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Nutritional Status and Food Preference Differences Among Primary School Students in Karangasem, Bali

Mellysa Kowara[12]*, I Putu Suiraoka[3], Yessi Crosita Octaria[4], Eny Kurnia Sari[5], Agnes A Malipu[5], Hera Nurlita[6]

[1]*PUI IPTEKS Center for Public Health Innovation (CPHI), Universitas Udayana, Indonesia*
[2] *School of Public Health, Faculty of Medicine, Universitas Udayana, Indonesia*
[3]*Poltekkes Kemenkes Denpasar, Indonesia*
[4]*Department of Nutrition, UPN Veteran Jakarta, Indonesia*
[5] *Global Alliance for Improved Nutrition (GAIN), Indonesia*
[6]*Ministry of Health of the Republic of Indonesia*
**Correspondence Author: mellysa.kowara@gmail.com*

Abstract

Nutritional status during primary school age is essential for optimal physical growth and cognitive development. Dietary transitions driven by modernization—including increased consumption of fast foods and sweetened beverages—may reduce the intake of nutrient-dense foods. This study aimed to describe the nutritional status and food preferences of students at SDN 2 Besakih, Karangasem, Bali. A cross-sectional study was conducted. Anthropometric measurements were obtained from all students present (n = 211) and assessed using BMI-for-age and height-for-age indicators based on WHO AnthroPlus standards. Food preference data were collected from 72 students selected through stratified sampling using a pictorial Likert-scale questionnaire. Data were analysed using univariate, bivariate, and multifactorial tests. Most students exhibited normal nutritional status, although both undernutrition and overnutrition were present. The leftward shift in BMI-for-age and height-for-age z-score curves indicated vulnerability to undernutrition and stunting. Female students demonstrated significantly higher preference scores for chicken dishes (p = 0.003) and milk-based or sweetened beverages (p = 0.009). Grade level influenced preferences for chicken dishes and beverages, with no significant interaction between gender and grade. Vegetable preference was relatively low across all groups. Primary school children in rural Karangasem face a double burden of malnutrition accompanied by shifting dietary preferences toward less balanced food choices. Strengthening school-based nutrition interventions, including nutrition education, healthy canteen programs, and routine growth monitoring, is critical to fostering healthy dietary habits early in life.

Keywords: school-aged children, nutritional status, food preferences

INTRODUCTION

The nutritional status of primary school–aged children (six to twelve years) is crucial for supporting optimal physical growth, cognitive development, learning capacity, and immune function.(1) At this stage, children require adequate, balanced, and diverse nutrient intake to sustain daily activities and prevent developmental impairments. Nutritional deficiencies during this period may hinder physical growth, reduce academic performance, and increase vulnerability to infectious and chronic diseases later in life. Conversely, excessive nutrient intake can contribute to obesity and elevate the risk of non-communicable diseases during adolescence and adulthood.(2) According to the 2023 Indonesian Health Survey (SKI), nutritional problems among school-aged children in Bali remain concerning. The prevalence of severe thinness and thinness among children aged five to twelve years was 2.6% and 3.6%, respectively, while the prevalence of overweight and obesity reached 14.9% and 11.8%.(3) These figures highlight the persistent double burden of malnutrition in this age group. Karangasem District is among the areas in Bali with notable nutritional challenges, reflected in a stunting prevalence of

13% and an underweight prevalence of 10.8%.(4)

Food preference and eating habits are key factors influencing the nutritional status of school-aged children. These behaviours do not develop in isolation; they are shaped by the family food environment, cultural eating norms, and broader dietary trends. Modernization has increasingly exposed children to fast foods, processed snacks, and sweetened beverages, potentially displacing traditional foods that are richer in fibre, vitamins, and protein.(5) Easy access to snacks and sugary drinks around schools may further reduce consumption of balanced foods such as fruits, vegetables, and protein-rich dishes.(6)

This situation is concerning because dietary habits formed during childhood tend to persist into adolescence and adulthood. When these habits are unhealthy, the risks of undernutrition, overnutrition, and stunting increase. Understanding children's food preferences is therefore essential for identifying emerging dietary patterns and their implications for nutritional status. Early identification is important because dietary behaviours established in middle childhood can influence long-term health trajectories.(7)

