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Association between Global Diet Quality Score (GDQS) and nutritional status among indonesian adolescents: A case study in Bogor District

Hubungan antara Skor Kualitas Diet Global (GDQS) dan status gizi pada remaja indonesia: Studi kasus di Kabupaten Bogor

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Abstract

Adolescents are a population group highly vulnerable to nutritional problems due to rapid physical growth, increased nutrient needs, and the formation of long-term eating habits. Understanding the quality of their diet is essential for preventing both nutrient deficiencies and diet-related non-communicable diseases (NCDs). This study aimed to assess adolescent diet quality using the Global Diet Quality Score (GDQS) and its Indonesian modification (GDQS-I) and examine their association with nutritional status. The GDQS was developed to meet the need for a concise, sensitive, and globally applicable metric capable of evaluating both undernutrition and the risk of NCDs. This cross-sectional study was conducted from August to September 2025 and included 61 eighth-grade students from SMPN 2 Ciomas, Bogor. Dietary intake was assessed using repeated 2×24-hour food recalls, and nutritional status was determined through anthropometric measurements using the BMI-for-age index. The results showed that most adolescents had a normal nutritional status (82%); however, their diet quality was generally poor, with 67.2% categorized as high-risk based on the GDQS and 95.1% based on the GDQS-I. The Wilcoxon signed-rank test indicated significantly lower GDQS-I scores than GDQS scores ($p<0.001$). The Spearman correlation test found no significant association between diet quality and nutritional status ($p>0.05$). In conclusion, these findings suggest that the GDQS-I may be useful for screening dietary risks among Indonesian adolescents, although further validation is required.

Keywords: Adolescents, diet quality, GDQS, GDQS-I, nutritional status

Abstrak

Remaja merupakan kelompok yang rentan terhadap masalah gizi karena berada pada masa pertumbuhan pesat dan pembentukan kebiasaan makan jangka panjang. Penelitian ini bertujuan menganalisis kualitas diet remaja menggunakan Global Diet Quality Score (GDQS) dan versi modifikasinya untuk Indonesia (GDQS-I), serta menguji hubungannya dengan status gizi. GDQS dikembangkan sebagai metrik diet yang ringkas, sensitif, dan dapat digunakan secara global untuk menilai dua sisi malnutrisi, yaitu kekurangan zat gizi dan risiko penyakit tidak menular (PTM). Penelitian *cross-sectional* ini dilakukan pada Agustus–September 2025 dengan melibatkan 61 siswa kelas 8 di SMPN 2 Ciomas, Kabupaten Bogor. Data konsumsi diperoleh melalui food recall 2×24 jam, sedangkan status gizi ditentukan melalui pengukuran antropometri menggunakan indeks IMT/U. Hasil menunjukkan bahwa sebagian besar remaja memiliki status gizi normal (82%), namun kualitas dietnya rendah, dengan 67,2% tergolong berisiko tinggi berdasarkan GDQS dan 95,1% berdasarkan GDQS-I. Uji *Wilcoxon signed-rank* menunjukkan skor GDQS-I secara signifikan lebih rendah daripada skor GDQS ($p<0,001$). Sementara itu, uji *korelasi Spearman* menunjukkan tidak terdapat hubungan signifikan antara kualitas diet dan status gizi ($p>0,05$). Temuan ini menunjukkan bahwa GDQS-I berpotensi digunakan sebagai

alat skrining untuk mengidentifikasi risiko gizi pada remaja di Indonesia, meskipun diperlukan penelitian lanjutan untuk menguji validitas dan konsistensinya.

Kata Kunci: : GDQS, GDQS-I, Kualitas diet, remaja, status gizi

Introduction

Adolescents are the future generation of Indonesia, serving as the foundation for the country's development. In 2022, the adolescent population aged 10–19 years in Indonesia reached 44,252,200 individuals (BPS, 2023). However, Indonesian adolescents are currently facing a triple burden of malnutrition, consisting of undernutrition, overweight, and micronutrient deficiencies, such as iron deficiency anemia (Rah et al., 2021). According to the Indonesia Health Survey (SKI) 2023, the nutritional burden among adolescents aged 13–15 years remains substantial, with 7,6% experiencing undernutrition, 16,2% being overweight, and 16,3% of individuals aged 5–14 years suffering from anemia (KEMENKES RI, 2023).

Adolescence is a transitional period from childhood to adulthood, during which rapid growth and development occur, accompanied by significant physical, behavioral, and psychosocial changes. Moreover, it is a critical stage for the formation of eating habits and dietary behavior (Said et al., 2023). The substantial increase in nutritional requirements during adolescence is often not balanced by appropriate dietary patterns (Oy et al., 2019). In addition, low-to-moderate diet quality scores are closely associated with poor dietary intake patterns and overweight conditions (Androutsos et al., 2023).

Poor diet quality among school-aged children and adolescents is a contributing factor to malnutrition in low- and middle-income countries (Said et al., 2023). Children and adolescents gain approximately 20–25% of their adult height and up to 50% of their adult weight during this life stage. To support this rapid physical growth, adequate nutrition is required to meet the increased need for energy, protein, minerals, and vitamins during adolescence (Wan et al., 2020). In addition, poor diet quality among adolescents may be partly attributed to unhealthy eating behaviors or habits, such as skipping meals, consuming inadequate or excessive portion sizes, and failing to meet dietary recommendations, all of which can negatively affect overall diet quality (Maneschy et al., 2024).

