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ORIGINAL RESEARCH

Exploring key factors behind stunting in Indonesian children: Insights from a descriptive study

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Abstract
Stunting remains a significant concern among the Indonesian population, and numerous studies have been conducted to decrease its prevalence. This study aims to analyze the risk factors for stunting in children aged 12 to 59 months. Utilizing a cross-sectional design, the research was conducted in the Sutojayan Health Center Work Area in Blitar. The research population consisted of 396 children aged 12 to 59 months, with a sample size of 60 children. The results indicated that maternal education (P-value = 0.010; OR = 4.4), maternal employment (P-value = 0.025; OR = 5.4), exclusive breastfeeding (P-value = 0.016; OR = 5.8), and environmental sanitation conditions (P-value = 0.027; OR = 3.6) are significantly related to the incidence of stunting. In contrast, children's immunization status did not show a significant relationship (P-value > 0.05). Stunting is influenced by various factors from pregnancy through preschool years, so prevention efforts must begin as early as possible. This includes improving maternal health, promoting breastfeeding, providing nutritious food, preventing infectious diseases, and ensuring a clean environment. The findings of this study encourage healthcare professionals to develop innovative strategies aimed at reducing stunting, particularly in Indonesia.

Keywords: Stunting; innovative prevention; community health services; child health; maternal health

Introduction

The prevalence of stunting in Indonesia remains alarmingly high (Siramaneerat, Astutik, Agushybana, Bhumkittipich, & Lamprom, 2024). Stunting in toddlers is defined as a condition where a child's height or length is significantly below the standard for their age, measured as less than -2 standard deviations on the WHO z-score table (Putri & Rong, 2021). This chronic nutritional issue arises from various factors, including socioeconomic conditions, the nutritional status of pregnant women, diseases during infancy, and inadequate nutritional intake in toddlers (World Health Organization, 2018). Stunting is a critical public health concern that must not be overlooked (Yani, Rahayuwati, Sari, Komariah, & Fauziah, 2023). Chronic malnutrition not only impedes a child's physical growth but also compromises their developmental potential due to insufficient nutritional intake (World Health Organization, 2014). Stunting before the age of two is particularly concerning, as it serves as an indicator of poor child development, impacting cognitive abilities throughout childhood and adolescence (Vaivada et al.,2020). In the long term, stunting reduces individual and community productivity and increases the risk of non-communicable diseases (Black et al., 2013; de Onis & Branca, 2016). Therefore, stunting is widely recognized as an essential indicator of child welfare within a nation. As of recent data, Indonesia's stunting prevalence stands at 21.5%, indicating that more than one-fifth of the nation's children face growth challenges. Some regions face heightened malnutrition rates due to poverty, limited healthcare access, and inadequate nutritional knowledge, highlighting significant disparities and challenges.

In East Java, the stunting prevalence was reported at 17.7% in 2023, which, while lower than the national average, remains a significant concern (Kementerian Kesehatan RI, 2023). Within this region, Blitar Regency exhibited a prevalence rate of 23.3%, ranking third-highest in East Java after Jember and Bondowoso Regencies (Dinas Kesehatan Provinsi Jawa Timur, 2023). This prevalence highlights the urgent need for targeted and effective

interventions to address underlying causes and improve child nutrition in the area **(Figure 1)**. To deal this issue, the Indonesian government implemented the National Strategy for Accelerating Stunting Reduction, as outlined in Presidential Regulation Number 72 of 2021. In line with this, the Blitar Regency Government has actively pursued initiatives to reduce stunting cases through its "Zero Stunting" program. Efforts include establishing a stunting reduction acceleration team supported by Blitar Regent Regulation Number 188/118/406/KPTS/2022, with teams operating at the regency, sub-district, and village levels (Astuti, Endarti, & Lestari, 2023). Research on the risk factors for stunting in developing countries has yielded varied results, highlighting the complexity of this issue (Prawirohartono, Nurdiati, & Haki, 2016). For instance, a study in Southeastern Kenya identified household food insecurity and low economic status as significant contributors to stunting (Shinsugi et al., 2016). Other studies have pointed to factors such as extended breastfeeding beyond 12 months, maternal education levels, and family income as critical determinants (Fenske et al., 2013). In Indonesia, specific factors like low exclusive breastfeeding rates, poor economic conditions, premature births, low maternal education, rural residency, and unsanitary environments have been identified as significant determinants (Indah & Nugraheni, 2018).