SDN 2 Besakih, located in a remote high-altitude area of Karangasem District, warrants particular attention within this context. Although district-level data indicate persistent nutritional challenges, school-specific assessments in this region remain scarce. SDN 2 Besakih was selected for this study because it has the largest student population among schools in the high-altitude Besakih area, making it a strategic and representative site for assessing the nutritional situation and dietary behaviours of children in this setting. Research on the nutritional status and food preferences of students at SDN 2 Besakih is therefore essential to generate baseline evidence that can inform school-based nutrition interventions, such as nutrition education and healthy canteen initiatives, to support ongoing child nutrition improvement efforts in Karangasem District.

METHODS

This study employed a quantitative analytical cross-sectional design to assess the nutritional status and food preferences of primary school students and to examine differences across gender and grade level. The research was conducted at SDN 2 Besakih in Karangasem District, Bali. The school is located in a remote rural highland area with limited accessibility, making it an important setting for examining nutritional conditions and dietary behaviours among children living in potentially vulnerable environments. The study population comprised all students enrolled in Grades 1 to 6 (N = 233). Informed assent was obtained from the parents or guardians of students selected to participate. Anthropometric measurements and food preference data collection were conducted in November 2024.

A. Anthropometric Assessment of Nutritional Status

Anthropometric measurements were conducted using a total sampling approach, whereby all students present on the day of data collection were included (n = 211). Body weight was measured using a digital scale, and height was measured using a microtoise; all equipment was calibrated prior to use. Measurements were performed by trained nutrition undergraduate stu-

dents who had completed instruction on research ethics and standardized measurement procedures to ensure data quality. Supervision was provided by nutrition lecturers and members of the research team.

The anthropometric data were analysed using Body Mass Index-for-Age (BMI-for-Age) and Height-for-Age (HFA) indicators based on the WHO AnthroPlus reference for children and adolescents aged 5 to 19 years.(8)

B. Student Food Preference Survey

The sample size for the food preference survey was calculated using a finite population sampling formula ($\alpha = 0.05$) based on the total number of enrolled students.

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}}$$

A final sample of 72 students was obtained, including an additional 5% to account for possible non-response, incomplete questionnaires, or student absenteeism. Stratified equal allocation was used to distribute the sample across grade levels, resulting in 12 students selected from each grade.

Food preference data were collected using a picture-based questionnaire that included food groups such as staple foods, animal-source protein, plant-based protein, vegetables, and fruits. Students rated their liking for each food item by shading star symbols corresponding to five categories: “like very much” (5 stars), “like” (4 stars), “neutral” (3 stars), “dislike” (2 stars), and “dislike very much” (1 star).

For students in Grades 1 to 3, the questionnaire was administered through assisted interviews conducted by the research team, as many younger children were not yet fully proficient in reading. Students in Grades 4 to 6 completed the questionnaire independently under the supervision of the researchers, with clarification provided when needed.

Data analysis included univariate, bivariate, and multifactorial statistical approaches. Univariate analysis was used to describe the distribution of nutritional status and eating behaviours. Bivariate analyses were performed using the Chi-square test to assess associations between gender and categorical dietary or hygiene practices. Additionally, a multifactorial (two-way) ANOVA was used to examine differences in food preference scores by gender and grade level and to identify potential interaction effects. These analytical procedures provided a comprehensive understanding of the nutritional profile and food preference patterns of the students.

This study received ethical approval from the Ethics Committee of the Faculty of Medicine, Universitas Udayana (Approval No. 2394/UN14.2.2.VII.14/LT/2024), issued on 7 October 2024.

RESULTS

Respondents Characteristics

A total of 211 school-aged children participated in this study. Their demographic characteristics are presented in Table 1. The age distribution was nearly equal: 105 children (49.76%) were in the 6

–9-year age group, and 106 children (50.24%) were in the 10–12-year group. Slightly more than half of the participants were male (110 children, 52.13%), while females comprised 101 children (47.87%).

Participants were enrolled across six grade levels. The largest proportion was in sixth grade (45 children, 21.33%), while first grade had the smallest proportion (20 children, 9.48%). The distribution across second to fifth grades ranged between 14.22% and 18.48%.

