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Ethnicity, physical activity, and the dietary intake of boarding high school students: A photovoice mixed method study

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Abstract

This study explores the dietary intake of female students and its associated factors to understand their meal experiences in a boarding high school setting through a photovoice study. A mixed-methods study included 60 students in paper-and-pencil assessment and 8 students in photovoice activities. The nutritionist measured the anthropometrics and trained the students to keep multiple 24-hour food records. A linear regression model was used to examine the associations and was complemented by a thematic analysis of the story from the produced photos. The result shows most students were at normal weight, and overnutrition was 26.7%. The mean of students' total energy, protein, fat, and carbohydrate intake was 1182 kcal, 38.7 g, 64.2 g, and 141.7 g, respectively, lower than national recommendations. Ethnicity and physical activity were found to be associated with students' dietary intake. In the photovoice study, 14 photos were produced, and six major themes emerged during focus group discussions. Sundanese and less physically active students tended to have higher dietary intakes. To conclude, students were aware of food shortages at school and made efforts to supplement their meals, but appropriate food choices were not made. It is necessary for schools to address students' meal preferences on school menus, promote healthy food, and provide practical nutritional information.

Keywords: Dietary intake, Ethnicity, Female student, High school, Photovoice, Physical activity.

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1. Introduction

Nowadays, overnutrition is prevalent in all age groups worldwide [1-3]. Adolescents are included, with an increase in prevalence of overweight, obesity, and nutritional issues [3-6]. Of the diet-related health risks, overweight was highlighted as responsible for 5.02 million deaths and 160 million disability-adjusted life years (DALYs) in 2019 [7]. Underweight still exists among adolescents but is improving, with a trend toward overnutrition [3, 6].

Unhealthy dietary practices cause overnutrition, which is commonly found in the form of irregular mealtimes and snacking behavior among adolescents, especially high school students with busy lifestyles [8-10]. Primarily, adolescents' food consumption is shaped at home. They are aware of family meals and the food prepared by their mothers [10, 11]. However, soon after starting school, peers' opinions and food at school tend to lead high school students to avoid eating proper meals [8-10, 12, 13]. High school-aged adolescents in Indonesia prefer to consume more sweet, confectionary, and greasy foods than other age groups [14]. Their calorie and protein intake do not tend to meet the recommendations [14].

Boarding schools may ensure that high school students have regular mealtimes, as the school provides breakfast, lunch, and dinner. In regular school, skipping breakfast is common among students, which affects their activities [9, 15] and daily nutrient intake [16] and leads to negative health outcomes [17]. A study of boarders in Kilimanjaro observed that their average intake of macronutrients met the recommended daily allowance (RDA) [18]. However, Kenyan boarding high school students did not have adequate energy and nutrient intake [19]. Like the aforementioned nations, the majority of the boarding schools in Indonesia offer three daily meals. With a concern for school readiness to apply the school lunch program in terms of resources, boarding school appears to be a potential starting point [20]. But again, the actual nutritional status of boarding school students in Indonesia is scarce to discuss. Rimbawan, et al. [20] found that students' nutrient adequacy in boarding schools was lower than the standard. The other study explained that with the lower intake, the total energy of the students was mostly from snacks for those who were overweight and main meals for those who were stunted [21].

This paper, therefore, aimed to add to those explorations of dietary intake among female high school students in a boarding school and sought to examine its associated factors. The selection of female participants was predetermined due to previous research indicating variations in health practices among high school students based on gender. Female students were able to apply a better daily lifestyle, but most nutrient intake remained lower, and their fat intake was higher than that of their male counterparts [18, 22]. With biological changes during the adolescent phase, females ofhigh school age are more prone to nutrient deficiencies [23]. Overweight female adolescents are likely to become obese women in adulthood [24]. Further investigation was conducted in this study to fully capture the meal experience and how the students perceived a balanced meal through photographic storytelling.

