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ORIGINAL PAPER

Association of eating behavior and diet quality among students in Taruna Nusantara Senior High School, Indonesia

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Abstract

Background: Poor adolescent diet quality is influenced by family eating habits, media promoting unhealthy foods, and body image pressures, leading to disordered eating, neglect of health considerations, and obesity. Even in controlled environments like boarding schools.

Objective: This study aims to assess association between eating behavior and dietary quality among students in Taruna Nusantara Senior High School (TN-SHS), Indonesia.

Methods: A cross-sectional study with 200 subjects aged 15-18 was conducted in January 2024. Participants were purposively sampled from TN-SHS boarding school. Data was collected using the Dutch Eating Behavior Questionnaire (DEBQ) and Diet Quality Index International (DQI-I), along with sociodemographic information, nutritional status, and physical activity. Analysis was performed using SPSS 29, employing multiple linear regression to examine the relationship between eating behaviors and diet quality.

Results: There was strong relationship between eating behavior and diet quality on different days, revealing that restrained eating correlates with better diet quality on average days (r=0.158, p=0.026), while external eating is linked to poorer diet quality. The association between eating behavior and diet quality on weekdays is weaker than on weekends. External eating consistently reduces diet quality across all periods (β=–1.380 to –1.854, p<0.01). Males exhibiting lower diet quality (β=–3.021 to –4.904, p≤0.002) and higher pocket money associated with improved diet quality, particularly on weekends (β=–3.633, p=0.021).

Conclusion: The study findings highlight the importance of managing external eating behaviors such as emotional eating, social eating, mindless eating, and binge eating, and suggest avenues for targeted interventions to promote healthier dietary habits.

Keywords: eating behavior, diet quality, adolescent, semi-military high school

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Introduction

According to the Indonesian Health Survey, the prevalence of obesity among adolescents aged 16-18 is 3.3% nationally, with Central Java reporting 2.9% for the same age group. Based on the Body Mass Index by Age, obesity rates for 15-18-year-olds in Indonesia are 3.5% for males and 3.1% for females.[1] This concerning trend is likely to have implications for both public health and the overall economic state of the country. The escalating prevalence of adolescent obesity in Indonesia poses a pressing concern.[2] Obesity increases the likelihood of non-communicable diseases such as high cholesterol level, hypertension high BMI, high blood sugar, and poor dietary also high in prevalence and increasing in Indonesia.[3,4] The surge in obesity in Indonesia is paralleled by a rise in diabetes, cerebrovascular disease, all of which are leading causes of mortality.[5,6]

Preventing obesity necessitates maintaining a healthy and balanced diet, which holds for adolescents as well. The quality of diet in high school adolescents significantly impacts their health and development during this critical period of rapid growth and maturation. Unfortunately, many teenagers tend to be affected by unhealthy eating habits, such as consuming fast food that is high in fat and sugar, as well as a lack of variety in their diet. Poor diet quality in teenagers can have a negative impact on their physical and mental health and can potentially cause long-term health problems. Therefore, it is important to understand the factors that influence the quality of their diet and take steps to improve them to ensure a healthy and fit adolescence.[7–9] Diet quality consists of four main categories: variety, adequacy, moderation, and overall balance of the diet.[10] High diet quality is related to the consumption of foods that meet macronutrient needs appropriately, both in terms of quantity and composition, as well as adequate micronutrient intake.[11] On the other hand, low diet quality is associated with high consumption of energy and fat, while low in fiber and micronutrients.[12]

Eating behavior is a critical factor that directly impacts the quality of an individual's diet. During adolescence, eating behavior exhibits crucial nutritional characteristics for growth. To ensure proper nutritional needs are met, adolescents must have good and regular eating habits.[13,14] Nonetheless, teenagers tend to engage in wrong eating behavior, namely consuming nutrients that are not following their needs or recommended dietary recommendations.[15,16] Wrong eating behavior like this can potentially cause nutritional problems that have a negative impact on their growth and health.[16] According to Agustina et al (2020) poor dietary quality and diversity, which is further reflected in their eating habits—many adolescents frequently skip meals, particularly by addressing meal frequency and reducing meal skipping, to help lower the risk of anemia and overweight-obesity among adolescent.[17] On the other hand, Setyowati et al. (2017) found that 69.2% of adolescents exhibit poor eating behavior in preventing anemia, with many having dietary restrictions by avoiding certain types of dishes.[18]

Adolescent eating behavior can be influenced by two factors: external and internal factors. External factors like family, peers, media, and food availability, along with internal factors such as physiological needs, body image, and personal beliefs, all influence eating behavior.[19] Children in boarding schools often consume excessive macronutrients like carbs, proteins, and fats, while lacking essential nutrients like iron, zinc, vitamin C, and calcium.[10,20] The diet quality of adolescents attending boarding schools can be meticulously monitored, allowing for targeted nutritional education and the inclusion of fresh fruits, vegetables, and lean proteins, encouraging informed dietary choices and promoting overall well-being. The essential to accurately assess eating habits to understand their impact on diet quality. To achieve this, the Dutch Eating Behavior Questionnaire (DEBQ) is used, which examines three key aspects of eating behavior: restrained eating, emotional eating, and external eating.[21] Assessing diet quality is imperative for identifying weaknesses and facilitating improvements, aiding individuals in understanding food composition and nutritional gaps. This knowledge promotes more effective efforts to enhance diet quality. To evaluate dietary quality and its impact on obesity, a reliable tool such as the Dietary Quality Index for

