Nutritional status and associated factors among high school students at Hue city, central Vietnam: a cross-sectional study

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Abstract

Background: Adolescents are a vulnerable group to malnutrition. However, there is a lack of research on the nutritional status of high school students, a group in a critical in the transitional phase from adolescence to adulthood. Our study aims to investigate the nutritional status and associated factors among high school students at central region of Vietnam. **Method:** We conducted a cross-sectional study with 739 students from four high schools in Hue City. Nutritional status was assessed using height-for-age and BMI-for-age indicators based on the WHO 2007 standards. Demographic characteristics and dietary behaviors were collected through a self-administered questionnaire. Logistic regression models were used to calculate odds ratios (ORs) and 95% confidence intervals (CIs) to explore factors associated with nutritional status of students. **Results:** Of the participants, approximately 3.2% were classified as stunted. About 6.0% were identified as thinness, while 11.9% and 2.6% were classified as overweight and obese, respectively. Additionally, students from high-income households were significantly less likely to be stunted (OR = 0.254; 95% CI: 0.076 - 0.853). **Conclusion:** Our study contributes to the growing evidence of the double burden of malnutrition among adolescents. Additionally, we highlight the significant influence of household income on stunting, underscoring the importance of improving economic conditions to achieve better nutritional outcomes.

Keywords: *malnutrition; adolescents; high school; Vietnam.*

1. INTRODUCTION

Malnutrition is a global public health problem due to its high prevalence. Adolescents have been shown to be a vulnerable group, with one in four experiencing stunting or thinness-indicative of both chronic and acute nutritional deficiencies [1]. Notably, the prevalence of malnutrition is higher in low- and middle-income countries compared to high-income countries, particularly regarding the double burden of malnutrition, which is more common in sub-Saharan Africa, Southeast Asia, and the Pacific [2]. Importantly, the double burden of malnutrition tends to be more prevalent among school-aged adolescents, who often exhibit substantial levels of stunting, thinness, and overweight [3]. Vietnam is no exception, with reports also indicating the presence of the double burden of malnutrition [4].

Several factors associated with malnutrition of adolescents. Socioeconomic status has been widely accepted as risk factor for nutritional problem. Specifically, undernutrition is more prevalent among low-income groups, while child overweight is more common in high-income households. Factors such as food access, parenting practices, rural residence, and sanitation are considered possible explanations for this disparity [5]. Additionally, parental characteristics play a significant role in adolescents' susceptibility to malnutrition, with particular emphasis on education, maternal age, occupation, and cultural factors. Furthermore, the education level of household heads was found to be positively associated with malnutrition, particularly among adolescent girls [6]. This highlights the importance of ensuring access to primary education, especially in rural areas where basic educational facilities are limited [6].

Rapid growth during adolescence leads to a high demand for nutrients and may result in growth faltering if nutritional requirements are not met. This period is characterized by increasing independence and greater exposure to environmental and social factors that shape dietary and physical activity behaviors throughout the life course. Notably, the consumption of processed foods high in salt, sugar, and fat tends to increase in low- and middle-income countries due to rapid urbanization, contributing not only to undernutrition and overweight/obesity but also to micronutrient deficiencies [7]. However, nutritional programming in some countries has not

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prioritized adolescents; for example, data on this age group are often not reported at regional and national levels, while children under five receive the most attention [7].

To date, several studies have explored nutrition status at national to various local level in Vietnam, however, major concerns in the existing literature are children under five years and primary school children. For example, a cross-sectional study was conducted in 200 children aged 6-24 months at the Nghe An Obstetric and Pediatric Hospital indicated that the prevalence of underweight, stunting, wasting was 23.5%, 27.5% and 12%, respectively [8]. Another cross-sectional study conducted across various regions in Vietnam, including the northern mountainous areas, Central Highlands, Red River Delta, North Central and coastal regions, Southeast, and Mekong River Delta, focused on children aged 6 months to 11.9 years and revealed distinct malnutrition patterns between rural and urban areas. Specifically, stunting and underweight were more prevalent in rural areas, while urban areas showed higher rates of overweight and obesity [9]. Importantly, there is a lack of attention to the nutritional status of high school students, who are in the transitional phase from adolescence to adulthood, during which nutrition plays a key role. Thus, our study aims to investigate nutritional status and associated factors among high school students at central region of Vietnam.

