Research article

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Prevalence of overweight, obesity and dietary quality among adolescent in a secondary school, Phu Yen Province in 2024

Tran Thi Thao Quyen[1], Bui Thi Hoang Lan[1]

[1.] Faculty of Public Health, University of Medicine and Pharmacy at Ho Chi Minh city

Abstract

Background/Objectives: The prevalence of overweight and obesity in children from middle-income countries has increased significantly. These conditions have short-term and long-term negative impacts on children's mental and physical health. Diet quality is a crucial factor in preventing and enhancing nutritional status.

Methods: A cross-sectional study was conducted from March 2024 to May 2024, involving 411 students at Hoang Van Thu Secondary School, Song Cau Town, Phu Yen Province. Self-completed questionnaires and directly measured anthropometric indices were used.

Results: The prevalence of overweight and obesity was 38.7%, with 24.8% classified as overweight and 13.9% as obese. The NCD-Protect score was 3.8 ± 2.2 points, the NCD-Risk score was 4 points, and the GDR score was 9 points. The proportion of students who consumed all five recommended food groups was 26.3%. Factors associated with overweight and obesity included frequency of skipping breakfast, and frequency of eating with family.

Conclusions: The prevalence of overweight and obesity in urban areas is high, and the dietary quality of students is generally low. Timely interventions, including communication strategies and health campaigns, are necessary to help students improve their status and overall health.

Keywords: Obesity and overweight, Diet quality, Secondary school, DQQ

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Author contact:
Tran Thi Thao Quyen
Email: tttquyen.ddytcc20@ump.edu.vn
Phone: +0982455438

1. INTRODUCTION

Nutritional quality play a crucial role in adolescent growth, development, and long-term health. Increased nutritional demands characterize adolescence; however, many adolescents exhibit poor dietary habits, such as consuming energy-dense, nutrient-poor foods and lacking dietary diversity. These habits contribute to the rising prevalence of overweight and obesity and increase the risk of non-communicable diseases (NCDs) in adulthood.

Globally, overweight and obesity among children and adolescents have reached alarming levels. According to the World Health Organization (WHO), over 390 million children aged 5–19 years were overweight or obese in 2023, accounting for approximately 20% [1], with projections reaching 30% by 2030 [2]. In Vietnam, national data indicate that the prevalence of overweight and obesity among urban children aged 5–19 years is 26.8%, significantly higher than in rural (18.3%) and mountainous areas (6.9%) [4]. Rapid urbanization and shifts in dietary patterns are key drivers of this trend.

Secondary school students are a critical population for intervention, as dietary

habits formed at this stage significantly impact future health. Adolescents tend to eat according to preference, with limited nutritional awareness, despite high essential nutrient requirements. Studying dietary quality and developing appropriate nutritional strategies for secondary school students is crucial for reducing overweight and obesity risks and improving public health.

Song Cau Town, a rapidly urbanizing area in Phu Yen Province, has experienced economic growth, but no research has yet examined student nutrition in this region. This study aims to determine the prevalence of overweight, obesity, and dietary quality among students in Hoang Van Thu Secondary School, Song Cau Town, Phu Yen Province, in 2024, and propose appropriate improvement measures.

2. MATERIALS AND METHODS

2.1. Study design

This cross-sectional study was conducted from March to May 2024 at Hoang Van Thu Secondary School in Song Cau Town, Phu Yen Province. The study received the approval from the Ethics Committee in Biomedical Research of the University of Medicine and Pharmacy at Ho Chi City (Approval No. 509/HĐĐĐ-ĐHYD, dated March 27, 2024).

2.2 Study subjects

Students were enrolled at the Hoang Van Thu Secondary School.

2.2.1 Inclusion criteria:

Students enrolled at the school in 2024 and parental or guardian consent obtained.

2.2.2 Exclusion criteria:

Students with medical conditions affecting body measurements (e.g., scoliosis, foot deformities).