2. Methods

This study used a mixed-methods design with female boarding high school students. A quantitative study aimed to assess students' dietary intake and its associations with measured variables, such as weight status, sociodemographic factors, physical activity, and nutritional knowledge, while a qualitative study aimed to capture students' meal experiences through a photovoice study [25]. Data collection for quantitative and qualitative information was conducted concurrently from January to March 2022. Information from the qualitative results was then used to provide further explanation of the quantitative results [26].

2.1. Participants

Recruitment for the study was conducted in a school setting after purposively selecting one boarding high school with an onsite learning school permit during the study period with a 100% face-to-face class. Students who passed the inclusion criteria—female students in grades 10 and 11 who were willing to participate and had completed parental consent forms—were scheduled for measurements between January and March 2022 during the first period of school. The assessment encompassed anthropometric measures as well as the completion of self-reported questionnaire that included dietary records, sociodemographic information, physical activity, and nutritional knowledge. Students who had dietary restrictions and/or chronic disease or who failed to complete all the measurements were excluded from the study. The students were also encouraged to participate in a photovoice study. The photovoice study initially recruited 10% of the total participants until saturation was achieved.

2.2. Instrumentation

2.2.1. DietaryIntake

The dietary intake of the students was obtained using a three-day food record method of two non-consecutive weekdays and one weekend day. The students were trained on how to complete the form prior to the study period [27], listing all food they consumed throughout the day, including portion estimation in household measures with a food image aid [28]. The study used food record forms as recommended for a nutritional survey in Indonesia [14].

2.2.2. Anthropometrics

Anthropometric measurements were conducted by trained personnel, measuring the body fat percentage, body weight, and height of the students using a Tanita weight scale typeBC-541 with a feature to measure body composition and a Seca 206 wall-mounted measuring tape. Body fat percentage [29] and World Health Organization (WHO)Reference 2007 [30] were used to evaluate the students' body fat and weight status, respectively. Generated using WHO AnthroPlus software, Body Mass Index (BMI)for age was applied, presenting the distribution of students' weight status as normal weight for a z-

score of -2 SD to 1 SD, overweight for a z-score more than 1 SD, obese for a z-score more than 2 SD, and underweight for a z-score less than -2 SD. The value of the z-score was used for further statistical analysis.

2.2.3. Sociodemographic Factors

We obtained sociodemographic data from the students using a self-reported questionnaire to collect information such as date of birth (to calculate age in years and months), ethnicity (an open-ended question that was grouped into Betawinese, Javanese, Sundanese, and others based on distribution), parents' education (middle school, high school, diploma, bachelor, master, and PhD), and monthly stipend (Indonesian Rupiah/IDR).

2.2.4. Physical Activity

The Physical Activity Questionnaire for Adolescents (PAQ-A) was used to measure students' physical activity [31]. Students whose score was 2.75 or more were considered physically active [32]. The value of the PAQ-A score was used for further statistical analysis. The English-originated PAQ-A questionnaire was translated into Bahasa by experts, including a nutritionist, a lecturer, and a high school English teacher, prior to the study.

2.2.5. Nutritional Knowledge

The nutritional knowledge of the students was obtained using a researcher-made general nutrition knowledge questionnaire from a literature review [33] following Indonesian food-based dietary guidelines [34]. The questionnaire was reviewed by three nutritionists using inter-objective congruence (IOC) methods and was pilot-tested with 30 high school students. Finally, a general nutrition knowledge questionnaire consisting of 45 questions was used after reaching the Kuder Richardson formula (KR-20) value of 0.7, which was considered acceptable [35]. The questionnaire included topics on nutrients and sources (12 items), food groups (17 items), dietary recommendations (11 items), and food effects on health (5 items), with dichotomous answers (multiple choice, yes/no, true/false) and scored as 1 for a correct answer and 0 for a wrong answer. The general nutrition knowledge questionnaire was primarily outlined in English and was translated into Bahasa by experts, including a nutritionist, a lecturer, and a high school English teacher.