Diet quality assessment is a method used to evaluate the adequacy of daily food intake in comparison with established dietary recommendations and guidelines. Good diet quality is characterized by a balanced and nutritious intake that meets individual needs, aiming to achieve optimal health and support biological functions without leading to nutrient deficiencies or overweight-related diseases (Amalia et al., 2023). One dietary quality assessment method that is not yet widely applied in Indonesia is the Global Diet Quality Score (GDQS). The GDQS is a dietary quality metric developed to address the limitations of previous dietary indicators, which were often only relevant to specific countries or populations and failed to capture the dual burden of malnutrition, both undernutrition and overnutrition, which remain major challenges in many countries (Intake, 2024).

One of the advantages of the GDQS is that it is entirely food-based and does not require food composition tables for analysis. This makes the calculation of GDQS scores substantially simpler than other diet quality metrics that rely on more complex data, such as the Alternate Healthy Eating Index [AHEI]). Therefore, the GDQS can be applied across diverse populations, including those in low-resource settings, where food composition and nutrient data are limited, such as in Indonesia (Intake, 2024).

The Global Diet Quality Score (GDQS) method for assessing diet quality not only focuses on nutrient adequacy, as in several other approaches, but also considers components related to the risk of non-communicable diseases, such as the consumption of ultra-processed foods (UPF), sugar-sweetened beverages, and high-fat meats. The assessment is divided into positive scores for healthy foods (e.g., vegetables, fruits, and fish) and negative scores for less healthy foods (e.g., added sugars and high-fat processed foods) and is aligned with the principles of balanced nutrition (Bromage et al., 2021).

Based on this background, the GDQS can serve as a relevant tool for assessing diet quality among Indonesian adolescents, who are

increasingly exposed to ultra-processed foods and are vulnerable to various forms of malnutrition. This study is the first to use the GDQS as a metric for assessing dietary quality in Indonesia. In addition, the GDQS-I, a modified version of the GDQS adapted to Indonesian dietary patterns, was developed to enhance its relevance. Therefore, this study aimed to examine the GDQS and GDQS-I and evaluate their validity as tools for assessing diet quality and their relationship with nutritional status among Indonesian adolescents.

Methods

This cross-sectional study was conducted in Bogor from August to September 2025 at SMPN 2 Ciomas (a public junior high school in Bogor Regency, Indonesia). The study location was selected using a purposive sampling method, considering that the school had not yet received the Free Nutritious Meal (MBG) program, had a sufficient number of 8th-grade students, had no prior research related to diet quality, and offered feasible access and permission for data collection. This study was approved by the Ethics Committee of IPB University (approval number 1850/IT3).KEPMSM-IPB/SK/2025.

The number of subjects was determined using the minimum sample size calculation formula by Lemeshow et al. (1990), resulting in a required sample of 59 participants.

$$n = \frac{(1.96^2)(0.276)(1-0.276)(252)}{0.1^2(252-1) + (1.96^2)(0.276)(1-0.276)} = 59$$

The population consisted of all eighth-grade students at SMP Negeri 2 Ciomas, Bogor Regency. The inclusion criteria were willingness to participate in the study, completion of all research stages, and not currently following a structured diet and/or exercise program. The exclusion criteria included absence due to illness or other academic reasons and incomplete responses. Based on the permission obtained from the school, 71 students from two classes were recruited. After the screening process, 61 subjects met the criteria, had complete data, and were included in the analysis.

The data collected included subject and family characteristics (socioeconomic and demographic), dietary intake data obtained through two non-consecutive 24-hour food recalls, and anthropometric measurements consisting of body weight and height. Data collection on subject characteristics was conducted directly at the school through interviews and self-administered questionnaires guided by the researcher and trained enumerators. Interviews and data collection were conducted concurrently with anthropometric measurements to determine the nutritional status of the participants.

Data were analyzed descriptively and inferentially using Microsoft Excel 365 and IBM SPSS Statistics 16. Descriptive analysis was performed to obtain the mean, standard deviation, and percentage of variables, including subject characteristics, socioeconomic characteristics, eating habits/preferences, nutritional status, and comparison of components in the dietary quality assessment methods. Inferential analyses included the Kolmogorov–Smirnov normality test, the Wilcoxon signed-rank test, and the Spearman correlation test. The Wilcoxon test was used to compare diet quality scores between the GDQS method and its modified version, while the Spearman correlation test was used to analyze the association between diet quality scores and the nutritional status of the participants.

Global Dietary Quality Score (GDQS)

The Global Diet Quality Score (GDQS) was developed by the Intake – Center for Dietary Assessment/FHI Solutions, in collaboration with the Harvard T.H. Chan School of Public Health and the National Institute of Public Health (INSP), Mexico, in response to the need for a concise, sensitive, and globally applicable dietary metric capable of assessing both dimensions of malnutrition, nutrient deficiencies, and the risk of non-communicable diseases (NCDs). This distinguishes GDQS from other diet quality indices, which generally assess only one aspect of diet quality (Bromage et al., 2021; Intake, 2022).

A major advantage of the GDQS is its ability to assess both nutrient adequacy and the risk of noncommunicable diseases (NCDs) within a single, simple measurement tool (Nguyen et al., 2023). International validation studies have shown that the GDQS can predict both nutrient adequacy and NCD risk in various population groups and countries. Therefore, the GDQS serves as an important tool for policymakers, researchers, and program

implementers to monitor, evaluate, and design effective diet improvement interventions at the national and global levels (Intake, 2024).

