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Double Burden of Malnutrition among Young Filipino Adolescents with Limited Diversity of Carbohydrate Sources and Excess Intake of Processed Food and Sugar-Sweetened Beverages

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Abstract

Adequate nutrition in adolescence is crucial for growth and development, and should remain a key public health priority. However, empirical studies on nutrition in young adolescents are limited, despite concerns about their diet quality. Identifying dietary sources of energy and nutrients can help guide improvements. The aim of this study was to analyze food intake and primary food sources of energy and nutrients in young Filipino adolescents in an urban setting. A 24-hour dietary recall and anthropometric survey of 132 students aged 11 - 12 years from four public schools in Manila was conducted. Energy and nutrient intakes were estimated using the Philippine Food Composition Tables and a stepwise methodology for free sugars. Estimated energy requirement (EER) was calculated using individual anthropometric data. Proportions below or above dietary guidelines were assessed. Food and beverage group contributions to total energy were determined and compared across energy intake-EER ratios for carbohydrates, sodium, and free sugars. The mean daily intakes of total energy, sodium, and free sugars were 1532.1 kcal, 1328.7 mg, and 33.1 g, respectively. Most participants (90.9% male, 79.5% female) consumed below their EER, while few consumed above the sodium (17.0% male, 18.2% female) and free sugar (22.7% male, 34.1% female) limits. Low energy

consumption was attributed to limited diversity of carbohydrate sources. High energy intake was attributed to increased intakes of salty and sugary foods, including ultra-processed meat and seafood, instant noodles, and sugar-sweetened beverages. Young adolescents had low overall caloric intake but derived a substantial portion of dietary sodium from ultra-processed meats and seafood, and free sugars from sugar-sweetened beverages and table sugar, with dietary patterns differing between low and high energy groups. These results underscore the need for food-specific nutrition interventions to promote balanced diets and reduce health risks in this vulnerable population.

Keywords

Dietary Intake, Energy, Nutrients, Adolescents, Philippines

1. Introduction

Adolescents have largely been overlooked because they are generally perceived as healthy, leading to limited efforts to thoroughly assess their health. However, puberty and social role transitions cause significant changes at this stage of life [1]. Adolescence is a period of rapid physical maturity and critical cognitive development, and with these changes come increased demand for energy and nutrients to achieve optimal growth [2]. Overall nutritional requirements are highest at this stage of human life cycle [3]; however, adolescents have been reported to have the poorest diet quality and the highest nonadherence to nutrition recommendations across all ages [4].

Fast-paced urbanization, along with progress in food technology, has led to a shift from traditional dietary patterns to those dominated by processed foods and beverages [5]. By definition, food processing is done "to alter the eating quality or shelf life of food", and this ranges from simple processes like boiling, salting, fermenting, or pasteurizing to make food edible and safe to eat, to more complex ones that require sophisticated machinery such as canning and bottling [6] [7]. Ultra-processed foods, on the other hand, is a term recently introduced to describe foods that undergo multiple industrial processes, are intentionally packaged for convenience, have an extended shelf life, and remain highly palatable [7]. Although processing has made food more accessible, there are nutritional concerns regarding ultra-processed foods containing high calories and large amounts of free sugars, refined starches, unhealthy fats, and sodium. Consumption of processed foods has become more prevalent owing to their growing availability, affordability, and accessibility [7]. The younger population is quicker in adopting new food products and giving up traditionally prepared foods, compared with other populations [8].

In the Philippines, a similar dietary shift is observed, with studies involving the use of both food weighing and 24-hour dietary recalls (24 HRs) showing decreased intakes of fruits, vegetables, and milk, along with increased consumption of sug-

ary, salty, and fatty foods among adolescents [9] [10]. Findings from the 2013 National Nutrition Survey (NNS) indicated that Filipino adolescents generally have suboptimal energy and macro- and micronutrient intakes [10]. However, little attention has been paid to foods and beverages consumed by adolescents and their contributions to energy and nutrient intake.

