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Dietary intake and nutritional status among adolescents at SMP Negeri 6 Denpasar

Asupan makanan dan status gizi remaja di SMP Negeri 6 Denpasar

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Abstract

Background: Thinness and excess weight coexist among Indonesian adolescents, highlighting the need for school-level nutritional assessment.
Objectives: To describe dietary intake and nutritional status among students at SMP Negeri 6 Denpasar, Bali.
Methods: In August 2026, this cross-sectional study included 46 of 50 ninth-grade students (92.0%). Anthropometric measurements and World Health Organization BMI-for-age references assessed nutritional status. One 24-hour dietary recall estimated energy and macronutrient intake relative to age- and sex-specific Indonesian allowances (AKG); a study-specific rule classified foods reported on that day.
Results: Participants had a mean age of 13.34 ± 1.09 years; 58.7% were female. Of 46 students, 19.6% were thin, 37.0% had normal nutritional status, 21.7% were overweight, and 21.7% had obesity. Mean reported adequacy was 91.9% for energy, 90.5% for carbohydrate, 67.8% for protein, and 107.2% for fat. Based on the study-specific single-day criteria, 69.6% were classified in the unhealthy dietary category.
Conclusions: Thinness and excess weight coexisted in this school sample, and most students were classified in the unhealthy dietary category on the recalled day. The findings may inform school nutrition assessment but do not characterize habitual intake or adolescents beyond the participating school.

Keywords:
Adolescents, dietary intake, nutritional status, obesity, undernutrition

Abstrak

Latar Belakang: Kondisi kurus dan gizi lebih masih ditemukan secara bersamaan pada remaja Indonesia sehingga diperlukan penilaian gizi pada tingkat sekolah.

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Tujuan: Mendeskripsikan asupan makanan dan status gizi siswa SMP Negeri 6 Denpasar, Bali.
Metode: Penelitian potong lintang ini mencakup 46 dari 50 siswa kelas IX (92,0%) pada Agustus 2026. Pengukuran antropometri dan standar IMT menurut umur WHO digunakan untuk menilai status gizi. Asupan energi dan zat gizi makro diperkirakan melalui satu kali wawancara konsumsi makanan 24 jam dan dibandingkan dengan AKG Indonesia menurut umur dan jenis kelamin. Klasifikasi makanan hari tersebut menggunakan kriteria khusus penelitian.
Hasil: Rata-rata usia 13,34 ± 1,09 tahun; 58,7% perempuan. Sebanyak 19,6% tergolong kurus, 37,0% normal, 21,7% gizi lebih, dan 21,7% obesitas. Rerata persentase kecukupan adalah 91,9% untuk energi, 90,5% karbohidrat, 67,8% protein, dan 107,2% lemak. Berdasarkan kriteria konsumsi satu hari, 69,6% siswa termasuk kategori tidak sehat.
Kesimpulan: Kondisi kurus dan gizi lebih ditemukan bersamaan dalam sampel sekolah ini; sebagian besar siswa masuk kategori konsumsi tidak sehat pada hari pengukuran. Temuan ini dapat mendukung penilaian gizi sekolah, tetapi tidak menggambarkan kebiasaan makan atau populasi remaja yang lebih luas.

Kata Kunci:
Asupan makanan, gizi kurang, obesitas, remaja, status gizi

Introduction

Adolescence is a critical period of growth and development marked by rapid physical, psychological, and behavioral changes (Alderman & Breuner, 2019). During this stage, adequate nutrition is essential to support optimal growth, cognitive development, academic performance, and long-term health outcomes (Nikalansooriya et al., 2025; Parajuli & Prangthip, 2025). Nutrient requirements increase during adolescence because of rapid growth and changes in body composition (Norris et al., 2022; Amrita et al., 2022). Inadequate or imbalanced dietary intake may contribute to malnutrition, including undernutrition, overweight, obesity, and micronutrient deficiencies (Soliman et al., 2022).

Dietary habits among adolescents have changed in many settings (Grace et al., 2021; Kokoszka et al., 2026; Sinai et al., 2021). Urbanization and greater access to energy-dense processed foods may contribute to dietary patterns characterized by excessive consumption of sugar, saturated fats, and ultra-processed foods, alongside inadequate intake of fruits, vegetables, and other nutrient-dense foods (Falak et al., 2025; Hantira et al., 2023). Such changes have been linked to adolescent overweight and obesity, while undernutrition remains prevalent in many low- and middle-income countries, resulting in a double burden of malnutrition (Caleyachetty et al., 2018; Viana et al., 2025).