2. MATERIALS AND METHODS

Study design and participants

We recruited students from four high schools in Hue City to participate in a cross-sectional study. Eligible participants were those currently enrolled at the selected schools and who consented to take part in the study. Students who were unable to have their height or weight measured due to disability were excluded. A total of 739 students were included in the final analysis.

Data collection

Height was measured without shoes using a calibrated stadiometer, with a precision of 0.1 cm. Participants were required to wear light clothing, and body weight was measured using an automatic scale (SECA, Japan) with an accuracy of 100 grams. Waist circumference was measured using a non-elastic tape, placed 1 cm above the umbilicus, during minimal respiration. All measurements were conducted by trained personnel.

Furthermore, participants were asked to complete a self-administered questionnaire that collected information on demographic characteristics and dietary behaviors. These included frequency of main meals (defined as consuming more than two dishes or two bowls per meal), breakfast consumption, frequency of snacks (submeals), and use of vitamin supplements.

Nutritional status assessment

Nutritional status was assessed using height-for-age and BMI-for-age indicators. Classification was based on the WHO 2007 Growth Reference for individuals aged 5 - 19 years. The categories were defined as follows:

Height for age: stunting: Z-score < -2 SD, normal: Z-score > -2 SD

BMI for age: Overweight: Z-score > +1SD; obesity: Z-score > +2SD; thinness: Z-score <-2SD; normal: -2SD < Z-score < +1SD [10].

Statistical analyses

We calculated z-score using WHO AthroPlus software. The data were described using frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables. Logistic regression models were used to calculate odds ratios (ORs) and 95% confidence intervals (CIs) to explore factors associated with nutritional status of students.

3. RESULTS

General information of participants

Table 1 presents the characteristics of the 739 participating students. The proportion of females was higher than males (53.6% vs. 46.4%). Most participants were in grade 11 (39.9%). A majority of students lived with their parents (85.5%) and came from high-income households (95.4%). About 70.8% reported consuming three main meals daily. Additionally, 48.7% of students reported always having breakfast, while 17.3% regularly consumed snacks. Vitamin supplement use was reported by 23.3% of participants (**Table 2**).

Nutritional status of participants

The minimum and maximum weights recorded were 30.0 kg and 99.7 kg, respectively. For height, the values ranged from 94.0 cm to 187.0 cm, and waist circumference ranged from 38.0 cm to 99.0 cm (**Table 3**).

Table 4 presents the nutritional status of the participants. Approximately 3.2% of the participants were classified as stunted. About 6.0% were identified as thinness, while 11.9% and 2.6% were classified as overweight and obese, respectively.

Factors associated with nutritional status of participants

Multivariable logistic regression models were used to examine the association between demographic factors, dietary behaviors, and nutritional status. No significant associations were observed with stunting for most variables, except for household income. Specifically, students from high-income households were significantly less likely to be stunted (OR = 0.254; 95% CI: 0.076–0.853) (**Table 5**). Additionally, no variables were found to be significantly associated with thinness (data not shown).

4. DISCUSSION

Our cross-sectional study involving 739 high school students revealed the presence of a double burden of malnutrition among school-aged adolescents. Specifically, 3.2% of students were classified as stunted and 6.0% as thin. In contrast, 11.9% were overweight and 2.6% were obese. Additionally, high household income was found to be negatively associated with stunting.

