidence separately, but not seeing the effect of risk factors on the incidence of stunting in families at risk of stunting, especially in the 6-23-year-old group. Researchers hope that this research can contribute ideas about appropriate policies to reduce the prevalence of stunting and make it easier to provide assistance to families at risk of stunting.

METHODS

Design, Time, and Place

This research design is an analytic study with a *cross-sectional* approach, using data obtained from the Indonesian Health Survey (SKI) which is sourced from the Basic Health Research (Riskesdas) data in 2023. Data collection, processing and analysis were carried out from October 2024 to February 2025. This study has received ethical approval from the Diponegoro University Research Ethics Commission with number 416/EA/KEPK-FKM/2024.

Sampling

Population of this study was all families at risk of stunting who had under-fives aged 6-23 months representing 38 provinces in Indonesia totaling 4,766 under-fives who had complete dependent and independent variable data. The sampling technique used *total sampling* technique. Total sampling is a sampling technique in research where the entire existing population is sampled for analysis. In this method, every element or individual in the population will be included in the study, so that no sample is left out.[18]

Data Collection Methods

The main respondents in this study were mothers aged 15-49 years (childbearing age category) who had children aged 6-23 months who came from families at risk of stunting. Mothers were selected because they had information related to the characteristics of the infants, the number of births, birth spacing, family planning participation and maternal age. The criteria for families at risk of stunting were married couples whose wives were aged 15-49 years, had at least 1 risk factor of latrine screening or inadequate drinking water sources or had at least 1 risk factor from the PUS 4 Too (too young, too old, too close, too many) met and were not modern family planning participants (traditional family planning participants or not family planning participants). The inclusion criteria in this study were mothers of toddlers who were willing to participate, could communicate well, had toddlers aged 6-23 months at the time of data collection, had height/length measurements taken on their toddlers and came from families at risk of stunting. Exclusion criteria were mothers aged <15 years and≥ 50 years, mothers who had under-fives aged (6-23) but not biological children, and moved domicile. Body length/height data were obtained through anthropometric measurements conducted by the SKI team. *Stunting* in this study was defined as having a height-for-age (TB/U) *z-score* of less than -2 SD. Data on age, gender and place of residence were collected through interviews using a standardized questionnaire. Gender was divided into male and female. Place of residence was categorized into urban and rural. Body length was measured using a body length measuring instrument with a precision of 0.1 cm.