Table 1. Demographic characteristics of elementary school students

Characteristics	Frequency	Percentage (%)
Age Group		
6-9 years	105	49.76
10-12 years	106	50.24
Sex		
Male	110	52.13
Female	101	47.87
Class/Grade		
First	20	9.48
Second	30	14.22
Third	39	18.48
Fourth	38	18.01
Fifth	39	18.48
Sixth	45	21.33
Total	211	100

Nutritional Status Based on BMI-for Age

Table 2 presents the nutritional status of participants by class grade as assessed using the BMI-for-Age index. Across all grade levels, the majority of students were classified within the normal nutritional status category, with proportions ranging from 60.00% in sixth grade to 79.49% in both third and fifth grades. However, indicators of both undernutrition (severe malnutrition and underweight) and overnutrition (overweight and obesity) were observed.

Undernutrition was most common in first grade (15.00% underweight) and sixth grade (22.22% underweight). Sixth grade also exhibited the highest proportion of severe malnutrition (13.33%). In contrast, the lowest prevalence of underweight was found in second grade (6.67%) and third grade (5.13%).

Overnutrition (overweight plus obesity) was most prominent in the fifth grade (15.38%), first grade (15.00%), and second grade (16.66%). Sixth grade showed the lowest prevalence of overnutrition (4.44%).

Table 2. Nutritional status based on BMI-for-Age by grade level

Nutritional Status (BMI-for-Age)	Frequency	Percentage (%)
First Grade		
Severe malnutrition	0	0.00
Underweight	3	15.00
Normal	14	70.00
Overweight	3	15.00
Obesity	0	0.00
Second Grade		
Severe malnutrition	1	3.33
Underweight	2	6.67
Normal	22	73.33
Overweight	4	13.33
Obesity	1	3.33
Third Grade		
Severe malnutrition	1	2.56
Underweight	2	5.13
Normal	31	79.49
Overweight	3	7.69
Obesity	2	5.13
Fourth Grade		
Severe malnutrition	2	5.26
Underweight	4	10.53
Normal	29	76.32
Overweight	2	5.26
Obesity	1	2.63
Fifth Grade		
Severe malnutrition	1	2.56
Underweight	1	2.56
Normal	31	79.49
Overweight	3	7.69
Obesity	3	7.69
Sixth Grade		
Severe malnutrition	6	13.33
Underweight	10	22.22
Normal	27	60.00
Overweight	2	4.44
Obesity	0	0.00
Respondent total	211	100

Figure 1 illustrates the distribution of BMI-for-Age z-scores. The curve representing the study population (red) is shifted to the left of the WHO reference curve (green), indicating that a substantial proportion of students have BMI-for-age values below the reference population mean. This shift suggests a higher concentration of children in underweight and mildly wasted categories.