Figure 1. Illustration of stunting (*Courtesy of www.darya-varia.com*).

Despite the valuable insights gained from various studies on stunting, it is crucial to recognize that differences in study locations and contexts prevent the generalization of these findings across different populations. Each region has its unique socio-economic, cultural, and environmental factors that can significantly influence child health outcomes. Therefore, localized research is essential to accurately identify the most dominant factors affecting stunting in specific areas. Focusing on particular communities can gain a deeper understanding of the local challenges and opportunities that shape children's nutritional status. This approach not only enhances the relevance of the findings but also informs targeted interventions that are more likely to be effective in addressing the root causes of stunting. The analysis considered several independent variables that are known to impact child growth and development, including maternal education, maternal employment, exclusive breastfeeding practices, and the completeness of immunizations. Maternal education plays a critical role in shaping a mother’s understanding of nutrition and health, while maternal employment can influence the availability of resources and time for childcare. Additionally, exclusive breastfeeding is vital for providing essential nutrients during the early months of life, and timely immunizations protect children from preventable diseases that could hinder their growth. Identifying the most significant determinants of stunting within this specific population contribute valuable insights that can guide local health policies and interventions, ultimately improving child health outcomes in the region. In this context, the present study aimed to analyze the risk factors associated with stunting among children aged 12 to 59 months in the Sutojayan Health Center area, located in Blitar Regency.

Method

The study employed an observational study design, which aligns well with the research objectives. This approach allows for the collection of data in a natural setting without manipulation of variables, providing insights into the real-world dynamics of the factors affecting stunting. This research was conducted in 2024 using a cross-sectional method, with a sample size ranging from 50 to 100 respondents (Anjayati, 2021). The cross-sectional method is designed to examine the dynamics of the correlation between risk factors and their effects through observations or data collection conducted at a single point in time (point-in-time approach) (Abduh, Alawiyah, Apriansyah, Sirodj, & Afgani, 2023). This design was chosen because it allows researchers to measure the prevalence of stunting and the factors associated with its occurrence at a specific moment. The study focused on a population of mothers with children aged 12 to 59 months in the Sutojayan Health Center area of Blitar Regency, totaling 396 individuals. From this population, a sample of 60 mothers with children aged 12 to 59 months was selected **(Figure 2)**. The sample selection was based on specific inclusion criteria, which included mothers who were willing to participate in the study, while the exclusion criteria were children with congenital disorders that could affect their nutritional status. The consecutive sampling method was employed for data collection. In this approach, all subjects who met the selection criteria were included in the study until the required sample size was reached. This method ensured that the sample was representative of the broader population and minimized the likelihood of selection bias. The data collected were primarily obtained through structured interviews using questionnaires designed to gather information on maternal education levels, exclusive breastfeeding practices, and environmental sanitation conditions. Additionally, secondary data, such as children's immunization records, were collected to complement the primary data. Data processing was conducted using the SPSS program in two stages. The first stage involved univariate analysis, which aimed to determine the frequency distribution of each research variable. This analysis provided an overview of the respondents' characteristics and the distribution of variables such as maternal education, exclusive breastfeeding, and environmental sanitation conditions. The results of the univariate analysis were essential for understanding the background of the respondents and the initial conditions before proceeding to more in-depth analysis.