To date, prevalence of malnutrition has received more attention from researchers at regional and national levels, especially in low-middle income countries. For example, a study in Indonesia reported that 10.0% of adolescents were stunted and 23.5% were obese among secondary school students [11]. Another survey of 24,053 school-going adolescents aged 12–15 years in South Asia found that the overall prevalence of stunting was 13%, while both thinness and overweight were 10.8% [3]. The proportions of stunting, wasting/thinness, and underweight were 47.4%, 19.5%, and 25.6%, respectively, among 1205 primary school children aged 6 - 12 years in Afghanistan [12]. The high proportion of malnutrition was supported by findings from a meta-analysis of 50 studies. In detail, the proportion of underweight children and adolescents was 25.1% (95% CI 17.3 - 33.7%); stunting 23% (95% CI 11.8 - 36.7%); wasting 24% (95% CI 15.2 - 34%); thinness 12.5% (95% CI 9.4 16.1%); overweight 11.4% (95% CI 7.2 - 16.3%); and obesity 6.9% (95% CI 3 - 12%) [2].

Vietnam is classified as a lower-middle-income country, where malnutrition remains a major public health concern. Stunting and thinness/underweight was at 10% and 14.5% with overweight and obesity in a cross-sectional study conducted on 3055 children aged 5 - 19 years old from main geographical regions [4]. Another cross-sectional study at National Children's Hospital with 167 adolescents aged 10 - 17 years found 13% of stunting malnutrition, 21.9% and 10.6% of adolescents were overweight - obese [13]. Notably, these proportions were reported to be higher among ethnic minority groups, with the prevalence of stunting reaching 48.0%, including 13.8% classified as severely stunted [14]. To our knowledge, most previous studies at both national and local levels have primarily focused on preschool-aged children and those under five years old. In contrast, limited evidence is available on high school students, who are in a critical transitional phase to adulthood and face increasing challenges from academic and social environments. Our findings highlight the double burden of malnutrition among high school students, underscoring the need for policymakers to include this age group in national nutritional programs.

Adolescents may be particularly susceptible to adopting unhealthy lifestyle behaviors, such as poor diet and physical inactivity, which can persist into adulthood. Notably, rapid urbanization in low- and middle-income countries exposes adolescents to increasingly obesogenic environments, characterized by energy-dense, ultra-processed diets and low levels of physical activity, often coexisting with food insecurity [15]. These conditions underscore the critical role of socioeconomic factors in shaping nutritional outcomes. A similar pattern was observed in our study, which identified an association between household income and stunting. Specifically, students from high-income households were less likely to be stunted. This finding aligns with previous studies that highlight the critical influence of socio-economic factors on adolescents' nutritional status. Therefore, improving economic conditions is essential to achieve better nutritional outcomes among adolescents [16].

Furthermore, the prevalence of overweight and obesity among high school students has received considerable attention. Existing evidence has focused on identifying factors associated with these conditions to inform intervention strategies. Variables such as sex, eating out, family monthly income, mode of transportation, and physical activity have been found to be significant predictors of overweight and obesity in this population [17]. Therefore, interventions targeting these factors are recommended to address this public health issue. Additionally, other studies have reinforced the influence of physical activity and dietary habits on overweight and obesity, emphasizing the crucial roles of both educational and home environments in promoting healthier lifestyles among students [18]. However, our study did not identify any significant factors associated with overweight and obesity.

Differences in sampling strategies may partially explain this discrepancy.

Our study is among the few that examine the nutritional status of high school students, a population in the transitional phase from adolescence to adulthood, during which nutrition plays a crucial role. However, several limitations should be noted. First, causality could not be established due to the cross-sectional study design. Second, our data were limited to students in Hue, which may not be representative of high school students in the central region of Vietnam. Therefore, further research is needed to clarify these findings.

In conclusion, our study contributes to the growing evidence of the double burden of malnutrition among adolescents. Specifically, we emphasize the need to include high school students in nutritional programs, as this group is often overlooked. Additionally, our findings highlight the significant influence of household income on stunting, underscoring the importance of improving economic conditions to achieve better nutritional outcomes.