2.3 Sample size and sampling method

The sample size was calculated using the formula:

$$n = \frac{z^2_{1-\alpha/2}p(1-p)}{d^2}$$

n is the required sample size; α is the type error probability, Z=1.96 with =0.05; d=0.1 is the margin of error; pis the rate of 29.9% from a 2019–2020 study in Hai Phong.

2.3.1 Sample size

The sample size was calculated using the formula:

$$n = \frac{z^2_{1-\alpha/2}p(1-p)}{d^2}$$

n is the required sample size; *α* is the type I error probability, Z=1.96; d=0.1 is the margin of error; *p* is rate of overweight and obesity according to Nguyen Quang Duc [7], which is 29.9%. Substituting these values into the formula, the sample size was calculated to be 323 students. To account for a potential 10% non-response rate, the final required sample size was 359 students.

2.3.2 Sampling method

A stratified random sampling method was employed based on four grade levels. Within each grade, 2-3 classes were randomly selected using a simple random sampling approach and all students in the selected classed were invited to participate in the study.

2.4. Data collection

Data were collected through self-administered questionnaires and direct anthropometric measurements.

2.4.1 Anthropometric measurements

Height (up to nearest 1 mm using a stadiometer) and weight (up to the nearest 100g using a Nhon Hoa CSK-120 weighing scale), BMI-for-age Z-score (BAZ) were classified using WHO 2007 standards[8]. Severe thinness (BAZ < -3SD); Moderate thinness (BAZ < -2 SD); Normal (-2 SD ≤

BAZ ≤ 1); Overweight (BAZ > 1 SD) and Obese (BAZ > 2 SD).

Dietary quality was assessed using the Dietary Quality Questionnaire (DQQ) [9], a validated tool based on 29 food groups to evaluate dietary adequacy. The DQQ relies on a 24-hour recall method, in which students report all foods and beverages consumed within the previous day. To minimize recall bias, the questionnaire employs a binary "yes/no" response format for each food group. All-5 represents the proportion of the population meeting the recommended intake of five key food groups, including fruits; vegetables; pulses, nuts, or seeds; animal-source foods; and starchy staples. Each food group within All-5 can be analyzed separately. A score of 5 indicates the minimum adherence to dietary recommendations. NCD-Protect Score ranging from 0 to 9, measures dietary factors protective against non-communicable disease (NCDs). It is based on consuming foods from 9 healthy food groups (whole grains, pulses, nuts and seeds, vitamin A-rich orange vegetables, dark green leafy vegetables, other vegetables, vitamin A-rich fruits, citrus, and oder fruits). The NCD-Risk Score, aslo ranging from o to 9, assesses dietary factors for NCDs. It is calculated based on the intake of foods from 8 unhealthy food groups(soft drinks, baked/grain-based sweets, other sweets, processed meat, unprocessed red meat, deep-fried food, fast food & instant noodles, and packaged ultra-processed salty snacks). The Global Diet Recommendations Score (GDR) aslo ranging from 0 to 18, is a composite index combining the NCD-Protect and NCD-Risk scores. It provides a comprehensive assessment of adherence to global dietary recommendations.

2.5. Statistical analysis

Data were entered using Epidata 4.6 and analyzed using STATA 17. Anthropometric indices and age in months of the study sample were calculated using WHO Anthro and WHO AnthroPlus software. Qualitative variables were described using frequencies and percentages. Quantitative were described using mean and standard deviation; If the distribution was not normal, they were described using the median and interquartile range. Chi-square test and Fisher's Exact Testwere appliedto examine the association between qualitative variables. Fisher's Exact Test was used when > 20% of the cells have expected counts < 5. Statistical significance was considered when the p-value < 0.05. The association between nutritional status, sociodemographic characteristics, dietary quality, and eating habits was assessed using trend analysis and Poisson regression, with prevalence ratios (PR) and 95% confidence intervals (CI).

