MPPKI

Media Publikasi Promosi Kesehatan Indonesia
The Indonesian Journal of Health Promotion

Research Articles   *Open Access*

Household Food Insecurity and its Association with Nutritional Status of Under Five Children in Indonesia

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ABSTRACT

Introduction: Food insecurity remains a global challenge for public health, particularly among children. In Indonesia, where childhood malnutrition persists despite progress, regional disparities in food access, exacerbated by dietary shifts and income inequalities, underscore the importance of understanding how household food insecurity impacts child nutrition.

Objective: to analyze the association between household food insecurity and nutritional status of Indonesian under-five children.

Method: Data were collected from children participating in the 2014 Indonesia Family Life Survey (IFLS). The 17 items of the Food Frequency Questionnaire (FFQ) were used in the food consumption score analysis to assess food insecurity based on the World Food Program (WFP) concept. Height and weight were measured to determine z-scores of weight-for-lengths. A multinomial logistic regression model was used to test the hypothesis.

Result: The study included 4,391 children aged 1-5 years. Multinomial logistic regression revealed that children from moderately and severely food-insecure households had significantly higher odds of being wasted, overweight, or obese compared to food-secure households. The analysis highlighted the dual burden of malnutrition, with food insecurity associated with both undernutrition and overnutrition.

Conclusion: Household food insecurity is strongly linked to both undernutrition and overnutrition in Indonesian children, presenting a dual burden of malnutrition. Public health interventions should target improving food security and ensuring access to diverse, nutrient-rich diets to reduce malnutrition in vulnerable populations.

Keywords: Food consumption score; Food insecurity; Malnutrition; Under-five children

INTRODUCTION

Food insecurity is a critical global health challenge, particularly in low- and middle-income countries, where it significantly affects child nutrition and development. In Indonesia, childhood malnutrition remains a persistent public health issue despite efforts to improve food accessibility and nutrition programs. A large portion of the population still experiences varying degrees of food insecurity, contributing to malnutrition in children, especially those under five years old. Research has consistently shown that the formative years of a child's life are the most vulnerable to the adverse effects of poor nutrition, leading to stunting, wasting, and other developmental challenges (1,2).

The association between household food insecurity (HFI) and child malnutrition has been extensively studied. Children in food-insecure households often face insufficient dietary intake, leading to poor nutritional status. In Indonesia, this problem is exacerbated by socio-economic inequalities, where low-income families are disproportionately affected. As such, understanding the dynamics of HFI and its direct link to child nutrition is crucial for developing targeted interventions to improve public health outcomes, particularly for under-five children (3,4).

Despite the progress in addressing childhood malnutrition in Indonesia, the issue of household food insecurity continues to be a major concern. Children from food-insecure households often suffer from inadequate nutrition, resulting in stunted growth and developmental delays. The most alarming aspect of this issue is the long-term effects of malnutrition, which can perpetuate cycles of poverty and health inequality in the population. Studies indicate that without proper intervention, the prevalence of stunting, wasting, and underweight conditions will remain high, especially among vulnerable groups in rural and urban-poor settings (Suciyanti et al., 2021; Masitoh et al., 2023).

A general solution to this problem would involve addressing food insecurity at its root causes, particularly through policy interventions that ensure equitable access to nutritious food for all households. This may include strengthening food distribution systems, providing social safety nets, and enhancing nutrition education programs aimed at caregivers and mothers. Additionally, public health initiatives targeting under-five children could focus on improving food security and dietary diversity to ensure better nutritional outcomes (5,6).