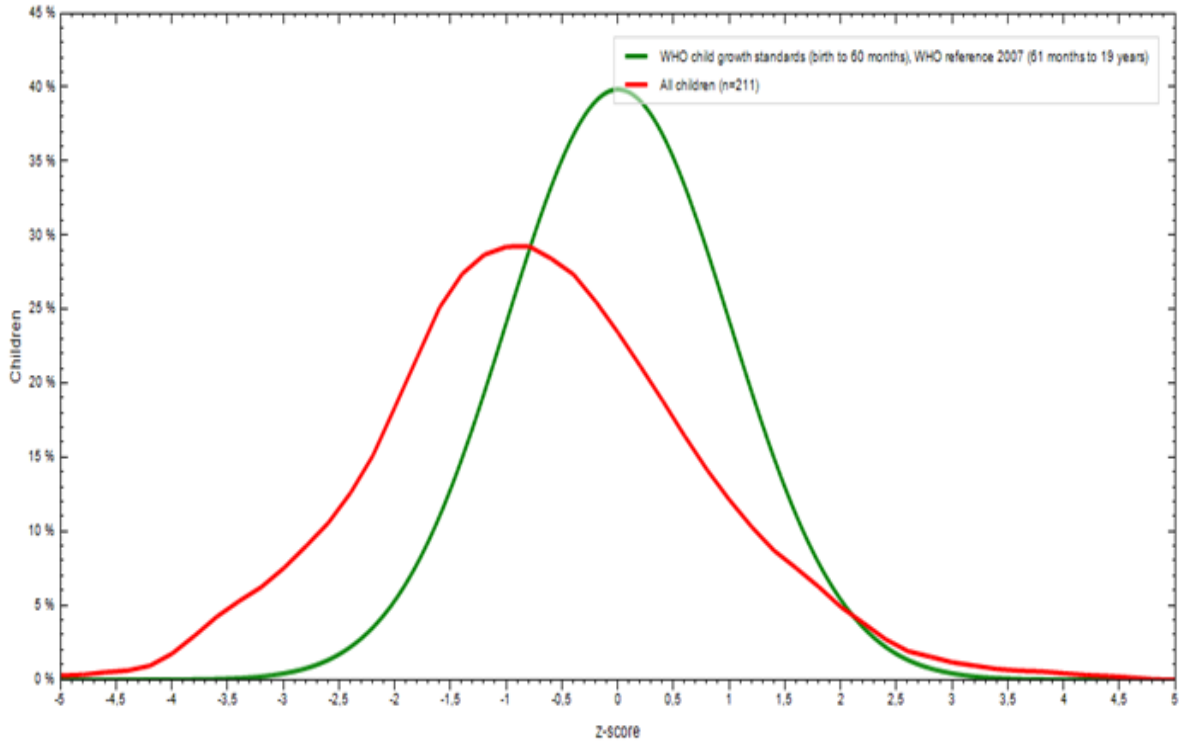

Figure 1. BMI-for-Age (BMI/A) z-score distribution curve

Nutritional Status Based on Height-for-Age

Table 3 summarizes the chronic nutritional status of participants as measured by height-for-age. Most students fell into the normal height-for-age category, although the proportion varied notably across grades, from 64.10% in third grade to 93.33% in second grade. No students were classified as tall or above average height.

Stunting (stunted and severely stunted combined) was evident in several grades. The highest prevalence was found in first grade (40.00%) and third grade (35.90%). Severe stunting occurred only in third grade (5.13%) and sixth grade (2.27%). The lowest prevalence of stunting was recorded in second grade (6.67%) and fourth grade (7.89%). Overall, these findings suggest substantial variation in chronic growth faltering across grade levels, with younger and intermediate grades experiencing the highest burden.

Table 3. Nutritional status based on Height-for-Age

Nutritional Status (Height-for-Age)	Frequency	Percentage (%)
First Grade		
Severely stunted	0	0
Stunted	8	40
Normal height-for-age	12	60
Tall/ above average height	0	0
Second Grade		
Severely stunted	0	0
Stunted	2	6.67
Normal height-for-age	28	93.33
Tall/ above average height	0	0
Third Grade		
Severely stunted	2	5.13
Stunted	12	30.77
Normal height-for-age	25	64.10
Tall/ above average height	0	0.00
Fourth Grade		
Severely stunted	0	0.00
Stunted	3	7.89
Normal height-for-age	35	92.11
Tall/ above average height	0	0.00
Fifth Grade		
Severely stunted	0	0.00
Stunted	4	10.26
Normal height-for-age	35	89.74
Tall/ above average height	0	0.00
Sixth Grade		
Severely stunted	1	2.27
Stunted	4	9.09
Normal height-for-age	40	90.91
Tall/ above average height	0	0.00
Respondent total	211	100

Figure 2 depicts the Height-for-Age z-score distribution. Similar to the BMI-for-Age pattern, the study population curve (red) is markedly shifted to the left of the WHO reference curve (green), indicating a high prevalence of chronic undernutrition or stunting within the school population.