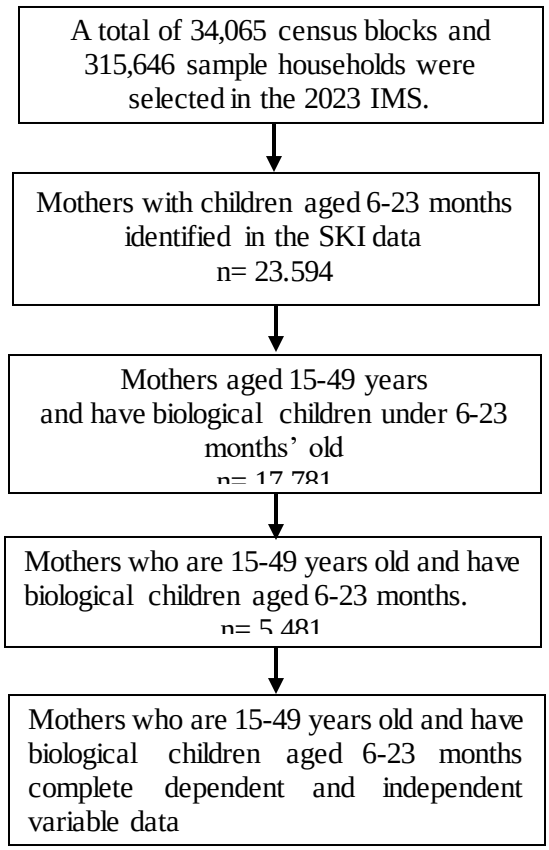

Figure 1. Flow of SKI 2023 Data Selection

Data Analysis

Univariate analysis was used to describe the collected variables such as maternal characteristics, characteristics of infants, birth spacing, number of births, family planning participation and maternal age, and latrine ownership. For categorical variables, analysis was conducted to determine the frequency distribution and proportion of the variables of incidence of stunting in families at risk of stunting, maternal characteristics, characteristics of infants, birth spacing, number of births, birth spacing, family planning participation and maternal age, and latrine ownership. Bivariate analysis was used to explore the relationship between independent variables and dependent variables. In addition, this analysis was used to select the independent variables that were included in the multivariate modelling. The statistical analysis test used was the *Chi-Square* test with a 95% confidence level and a significant level of alpha (a) = 0.05. Multivariate analysis was used to determine which variables had the most influence on the incidence of stunting in families at risk of stunting and to obtain the best model in determining the risk factors for stunting in families at risk of stunting in Indonesia. The analysis method used was multiple logistic regression. Independent variables that were significant in the bivariate analysis ($p < 0.25$) were included in the multivariate regression model.

RESULTS AND DISCUSSION

In this study, researchers will examine the characteristics of mothers and the characteristics of infants. Mother characteristics include mother's age, mother's education and mother's occupation, while the characteristics of the baduta include the sex of the baduta, the age of the baduta and the place where the baduta live. The age of the newborns and mothers in this study were not normally distributed. The median age of the children in this study was 15 months. Children who were stunted tended to be older than those with normal height. The median age of the stunted group was 17.00 ± 4.82 months, higher than the normal nutrition group (14.00 ± 5.22 months). This difference indicates that stunting cases increase with the age of the infants. This is because older children have experienced malnutrition and infectious diseases for longer, so this long exposure condition causes older children to experience more stunting[19].

The distribution by sex of the under-five children showed a higher proportion of stunting in boys (20.40%) compared to girls (15.70%). In other words, boys have a 1.3 times higher risk of being stunted than girls. This pattern of vulnerability by gender is consistent with global findings that show boys tend to be more vulnerable to stunting than girls. This is due to greater energy requirements for growth in males than females[20]. These higher energy needs are sometimes not always met, especially in families with economic limitations[21]. The distribution by mother's education showed a higher proportion of stunting in mothers with

low education levels (19.70%) compared to mothers with high education (16.70%). The level of education makes it easier for mothers to understand and receive information about nutrition and health from outside. Mothers with higher levels of education will more easily receive information from outside, compared to mothers who have lower levels of education[22]. Low levels of maternal education will make it difficult for mothers to receive direction and mothers tend not to believe in the importance of fulfilling nutritional needs or the importance of other health services that support the growth and development of children[23,24].

Table 1. Description of Subject Characteristics

Variables	Height (N=4766)				*p*
	Stunting (n=865) median±SD	n(%)	Normal (n=3901) median±SD	n(%)	
Toddler age (months)[a]	17,00 (4,82)		14,00 (5,22)		0,00[b]
Mother's age (years)[a]	33,00 (6,22)		33,00 (5,28)		0,24[b]
Gender					
Male		503 (20,40)		1957 (79,60)	0,00[c]
Female		362 (15,70)		1944 (84,30)	
Mother's Education					
Low (≤SMP)		445 (19,70)		1813 (80,30)	0,00[c]
High (≥SMA)		420 (16,70)		2088 (83,30)	
Mother's Occupation					
Work		389 (18,10)		1757 (81,90)	0,85[c]
Not Working		457 (17,90)		2100 (82,10)	
Place of Residence					
Rural		501 (19,80)		2032 (80,20)	0,00[c]
Urban		364 (16,30)		1869 (83,70)	

Presentation of data based on the normality of the data.
a. Non-Normal Distribution (median ± standard deviation).
b. Mann Whitney Test
c. Chi Square Test