Numerous studies have identified key interventions to mitigate the impact of household food insecurity on child nutrition. Masthalina et al. (3) demonstrated that children in food-insecure households frequently experience reduced food portions, leading to higher rates of malnutrition. This study emphasizes the need for policies that prioritize equitable food distribution and support for low-income families. Similarly, Nurrachmawati et al. (4) found that stunting is significantly associated with food insecurity in urban areas of Indonesia. Their research highlights the importance of ensuring not only food availability but also its nutritional quality, as children require diverse diets for proper growth and cognitive development. Furthermore, the work by Suciyanti et al. (7) points to the role of dietary diversity in preventing malnutrition. The lack of variety in food intake has been identified as a major contributor to both stunting and anemia in children under five. The authors suggest that interventions promoting agricultural diversity, local food production, and affordable access to nutritious foods can help alleviate these health issues. Vatsa et al. (8) expanded this argument, suggesting that addressing food insecurity during the critical early years of life is essential for breaking the cycle of poverty and improving overall child development outcomes.

The socio-economic factors exacerbating food insecurity also demand attention. Studies by Atoloye et al. (1) and Masitoh et al. (9) have identified low socio-economic status as a significant predictor of food insecurity and malnutrition in children. These findings underscore the importance of addressing the broader socio-economic determinants of health, such as poverty and access to education, to create sustainable improvements in child nutrition.

While significant progress has been made in understanding the association between household food insecurity and child malnutrition, several gaps remain. Existing research largely focuses on urban areas, leaving rural and marginalized communities underrepresented. The study by Nurrachmawati et al. (4) highlights the urban context, yet rural areas in Indonesia face distinct challenges that also demand attention. Another gap in the literature is the limited exploration of the long-term impacts of early childhood malnutrition beyond physical health, such as cognitive and emotional development, as indicated by Vatsa et al. (8).

Furthermore, while there is an abundance of data on the prevalence of food insecurity and malnutrition, studies rarely address the effectiveness of specific interventions designed to improve both food security and nutrition outcomes in under-five children. For example, Masitoh et al. (9) and Olodu et al. (5) point to the correlation between food insecurity and stunting but provide little insight into the success rates of ongoing intervention programs. This creates a gap in the evidence base regarding which policies and practices yield the most significant improvements in child nutrition in the Indonesian context.

The objective of this study is to analyze the association between household food insecurity and the nutritional status of children under five in Indonesia. This research aims to contribute to the field of nutritional epidemiology by providing evidence on the relationship between household food insecurity and child malnutrition, particularly in the Indonesian context, where disparities in food access and socio-economic conditions persist. The novelty of this study lies in its comprehensive examination of both urban and rural populations, addressing the existing research

gaps. Additionally, the study will explore the cognitive and emotional effects of malnutrition, an area that has been underexplored in previous research (7,8).

The scope of this study includes a detailed analysis of household food insecurity indicators, child nutritional status (focusing on stunting, wasting, and underweight conditions), and the socio-economic factors that influence these outcomes. By examining both physical and developmental health, this research will provide a more holistic understanding of how food insecurity affects under-five children in Indonesia. The findings will be critical for policymakers and public health professionals seeking to design targeted interventions to combat malnutrition and improve child health outcomes.

METHOD

This study adopted a cross-sectional design, leveraging secondary data from the fifth wave of the Indonesian Family Life Survey (IFLS) conducted in 2014. The IFLS dataset includes anonymous data accessible to researchers under the guidelines provided by the RAND Corporation . A total of 4,391 children aged 1 to 5 years were included in the analysis. Data collection focused on measuring food insecurity using the World Food Program (WFP) framework (10). Food consumption was assessed using the Food Frequency Questionnaire (FFQ), which considered 17 different food items consumed in the seven days preceding the interview. These items were grouped into nine food categories, with the frequency of consumption aggregated into a food consumption score (FCS). The FCS was then categorized into three food consumption groups (FCGs): poor (<21), borderline (21-35), and acceptable (>35). This study defined severely food-insecure as those who were in the "poor" group of FCGs, moderately food insecure for the "borderline" group, while food-secure were defined as those in the "acceptable" group of FCGs (11). Nutritional status was assessed through z-scores based on height and weight measurements. Descriptive statistics, including frequencies and means with standard deviations (SDs), were used to summarize the data. Multinomial logistic regression was applied to assess the relationship between food insecurity and nutritional status. All analyses were conducted using SPSS version 27.0.