The GDQS consists of 25 food groups classified into three categories: 16 healthy food groups (e.g., vegetables, fruits, and legumes), seven unhealthy food groups (e.g., sugar-sweetened beverages and ultra-processed foods), and two food groups considered unhealthy when consumed in excess (red meat and high-fat dairy products). The assessment was based on the amount of consumption of each food group within a 24-hour period, with a total score ranging from 0 to 49. A higher GDQS indicates better diet quality, reflecting higher consumption of healthy foods and lower consumption of unhealthy foods. A GDQS score ≥23 indicates a low risk for both nutrient inadequacy and NCDs, a score between ≥15 and <23 indicates a moderate risk, and a score <15 indicates a high risk of NCDs (Bromage et al., 2021).

Developing Global Dietary Quality Score for Indonesian (GDQS-I)

The Global Diet Quality Score for Indonesians (GDQS-I) is a modified version of the GDQS components and scoring system, adjusted to reflect the dietary consumption patterns of the Indonesian population. The primary reference for its development was the Indonesian Balanced Nutrition Guidelines (PGS) 2014, which provides dietary recommendations in terms of servings per day. The GDQS uses a cut-off system based on consumption in grams per day. Therefore, in the GDQS-I, the daily gram-based cut-offs were determined by aligning the PGS recommendations with the findings of Susetyowati et al. (2025).

That study developed the Quality Eating Index (QEI) through a process involving a literature review, expert consultation, instrument testing, and construct and criterion validation. This process produced consumption thresholds (grams/day) for various food groups based on both the PGS recommendations and actual Indonesian dietary patterns, serving as the foundation for the GDQS-I cutoff modification.

The main difference between the GDQS and GDQS-I lies in the consumption thresholds (cut-offs) for each food group, which were adjusted according to the average dietary intake of the Indonesian population (Table 1). For healthy food groups, such as fruits and vegetables, the recommendations were based on 2–3 servings of fruit and 3–4 servings of vegetables, with one serving equivalent to 100 g (Susetyowati et al., 2025). In the GDQS-I, all types of fruits and vegetables were grouped together rather than classified by type, as the PGS 2014 treats all fruits and vegetables as equivalent in serving size and does not specify intake recommendations by variety.

The refined grains and baked goods group, colored and white roots, and tubers were classified as carbohydrate sources with a total recommendation of 3–4 servings (300–400 g/day). In the GDQS-I calculation, refined grains and baked goods accounted for 50% of the total carbohydrate recommendation, whereas colored and non-colored tubers accounted for 25% each. According to Pusdatin 2021, rice consumption in Indonesia reached approximately 35,8 million tons per year, placing Indonesia as the third-largest country in global domestic rice consumption (KEMENTAN RI, 2021),

The components of fish and shellfish, poultry and game meat, eggs, and red meat were modified based on the animal protein intake recommendation (3–4 servings per day), resulting in the following total consumption ranges per component: fish and seafood, 80–160 g/day; poultry, 80–160 g/day; eggs, 40–60 g/day (approximately one egg); and red meat, 70–140 g/day. Plant-based proteins were divided into two groups: legumes (including tofu and tempeh, 50–110 g/day) and nuts (45–55 g/day) (Susetyowati et al. 2025). Meanwhile, the remaining nine components–whole grains, low-fat dairy, high-fat dairy, processed meat, sweets and ice cream, sugar-sweetened beverages, juice, white roots and tubers,and purchasedddeep-friedd food– retained the original GDQS cut-offs, as no specific national dietary recommendations exist in Indonesia for those food groups.

Result and Discussion

Characteristics of Subjects and Families

Approximately half (59.0%) of the subjects in this study were female, and three-quarters (75.4%) were 13 years old, thus classified as early adolescence. In terms of economic aspects, three-quarters (75.4%) of the participants had a

moderate daily allowance for food and beverages (Rp 10,000–15,000 per day). Approximately half (59.0%) of the adolescents lived with their parents, indicating that nuclear family structures remained predominant. Regarding the family's socioeconomic status, the parents' education levels were mostly at the senior high school or equivalent level (fathers: 39.3%; mothers: 29.5%), with the majority of fathers working as laborers or farmers (59.0%), while most mothers were unemployed or homemakers (90.2%). Nearly three-quarters (73.8%) of the families were of medium size (4–6 members), with an average family income of Rp 1,436,475/capita/month. Overall, these characteristics indicate that most participants came from middle-income families with moderately educated parents and a simple lifestyle, which may influence adolescents' consumption patterns and diet quality.