The distribution according to where the children live shows that children living in rural areas (19.80%) are much more stunted than those living in urban areas (16.30%). In rural areas, the high incidence of stunting is due to several factors such as infectious diseases, poverty level and education. The prevalence of infectious diseases (such as diarrhea) in rural areas tends to be higher than in urban areas. This is due to inadequate sanitation and limited access to health services, leading to high cases of stunting in rural areas[25,26]. In addition, the high level of poverty in rural areas also results in limited access to nutritious food, health services, and education, which significantly contributes to the problem of stunting in children[25,27,28]. In addition, in rural areas, many mothers have low education levels. Low levels of maternal education will make it difficult for mothers to receive direction and mothers tend not to believe in the importance of fulfilling nutritional needs or the importance of other health services that support the growth and development of children. Maternal education is fundamental to achieving good under-five nutrition[23,24].

Table 2 shows the association between maternal and environmental health factors and the incidence of stunting in families at risk of stunting. The table shows that birth spacing, number of births, modern family planning, and latrine ownership are associated with the incidence of stunting in families at risk of stunting ($p < 0.05$). Maternal age was not associated with stunting in this study.

In this study, mothers whose birth spacing was at risk, their children tended to be stunted (22.7%) higher than mothers whose birth spacing was not at risk (17.7%). Likewise, with the number of births, mothers with too many births tended to have stunted children (19.8%), much higher than mothers with the ideal number of births (16.5%). In the modern family planning variable, a higher proportion of mothers who used modern family planning (19.4%) had stunted children, compared to mothers who did not use modern family planning (17.1%). Another finding in this study was that far more under-five children living in

households with improper latrines (19.8%) were stunted compared to under-five children living in households with proper latrines (16.7%).

Table 2. Relationship between Maternal and Environmental Health Factors and the Incidence of Stunting in Families at Risk of Stunting

Variables	Height (N=4766)				R	5%CI	p
	Stunting (n=865)		Normal (n=3901)				
	n	%	n	%			
Birth Distance							
At Risk	94	22,7	320	77,3	,282	,061-1,548	0,014
Not at Risk	771	17,7	3581	82,3			
Number of Births							
Too Much	482	19,8	1956	80,2	,202	,064-1,357	0,003
Ideal	383	16,5	1945	83,5			
Modern Family Planning							
Not using modern family planning	450	17,1	2181	82,9	,880	0,780-0,993	0,041
Using Modern Family Planning	415	19,4	1720	80,6			
Mother's age							
At Risk	348	18,6	1523	81,4	,042	0,921-1,178	0,542
Not at Risk	517	17,9	2378	82,1			
Latrine Ownership							
Not Feasible	438	19,8	1774	80,2	,184	1,050-1,336	0,007
worth	427	16,7	2127	83,3			

The results of the multivariate analysis listed in table 3 show that the predictors of stunting in families at risk of stunting are birth spacing (OR: 1.422; 95% CI: 1.1114-1.817), number of births (OR: 1.323; 95% CI: 1.137-1.540) and latrine ownership (OR: 1.327; 95% CI: 1.140-1.544). In this study, logistic regression analysis was conducted with variable selection using the *backward LR* method because it can minimize *overfitting* and help ensure that only variables that really have an influence on the dependent variable are included in the model. The first step, before conducting multiple logistic regression analysis, is to test for *multicollinearity* between the *independent* variables, namely the variable of birth spacing with modern family planning participation and the number of births with modern family planning participation, which in theory allows correlation. The results showed that there was a high correlation between birth spacing, number of births and modern family planning participation with *p value = 0*.000 so that the modern family planning participation variable which had the largest *p value was* not included in the model.