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Ethics approval: The study was approved by the Ethics Committee in Biomedical Research, University of Medicine and Pharmacy, Hue University (MS: H2024/453)

Table 1. Characteristics of participants

Characteristics		Frequency (n)	Percentage (%)
Sex	Males	343	46.4
	Females	396	53.6
Grade	10	281	38.0
	11	295	39.9
	12	163	22.1
Household income	Low	34	4.6
	High	705	95.4
Living situation	Living with both parents	632	85.5
	Living only with mother	65	8.8
	Living only with father	17	2.3
	Other	25	3.4
Total		**739**	**100**

Table 2. Diet behavior information

Characteristics		Frequency (n)	Percentage (%)
Number of main meals	1	24	3.2
	2	192	26.0
	3	523	70.8
Frequency of eating breakfast	Always	360	48.7
	Sometimes	303	41.0
	Rarely	52	7.0
	Never	24	3.3
Frequency of eating snacks	Always	128	17.3
	Sometimes	421	57.0
	Rarely	150	20.3
	Never	40	5.4
Use of vitamins supplements	Yes	172	23.3
	No	567	76.7
Total		**739**	**100**

Table 3. Anthropometric indices of the participants

	Min	Max	Mean	SD
Weight (kg)	30.0	99.7	55.5	11.8
Height (cm)	94.0	187.0	164.0	8.8
Waist circumference (cm)	38.0	99.0	70.2	9.6

Table 4: Nutritional status of the participants

Characteristics	Frequency (n)	Percentage (%)
Height for age		
Normal	715	96.8
Stunted	24	3.2
BMI for age		
Thinness	44	6.0
Normal	588	79.6
Overweight	88	11.9
Obese	19	2.6
Total	**739**	**100**

Table 5. Factors associated with stunting

Characteristics		Stunting		
		OR	95% CI	p
Grade	10	1		
	11	1.21	0.427 - 3.444	0.717
	12	1.845	0.616 - 5.284	0.274
Sex	Males	1		
	Females	0.951	0.395 - 2.288	0.911
Living situation	Living with both parents	1		
	others	1.807	0.656 - 4.981	0.253
Number of main meals	< 3	1		
	3	1.770	0.568 - 5.520	0.325
Frequency of eating breakfast	Always	1		
	Others	0.422	0.167 - 1.065	0.068
Household income	Low	1		
	High	**0.254**	**0.076 - 0.853**	**0.027**
Frequency of eating snacks	Always			
	Others	1.049	0.342 - 3.218	0.933
Use of vitamins supplements	Yes	1		
	No	2.192	0.636 - 7.559	0.214

REFERENCES

1. Killel E, Mandara F, Kuwawenaruwa A, Azizi K, Masumo R, Leyna G, Martin H, McHau G, Elisaria E: Prevalence and risk factors of stunting and thinness among school adolescents in Zanzibar Island: a school based cross-sectional study. Bulletin of the National Research Centre 2025, 49:33.

2. Khan DSA, Das JK, Zareen S, Lassi ZS, Salman A, Raashid M, Dero AA, Khanzada A, Bhutta ZA: Nutritional Status and Dietary Intake of School-Age Children and Early Adolescents: Systematic Review in a Developing Country and Lessons for the Global Perspective. Frontiers in nutrition 2021, 8:739447.

3. Estecha Querol S, Iqbal R, Kudrna L, Al-Khudairy L, Gill P: The Double Burden of Malnutrition and Associated Factors among South Asian Adolescents: Findings from the Global School-Based Student Health Survey. Nutrients. 2021, 13(8).

4. Hoang N, Hoang N, Tran D, Le H, Le T, Szymlek-Gay E, Le H, Le H, Dang D, Phung H: Prevalence of and Socio-Demographic Factors of Malnutrition Among Vietnamese Children and Adolescents: A Cross-Sectional Study. Healthcare. 2025, 13:612.