In addition to urban sedentary lifestyles, the increased risk of many non-communicable diseases, such as cardiovascular disease and metabolic syndrome, has been associated with excessive sodium and sugar consumption. Longitudinal studies have shown associations among high sodium intake, high blood pressure [11], and psychological distress [12], whereas excess free sugar intake has been linked to increased risk of hypertension [13], dental caries [14], and insulin resistance [15]. Free sugars have gained global attention, especially following the World Health Organization guidelines to limit their consumption [16]. However, research on sodium and free sugar intakes among young adolescents remains scarce, particularly in low- and middle-income countries. In the Philippines, limited data are available to assess accurately adherence to these dietary recommendations.

To develop effective interventions addressing diet quality, it is crucial to identify the primary food sources of such imbalances. Examining the amount of each food that contributes to the overall energy and nutrient intake of young adolescents is important for detecting potential dietary excesses and deficiencies and for identifying areas for improvement in promoting a healthy, well-balanced diet that is critical for growth and development. Considering the double burden of malnutrition faced by young Filipino adolescents—overnutrition and undernutrition [17]—assessment of diet quality should be focused on overall energy consumption. Understanding these dietary patterns can inform policy and programs to improve adolescent nutrition outcomes in urban areas.

The aim of this study was to analyze the dietary patterns of young Filipino adolescents in an urban area and determine the food and beverage groups that contribute the most to their overall energy, carbohydrate, sodium, and free sugar intake.

2. Materials and Methods

2.1. Study Design

We conducted a 24 HR survey and anthropometric measurements of young adolescents enrolled in public junior high schools in Manila.

2.2. Study Area and Participants

Manila, the study area, is highly urbanized, with a total population of 1.8 million, 17.2% of whom were adolescents aged 10 - 19 years as of 2020 [18]. Known for its rich historical landmarks and bustling urban environment, Manila represents a convergence of traditional and modern lifestyles akin to those of many capital cities. As part of the National Capital Region, the city has a Human Development Index (HDI) of 0.743 in 2022, surpassing the national HDI of 0.710 [19]. In 2023,

it also recorded a lower poverty incidence of 1.1% compared with the national rate of 10.9% [20]. As the capital city, it provides access to top healthcare and education services.

Of thirty-five public high schools in the City of Manila, four were randomly selected for the study. Purposive sampling was employed within these schools to select study participants of adolescents aged 11 or 12. We excluded students using medications that could affect food intake, such as appetite suppressants or stimulants, and those who were on a strict dietary regimen for religious or medical reasons at the time of the survey. Finally, a total of 132 students were included in this study during the study period of one month.

2.3. Data Collection

Briefings and distribution of consent and assent forms were conducted 1 - 2 days prior to data collection to give the students and their parents sufficient time to consider their participation. During this time, a printed visual guide was provided to the participants to make the reporting of portion sizes easier to estimate. The visual guide presented standardized household measurements of spoons and cups printed on a 1:1 scale.

The height and weight of the participants were measured at school, and their age and sex were noted. A dietary assessment was conducted using a single 24HR form to gather data on participants' food intake, considering the compliance with the food recall by participants aged 11 or 12 years old. Detailed, quantitative information on an individual's food and beverage consumption is captured in a 24 HR, which can be used to assess food and nutrient intakes, and dietary patterns [21]. This study utilized a 24 HR form from the 2018-2019 Expanded National Nutrition Survey (ENNS), developed by the Philippine Department of Science and Technology—Food and Nutrition Research Institute (DOST-FNRI). Interviewers were specifically trained in administering a 24 HR via telephone call to ensure that data collection was standardized. Information on all foods and beverages consumed a day prior to the interview was recorded as food items, and the portion size of each food item was logged as a household measure. The validity of the telephone interview methodology to obtain 24 HR dietary recalls, in comparison with face-to-face interviews, has been previously discussed [22] [23].

2.4. Variables and Indicators

Weight was measured using TANITA digital scale to the nearest 0.1 kg, and height was measured using a Seca stadiometer to the nearest 0.1 cm. The nutritional status of young adolescents was assessed using age and anthropometric data. The computed height-for-age and body mass index (BMI)-for-age of each participant were classified based on the WHO growth reference charts [24]. Those whose height-for-age Z-score was <−2 SD were considered stunted, while those whose BMI-for-age Z-score was >1 SD were considered overweight/obese.