RESULTS

The sociodemographic characteristics of the study subjects revealed several key insights relevant to understanding the prevalence of food insecurity and its impact on nutritional outcomes (Table 1). The study involved 4,391 participants, with a fairly balanced distribution between boys (52.7%) and girls (47.3%). A significant proportion of the population resided in urban areas (58.5%), while the remaining 41.5% were from rural settings. This urban-rural divide is particularly important when considering the differential access to food resources and healthcare infrastructure. The nutritional status data indicated that 69.1% of the children had normal weight, while 7.7% were classified as wasted and 3.1% as severely wasted. Furthermore, 11.1% of the children were at possible risk of becoming overweight, 4.8% were overweight, and 4.2% were obese. Household food security was another critical factor, with 21.5% of households classified as food secure, 26.3% as moderately food insecure, and 52.1% as severely food insecure.

Table 1. Sociodemographic characteristics of subjects

Characteristics	n	%
Age, mean±SD	29.4±17.7	
Sex		
Boys	2,312	52.7
Girls	2,079	47.3
Residence		
Urban	2568	58.5
Rural	1823	41.5
Average of household income per month	IDR 2,946,628	
Nutritional status		
Severely wasted	134	3.1
Wasted	339	7.7
Normal	3,034	69.1
Possible risk of overweight	489	11.1
Overweight	210	4.8
Obese	185	4.2
Household food security		
Food secure	2,288	21.5
Moderately food insecure	1,157	26.3

Severely food insecure	946	52.1

The multinomial logistic regression analysis (Table 2) shows a significant association between food insecurity and various forms of malnutrition in children. Individuals experiencing moderate food insecurity are more likely to be severely wasted (OR: 1.812, 95% CI: 1.211–2.711) and wasted (OR: 2.017, 95% CI: 1.551–2.624) compared to food-secure individuals. Similarly, severely food-insecure individuals have an increased likelihood of being severely wasted (OR: 1.657, 95% CI: 1.069–2.570) and wasted (OR: 1.866, 95% CI: 1.404–2.479). The risk of overweight is also higher in those who are moderately (OR: 1.450, 95% CI: 1.149–1.828) and severely food-insecure (OR: 1.820, 95% CI: 1.442–2.298). Furthermore, moderate food insecurity is associated with an increased likelihood of being overweight (OR: 1.589, 95% CI: 1.147–1.828) and obese (OR: 2.221, 95% CI: 1.584–3.114). Severe food insecurity also significantly raises the odds of being overweight (OR: 1.461, 95% CI: 1.023–2.087) and obese (OR: 1.586, 95% CI: 1.071–2.349). These findings demonstrate that increasing levels of food insecurity are linked to both undernutrition and overnutrition outcomes, highlighting the dual burden of malnutrition among food-insecure populations.

Table 2. Multinomial logistic regression analysis on the relationship between food insecurity and nutritional status

	Severely Wasted OR (95% CI)	Wasted OR (95% CI)	Possible risk of overweight OR (95% CI)	Overweight OR (95% CI)	Obese OR (95% CI)
Food secure	-	-	-	-	-
Moderately food insecure	1.812* (1.211 – 2.711)	2.017** (1.551 – 2.624)	1.450* (1.149 – 1.828)	1.589* (1.147 – 1.828)	2.221* (1.584 – 3.114)
Severely food insecure	1.657* (1.069 – 2.570)	1.866** (1.404 – 2.479)	1.820** (1.442 – 2.298)	1.461* (1.023 – 2.087)	1.586** (1.071 – 2.349)

OR indicates odds ratio; CI, confidence interval; $* p < 0.05$; and $** p < 0.001$. Multinomial logistic included severely underweight, underweight, overweight, and obese with reference to normal-weight groups.

