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Fragile Futures: How Socioeconomic Factors Shape Severe Wasting in Toddlers

Amelia Putrie Devitasari

Faculty of Economics and Business, Brawijaya University, Indonesia

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Abstract: This study examines the influence of socioeconomic factors on the prevalence of wasting among toddlers in Boyolali Regency during 2014–2023. Despite improvements in economic indicators such as Gross Regional Domestic Product (GRDP) and per capita income, progress in reducing wasting has lagged behind neighboring areas. Using multiple linear regression analysis, the study investigates the relationship between GRDP, poverty, food prices, per capita income, and the number of children on severe wasting rates. The study uncovers that poverty and food prices have a significant positive impact on wasting, while per capita income has a significant but negative impact, suggesting that increased income worsens wasting due to inequality and shifting consumption priorities. Whereas, GRDP and the number of children show no significant relationship with wasting. The study concludes that poverty and food prices require targeted interventions to address inequality and promote nutrition education. Policy implications include improving social assistance programs and enhancing access to quality food. This research contributes to understanding socioeconomic determinants of malnutrition and supports local government strategies to improve child nutrition.

Keywords: Poverty, Food Prices, GRDP, Per Capita Income, Wasting

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AUTHOR**Amelia Putrie Devitasari
devitasari.amelia-
putrie@gmail.comFaculty of Economics and
Business, Universitas Brawijaya,
Indonesia

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INTRODUCTION

Proper nutrition during the first 1,000 days of life is vital for healthy growth and development. Wasting, a form of undernutrition marked by low weight-for-height, can lead to stunting, increased risks of obesity, non-communicable diseases, and even mortality in severe cases (Kemenkes, 2018). Beyond physical health, wasting disrupts brain development, reducing cognitive abilities and learning capacity. Studies show that stunted children have lower IQs than their non-stunted peers, though treatment can mitigate some of these effects (Koshy et al., 2022). The resulting physical and cognitive limitations hinder individual productivity and reduce human resource quality, which can have significant economic repercussions, as evidenced by Suryana and Aziz’s (2023) estimation of IDR 16,970.8 trillion in potential economic losses due to stunting in Indonesia.

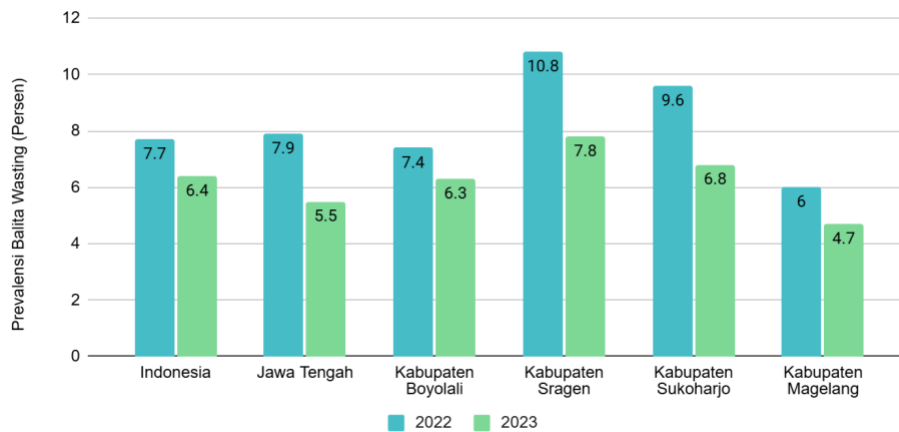


Figure 1. Prevalence of Wasting Toddlers in Indonesia, Central Java, Boyolali Regency, and Neighboring Regions 2022–2023

Source: Kemenkes (2024)

Recent surveys highlight a decline in wasting prevalence among toddlers in Indonesia, from 7.7% to 6.4% in 2023 (Kemenkes, 2024). Central Java showed a 2.4% reduction in wasting, with Boyolali Regency reporting a modest decrease from 7.4% in 2022 to 6.3% in 2023. Despite these improvements, Boyolali’s progress lags behind neighboring regions like Sragen and Sukoharjo, which achieved more significant reductions. This disparity indicates the need for more effective interventions in Boyolali to close the gap and reduce toddler wasting rates further.