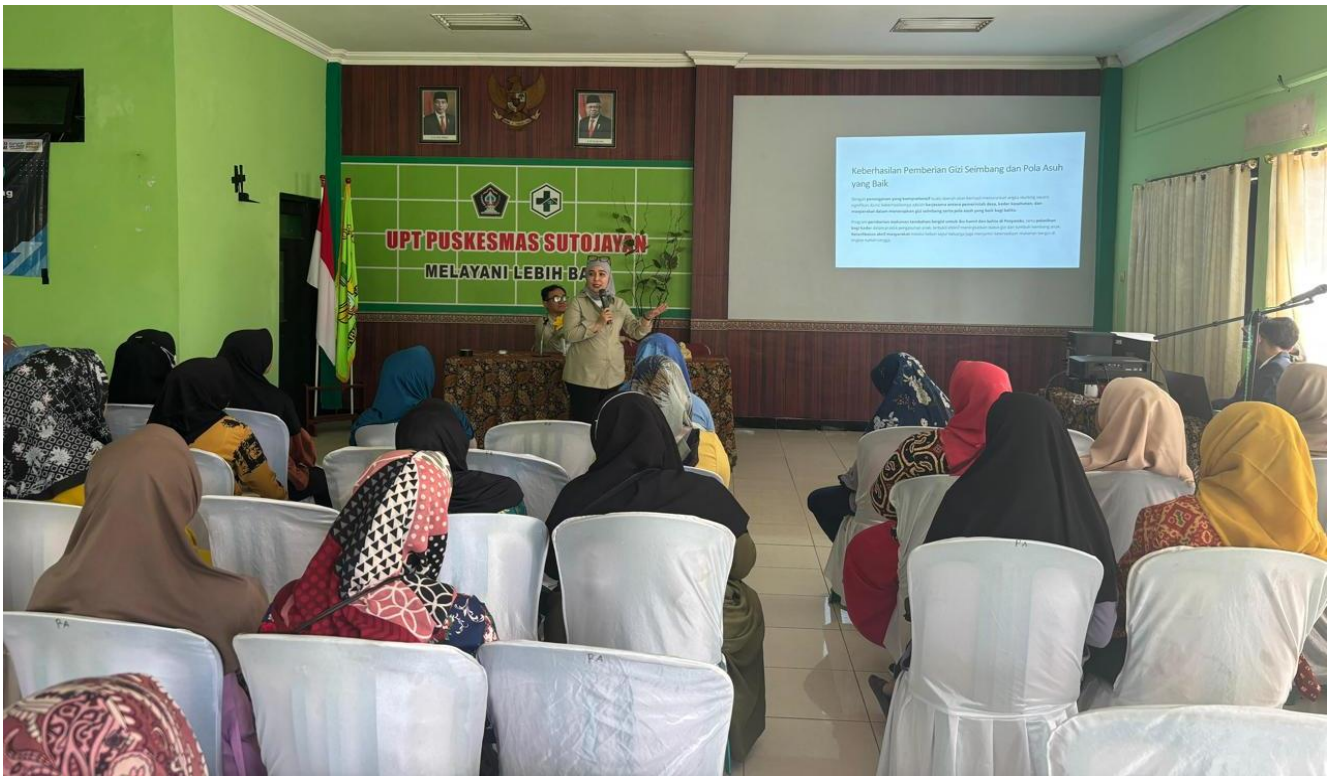

Figure 2. Data collection process.

The second stage involved bivariate analysis, which was used to determine the relationship between each independent variable and the incidence of stunting in children aged 12 to 59 months. This analysis was performed using the chi-square test with an alpha value of 0.05, allowing the researchers to assess the statistical significance of the relationships. The chi-square test was chosen because it is appropriate for analyzing categorical data and helps identify whether there is a significant relationship between the studied variables. The results of the bivariate

analysis provided deeper insights into the factors contributing to stunting in the study area. Overall, this study yielded important insights into the factors associated with stunting among toddlers at the Sutojayan Health Center in Blitar. The findings of this study are expected to serve as a foundation for public health programs and policies aimed at improving the nutritional and health status of children in the region.

Results

The following table presents the research findings on these variables, including the distribution of respondents based on maternal education and employment levels, the frequency of exclusive breastfeeding, environmental sanitation conditions, and the incidence of stunting among toddlers. The explanation of this table is intended to provide a clearer picture of how each variable influences the incidence of stunting in the study area. The table reveals striking data regarding the prevalence of stunting and the characteristics of mothers, as well as environmental conditions that may have influenced stunting among children in the area **(Table 1)**. According to the data, 30% of children experienced stunting, indicating that nearly one-third of the children in this region face serious growth issues. This figure underscores the urgent need for more effective nutritional and health interventions to address the problem of stunting. The characteristics of the mothers recorded in this study showed that the majority had a high level of education, with 58.3% achieving this status. Higher maternal education is typically correlated with better knowledge of nutrition and child health, which positively contributes to child growth. However, a significant proportion of mothers, 68.3%, were unemployed, which may limit access to adequate economic and health resources despite their educational background. Furthermore, data on exclusive breastfeeding revealed that 60% of children did not receive exclusive breastfeeding during the first six months of life. Exclusive breastfeeding is crucial for providing optimal nutrition and protecting children from various diseases; thus, its absence could be a contributing factor to the high rate of stunting in this area.

