



Analysis of Family Nutrition and Physical Activity (FNPA) and food security as predictors of adolescent obesity at SMAN 98 Jakarta

Analisis Family Nutrition and Physical Activity (FNPA) dan ketahanan pangan sebagai prediktor obesitas remaja di SMAN 98 Jakarta

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Abstract

Obese adolescents are at an increased risk of obesity in adulthood. The Family Nutrition and Physical Activity (FNPA) screening tool was developed for children and adolescents to identify families at risk and facilitate early obesity counseling and intervention strategies. This study aimed to examine the association between family nutrition and physical activity (FNPA), household food security, and nutritional status among adolescents. A cross-sectional study was conducted at SMAN 98 Jakarta, involving 318 students in June and July 2026. Nutritional status was assessed using BMI-for-age, FNPA was measured using a standardized questionnaire, and food security was assessed using the Household Food Insecurity Access Scale. Data were analyzed using chi-square tests, correlation analysis, and multinomial logistic regression analysis. The results showed No significant association was found between food security and nutritional status ($p = 0.448$). FNPA scores were not significantly correlated with BMI-for-age Z-scores ($r = 0.018$; $p = 0.751$). Multinomial logistic regression analysis showed that sex was the only variable significantly associated with nutritional status, with female adolescents more likely to have a normal nutritional status than undernutrition ($p = 0.036$; OR = 2.934; 95% CI: 1.073–8.022). In conclusion, these findings suggest that family environment and household food security alone may not sufficiently explain adolescent obesity, highlighting the role of broader behavioral and environmental factors in adolescent obesity.

Keywords: FNPA, food security, nutritional status, obesity, students

Abstrak

Remaja obesitas memiliki risiko lebih tinggi untuk menjadi obesitas saat dewasa. Alat skrining *Family Nutrition and Physical Activity* (FNPA) dikembangkan untuk anak dan remaja dalam mengidentifikasi keluarga berisiko dan mendukung konseling serta intervensi obesitas secara dini. Penelitian ini bertujuan untuk menganalisis hubungan gizi keluarga dan aktivitas fisik (*Family Nutrition and Physical Activity* / FNPA) serta ketahanan pangan rumah tangga dengan status gizi remaja. Penelitian ini menggunakan desain cross-sectional dan dilakukan di SMAN 98 Jakarta dengan melibatkan 318 siswa pada bulan Juni dan Juli 2026. Status gizi dinilai menggunakan indeks massa tubuh menurut umur (IMT/U), FNPA diukur menggunakan kuesioner terstandar, dan ketahanan pangan dinilai menggunakan *Household Food Insecurity Access Scale* (HFIAS). Analisis data dilakukan menggunakan uji chi-kuadrat, analisis korelasi, dan regresi logistik multinomial. Hasil penelitian menunjukkan tidak terdapat hubungan yang signifikan antara ketahanan pangan dan status gizi ($p = 0,448$). Skor FNPA tidak berkorelasi signifikan dengan nilai Z IMT/U ($r = 0,018$; $p = 0,751$). Analisis regresi logistik multinomial menunjukkan bahwa jenis kelamin merupakan satu-satunya variabel

yang berhubungan signifikan dengan status gizi, di mana remaja perempuan lebih berpeluang memiliki status gizi normal dibandingkan gizi kurang ($p = 0,036$; $OR = 2,934$; $95\% CI: 1,073-8,022$). Kesimpulan, lingkungan keluarga dan ketahanan pangan rumah tangga saja belum cukup untuk menjelaskan kejadian obesitas pada remaja, sehingga diperlukan pertimbangan faktor perilaku dan lingkungan yang lebih luas di luar konteks rumah tangga.

Kata Kunci: FNPA, ketahanan pangan, obesitas, siswa, status gizi

Introduction

Adolescent obesity has become a growing public health concern worldwide. Adolescents with obesity are at an increased risk of physical, social, and psychological health problems and are more likely to remain obese in adulthood (Kansra et al., 2021). In addition to health consequences, obesity during adolescence has been associated with poor academic performance and reduced quality of life (Ma et al., 2020). Globally, overweight and obesity account for approximately 2.3% of disability-adjusted life years (DALYs), highlighting their substantial contribution to the global disease burden (WHO, 2025).