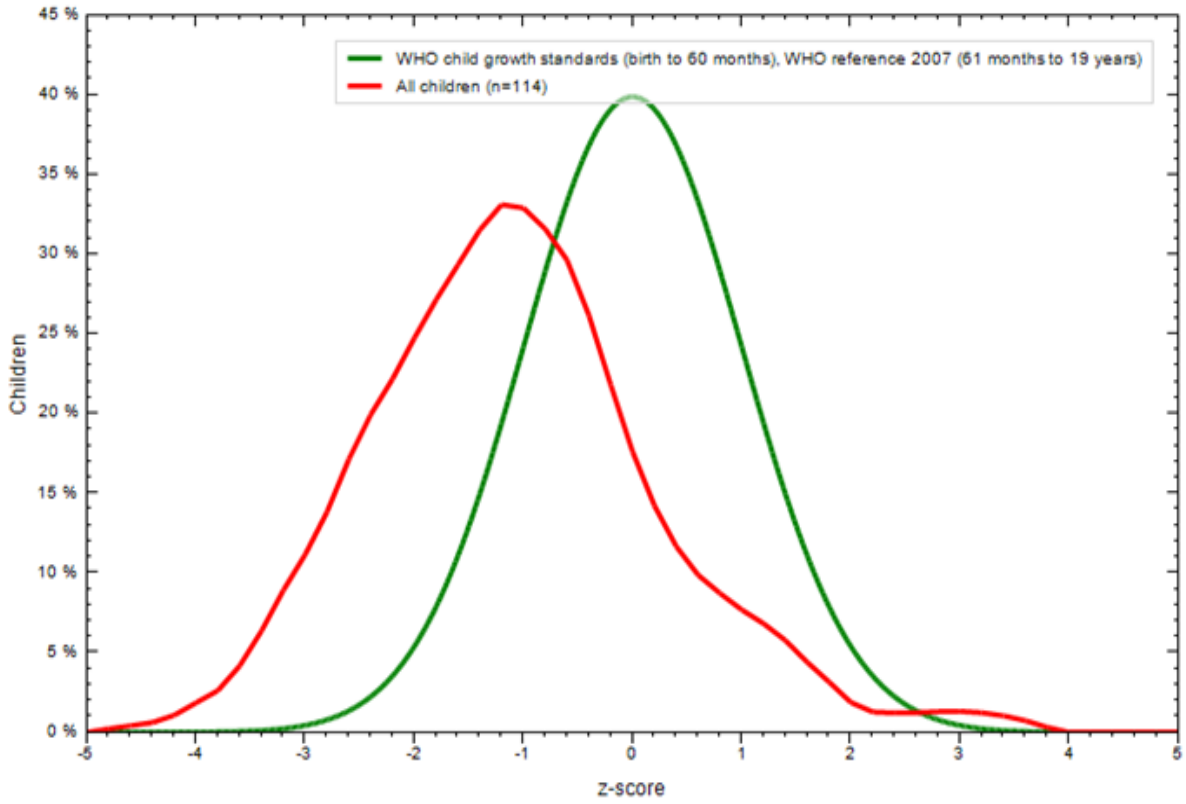

Figure 2. Height-for-Age z-scores

Eating and Hygiene Habits of Elementary School Students

The results of the Chi-square analysis comparing dietary and hygiene habits between male and female students are presented in Table 4. Overall, no statistically significant differences were found across any of the assessed variables, as all p-values exceeded the 0.05 threshold.

With regard to dietary habits, a slightly higher proportion of female students reported having food allergies (54.55%) compared with males (45.45%), although this difference was not statistically significant ($p = 0.966$). Meal completion habits were similar across genders, with most students, 46.15% of males and 53.85% of females, reporting that they always finished their meals ($p = 0.868$).

Breakfast practices also showed comparable patterns between groups. Although a higher proportion of females (57.14%) reported consistently eating breakfast compared with males (42.86%), this difference was not significant ($p = 0.459$). Both boys (61.90%) and girls (67.74%) reported consuming balanced foods for breakfast, and no significant difference was noted in breakfast frequency ($p = 0.322$).

In terms of hygiene, both groups demonstrated excellent behaviours. Nearly all males (96.97%) and females (94.87%) stated that they always washed their hands ($p = 0.657$), indicating strong adherence to basic hygiene practices across the student population.

Table 4. Eating and hygiene habits of elementary school students

Characteristics	Criteria	Gender		P-value
		Male	Female	
Food allergy	Yes	10 (45.45)	12 (54.55)	0.966
	No	23 (46.00)	27 (54.00)	
Habit of finishing meals	Always	30 (46.15)	35 (53.85)	0.868
	Sometimes	3 (42.86)	4 (57.15)	
Habit of breakfast	Always	21 (42.86)	28 (57.14)	0.459
	Sometimes	12 (52.17)	11 (47.83)	
Type of breakfast	Unbalanced foods	8 (38.10)	10 (32.26)	0.664
	Balanced foods	13 (61.90)	21 (67.74)	
Frequency of breakfast	Always	12 (57.14)	12 (42.86)	0.322
	Sometimes	9 (42.86)	16 (57.14)	
Habit of washing hands	Always	32 (96.97)	37 (94.87)	0.657
	Sometimes	(3.03)	2 (5.113)	

