

Original Research

Factors Associated with Undernutrition among Children Under Five Years of Age in Bangkalan: A Cross-Sectional Study

Iin Setiawati^{1*}, Selvia Nurul Qomari¹, Dana Daniati¹

¹Department of Midwifery Noor Huda Mustofa University Bangkalan, East Java, 69116, Indonesia

ABSTRACT

Background: The malnutrition issue in Indonesia remains a health challenge that the government has not yet completely solved. If we look at overall prevalence of stunting, both mid and severe, the prevalence is 30.8%. The purpose of this study is to analyze the factors associated with stunting among children under 5 years of age in Bangkalan district.

Methods: This study This quantitative study employed an analytical observational study with a cross-sectional design to identify factors associated with undernutrition among children under five years of age in Bangkalan Regency. The samples are 398 toddler using proportional random sampling, The dependent variable was undernutrition among children under five and independent sex, History of low birth weight, Maternal anemia during pregnancy and History of chronic energy deficiency, analyzed using chi square.

Results: The value <0.001 which means that the nutritional status of the toddler significantly influences stunting in toddlers. The p -value 0.007 which means that the anemia history of mothers significantly influences stunting in toddlers and stunting in toddlers is strongly influenced by the mother's CED history, as indicated by the p value $<\alpha$ (p value < 0.001).

Conclusion: This study identified several maternal and child factors associated with undernutrition among children under five years of age in Bangkalan Regency. Although child sex and a history of low birth weight were not significantly associated with undernutrition, maternal nutritional conditions during pregnancy and the nutritional status of children remain important determinants that should be addressed through comprehensive maternal and child health interventions.

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CONTACT

Iin Setiawati



iinsetiawati221@gmail.com

Department of Midwifery Noor
Huda Mustofa University
Jln. RE Martadinata No. 45,
Bangkalan, East Java, 69116,
Indonesia

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INTRODUCTION

Malnutrition among children under five years of age remains a major public health challenge worldwide because it adversely affects child survival, physical growth, cognitive development, educational achievement, and future economic productivity. Undernutrition during the first 1.000 days of life has irreversible consequences, increasing susceptibility to infectious diseases and reducing human capital across the life course. Consequently, improving child nutrition has become one of the primary targets

of the Sustainable Development Goals (SDGs), particularly Goal 2 (Zero Hunger) and Goal 3 (Good Health and Well-being), which emphasize ending all forms of malnutrition through multisectoral interventions (Pudjirahaju et al., 2025; Weise, 2025)

Despite continuous global efforts, childhood malnutrition remains highly prevalent in many low- and middle-income countries, including Indonesia. National health reports indicate that chronic undernutrition continues to affect a substantial proportion of Indonesian children under five. According to the East Java Provincial Health Office, the prevalence of stunting in Indonesia remains high, with the combined prevalence of moderate and severe stunting reaching 30.8% (Dinas kesehatan Jawa Timur, 2023). Although the Indonesian government has implemented numerous nutrition-specific and nutrition-sensitive interventions to accelerate stunting reduction, including strengthening maternal and child nutrition programs and integrating SDG-based policies, childhood malnutrition continues to represent a major public health burden (Atamou et al., 2023).

At the district level, Bangkalan Regency remains one of the priority areas for nutritional interventions. The number of stunted children decreased from 2.300 cases (38.9%) in 2021 to 1.931 cases (26.2%) in 2022 and further declined to 10.2% in 2023 (Dinas kesehatan Jawa Timur, 2023). Nevertheless, several subdistricts, including Tanjung Bumi, Bangkalan, and Kokop, continue to report the highest number of affected children, indicating persistent disparities in child nutritional status.

Previous studies have demonstrated that childhood undernutrition is a multifactorial condition influenced by interactions between biological, maternal, household, and environmental determinants. Child-related factors include age, sex, birth weight, birth order, history of infectious diseases, immunization status, and breastfeeding practices. Maternal characteristics such as educational level, nutritional status, anemia during pregnancy, and birth spacing have also been consistently associated with poor child nutritional outcomes. In addition, socioeconomic conditions, household income, family size, food security, hygiene practices, and environmental sanitation significantly contribute to the occurrence of undernutrition and stunting (Ali, 2021; Komalasari et al., 2020; Patriota et al., 2024; Syahrial, 2021; Ummah, 2024).