The prevalence of adolescent obesity in Asia is among the highest globally, with several Southeast Asian countries reporting rapid increases in excess body weight among adolescents (Tham et al., 2023). Approximately one in five school-aged children are overweight or obese (UNICEF Indonesia, 2022). Increased consumption of energy-dense foods, high intake of sugar-sweetened beverages, and reduced physical activity are recognized contributors to this trend.

From a biopsychosocial perspective, adolescent obesity results from the interaction of biological, psychological, and behavioral factors. These include age, sex, dietary patterns, physical activity, parenting practices, and the broader family and social environment. Although food choices and activity patterns may appear to be individual behaviors, they are strongly shaped by family habits and parental roles through cultural, social, and environmental mechanisms (Badriyah & Ekaningrum, 2022; Brambila-Paz et al., 2022; Pengpid & Peltzer 2019). Therefore, the family setting plays a critical role in shaping adolescents' eating behavior and lifestyle practices.

Conventional obesity prevention strategies have largely focused on monitoring the body

mass index and intervening after the occurrence of overweight. However, these approaches often show limited long-term effectiveness. Consequently, the early identification of obesogenic environments and preventive strategies targeting family level behaviors have been increasingly emphasized (Elvsaaas et al., 2017). One such approach is the Family Nutrition and Physical Activity (FNPA) screening tool, which was developed to assess household environments related to dietary habits, physical activity, and lifestyle behaviors that may increase obesity risk (Ihmels et al., 2009).

The FNPA screening tool has been widely applied in research and clinical settings to identify families at risk and support early counseling and intervention strategies (Herbenick et al., 2018; Tucker et al., 2017). Lower FNPA scores indicate a less supportive family environment and higher potential for obesogenic behaviors, whereas higher scores reflect healthier household practices. Despite its widespread international use, evidence regarding the application of the FNPA screening tool in Indonesia remains limited.

Household food security is another important factor associated with nutritional outcomes in adolescents. Food-insecure households often face constrained access to nutritious foods and limited opportunities for physical activity, which may increase the risks of undernutrition and overnutrition. The coexistence of food insecurity and obesity, particularly in low- and middle-income populations, reflects the complex nature of the double burden of malnutrition (Coleman-Jensen et al., 2021). However, the mechanisms linking food insecurity and obesity remain unclear, especially among adolescents.

To date, studies examining the combined role of family environment, physical activity, and household food security in adolescent obesity in Indonesia are limited. No previous studies have specifically evaluated the FNPA screening tool in

an Indonesian adolescent population. This study addresses this gap by examining the association between FNPA and household food security with the nutritional status of adolescents at SMAN 98 Jakarta. The findings are expected to contribute evidence for family based and context-specific obesity prevention strategies and support national health and nutrition policy development.

Methods

This study used a cross-sectional research design. The study was conducted at SMAN 98 Jakarta from June to July of 2025. SMAN 98 Jakarta was selected because it has the largest number of students in East Jakarta and represents the adolescent population at risk of being overweight and obese. The research population consisted of 11th grade students of SMAN 98 Jakarta in 2025 who had been given permission by the school because 10th grade students were having school orientation activities and 12th grade students were having national exams. The sampling method employed was total sampling, with 318 students participating. The inclusion criteria were respondents who were in good health and willing to participate in the study. The exclusion criterion was a change in dietary intake due to illness.

The Family Nutrition and Physical Activity (FNPA) variable was measured using 20 survey questions to ensure that all constructs were represented by at least two items. These questions were coded using a 2-, 3-, or 4-point Likert scale, respectively. Each question had response options ranging from one to four based on the frequency of performing each behavior ("almost never," "sometimes," "usually," or "almost always"), resulting in a total score of 20–80. The responses to each question within a construct were summed to obtain the total score. All responses were summed to produce a total score for the entire screening tool. This total score was subsequently used to interpret family environment and behavioral outcomes. Lower total scores indicate a less supportive and more obesogenic family environment.