2.3. Data Analysis

Data analysis was performed using SPSS version 28.0 (Chulalongkorn University license). Descriptive statistics of participants' characteristics are presented in frequencies with percentages for categorical data and means (standard deviation; SD) or medians (interquartile rank; IQR) for continuous data. A simple correlation was analyzed using Spearman's rank correlation test. To examine the extended correlation between the students' characteristics and dietary intake, a multiple linear regression was performed. Regression models were also tested to show plausible correlations. Total energy and protein intake-dependent variables were log-transformed, as the data were skewed. Significance was set at $p < 0.05$ with a 95% Confidence Interval (CI).

2.4. Photovoice Procedure

The photovoice part included three sequential activities: the initial meeting, photo-taking, and focus group discussion (FGD) [25]. During the initial meeting, the researcher introduced the photovoice method, the objective of the study, the photo-taking task, and ethics concerns to the students. The session's emphasis was to build rapport between the students and the research team. The students were asked to produce at least one photo describing what they perceived as balanced meals and/or the experience of eating those meals. They were given two weeks to take photos before the FGD session. All the photos were then displayed during the FGD, which lasted about 60–90 minutes. It began with each photographer sharing the stories behind their photo(s) and was followed by commentary from the rest of the group members. FGD guidelines and questions were adapted from previous studies [25, 36] and were related to 1) the food and the experience, 2) linkage with a balanced meal, and 3) comments or suggestion to peers. The guidelines were also pre-tested with female high school students and young female adults.

FGDs were held face-to-face and separately with junior and senior students based on their ease in explaining their thoughts and experiences. The FGD was moderated, recorded, and transcribed verbatim by the researcher for analysis. Thematic analysis was performed based on the transcript of the FGD for the photographs' storytelling [37-39]. Data saturation was reached when no new information emerged during additional FGDs. Written and verbal consent for the recording process was obtained from all photovoice participants prior to the study.

3. Results

3.1. Quantitative Results

A total of 60 female boarding high school students were recruited. The mean age of the students was 15.75 (SD 0.7)years, and students majoring in science subjects were predominant (81.7%) Table 1. Betawinese (33.3%), Sundanese (26.7%), and Javanese (23.3%) were found to be the top three ethnicities among the participating students. Almost all of the students' parents had completed high school. Specifically, 51.7% of the mothers and 35.0% of the fathers had attained high school, and 38.3% of the fathers had attained a bachelor's degree. The students received an average allowance from their parents of approximately IDR 400,000.00, or USD 26.2 per month. Students' physical activity scores were averaged at 2.1 (IQR 0.6), which means they were physically inactive based on the PAQ-A [32]. The mean score of students' knowledge of general nutrition was 64 (SD 7.3) out of 100.

Nearly one-third of the students (26.7%) were overweight or had a BMI z-score value of more than 1 SD. The rest of the students had a normal BMI (73.3%), and no underweight cases were found. The mean BMI z-score, which was 0.47 SD, or in the normal weight category, also reflected this. The proportion of overweight students was higher when the students were assessed using body fat percentages [29]. There were 58.3% overfat students, and 30% of them were obese.

Table 1.
Characteristics of participants (N=60).

Characteristics	N = 60	
	n	%
Major		
Science	49	81.7
Social	11	19.3
Ethnicity		
Betawinese	20	33.3
Javanese	14	23.3
Sundanese	16	26.7
Others	10	16.7
Mother's education		
Middle school	6	10.0
High school	31	51.7
Diploma	2	6.7
Bachelor	16	26.7
Master/PhD	3	5.0
Father's education		
Middle school	4	6.7
High school	21	35.0
Diploma	6	10.0
Bachelor	23	38.3
Master/PhD	6	10.0
Body mass index		
Normal (-2SD ≤ z-score ≤ 1SD)	44	73.3
Overweight (1SD < z-score ≤ 2SD)	10	16.7
Obese (z-score > 2SD)	6	10.0
Body fat percentage		
Normal	25	41.7
Overfat	17	28.3
Obese	18	30.0
Characteristics	Median (IQR)	Min, Max
Age, years	16 (1)	14, 17
Stipend, IDR (thousand)	400.0 (190.15)	200, 1500
Physical activity, score	2.1 (0.60)	1.14, 2.99
Characteristics	Mean (SD)	Min, Max
Body mass index, z-score	0.47 (1.00)	-1.50, 2.60
Body fat percentage, %	32.20 (5.70)	22.2, 46.3
Nutrition knowledge, score	64 (7.3)	49, 80