The food items recorded in the 24 HR were individually matched with the clos-

est food item code in the Philippine Food Composition Tables 2019 (PhilFCT) based on food descriptions such as common name, method of preparation, and ingredients [25]. Household measurements were converted to weights (in grams) as edible portions based on Food Exchange Lists for Meal Planning [26]. Both references were tailored to the Filipino diet and produced by the DOST-FNRI.

The energy (kcal), carbohydrate (g), protein (g), total fat (g), and sodium (mg) contents of each food item were calculated based on the nutrient content of the corresponding food item code in the PhilFCT, which provides energy and nutrient content information for 1541 food items commonly consumed by Filipinos. Furthermore, the free sugar (g) content in individual food items was calculated using the method developed by Kibblewhite *et al.* [27] and incorporated to complement the PhilFCT. This procedure was performed because the PhilFCT only provides values for total sugars and lacks data on free sugars. Details of the free sugar estimation process have been reported elsewhere [28].

Individual food items were categorized into 25 food and beverage groups modified from Filipino food-based dietary guidelines [29], as shown in **Table 1**. The modification was based on the eating habits of Filipino adolescents, considering industrial food processing and sodium or sugar content. The table shows food and beverage groups; sample food items; and their relevance to industrial food processing classifications: unprocessed or minimally processed, processed culinary ingredients, processed, or ultra-processed, as proposed by Monteiro *et al.* [7]. Processed foods refer to products produced by combining unprocessed or minimally processed foods with processed culinary ingredients and have undergone some degree of preservation or fermentation processes. Ultra-processed foods are manufactured entirely through a series of industrial processes, such as chemical modification and extrusion, and are enhanced by additives not normally found in kitchens, such as high fructose corn syrup and hydrogenated or interesterified oils [7].

Percentages of energy intake from carbohydrate, protein, total fat, and free sugar consumption, relative to total energy intake, were calculated to evaluate the satisfaction of nutrient intake balanced with energy intake.

Estimated Energy Requirement (EER) is the dietary energy intake required to maintain energy balance of a healthy person [30]. In this study, EER was individually calculated relative to each participant's age, sex, weight, and height, with assumed engagement in physical activity [10]. The ratio of reported energy intake to EER (energy intake-EER ratio) was used as an indicator of individual satisfaction with food intake relative to the energy requirement. Based on the concerns for both under- and overnutrition among adolescents in the Philippines and the need for dietary recommendations referring to food sources or food and beverage groups, we evaluated consumption by food and beverage groups according to the level of daily energy intake. Given that energy requirements differ by sex, height, and weight, the energy intake-EER ratio of each participant was used and divided into three categories: lower (<25th percentile), middle (25th-75th percentile), and upper (>75th percentile).

Table 1. Grouping of food and beverages.

Food categories	Food and beverage groups	Sample food items	Processing classifications			
			Unprocessed or minimally processed	Processed culinary ingredients	Processed	Ultra-processed
Grains, breads, and noodles	Grains	Rice, wheat, corn, flours, oatmeal, hominy	✓			
	Bread	*Pandesal*, *mamon*, loaf bread, wheat bread, crackers			✓	
	Pastries	Cake, pies, doughnut, cupcake				✓
	Chips and snacks	Corn or potato chips with or without flavoring, popcorn				✓
	Instant noodles	Instant canton, instant noodle soup, cup noodles				✓
Animal sources including dairy and eggs	Meats	Beef, pork, or chicken meat including blood and innards	✓			
	Seafood	Tilapia, milkfish, squid, crab, mussels	✓			
	Processed meat and seafood	Jerky, canned sardines, canned tuna			✓	
	Ultra-processed meat and seafood	Sausage, bacon, ham, corned beef, meatloaf, liver spread, fish ball				✓
	Milk	Fresh, evaporated, skim milk, plain yoghurt	✓			
	Cheeses	Cheddar, cheese spread			✓	
	Ice cream	Ice cream				✓
	Eggs	Chicken, quail, or duck egg	✓			
Fruits and vegetables	Fruits and vegetables	Garlic, onion, carrot, potato, banana, papaya, mango	✓			
	Fruits and vegetables in brine or syrup	Canned green peas, canned mushroom, canned pineapple			✓	
	Nuts and seeds	Peanut, kidney bean, mung bean, soybean	✓			
Sweets and seasonings	Sugars	White sugar, brown sugar, syrup		✓		
	Confectionery	Candies, chocolates, caramel, jelly, marshmallow, gums				✓
	Salts	Salt		✓		
	Sauces and condiments	Soy sauce, fish sauce, shrimp paste, vinegar, catsup, lechon sauce, mayonnaise				✓
	Fats and oils	Coconut oil, corn oil, lard, margarine, butter		✓		
Drinks	Plain coffee and tea	Plain coffee or tea without milk or sweeteners	✓			
	Soft drinks	Cola, root beer, citrus-flavored soda				✓
	Juice and sweetened tea drinks	Pineapple juice, mango juice, lemon iced tea, apple green tea, milk tea				✓
	Blended coffee drinks	Instant coffee mix, 3-in-1 coffee				✓