Food security was measured using the Household Food Insecurity Access Scale (HFIAS). Each question was answered by respondents using a value scale from 0 to 3, where 0 indicated "never," 1 indicated "rarely" (1–2 times in 4 weeks), 2 indicated "sometimes" (3–10 times in 4 weeks), and 3 indicated "often" (>10 times in 4 weeks). Based on this method,

food security levels were categorized into four groups: food secure (total score 0–1), mildly food insecure (score 2–7), moderately food insecure (score 8–14), and severely food insecure (score 15–27).

Data on obesity were collected by measuring the students' body weight and height. Body weight was measured using a calibrated digital scale with an accuracy of 0.1 kg, and height was measured using a microtoise with an accuracy of 0.1 cm. The measurements were then used to calculate the Body Mass Index-for-Age (BMI-for-age) by dividing body weight (kg) by height squared (m²). BMI-for-age was classified into three categories: thinness and severe thinness, normal, overweight, and obese. Students were categorized as having severe thinness (BMI-for-age Z-score < -3 SD), thinness (-3 SD to < -2 SD), normal weight (-2 SD to ≤ +1 SD), overweight (> +1 SD to ≤ +2 SD), and obesity (> +2 SD).

The data analysis in this study consisted of univariate, bivariate, and multivariate analyses. Univariate analysis was conducted using frequency distribution and percentages. Bivariate analysis was conducted using the chi-square test to determine the relationship between categorical variables and nutritional status, and Pearson's correlation was used to determine the relationship between the FNPA score and nutritional status. Multivariate analysis was conducted using multinomial logistic regression because the variables used three categories to examine the risk factors of the independent variables and nutritional status of the participants. The socio-demographic data we obtained from the study contained missing data, including parental education status, parental occupation, and parental income, which is a limitation of the study.

This study was approved by the Health Research Ethics Committee of Universitas Indonesia Maju, as stated in letter No. 1981/Sket/Ka-Dept/RE/UIMA/VI/2025.

Result and Discussion

Socio-Demographic Characteristics and Nutritional Status of Respondents

Table 1. Socio-Demographic Characteristics and Nutritional Status of Respondents

Variable	Category	n	%
Age	≤16 years	186	58.5
	>16 years	132	41.5

Gender	Female	175	55.0
	Male	143	45.0
Daily Allowance	≤ IDR 20,000	108	33.3
	> IDR 20,000	212	66.7
Household Size	≤5 persons	246	77.4
	>5 persons	72	22.6
Nutritional Status (BMI-for-age)	Thinness and Severe Thinness	21	6.6
	Normal	199	62.6
	Overweight and Obese	98	30.8

Note: Thinness includes severely thin and thin categories, and obesity includes overweight and obese categories, based on the WHO BMI-for-age standards.

A total of 318 adolescents participated in the study. Most respondents were aged ≤16 years (58.5%) and were females (55.0%). The majority reported a daily allowance of more than IDR 20,000 (66.7%) and lived in households with five or fewer household members (77.4%).

Based on the BMI-for-age classification, 199 adolescents (62.6%) had a normal nutritional status, 98 (30.8%) were categorized as overweight or obese, and 21 (6.6%) were classified as thin or severely thin (Table 1). These findings indicate that, although most adolescents had a normal nutritional status, the prevalence of overweight and obesity was relatively high.