Note: IDR: Indonesian Rupiah. IQR: Interquartile rank. SD: Standard deviation. Min: Minimum. Max: Maximum.

Table 2 shows the body fat percentage measurement results. It was not only overweight students based on the BMI who had an excess of body fat but also almost half of the students with a normal BMI (43.2%).

Table 2.
Student's body fat percentage.

	Body fat percentage		Total
	Normal	Overfat/Obese	
BMI, n (%)			
Normal	25 (56.8)	19 (43.2)	44 (73.3)
Overweight/Obese	0 (0.0)	16 (100.0)	16 (26.7)
Total	25 (41.7)	35 (58.3)	60 (100.0)

The dietary intake of the students is summarized in Table 3. Of the 60 female students, the mean total energy intake was 1,182 kcal, with a mean protein, fat, and carbohydrate intake of 38.7 grams, 64.2 grams, and 141.7 grams, respectively, in their daily consumption. The average of the students' energy distribution from protein, fat, and carbohydrate intake was

13.0%, 38.0%, and 48.7%, respectively. The food intake of all students was below the Indonesian RDA [40]. Moreover, energy from fat seemed to contribute more to students' daily intake, leaving carbohydrate proportions lower than recommendations.

Table 3.
Student's dietary intake.

Food intake	RDA	Mean (SD)	Min – Max
Total energy, kcal	2,050 / 2,100	1,182 (464.4)	472 – 2,252
Protein, g	65.0	38.7 (16.5)	16.1 – 87.0
Fat, g	70.0	64.2 (7.3)	16.8 – 108.3
Carbohydrate, g	300.0	141.7 (55.9)	51.2 – 291.3
Energy distribution			
Protein, %	≈ 12.0	13.0 (3.0)	8.0 – 19.0
Fat, %	≈ 30.0	38.0 (5.8)	26.0 – 52.0
Carbohydrate, %	≈ 57.0	48.7 (6.3)	34.0 – 64.0

Note: RDA: Recommended dietary allowance. SD: Standard deviation. Min: Minimum. Max: Maximum. g: Grams. kcal: Kilocalories.

Table 4 presents the direct correlation between the independent variables and dietary intake. Significant inverse correlations were found between physical activity and total energy (r_s = -0.327, p = 0.011), protein intake (r_s = -0.267, p = 0.039), fat intake (r_s = -0.278, p = 0.032), and carbohydrate intake (r_s = -0.282, p = 0.029) of the students.

Table 4.
Bivariate correlation of student's characteristic and dietary intake (Spearman's Rho).

Characteristics	Dietary intake			
	Total energy	Protein	Fat	Carbohydrate
Stipend	0.00	-0.05	-0.03	0.01
Age, years	0.12	0.00	0.15	0.10
BMI, z-score	-0.06	-0.05	-0.08	-0.07
Physical activity, score	-0.33	-0.27	-0.28	-0.28
Nutrition knowledge, score	-0.05	-0.05	-0.04	-0.03

Note: Bold text indicates significancy at p-value < 0.05.