Adolescents (DQI-I) is essential, providing insights into the relationship between diet and associated problems. In the context of a semi-military boarding school like Taruna Nusantara Senior High School in Indonesia, which advocates healthy eating through balanced meals, portion control, and diverse food options, students' dietary quality may vary due to distinct eating behaviors, rendering it an ideal setting for this study. A comprehensive examination of the interactions between the two factors will offer a clearer perspective on their impact on an individual's health. Such research is scarce, particularly in school settings with a semi-military boarding system. These environments differ significantly from typical school contexts due to their unique characteristics, such as highly structured mealtimes, restricted food access, regulated daily routines, and heightened peer influence. These factors may have a substantial impact on students' dietary behaviors and overall nutrition, making this population an important yet underexplored group in dietary research. Researching to analyze the intricate relationship between diet quality, eating habits, and nutritional status is essential, intending to provide valuable insights for lifestyle improvements and enhanced nutritional guidance. This research aims to offer a new prospective on the evolving of eating behavior and diet quality among students in semi-military boarding school and focused on assessing the association between eating behavior and diet quality.

Methods

This cross-sectional study was conducted in January 2024 at Taruna Nusantara Senior High School, a semi-military boarding school in Central Java, Indonesia. A total of 200 students aged 15–18 years were selected through purposive sampling, with inclusion criteria requiring active enrolment and dormitory residence for at least three months. Students with metabolic disorders, prescribed diets, or incomplete responses were excluded.

Ethical approval was granted by the Ethics Committee of the Faculty of Medicine, Universitas Indonesia (KET-1819/UN2.FI/ETIK/PPM.00.02/2023).

Sociodemographic data, including age, sex, class, family structure, parental education and employment, household income, and pocket money, were collected using a structured questionnaire. Family size was categorized as small (≤3 members), medium (4–6), or large (≥7). Parental education was grouped into secondary (college/vocational or lower) and higher (bachelor's or above); employment status was recoded as both work or one work. Monthly household income was recoded into two categories: up to 3,500,000 IDR and above, while pocket money was grouped into amounts of 500,000 IDR or less and more than that.

Nutritional status was assessed using BMI-for-age Z-scores (BAZ) and classified into thinness, normal, overweight, and obese. Physical activity was measured using the PAQ-A, with scores above or below 2.75 used to categorize students as active or less active, respectively. Eating behaviors emotional, external, and restrained were measured using the Dutch Eating Behavior Questionnaire (DEBQ). Dietary intake was assessed using two non-consecutive 24-hour recalls (weekday and weekend) and analyzed using NutriSurvey software for nutrient intake and food group distribution. These data were used to calculate Diet Quality Index-International (DQI-I) scores (0–100), reflecting variety, adequacy, moderation, and balance. Data were analyzed using IBM SPSS Statistics version 29. Descriptive, bivariate, and multivariate analyses were conducted to examine the associations between eating behaviors, physical activity, sociodemographic factors, and diet quality.

Results

The sociodemographic characteristic of the subject is present in **Table 1** below. The median age of respondents was 16, with a majority being male (66%) and from medium-sized families (73.5%). Most parents had higher education (77%) and over half (53.5%) were dual earners. Additionally, 79% of families earned above 3.5 million IDR, and 74.5% of participants received up to 500,000 IDR

in pocket money. Regarding nutritional status, the majority, 152 people or 76%, have a normal weight. Those categorized as overweight account for 42 individuals or 21%, while a small number, 4 or 2%, are classified as obese. Underweight nutritional status is the least common with only 2 individuals or 1%. In terms of physical activity, 144 participants, or 72%, engage in high levels of activity, while the remaining 56, or 28%, have low levels of physical activity.

Table 1. Sociodemographic characteristics of the respondents (N = 200)

Characteristic	n	%
Gender		
Male	132	66
Female	68	34
Age		
15 years old	7	3.5
16 years old	126	63
17 years old	67	33.5
Family Member		
Small Family (≤ 3 Members)	44	22
Medium Family (4-5 Members)	147	73.5
Large Family (≥6 Members)	9	4.5
Parental Education*		
Secondary Education	55	23
Higher Education	154	77
Parental Employment Status		
Both Parent's Work	107	53.5
Only One Parent's Work	93	46.5
Parental Income Monthly		
≤ 3.5 Million (IDR)	42	21
> 3.5 Million (IDR)	158	79
Pocket Money Monthly		
≤ 500.000 (IDR)	149	74.5
>500.000 (IDR)	51	25.5
Nutritional Status**		
Underweight	2	1
Normal	152	76
Overweight	42	21
Obese	4	2
Physical Activity***		
High	144	72
Low	56	28

*Parental Education: Secondary Education including college or vocational and lower, Higher Education including bachelor's degree and higher **Nutritional status based on Permenkes no 2 of 2020 concerning anthropometric standards with the details: (-3SD to <-2SD) = Thinness, (-2SD to +1SD) = Normal, (+1SD to +2SD) = Overweight, and (>2SD) = Obese ***Physical Activity: Active adolescents (High) have a score (PAQ-A) more than 2.75, and if less than that can be describe about less active (Low).