2.5. Data Analysis

This study presented energy and nutrient intakes, as well as adherence to nutritional guidelines, using descriptive statistics. Participants were primarily grouped to compare absolute intakes. Patterns of food consumption by food groups were observed according to the absolute energy intake.

Mean and median energy and nutrient intakes and percentages of energy intake by nutrients relative to total energy intake, and EER were calculated separately for male and female participants. Mann-Whitney U test was performed to compare the median energy and nutrient intake, weight, and height of males and females.

To evaluate the proportion of participants who met nutritional recommendations, the percentages of participants who reported consumption below the EER, below the acceptable macronutrient distribution range (AMDR), above the recommended sodium intake, and above the recommended free sugar consumption were calculated separately for male and female participants. The AMDR for carbohydrate, protein, and total fat were 55% - 79%, 6% - 15%, and 15% - 30%, respectively [31]. The recommendation for sodium consumption was <1883 mg/day according to the WHO guidelines on sodium intake for adults and children 2012 [32], and the recommendation for free sugar consumption was <10% of total energy intake, according to the WHO guidelines on sugar intake for adults and children 2015 [16]. A Z-test was performed to determine the difference in the proportion of participants who satisfied the AMDR by sex.

To evaluate the distribution of food intake among the 25 food and beverage groups, we calculated the mean, quartile percentiles, and percentage contribution to the mean total energy intake. The contributions of individual food and beverage groups to carbohydrate (g/day), sodium (mg/day), and free sugar (g/day) intake were calculated by energy intake-EER ratio category (lower, middle, and upper). Kruskal-Wallis test was performed to determine the statistical difference in median nutrient intakes of the three energy intake-EER ratio groups. Dunn's post hoc test with Hold-Sidak correction for family-wise error rate was further employed when a statistically significant result was obtained from Kruskal-Wallis test.

Data were analyzed using Stata SE 15.1, with the significance level set at 0.95

2.6. Ethical Considerations

The study protocol was approved by the University of the Philippines Manila Research Ethics Board (UPMREB 2023-0253-01). Informed consent and assent forms were distributed to the selected classes beforehand and were physically retrieved on the day of data collection. Only those whose forms both consented to and were assented to via signatures by the parent and child, respectively, were included in the study.

3. Results

3.1. Participant Characteristics

Table 2 presents the characteristics of the study population. In total, 132 young

adolescents (33.3% male, 66.7% female) were enrolled in this study. The average height and weight were 152.1 ± 8.9 cm and 47.0 ± 13.5 kg for male participants, and 147.3 ± 6.4 cm and 41.0 ± 8.9 kg for female participants, respectively. The proportions of individuals who were stunted and overweight/obese were 2.3% and 36.4% for males, and 15.9% and 14.8% for females, respectively.

Table 2. Participant characteristics (n = 132).

	Male*	Female*
n	44 (33.3%)	88 (66.7%)
Height (cm)	152.1 ± 8.9	147.3 ± 6.4
Weight (kg)	47.0 ± 13.5	41.0 ± 8.9
Height-for-age[a]		
Stunted	1 (2.3%)	14 (15.9%)
Normal	43 (97.7%)	74 (84.1%)
BMI-for-age[b]		
Thin	0 (0.0%)	6 (6.8%)
Normal	28 (63.6%)	69 (78.4%)
Overweight/obese	16 (36.4%)	13 (14.8%)

*Values were presented in n (%) or mean ± SD. Based on WHO growth reference charts, the [a]height-for-age cutoff for stunting was Z-score < −2 SD; while [b]BMI-for-age cutoff for thinness was Z-score was <−2 SD and overweight/obese was Z-score was >1 SD.