Food Preferences of Elementary School Students

Table 5 presents the mean food preference scores across four food categories by gender and grade level, along with the results of a two-way ANOVA. A significant main effect of gender was observed for preferences toward chicken dishes ($p = 0.003$) and milk beverages ($p = 0.009$), with female students consistently reporting higher preference scores across grade groups.

Grade level also had a significant effect on preference for chicken dishes ($p = 0.009$) and milk beverages ($p = 0.016$), suggesting that these preferences shift as children advance in school. In contrast, preferences for full meal dishes ($p = 0.766$ for gender; $p = 0.141$ for grade) and vegetable dishes ($p = 0.142$ for gender; $p = 0.096$ for grade) showed no significant variation across gender or grade level.

Importantly, no significant interaction effects were found between gender and grade for any of the food categories ($p > 0.10$). This indicates that although boys and girls differed in certain preference categories, the overall pattern of changes across grade levels was similar for both sexes.

Table 5. Food preferences by gender and grade

Food Preference Category	Gender	Grade 1-2 ($\bar{x}$±SD)	Grade 3-4 ($\bar{x}$±SD)	Grade 5-6 ($\bar{x}$±SD)	P-value (Gender)	P-value (Grade)	P-value (Gender x Grade)
Chicken dishes	Male	4.40 ± 0.66	3.70 ± 0.71	3.76 ± 0.75	0.003*	0.009*	0.415
	Female	4.62 ± 0.67	4.12 ± 0.70	4.47 ± 0.75			
Full meal dishes	Male	4.30 ± 0.29	3.78 ± 0.99	3.82 ± 0.98	0.766	0.141	0.103
	Female	3.89 ± 1.08	4.37 ± 0.90	3,45 ± 0.23			
Vegetable dishes	Male	4.00 ± 1.04	3.83 ± 1.17	3.00 ± 1.24	0.142	0.096	0.196
	Female	3.61 ± 1.23	2.83 ± 1.16	3.20 ± 0.29			
Milk beverages	Male	4.70 ± 0.73	4.67 ± 0.75	3.86 ± 1.00	0.009*	0.016*	0.323
	Female	5.00 ± 0.76	4.93 ± 0.82	4.70 ± 0.96			

To support the statistical findings, a graphical illustration of mean food preference scores by gender and grade level was generated. As shown in Figure 3, females consistently demonstrated higher preferences for more palatable items, particularly chicken dishes and sweetened beverages, across grade groups. Despite these differences in magnitude, the overall trends across grades were parallel for both genders, reinforcing the absence of significant interaction effects in the two-way ANOVA.