Table 2 presents scores for both weekdays and weekends which enables comparison of dietary patterns on different days. The overall DQI-I scores are 53 for weekdays and 48 for weekends, indicating slightly better diet quality during weekdays. This table highlights the need for dietary improvements, particularly in fruit and vegetable intake, moderation of fats, sodium, and empty calorie foods, and achieving better nutrient balance.

Table 3 reveals that the median score for restrained eating, at 3.2, surpasses those of emotional eating and external eating, which range from 1.3 to 5. The mean scores similarly highlight that restrained eating, with an average of 3.2, is the dominant eating behavior, suggesting it is the most prevalent among the respondents. **Figures 1** show the dominant eating behavior of the respondent details among the study participants (N = 200),

displaying the count (n) and proportion (%) of each sub-scale.

The distribution of predominant eating behaviors among the study participants (N = 200), including the frequency (n) and percentage (%) for each subscale. Restrained Eating emerged as the most prevalent behavior, reported by 52.5% of respondents, followed by External Eating at 37.5%. Emotional Eating was comparatively less common, observed in only 5.5% of participants.

Table 2. Component of diet quality between weekdays and weekend

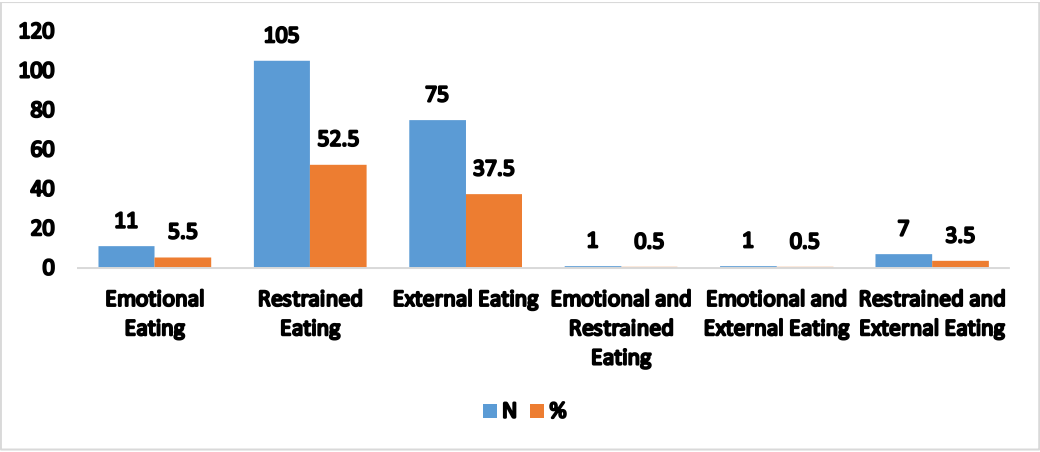
Variable	Score DQI-I	Diet Quality	
		Weekdays* Median (Min-Max)	Weekend** Median (Min-Max)
Variety	0-20	17(7-20)	17(9-20)
Food Group	0-15	12(6-15)	12(6-15)
Protein Source	0-5	5(1-5)	5(3-5)
Adequacy	0-40	12(5-24)	12(5-22)
Vegetable[a]	0-5	1(0-3)	0(0-1)
Fruit[a]	0-5	0(0-1)	0(0-5)
Grain[a]	0-5	1(0-5)	1(0-5)
Fiber[a]	0-5	1(1-5)	1(1-5)
Protein[a]	0-5	3(1-5)	3(1-5)
Iron[a]	0-5	3(1-5)	3(1-5)
Calcium[a]	0-5	1(1-3)	1(1-3)
Vitamin C[a]	0-5	1(1-3)	1(1-5)
Moderation	0-30	21(15-30)	21(0-30)
Total fat	0-6	0(0-6)	0(0-6)
Saturated fat	0-6	6(1-6)	6(0-6)
Cholesterol	0-6	6(6-6)	6(0-6)
Sodium	0-6	6(3-6)	6(0-6)
Empty calories foods	0-6	0(0-6)	0(0-6)
Overall balance	0-10	2(0-8)	0(0-8)
Macronutrient ratio[b]	0-6	0(0-6)	0(0-6)
Fatty acid ratio[b]	0-4	2(0-2)	0(0-4)
DQI-I Score	0-100	53(32-75)	48(32-67)

[a] data from Permenkes about *Angka Kecukupan Gizi* No 28 in 2019 [b] data from Permenkes about *Pedoman Gizi Seimbang* No 41 in 2014
*Weekdays: Sunday to Friday **Weekend: Saturday to Sunday

Table 3. Eating Behavior of the Respondent* (N = 200)

Sub-Scales	Median
Emotional Eating	1.7 (1.0 – 5.0)
Restrained Eating	3.2 (1.3 – 5.0)
External Eating	2.7 (1.0 – 4.7)

*Eating Behavior calculated using Dutch Eating Behavior Questionnaire



*The above percentages represent the proportion of the total population

Figure 1. Dominant eating behavior of the respondent (N = 200)

A minority of respondents exhibited mixed eating behavior patterns, with combinations such as Emotional and Restrained Eating, Emotional and External Eating, and Restrained and External Eating accounting for between 0.5% and 3.5% of the sample. **Table 4** show the associations between distinct eating behavior patterns and diet quality across different weekdays, and weekends. The findings indicate that on the overall average across both weekdays and weekends**,** restrained eating, characterized by conscious control over food intake, is positively associated with higher diet quality.