The socio-demographic characteristics of the respondents show that 186 respondents were ≤16 years old (58.5%). This age represents a critical developmental phase characterized by increased nutritional needs due to rapid physical growth and high learning activities. This finding aligns with previous studies reporting that adolescence is a nutritionally vulnerable period, during which accelerated physical growth increases nutritional demands. Dietary behaviors formed during adolescence may

contribute to nutritional problems with long-term health consequences (Lassi et al., 2017; Mahriani & Indriyanti, 2022). The proportion of female respondents (55%) was higher than that of male respondents. This may influence dietary behavior, as adolescent girls tend to pay more attention to their appearance and are more likely to practice food restriction than boys (Marsyusman et al., 2020). Most respondents reported having a daily allowance averaging IDR 20.000. The amount of allowance may influence food choices, including access to nutritious food and the tendency to consume fast food outside the home (Hakimi et al., 2023). The average household size was 4–5 people, which may affect food distribution within the family (Prasetyaningtyas & Nindya, 2018).

Based on nutritional status, although most respondents (62.6%) had a normal nutritional status, the proportion of students who were overweight and obese was relatively high compared to those who were underweight and severely underweight, with 30.8% being overweight and obese. This indicates that the main nutritional issue among adolescents at SMAN 98 is overweight and obesity. This phenomenon aligns with the dietary patterns of Indonesian adolescents, who are increasingly exposed to fast food, sugary beverages, and low to moderate levels of physical activity (Kemenkes, 2023).

Compared with national data, the prevalence of adolescent obesity in this study was higher than that reported in the Indonesian Health Survey (2023), which reported 11.9% overweight and 7.8% obesity in adolescents. This suggests that obesity has emerged as a significant issue among senior high school students, particularly in urban areas such as Jakarta, where access to modern foods and sedentary lifestyles are widespread.

Household Food Security and Nutritional Status

Table 2. Relationship Between Food Security with Nutritional Status

Variable	Nutritional Status			P
	Thinness and Severe Thinness n (%)	Normal n (%)	Overweight and Obesity n (%)	
Food Security Level				0.448
Secure	9 (5.1)	119 (66.9)	50 (28.1)	
Light Insecurity	8 (8.2)	56 (57.1)	34 (34.7)	
Mild Insecurity	2 (6.5)	19 (61.3)	10 (32.3)	
Severe Insecurity	2 (18.2)	5 (45.5)	4 (36.4)	

The distribution of nutritional status across household food security levels is presented in Table 2. Normal nutritional status was the most common category in all food security groups. No statistically significant association was observed between household food security and nutritional status ($p = 0.448$).

Food security status showed that more than half of the respondents' families were food secure (56%), while 30.8% were slightly insecure, 9.7% were mildly insecure, and 3.5% were severely insecure. Most respondents came from food-secure families (56% of the total). However, approximately 44% of the participants experienced varying degrees of food insecurity, with the largest category being marginal food insecurity (30.8%). This indicates that, although most families had adequate food access, a substantial proportion of adolescents remained at risk of limited food availability and affordability. Household food security refers to consistent access to sufficient, safe, nutritious, and affordable food (Ihab et al., 2013). This is crucial because household food security directly influences adolescent dietary patterns. According to Gianfredi et al., (2025), food insecurity is not only associated with undernutrition but may also lead to overweight and obesity due to the reliance on inexpensive, energy-dense, but nutrient-poor foods.

Analysis of the association with nutritional status showed that most respondents from food-secure households had a normal nutritional status (66.9%). In contrast, adolescents from food-insecure households (light, mild, or severe) were more likely to experience thinness and obesity. However, statistical testing yielded $p = 0.448$, indicating that the relationship between food security and the nutritional status was not statistically significant.

The absence of a significant association between household food security and nutritional status contrasts with the findings for younger children but aligns with several adolescent-focused studies. During adolescence, nutritional status is influenced not only by household food availability, but also by individual autonomy, eating patterns outside the home, peer influence, and exposure to energy-dense foods. Previous studies have shown that adolescents' eating behaviors are strongly shaped by school food environments, breakfast habits, and peer norms, which may attenuate the influence of household food security on BMI (Angesti et al., 2022; Kamaruddin et al., 2023; Özer et al., 2021).