Table 1. Comparison between GDQS and GDQS-I

Food Group	GDQS Categories of consumed amounts (g/d)				GDQS-I Categories of consumed amounts (g/d)				Point values			
	Low	Medium	High	Very High	Low	Medium	High	Very High	Low	Medium	High	Very High
Healthy Fruits												
Citrus fruits	<24	24–69	>69									
Deep orange fruits	<25	25–123	>123	<200	200-300	>300		0	3	6		
Other fruits	<27	27–107	>107									
Vegetables												
Dark green leafy vegetables	<13	13–37	>37									
Cruciferous vegetables	<13	13–36	>36									
Deep orange vegetables	<9	9–45	>45	<300	300-400	>400		0	2,75	5,5		
Other vegetables	<23	23–114	>114									
Legumes	<9	9–42	>42		<50	50-110	>110		0	2	4	
Colored roots and tubers	<12	12–63	>63		<30	30-37	>37		0	0,25	0,5	
Nuts and seeds	<7	7–13	>13		<45	45-55	>55		0	2	4	
Whole grains	<8	8–13	>13		<8	8–13	>13		0	1	2	
Liquid oils	<2	2–7.5	>7.5		<2	2–7.5	>7.5		0	1	2	
Fish and shellfish	<14	14–71	>71		<80	80-160	>160		0	1	2	
Poultry and game meat	<16	16–44	>44		<80	80-160	>160		0	1	2	
Low fat dairy	<33	33–132	>132		<33	33–132	>132		0	1	2	
Eggs	<6	6–32	>32		<40	40-60	>60		0	1	2	
Unhealthy in excessive amounts												
High fat dairy (in milk	<35	35–142	>142–734	>734	<35	35–142	>142–734	>734	0	1	2	0

equivalents)									
Red meat	<9	9–46	>46	<70	70-140	>140	0	1	0
Unhealthy									
Processed meat	<9	9–30	>30	<9	9–30	>30	2	1	0
Refined grains and baked goods	<7	7–33	>33	<100	100-200	>200	2	1	0
Sweets and ice cream	<13	13–37	>37	<13	13–37	>37	2	1	0
Sugar-sweetened beverages	<57	57–180	>180	<57	57–180	>180	2	1	0
Juice	<36	36–144	>144	<36	36–144	>144	2	1	0
White roots and tubers	<27	27–107	>107	<47	47-58	>58	2	1	0
Purchased deep fried foods	<9	9–45	>45	<9	9–45	>45	2	1	0

Diet Quality based on GDQS and GDQS-I

Diet quality refers to the quality of the food and beverages consumed by an individual. It serves as an indicator to assess dietary intake and eating patterns in relation to established dietary recommendations and consumption guidelines (Sekarini et al., 2022). Good diet quality is a key factor in promoting the health and well-being of adolescents. Assessing diet quality plays an important role in evaluating an individual's eating patterns against recommended dietary guidelines. Assessing diet quality in populations at various stages of nutritional transition is essential, as it provides valuable information on diet-related transitions (Kishino et al., 2024).

In this study, the diet quality of the participants was assessed using the GDQS and GDQS-I methods. Based on the previously modified cut-off points and scoring system, the participants' consumption data were analyzed to generate diet quality scores. The diet quality scores of the participants assessed using the GDQS and GDQS-I are presented in Table 2.

Table 2. Distribution of subjects based on diet quality scores using GDQS and GDQS-I (n=61)

Diet quality	GDQS		GDQS-I		p-value*
	n	%	n	%	
Low risk (≥23)	1	1.6	0	0.0	<0.001**
Moderate risk (<23 and ≥15)	19	31.1	3	4.9	
High risk (<15)	41	67.2	58	95.1	
Mean±SD	13.3±3.4		10.2±2.9		

**Analysis was conducted using the Related-Samples Wilcoxon Signed Rank Test*
***Significance level (p-value) <0.05*.

As shown in Table 2, which presents the distribution of subjects according to diet quality assessed by the two methods GDQS and GDQS-I, the scoring and assessment system of GDQS indicated that nearly three-quarters of the subjects (67.2%) were categorized as high-risk (<15), 31.1% as moderate-risk, and only 1.6% as low-risk (≥23). However, when assessed using the GDQS-I, the proportion of participants classified as high-risk increased sharply to 95.1%, while 4.9% were categorized as moderate-risk, and none were categorized as low-risk, either for malnutrition or for future non-communicable disease (NCD) risk. The mean GDQS-I score (10.2 ± 2.9) was also lower than the global GDQS score (13.3 ± 3.4), indicating that the modified cutoff standards resulted in a lower assessment of dietary quality. The Wilcoxon signed-rank test revealed a significant difference between the two

assessment methods ($p < 0.001$), suggesting that the diet scores obtained from the GDQS and GDQS-I differed significantly. This difference became apparent after adjusting the daily intake cut-offs (gram/day) in the GDQS-I, which were developed based on the Indonesian Balanced Nutrition Guidelines (PGS) 2014 and actual national consumption data.

As national dietary recommendations emphasize increasing the consumption of vegetables, fruits, and protein sources, the GDQS-I assigns lower scores to eating patterns that do not yet meet these recommendations. Based on the study by Arsenault et al. (2025), which validated the GDQS among adolescents aged 10–14 years across four countries (Mexico: n = 2,533; United States: n = 685; China: n = 1,087; and United Kingdom: n = 1,675), as presented in Figure 1, the findings also showed that the GDQS-I produced considerably lower average diet quality scores than the GDQS results, both in Indonesia and in other countries.

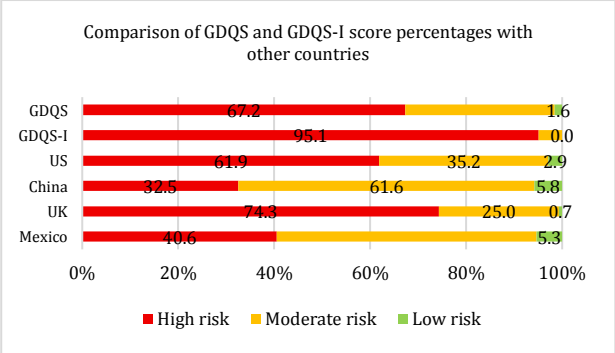

Figure 1. Comparison of GDQS and GDQS-I score percentages with those of other countries.