Table 4. Association between eating behavior and diet quality (N = 200)

Dependent variable	Independent variable	r value	p-value
Diet Quality	**Eating Behavior**		
DQI-I Score Weekdays	Emotional Eating	0.043	0.549
	Restrained Eating	0.087	0.220
	External Eating	0.218**	0.002
DQI-I Score Weekends	Emotional Eating	0.138	0.052
	Restrained Eating	0.199**	0.005
	External Eating	0.274**	0.001
DQI-I Score Average	Emotional Eating	0.110	0.122
	Restrained Eating	0.158*	0.026
	External Eating	0.305**	0.001

Statistical analysis used spearman correlation.
**. Correlation is significant at the 0.01 level (2-tailed) *. Correlation is significant at the 0.05 level (2-tailed)

In contrast, external eating—driven by environmental cues such as food visibility or social settings—is strongly linked to lower diet quality, while emotional eating shows minimal influence. During weekdays, the relationship between eating behaviors and diet quality appears attenuated, with neither emotional nor restrained eating showing a notable effect; however, external eating continues to negatively impact diet quality. On weekends, these associations become more pronounced: individuals engaging in restrained eating maintain better diet quality, while external eating remains a significant determinant of poorer dietary outcomes. These patterns underscore the heightened influence of social and environmental factors on eating behavior and diet quality during weekends, suggesting a context-dependent vulnerability to less healthy eating practices.

Table 5 presents a comparative analysis of the Diet Quality Index-International (DQI-I) across various demographic groups, detailing mean scores and ranges for weekdays, weekends, and overall daily averages. Statistically significant gender differences were identified, with males consistently exhibiting higher mean diet quality scores across all periods compared to females. Although age differences were not statistically significant, younger participants (≤15 years) tended to have higher mean DQI-I scores. Other demographic variables—including family size, parental education, employment status, and household income—did not significantly influence diet quality. However, pocket money showed a notable effect: participants with ≤500,000 IDR had significantly lower weekday diet quality compared to those with greater financial resources. While variations in nutritional status and physical activity levels were observed—with normal BMI and high activity levels generally linked to higher diet quality—these differences were not statistically significant.

Following this, **Table 6** provides results from a multivariate analysis examining factors influencing diet quality across different timeframes. The analysis highlights several key determinants: external eating consistently correlates with lower diet quality across weekdays, weekends, and average days; gender differences persist, with females demonstrating better diet quality than males; and higher pocket money is positively associated with improved diet quality, particularly on weekends.

Table 5. Association between Diet Quality Index International and sociodemographic characteristic (N=200)

Characteristic	Diet Quality Index International					
	Weekdays		Weekend		Average	
	Mean±SD Median (Min-max)	p-value	Mean±SD Median (Min-max)	p-value	Mean±SD Median (Min-max)	p-value
Gender						
Male	55 (32-75)	<0.001 [b]	49 (33-67)	0.003 [b]	52±5.63	<0.001 [a]
Female	48 (39-62		46 (32-64)		47.90±4.56	
Age						
15 years old	56 (47-69)	0.405 [c]	51 (42-56)	0.947 [c]	53.5 (44.5-60.5)	0.570 [c]
16 years old	53 (39–68)		48 (32-67)		49.75 (38-65)	
17 years old	52 (32-75)		48 (32-65)		50 (40-70)	
Family Member						
Small Family	53 (39-64)	0.733 [c]	48 (35-67)	0.168 [c]	49.5 (41.5-65)	0.253 [c]
Medium Family	52 (32-75)		48 (32-65)		50 (38-70)	
Large Family	56 (42-61)		53 (44-60		53 (48-59.5)	
Parental Education						
Secondary Education	51.76±6.36	0.448 [a]	47.50 (32-60)	0.573 [b]	49.25 (40-62.50)	0.420 [b]
Higher Education	52.68±7.49		48 (32-67)		50.75 (38-70)	
Parental Employment Status						
Both Work	52.26±7.10	0.656 [a]	48 (32-67)	0.526 [b]	49.50 (38-65)	0.641 [b]
One Work	52.72±7.44		48 (32-65)		50.50 (40-70)	
Parental Income						
≤ 3.5 Million	53.16±7.37	0.488 [a]	51 (32-61)	0.400 [b]	51 (40-61.50)	0.378 [b]
> 3.5 Million	52.29±7.22		48 (32-67)		49.75 (38-70)	
Pocket Money						
≤ 500000 (IDR)	48.82±6.91	0.030 [a]	51 (40-62)	0.076 [b]	50.14±5.37	0.675 [b]
>500000 (IDR)	52.81±7.20		48 (32-67)		50.74±5.66	
Nutritional Status						
Normal	53 (32-75)	0.025 [b]	48 (32-67)	0.076 [b]	50 (38-70)	0.548 [b]
Overweight	51.50 (47-56)		52 (46-58)		51.75 (46.50-57)	
Physical Activity						
High	54 (32-75)	0.221 [b]	48 (32-67)	0.131 [b]	51 (38-70)	0.066 [b]
Low	51 (39-69)		48 (33-64)		48.50 (40.50-61.50)	