3. RESULTS

Table 1: Nutritional status based on BMI-for-Age Z-Score BAZ (n=411)

Nutritional Status	**n**	**%**
Severe thinness	17	4,1
Normal	236	57,4
Overweight	102	24,8
Obese	57	13,9

A total of 411 students participated in the study. Table 1 show that students had a normal nutritional status according to BMI-for-age classification (57.4%). However, the

prevalence of overweight and obesity was relatively high, accounting for 38.7%, with overweight at 24.8% and obesity at 13.9%.

Table 2: Indicators of Diet Quality (n=411)

Characteristic	**n**	**%**
All-5		
Attained	108	26,3
No attained	303	73,7
NCD-Protect Score*	3,8±2,2	GTLN: 0 - GTNN: 9
NCD-Risk Score**	4(3-5)	
GDR Score**	9(7-11)	

NCD(non-communicable disease), GDR Score (Global Dietary Recommendation Score),
**Median± Standard deviation , **Median (interquartile)*

Table 2 indicates the main indicators of diet quality. Only 26.3% of students met the recommended intake of all five food groups. The mean NCD-Protect score was 3.8 ± 2.2, ranging from 0 to 9. The median NCD-Risk score had a median of 4 with an interquartile range of 3–5, while the median GDR score was 9 (IQR: 7–11).

Table 3: Eating habits (n=411)

Eating Habits	**n**	**%**
Breakfast skipping		
Yes	201	48,9
No	210	51,1
Frequency of skipping breakfast (n=201)		
Frequently (≥5 times/week)	37	18,5
Occasionally (3-4 times/week)	114	57
Rarely (≤ 2 times/week)	49	24,5
Family meal		
Yes	392	95,4
No	19	4,6
Family meal frequency (n=392)		
Always (≥ 7 times/week)	221	56,4
Frequently (≥5 times/week)	92	23,5
Occasionally (3-4 times/week)	51	13,0
Rarely (≤ 2 times/week)	28	7,1

Table 3 indicates the main eating habits. The prevalence of breakfast skipping was relatively high (48.9%), with most students skipping breakfast 3–4 times per week (57%). The majority of students (95.4%) ate meals with their families, with 56.4% reporting daily family meals (≥7 times per week).

Table 4: Associations of overweight/obesity and diet quality(n=411)

Characteristic	**Overweight/Obesity**		**p**	**PR (95% CI)**
	Yes n= 159	**No n= 252**		
All-5				
Attained	42 (38,9%)	66 (61,1%)	0,96	1(0,76 – 1,32)
No attained	117 (38,6%)	186 (61,4%)		
NCD-Protect Score	3,7±2,2*	3,8±2,2	0,616	0,98 (0,93 – 1,04)
NCD-Risk Score	4(3-5)**	4(3-5)**	0,239	0,96 (0,90 – 1,02)
GDR-Score	9(7-11)**	9(7-10)**	0,651	1,01 (0,97 – 1,06)

*Data expressed as n(%), *Mean ± Standard deviation, **Median (interquartile)*

Table 4 no significant associations were found between overweight/obesity and dietary quality indicators, including meeting the recommended intake of All-5, NCD-Protect Score, NCD-Risk Score, and GDR Score.