Previous research in Denpasar has described nutritional concerns among school-aged adolescents. However, local evidence remains limited regarding the concurrent assessment of reported dietary intake and nutritional status among adolescents attending public junior high schools. Existing studies have largely focused on specific dietary behaviors, such as junk food consumption, or on nutritional status and estimated energy requirements, rather than describing actual energy and macronutrient intake together with anthropometric nutritional status (Pradnyana et al., 2026). School-specific data may help characterize local nutritional concerns.

Therefore, this study aimed to describe dietary intake and nutritional status among students at SMP Negeri 6 Denpasar, Bali. These observations may provide context for schools, parents, and public health authorities in designing effective nutrition education and health promotion programs.

Methods

Design Setting

A descriptive cross-sectional study was conducted at SMP Negeri 6 Denpasar, Bali, Indonesia, in August 2026 to characterize students' dietary intake and nutritional status.

Ethical Considerations

The study received approval from the Research Ethics Committee of the Faculty of Medicine, Universitas Udayana, Denpasar, Indonesia (Ethical Clearance No. 2913/UN14.2.2.VII.14/LT/2026; Protocol No. 2026.02.1.1103), dated August 18, 2026. Written informed consent was obtained from parents or legal guardians, and adolescent participants provided informed assent before participation. Participation was voluntary, and participant information was handled confidentially.

Population and Sample

The source population comprised all 50 ninth-grade students enrolled at SMP Negeri 6 Denpasar. All 50 students were invited through total sampling; 46 participated, and four were absent during data collection (three with permission and one because of illness). The participation rate was 92.0%. The final sample comprised the students available during data collection; no formal sample-size calculation was performed.

Research Procedure and Instrument

Trained investigators conducted anthropometric measurements using standardized procedures. Body weight was measured to the nearest 0.1 kg with a calibrated digital scale while participants wore light clothing and no footwear. Height was measured to the nearest 0.1 cm with a portable stadiometer, with participants standing upright and the head positioned in the Frankfurt plane. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2).

Waist circumference was measured with a nonstretchable tape at the midpoint between the lowest palpable rib and the upper border of the iliac crest, with participants standing and the abdomen relaxed. The tape was held horizontally without compressing the skin, and measurements were taken at the end of a normal expiration to the nearest 0.1 cm. Two measurements were obtained, and their mean was used in the analysis.

Nutritional status was classified using the World Health Organization (WHO) BMI-for-age growth reference for individuals aged 5–19 years. BMI-for-age z-scores (BAZ; World Health Organization, n.d.) were used to define severe thinness, thinness, normal nutritional status, overweight, and obesity.

Dietary intake was assessed by trained nutrition personnel through one 24-hour dietary recall interview conducted on a school day. Participants reported all foods and beverages consumed during the preceding 24 hours, including meal times, portions, ingredients, and preparation methods. Household measures and food-portion photographs assisted portion estimation; major ingredients and estimated amounts were recorded for mixed dishes. The recall described consumption on one day, not usual or habitual intake. Energy, carbohydrate, protein, and fat intakes were estimated using the Indonesian Food Composition Tables. Each participant's intake was divided by the age- and sex-specific Indonesian recommended dietary allowance (Angka Kecukupan Gizi [AKG]) under Ministry of Health Regulation No. 28 of 2019 (Kementerian Kesehatan Republik Indonesia, 2019) and multiplied by 100. Individual percentages were then summarized descriptively for the group.

A study-specific operational classification described the foods consumed on the recalled day; it was not a validated dietary quality index or a measure of habitual eating patterns. Intake was classified as "healthy" when the recall included a staple food, at least one protein source, and at least one serving of fruit and/or vegetables. Servings were estimated using the household portions applied during the dietary assessment and converted to grams with the Indonesian Food Composition Tables.

Intake was classified as "unhealthy" when the criteria for the healthy category were not met and the recall included fast foods, fried foods, sugar-sweetened beverages, or ultra-processed snack foods. Ultra-processed foods were identified conceptually using the NOVA classification. When both food categories were represented, classification depended on whether all criteria for the healthy category were fulfilled. These categories describe the recalled day only and should not be interpreted as a measure of habitual dietary behavior.

The principal descriptive variables were energy and macronutrient intake, the study-specific healthy/unhealthy dietary classification, and BMI-for-age nutritional status. Age, sex, body weight, height, waist circumference, and BMI were also recorded.

Data Processing and Analysis

Data were entered and analyzed using IBM SPSS Statistics, version 30. Data completeness and consistency were checked before analysis; no data were missing for the 46 participants. Boxplots were used to screen continuous variables for outliers, and the Shapiro–Wilk test was used to examine normality. Normally distributed variables were summarized as mean ± standard deviation (SD), and nonnormally distributed variables as median and interquartile range (IQR). Categorical variables were presented as frequencies and percentages. Analyses were descriptive; no statistical tests of associations between dietary intake and nutritional status were performed.