[a] Statistic analysis used T-test for parametric mean comparison test, [b] Man Whitney U for non-parametric comparison test [c] Kruskal Walis for non-parametric comparison test

Table 6. Multiple linear regression analysis of diet quality (N = 200)

Parameter	Diet Quality											
	Weekdays[a]				Weekend[b]				Average[c]			
	Parameter Estimate	Standard Error	95% CI	p-value	Parameter Estimate	Standard Error	95% CI	p-value	Parameter Estimate	Standard Error	95% CI	p-value
Constant	46.989	10.27	26.73	<0.001**	61.908	9.955	42.274	<0.001**	51.526	2.632	46.335	<0.001**
Eating Behavior												
Emotional Eating	-	-	-	-	1.409	0.619	0.189	0.024*	1.252	0.502	0.263	0.013*
External Eating	-1.380	0.510	-2.385	0.007*	-1.854	0.490	-2.820	<0.001**	-1.651	0.397	-2.435	<0.001**
Restraint Eating	-	-	-	-	0.637	0.728	-0.799	0.383	0.212	0.592	-0.956	0.721
Gender	-4.904	1.000	-6.890	<0.001**	-3.021	0.951	-4.895	0.002*	-4.071	0.769	-5.588	<0.001**
Family Member	-	-	-	-	1.178	0.972	-0.739	0.227	-	-	-	-
Pocket Money	2.944	1.705	-0.418	0.086	-3.633	1.567	-6.723	0.021*				
Nutritional Status	2.693	4.476	-6.699	0.572	-3.483	4.394	-12.150	0.429				
Physical Activity	-	-	-	-	1.276	0.972	-0.641	0.191	1.133	0.788	-0.421	0.152

[a]Dependent variable: DQI-I Weekdays
*Significance level at p-value <0.05; **significance level at p-value <0.01
R Square = %, P-value = <0.01 analyzed with multiple linear regression using enter method.
[b]Dependent variable: DQI-I Weekend
Significance level at p-value <0.05; significance level at p-value <0.01
R Square = %, P-value = <0.01 analyzed with multiple linear regression using enter method.
[c]Dependent variable: DQI-I Average
Significance level at p-value <0.05; significance level at p-value <0.01
R Square = %, P-value = <0.01 analyzed with multiple linear regression using enter method.

Emotional eating was found to have a positive association with diet quality on weekends and average days, though nutritional status and physical activity were not significant predictors in the multivariate model. These findings underscore the multifaceted nature of dietary behaviors and suggest specific socio-demographic and behavioral factors that could inform targeted nutrition interventions.

Discussion

The study found that Most respondents are male, constituting 66% of the total sample, whereas females make up 34%. This skew towards male respondents might influence certain aspects of the study, such as perspectives or behaviors observed. The high proportion of male respondents in this study may influence the observed eating behavior patterns, particularly in the context of adherence to structured mealtimes, peer pressure, and the rigid daily routines typical of semi-military boarding schools such as Taruna Nusantara. In such environments, male students often engage in higher levels of physical activity compared to females, which can affect their daily energy needs and food preferences. This may lead to greater food intake in terms of quantity, but not necessarily in terms of dietary quality, as reflected in DQI-I scores. Additionally, external eating behavior may be more prominent among males in socially competitive and structured settings, while restrained eating could be more difficult to maintain consistently. Although emotional eating might be less pronounced in a highly disciplined environment, it remains relevant for understanding individual differences in response to stress or social pressure. Among the respondents, the highest proportion falls within the 16 years old category (63%). This concentration around the 16-17 age range suggests that the study largely targets adolescents, potentially influencing the interpretation of results, especially concerning behaviors typical of this age group such as irregular eating patterns, increased sensitivity to social norms, and a heightened responsiveness to environmental cues. These developmental characteristics may affect both the quality of diet and the expression of eating behaviors, including tendencies toward *external eating*, *emotional eating*, and inconsistent dietary restraint. This aligns with the Indonesian Ministry of Education and Culture Regulation (*Permendikbud*) No. 1 of 2021, which states that the minimum age for high school students is 15 years, and the maximum age is 21 years. This age range corresponds with the age range present in this study.[22] On the other hand, most respondents come from medium-sized families (73.5%) this distribution might indicate different dynamics in terms of family support, resources, and interactions that could impact various aspects of the respondents' lives, including their nutritional status and physical activity levels. In contrast, within the scope of this research, the mean family size reported among the respondents is slightly higher, amounting to 4 members per household. This slight discrepancy suggests that respondents may come from somewhat larger families than the national average, potentially affecting sociodemographic factors such as food availability, parental supervision, and sibling influence.[23] In larger households, dietary choices may be shaped by limited resources and older siblings, while parental control may be less direct.[24] These factors can influence adolescents' eating habits and diet quality scores. Additionally, students from larger families may be more familiar with group living, aiding their adjustment to structured environments like semi-military boarding schools.