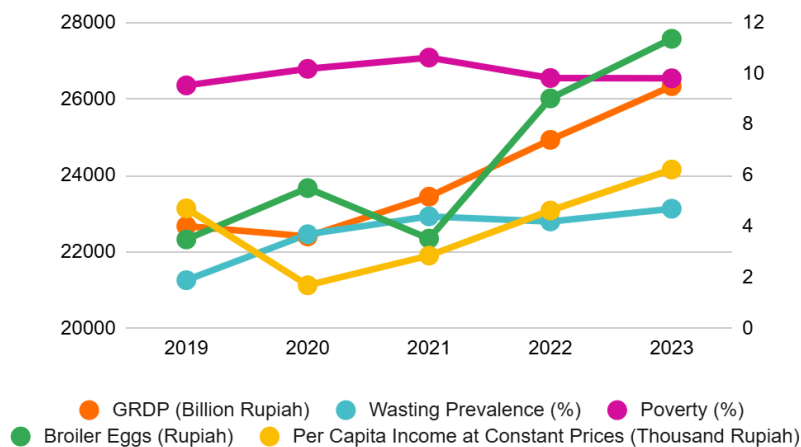


Figure 2. Trends in GRDP, Poverty, Food Prices (Broiler Eggs), Per Capita Income, and Prevalence of Wasting Toddlers in Boyolali Regency 2019–2023

Source: Statistics Indonesia (2024) and Dinkes Boyolali Regency (2024)

Wasting is closely tied to socioeconomic factors, such as poverty and access to nutritious food. Over the past five years, Boyolali Regency has shown an inverse correlation between wasting prevalence and GDP growth, with poverty exacerbating poor health outcomes (Sarjito, 2024). Limited financial resources hinder access to healthcare and nutritious foods, reducing dietary diversity and increasing malnutrition risks (Alta et al., 2023). Inadequate complementary feeding after the exclusive breastfeeding period further elevates wasting risks. Proteins, especially from animal sources like eggs and meat, play a critical role in preventing wasting and supporting cognitive development (UNICEF, WHO, 2023; Ernawati et al., 2016).

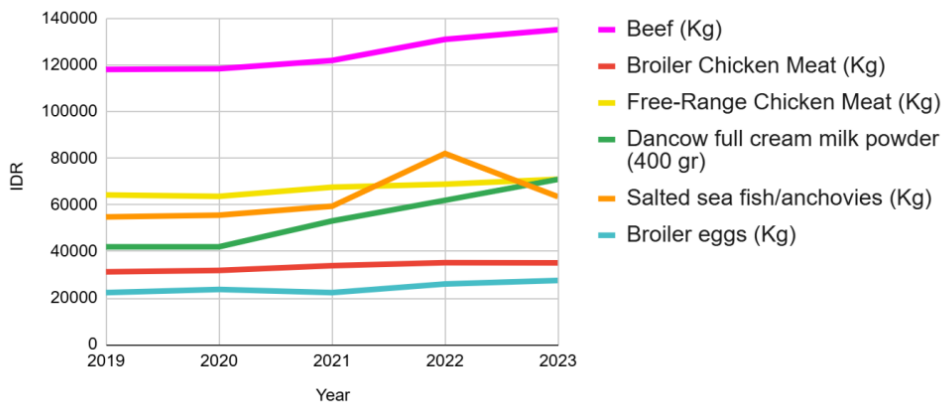


Figure 3. Food Price (Animal Protein) in Boyolali Regency 2019–2023
Source: SiHaTi (2024)

In Boyolali Regency, eggs are the most accessible source of animal protein for low-income families. However, the rising cost of dairy and eggs poses challenges for households in meeting nutritional needs. Over the past five years, the prevalence of wasting has generally mirrored fluctuations in egg prices, except in 2021 and 2022, when other factors likely influenced the trends. Per capita income growth generally aligns with reductions in wasting, underscoring the importance of economic improvements in addressing malnutrition. Yet, even with rising incomes, the affordability of high-protein foods remains a critical issue.