Adolescents from food-secure households may still develop obesity due to frequent consumption of fast food and sugar-sweetened beverages, while those from food-insecure households may maintain a normal nutritional status through adaptive coping strategies or school-based food access. These findings suggest that household food security alone may not adequately explain variations in adolescent BMI, particularly in urban environments, where food access is relatively abundant, but food quality and dietary behaviors vary widely.

Therefore, intervention strategies should not solely focus on household food provision but also emphasize adolescent-centered nutrition education, the promotion of healthy eating behaviors, and supportive school food environments to prevent the double burden of malnutrition.

Family Nutrition and Physical Activity (FNPA) Score and Nutritional Status

Table 3. Correlation Between FNPA Score and BMI-for-Age Z-Score

Variable	Mean±SD	r	p-value
FNPA Score	49.46±6.06	0.018	0.751
BMI-for-age Z-score	0.18 ± 1.46		

The mean FNPA score among the respondents was 49.46 ± 6.06 . Pearson's correlation analysis showed no significant correlation between FNPA scores and BMI-for-age Z-scores ($r = 0.018$; $p = 0.751$), as shown in Table 3.

FNPA is an instrument used to assess the family environment regarding eating habits, physical activity, and lifestyle behaviors that may affect children's nutritional status. A low FNPA score reflects a less supportive family environment for balanced nutrition and physical activity, which is associated with an increased risk of overweight or obesity among children (Davison et al., 2013). Conversely, a high FNPA score indicates a healthier environment that may protect children from over-nutrition (Ihmels et al., 2009).

The study revealed that the average FNPA score among the respondents' families was 49.46 ± 6.06 , indicating a moderately supportive family environment for balanced eating and activity. Among the FNPA indicators, the highest mean was for family involvement in physical activity (5.58), and the lowest was for overall

physical activity (3.91). These low scores indicate that although families were aware of healthy food choices, they had not yet established consistent physical activity routines, either individually or collectively. This may reflect typical adolescent behavior, as increased screen time reduces opportunities for physical activity (Sagre & Ahlawat, 2023).

FNPA scores showed no significant correlation with BMI-for-age ($r = 0.018$; $p = 0.751$), indicating that family related eating and physical activity practices measured by FNPA were not directly associated with the nutritional status of adolescents in this study.

The lack of a significant association between FNPA scores and nutritional status may be explained by these developmental and contextual factors. FNPA primarily reflects family level practices related to meals, physical activity, and screen time. While these factors are strong predictors of nutritional status in children, their influence may diminish during adolescence due to increasing independence, reduced parental supervision, and stronger peer and environmental influences on food choices. Adolescents often spend more time outside the home, consume meals away from family settings, and engage in sedentary behaviors driven by academic demands and screen time. Consequently, family practices measured by the

FNPA may not directly translate into adolescents' actual energy intake or physical activity levels, which may explain the absence of a significant correlation with BMI-for-age despite moderate family support for healthy behaviors.

These results differ from those of some previous studies, such as Kocaadam-Bozkurt et al. (2022), who found that low FNPA scores were associated with a higher BMI in children. Such differences may be explained by factors including respondent homogeneity (most came from middle socioeconomic backgrounds), as well as external influences beyond the family, such as the school environment, peers, and access to fast foods, which may have a stronger effect on adolescents' nutritional status. Uslu (2024) reported that the overall regression model was statistically significant, with nine analyzed variables explaining 67% of the variance in BMI. This finding indicates that FNPA-related factors play an important role in determining the BMI. Beverage and food preferences emerged as factors with strong and significant effects on BMI. Specifically, beverage preferences were associated with a higher BMI, whereas food preferences were negatively associated with BMI. These findings support the notion that individuals' beverage choices and dietary habits play crucial roles in body weight and overall health.