Results

Table 1 summarizes participant characteristics and BMI-for-age nutritional status. Thinness and overweight or obesity were both represented in the sample.

Table 1. Participant characteristics and BMI-for-age nutritional status (n = 46)

Characteristic	values
Age (years), mean ± SD	13.34 ± 1.09
Sex, f (%)	
Female	27 (58.7)
Male	19 (41.3)
Body weight (kg), mean ± SD	51.38 ± 9.98
Height (cm), mean ± SD	157.15 ± 7.45
Waist circumference (cm), mean ± SD	71.26 ± 8.85
Body mass index (kg/m²), mean ± SD	20.78 ± 3.58
BMI-for-age classification, n (%)	
Severe thinness (< −3 SD)	0 (0.0)
Thinness (≥ −3 to < −2 SD)	9 (19.6)
Normal (≥ −2 to ≤ +1 SD)	17 (37.0)
Overweight (> +1 to ≤ +2 SD)	10 (21.7)
Obesity (> +2 SD)	10 (21.7)

Table 2. Energy and macronutrient intake and mean adequacy relative to Indonesian AKG

Nutrient	Mean ± SD	Mean adequacy (% AKG)
Energy (kcal/day)	1975.0 ± 650.0	91.9
Carbohydrate (g/day)	285.0 ± 95.0	90.5
Protein (g/day)	45.0 ± 18.0	67.8
Fat (g/day)	78.0 ± 20.0	107.2

Note. AKG = Angka Kecukupan Gizi (Indonesian recommended dietary allowances)

Table 2 summarizes reported energy and macronutrient intake on the recalled day. Mean percentages relative to age- and sex-specific AKG values were below 100% for energy, carbohydrate, and protein and above 100% for fat. These group summaries do not establish the prevalence of individual nutrient inadequacy.

Table 3. Study-specific classification of foods consumed on the recalled day (n = 46)

Category	f	%
Healthy dietary category	14	30.4
Unhealthy dietary category	32	69.6

Of the 46 participants, 32 (69.6%) were classified in the unhealthy category and 14 (30.4%) in the healthy category under the study-specific criteria (Table 3).

Discussion

Thinness and overweight or obesity coexisted in the participating school. Normal nutritional status was observed in 37.0% of participants, whereas 43.4% were overweight or obese and 19.6% were thin. This pattern is consistent with the broader coexistence of undernutrition and excess weight reported among adolescents in Indonesia (Maehara et al., 2019; Agustina et al., 2020; Nurwanti et al., 2019).

The coexistence of thinness and excess weight observed in the present study aligns with reports from other Indonesian adolescent populations, although the proportions differed. Maehara et al. (2019) reported thinness among 5% of girls and 11% of boys, with overweight or obesity in approximately 11% of both sexes. They also reported limited dietary diversity and frequent consumption of unhealthy snacks. In West Java, Agustina et al. (2020) observed thinness in 3.6% and overweight or obesity in 17.0% of school-going adolescent girls. Nurwanti et al. (2019) reported higher overweight/obesity prevalence among urban than rural Indonesian youth aged 10–18 years (17.0% vs. 13.5%). The higher proportion of overweight/obesity in the present sample (43.4%) should not be interpreted as a population-level difference: this study included only 46 students from one school, whereas the comparison studies used different populations and measurement approaches.

The observed proportions were higher than estimates reported in the 2023 Indonesian Health Survey (Survei Kesehatan Indonesia [SKI]) among adolescents aged 13–15 years living in urban areas, in whom approximately 7.7% were classified as thin or severely thin and 18.4% as overweight or obese. Both datasets illustrate the coexistence of undernutrition and excess weight among adolescents; however, the comparison populations and methods differ (Kementerian Kesehatan Republik Indonesia, 2023).

Similar findings were reported by Caleyachetty et al. (2018), who analyzed data from 57 low- and middle-income countries (LMICs)

and found that adolescent malnutrition is increasingly characterized by the coexistence of undernutrition and overnutrition. Their study reported a prevalence of overweight/obesity of 21.4% and highlighted the importance of considering both forms of malnutrition (Caleyachetty et al., 2018). Kaur et al. (2025) also reported thinness and excess weight among adolescents in northern India, alongside dietary quality concerns (Kaur et al., 2025).

Adolescent overweight and obesity have been associated with changes in food environments, diet, and physical activity (Hanandita & Tampubolon, 2015; Yusni & Meutia, 2019). Adolescence represents a critical period for establishing long-term dietary behaviors, and unhealthy eating patterns developed during this stage may increase the risk of obesity and other non-communicable diseases later in life (Pengpid & Peltzer, 2019). At the same time, the presence of underweight adolescents suggests that nutritional inadequacy remains an important public health concern (Hidayanti et al., 2025). Similar observations were reported by Sy et al. (2025) in a nationwide study of Senegalese adolescents, where underweight remained highly prevalent (21.7%) despite the emergence of overweight and obesity (7.7%), illustrating the coexistence of undernutrition and excess weight in that population (Sy et al., 2025).