3.2. Nutrient and Energy Distributions

Table 3 summarizes energy and nutrient intakes according to sex. Mean energy and nutrient intakes were higher than the median values for both sexes. Summary statistics showed right-skewed distributions of energy and nutrient consumption. Free sugar intake as a percentage of the total energy intake among females was significantly higher than that among males ($p = 0.0466$). For other nutrients and energy consumption among adolescents aged 11 - 12 years, few differences were observed between males and females. EER was significantly higher in males than in females ($p < 0.0001$).

Table 4 shows the proportion of participants who consumed below or above the recommended energy and nutrient intakes according to sex. Overall, there was a shortage of energy consumption, as the majority of male (90.9%) and female (79.5%) participants consumed below the EER. Regarding macronutrients, almost half of male (45.5%) and female (46.6%) participants did not take enough carbohydrate. Nevertheless, all participants except one female were able to obtain sufficient protein and total fat. On the contrary, excessive sodium and free sugar intakes were observed in a considerable proportion of the study population (17.4% and 30.3%, respectively). The level of non-compliance with the WHO guideline was relatively similar in both sexes for sodium (17.0% and 18.2% for male and female, respectively), whereas that for free sugar, was higher among females (34.1% vs. 22.7%).

Table 3. Energy and nutritional intakes according to sex (n = 132).

Dietary intakes	Male (n = 44)		Female (n = 88)		Total (n = 132)		p-value[†]
	Median	Mean ± SD	Median	Mean ± SD	Median	Mean ± SD	
Energy (kcal)	1442.7	1514.8 ± 665.2	1369.0	1540.7 ± 766.8	1374.5	1532.1 ± 732.1	0.8484
EER (kcal)	2434.1	2480.2 ± 365.6	2058.7	2055.5 ± 214.2	2143.7	2197.0 ± 338.7	<0.0000
Carbohydrates (g)	200.2	206.8 ± 107.9	197.0	217.0 ± 129.6	198.4	213.6 ± 122.5	0.6507
Protein (g)	51.0	51.9 ± 21.9	45.2	50.0 ± 23.1	46.5	50.6 ± 22.6	0.6637
Total Fat (g)	49.4	52.7 ± 27.3	47.8	53.5 ± 35.4	48.5	53.2 ± 32.8	0.6607
Sodium (mg)	1056.8	1380.5 ± 1505.9	1143.5	1302.8 ± 1229.1	1133.1	1328.7 ± 1322.5	0.8910
Free Sugars (g)	11.0	23.7 ± 32.4	20.5	37.9 ± 50	19.3	33.1 ± 45.3	0.0651
As % of Energy							
Carbohydrates	58.0	53.6 ± 13	56.1	55.2 ± 12.8	56.2	54.7 ± 12.9	0.5241
Protein	13.1	14.2 ± 3.9	12.4	13.9 ± 5	12.9	14 ± 4.6	0.7194
Total Fat	30.0	31.9 ± 11.6	30.0	31.2 ± 11.9	30.0	31.4 ± 11.8	0.7530
Free Sugars	3.6	5.7 ± 6.1	5.9	8.4 ± 8	5.7	7.5 ± 7.5	0.0466

[†]Difference between male and female determined by Mann-Whitney U Test.

Table 4. Proportion below or above the recommended energy and nutrient intakes according to sex (n = 132).

Below or Above Recommendations	Male (n = 44)	Female (n = 88)	Total (n = 132)	p-value[†]
Below EER[a]	90.9	79.5	83.3	0.0986
Below AMDR for carbohydrates[b]	45.5	46.6	46.2	0.9018
Below AMDR for protein[c]	0	1.1	0.8	0.4778
Below AMDR for total fat[d]	0	0	0	-
Above limit for sodium[e]	17.0	18.2	17.4	0.8711
Above limit for free sugar as % of energy[f]	22.7	34.1	30.3	0.1805

[†]Difference between male and female determined by Test of Proportions. Dietary recommendations were based on: [a]Estimated Energy Requirement (EER) computed individually; Acceptable Macronutrient Distribution Range (AMDR) of percent energy from [b]carbohydrate < 55% - 79%; [c]protein < 6% - 15%; and [d]total fat < 15% - 30%; [e]WHO Guideline on Sodium Intake for Adults and Children 2012 (recommendation for children was extrapolated from adults based on energy requirements: <1883 mg); and [f]WHO Guideline on Sugars Intake for Adults and Children (2015) of limit intake to <10% of total energy.