These findings provide important insights and critical considerations for nutrition and health care practitioners. The lower diet quality scores produced by the GDQS-I compared to the GDQS suggest that the consumption thresholds used may be too high relative to the actual dietary capacity of the Indonesian population. Conversely, the cut-off system in the GDQS was developed through cross-country empirical analyses and statistical performance testing across various low- and middle-income populations, resulting in lower consumption thresholds that more accurately reflect dietary conditions in poorer and developing countries (Bromage et al., 2021).

Therefore, further evaluation is needed to determine whether the cut-off adjustments in the GDQS-I are appropriately aligned with Indonesian dietary habits or whether additional modifications are required to ensure greater relevance and consistency with global diet quality assessment standards. The substantial differences between GDQS and GDQS-I scores not only reflect the distinct standards or cut-offs used but may also be influenced by cultural, socioeconomic, and local food-environment factors that shape preferences and access to key GDQS food groups, such as vegetables, fruits, and protein sources. Dietary patterns in Indonesia remain dominated by the high consumption of carbohydrate-based staple foods (particularly rice) alongside a relatively low intake of vegetables, fruits, and animal-source protein, as reported by the Global Dietary Database and cross-country studies across Asia and Europe (Pries et al., 2025). In contrast, dietary patterns in high-income and developed countries tend to be more diverse and are supported by better access to fresh products, higher protein consumption, and greater daily intake and variety of fruits and vegetables (Giannetti et al., 2023). Cross-cultural comparisons have also shown that traditional Indonesian foods are often high in carbohydrates and fats due to cooking methods that rely heavily on frying, whereas other countries have culinary traditions emphasizing fresh, baked, or steamed foods, which contribute more positively to diet quality (Gaupholm et al., 2023). This is reflected in the GDQS-I scores, in which cut-offs based on Indonesian dietary recommendations resulted in substantially lower overall scores.

Socioeconomic status and family education level also influence purchasing power and nutritional knowledge, affecting the ability to choose healthier foods. Adolescents from families with lower socioeconomic and educational backgrounds tend to have poorer diet quality scores, even when assessed using the same tool (Dewi et al., 2023). This is consistent with the findings of the present study, in which most participants came from middle-income households with moderate parental education and simple lifestyle patterns, contributing to diet quality scores that generally fell within moderate or low categories.

Nutritional Status

Nutritional status refers to the condition resulting from the balance between nutrient intake from food and the body's nutrient

requirements for metabolism. Each individual requires different nutrient intakes depending on factors such as age, sex, physical activity, body weight, and other physiological conditions of the body. Indicators of nutritional status are measurable signs used to describe an individual's nutritional status (KEMENKES RI, 2017).

Nutritional problems among adolescents must be prevented and addressed, as adolescence is a period characterized by increased nutritional needs and vulnerability to nutritional imbalances. Nutritional problems during adolescence can negatively affect nutritional status and lead to long-term health consequences (Norris et al., 2022). The distribution of the subjects based on nutritional status is presented in Table 3.

Table 3. Distribution of subjects based on nutritional status (n= 61)

Nutritional Status (BMI-for-Age)	n	%
Severe undernutrition (Z-Score < –3.0)	1	1.6
Undernutrition (–3.0 < Z-Score < –2.0)	5	8.2
Normal (–2.0 ≤ Z-Score ≤ 1.0)	50	82.0
Overweight (1.0 < Z-Score ≤ 2.0)	3	4.9
Obesity (Z-Score > 2.0)	2	3.3
Mean ± SD	-0.66 ± 1.16	

Among the 61 subjects, the majority had a normal nutritional status, with 50 individuals (82.0%) falling within the Z-score range of –2.0 to ≤1.0. However, 18.0% of the participants were classified as having an abnormal nutritional status, consisting of undernutrition (8.2%), severe undernutrition (1.6%), overweight (4.9%), and obesity (3.3%). This finding indicates that, although most participants had a normal nutritional status, the issue of the double burden of malnutrition remains a matter of concern.

The presence of both undernourished and overnourished subjects may indicate an imbalance in dietary patterns that do not correspond to energy and nutrient requirements, either due to insufficient or excessive intake of food. If left unaddressed, malnutrition and abnormal nutritional status among adolescents may increase the risk of growth disorders, reproductive health problems, weakened immunity, and greater susceptibility to infectious diseases. Moreover, adolescent malnutrition may contribute to decreased cognitive function, poor academic performance and reduced productivity (Al Rahmad et al., 2020; Ranisavljev et al., 2025).

Association Between GDQS and Nutritional Status

Diet quality is a key indicator of how closely an individual's dietary pattern adheres to balanced nutrition guidelines. Good diet quality contributes to better nutritional status, whereas increased consumption of a "non-healthy diet," such as fast food and ultra-processed foods, makes individuals more prone to being overweight or obese (Zheng et al., 2023).

Research conducted in Southeast Asia has shown that the consumption of healthy food groups among adolescents remains suboptimal, highlighting the need to improve overall dietary quality. This finding is consistent with a study conducted in the United Kingdom, which revealed that adolescents with poor diet quality and low physical activity levels, accompanied by a high body mass index (BMI), were at a greater risk of developing nutritional problems (Robinson et al., 2021).