Multiple linear regression was performed to examine the association between students' characteristics and total energy, protein intake, fat intake, and carbohydrate intake as dependent variables. There was no significant association between sociodemographic factors (Model 1, Table 5) and dietary intake. Physical activity was again found to be negatively correlated with students' total energy (**β** = -0.125, p = 0.032) when it was included in the model with other characteristics, such as stipend, BMI, and nutritional knowledge (Model 2, Table 5). The ethnicity of the students, especially Sundanese, was found to be associated with total energy (**β** = 0.137, p = 0.025) (Model 3, Table 5). Both physical activity and being Sundanese were significantly associated with dietary intake after adjusting for the maximum plausible correlated variables for age, stipend, ethnicity, BMI, physical activity, and nutritional knowledge (Model 4, Table 5). Specifically, physical activity was negatively correlated with all dietary intakes: total energy (**β** = -0.151, p = 0.011), protein intake (**β** = -0.161, p = 0.011), fat intake (**β** = -16.940, p = 0.040), and carbohydrate intake (**β** = -44.996, p = 0.021). Being Sundanese was positively associated with total energy (**β** = 0.150, p = 0.013), fat intake (**β** = 16.445, p = 0.048), and carbohydrate intake (**β** = 39.695, p = 0.044).

3.2. Qualitative Results

Of the 60 female students, eight were involved in the photovoice study. They represented grades 10 (n = 4) and 11 (n = 4) and produced 14 photos related to their perspectives and experiences with balanced meals and general nutrition. The saturation of the information was reached after the FGD. Six major themes emerged through the discussion: (1) awareness of having unbalanced meals; (2) reflecting on the daily meal and self-defining a balanced meal; (3) consideration of the food lacking at school; (4) having a tendency to improve meal experience or taste; (5) being receptive during the COVID-19 situation; and (6) experienced-based support for peers.

Awareness of having unbalanced meals. The first theme describes students' awareness of their everyday menu at school. The students shared their meal experiences and thoughts related to food composition. They also expressed disappointment with not getting food when the food was out.

This is very interesting; the food was so lacking compared with the content of Isi Piringku. It only consisted of rice and tempeh. (4, 11th grade)

The food already contained nutrients, but it was not complete. There were no vegetables, fruit, or meat (animal-based protein). Actually, there was chicken in the soup, but I did not get it. (5, 10th grade, Figure 1).

Reflecting on the daily meal and self-defining a balanced meal. The second theme describes the definition of balanced meals from high school students' perspectives. Participating students used their daily food when explaining what a balanced meal was for them.

Table 5.
Multiple linear regression model of student's characteristic and dietary intake.