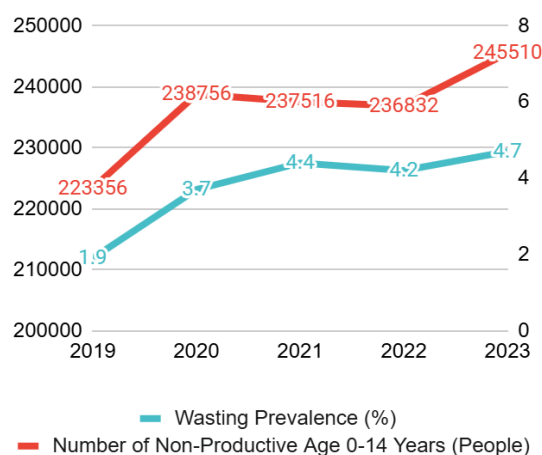


Figure 4. Trends in Number of Non-Productive Age 0–14 Years and Prevalence of Wasting Toddlers in Boyolali Regency 2019–2023
Source: Statistics Indonesia, Boyolali Regency Office and Dinkes Boyolali Regency (2024)

Addressing wasting requires targeted interventions emphasizing high-protein food consumption, parental involvement, and support for low-income families. The Ministry of Health emphasizes the importance of eggs, milk, and meat in children's diets, but having multiple children often strains limited resources in low-income households (Devid Trio Issadikin, 2023). This study explores the socioeconomic factors influencing wasting, focusing on GRDP, poverty, food prices, per capita income, and family size. The findings aim to contribute to theoretical knowledge, guide future research, and support the Boyolali Regional Government in designing effective programs to combat toddler wasting.

LITERATURE REVIEW

Rainbow Model Determinant of Health oleh Dahlgren dan Whitehead

Dahlgren and Whitehead (2007) proposed a theory of health determinants, highlighting the importance of socioeconomic, cultural, and environmental factors in shaping public health from an equity perspective. This theory is illustrated through a model known as the "rainbow model." According to Dahlgren and Whitehead, health status is influenced not only by economic growth and per capita income but also by factors like poverty and income equality.

In support of this theory, a study by Ade Nurul Aida (2019) found that per capita income, exclusive breastfeeding, poverty rates, access to proper sanitation, and protein consumption all have a simultaneous impact on stunting in Indonesia. Similarly, recent research by Yati Karyati (2021) showed that economic growth, poverty rates, and education levels contribute to stunting in the 10 regions with the highest prevalence in Indonesia.

Lifestyle, shaped by socioeconomic and environmental factors, also plays a significant role in health outcomes. Dahlgren and Whitehead (2021) pointed out that, regarding nutrition, not all parents of young children can provide healthy food. Access to nutritious food, income levels, and food prices are key factors that parents consider when feeding their children.

Furthermore, the number of children in a family also influences nutritional behavior. Families with more children tend to have greater food needs, which can affect both the quality and quantity of food available. The larger the family, the higher the likelihood of undernutrition. A literature review by Soleha and Zelharsandy (2023) further supports this idea, revealing that the number of children affects how families allocate their income to meet the nutritional needs of children and other family members.