Multinomial Logistic Regression Analysis of Factors Associated with Nutritional Status

Table 4. Multinomial Logistic Regression Analysis of Factors Associated with Nutritional Status

Variable	Normal OR (95% CI) ¹	Obesity OR (95% CI) ²	p-value ³
FNPA Score	1.01 (0.93-1.09)	1.00 (0.92-1.09)	0.895
Age (≤ 16 years)	2.10 (0.78-5.63)	2.26 (0.81-6.32)	0.140
Sex (Female)	2.93 (1.07-8.02)	2.10 (0.74-5.97)	0.036
Daily allowance ($\leq$ IDR 20,000)	1.04 (0.40-2.74)	0.70 (0.25-1.93)	0.937
Household size (≤ 5 persons)	1.09 (0.38-3.12)	1.10 (0.37-3.32)	0.878
Smoking Status (Smoke)	3.91 (0.95-16.18)	2.13 (0.49-9.3)	0.06
Food Security (Security)	6.45 (0.98-46.63)	2.76 (0.39-19.59)	0.053
Food Security (Light Insecurity)	3.78 (0.56-25.34)	2.44 (0.34 - 17.50)	0.171
Food Security (Mild Insecurity)	5.22 (0.52-52.75)	2.86 (0.26-31.49)	0.162

Note:

^{1,2})Reference category is Thinness and Severe Thinness

³)The reported p-value represents the P value obtained from the comparison between the normal nutritional status model and the thinness and severe thinness categories.

Multinomial logistic regression analysis showed that sex was significantly associated with nutritional status. Female adolescents had nearly three times higher odds of being overweight or obese than having normal nutritional status (OR = 2.93; 95% CI: 1.03-8.33;

$p = 0.044$). This finding suggests that female adolescents in this population may be more vulnerable to excess weight gain, potentially due to differences in physical activity patterns, sedentary behavior, and dietary habits than their male counterparts.

However, this result contrasts with the findings reported by Intantiyana et al. (2018), who found that females with good eating behavior and a positive body image were more likely to have a normal nutritional status. This discrepancy may be explained by contextual differences, including variations in physical activity patterns, exposure to energy-dense foods, and sociocultural factors influencing body image and dietary practices among adolescents.

Study Limitations

Several measurement limitations must be acknowledged. FNPA data were self-reported by adolescents, which may introduce recall and social desirability biases, potentially leading to an overestimation of healthy family practices. Additionally, household food security was assessed using a questionnaire-based approach that may not fully capture fluctuations in food access, food quality, or intra-household food distribution, resulting in possible misclassifications.

Furthermore, FNPA does not directly measure dietary intake, total energy consumption or micronutrient adequacy. Adolescents with similar FNPA scores may exhibit different nutritional statuses due to unmeasured factors such as snacking frequency, portion size, and sedentary behavior.

Strengths of the Study

Despite these limitations, this study has several notable strengths. This study is among the first to apply the FNPA instrument in an Indonesian adolescent population and examine its relationship with nutritional status and household food security. The inclusion of multiple determinants provides a comprehensive perspective on adolescent nutrition in urban contexts.

Policy and Program Implications

These findings suggest that interventions aimed at improving the nutritional status of adolescents should not rely solely on family based approaches. School-based nutrition education, regulation of food environments around schools, promotion of physical activity, and peer-supported healthy lifestyle programs may be more effective approaches. Policymakers should integrate household, school, and community-level strategies to address the triple burden of adolescent malnutrition.

Conclusion

The main nutritional status issue among adolescents at SMAN 98 is overweight and obesity. The analysis of the relationship between FNPA scores and nutritional status revealed a very low correlation coefficient, indicating no significant association between FNPA scores and the nutritional status. After controlling for age, daily allowance, number of household members, smoking status, and food security level, only sex was found to be significantly associated with nutritional status.

Integrated multi-level interventions involving nutrition education, physical activity promotion, and supportive school food environments are needed to address obesity among adolescents. Future studies may develop a threshold score to determine risk limits and apply Receiver Operating Characteristic (ROC) curve analysis to evaluate the sensitivity and specificity of FNPA scores in identifying obesogenic environments to determine the most optimal cutoff point based on a balance of sensitivity and specificity. Through this approach, the FNPA threshold is no longer set in general terms but is based on empirical data, making it more accurate in identifying at-risk adolescents and more relevant for use as a screening tool in various population contexts.

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