A large proportion of parents in this study have attained a relatively high level of education and income, indicating an overall affluent and educated sample. This socioeconomic background may influence various lifestyle factors, including access to resources, dietary choices, and health-related behaviors among the respondents. The average pocket money per respondent is 500,000 IDR, with 66% of respondents falling within this range. This variable reflects individual financial autonomy and could influence spending habits, including dietary choices and participation in physical activities. Based on the findings elucidated in the study undertaken by Kurniawan (2017), there exists a significant correlation between the disbursement of pocket money and an

individual's consumption patterns, indicating that a surge in pocket money allocation is concurrent with heightened levels of energy sufficiency.[25] Therefore, higher income levels have an impact on the total consumption of students, affecting their nutritional status. Most respondents have a normal weight (76%), these findings provide an overview of the distribution of weight categories within the sample population, which is crucial for understanding health risks and intervention strategies. A significant portion of respondents (72%) engage in high levels of physical activity, while a smaller proportion (28%) have low levels of physical activity. This disparity in activity levels may have implications for overall health outcomes and could potentially correlate with nutritional status. In the context of a semi-military boarding school setting, such as Taruna Nusantara, this trend is not unexpected. Physical activity is embedded into the students' daily routine through a structured schedule that includes regular exercise, drills, and physical training, contributing to consistently high physical activity levels. Moreover, meeting a minimum standard of physical fitness is often part of the school's admission criteria, which may explain why most respondents have normal or healthier physical status. Research from Praditasari (2018), indicates that very light physical activity poses a risk factor 9.533 times greater for obesity compared to light physical activity (95% CI: 1.847-49.204).[26] This finding aligns with study Nisa et al (2021), which highlights a significant relationship between physical activity and the nutritional status of adolescents, and adolescents with insufficient physical activity are 1.937 times more likely to be overweight or obese than those who engage in adequate physical activity (95% CI: 1.06-3.53).[27] However, study from Nabawiyah et al (2021) suggests that there is no significant correlation between physical activity and adolescent nutritional status.[28] Adolescent nutrition is influenced by both dietary patterns and physical activity, where sufficient and balanced physical activity especially at moderate to high intensity combined with adequate energy intake supports healthy growth and helps reduce the risk of obesity, ultimately impacting their overall nutritional status.[29]

The individuals eating patterns and quality are thoroughly analyzed, with an emphasis on weekdays and weekends. Table 2 breaks down the dietary components into five categories: Variety, Protein Source, Adequacy, Moderation, and Overall Balance. According to the research, the weekend intake of a wide range of food groups is significantly lower than weekday consumption, according to the research. Several studies on diet quality, although the subjects are not the same, show that diet quality on weekdays and weekends, the amount of nutrient dense food consumed is less on weekends than weekdays.[30,31] Results from Danish studies on children aged 4 to 14 show that during the vacations, compared to school days, children consume fewer of the purportedly healthy food groups (vegetables and fruits).[32] Lunch and snack intake, as well as the amount of vegetables consumed, are far more sufficient on weekdays than on holidays. Additionally, according to Ruopeng (2015), there is a decrease in the consumption of fruits and vegetables, a rise in the consumption of fast food, a decrease in the Healthy Eating Index-2010 score, and an increase in caloric and total fat intake during the holidays.[33] Prior research indicated that as compared to school days, holidays are a time when people eat less healthfully. [31] The majority of participants showed consistent eating behavior on weekdays and weekends by consuming protein from three or more sources each day. Adequacy category revealed a noteworthy lack of consumption of fruits and vegetables, as a sizable portion of participants did not achieve the suggested serving sizes. Most of grains also consumed less than the suggested amounts, albeit at a somewhat higher percentage than fruits and vegetables. This is consistent with study by Esposito et al. that shows workday consumption of veggies, lunch, and snacks is substantially more adequate than it is on holidays.[34] This research also found that the consumption of iron, calcium, vitamin C is still relatively low compared to the recommendations, this is in line with research from Safitri et al in 2019 which stated that the intake of iron and vitamin C is still below the recommended adequacy of consumption, this food is by what is recommended, which means that the quality of school children's diets in Indonesia is

