Association Between Food Insecurity and Obesity Among Indonesian Adolescents

Hardi Firmansyah[a], Rasita Purba[b], Edy Marjuang Purba[c] and Risti Rosmiati[d]
Nutrition Study Program, Faculty of Engineering, Universitas Negeri Medan, Jl. Willem Iskandar Psr V, Medan, Indonesia

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Abstract: The emergence of food insecurity and obesity as significant public health challenges, particularly concerning Indonesian adolescents, has garnered global attention. In the face of distinctive socioeconomic complexities, Indonesia is confronting a simultaneous surge in the prevalence of food insecurity and obesity. This study examined the interrelation between food insecurity and obesity within the cohort of Indonesian adolescents. Data were meticulously collected from participants within the 2014 Indonesia Family Life Survey (IFLS) purview. A comprehensive evaluation of food insecurity based on the conceptual framework outlined by the World Food Program (WFP) was conducted utilizing the 17-item Food Frequency Questionnaire (FFQ). Furthermore, the assessment of Body Mass Index (BMI)-for-age z-scores was facilitated by the meticulous height and weight measurements recording. A multinomial logistic regression model was subsequently deployed to scrutinize the test hypothesis. The study encompassed a cohort of 4883 adolescents aged between 10 and 18 years old. Notably, an augmented proportion of overweight and obese individuals was recorded among those grappling with food insecurity in comparison to their food-secure counterparts. The results obtained from the multinomial logistic regression models unequivocally underscored the heightened probability of being overweight and obese among those grappling with moderate and severe food insecurity. Additionally, an explicit correlation between household food insecurity and an elevated predisposition to obesity was conclusively established.

1 INTRODUCTION

In recent decades, the coexistence of food insecurity and obesity has emerged as a consequential global public health problem (Huizar et al., 2021). The discernible convergence of these complex issues, which has transpired amid the rapid socioeconomic transformations and shifts in dietary norms within societies, has evoked extensive research and policy deliberations worldwide (Frongillo & Bernal, 2014). Indonesia, characterized by a rich tapestry of cultural diversity, intricate economic dynamics, and notable demographic transformations, is an intriguing case study within this multifaceted landscape. Within this context, the exploration of the correlation between food insecurity and obesity among the cohort of Indonesian adolescents assumes profound significance, offering an invaluable vantage point to comprehend the broader implications for local and global health comprehensively (Carvajal-Aldaz et al., 2022; Dewi et al., 2020).

Indonesia, an expansive archipelagic nation characterized by its cultural diversity, has achieved significant milestones in pursuing economic advancement in recent years. Nevertheless, this trajectory of progress has been concomitantly marred by a host of intricate socioeconomic impediments, notably encompassing disparities in equitable access to adequate, uncontaminated, and nourishing sustenance (Amrullah et al., 2019). Simultaneously, the transformative shifts in dietary predilections and consumption behaviors, fostered by the forces of urbanization and globalization, have engendered a novel spectrum of nutritional complexities, most

[a] https://orcid.org/0009-0009-3541-4469
[b] https://orcid.org/0000-0001-6810-8200
[c] https://orcid.org/0009-0007-1523-5522
[d] https://orcid.org/0000-0002-2829-6419

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notably evidenced by the surging prevalence of obesity within the adolescent demographic (Maruapula et al., 2011; Ogden et al., 2018; Pirgon & Aslan, 2015). The coexistence of these intricate predicaments, namely food insecurity and obesity, incites an intriguing discourse surrounding the intricate interplay between these phenomena, shedding light on their potential shared determinants and underlying drivers (Carvajal-Aldaz et al., 2022).

This comprehensive study rigorously investigates the intricate correlation between food insecurity and obesity within the demographic of Indonesian adolescents. By meticulously examining diverse factors encompassing both economic and behavioral dimensions, this research unveils the nuanced interconnections linking insufficient access to essential food resources with the escalating incidence of obesity. By delving into this complex interrelationship, the study aspires to furnish invaluable insights into the global discourse surrounding mitigating the dual challenges posed by the coexistence of malnutrition and overnutrition, thereby deciphering the potential pathways at the nexus of these multifaceted predicaments. This study's focal point centers on analyzing the interplay between food insecurity and obesity among Indonesian adolescents.