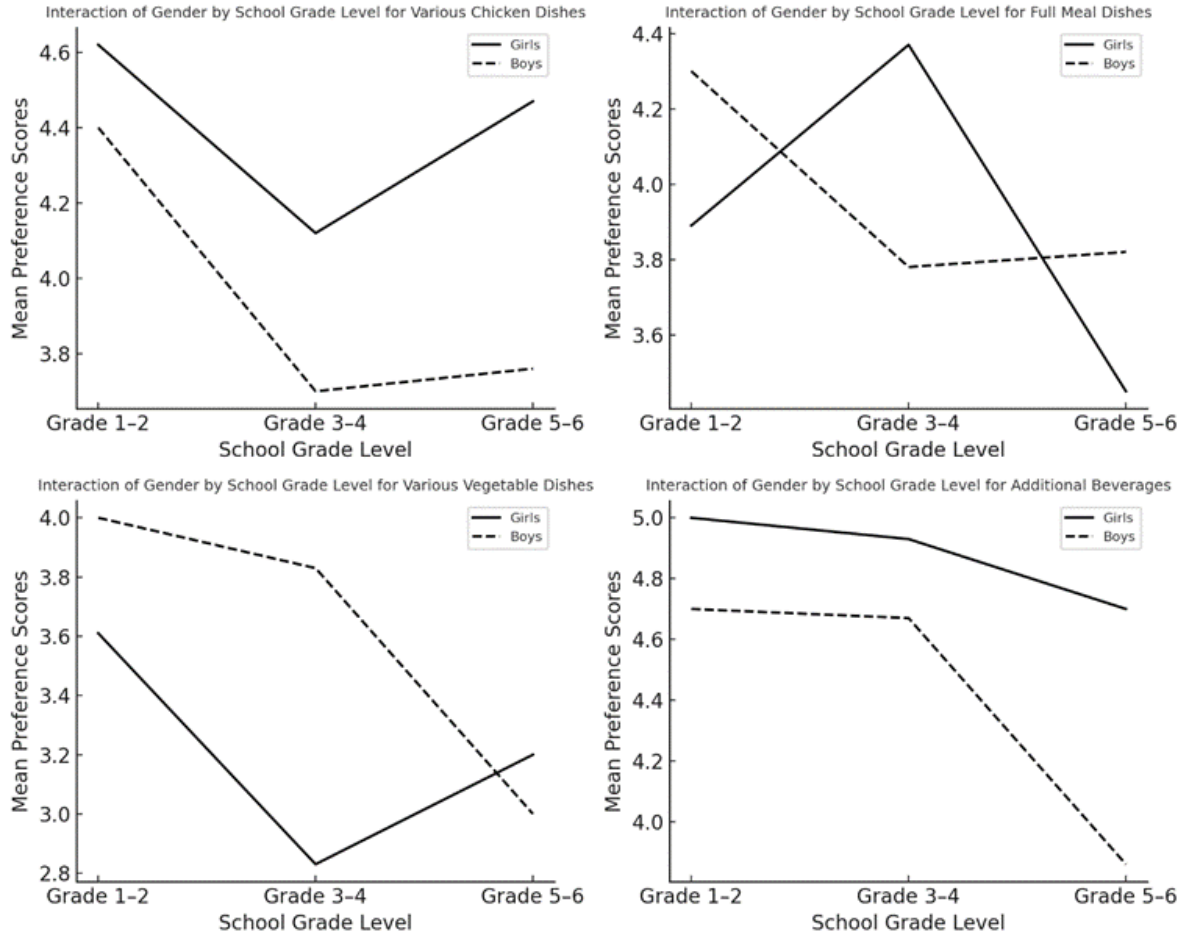

Figure 3. Food preferences based on gender and grade

DISCUSSION

This study examined the nutritional status and food preferences of primary school children in Karangasem, Bali, and revealed a clear manifestation of the double burden of malnutrition, with both undernutrition and overnutrition occurring within the same population. The leftward shift of both BMI-for-age and height-for-age z-score curves relative to the WHO growth reference indicates that undernutrition, particularly growth faltering, remains a critical challenge in this setting. These findings are consistent with national patterns, which continue to demonstrate the coexistence of undernutrition and rising overweight among Indonesian children.(3)

According to the 2023 Indonesian Nutritional Status Survey (SKI), nutritional problems among children aged 5–12 years remain widespread, with a stunting prevalence of 14.1 percent and severe stunting at 4.6 percent. In addition, 3.5 percent of children were categorized as severely thin and 7.5 percent as thin, while overweight and obesity affected 11.9 percent and 7.8 percent, respectively.(3) These trends corroborate earlier findings by Rachmi et al.

(2016), who reported a simultaneous decline in stunting and underweight accompanied by an increase in overweight and obesity among Indonesian children aged 2.0–4.9 years—an early indicator of the country's ongoing nutrition transition.(9) Additional evidence among school-aged children further highlights the persistent prevalence of stunting, thinness, and micronutrient deficiencies.(10)

At the same time, this study found that a substantial proportion of students were overweight or obese, particularly in the younger grades. This pattern aligns with growing exposure to energy-dense, nutrient-poor foods among Indonesian children. The progressive shift from traditional, minimally processed foods to modern convenience items, including sweetened beverages, packaged snacks, and fast foods, has been widely recognized as a key driver of excessive weight gain in this age group. (11) These dietary shifts underline the need to strengthen school-based nutrition promotion, focusing on building healthy eating habits from early childhood.(12–14)

he assessment of food preferences revealed distinct behavioural patterns. Female students consistently demonstrated higher preference scores for chicken dishes and milk-based beverages than males. These findings echo previous studies suggesting that gender differences in taste preferences and food choices may emerge early, influenced by sociocultural expectations, household feeding practices, and individual taste sensitivities.(15) The significant grade-level effects observed for chicken dishes and beverages further suggest that children's flavour preferences and food choices evolve with age, possibly reflecting increasing autonomy, changing exposure, and expanding food environments.(16) The absence of gender–grade interaction effects indicates that, although boys and girls differ in overall preference levels, their developmental patterns of change across grades follow similar trajectories.