5. Garcia S, Sarmiento OL, Forde I, Velasco T: Socio-economic inequalities in malnutrition among children and adolescents in Colombia: the role of individual-, household- and community-level characteristics. Public Health Nutr. 2013, 16(9):1703-1718.

6. Paul D, Chakraborti C, Mishra P: Factors affecting malnutrition of rural adolescent girls: Evidences from selected districts of West Bengal. Children and Youth Services Review. 2023, 152:107065.

7. Choedon T, Brennan E, Joe W, Lelijveld N, Huse O, Zorbas C, Backholer K, Murira Z, Wrottesley SV, Sethi V: Nutritional status of school-age children (5–19 years) in South Asia: A scoping review. 2024, 20(2):e13607.

8. Vũ Thị Quyên, Phạm Thị Thanh Nga, Nguyễn Thị Việt Hà. Tình trạng dinh dưỡng và một số yếu tố liên quan đến suy dinh dưỡng ở trẻ từ 6 đến 24 tháng tuổi tại bệnh viện Sản Nhi Nghệ An. Tạp chí Y học Việt Nam. 2023, 527.

9. Tran NT, Tran VK, Tran DT, Nguyen TTN, Nguyen SD, Nguyen HT, Nguyen TS, Thanh Le TV, Nguyen PTL, Dang HT et al: Triple burden of malnutrition among Vietnamese 0·5-11-year-old children in 2020-2021: results of SEANUTS II Vietnam. Public Health Nutr. 2024, 27(1):e259.

10. World Health Organization, Growth reference data for 5-19 year.

11. Nuryani N, Paramata YJJGdDI: Associated factors of adolescents malnutrition in junior high school student. 2020, 8(1):9-21.

12. Rahimi B, Khalid A, Lali W, Khalid W, Rahimi J, Taylor W: Prevalence and associated risk factors of stunting, wasting/thinness, and underweight among primary school children in Kandahar city, Afghanistan: a cross-sectional analytical study; 2024.

13. Đỗ Thị Cần, Lưu Thị Mỹ Thục, Nguyễn Thuỳ Linh. Thực trạng suy dinh dưỡng và một số yếu tố liên qua ở trẻ vị thành niên tại Bệnh viện Nhi trung ương. Tạp chí Y học Việt Nam. 2024, 543.

14.Hoàng Văn Phương, Nguyễn Song Tú, Nguyễn Thúy Anh. Tình trạng dinh dưỡng ở học sinh 11-14 tuổi một số trường phổ thông dân tộc bán trú tỉnh Điện Biên, năm 2018. Tạp chí Y học Việt Nam. 2023, 520.

15. Wrottesley SV, Mates E, Brennan E, Bijalwan V, Menezes R, Ray S, Ali Z, Yarparvar A, Sharma D, Lelijveld N: Nutritional status of school-age children and adolescents in low- and middle-income countries across seven global regions: a synthesis of scoping reviews. Public Health Nutr. 2023, 26(1):63-95.

16. Ali MS, Haque MJ, Islam A, Haque MA, Awal MAJEJoN, Sciences F: Study on nutritional status of the adolescent relationship with their socio-economic status in Bagha, Rajshahi. 2024, 6(4).

17. Anteneh ZA, Gedefaw M, Tekletsadek KN, Tsegaye M, Alemu D. Risk factors of overweight and obesity among high school students in Bahir Dar City, North West Ethiopia: school based cross-sectional study. Adv Prev med 2015. 2015:294902.

18. Gautam L, Thapa M, Pokhrel P, Bhusal S, Paudel K, Adhikari TB. Prevalence and factors associated with overweight and obesity among adolescents in Nagarjun municipality: a cross-sectional study. BMJ Public Health 2024, 2(2):e001675.