DISCUSSION

The sociodemographic characteristics of the subjects in the study, as presented in Table 1, provide crucial insights into the relationship between household food insecurity and nutritional status. These findings indicate a broad spectrum of nutritional challenges, highlighting the dual burden of malnutrition—both undernutrition and overnutrition—among children in food-insecure households, a trend also noted in similar studies[3,7]. A closer look at each nutritional status reveals notable trends. Wasting, seen in 7.7% of the children, aligns with research showing that food insecurity significantly heightens the risk of undernutrition, particularly in rural areas where food scarcity is more prevalent [4,12]. On the other hand, the 11.1% of children identified as at risk of overweight, and the 4.8% classified as overweight, support studies highlighting the paradox of food insecurity leading to overnutrition due to limited access to quality food [5]. This duality is further complicated by socioeconomic factors, as noted by Atoloye et al. [1], who argue that poverty exacerbates the nutritional disparities within households.

The results corroborate the established relationship between food insecurity and malnutrition, particularly in low- and middle-income countries (LMICs). Similar to findings by Büttner [13], this study demonstrates the dual burden of malnutrition, where children face both undernutrition and overnutrition, particularly in households experiencing severe food insecurity. Study in Ethiopia have shown comparable results, with food insecurity being a significant predictor of both forms of malnutrition [14]. The high percentage of severely food-insecure households in this study (52.1%) is consistent with the findings of Betebo et al. [12] and Esamil [15], where household food insecurity was strongly associated with higher rates of undernutrition among children. Furthermore, the urban-rural divide observed in this study aligns with Steyn et al. [16], who emphasized that urbanization in LMICs often leads to shifts in dietary patterns, contributing to malnutrition. These findings highlight the complex interplay between socioeconomic status, access to food, and the nutritional status of children.

The findings of this study underline the critical need for comprehensive public health interventions that address both food insecurity and malnutrition in LMICs. The high prevalence of both wasting and overweight children in the same population reflects the growing challenge of the dual burden of malnutrition, as noted by Liu et al. [17]. This dual burden complicates healthcare resource allocation and demands targeted strategies that consider the specific nutritional needs of both undernourished and overnourished children [18]. Furthermore, the severe level of food insecurity identified in this population suggests that interventions must focus on improving food access and ensuring dietary diversity, as limited food variety has been linked to malnutrition [19]. The observed urban-rural differences also imply that policies must be tailored to the unique challenges faced by both urban and rural populations to

effectively reduce malnutrition across different settings (20). Addressing food insecurity holistically could lead to substantial improvements in children's nutritional status and overall development (21).

The relationship between food insecurity and malnutrition is a complex public health issue, particularly in low- and middle-income countries (LMICs). The findings from the multinomial logistic regression analysis in Table 2 highlight the dual burden of malnutrition, revealing that food insecurity is significantly associated with both undernutrition and overnutrition. This analysis provides insights into how different levels of food insecurity relate to various nutritional statuses, including severely wasted, wasted, overweight, and obese categories. The results show that moderate food insecurity increases the odds of being severely wasted by 1.812 times (p < 0.05) compared to food-secure individuals. Similarly, severe food insecurity is associated with a 1.657 times higher risk of severe wasting (p < 0.05). These findings align with existing research, which consistently demonstrates that food-insecure children are at a significantly higher risk of undernutrition, particularly wasting (12). Wasting often results from acute food shortages or prolonged periods of inadequate nutrition, which are common in food-insecure households (14). The high prevalence of severe wasting in food-insecure populations suggests that interventions aimed at improving food security could effectively reduce this form of malnutrition. In addition to severe wasting, moderate and severe food insecurity also significantly increase the odds of being wasted. The odds ratio for moderate food insecurity is 2.017 (p < 0.001), while severe food insecurity shows an odds ratio of 1.866 (p < 0.001). This aligns with findings from studies conducted in Ethiopia and Kenya, where food insecurity was linked to higher rates of wasting and stunting (12,22). These results emphasize the critical need for targeted nutritional interventions in food-insecure households, as wasting is a key indicator of acute malnutrition.