These multiple determinants interact throughout the life course, ultimately impairing physical growth, neurocognitive development, and increasing the risk of chronic diseases later in adulthood. Although numerous studies have investigated determinants of stunting in Indonesia, several important gaps remain. Most previous studies have focused on individual determinants such as feeding practices, parenting behavior, socioeconomic status, or environmental sanitation separately (Ali, 2021; Komalasari et al., 2020; Patriota et al., 2024; Syahrial, 2021; Ummah, 2024).

Limited evidence has simultaneously examined maternal health conditions during pregnancy, child health history, birth outcomes, and nutritional status within a comprehensive framework at the district level. Furthermore, evidence from Bangkalan Regency remains scarce despite its continuing burden of childhood undernutrition and its unique demographic and socioeconomic characteristics. This lack of locally generated evidence limits the development of targeted interventions that address the specific determinants of child malnutrition in the region.

The present study addresses these gaps by comprehensively examining multiple maternal, child, and household factors associated with undernutrition among children under five years of age in Bangkalan Regency. Unlike previous studies that primarily evaluated isolated risk factors, this research integrates maternal anemia during pregnancy, low birth weight, history of childhood illness, child nutritional status, and other

demographic characteristics to identify the most influential predictors of undernutrition in the local context. The findings are expected to provide evidence for designing more effective, context-specific nutrition prevention strategies and strengthening district-level nutrition policies.

Therefore, this study aimed to identify the factors associated with undernutrition among children under five years of age in Bangkalan Regency using a cross-sectional study design. Understanding these determinants is essential for developing evidence-based interventions to prevent undernutrition and improve child health outcomes in areas with a high burden of nutritional problems. The findings are also expected to contribute to the existing body of knowledge by providing context-specific evidence on the determinants of undernutrition, thereby supporting future research and informing nutrition policies and intervention strategies in similar settings.

MATERIALS AND METHOD

Study Design and Setting

This quantitative study employed an analytical observational study with a cross-sectional design to identify factors associated with undernutrition among children under five years of age in Bangkalan Regency, East Java Province, Indonesia. The study was conducted from August to September 2024 in three subdistricts with the highest prevalence of child undernutrition, namely Bangkalan, Tanjung Bumi, and Kokop. These areas were purposively selected based on reports from the Bangkalan District Health Office indicating a high burden of nutritional problems among children under five.

Population and Sample

The target population comprised all children aged 0–59 months residing in Bangkalan Regency, with an estimated population of 79.600 children according to the Bangkalan District Health Office. The study population included mothers and their children aged 0–59 months living in the selected subdistricts. Eligible participants were mothers who: (1) had children aged 0–59 months; (2) were permanent residents of the study area; (3) were able to communicate in Bahasa Indonesia; and (4) possessed a Maternal and Child Health (MCH/KIA) handbook. Children with documented chronic diseases, particularly gastrointestinal disorders affecting nutritional status, were excluded. Mothers who declined participation or were unable to complete the interview were also excluded.

The minimum sample size was calculated using the formula for hypothesis testing in an analytical cross-sectional study based on the odds ratio reported in previous studies investigating determinants of child undernutrition. The calculation assumed a significance level (α) of 0.05 ($Z\alpha = 1.96$), statistical power of 80% ($Z\beta = 0.842$), and an estimated prevalence of undernutrition of 30.8% (0.308). The minimum required sample size was 398 mother–child pairs. Participants were recruited using proportional random sampling from the selected subdistricts.

Research Variables and Measurements

The dependent variable was undernutrition among children under five, assessed using the Weight-for-Height/Length Z-score (WHZ) based on the WHO Child Growth Standards (2006) (Menteri kesehatan Republik Indonesia, 2020). Children were classified as: (1) Undernutrition (wasting): $WHZ < -2 SD$; and (2) Normal nutritional status: $WHZ \geq -2 SD$ to $+1 SD$. Stunting status was also assessed using Height-for-Age

Z-score (HAZ) and categorized as: (1) Stunted: $HAZ < -2$ SD; (2) Not stunted: $HAZ \geq -2$ SD.