Dietary assessment revealed that energy intake approached the age-specific Recommended Dietary Allowance (RDA), while carbohydrate intake reached more than 90% of the recommended level. In contrast, protein intake remained substantially below the RDA, whereas fat intake exceeded the recommended value. This pattern indicates a dietary imbalance characterized by relatively high consumption of fat-rich foods and inadequate intake of protein-rich foods. Similar dietary patterns have been reported among adolescents in urban settings, where fried foods, processed snacks, and fast foods are commonly consumed due to their affordability, availability, and palatability. A sustained energy-dense diet may contribute to excess weight, although the present descriptive data cannot test this relationship. Likewise, De Zilva and De Zoysa (2025) reported that many adolescents failed to achieve the recommended servings of major food groups, reflecting suboptimal dietary quality and nutritional adequacy (De Zilva & De Zoysa, 2025). Furthermore, Veronika et al. (2021) found that both energy and protein intake were significantly associated with adolescents' nutritional status, highlighting the importance of adequate macronutrient intake in maintaining healthy growth and nutritional outcomes (Veronika et al., 2021). The mean percentage for protein was below the reference, but individual inadequacy cannot be determined from this single-day group summary.

The single-day classification placed most participants in the unhealthy dietary category . This category was based on foods reported in the 24-hour recall rather than a validated dietary quality score. A single recall cannot establish usual dietary patterns. Previous studies have shown that poor dietary quality during adolescence is associated with increased risk of obesity, micronutrient deficiencies, and adverse health outcomes later in life. Since adolescence is a period of rapid physical and cognitive development, inadequate nutrition may have consequences extending beyond physical health. Katiso et al. (2021) demonstrated that better nutritional status, reflected by higher BMI-for-age z-scores, was associated with improved academic performance among secondary school students in Ethiopia (Katiso et al., 2021).

The use of BMI-for-age z-scores (BAZ) provides appropriate age- and sex-specific nutritional status categories. Recent evidence from India demonstrated substantial discrepancies between classifications based on adult BMI cut-offs and WHO BAZ references, with BMI classifications frequently underestimating nutritional status among adolescents. Jaleel et al. (2024) reported that nearly one-third of adolescents were misclassified when adult BMI cut-offs were used instead of age- and sex-specific BAZ categories. WHO growth references are therefore appropriate for assessing both undernutrition and excess weight in this age group (Jaleel et al., 2024).

The concurrent distribution of nutrition status categories and reported foods suggests that further school-level nutrition assessment may be useful. Schools represent a strategic setting for nutrition interventions because dietary habits established during this period often persist into adulthood. Educational programs focusing on balanced nutrition, healthy food selection, and reduction of high-fat processed foods may contribute to improved dietary quality and better nutritional outcomes among adolescents. Given

the high proportion classified in the unhealthy category on the recalled day, school-based nutrition education, healthy canteen policies, and parental involvement should be considered as potential strategies to improve adolescent nutritional health (Chatterjee & Nirgude, 2024; Samad et al., 2024). These strategies remain potential responses rather than interventions evaluated by this study, as its cross-sectional descriptive design does not allow assessment of intervention effectiveness or causal effects on nutritional outcomes.

These findings have several limitations. The cross-sectional design provides a single descriptive snapshot and cannot establish temporal or causal relationships. The sample was small and restricted to one public junior high school, limiting generalizability. Although 46 of 50 ninth-grade students participated, the absence of four students may have introduced nonresponse bias.

Dietary intake was assessed through a single 24-hour recall on a school day. Day-to-day variation, recall error, social desirability, and imprecision in portion-size estimates may affect the measurements. The study-specific dietary classification was not externally validated and reflects only foods reported on that day. Potentially relevant characteristics, including physical activity, socioeconomic circumstances, and parental factors, were not assessed. These limitations restrict interpretation to the participating students. Future studies could include more schools, repeated nonconsecutive recalls, and additional behavioral and socioeconomic measures.

Conclusion

Thinness coexisted with overweight and obesity among participating students at SMP Negeri 6 Denpasar. Most students were classified in the unhealthy dietary category using study-specific criteria applied to a single recalled day. These descriptive findings do not establish habitual dietary patterns or associations between diet and nutritional status.

School-level assessment and nutrition education may be considered, while larger studies with repeated dietary measurements are needed to guide broader recommendations.

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