Research Framework

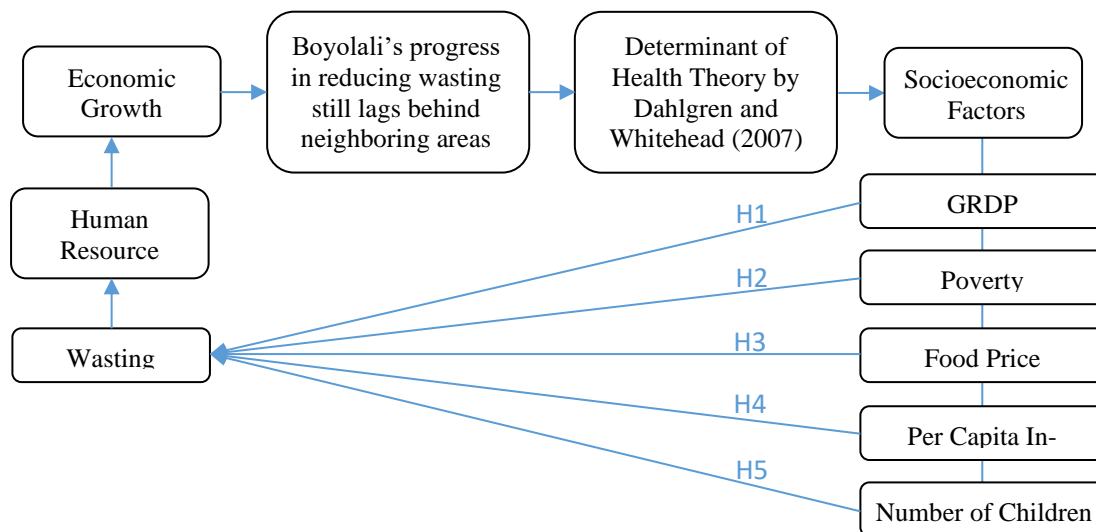


Figure 4. Research Framework

Source: Author (2024)

This study analyzes the impact of socioeconomic factors on wasting in children under five in Boyolali Regency from 2014 to 2023, emphasizing how wasting affects human resource quality and economic growth. The slower reduction in wasting rates in Boyolali compared to neighboring areas in 2023 suggests less effective local government interventions. Using Dahlgren and Whitehead's (2007) health determinant theory, the study examines factors such as GRDP, poverty rates, food prices, per capita income, and the number of children. The findings aim to inform the development of more effective programs and policies to combat undernutrition especially wasting in Boyolali Regency.

Hypothesis Development

Weil (2014) found that an increase in national income leads to improved health in various ways, such as better nutritional fulfillment and the development of public health infrastructure. The relationship between these factors is mutually influential. A study by Aswanto (2023) showed a positive impact of health on GDP. Based on these findings, the hypothesis of this study is:

H1: GRDP has a significant effect on wasting in children under five in Boyolali Regency.

Siddiqui (2020) discovered a strong link between poverty and undernutrition in children. Poverty can lower the quality of food intake and exacerbate the deficiency of essential vitamins and minerals, worsening the undernutrition condition. These findings are consistent with those of Manyong et al. (2021), who also found that wasting is more severe in poor households. Based on these findings, the hypothesis of this study is:

H2: Poverty has a significant effect on wasting in children under five in Boyolali Regency.

Woldemichael et al. (2017) found that inflation in food prices, particularly wheat, has a negative and significant impact on child nutrition in rural areas. Additionally, a study by Akerele et al. (2024) revealed that rising prices of animal-based protein foods such as meat, eggs, and fish significantly contribute to the increase in stunting among children under five. Based on these previous studies, the hypothesis of this research is:

H3: Food prices have a significant effect on wasting in children under five in Boyolali Regency.

In Canella et al.'s (2019) research, higher rates of overweight, stunting, and wasting were found among children from low-income households. Weil (2014) also found a strong correlation between income and health, particularly in developing countries. He found that higher per capita income correlates not only with life expectancy but also with various other health status indicators. Based on these previous findings, the hypothesis of this study is:

H4: Per capita income has a significant effect on wasting in children under five in Boyolali Regency.

In Song's (2019) research, the number of children was found to significantly influence the nutritional status of children under five. Issadikin (2023) also discovered a negative and significant relationship between the number of children in a family and the nutritional status of young children. Based on these findings, the hypothesis of this study is:

H5: The number of children has a significant effect on wasting in children under five in Boyolali Regency.