The independent variables included: (1) Child's sex (male/female); (2) History of low birth weight (LBW), categorized as LBW (<2.500 g) and normal birth weight (≥ 2.500 g); (3) Maternal anemia during pregnancy, defined as hemoglobin concentration <11.0 g/dL according to WHO criteria; and (4) History of chronic energy deficiency (CED) during pregnancy, defined as maternal mid-upper arm circumference (MUAC) <23.5 cm. Information regarding maternal anemia, CED, and birth weight was obtained from the Maternal and Child Health (MCH/KIA) handbook and maternal health records.

Data Collection Procedure

Prior to data collection, research approval was obtained from the Regional Development and Political Affairs Agency (Bakesbangpol) and the Bangkalan District Health Office. Data collection was conducted over four weeks by trained research assistants. Primary data were collected through direct anthropometric measurements and structured observation forms.

Children's body weight was measured using calibrated digital weighing scales, while body length or height was measured using standardized infantometers or stadiometers according to WHO anthropometric measurement procedures. Information on the child's age, sex, maternal anemia during pregnancy, history of CED, and birth weight was extracted from the Maternal and Child Health (MCH/KIA) handbook and health center registers. All completed questionnaires were checked for completeness (editing), assigned numerical codes (coding), entered into a computerized database, and verified before statistical analysis.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 25. Descriptive (univariate) analysis was performed to summarize participants' characteristics using frequencies and percentages. Associations between independent variables and undernutrition were initially examined using the Chi-square test. Variables with $p < 0.25$ in the bivariate analysis were subsequently entered into a multivariable logistic regression model to identify independent predictors of undernutrition while controlling for potential confounding variables. The strength of association was presented as Adjusted Odds Ratios (AORs) with 95% Confidence Intervals (95% CI). Statistical significance was established at $p < 0.05$.

Ethical Considerations

Ethical approval for this study was obtained from the Health Research Ethics Committee of STIKES Ngudia Husada Madura (Approval No. 2312/KEPK/STIKES-NHM/EC/IV/2024). Administrative permission to conduct the research was granted by the Regional Development and Political Affairs Agency (Bakesbangpol) of Bangkalan Regency (Permit No. 00.9.2/352/433.207/2024) and the Bangkalan District Health Office. Before data collection, all participating mothers received detailed information regarding the objectives and procedures of the study. Written informed consent was obtained from each participant. Confidentiality and anonymity were maintained by assigning identification codes to participants and ensuring that all collected data were used solely for research purposes.

RESULTS

Tabel 1. Characteristics of Toddlers, Health History of Pregnant Women and Stunting (n = 398)

Variable	Univariate n (%)
Gender	
Male	182 (45.7)
Female	216 (54.3)
LBW History	
LBW	20 (5)
Not LBW	378 (95)
Nutritional Status	
Poor Nutrition	54 (13.6)
Normal	344 (86.4)
Anemia History	
Anemia	93 (23.4)
Not Anemia	305 (76.6)
CED History	
CED	182 (45.7)
Not CED	216 (54.3)
Stunting	
Stunting	153 (38.4)
Not Stunting	245 (61.6)

Table 1 shows Toddler Characteristics, Pregnant Women's Health History, and Stunting The majority of toddlers are female (216, or 54.3%), and nearly all of them have no history of LBW, namely 378 toddlers (95%), almost all toddlers have normal nutritional status, namely 344 toddlers (86.4%), almost all mothers had no history of anemia during pregnancy, namely 305 mothers (76.6%), the majority of mothers did not have a history of CED, namely 216 mothers (54.3%), the majority of toddlers do not stunting, namely 245 toddlers (61.6%).

Tabel 2. Cross Tabulation of Dependent and Independent Variables (n = 398)

Variable	Bivariate		p-value*	OR	95% CI
	Stunting n (%)	Not Stunting n (%)			
Gender					
Male	70 (39.6)	112 (60.4)	0.674	1.091	0.727-
Female	83 (37.5)	113 (62.5)			1.636
LBW History					
LBW	8 (35)	12 (65)	0.746	0.856	0.334-
Not LBW	145 (38.6)	233 (61.4)			2.195
Nutritional Status					
Poor	21 (87)	33 (13)	<0.001	15.075	6.598-
Nutrition	132 (30.8)	212 (69.2)			34.448
Normal					
Anemia History					
Anemia	36 (50.5)	57 (49.5)	0.007	1.918	