The second stage was to include all variables that had a *p-value* <0.25, namely the variables of birth spacing, number of births and latrine ownership with the exception of modern family planning participation, which had a very high correlation. Birth spacing had a B coefficient of 0.352, with a *p-value of* 0.005, which also showed a significant association. The OR value of 1.422 indicates that the shorter the birth spacing between children, the higher the chance of stunting with an increase of 42.2%. The number of births has a B coefficient of 0.280, which means that an increase in the number of births is associated with an increase in the likelihood of stunting in families at risk of stunting. The p value <0.001 indicates a significant relationship between the number of births and the incidence of stunting in families at risk of stunting. The OR value of 1.323 indicates that each additional birth increases the likelihood of stunting by 32.3%. Latrine ownership shows a B coefficient value of 0.283, with a *p-value* <0.001, which means that latrine ownership is significantly associated with the incidence of stunting in families at risk of stunting. The OR value of 1.327 indicates that inadequate latrine ownership is associated with an increased likelihood of stunting by 32.7%. Overall, the variables of number of births, birth spacing and latrine ownership significantly influence the incidence of stunting in families at risk of stunting in Indonesia.

Table 3. Analysis of Determinants of Stunting Incidence in Families at Risk of Stunting

Variables	B	p	OR	CI95%	
				Lower limit	Upper limit
Birth Distance	0,352	0,005	1,422	1,114	1,817
Number of Births	0,280	0,000	1,323	1,137	1,540
Latrine Ownership	0,283	0,000	1,327	1,140	1,544

Birth spacing that is too close has an effect on increasing the risk of stunting in children. Research conducted in Ghana showed that birth spacing between 24 to 35 months had a lower likelihood of stunting compared to birth spacing less than 24 months[29]. This may be explained by the fact that mothers who have short birth spacing do not have sufficient time to restore their body's nutrient reserves after giving birth to the previous child, which may affect the nutritional quality of subsequent pregnancies. In Indonesia, birth spacing of less than two years has long been considered a risk factor that can lead to health problems in mothers and children. A study in Purbalingga revealed that mothers with less than 2 years apart in pregnancy were 4 times more likely to give birth to stunted children[30]. Close birth spacing also increases the likelihood of low birth weight (LBW) and preterm birth, both of which are significant risk factors for stunting[31]. In Indonesia, research conducted by Hastuti et al. (2019) showed that shorter birth spacing is directly related to the incidence of child stunting, where children born to mothers with birth spacing of less than two years are more prone to stunted growth[32]. Too close a birth spacing reduces the mother's recovery time, which impacts the quality of nutrition that can be provided to the child, both during pregnancy and after birth. Therefore, setting a healthy birth spacing of more than two years can reduce the risk of stunting [33]. Research by Ratnawati et al. (2022) supports this finding, showing that birth spacing that is too close causes mothers to be unable to provide adequate care to each child, both in terms of exclusive breastfeeding and meeting appropriate nutritional needs [34].

Further research shows that short birth spacing is also associated with an increased prevalence of maternal and child infections, which in turn can affect the nutritional status of the child. This is in line with the results of a study that revealed that pregnancies that are too frequent and close together cause disruptions in the mother's recovery phase and limitations in breastfeeding[34]. The study by Santosa et al. (2022) confirmed that mothers with birth spacing of less than two years tend to have children who are more prone to stunting due to limited nutritional fulfillment during critical periods of child development[(35)].

The number of births is an important factor that can influence the incidence of stunting in children. Several studies have shown that a high number of births is associated with an increased risk of child stunting. This is due to various factors, including limited family resources, fatigue of mothers who give birth to a large number of children, and decreased attention to each child. The results of this study are supported by a study conducted in Palembang which concluded that mothers who have more than one child have a 12 times greater chance of having stunted children [30,36]. This condition is closely related to maternal nutritional limitations which can affect child development [37]. In addition, lower family socioeconomic factors also play a role in increasing the prevalence of stunting in children from families with many children[37]. Research by Fink et al. (2014) confirms that families with more children often face constraints in providing adequate nutritious food, which can affect children's growth[38]. Therefore, pregnancy management and limiting the number of births may serve as important strategies to reduce the prevalence of stunting[36].