Table 4. Association between diet quality (GDQS and GDQS-I) and nutritional status

Diet Quality	Nutritional status (BMI-for-Age)										p-value*	r
	Severe undernutrition		Under-nutrition		Normal		Overweight		Obesity			
	n	%	n	%	n	%	n	%	n	%		
GDQS												
Low risk	0	0.0	0	0.0	1	1.6	0	0.0	0	0.0		
Moderate risk	0	0.0	2	3.3	16	26.2	1	1.6	0	0.0	0.683	0.053
High risk	1	1.6	3	4.9	33	54.1	2	3.3	2	3.3		
GDQS-I												
Low risk	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.185	0.172

Moderate risk	0	0.0	0	0.0	2	3.3	1	1.6	0	0.0
High risk	1	1.6	5	8.2	48	78.7	2	3.3	2	3.3

Table 4 shows that there was no strong link between the two variables, whether GDQS scores (p = 0.683) or GDQS-I scores (p = 0.185). According to the distribution of subjects, most of the people who were placed in the high-risk group based on both GDQS and GDQS-I scores were actually in the normal nutritional status group (54.1% and 78.7%, respectively). A small proportion of participants were undernourished (4.9–8.2%) or obese (3.3%). These results may be explained by the existence of various factors affecting adolescents' nutritional status, which frequently interact and extend beyond diet quality. These factors include dietary habits and preferences, physical activity levels, nutritional knowledge, and familial and socioeconomic attributes, including family size, parental education, occupation, and income. Household food security is often associated with nutritional outcomes in adolescents. Moreover, environmental factors, including living conditions, school environment, hygiene, and sanitation, can influence the nutritional status of adolescents (Amoadu et al., 2024).

However, the low diet quality seen with both the GDQS and GDQS-I methods shows that most people still had poor diet quality and were at a high risk of malnutrition and future non-communicable diseases (NCDs). This is especially troubling because 18.0% of the participants had an abnormal nutritional status. These results align with those of Nguyen et al. (2023), who examined 1,001 Vietnamese young women aged 16–22 years and found no significant correlation between the GDQS and anthropometric indices (BMI and MUAC). The study identified a significant correlation between diet quality and nutritional status, indicating that each 1-point increase in the GDQS corresponded to a decreased probability of undernutrition (odds ratio [OR] = 0.87; 95% CI: 0.83–0.91). This means that improving your diet is still an important step in maintaining your health and nutrition. Diet quality assessment was based on the Balanced Nutrition Guidelines. These include limiting sugar, salt, and fat intake and recommending a wide variety of food. A good diet not only helps the body function well but also helps maintain a healthy and balanced body (Larruy-García et al., 2024).

The comparison of the methods and diet quality scores between the GDQS and GDQS-I shows that the GDQS was designed as a global diet quality assessment tool. The consumption thresholds for each food group were in accordance with international dietary patterns and recommendations. This makes it ideal for comparing countries, monitoring the world, and examining dietary trends in different groups of people. However, it may not be as effective in countries with specific eating habits. The GDQS-I, on the other hand, is an adapted version that uses consumption cut-offs based on Indonesia's Pedoman Gizi Seimbang (PGS) and national dietary intake data. This makes it more useful for local assessments, program planning, and deciding which interventions to prioritize. The standards used in the GDQS-I were changed to fit the Indonesian diet, which is known for not consuming enough vegetables, fruits, and protein sources. As a result, GDQS-I scores are usually lower and may better show the large difference between what people eat now and what the government says they should eat. This pattern may also suggest that the GDQS-I cut-offs are relatively high, which means that more research is needed to determine whether these standards are still good when compared to global diet quality assessment benchmarks.

This study had several limitations that should be considered in future research. The limited sample size and implementation of non-random sampling may constrain the statistical power and diminish the generalizability of the results to a wider population. The cross-sectional study design also precludes the evaluation of causal relationships or the establishment of a temporal sequence between diet quality and nutritional status. This study lacked biochemical validation and supplementary anthropometric measurements beyond BMI, thereby constraining the thoroughness of the nutritional status evaluation, particularly regarding micronutrient status. Significant confounding variables, including physical activity, socioeconomic status, and living environment, were not entirely controlled for, allowing for the potential influence of additional factors on the observed relationships in this study.

Conclusion

The assessment results using both the GDQS and GDQS-I methods indicated that the majority of participants had a low diet quality, which poses a high risk of both malnutrition and non-communicable diseases (NCDs) in the future. This finding is reflected in the relatively high proportion of participants with abnormal nutritional status. The correlation analysis between diet quality and nutritional status revealed no significant association between these two variables, whether assessed using the GDQS or GDQS-I scores.

The evaluation of diet quality through the modified GDQS-I considers multiple aspects of food consumption and dietary preferences specific to the Indonesian population in its scoring system. Moreover, the GDQS-I has been adapted to align with the Indonesian Dietary Guidelines (PGS), making it more relevant for use in Indonesia. However, this modified scoring matrix yielded considerably lower results than the original GDQS and did not show a significant correlation with nutritional status based on BMI-for-age. Therefore, it can be concluded that the GDQS-I can serve as a screening tool to assess diet quality and potential nutritional risk among Indonesian adolescents. However, further studies are needed to examine its validity and consistency with other nutritional indicators.