METHOD

This study employs an associative research type and a quantitative approach to examine the relationship between the nutritional status of children under five and GDP, poverty, food prices, per capita income, and the number of children in Boyolali Regency during the 2014–2023 period. Using secondary data, the information for this study was sourced from the Statistics Indonesia, Boyolali Regency Office, the Boyolali Regency Health Office (Dinkes), and the Central Java Commodity Price and Production Information System (SiHaTi).

This study utilizes a multiple linear regression analysis method with a 10% significance level to determine the influence of five independent variables—GDP, the number of people living

in poverty, food prices (broiler eggs), per capita income, and the number of children—on the dependent variable, undernutrition. The variables used in this study are as follows:

Y: The dependent variable representing the number of wasting children under five in Boyolali Regency.

X₁: The independent variable representing GDP in Boyolali Regency.

X₂: The independent variable representing the number of people living in poverty in Boyolali Regency.

X₃: The independent variable representing food prices (broiler eggs) in Boyolali Regency.

X₄: The independent variable representing per capita income in Boyolali Regency.

X₅: The independent variable representing the number of children in Boyolali Regency.

Thus, the multiple linear regression model for this study can be expressed by the following equation:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

RESULTS AND DISCUSSION

Data Analysis Results

The descriptive analysis of variables provides an overview of the data used in this study. Based on the processed data from the research on the impact of socioeconomic factors on wasting in children under five in Boyolali Regency from 2014 to 2023, the analysis highlights key patterns and trends within the dataset

Table 1. Descriptive Analysis Results

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Wasting	10	10	24	16	5,029
GDRP (billion)	10	17.201	26.334	21.695	2.827
Poverty	10	97180	120000	108697,00	8554,240
Food Price (broiler eggs)	10	19837	27571	23503,50	2767,724
Per Capita Income	10	17957172	24157046	21253459,40	2019624
Number of Children	10	210140	239860	229728,00	9711,661

Source: Primary Data Processing (2024)

The descriptive analysis shows that the average number of wasting cases among children under five in Boyolali Regency is 16, with a standard deviation of 5.03. The number of cases ranged from a low of 10 in 2016 to a high of 24 in 2023. Over the past decade, Boyolali's GDRP averaged IDR 21.695 trillion, with a standard deviation of IDR 2.827 trillion. The lowest GDP was recorded in 2014 at IDR 17.201 trillion, while the highest was IDR 26.334 trillion in 2023. The average poverty level during the same period was 108,697 people, with a range of 97,180 to 120,000 people and a standard deviation of 8,554.

The average price of broiler eggs in Boyolali over the last 10 years was IDR 23,503.50 per kilogram, with a standard deviation of IDR 2,767.72. Prices varied from IDR 19,837 in 2016 to IDR 27,571 in 2023. Per capita income averaged IDR 21,253,459.40, with the lowest recorded in 2014 at IDR 17,957,172 and the highest in 2023 at IDR 24,157,046. Lastly, the number of children in Boyolali had an average of 229,728, ranging from 210,140 to 239,860, with a standard deviation of 9,711.

Hypothesis Testing

Through multiple linear regression testing, the correlation between independent variables and dependent variables was found as follows:

Table 2. T-test

Hipotesis	Unstandardized Coefficients	Standardized Coefficients	P-Value	Hypothesis Testing
H1	-5,543	-0,312	0,433	Rejected
H2	0,001	0,852	0,045	Accepted
H3	0,002	1,058	0,008	Accepted
H4	2,580	1,036	0,063	Accepted
H5	4,198	0,081	0,715	Rejected

Source: Primary Data Processing (2024)

The GRDP variable has a probability value of 0.433, which is greater than 0.10, indicating that the correlation is not significant. As a result, hypothesis H1 is rejected. The poverty variable has a coefficient value of 0.001, indicating a positive correlation between poverty and wasting. This means that an increase of 1,000 people living in poverty corresponds to an increase of one child experiencing wasting. The probability value of poverty is 0.045, which is less than 0.10, showing a significant impact on wasting, and thus hypothesis H2 is accepted. The food price variable has a coefficient value of 0.002, also indicating a positive correlation. This suggests that every IDR 1,000 increase in food prices leads to an increase of two children experiencing wasting. With a probability value of 0.008, which is less than 0.10, food prices significantly influence wasting, confirming hypothesis H3.