2 METHODS

2.1 Data Source and Participants

The methodology employed in this study entailed using secondary data sourced from the fifth wave (2014) of the Indonesian Family Life Survey (IFLS). The datasets incorporated within the ambit of the IFLS were accessed in compliance with the established RAND Corporation guidelines, ensuring the anonymity and confidentiality of the data accessible to researchers. The study specifically focused on adolescent respondents within the age bracket of 10 to 18 years old. Subsequently, a comprehensive analysis was conducted solely on those respondents who had provided substantive data concerning their nutritional status, anthropometric measurements, and pertinent sociodemographic information. Upon applying the stipulated inclusion criteria, a total of 4883 participants were deemed eligible for incorporation within the scope of this study.

2.2 Measurement of Food Insecurity, Nutritional Status, and Covariates

The assessment of food insecurity in this study was conducted in adherence to the conceptual framework outlined by the World Food Program (WFP). Analyzing food consumption patterns was instrumental in deriving the Food Consumption Scores (FCS). The computation of the FCS was predicated upon the comprehensive evaluation of dietary patterns using the 17 distinct items collated from the Food Frequency Questionnaire (FFQ). Precisely, the study ascertained the frequency of consumption for each of the 17 food items over a period of seven days immediately preceding the interview. Subsequently, all food items were categorized into nine distinct food groups, as stipulated by the guidelines outlined by the United Nations and the World Food Program (UN-WFP, 2015). Based on the cumulative scores derived from each food group, the Food Consumption Scores (FCS) were subsequently categorized into three distinct Food Consumption Groups (FCGs) cut-offs. Finally, within the purview of this study, the classification of adolescents as severely food insecure, moderately food insecure, or food secure was contingent upon their respective placements within the designated FCG categories. Specifically, individuals falling within the "poor" (<21) group of FCGs were classified as severely food insecure, and those within the "borderline" (21 to 35) group were identified as moderately food insecure. In comparison, those within the "acceptable" (>35) group were categorized as food secure, drawing from the guidelines established by the United Nations and the World Food Program (UN-WFP, 2015; WFP, 2008).

This study's categorization of nutritional status encompassed distinct classifications, namely severely underweight, underweight, normal, overweight, and obese. The determination of these classifications was predicated upon the computation of the BMI (Body Mass Index) for age z-score (Kemenkes, 2020). The analysis incorporated several covariates, including age, sex, household income, and the parents' nutritional status and educational attainment.

2.3 Statistical Analysis

The descriptive statistics were meticulously outlined, featuring frequencies and means alongside their corresponding standard deviations (SDs). A multifaceted multinomial logistic regression methodology was undertaken to comprehensively

explore the correlation between food insecurity and nutritional status. Notably, the analytical model incorporated meticulous adjustments for various covariates, including age, sex, household income, and the parents' nutritional status and educational attainment. The entire statistical analysis was carried out using SPSS V.26.0.

3 RESULTS AND DISCUSSION

A total of 4883 adolescents, aged between 10 and 18 years old, actively participated in the study. The demographic characteristic of the participants is presented comprehensively in Table 1.

Table 1: Demographic characteristics of participants.

Characteristics	n	%
Age, mean (±SD)	13.4 (2.5)	
Sex		
Boys	2517	51.5
Girls	2366	48.5
Household income, mean (IDR)	2,740,000	
Parent's educational level		
Unschooled	63	1.3
Primary school	1389	28.4
Junior high school	1042	21.3
Senior high school	1635	33.5
Tertiary education	754	15.4
Parent's nutritional status		
Severely underweight	22	0.5
Underweight	43	0.9
Normal	1814	37.1
Overweight	1003	20.5
Obese	2001	41.0
Food security		
Severely food insecure	213	4.4
Moderately food insecure	1428	29.2
Food secure	3242	66.4

On average, the adolescents were 13.4 years old. Most of the adolescent population consisted of boys. Roughly 33.5% of the parents had attained education up to the senior high school level, while more than half were classified as overweight or obese. Additionally, approximately 33.6% of the adolescents lived in households characterized by food insecurity.

As depicted in Table 2, the adjusted multinomial logistic regression models distinctly revealed a statistically significant correlation between severe and moderate food insecurity and the prevalence of adolescent overweight and obesity. Relative to the group classified as food-secure, individuals classified as severely food insecure exhibited a 2.94-fold and 5.11-fold heightened risk of being overweight and obese, respectively. Similarly, a parallel association was observed for individuals classified as moderately food insecure, indicating elevated odds of experiencing overweight and obesity within this group.