Latrine ownership affects the incidence of stunting in families at risk of stunting. Proper latrine ownership and good environmental sanitation play an important role in preventing infectious diseases such as diarrhea, which can directly affect children's nutritional status and contribute to stunting. Several studies have shown that access to good sanitation is strongly associated with reduced stunting prevalence, as poor sanitation facilities can lead to recurrent infections and impaired child growth[39] [40]. Research conducted by Zalukhu et al. (2021) in Nagari Balingka, Agam Regency, found that poor environmental sanitation, including the

use of improper latrines, was significantly associated with the incidence of stunting. In this study, children from families without proper latrine facilities had a higher risk of stunting compared to children living in homes with proper latrine facilities[41]. This suggests that access to good latrine facilities can reduce the transmission of diseases that can affect children's nutritional status, thereby reducing the incidence of stunting. In addition, research by Olo et al. (2021) is also in line with this study, which shows that the use of inadequate toilet facilities, open defecation behavior, and lack of access to adequate sanitation contribute to the increasing prevalence of stunting in children in Indonesia. In this study, open defecation behavior and lack of healthy latrine facilities were found to have a strong association with the incidence of stunting, especially in areas with poor sanitation[42]. This emphasizes the importance of improving access to proper sanitation facilities as part of stunting prevention efforts. In addition to affecting the incidence of infections, poor sanitation is also associated with children's digestive system disorders, such as Environmental Enteric Dysfunction (EED), which is a chronic inflammation of the gastrointestinal tract that can inhibit nutrient absorption and lead to long-term malnutrition. EED has been shown to be one of the main causes of stunting in many developing countries, including Indonesia. Therefore, improved sanitation and increased access to proper latrines can serve as an effective preventive measure to reduce stunting rates[40].

Maternal age was not associated with stunting in families at risk of stunting. This could be because health education programs and better antenatal care may have reduced the negative impact of young maternal age <20 years on the incidence of stunting. Research by Santosa et al. (2021) in Indonesia showed that with better health services, such as regular antenatal check-ups and nutritional supplementation, maternal age was not always directly associated with stunting[43]. Research conducted by Arifin et al. (2022) in Indonesia revealed that although maternal age plays a role as a risk factor for stunting, factors such as maternal education and access to health services have more influence on child health[44]. ≥On the other hand, older maternal age, i.e. mothers who become pregnant at the age of over 35 years, is also often associated with a higher risk of pregnancy and birth complications, such as premature birth, low birth weight birth, or other health problems. However, in this study, no significant association was found between too old maternal age and the incidence of stunting. This may be due to increased access to medical technology and adequate health interventions for older mothers, which can help reduce the negative impact of pregnancy at an advanced age. Research by Gupta and Santhya (2020) in India also found that although maternal age is associated with some birth risks, optimal medical support can reduce adverse effects on the child, including stunting[45] . In addition, at older ages, mothers may have more experience in caring for children, and have more economic and social resources that support child health and nutrition. Research by Rana and Goli (2016) in Indonesia also showed that although older mothers have a higher likelihood of giving birth to low birth weight children, they are more likely to access better health care and have more knowledge about adequate nutrition to prevent stunting[46] .

Modern family planning participation is associated with the incidence of stunting in families at risk of stunting. However, a Prevalence Ratio (PR) value smaller than 1 indicates that the effect is relatively small. This may be because the direct effect of contraceptive use on stunting is more complex and influenced by other factors. In addition, a study by Rana and Goli (2016) showed that reducing the birth rate through contraceptive use not only reduces stunting, but also reduces maternal malnutrition which can have an

impact on child health[46]. Contraceptive use or participation in family planning programs has been shown to have an effect on reducing the risk of stunting through managing the number of births and healthier birth spacing. This is consistent with the pathway model proposed by Fentiana et al. (2022), which showed that contraceptive use reduced the prevalence of stunting by 2.25%[47]. Participation in modern family planning gives mothers the opportunity to recover and provide more attention to each child, reducing the risk of stunting. This is supported by research from Flood et al. (2019), which identified that modern contraceptive use in Guatemala had a positive effect on linear child growth and reduced the prevalence of stunting [48]**.** Multicollinearity between family planning participation, number of births and birth spacing caused the modern family planning participation variable not to be included in the multiple logistic regression analysis. This multicollinearity occurs because family planning participation and number of births and birth spacing are often interrelated. Families who have more children are less likely to participate in family planning programs, which in turn affects the welfare and growth of children. This study is in line with the analysis by Tamirat et al. (2021), which states that high-risk fertility behaviors, including very close births, are closely associated with increased prevalence of stunting and anemia in children. In this context, family planning participation serves as an intervention that can influence birth rates and birth spacing, which indirectly affect the incidence of stunting[49].