Variabel	Bivariat		p-value*	OR	95% CI
	Stunting n (%)	Not Stunting n (%)			
Not Anemia	117 (34.8)	188 (65.2)			1.199-3.069
CED History					
CED	70 (69.2)	112 (30.8)	<0.001	15.750	9.443-26.269
Not CED	83 (12.5)	133 (87.5)			

Note: *Chi-Square Test; OR = Odds Ratio; 95% CI = 95% Confidence Interval

Tabel 2 shows, the majority of female toddlers are not stunted (62.5%), Stunting in toddlers is not significantly influenced by the toddler's gender, as indicated by the p value $> \alpha$ ($0.674 > 0.05$). With a 95% confidence interval, the OR is 1.091, indicating that the likelihood of stunting is 1.09 times higher for females. shows a stunting risk that is 0.7 times lower and 1.6 times higher than the lowest. The majority of toddlers with a history of LBW (65%) suffer from stunting; The toddler's LBW history has no discernible effect on stunting, according to the p -value $> \alpha$ ($0.746 > 0.05$); the OR is 0.856, indicating that LBW is 0.85 times at risk of stunting, and the CI is 95%, indicating 0.3 times the lowest risk and 2.19 times the highest risk of stunting.

Almost all toddlers who are poor nutrition experience stunting (87%), the p -value $< \alpha$ ($< 0.001 < 0.05$) which means that the nutritional status of the toddler significantly influence stunting in toddlers, the OR shows 15.075, which means that Poor nutrition of toodler is 15 times at risk of experiencing stunting and the CI is 95 % shows 6.59 times the lowest risk and 34.44 times the highest risk of experiencing stunting.

Most mothers who do not have a history of anemia, their toddlers do not experience stunting (65.2%). The p -value $< \alpha$ ($0.007 < 0.05$) which means that the anemia history of mother significantly influence stunting in toddlers, the OR shows 1.918, which means that anemia history of toodler is 1.9 times at risk of experiencing stunting and the CI is 95 % shows 1.19 times the lowest risk and 3.06 times the highest risk of experiencing stunting. Stunting does not affect toddlers of nearly all women who do not have a history of CED (87.5%). Stunting in toddlers is strongly influenced by the mother's CED history, as indicated by the p value $< \alpha$ ($0.000 < 0.05$). The OR is 15.750, meaning that a toddler with a CED history is 15.7 times more likely to experience stunting, and the CI is 95%. demonstrates a stunting risk that is 9.44 times lower and 26.2 times higher.

DISCUSSION

Factors Related to Gender That Influence Stunting in Toddlers in Bangkalan District

The present study found that child sex was not significantly associated with undernutrition among children under five years of age in Bangkalan Regency. Although female children showed a slightly higher odds of undernutrition than males. One possible explanation is that nutritional status during early childhood is primarily determined by environmental and behavioral factors rather than biological sex. Although boys generally have higher energy requirements because of greater lean body mass and physical activity, these physiological differences do not necessarily translate into different nutritional outcomes when both boys and girls have similar access to food, health services, and caregiving.

In addition, nutrition programs implemented in Indonesia provide equal growth monitoring, immunization, breastfeeding promotion, and complementary feeding education for both sexes, thereby reducing sex-related disparities in nutritional status. This equitable access to essential child health and nutrition services may contribute to minimizing biological or social differences in nutritional outcomes between boys and girls. Consequently, other determinants such as household socioeconomic conditions, maternal nutritional status, feeding practices, infectious diseases, and birth outcomes may play a more important role in explaining undernutrition than child sex alone (Setiawati et al., 2022; Yuningsih, 2022).

The absence of a significant association between child sex and undernutrition in this study is consistent with several previous studies reporting that biological sex is not an independent predictor of child nutritional status after adjustment for socioeconomic and maternal factors. Conversely, our findings differ from those reported by Setiawati et al. (2022) and Yuningsih (2022), who found that boys were significantly more likely to experience stunting than girls (Setiawati et al., 2022; Yuningsih, 2022). Likewise, Baig-Ansari et al. (2006) observed a higher prevalence of stunting among girls, suggesting that the relationship between sex and child nutritional status may vary across settings. UNICEF (2020) also emphasizes that nutritional inequalities are more strongly influenced by gender-related social factors, including access to education, food security, and maternal empowerment, rather than biological sex itself (UNICEF, 2020).