Several strategies can be implemented to improve adolescents' diet quality and reduce the risk of nutrition-related problems. These include enhancing nutrition education for adolescents, introducing subsidies or price incentives to make nutritious foods more accessible to low-income families, and implementing more targeted nutrition interventions, such as school-based healthy breakfast programs, nutrition literacy training for parents, the use of digital media for healthy eating promotion, and stricter regulation of advertisements for foods high in sugar, salt, and fat that target adolescents.

References

Al Rahmad, A. H., Miko, A., Labatjo, R., Fajriansyah, F., Fitri, Y., & Suryana, S. (2020). Malnutrition prevalence among toddlers based on family characteristics: A cross-sectional study in the rural and urban areas of Aceh, Indonesia. *Sri Lanka Journal of Child Health, 49*(3), 263. https://doi.org/10.4038/sljch.v49i3.9145

Amalia, N. N., Dieny, F. F., Candra, A., & Nissa, C. (2023). Hubungan daya terima makanan dengan kualitas diet pada santri. *Gizi Indonesia, 46*(1), 43–56. https://doi.org/10.36457/gizindo.v46i1.761

Amoadu, M., Abraham, S. A., Adams, A. K., Akoto-Buabeng, W., Obeng, P., & Hagan, J. E. (2024). Risk factors of malnutrition among in-school children and adolescents in developing countries: A scoping review. *Children, 11*(4), 1–19. https://doi.org/10.3390/children11040476

Androutsos, O., Tsiampalis, T., Kouvari, M., Manou, M., Dimopoulou, M., Georgiou, A., Kosti, R. I., & Charmandari, E. (2023). Assessment of diet quality in children and adolescents with overweight or obesity in Greece. *Children, 10*(7), 1–11. https://doi.org/10.3390/children10071261

Arsenault, J. E., Ali, N. B., Atayde, A. M. P., Batis, C., Becquey, E., Bromage, S., Deitchler, M., Diop, L., Gelli, A., Gutierrez, A. C., Kehoe, S. H., Krishnaveni, G. V., Leonardo, S., Moursi, M., & Nkengfack, B. T. (2025). Development and validation of the Global Diet Quality Score (GDQS) for children 5 to 9 years of age. *Nutrition Reviews, 83*(Supplement_1), 37–49. https://doi.org/10.1093/nutrit/nuae146

Badan Pusat Statistik. (2023). *Statistik Indonesia 2023*. https://www.bps.go.id/publication/2020/04/29/e9011b3155d45d70823c141f/statistik-indonesia-2020.html

Bromage, S., Batis, C., Bhupathiraju, S. N., Fawzi, W. W., Fung, T. T., Li, Y., Deitchler, M., Angulo, E., Birk, N., Castellanos-Gutiérrez, A., He, Y., Fang, Y., Matsuzaki, M., Zhang, Y., Moursi, M., Gicevic, S., Holmes, M. D., Isanaka, S., Kinra, S., … Willett, W. C. (2021). Development and validation of a novel food-based Global Diet Quality Score (GDQS). *The Journal of Nutrition, 151*, 75S–92S. https://doi.org/10.1093/jn/nxab244

Dewi, N. U., Khomsan, A., Dwiriani, C. M., Riyadi, H., Ekayanti, I., Hartini, D. A., & Fadjriyah, R. N. (2023). Factors associated with diet quality among adolescents in a post-

disaster area: A cross-sectional study in Indonesia. *Nutrients, 15*(5), 1–20. https://doi.org/10.3390/nu15051101

Gaupholm, J., Papadopoulos, A., Asif, A., Dodd, W., & Little, M. (2023). The influence of food environments on dietary behaviour and nutrition in Southeast Asia: A systematic scoping review. *Nutrition and Health, 29*(2), 231–253. https://doi.org/10.1177/02601060221112810

Giannetti, A., Pession, A., Bettini, I., Ricci, G., Giannì, G., & Caffarelli, C. (2023). IgE mediated shellfish allergy in children—A review. *Nutrients, 15*(14), 1–16. https://doi.org/10.3390/nu15143112

Intake. (2022). *The Global Diet Quality Score toolkit* (Issue October). Intake – Center for Dietary Assessment at FHI 360.

Intake. (2024). *Country stories that inspire: Motivating GDQS data to action* (Issue October). Intake – Center for Dietary Assessment at FHI 360.

Kementerian Kesehatan Republik Indonesia. (2017). *Bahan ajar gizi: Penilaian status gizi* (Edisi 2017). Kementerian Kesehatan Republik Indonesia.

Kementerian Kesehatan Republik Indonesia. (2023). *Survei Kesehatan Indonesia (SKI) 2023*. Badan Kebijakan Pembangunan Kesehatan, Kementerian Kesehatan Republik Indonesia. https://www.badankebijakan.kemkes.go.id/ski-2023-dalam-angka/

Kementerian Pertanian Republik Indonesia. (2021). *Buletin konsumsi pangan tahun 2021*. Pusat Data dan Sistem Informasi Pertanian, Sekretariat Jenderal Kementerian Pertanian Republik Indonesia. http://epublikasi.setjen.pertanian.go.id/arsip-buletin/53-buletin-konsumsi/772-buku-buletin-konsumsi-pangan-semester-i-2021