Environmental sanitation conditions were also concerning, with 68.3% of families living in poor sanitary conditions. Poor sanitation can lead to infectious diseases that impede a child's growth, emphasizing the need for improved sanitation facilities as part of efforts to prevent stunting. Conversely, immunization data showed more positive results, with nearly all children (88.3%) having received complete immunizations, which are essential for protecting children from diseases that could hinder their growth and development. High immunization rates reflect good awareness and access to basic healthcare services; however, other factors such as nutrition and sanitation still require serious attention to reduce stunting rates in the area. The table indicates a significant relationship between maternal education and the incidence of stunting, with a P-value of 0.010, an Odds Ratio (OR) of 4.4, and a 95% Confidence Interval (CI) of 1.37-14.49 **(Table 2)**. This suggests that mothers with lower education levels are 4.4 times more likely to have stunted children compared to those with higher education levels. Maternal education is a vital factor in determining a child's nutritional status, as more educated mothers tend to possess better knowledge of health and nutrition, enabling them to implement better childcare practices. Additionally, maternal employment was found to have a significant relationship with the incidence of stunting, evidenced by a P-value of 0.025, an OR of 5.4, and a 95% CI of 1.10-26.78. This data indicates that children of unemployed mothers are 5.4 times more likely to experience stunting compared to those of employed mothers. This disparity may arise from better access to economic resources and healthcare services for employed mothers, which supports optimal child growth and development. Employed mothers may also have greater awareness of the importance of nutrition and child health.

Table 1. Profile of the participants.

Variables	Groups	*n*	Percentage (%)
Stunting Incidence	Normal	42	70
	Stunting	18	30
Maternal Education	High	35	58.3
	Low	25	41.7
Maternal Employment	Employed	19	31.7
	Unemployed	41	68.3
Exclusive Breastfeeding	Exclusive	24	40
	Non-Exclusive	36	60
Environmental Sanitation	Good Sanitation	19	31.7
	Poor Sanitation	41	68.3
Immunization Status	Complete	53	88.3
	Incomplete	7	11.7

Table 2. Study analysis.

Variable	Groups	Stunting Incidence				*p*	OR 95% CI
		Normal		Stunting			
		n	%	*n*	%		
Maternal Education	High	29	82.9	6	17.1	0.010	4.4
	Low	13	52	12	48		(1.37-14.49)
Maternal Employment	Employed	17	89.5	2	10.5	0.025	5,4
	Unemployed	25	61	16	39		(1.10-26.78)
Exclusive Breastfeeding	Exclusive	21	87.5	3	12.5	0.016	5,8
	Non-exclusive	21	58.3	15	41.7		(1.25-19.86)
Environmental Sanitation	Good	17	89,5	2	10.5	0.025	5,4
	Poor	25	61	16	39		(1.10-26.78)
Immunization Status	Complete	36	67.9	17	31.1	0.334	0,35
	Incomplete	6	85.7	1	14.3		(0.39-3.16)

Similarly, exclusive breastfeeding was significantly related to the incidence of stunting, with a P-value of 0.016, an OR of 5.8, and a 95% CI of 1.25-19.86. This means that children who did not receive exclusive breastfeeding were 5.8 times more likely to experience stunting compared to those who did. Exclusive breastfeeding is vital for providing optimal nutrition and protecting children from diseases that could hinder growth. It also supports the development of the child's immune system and ensures they receive appropriate nutrition during the critical early growth phase. A significant relationship was also found between environmental sanitation and stunting, with a P-value of 0.025, an OR of 5.4, and a 95% CI of 1.10-26.78. This indicates that children living in poor sanitary conditions are 5.4 times more likely to experience stunting compared to those in good sanitary conditions. Poor environmental sanitation increases the risk of infections and diseases that can stunt a child's growth, highlighting the need for improvements in sanitation as a crucial step in preventing stunting. However, the statistical analysis of immunization status did not show a significant relationship with the incidence of stunting, as the P-value was greater than 0.05 and the 95% CI included zero. This suggests that while immunization is important for preventing diseases, it may not directly influence the incidence of stunting. Other factors such as nutrition, maternal education, employment, exclusive breastfeeding, and environmental sanitation appear to have a stronger impact on a child's nutritional status. From this analysis, it can be concluded that significant risk factors for stunting include maternal education, maternal employment, exclusive breastfeeding, and environmental sanitation. These factors should be the primary focus of child nutrition and health intervention programs. Enhancing maternal education and economic empowerment can reduce significantly the incidence of stunting **(Figure 3)**. Public health programs must be designed to address these risk factors in a holistic and sustainable manner.