Interestingly, food insecurity is not only associated with undernutrition but also with an increased risk of overweight. Moderate food insecurity is linked to a 1.450 times higher risk (p < 0.05), while severe food insecurity raises the risk to 1.820 times (p < 0.001). This dual burden of malnutrition—where food insecurity leads to both undernutrition and overnutrition—has been recognized in numerous studies (17,23). In LMICs, this paradox can be attributed to the consumption of energy-dense but nutrient-poor foods, which are often more affordable but contribute to excessive calorie intake and poor diet quality (16). The analysis further reveals that moderate food insecurity is associated with higher odds of being overweight (p < 0.05) and obese (p < 0.05). Severe food insecurity also increases the odds of overweight (p < 0.05) and obesity (p < 0.001). These findings are consistent with the nutritional transition occurring in LMICs, where urbanization and economic constraints lead to a shift towards processed, high-calorie foods that contribute to overnutrition (16,18). The dual burden of malnutrition—where undernutrition and obesity coexist—poses significant public health challenges, as these conditions lead to long-term health risks such as cardiovascular disease and diabetes (24).

This study's findings align with previous research that has highlighted the dual burden of malnutrition in LMICs. For instance, Liu et al. (17) found that food insecurity is a significant predictor of both undernutrition and obesity, similar to the patterns observed in this analysis. In Ethiopia, Betebo et al. (12) also reported a strong association between food insecurity and malnutrition, emphasizing the urgent need for interventions in food-insecure households. Moreover, the dual burden of malnutrition highlighted in this study is consistent with the findings of Vaezghasemi et al. (23), who noted that food insecurity increases the risk of both undernutrition and overnutrition. The relationship between food insecurity and overweight/obesity has been increasingly recognized, particularly in urbanized regions of LMICs, where economic constraints lead to the consumption of cheap, energy-dense foods. Studies by Steyn et al. (16) and Muche et al. (14) reinforce the idea that poor dietary diversity and limited access to nutritious foods contribute to both undernutrition and overnutrition in food-insecure populations.

The dual burden of malnutrition observed in this study has profound scientific and practical implications. Scientifically, it underscores the need for a comprehensive understanding of how food insecurity affects nutritional outcomes across the spectrum—from wasting to obesity. This complexity requires a multifaceted approach to research and intervention, as traditional strategies aimed solely at addressing undernutrition may not be sufficient in contexts where overnutrition is also prevalent (25). Practically, these findings suggest that policies aimed at improving food security should focus on both the quantity and quality of food. Interventions that ensure access to nutrient-dense foods, while also addressing the affordability and availability of healthier options, are crucial for tackling the dual burden of malnutrition (13). Additionally, public health programs must consider the broader socioeconomic factors that contribute to food insecurity, such as poverty and urbanization, in order to effectively mitigate malnutrition in vulnerable populations (18). The relationship between food insecurity and nutritional status is multifaceted, with significant implications for public health policy and intervention strategies. Addressing both undernutrition and overnutrition through targeted, context-specific approaches is essential to reducing the health burden of malnutrition in LMICs.

CONCLUSION

This study highlights the significant association between household food insecurity and the nutritional status of children under five in Indonesia. The findings underscore the dual burden of malnutrition, where children from food-insecure households are at a heightened risk of both undernutrition and overnutrition. The results of the multinomial logistic regression analysis demonstrate that increasing levels of food insecurity are linked to a higher likelihood of severe wasting, wasting, overweight, and obesity. These findings reinforce the need for targeted public health interventions that address both food access and quality to combat the full spectrum of malnutrition.

SUGGESTION

Effective policies should focus on improving food security through comprehensive strategies that ensure equitable access to nutrient-rich foods and address socioeconomic disparities. Interventions must be tailored to the unique challenges of both urban and rural populations to reduce malnutrition and improve child health outcomes. Addressing the dual burden of malnutrition is crucial to breaking the cycle of poverty and promoting the long-term health and development of children in food-insecure households.

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