Table 5: Associations between Overweight/Obesity and eating habits

Đặc tính	Overweight/Obesity		p	PR (KTC95%)
	Yes	No		
Breakfast skipping				
Yes	87 (43,3%)	144 (56,7%)	0,061	1,26 (0,99 – 1,61)
No	72 (34,3%)	138 (65,7%)		
Frequency of skipping breakfast (n=201)				
Frequently (≥5 times/week)	10 (26,3%)	28 (73,7%)		
Occasionally (3-4 times/week)	53 (46,5%)	61 (53,5%)	0,039*	1,28 (1,01 – 1,63)
Rarely (≤ 2 times/week)	24 (49,0%)	25 (51,0%)		
Family meal				
Yes	151 (38,5%)	241 (61,5%)	0,754	0,91 (0,53 – 1,57)
No	8 (42,1%)	11 (57,9%)		
Family meal frequency (n=392)				
Always (≥ 7 times/week)	83 (37,6%)	138 (62,4%)		1
Frequently (≥5 times/week)	34 (37,0%)	58 (63,0%)	0,921	0,98 (0,72 – 1,35)
Occasionally (3-4 times/week)	18 (35,3%)	33 (64,7%)	0,766	0,94 (0,62 – 1,41)
Rarely (≤ 2 times/week)	16 (57,1%)	12 (42,9%)	0,024	1,52 (1,05 – 2,19)

Table 5 indicates the associations between overweight/obesity and eating habits. The frequency of skipping breakfast was significantly associated with overweight and obesity. Specifically, students who skipped breakfast ≤2 times per week had a 1.64 times higher likelihood of being overweight or obese compared to those who skipped breakfast ≥5 times per week (PR = 1.64; 95% CI: 1.02–2.64), with a statistically significant difference (p = 0.039).

Additionally, the frequency of family meals was also significantly associated with overweight and obesity. Students who ate with their families ≤2 times per week had a 1.52 times higher prevalence of overweight and obesity compared to those who had family meals ≥7 times per week (PR = 1.52; 95% CI: 1.05–2.19), with a statistically significant difference (p = 0.024). However, no significant association was found between overweight/obesity and the general variables of skipping breakfast or eating with family.

4. DISCUSSION

The prevalence of overweight and obesity in our study was relatively high at 38.7%, with the rates of overweight and obesity being 24.8% and 13.9%, respectively. Our results show a higher prevalence of overweight and obesity compared to the National Institute of Nutrition's 2020 nutrition survey (urban areas: 26.8%, rural areas: 18.3%, and mountainous areas: 6.9%) [10]. This study aligns with the findings of Le Thi Thu Huong and Trinh Bao Ngoc in two urban districts of Hanoi in 2020, which reported an overweight and obesity prevalence of 38.4%. Meanwhile, a study by Le Thi Ngoc Trinh and Bui Thi Hoang

Lan conducted in Vinh Long province in 2023 found an even higher prevalence of 43.62% among children with overweight and obesity (OWOB) [11].

Our study found a median recommendation score of 9, a median risk score of 4, and a mean protective score of 3.8 ± 2.2. These scores differed from the dietary quality data in Vietnam from 2021-2022, where the recommendation score was 10.8, the risk score was 2.6, and the protective score was 4.4 [76]. This discrepancy may be due to the different age groups studied; adult subjects tend to adhere more strictly to dietary guidelines, prioritize healthy food choices, and limit unhealthy foods. The risk score in children was higher than that in adults. The abundance of snack vendors around schools gives children increased access to and consumption of high-risk food groups such as sugary drinks, sweets, fast food, instant noodles, and snacks.

Our study identified a correlation between OWOB and school grade level. The prevalence of OWOB was higher in grades 8 and 9 compared to grade 6. This result aligns with the study by Tong Thi Thanh et al. [12] on secondary school students in Son La city, which found the highest prevalence in grade 9 (44.3%) and grade 8 (20.8%). However, our findings differ from those of Le Thi Ngoc Trinh et al. [11] on secondary school students in Vinh Long province, which showed a decreasing trend of OWOB with age ($p=0.012$). Similarly, the study by Le Thi Thu Huong et al. [10] on students aged 11-14 in Hanoi in 2020 found that OWOB prevalence decreased with age ($p<0.05$). This discrepancy may be attributed to biological factors, the timing of study execution, and geographical and cultural characteristics. In our study population, early-maturing children may have entered the late puberty stage in higher grades, where height growth slows while weight gain continues, leading to a higher OWOB prevalence. Additionally, social and nutritional contexts have changed significantly over the decades, with increased access to processed foods and more sedentary lifestyles contributing to the differences in findings across studies conducted at different times.