Discussion

The results of the bivariate analysis indicate a significant impact of maternal education on the incidence of stunting. This finding aligns with several studies that demonstrate mothers with lower education levels have a higher percentage of stunted children compared to those with medium and high education (Javid & Pu, 2020; Beal et al., 2019). Highly educated mothers typically provide cognitive and social benefits to their families, as they are more attentive to health issues and better able to identify their children's health problems (Vanneman & Vikram, 2019). The level of education influences their ability to address various family challenges through the information they acquire. Well-educated parents also possess better knowledge of nutrition and child-rearing, making maternal education a strong predictor of stunting (Utami, Setiawan, & Fitriyani, 2019). Maternal employment is significantly related to the incidence of stunting in children. Working mothers tend to positively influence their children's health and education. Earning an income can meet their children's nutritional needs and access relevant information about health and nutrition. A study conducted in Aligarh found that the prevalence of stunting was higher among children whose mothers were not employed. This is likely because working mothers have better access to resources and facilities that support children's health, including nutritious food, healthcare services, and education about healthy eating patterns (Dervisevic, Bue, & Perova, 2021; Savita & Amelia, 2020).

Moreover, employed mothers usually have broader insights due to their frequent interactions with various social and professional environments. These interactions enable them to gain up-to-date information on maintaining their children's health and nutrition (Sultan, 2014). Additionally, maternal employment is directly linked to increased family income and living standards. With a higher income, working mothers can provide more nutritious and diverse food for their children, which is crucial for preventing stunting. The opportunity to offer better education and access to adequate healthcare services is also enhanced, all contributing to optimal child growth and

development. Therefore, promoting women's participation in the workforce could be an effective strategy for reducing the prevalence of stunting in society (Reurings, Vossenaar, Doak, & Solomons, 2013). Exclusive breastfeeding is closely related to the incidence of stunting in children. Children who do not receive exclusive breastfeeding are at a higher risk of stunting. Furthermore, exclusive breastfeeding provides nutrition that is most suitable for a baby's needs during the first six months of life, ensuring that the baby receives all the nutrients necessary for optimal growth and development. Additionally, exclusive breastfeeding contains various bioactive components, including proteins and essential fatty acids, which play a crucial role in supporting the immune system and overall organ function of the baby. The nutrients in breast milk are easily digested and absorbed by the baby's body, ensuring efficient utilization of each nutrient (Indah & Nugraheni, 2018). Aside from being an optimal source of nutrition, exclusive breastfeeding for the first six months, followed by breastfeeding along with complementary foods until the age of two, provides significant protection against various diseases **(Figure 4)**.

Figure 3. Illustration of maternal healthy activities (Courtesy of www.unsplash.com).

One key benefit of exclusive breastfeeding is the reduced risk of diarrhea, a leading cause of morbidity and mortality in infants and children in developing countries. Diarrhea is often caused by pathogens transmitted through contaminated water, and exclusive breastfeeding helps minimize a baby's exposure to these pathogens by providing a sterile and uncontaminated food source. Reducing the frequency and severity of diarrhea supports a baby's digestive health and promotes healthy growth (Kementerian Kesehatan RI, 2018). Moreover, exclusive breastfeeding has been shown to reduce the risk of respiratory infections and other infectious diseases. The antibodies and immune cells present in breast milk provide additional protection against various infections, helping to maintain the baby’s health and prevent conditions that could hinder their growth and development. Research indicates that infants who receive exclusive breastfeeding have lower rates of infections compared to those who do not. Therefore, promoting exclusive breastfeeding is vital not only for ensuring adequate nutrition but also for providing comprehensive health protection for infants, ultimately reducing the risk of stunting and supporting optimal development (Vaivada, Akseer, & Selai Akseer, 2020; Angdembe, Dulal, Bhattarai, & Karn, 2019). However, after six months of age, exclusive breastfeeding should be complemented with appropriate foods, as the baby's nutritional needs can no longer be met by breast milk alone. Toddlers who receive only exclusive breastfeeding after six months without complementary foods have a 2.77 times higher risk of stunting compared to those who receive both (Nsereko et al., 2018). In this study, poor environmental sanitation conditions were found to affect the incidence of infectious diseases. Children with a history of infections had a 3.66 times higher risk of stunting compared to those