still relatively low.[35] On the other side for sub moderation results show that consumption of total fat, saturated fat, and empty calories is elevated, particularly on weekends. Throughout the week, consumption of sodium and cholesterol remained high. Activities that occur on unrestricted weekends in the school setting, where respondents have the freedom to eat out and consume food without the strict supervision and measurement that is typically applied in the school environment, can be a mediator in the increase in consumption of fat, saturated fat, and empty calories. For this overall balance the ratios of fatty acids and macronutrients indicated that a significant amount of the food was outside of the permitted range, particularly on weekends. Study from Triatmoko et al in 2024 found that high school students in semi-military schools had significantly lower diet quality on weekends compared to weekdays, indicating the negative impact of a less structured weekend environment on adolescents' eating habits.[36] Consistently low intake of fruits, vegetables, and grains—paired with excessive consumption of fats and empty calories—reflects a nutrient-poor, energy-dense diet that may elevate chronic disease risk, with nearly half of participants failing to meet recommended fruit and vegetable intake, posing a significant public health concern.[37] Despite various efforts to encourage adolescents to include vegetables and fruit in their daily diets, previous studies have reported a decline in their consumption.[38,39] This ongoing trend underscores the need for more effective public health initiatives and educational programs to promote healthier eating habits among young people and address the decreasing intake of these vital food groups. In another study, it was found that more than one-third of the sample scored less than 50% of the total score, indicating that a significant percentage of adolescents had low diet quality. This finding aligns with the results of the current study.[10,40–42] The causes of low diet quality among adolescents can be attributed to several factors, including poor nutritional knowledge, limited availability of healthy food options, high consumption of fast food and processed snacks, socio-economic constraints, and lack of parental guidance or supervision in dietary habits. Additionally, the influence of peer pressure and media on food choices also plays a critical role in shaping the dietary patterns of this age group. Enhancing the nutritional well-being of adolescents necessitates holistic initiatives tailored to their specific needs. These interventions should encompass multifaceted approaches, including educational campaigns aimed at bolstering nutritional awareness, initiatives to broaden access to affordable yet nutrient-rich food selections, advocacy for making healthy food options more readily available to students and members of the community, and empowerment programs for parents and caregivers to model and reinforce healthy eating behaviors. It is widely acknowledged that a healthy diet is often accompanied by other beneficial behaviors, such as increased levels of physical activity, which together contribute to an overall healthier lifestyle and enhance various aspects of physical and mental well-being.[43–45]

Data on the eating habits of the participants are shown in Table 3, where, in comparison to emotional and external eating, restricted eating has the greatest median and mean scores. In particular, the range for emotional and external eating is 1.3 to 5, but the median score for controlled eating is 3.2. With an average score of 3.2, the mean scores highlight the predominance of restrained eating even more, indicating that it is the respondents' preferred eating behavior. The study participants' most common eating behaviors are described in detail in Table 4, which also shows the count (n) and proportion (%) of each sub-scale. With 52.5% of respondents reporting restricted eating, it is the most common behavior, followed by external eating with 37.5%. Emotional eating is less common, as just 5.5% of participants reported experiencing it. Furthermore, a tiny percentage of participants engage in mixed eating behaviors, contributing between 0.5% and 3.5% of the total. These combinations include emotional and restrained eating, emotional and external eating, and restrained and external eating. According to a study conducted in China among adolescents aged 11 to 17 years, there are significant differences in eating behavior between genders as measured by the DEBQ, with a higher percentage of female

adolescents reporting emotional, restrained, and external eating behavior than male adolescents.[46] This study results show that respondents generally exhibit restrained eating behavior, pointing to a propensity for limiting food intake or following certain dietary recommendations. In Depboylu's study, it is mentioned that students with inadequate energy, carbohydrate, and protein intake scored higher in restrained eating compared to those with excessive energy, carbohydrate, and protein intake.[47] But it's important to think about how these eating habits might affect general health and wellbeing. In the study conducted by Nurdiani et al., it was observed that there is a positive and significant relationship between restrained eating behavior and BMI, showing that higher levels of restrained eating are associated with an increased BMI. This finding aligns with the restrained eating theory which posits that skipping meals can cause irregular eating patterns. This irregularity can lead to counter-regulatory eating, where individuals overcompensate by overeating after periods of restraint, ultimately resulting in weight gain. [48] This study also found results on the eating habits of respondents in more than one category, where the assessment results obtained the same number in the two categories of eating habits for each respondent. This means that the respondent has a complex and multifactorial eating pattern.

This research looks at the associations between different eating behavior and diet quality on weekdays and weekends. It shows that depending on the day of the week, there are different relationships between eating behavior and diet quality. People who practice restricted eating, which is defined as selecting foods carefully, typically have better-quality diets on average. On the other hand, poorer nutrition quality is associated with reliance on outside cues, such as food availability or social conditions, as observed in external eating. A prior study found a potential relationship between restricted eating and increased weight gain in adults,[49,50] as well as an increased risk of obesity in preadolescent and adolescent girls.[51,52] A study conducted in the United States of America revealed a positive correlation between the scores on the restriction scale and BMI (adjusted β = 0.39 kg/m2; 95% confidence interval (CI) = 0.34–0.44; $p < 0.001$) as well as weight gain (adjusted β = 0.33 pounds; 95% CI = 0.17–0.49; $p < 0.001$)[53]. On typical days, however, it seems that emotional eating has little effect on the quality of the diet. The impact of eating habits on diet quality is less noticeable during the week. While external eating continues to influence diet quality, it does so less than on ordinary days. Emotional and constrained eating are found to have minor relationships with diet quality. This finding contrasts with a study conducted by Sekarini on adolescents in Semarang, which demonstrated a significant relationship between emotional eating behaviors and diet quality. The results indicated a positive correlation with emotional eating ($p=0.005$; $r=0.236$) and a negative correlation with diet quality ($p=0.002$; $r=-0.261$), suggesting that as emotional eating increases, diet quality tends to decrease.[54] The impact of eating behavior on diet quality is especially noticeable on the weekends. Although students live in a structured semi-military boarding school environment, they still have the freedom to purchase food during weekends. This relative flexibility in food access may lead to greater expression of individual eating behaviors such as emotional or external eating which in turn can influence their overall diet quality during this period. The relevance of consistent eating behaviors is suggested by the tendency for those who follow restrained eating habits to retain improved diet quality. Furthermore, external eating continues to have a substantial impact on diet quality, suggesting the influence of environmental or social variables, which is especially noticeable on weekends. These observations are statistically supported by Table 3 findings, which show strong relationships between eating habits and diet quality on various kinds of days based on spearman correlation analyses. The significant differences in diet quality between men and women, with men scoring higher on weekdays and on average, and showing significant differences over the weekend. Although the study by Dewi et al. (2013), [55] was conducted in a regular public school setting, their finding that boys scored higher than girls on the DQI-I also appears in this semi-military boarding school context. This suggests that gender may