Similarly, Kwami et al. (2019) reported that caregiver characteristics, particularly caregiver gender and caregiving practices, contributed more substantially to child nutritional outcomes than the child's sex (Kwami, 2019; Susanto et al., 2024). These inconsistencies across studies may reflect differences in study populations, nutritional indicators, cultural practices, and analytical approaches. Previous studies mainly examined stunting, which reflects chronic malnutrition, whereas the present study focuses on undernutrition among children under five. Furthermore, socioeconomic conditions, feeding behaviors, health service utilization, and maternal characteristics differ considerably across regions, potentially modifying the relationship between child sex and nutritional outcomes. Differences in sample size, study design, and statistical adjustment for confounding variables may also explain the variation in findings reported across studies.

The findings of this study suggest that nutrition interventions in Bangkalan should not prioritize children solely based on sex. Instead, intervention strategies should focus on modifiable determinants of undernutrition, including improving maternal nutritional status during pregnancy, preventing low birth weight, promoting appropriate infant and young child feeding practices, preventing childhood infections, and strengthening household food security. These comprehensive interventions are expected to have a greater impact on reducing undernutrition than sex-specific approaches.

Determining Factors of LBW on Stunting in Bangkalan District

The study's findings indicate Stunting affects the majority of toddlers with a history of LBW. Birth weight is a reliable indicator of a child's likelihood of survival, growth, long-term health, and psychological development (Meikawati et al., 2021). Low birth weight is an event where a baby is born prematurely and the birth weight is less than 2500 grams. However, there are also babies who are born at term but whose birth weight is less than 2500 grams, these babies are still categorized as low birth weight regardless of gestational age when the baby is born (Sholihah, 2023)

The results of study showed that history of LBW in toddlers was not significant to stunting, although, children without a history of LBW had lower odds of stunting than those with LBW; however, the association was not statistically significant (OR = 0.856; $\rho = 0.746$). This is different from research results of Shiyvia (2023) which stated that LBW and stunting in toddlers were related, based on the results of the Chi-Square test, which showed a p-value of 0.022 ($p < 0.05$) at a significance level of 5% ($\alpha = 0.05$). Conversely, the obtained Odds Ratio (OR) value of 4.333 indicated that toddlers with LBW had a 4.333-fold higher likelihood of developing stunting than toddlers without LBW (Sholihah, 2023).

One possible explanation for the absence of a significant association between a history of low birth weight (LBW) and stunting in this study is the occurrence of postnatal catch-up growth. Children born with LBW have the potential to achieve normal linear growth when they receive adequate nutrition, exclusive breastfeeding, appropriate complementary feeding, complete immunization, and timely management of childhood illnesses during the first two years of life. Several longitudinal studies have demonstrated that although LBW increases the initial risk of growth failure, this risk can be substantially reduced through optimal nutritional care and a supportive home environment. Therefore, LBW does not inevitably result in stunting, particularly when early-life interventions are successfully implemented (Yuningsih, 2022).

Another possible explanation is that LBW is only one of many determinants of stunting, and its effect may be attenuated when other factors are more dominant. Child growth is influenced by multiple interacting determinants, including maternal nutritional status, recurrent infections, feeding practices, household food security, environmental sanitation, parental education, and access to health services. In the present study, these postnatal environmental factors may have had a greater influence on children's growth than birth weight alone, thereby reducing the independent contribution of LBW to stunting (Yuningsih, 2022).

Furthermore, the lack of statistical association may also be related to the characteristics of the study population. The proportion of children with LBW in the study was relatively small, which may have limited the statistical power to detect a significant relationship. In addition, birth weight information was obtained retrospectively from MCH handbooks, introducing the possibility of incomplete documentation or non-differential misclassification that could bias the observed association toward the null (Sholihan, 2023).

The discrepancy between the present findings and those reported by Sholihah (2023) may also reflect differences in study settings, participant characteristics, sample size, and adjustment for confounding factors. While LBW is a well-established biological risk factor for impaired growth, its long-term effect is highly dependent on the quality of postnatal care and the child's nutritional environment. Consequently, the absence of a significant association in this study should not be interpreted as evidence that LBW is unimportant, but rather that its impact may be modified by favorable postnatal conditions and other contextual factors. The findings of this study suggest that interventions to prevent stunting should not focus solely on reducing the incidence of LBW but should also strengthen postnatal nutrition programs, growth monitoring, breastfeeding support, infection prevention, and complementary feeding practices to promote optimal catch-up growth among children born with LBW.