without such a history. Inadequate food intake and infections directly contribute to stunting. It is estimated that half of malnutrition cases arise from recurrent intestinal parasitic infections due to a lack of safe drinking water, inadequate sanitation, poor personal hygiene, and unsatisfactory environmental conditions (Yoseph & Beyene, 2020). Children exposed to enteric pathogens experience enteric inflammation and impaired linear growth, even in the absence of diarrhea (Kosek, 2017). Acute respiratory infections (ARI) are another common issue among children. Those with a history of ARI are three times more likely to experience stunting than those without such a history (Himawati & Fitria, 2020).

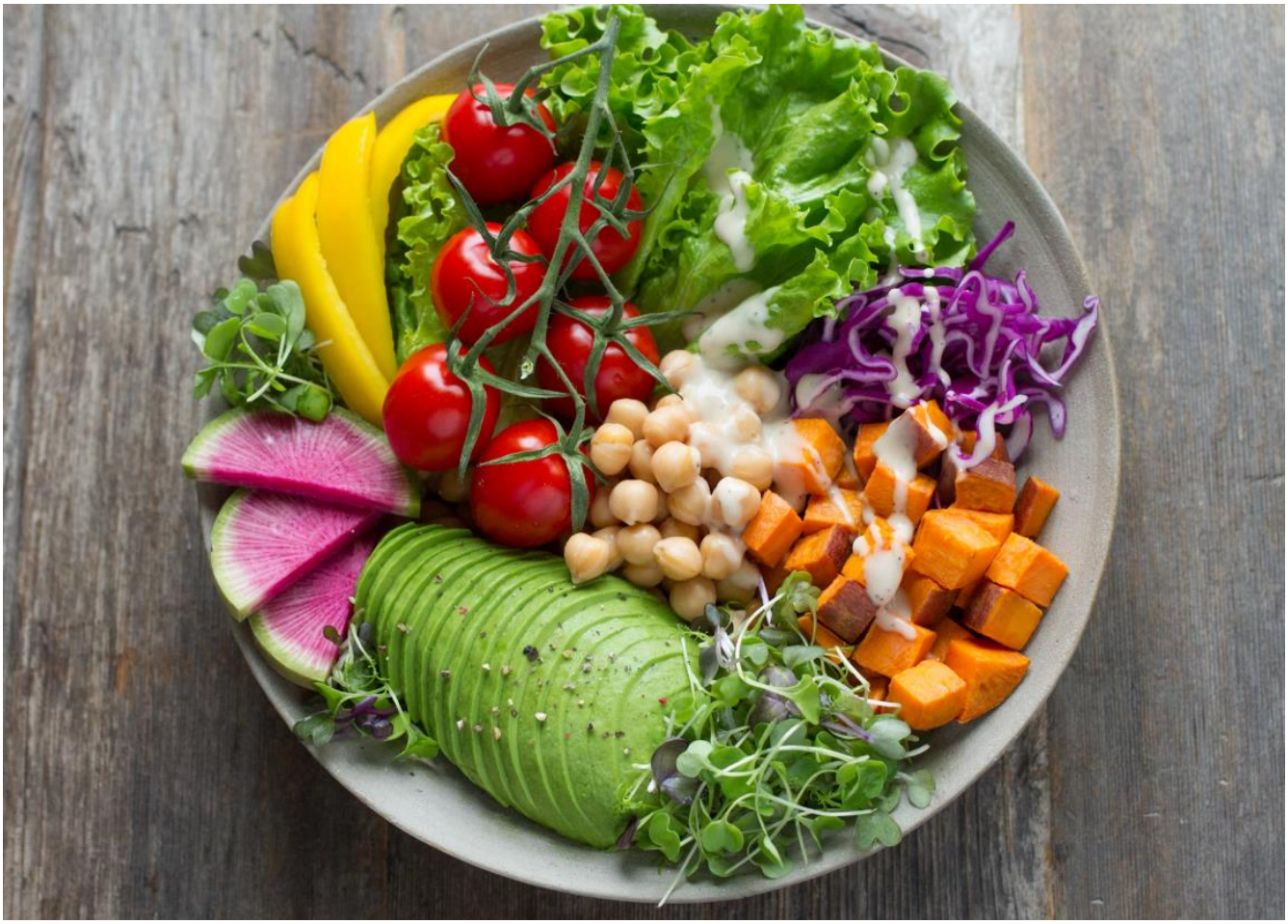

Figure 4. Illustration of healthy food for breastfeeding (Courtesy of www.unsplash.com).

Children suffering from ARI experience metabolic disturbances due to inflammation, affecting the chondrocytes in bones and disrupting the bone formation process. Rapid growth and development occur in children under five, and a history of ARI can hinder this progression (Sinharoya, Clasena, & Martorell, 2020). Community involvement, particularly from healthcare professionals, is crucial in preventing and mitigating stunting (Angraini, Carolia, Tjiptaningrum, & Kurniati, 2023). One of the roles of doctors in reducing stunting rates is through Specific Nutritional Interventions. These interventions can include implementing and supervising the provision of supplementary food (PMT) and other measures targeting pregnant women, breastfeeding mothers, and children aged 0-23 months. Encouraging continued breastfeeding until the child reaches 23 months is also essential. Complementary feeding (MP-ASI) must be introduced once exclusive breastfeeding is no longer sufficient (Anzar, 2019). Additionally, the lack of adequate screening tools has been identified as a challenge for health workers in fulfilling their roles in stunting prevention efforts. Therefore, it is essential for healthcare professionals to be equipped with proper tools and training for stunting prevention to ensure the smooth implementation of interventions (Muhdar et al., 2022). In this increasingly modern era, numerous innovations have emerged to address the issue of stunting. Advanced technologies are being widely adopted to tackle this problem. Several studies have explored the use of applications as tools for stunting prevention, including the "Sobat Gesit" application (Christiana et al., 2024), the "EduStunting" Android-based adolescent nutrition education application (Resmiati, Putra, & Femelia, 2021), and the "Stunting Prevention" application for educating mothers and monitoring the nutritional