Characteristics	(lg) Total energy			(lg) Protein intake			Fat intake			Carbohydrate intake		
	Beta	***P***	**95% CI**	**Beta**	***P***	**95% CI**	**Beta**	***P***	**95% CI**	**Beta**	***P***	**95% CI**
Model 1												
Age	0.028	0.401	-0.04; 0.09	-0.007	0.836	-0.07; 0.06	4.257	0.338	-4.56; 13.07	0.338	0.445	-12.89; 28.96
Stipend	-0.002	0.837	-0.03; 0.02	-0.003	0.808	-0.03; 0.02	-0.120	0.942	-3.38; 3.14	0.942	0.695	-9.27; 6.22
Model 2												
Age	0.000	0.993	-0.07; 0.07	-0.037	0.298	-0.11; 0.03	1.094	0.815	-8.23; 10.42	0.448	0.968	-21.72; 22.62
Stipend	0.002	0.846	-0.02; 0.03	0.002	0.846	-0.02; 0.03	0.357	0.831	-2.98; 3.69	-0.347	0.930	-8.27; 7.58
BMI, z-score	-0.013	0.575	-0.06; 0.03	-0.009	0.701	-0.06; 0.04	-2.778	0.381	-9.08; 3.53	-3.607	0.631	-18.59; 11.38
Physical activity	-0.125	0.032	-0.24; -0.01	-0.139	0.021	-0.26; 0.02	-14.418	0.068	-29.96; 1.13	-36.543	0.052	-73.49; 0.41
Nutrition knowledge	-0.001	0.727	-0.01; 0.00	-0.002	0.598	-0.01; 0.00	0.088	0.841	-0.79; 0.96	0.022	0.983	-2.06; 2.10
Model 3												
Age	0.035	0.291	-0.03; 0.10	0.001	0.967	-0.07; 0.07	4.914	0.277	-4.06; 13.89	10.520	0.328	-10.83; 31.87
Stipend	-0.008	0.531	-0.03; 0.02	-0.006	0.667	-0.03; 0.02	-0.791	0.637	-4.13; 2.55	-2.665	0.504	-10.61; 5.28
Javanese	0.065	0.295	-0.06; 0.19	0.012	0.850	-0.12; 0.14	9.281	0.277	-7.67; 26.23	13.854	0.494	-26.46; 54.17
Sundanese	0.137	0.025	0.02; 0.26	0.090	0.158	-0.04; 0.22	15.979	0.054	-0.26; 32.21	36.338	0.065	-2.28; 74.96
Ethnicity other	0.064	0.340	-0.07; 0.20	0.036	0.611	-0.11; 0.18	6.914	0.453	-11.42; 25.25	23.141	0.292	-20.46; 66.74
Model 4												
Age	0.003	0.925	-0.06; 0.07	-0.032	0.373	-0.10; 0.04	1.285	0.787	-8.23; 10.80	1.375	0.903	-21.06; 23.81
Stipend	-0.002	0.882	-0.03; 0.02	0.001	0.953	-0.03; 0.03	-0.199	0.907	-3.61; 3.21	-1.139	0.777	-9.18; 6.9
Javanese	0.089	0.147	-0.03; 0.21	0.038	0.553	-0.09; 0.17	11.217	0.190	-5.74; 28.18	20.305	0.313	-19.70; 60.31
Sundanese	0.150	0.013	0.03; 0.27	0.105	0.095	-0.02; 0.23	16.445	0.048	0.11; 32.78	39.695	0.044	1.17; 78.21
Ethnicity other	0.126	0.074	-0.01; 0.26	0.104	0.163	-0.04; 0.25	12.336	0.208	-7.10; 31.77	40.075	0.085	-5.77; 85.92
BMI, z-score	-0.003	0.900	-0.05; 0.04	-0.002	0.941	-0.05; 0.05	-1.679	0.596	-8.00; 4.64	-0.835	0.911	-15.74; 14.07
Physical activity	-0.151	0.011	-0.27; -0.04	-0.161	0.011	-0.28; -0.04	-16.940	0.040	-33.06; -0.82	-44.996	0.021	-83.01; -6.98
Nutrition knowledge	-0.002	0.502	-0.01; 0.00	-0.003	0.445	-0.01; 0.00	-0.009	0.984	-0.89; 0.87	-0.299	0.774	-2.38; 1.78

Note: lg: Log transformed. Bold text indicates significancy at p-value < 0.05.

Figure 1.
Example of student's awareness of having unbalanced meal.

Balanced is when the content of the plate includes rice, vegetables, tofu, tempeh, eggs, and meat, and there should be fruits too. (5, 10th grade)

Food that contains protein, carbohydrates, and fiber in balanced portions, not too much or too little, so it's just the right portion. (3, 11th grade, Figure 2)

It includes everything we need, such as vegetables, fruit, rice, tempeh, tofu, and milk. (6, 10th grade)

Figure 2.
Defining balanced meal.

Consideration of the food lacking at school. The thirdtheme depicts students' responses to facing a lack of meal experiences at school. They made some effort, such as preparing or asking someone to bring food from home or buying some food at the canteen to complete their meals.

I don't like the menu with telur balado (boiled egg with chilli sauce). I usually take the rice only and look for other foods, like abon sapi (meat floss) that I brought from home or some fried food like fritters bought from the canteen (5, 10th grade).

I look for foods that have vegetables in them like soto, consisting of chicken, rice noodles, cabbage, and choy sum, and eat it during the day when the school menu has no vegetables (7, 10th grade).

Having a tendency to improve meal experiences or taste. This theme depicts students' efforts to have a good meal despite having the same menu every seven days. Students used the school canteen when they did not want to eat as usual.