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

	Overweight OR (95% CI)	Obese OR (95% CI)
Severely food insecure	2.94** (1.76-4.94)	5.11** (2.42-10.78)
Moderately food insecure	2.26** (1.77-2.90)	3.94** (2.68-5.81)

OR indicates odds ratio; CI, confidence interval; ** $p < 0.001$. Multinomial logistic included severely underweight, underweight, overweight, and obese with reference to normal-weight groups. Table only listed the results of overweight and obesity group. All the regression analyses were adjusted for age, sex, household income, parent's educational level, and parent's nutritional status.

Food insecurity, characterized by the persistent insufficiency in accessing an adequate, safe, and nourishing food supply, can significantly influence individuals' dietary choices and overall weight status. Individuals grappling with food insecurity often encounter obstacles in acquiring a well-rounded and varied diet, thereby consuming energy-dense, nutrient-depleted food items (Landry et al., 2019; Leung et al., 2014). This prevalent phenomenon contributes to developing detrimental dietary patterns and amplifies the susceptibility to weight-related complications, including the onset of overweight and obesity (Dhurandhar, 2016).

Under circumstances of food insecurity, individuals may be compelled to prioritize food quantity over its nutritional quality. Resource constraints often prompt individuals to opt for more economical, high-calorie alternatives that frequently exhibit high concentrations of detrimental fats and added sugars while concurrently being deficient in vital vitamins and minerals. Such dietary preferences can yield an imbalanced nutritional intake lacking the essential elements for fostering optimal health (Bocquier et al., 2015).

"Junk foods" or "empty calories" often describe energy-dense, nutrient-poor food items. These products possess a high caloric value relative to their nutritional composition and commonly encompass sugary snacks, fast food, sugary beverages, and heavily processed foodstuffs. Their consumption can lead to excessive intake of calories devoid of essential

vitamins, minerals, and other vital nutrients, consequently fostering weight gain and triggering adverse health implications (Bhaskar, 2012; Payab et al., 2015; Singh et al., 2021). The consumption of energy-dense, nutrient-poor foods, arising from circumstances of food insecurity, can significantly contribute to the onset of weight gain and obesity. These food items typically boast a high caloric content and a low satiety quotient, prompting individuals to consume bigger portions to attain satiation. Over time, this consumption pattern can culminate in an excessive calorie intake, thereby fostering subsequent weight gain (Stelmach-Mardas et al., 2016).

The issue of food insecurity is intricately intertwined with various socioeconomic determinants, notably income and educational disparities. Due to financial constraints, individuals of lower socioeconomic status frequently encounter impediments in accessing wholesome food options. The elevated costs associated with procuring fresh fruits, vegetables, lean protein sources, and whole grains can prove prohibitive for families grappling with food insecurity, compelling them to resort to comparatively more economical yet less nutrient-dense alternatives (Bocquier et al., 2015).

The intricate interplay between food insecurity and its profound impact on the development of unhealthy dietary patterns can instigate a self-perpetuating cycle. Diets lacking in essential nutrients can foster weight gain and give rise to interconnected health complications, thereby exacerbating individuals' challenges in obtaining and affording nutritious food options. Complications arising from compromised nutrition may escalate healthcare expenditures and curtail economic prospects, thereby perpetuating the cycle of food insecurity (Shinwell et al., 2022). The nexus between food insecurity, detrimental dietary patterns, and weight status represents a multifaceted and intricate relationship. The persistent struggle to secure sufficient and wholesome sustenance often precipitates a reliance on energy-dense, yet nutrient-sparse alternatives, contributing to the emergence of weight gain and associated health adversities. This underscores the critical imperative for comprehensive interventions targeting the holistic spectrum of food insecurity alongside the broader socioeconomic determinants of health. By addressing challenges pertinent to food accessibility, affordability, nutrition education, and social support, we can strive to interrupt the cycle of unhealthy dietary patterns and enhance the overall welfare of populations grappling with food insecurity (Dhurandhar, 2016).

4 CONCLUSIONS

In comparison to individuals with food security, a notable proportion of those grappling with food insecurity reported a higher incidence of being overweight and obese. Notably, moderate and severe food insecurity were significantly linked to heightened odds of being overweight and obesity. Furthermore, household food insecurity was identified as a contributing factor amplifying the likelihood of being overweight and obese.

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