Determining Factors of Nutritional Status on Stunting in Bangkalan district

The result study show almost all toddlers have normal nutritional status, namely 344 toddlers. The results of study show Almost all toddlers who have poor nutrition experience stunting, the p value $< \alpha$ which means that the nutritional status of the toddler significantly influence stunting in toddlers. The OR shows 15.075, this indicates that a toddler who is malnourished has a fifteen-fold increased risk of stunting. According to Swaidatul's (2023) research, stunting in toddlers at Posyandu Sabulmil is correlated with their nutritional state, according to the study's findings, indicating that H1 is accepted.

Moreover, the p -value of 0.04 is consistent with Yuningsih (2022), meaning that there is a relationship between nutritional status and stunting. According to results, it can be understood that toddlers with poor nutritional status have a correlation with stunting, this is due to the fact that toddlers' physical and mental development are impacted by their dietary state. The same thing was also shown by Wijhati, Nuzuliana, and Pratiwi (2021) who explained that effect of inadequate consumption of the primary cause of malnutrition is dietary deficiencies, as a result of which toddlers tend to experience stunting.

Malnutrition in children causes them to get sick easily and be stunted (AF & Soares, 2023; Cahyani et al., 2019; Yuningsih, 2022). The growth and development of toddlers are significantly impacted by their dietary status. If toddlers receive adequate nutrition, their nutritional status will be better. Good nutritional status will also increase immunity of toddlers; toddlers will not get sick easily so that their growth and development will be optimal. Indirectly, toddlers will be protected from stunting.

Efforts to improve the nutritional condition of toddlers so that stunting does not arise is the approach of feeding by parents. some research can show how children are fed has the biggest impact on whether they become malnourished. This includes how parents feed their kids from when they are born, like giving breast milk or formula, giving water or other drinks, what kinds of food are offered, and how often meals are given. The research shows that the way parents feed their children plays a big role in how well-nourished the children are. Parents who follow good feeding habits, such as giving enough food that is healthy and balanced from an early age, usually have children who are better nourished (Susanto et al., 2024)

Determining Factors of Anemia History in Pregnant Women on Stunting in Bangkalan District

The result study show almost all mothers had no history of anemia during pregnancy. The results of study show p value $< \alpha$ which means that the anemia history of mothers significantly influences stunting in toddlers. The OR shows 1.918, which means that anemia history of toodler is 1.9 times at risk of experiencing stunting. These findings are consistent with Meikawati's 2023 study, which shows that the likelihood of stunting is highest for mothers with a history of LBW ($p=0.004$) and maternal anemia during pregnancy ($p=0.001$) (Meikawati et al., 2021). Stunting is 3.60 times more likely to occur in toddlers whose mothers had a history of anemia during pregnancy than in babies whose mothers do not, according to research. Riskesdas 2018 shows that in Indonesia as many as 48.9% of pregnant women experience blood deficiency during pregnancy (Kemenkes RI, 2023).

The health of a pregnant woman during pregnancy greatly affects the health of her fetus. Including incidence of anemia, if a pregnant mother experiences anemia, the nutrition provided to fetus is insufficient, so that stimulation of fetus to grow and develop optimally is reduced. Thus, after baby is born, pregnant mother's health still has an effect

on baby who has been born. Furthermore, only at the conclusion of the study were the upgraded IFA tablets given out, despite the fact that it was intended that trained clinicians would provide pregnant women with superior IFA during their nutrition counseling sessions and one-on-one meetings. This was because of delays in getting approval and buying the tablets. As a result, fewer women than expected got the IFA, even though they were still benefiting from other parts of the project (Beatty et al., 2024).

By the end of the project, other better brands of IFA also became widely available. Thus, about 90% of moms in the control and treatment groups said they eventually used a better brand. Nonetheless, the project's advertised brand was more widely utilized in the therapeutic settings. Indirectly preventing child stunting by supplying iron and folic acid and lowering the prevalence of anemia in expectant mothers (Beatty et al., 2024).