Kishino, M., Hida, A., Chadeka, E. A., Inoue, M., Osada-Oka, M., Matsumoto, S., Njenga, S. M., Hamano, S., & Nagi, S. (2024). Association between diet quality and risk of stunting among school-aged children in *Schistosoma mansoni* endemic area of western Kenya: A cross-sectional study. *Tropical Medicine and Health, 52*(1). https://doi.org/10.1186/s41182-023-00566-0

Larruy-García, A., Mahmood, L., Miguel-Berges, M. L., Masip, G., Seral-Cortés, M., De Miguel-Etayo, P., & Moreno, L. A. (2024). Diet quality scores, obesity and metabolic syndrome in children and adolescents: A systematic review and meta-analysis. *Current Obesity Reports, 13*(4). https://doi.org/10.1007/s13679-024-00589-6

Maneschy, I., Jimeno, A., María, M., Berges, L. M., Rupérez, A. I., Daniela, A., Ramiréz, O., Masip, G., & Moreno, L. A. (2024). Eating behaviours and dietary intake in children and adolescents: A systematic review. *Current Nutrition Reports*, 363–376. https://doi.org/10.1007/s13668-024-00544-w

Nguyen, P. H., Tran, L. M., Hoang, N. T., Deitchler, M., Moursi, M., & Bergeron, G. (2023). The Global Diet Quality Score is associated with nutrient adequacy and depression among Vietnamese youths. *Annals of the New York Academy of Sciences, 1528*(1), 48–57. https://doi.org/10.1111/nyas.15053

Norris, S. A., Frongillo, E. A., Black, M. M., Dong, Y., Fall, C., Lampl, M., Liese, A. D., Naguib, M., Prentice, A., Rochat, T., Stephensen, C. B., Tinago, C. B., Ward, K. A., Wrottesley, S. V., & Patton, G. C. (2022). Nutrition in adolescent growth and development. *The Lancet, 399*(10320), 172–184. https://doi.org/10.1016/S0140-6736(21)01590-7

Oy, S., Witjaksono, F., Mustafa, A., Setyobudi, S. I., & Fahmida, U. (2019). Problem nutrients in adolescent girls with anemia versus nonanemic adolescent girls and the optimized food-based recommendations to meet adequacy of these nutrients in adolescent school girls in East Java, Indonesia. *Food and Nutrition Bulletin, 40*(3), 295–307. https://doi.org/10.1177/0379572119851326

Pries, A. M., Feeley, A., & Kupka, R. (2025). Diet quality among older adolescent boys and girls in the Southeast Asia region. *Maternal & Child Nutrition, 21*(2). https://doi.org/10.1111/mcn.13774

Rah, J. H., Melse-Boonstra, A., Agustina, R., van Zutphen, K. G., & Kraemer, K. (2021). The

triple burden of malnutrition among adolescents in Indonesia. *Food and Nutrition Bulletin, 42*(1_suppl), S4–S8. https://doi.org/10.1177/03795721211007114

Ranisavljev, M., Kurniawan, A. L., Ferrero, E., Shinde, S., Zhao, S., Partap, U., Mkwanazi, N., Dah, N. C., Agure, E., Berhane, H. Y., Neumann, C., Alangea, D. O., Liu, S., Ostojic, S. M., Fawzi, W. W., Walsh, F., Bärnighausen, T., Ouédraogo, M., Napon, K., … Laxy, M. (2025). Community-based interventions addressing multiple forms of malnutrition among adolescents in low- and middle-income countries: A scoping review. *Nutrition Journal, 24*(1). https://doi.org/10.1186/s12937-025-01136-2

Robinson, E., Boyland, E., Chisholm, A., Harrold, J., Maloney, N. G., Marty, L., Mead, B. R., Noonan, R., & Hardman, C. A. (2021). Obesity, eating behavior and physical activity during COVID-19 lockdown: A study of UK adults. *Appetite, 156*. https://doi.org/10.1016/j.appet.2020.104853

Said, F. A., Khamis, A. G., Salmin, A. H., Msellem, S. N., Mdachi, K., Noor, R., Leyna, G., & McHau, G. J. (2023). Influence of diet quality on nutritional status of school-aged children and adolescents in Zanzibar, Tanzania. *PLOS ONE, 18*(10), 1–12. https://doi.org/10.1371/journal.pone.0293316

Sekarini, A. G. A., Fitranti, D. Y., Tsani, A. F. A., & Noer, E. R. (2022). Hubungan emotional eating dan kualitas diet dengan kenaikan berat badan pada mahasiswi saat pandemi COVID-19. *Amerta Nutrition, 6*(3), 272–280. https://doi.org/10.20473/amnt.v6i3.2022.272-280

Susetyowati, S., Huriyati, E., Faza, F., Sanubari, N. D. G., & Syauqy, A. (2025). Development of a quality eating index and its relationship with nutritional status in adults. *Journal of Public Health Research, 14*(2). https://doi.org/10.1177/22799036251329420

Wan, L., Jakkilinki, P. D., Singer, M. R., Bradlee, M. L., & Moore, L. L. (2020). A longitudinal study of fruit juice consumption during preschool years and subsequent diet quality and BMI. *BMC Nutrition, 6*(1), 4–11. https://doi.org/10.1186/s40795-020-00347-6

Zheng, X., Wang, H., & Wu, H. (2023). Association between diet quality scores and risk of overweight and obesity in children and adolescents. *BMC Pediatrics, 23*(1), 1–8. https://doi.org/10.1186/s12887-023-03966-7