Per capita income shows a coefficient value of 2.580, indicating a positive correlation between per capita income and wasting. This implies that every IDR 100 increase in per capita income results in 258 more children experiencing wasting. The probability value for per capita income is 0.063, which is below 0.10, demonstrating a significant effect on wasting and supporting hypothesis H4. Meanwhile, the number of children variable has a probability value of 0.715, which is greater than 0.10, indicating no significant correlation. Therefore, hypothesis H5 is rejected.

Relationship between Variables

The Impact of GRDP on Wasting Among Children under Five in Boyolali Regency

The Determinants of Health Theory by Dahlgren and Whitehead (2007) suggests that health is influenced by economic growth. However, this study reveals that Gross Regional Domestic Product (GRDP) is not a direct determinant of wasting among children in Boyolali Regency. This means that although an increase in GRDP can positively affect the economy as a whole, its benefits are not always felt immediately or equitably by all community members, particularly those most vulnerable to malnutrition. Supporting this finding, Biggs (2010) highlighted that while national economic growth, measured by GDP, can positively influence public health, its effects are heavily mediated by poverty levels and inequality. In cases where poverty and inequality rise, even higher GDP levels fail to significantly improve health outcomes.

Similarly, Sterck (2018) argued that national income does not always reflect a government's ability to distribute resources equitably. Regional governments may face challenges in leveraging GRDP growth to deliver universal healthcare services accessible to all societal groups. This explains why improvements in GRDP may not immediately translate into better health or nutrition outcomes, especially for children in impoverished households. These findings suggest that without targeted poverty alleviation efforts and measures to reduce inequality, macroeconomic growth

indicators like GRDP may not be sufficient to enhance community health or nutritional status effectively.

The Impact of Poverty on Wasting Among Children under Five in Boyolali Regency

This study finds that children are more likely to suffer from malnutrition as poverty rises. This aligns with Dahlgren and Whitehead's Determinants of Health Theory (2007) and the AAP Council on Community Pediatrics (2016), which highlight that children from low-income families are more vulnerable to issues such as food insecurity, housing instability, limited access to healthcare, and disrupted education. These factors exacerbate the risk of malnutrition, hindering optimal child development.

Poverty is often described in terms of limitations in meeting basic needs, particularly nutritious food. Families with low purchasing power struggle to afford quality food necessary for their children's healthy growth. With constrained income, they may opt for cheaper, nutrient-poor options, such as carbohydrate-heavy foods lacking in protein, vegetables, and fruits. As a result, children in these families face a higher risk of nutritional deficiencies, which can adversely affect their long-term health and development (Habriyanto et al., 2023).

Social assistance programs in Boyolali Regency, such as subsidized rice distribution (Raskin), often fall short due to poor implementation. According to Retnosari in Solopos (2015), the rice provided under the Raskin program is often resold or exchanged for better-quality rice, as its poor quality renders it unsuitable for consumption. Instead of alleviating food insecurity, these programs fail to maximize their intended impact on improving nutrition. Additionally, rising prices of staple foods worsen the plight of impoverished families, further limiting their ability to meet the daily nutritional needs of their children.

The Impact of Food Prices on Wasting Among Children under Five in Boyolali Regency

Dahlgren and Whitehead (2021) argue that food prices are an important consideration for parents when feeding their children. An increase in the prices of staple foods worsens the situation for low-income families, limiting their ability to provide healthy food for their children. As the prices of essential items like rice, eggs, and vegetables rise, the purchasing power of poor families decreases. This forces them to cut back on nutritious foods, which increases the risk of malnutrition (Chen and Paterson, 2006).