In contrast, preferences for vegetables and full-meal dishes did not vary significantly by gender or grade. This could reflect a generally moderate acceptance of these food categories or may signal limited exposure to diverse vegetables and balanced meals in both home and school environments.(17) The Indonesian Health Survey (SKI) 2023 reported that 11.8 percent of the population did not consume fruits and vegetables, with limited availability and high perceived cost being the most common reasons (61.8 percent).(3) Previous studies among Indonesian schoolchildren similarly highlight low vegetable intake, often driven by limited access, insufficient nutrition education, and a preference for fried or highly palatable energy-dense foods. The low preference for vegetables identified in this study reinforces the need to expand nutrition education and improve access to appealing, nutritious foods in the school setting.(18)

Hygiene practices, particularly handwashing, were generally strong among the students. These findings are consistent with community-based evidence showing that targeted school interventions can substantially improve knowledge, attitudes, and handwashing behaviours in Indonesian children.(19) Breakfast habits, however, were more variable, with a portion of students reporting inconsistent breakfast consumption. This is concerning, as skipping breakfast has been linked to reduced cognitive performance, lower energy availability, poor attention, and decreased academic achievement among school-aged children. (20)

Taken together, the study findings highlight the multifaceted nature of nutrition challenges among primary school children in this rural setting. Nutritional vulnerabilities, including undernutrition and emerging diet-related overnutrition, are intertwined with shifting dietary preferences and behavioural patterns that evolve across childhood. Although the study was limited by its cross-sectional design, reliance on self-reported data, and focus on a single school, the trends observed are broadly aligned with regional and national evidence. These results emphasize middle childhood as a critical window during which dietary habits, food preferences, and long-term nutrition trajectories are shaped,

ultimately influencing health outcomes throughout the life course.(1)

CONCLUSION

This study demonstrated the concurrent presence of undernutrition and emerging diet-related overnutrition among primary school children in Karangasem, Bali, and highlighted notable variations in food preferences across gender and grade levels. The leftward shift of BMI-for-age curves indicated that growth-related nutritional problems remain widespread in this population. Moreover, students' stronger preference for animal-source foods and sweetened beverages, coupled with their relatively low preference for vegetables, suggests an ongoing shift toward less balanced dietary patterns. Although hygiene practices, particularly handwashing, were generally strong, inconsistent breakfast habits point to behavioural gaps that may influence both learning performance and nutritional well-being.

Collectively, these findings underscore the critical need to reinforce nutrition education, foster supportive and balanced food environments within schools, and strengthen the role of parents and teachers in cultivating healthy dietary behaviours during middle childhood. Enhancing school-based programmes, such as structured nutrition education, healthy canteen initiatives, and routine growth monitoring, will be essential for tackling both undernutrition and the growing risk of excess weight, ultimately supporting children in achieving healthy growth and improved long-term health outcomes.

STUDY LIMITATION

This study has several limitations that should be acknowledged. First, food preference data were self-reported, making them susceptible to recall bias and social desirability bias. Second, the cross-sectional design limits the ability to establish causal relationships between dietary preferences and nutritional status. Third, key determinants of child nutrition, including morbidity history, recent illness, dietary intake patterns, household food security, parental education, and socioeconomic status, were not assessed in this study, although they may contribute significantly to the nutritional outcomes observed.

Fourth, data were collected from a single rural primary school, and the sample size for the food preference survey was relatively small, which may restrict the generalizability of the findings to other schools or regions in Karangasem District. Future research involving larger and more diverse samples, along with more comprehensive assessments of dietary and sociodemographic factors, would provide a deeper understanding of the determinants of child nutrition in similar settings.

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