This is Boncabe (chili flakes). I brought them from home and added it myself because I like spicy food. I add it on occasion if I feel like eating spicy food (5, 10th grade).

Because I like sweet soy sauce and crackers, I bought it myself at the canteen (2, 11th grade).

Being receptive during the COVID-19 situation. The students expressed excitement about a new drink that the school provided during the COVID-19 situation. This theme describes students' acceptance of Wedang Jahe, (hot ginger drink) with and without scientific reasons.

There is Wedang Jahe, it's really good for immunity, as currently we are having a pandemic, so there are lots of benefits from drinking the wedang (3, 11th grade).

I got this food, so I took a photo, and I got Wedang Jahe too (7, 10th grade).

It [Wedang Jahe] is served by the school every Tuesday and Saturday morning, which started when COVID-19 happened (5, 10th grade).

Experience-based support. The students expressed their concerns about having balanced meals based on their own experiences studying in boarding school.

If you don't get a balanced meal, you can look for it like I usually do, for example, by bringing fruit (from home) and drinking lots of water to be able to concentrate. Then, if you don't like the food, don't just skip it. It's better to find other food so that your stomach is full (7, 10th grade).

Figure 3.
Experienced-based support for peers.

We can eat food like in the picture (sugary drinks and deep-fried food from the canteen), but not too often, and we have to balance it with food that follows the Isi piringku because it will benefit us in the future as adults. If we often eat unhealthy food, then the results will appear when we are old. While we are still young, we have to eat those balanced meals, so when we are old, we will not get sick so easily. (4, 11th grade, Figure 3).

4. Discussion

In this study, we found that female boarding high school students' dietary intake was lower than national recommendations. Factors associated with this intake were the students' ethnic origins and physical activity levels. The students were aware of the food lacking at school, and they attempted to supplement their meals and promote eating balanced meals to their peers.

Students' average intake of total energy, protein, and carbohydrate only reached half of the national recommendations, while their average intake of fat nearly reached the threshold but was still below the recommendation [40]. The intake was also lower than in previous studies among general high school students, private high school students, and boarding high school students [18, 19, 41, 42]. Food environment and busy school routine were reasons given for the students' dietary intake, as indicated in the photovoice study. With finite choices and repetitive food, the school meal did not help students meet the recommendations for total energy, carbohydrate, and protein intake [18, 19, 41]. Food available at school was also

greasy, carbohydrate-rich, and lacking in protein [43]. Although the school had a full-service kitchen, which would make it possible to supply healthier foods, these were unavailable because menu and food decisions were made by school staff, [44] who required practical nutritional guidelines [45]. Fish provision on the school menu inversely indicated wealth compared to meat or chicken [46]. The concern was acknowledged by the school principal, who emphasized the importance of affordability for the institution.

Despite the overall low intakes, this study discovered that being Sundanese increased the likelihood of a student having higher intakes of total energy, fat, and carbohydrates. This is intriguing, as previous studies have stated otherwise. The Sundanese are mainly known for eating a plant-based diet [47, 48]. Consuming less saturated fat and more fresh vegetables indicates a more anti-inflammatory profile for the Sundanese [47]. However, they may experience dietary transition due to migration or their new communities' dietary patterns [48]. Dietary practices among students were also influenced by these environments [11, 49-51]. The school, with the aforementioned fixed menu and tuck shops, gave the students food. Having a shop inside the school that only sells salty, deep-fried food and sweets was associated with a higher consumption of these unhealthy foods [49]. Still, students stated their intentions to choose healthy food if it was accessible, as convenience was important due to their busy lifestyles [51].