Consistent with this, the findings of this study reveal that as the price of eggs increases, it becomes more difficult for families to meet their children's nutritional needs. In this context, eggs, as a source of high-protein food, reflect the challenges faced by low-income households in accessing nutrient-rich food. Habriyanto et al. (2023) also found that when the prices of basic goods rise, poor families are forced to reduce their purchase of nutritious foods and opt for cheaper carbohydrates. This increases the risk of malnutrition among young children, particularly because essential proteins and micronutrients for growth are not sufficiently provided. This highlights how food prices significantly impact access to quality food for families.

The Impact of Per Capita Income on Wasting Among Children under Five in Boyolali Regency

Dahlgren and Whitehead (2021) state that health is influenced by per capita income, as income is a key factor in parents' decisions on how to feed their children. This study finds that an increase in per capita income in Boyolali Regency actually exacerbates wasting among children, which contrasts with the theory by Rahardja and Manurung (2008) that suggests higher per capita GRDP leads to improved purchasing power, boosting the economy, and improving health and nutrition conditions.

In Boyolali, this discrepancy may be attributed to increased consumption of non-food items as income rises. Engel's Law suggests that when per capita income increases, expenditures on food rise arithmetically, while other consumptive expenses—such as for fuel, clothing, and rent—rise geometrically (Zimmerman, 1932; Kindleberger, 1989 in Puspita and Agustina, 2019).

Additionally, inequality in Boyolali plays a role in the insignificant results observed. The income distribution gap between the bottom 40% and top 20% of the population in Boyolali reached 25.84% in 2023 (Statistic Indonesia, 2024).

Despite the average increase in per capita income, low-income families still struggle to benefit from this economic growth. With limited purchasing power, vulnerable families cannot increase their consumption of nutritious foods, even as average income rises. This is because per capita income fails to account for income inequality and access to healthcare services (Stiglitz et al., 2010; Farlow, 2016). For higher-income families, consumption patterns shift toward secondary and tertiary needs, as predicted by Engel's Law. Therefore, even with an increase in per capita income, children's nutritional status does not automatically improve, as consumption priorities shift away from meeting children's nutritional needs.

The Impact of Number of Children on Wasting Among Children under Five in Boyolali Regency

According to Dahlgren and Whitehead's Determinants of Health Theory (2007), the number of children reflects the economic burden on a household, affecting the quality and quantity of food available for children. The Trade-off Theory suggests that the more children a family has, the lower the quality of health for each child (Becker and Gregg, 1973; Millimet and Wang, 2010). When family income and parental attention are divided among many children, the likelihood of each child not receiving adequate nutrition increases.

However, this study reveals no significant impact of family size on wasting among children in Boyolali Regency. This lack of significance may be due to social support from the community or extended family, which plays an important role in alleviating the burden of caregiving, both materially and in terms of labor. In rural areas with collective caregiving patterns, children in larger families are not as adversely affected in terms of nutritional status. As Nugraha et al. (2019) noted, social support from family—including emotional, material, informational, and logistical assistance—can prevent malnutrition in children.

Dominant Factors Influencing Wasting Among Children in Boyolali Regency

This study finds that there is a strong correlation between socioeconomic factors and wasting among children under five in Boyolali Regency. Food Prices and Poverty are the two main factors that influence malnutrition. Poverty hinders access and reduces the options available for obtaining healthy food (Alta et al., 2023). Lee et al. (2013) also noted that food insecurity is directly linked to poverty, leading to poor health. This poses a significant challenge for low-income families, especially those with young children, as they require adequate food to support healthy brain development (UNICEF, WHO, and the World Bank, 2023).

Poverty itself is already a significant challenge for ensuring adequate nutrition for young children. With rising food prices, poor residents find it even harder to meet their basic food needs. Lee et al. (2016) emphasized that food price hikes increase the prevalence of malnutrition. This occurs because food price increases are not matched by proportional increases in income (Sadikkeen et al., 2024). Consequently, families must find ways to adjust, often cutting back on food expenditures, which leads to malnutrition in children under five years old (Chen and Pater-son, 2006; Habriyanto et al., 2023).