CONCLUSION

This study provides an overview of the variables that are associated with and have an influence on the incidence of stunting in families at risk of stunting in children aged 6-23 months in terms of maternal factors including birth spacing, number of births, maternal age, modern family planning participation and environmental health factors including latrine ownership. Birth spacing, number of births, and latrine ownership are predictors of stunting in families at risk of stunting. Several maternal and environmental factors play an important role in the incidence of stunting in families at risk of stunting in Indonesia. A high number of births is associated with an increased risk of stunting. Mothers who have too many births (≥ 3 years) have a greater risk of stunting due to limited family resources and divided attention for each child. Spacing births too close together (<2 years) was also found to be a factor that increases the risk of stunting, as it reduces the mother's recovery time and affects the quality of nutrition in subsequent pregnancies. In addition, proper latrine ownership and good environmental sanitation were shown to have a significant effect on reducing the incidence of stunting, as it can reduce infections that have an impact on children's nutritional status.

Maternal age, on the other hand, showed no significant association with stunting, which may be due to improvements in access to health services and better antenatal care. Modern family planning participation was associated with reduced risk of stunting, although the effect was relatively small due to *multicollinearity* with number of births and birth spacing. These findings suggest that factors such as good family planning and improved sanitation and maternal nutrition should be a major focus of stunting prevention efforts in Indonesia.

Suggestions for related agencies, especially the National Population and Family Planning Agency (BKKBN) and the Provincial or Regency / City Health Office that policies to extend birth spacing and limit the number of births need to be considered as part of efforts to reduce the prevalence of stunting. The approach to families at risk of stunting that emphasizes aspects of nutrition-sensitive interventions needs to pay attention to risk factors that affect the incidence of stunting in families at risk of

stunting so that the assistance provided is more targeted and effective and efficient. Through programs that support family planning and improve maternal nutrition, it is hoped that it can reduce the stunting rate, which is still a major problem in Indonesia. Therefore, a holistic approach involving improved maternal nutrition, good family planning, and appropriate health education is needed. In addition, proper latrine ownership and good environmental sanitation play an important role in preventing child stunting. Therefore, efforts to improve access to proper sanitation, including education on the importance of good hygiene behavior, as well as the development of better sanitation infrastructure, should be a priority in Indonesia's stunting reduction program. A good sanitation-based approach can help reduce the spread of infectious diseases and support the fulfillment of adequate nutritional needs. Future researchers are expected to examine the incidence of stunting in stunting risk families with the target of pregnant women. Because the nutritional status of mothers and maternal care during pregnancy can also affect the incidence of stunting, especially causing Low Birth Weight (LBW) which will have an impact on the nutritional status of children in the future.

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AUTHOR'S CONTRIBUTION

The lead author (RR) was responsible for determining the research objectives, conducting a review of relevant literature, developing the theoretical framework of this study, data processing, data analysis, preparing the initial draft of the article and revising the article until publication. The second author (MZ) provided methodological guidance regarding the use of secondary data, provided advice on appropriate statistical analysis, assisted in determining relevant variables for research, and guided in the preparation of the draft article. The third author (SR) contributed to the presentation of the research results and contributed to the direction of policy recommendations based on the research results. The fourth author (SU) provided important feedback during the writing process to improve the quality and feasibility of the article, provided additional perspectives regarding the interpretation of the results and analysis of the research results, and provided input on the discussion and conclusion sections to make the research results more applicable.

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