status of children aged 0-36 months (Rufaindah & Patemah, 2021). Moreover, simple methods can be implemented by the general public to prevent stunting, such as improving dietary patterns, parenting styles, and promoting healthy and hygienic lifestyles (Rufaindah & Patemah, 2021). Addressing the multifaceted issue of stunting requires a comprehensive approach that includes enhancing maternal education and employment, promoting exclusive breastfeeding, improving environmental sanitation, and fostering community involvement. Implementing targeted interventions and utilizing modern technologies can significantly reduce the prevalence of stunting and promote optimal growth and development for children.

Conclusion

This study identified several significant risk factors associated with the incidence of stunting in children aged 12 to 59 months. Specifically, maternal education, maternal employment, exclusive breastfeeding, and environmental sanitation conditions were found to have meaningful relationships with stunting rates. In contrast, the completeness of immunization did not demonstrate a significant correlation with the incidence of stunting. Stunting is a complex issue influenced by multiple factors, highlighting the need for more in-depth and retrospective studies that incorporate additional variables to address the limitations of this research. Future studies should consider factors such as family economic status, daily nutritional intake, access to healthcare services, and other social and environmental conditions that may contribute to the occurrence of stunting. Gaining a better understanding of the interactions among these factors can reduce the prevalence of stunting and enhance the health and well-being of children in affected areas.

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Author's perspective

Key points

- The prevalence of stunting in Indonesia remains alarmingly high.
- Chronic malnutrition not only impedes a child's growth but also compromises their developmental.
- Maternal education plays a critical role in shaping a mother's understanding of nutrition and health.

Potential areas of interest

- What are the primary contributing factors to stunting among Indonesian children?
- How do socio-economic, cultural, and environmental aspects influence stunting rates in Indonesia?
- What interventions could be designed to address the key factors contributing to stunting?

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