Depicted through FGDs in photovoice activities, the way Sundanese students coped with the food shortage at school supported the findings. Sundanese students, like other students, had food they disliked. As they were able to remember which menu was served on which day, they chose not to eat the food and substituted it with other food they had prepared at home or bought at the shop. The foods disliked by Sundanese students were telur balado (boiled egg topped with chili), stir-fried morning glory/long bean/chayote, karedok (mixed raw vegetables with peanut sauce), fried yellow tofu, and mackerel tuna. Their substituted foods were abon sapi (sweet meat floss), vegetable fritters, omelettes, sunny-side-up, instant noodles, batagor (fried fish cakes with peanut sauce), chocolate buns, and other snacks. When these students did not eat the food they disliked (vegetables or less oily food), they tended to eat more fried food, instant noodles, and sweet food or snacks that were high in fat and carbohydrates as well as total energy. It was noteworthy that the students understood complete food but did not make healthier choices [15]. It may be that the Sundanese students snacked on sweets because they were used to eating traditional carbohydrate-rich desserts [48].

Another factor associated with students' dietary intake in the present study was physical activity. Students' physical activity was mostly categorized as inactive, following the PAQ-A manual [32]. Despite COVID-19 measures, the school was run onsite and had no restrictions on outdoor activities. However, the students spent most of their time sitting during recess, with little sport or physical activity. The trend is similar for adolescents in other developing countries [13, 52, 53]. Although the school allocated another 15 minutes every two days specifically for physical activity besides mandatory physical education (PE), most participating students were just standing instead of moving their bodies. To achieve adequate physical activity, it was suggested that PE educators lead PE classes or allocate outdoor time [53].

The findings of our study indicate a constant negative correlation between increased levels of physical activity and the consumption of total calories and macronutrients. This finding resonates with previous studies. Among the Portuguese, consumption of free sugar was lower in regularly active adolescents [54]. Another study discussed the same finding: that with more physical activity, the consumption of added sugar or sugar-sweetened beverages was less likely [55]. Also, a lower intake of total energy, carbohydrates, and fat was observed among those who had a higher step count [56]. Healthy foods or behaviors were found to be associated with physical activity. Female adolescents with sedentary behavior over 8 hours had a higher likelihood of fast food and carbonated drinks than the brief ones [55].

During photovoice FGDs, we were able to observe the students' awareness of sufficient water consumption with regard to being mobile between school and dorm activities. The students were concerned about the experience and advised their friends to drink enough water to remain alert during classes and other activities. In a boarding school setting, there was no item measuring this condition in the PAQ-A questionnaire. This may be another detail that participants in this study included as less physically active students.

The findings of the present study indicated that increasing students' physical activity may reduce their intake of total energy, fat, and carbohydrates, which is necessary as many female students are overweight or overfat. Supporting existing habitual physical activity, the school principal could consider letting the PE teacher or an advisor with PE experience accompany the students during morning stretching schedules. The school is also encouraged to consider students' preferences when deciding on the menu cycle and to counsel in-school shops to provide healthier food or snacks, such as steamed food rather than deep-fried food. Furthermore, the provision of fundamental nutritional information can offers student and staff valuable knowledge to facilitate improved decision-making regarding their dietary selections.

Our study recruited students from one boarding school, which may limit the generalizability of the findings. Also, despite obtaining food records for multiple days and providing training for the students, self-reported dietary intake may include inaccuracies in students' actual intake. We relied on students' memories and abilities to estimate food portions that differed for each individual. Future research may consider assessing dietary intake through 24-hour food recall or food weighing for better estimations.

5. Conclusion

Female students were prone to having inadequate dietary intake, despite being provided with three meals a day. The intake was found to be correlated with students' ethnicity and physical activity. The photovoice activity revealed that the food provided and available in the canteen influenced the students' food consumption. The students were aware of balanced meals and possible unmet needs. Consequently, they made efforts to complete and improve their meals, including

purchasing food from the canteen. Students showed good acceptance of new food provided by the school, regardless of the persistent lack of food.

The findings on student's dietary intake added to the fact that meals provided in boarding schools need to be improved. Photovoice justified it with the student's meal experience. Properly balanced meal concepts and good adaptation to food deficiencies, which were conveyed by the students could, assure the understanding of the Indonesian nutrition slogan among adolescents. Finally, the present study suggests that a nutrition program is considered necessary in boarding school to support student's diet and nutritional status.

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