CONCLUSION AND SUGGESTIONS

Conclusion

The conclusion of this study shows that socioeconomic factors have diverse relationships with childhood malnutrition in Boyolali Regency. Poverty and food prices are the dominant factors contributing to the increase in malnutrition rates in the region. Poor families with low incomes often cannot provide nutritious food for their children, resulting in insufficient nutrition for their growth and development. This situation is further exacerbated by high food prices, particularly for eggs, which serve as a primary source of protein. The increase in food prices reduces the

purchasing power of poor families, narrows their access to quality food, and increases the risk of malnutrition. In addition to these factors, an increase in per capita income can also worsen malnutrition when consumption priorities shift away from meeting children's nutritional needs and toward secondary and tertiary needs.

On the other hand, Gross Regional Domestic Product (GRDP) and family size do not show a significant impact on childhood malnutrition in this area. Vulnerable groups, such as poor families, continue to face difficulties in meeting their children's nutritional needs despite macroeconomic improvements due to the high levels of poverty and inequality in Boyolali. The lack of an impact from family size may be attributed to social support from the community and extended family, which eases the caregiving burden, allowing the children's nutritional status to remain stable, even in larger families.

Suggestion

This study shows that poverty and food prices are two significant socio-economic factors influencing childhood malnutrition in Boyolali Regency. Therefore, the Boyolali local government is advised to reduce malnutrition rates by implementing a credit guarantee fund program to assist producer organizations, particularly smallholder farmers, in increasing their access to credit for purchasing agricultural inputs and enhancing their capacity to invest in agriculture. Additionally, a capacity-building program should be introduced to improve producers' access to agricultural credit. This would foster collective learning, strengthen stakeholders' capacity to design and provide loans to smallholder families, and ultimately improve their livelihoods.

A program to create job opportunities for youth in the agricultural sector should also be initiated. In Boyolali Regency, 25,787 residents are unemployed, while agriculture, forestry, and fisheries contribute significantly to the regional GDP. Growth in agriculture across various sectors can help reduce poverty by increasing farmers' income and creating jobs in rural areas. This program can enhance productivity, improve job access for poor youth, and positively impact poverty reduction in rural areas.

Lastly, the social assistance program should be restructured. The current rice-based assistance should be replaced with food aid consisting of eggs, along with milk, vegetables, and fruits, specifically targeted at young children and pregnant women to prevent malnutrition in mothers and babies at birth. If implemented with proper quality control, this program could be more effective. Poor-quality food aid creates inefficiencies, whereas eggs, as a source of animal protein, can positively affect children's nutritional status. Therefore, this program should be accompanied by quality monitoring, nutritional education, and support from reliable food providers to ensure optimal results.

IMPLICATIONS

The findings of this study highlight the critical need for socio-economic interventions to combat childhood malnutrition in Boyolali Regency. The significant influence of poverty on malnutrition underscores the vital role of economic resources in ensuring adequate nutrition. When families struggle to meet basic needs, such as access to nutritious food, the risk of malnutrition increases, leading to poorer health outcomes and diminished future productivity of human resources.

Additionally, the study reveals that food prices, particularly for eggs as a key source of animal protein, play a pivotal role in childhood malnutrition. This finding underscores the necessity of stabilizing the prices of essential food items. Implementing subsidies or price controls for staple commodities could directly reduce malnutrition rates. By addressing these economic factors, the government can create an environment that fosters better childhood development, enhances the quality of human resources, and drives sustainable regional economic growth.

LIMITATIONS

This study has several limitations that should be acknowledged. First, it relies solely on secondary data obtained from official institutions, such as the *Badan Pusat Statistik* (Statistics Indonesia) and the *Dinas Kesehatan* (Health Office) of Boyolali Regency. This reliance restricts the exploration of other potential factors influencing childhood malnutrition, such as parental income, dietary habits, family size, parenting practices, parental education, and access to healthcare services. Consequently, the findings may lack a comprehensive understanding of the household-level causes of malnutrition.

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