Our study did not find a significant relationship between protective, risk, and recommendation scores. A study in China found a higher obesity rate associated with a higher risk score and a lower overweight and obesity (OWOB) prevalence associated with a higher recommendation score. Conversely, the protective score was not significantly associated with obesity. That study also found that the recommendation score aligned with the 11 WHO global dietary recommendations on fruits and vegetables, legumes, nuts, whole grains, fiber, saturated fat, salt, sugar, processed meats, and unprocessed red meats [13].

Additionally, a U.S. study on children aged 2–19 years examining diet quality using three indices (HEI-2015, the Alternative Healthy Eating Index (AHEI), and the Mediterranean Diet Score) showed that HEI-2015 and the Mediterranean Diet Score were positively associated with OWOB [14]. However, the AHEI, which includes food groups linked to non-communicable diseases, did not show a significant association with OWOB ($p > 0.05$). Given the large sample size of 18,542 in the U.S. study, along with racial and cultural differences, these factors may have contributed to the variation in findings.

Our study found a significant association between OWOB and breakfast-skipping frequency. Specifically, students with a lower frequency of skipping breakfast had a higher OWOB prevalence: 49% for those skipping breakfast ≤ 2 times per week and 26.3% for those skipping ≥5 times per week. Several studies have demonstrated the link between breakfast skipping and OWOB. The study by Marianny Espírito Santo Rocha et al. [15] in Brazil found that

OWOB prevalence was higher among girls who skipped breakfast (less than five times per week) compared to those who regularly ate breakfast. Additionally, a meta-analysis by Alice Monzani et al. showed inconsistencies, with girls who ate breakfast regularly exhibiting a lower BMI at the end of the study, while overweight children who never ate breakfast had a reduced BMI throughout the study. These discrepancies may be explained by differences in breakfast quality, food choices, and eating habits across research locations.

Our analysis also revealed a statistically significant relationship between OWOB and family meal frequency. Our study found that students who ate with their families ≤ 2 times per week had an OWOB prevalence 1.52 times higher than those who ate with their families ≥7 times per week. A study by Beatriz Tosé Agathão et al. [16] on children aged 9-17 in Brazil found that frequent family meals positively impacted mental health and reduced obesity in adolescents. Abykeyla Mellisse Tosatti et al. [17] conducted a systematic review showing that daily family meals led to higher consumption of fruits, vegetables, protein, and calcium while reducing sugar and sugary beverage intake. A systematic review of 25 studies evaluating the association between family meals and nutritional status found that in 17 studies, children who had frequent family meals (≥ 5 times per week) had a lower OWOB prevalence compared to those who rarely ate with their families [18]. Family meals contribute positively to health by promoting home-prepared, nutritious meals, strengthening family bonds, and supporting emotional and mental well-being.

Strengths and Limitations: Anthropometric measurements were directly obtained, and the DQQ questionnaire was translated into Vietnamese, with food names adapted to the local population. However, our study had some limitations, as self-reported questionnaires could lead to reporting bias. Additionally, the DQQ tool has not been validated for children in Vietnam.

5. CONCLUSION

The prevalence of overweight and obesity was relatively high at 38.7%, with overweight accounting for 24.8% and obesity for 13.9%. Diet quality was assessed as moderate to low. Factors associated with overweight and obesity included frequency of skipping breakfast, and frequency of family meals.

Schools and parents should prioritize promoting healthy eating habits, particularly for students at risk of overweight and obesity. Schools can organize parent-teacher meetings to inform families about the importance of proper nutrition and a healthy lifestyle for students. Parents should be encouraged to eat meals regularly with their children, ensuring meals include all five recommended food groups: starches, vegetables, fruits, legumes and nuts, and animal-based foods. Additionally, nutritional education should be integrated into extracurricular lessons, particularly emphasizing the importance of a nutritious breakfast.

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