Determining Factors of CED History on Stunting in Bangkalan District

The result study show the majority of mothers did not have a history of CED. The results of the study show that toddler stunting is significantly influenced by the mother's history of CED, with a p value $< \alpha$. A child with a history of CED is 15.7 times more likely to suffer from stunting, according to the OR of 15.750. These findings are in line with Setiawati's research (2024), which explains the association between a history of CED and the prevalence of stunting. The OR value of 36.19 indicates that pregnant women with a history of CED are 36.19 times more likely to have stunted offspring (Setiawati & Maulana, 2024b, 2024a).

The growth and development of the fetus can be impacted by the nutrition a woman consumes both before and during pregnancy. A healthy term baby with an appropriate body mass is likely to be born normally if mother's nutritional requirements are met both before and during pregnancy. The nutritional adequacy of pregnant is influenced by adequacy of good nutritional absorption while woman is pregnant. The importance of an appropriate and healthy nutritional pattern will help growth and development of the baby when it is born (Putri Adila et al., 2023).

According to some studies, CED issues must be addressed and identified as soon as feasible since the kid will have an impact on the subsequent life cycle; failing to do so will result in a protracted vicious cycle. Since stunting prevention is implemented upstream and downstream, the government implements a number of programs aimed at preventing and reducing stunting, including targeted and sensitive interventions. Particular actions are the study examined measures or events organized especially for 1000 HPK. The results showed that mothers who had a history of CED during pregnancy were more likely to have children with stunting, with 88.9% of those cases, compared to 41.3% of mothers without such a history. This difference was statistically significant, meaning it is unlikely to have happened by chance (Putri Adila et al., 2023).

A mother's health and nutrition before and during pregnancy can influence how well the baby grows. If a pregnant woman isn't getting enough nutrition, it can lead to slow baby growth, which is called stunting. It can also make the baby more likely to become obese or develop serious health problems later in life. Poor nutrition in the mother can lower her blood volume, which is important because blood carries nutrients and oxygen to the baby through the placenta. When blood volume drops, the heart doesn't pump enough blood to the placenta, leading to a smaller placenta. As a result, the baby may receive less oxygen and nutrients. Additionally, the baby may not grow well and may be born with a low birth weight if oxygen and nutrients are not given correctly (Putri Adila et al., 2023).

Based on these findings, several recommendations can be proposed. First, improving maternal nutritional status before and during pregnancy should be prioritized through adequate nutritional counseling, balanced dietary intake, and routine antenatal care. Second, preventing maternal anemia should be strengthened by ensuring early screening of hemoglobin levels, improving adherence to iron–folic acid supplementation, and promoting nutrition education throughout pregnancy. Third, prevention of CED among pregnant women should include regular monitoring of MUAC, provision of appropriate nutritional supplementation for women at risk, and early identification of mothers requiring intensive nutritional support. Finally, routine monitoring of the nutritional status of children under five should be reinforced through regular growth assessment at community health posts and primary healthcare facilities, accompanied by timely nutrition counseling and early intervention for children identified with growth faltering.

The strength of this study lies in its simultaneous analysis of several maternal factors and child characteristics, thereby providing a more comprehensive picture of the determinants of undernutrition among under-fives in Bangkalan Regency. Implementing these evidence-based interventions is expected to contribute to reducing the burden of undernutrition among children under five and support the achievement of national and global child nutrition targets. As this study employed a cross-sectional design, causal relationships between the identified factors and undernutrition cannot be established. Future longitudinal or prospective cohort studies are recommended to confirm these associations and evaluate the effectiveness of maternal and child nutrition interventions over time.

CONCLUSION

The significant determining factors were nutritional status, The history of CED and anemia in expectant mothers were taken into consideration, but the factors related to gender and history of LBW were not significant. This study identified several maternal and child factors associated with undernutrition among children under five years of age in Bangkalan Regency. Although child sex and a history of low birth weight were not significantly associated with undernutrition, maternal nutritional conditions during pregnancy and the nutritional status of children remain important determinants that should be addressed through comprehensive maternal and child health interventions.

These findings highlight that undernutrition is a multifactorial condition requiring integrated strategies across the continuum of care, from pregnancy to early childhood. Based on these findings, interventions to prevent undernutrition should prioritize improving maternal nutritional status before and during pregnancy, preventing maternal anemia and chronic energy deficiency, and strengthening routine growth monitoring among children under five. Future studies are recommended to employ longitudinal designs and include broader socioeconomic, dietary, and environmental factors to better understand the determinants of undernutrition and guide more effective nutrition interventions.

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