consistently influence diet quality among Indonesian adolescents, regardless of differences in school environment or structure. Scores on all components of the DQI-I (variety, adequacy, moderation, overall balance) were also higher in adolescent males than females. However, despite the values obtained for the adequacy, moderation, and overall balance components falling far from the point range, with only the adequacy of grains and protein not scoring too low, diet quality assesses food intake according to established dietary recommendations or nutritional guidelines, serving as a crucial determinant of an individual's nutritional status. [55,56]

In the present study, the relationship between age and diet quality was not statistically significant. All respondents were aged between 15 and 17 years, falling within the category of middle adolescence a developmental stage characterized by increasing autonomy, strong peer influence, and heightened media exposure, which may contribute to less consistent dietary patterns. While previous research suggests that younger adolescents (under 15 years old) tend to have higher diet quality scores particularly during weekdays and on average.[57] This pattern was not observed here, likely due to the absence of participants below 15 years of age in the sample. Particularly regarding dietary preferences, there's a strong sway towards food selections rich in fats and sugars, largely influenced by peer interactions and media exposure.

On this the study revealed that individuals with lower levels of pocket money exhibited decreased diet quality scores, particularly notable during weekdays, thus emphasizing the significant economic implications on the accessibility of nutritious food options**.** Interestingly, this pattern is also observed in a semi-military boarding school context. Despite the structured environment, students still have opportunities to purchase food whether at the school canteen on weekdays, albeit limited, or more freely during weekends. Teenagers who have a lot of pocket money frequently don't think about moral issues while deciding what to eat because they have more purchasing power and can choose what kind and how much to eat.[58] If teenagers have a lot of pocket money, they usually choose sugary snacks and fast meals, which are high-calorie foods with proven health risks.[59,60]

This implies that when making food decisions, teenagers with more discretionary cash can prioritize convenience and preference over ethical considerations about health, while the nutritional status in this study also influences diet quality on weekdays, as individuals with a normal nutritional status tend to score higher than those who are overweight. Also, in this study found that individuals with high physical activity have higher diet quality scores on weekdays, though not significantly, suggesting a potential relationship between physical activity and healthier food choices; similarly, adolescents with low diet quality and low physical activity are at a significantly increased risk, with 10.4 and 7.2 times greater likelihood respectively, of developing obesity.[61] However, in this study, no significant differences were found in diet quality based on family size, parental education, employment status, or parental income, suggesting that these sociodemographic factors may have a less direct impact on adolescents' dietary quality. This finding is particularly interesting in the context of a semi-military boarding school population, where students do not live at home on a daily basis. As a result, the direct influence of family dynamics or household environment on their eating behavior may be reduced. Daily meals are generally provided within the institution under structured schedules and limited food environments, which may diminish the role of parental socioeconomic status in shaping food choices. Nevertheless, future discussions may still consider how background factors subtly interact with individual autonomy, peer influence, and institutional food policies, and how tailored interventions can further support healthy eating behaviors in such unique settings.

A key strength of this study is its focus on students in a semi-military boarding school, a controlled environment that minimizes external influences like regional diets or socioeconomic factors. This allows for a clearer understanding of how structured school settings shape eating behaviors and diet quality, providing valuable insights for targeted nutrition programs and policies in similar educational contexts. However,

it is imperative to note potential biases introduce due to reliance on assessment of DQI-I, 24-hour recall is used to gather intake data, which may not accurately represent long-term eating patterns. There is a possibility that respondents may provide answers that are perceived as more socially acceptable or healthy, rather than what they consumed.

Conclusion

This study highlights that semi-military boardings school adolescent diet quality is influenced by several interrelated factors, especially on weekends. Males generally had higher diet quality scores than females, and younger adolescents showed slightly better, though not significant, scores. Lower pocket money was linked to poorer weekday diet quality, reflecting the impact of financial autonomy on food choices. Eating behaviors also mattered restrained eaters had better diet quality, while external eaters consumed less healthy diets, and emotional eating showed weaker, varying associations. Physical activity was positively linked to diet quality, though not significantly. Family size and parental socioeconomic factors showed no notable influence, indicating individual behaviors play a stronger role. These findings stress the need for structured eating, better nutrition knowledge, and targeted weekend interventions to improve adolescent diet quality.

Conflict of interest

The authors declared no conflict of interest regarding this article.

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