3.3. Food and Beverage Group Distributions

Table 5 shows the distribution of total energy intake by food and beverage groups. The largest proportion of energy was derived from grains, accounting for one-third (34.1%) of the total daily intake, followed by meats (11.4%). The remaining substantial portions of energy were derived from ultra-processed meat and seafood (7.2%), processed meat and seafood (6.2%), fats and oils (5.9%), bread (5.3%), and pastries (4.9%), most of which were processed foods. The summary statistics of percentiles showed right-skewed distributions of consumption of individual food and beverage groups. This result is due to half of the participants not consuming specific food items, which explains why the median intake was zero for most of food and beverage groups, except grain, meats, fats and oils, and ultra-processed meat and seafood.

Table 5. Food and beverage group distribution of total energy intake (kcal/day) (n = 132).

Food and beverage groups	25th percentile	50th percentile (Median)	75th percentile	Mean	% Contribution to Mean Total Energy
Grains	245.9	491.7	737.6	522.0	34.1
Bread	0.0	0.0	57.7	80.7	5.3
Pastries	0.0	0.0	142.0	75.2	4.9
Chips and snacks	0.0	0.0	0.0	37.1	2.4
Instant noodles	0.0	0.0	0.0	64.1	4.2
Meats	0.0	142.9	246.6	173.9	11.4
Seafood	0.0	0.0	0.0	28.4	1.9
Processed meat and seafood	0.0	0.0	163.1	95.7	6.2
Ultra-processed meat and seafood	0.0	69.2	173.5	116.1	7.6
Milk	0.0	0.0	0.0	1.0	0.1
Cheeses	0.0	0.0	0.0	2.5	0.2
Ice cream	0.0	0.0	0.0	36.1	2.4
Eggs	0.0	0.0	63.9	37.1	2.4
Fruits and vegetables	0.0	3.3	17.0	20.9	1.4
Fruits and vegetables in brine or syrup	0.0	0.0	0.0	0.7	0.0
Nuts and seeds	0.0	0.0	0.0	2.4	0.2
Sugars	0.0	0.0	0.0	25.5	1.7
Confectionery	0.0	0.0	0.0	11.9	0.8
Salts	0.0	0.0	0.0	0.1	0.0
Sauces and condiments	0.0	0.0	13.3	14.7	1.0
Fats and oils	34.6	79.4	135.6	90.1	5.9
Plain coffee and tea	0.0	0.0	0.0	4.3	0.3
Soft drinks	0.0	0.0	0.0	24.0	1.6
Juice and sweetened tea drinks	0.0	0.0	20.4	54.7	3.6
Blended coffee drinks	0.0	0.0	0.0	12.8	0.8
Total	994.0	1374.5	1885.1	1532.1	100.0

Tables 6-8 show food and beverage group distributions of carbohydrate, sodium, and free sugar intakes according to energy intake-EER ratio, respectively. Table A1 and Table A2 in the appendix show the food and beverage group distributions of protein and total fat. Given that carbohydrate contributes significantly to total energy intake, its consumption is expected to increase proportionally to energy ratio. Participants in the lower ratio group reported the lowest amount of carbohydrate intake at 102.5 g/day, which nearly doubled in the middle ratio group at 195.0 g/day and nearly tripled in the upper ratio category at 362.0 g/day. In proportional terms, the lower ratio group had the highest contribution of grains relative to total carbohydrate intake, compared with other ratio groups.

However, in absolute terms, the actual quantity of grains consumed was greater in the upper ratio group. The large proportional contribution of grains (66.8%) in the lower ratio group indicates high reliance of this group on one carbohydrate source. In contrast, almost half the amount of carbohydrate intake in the upper ratio group came from grains (46.2%), while substantial amounts were also contributed by juice and sweetened tea drinks (9.7%) and bread (8.1%).

Table 6. Food and beverage group distribution of carbohydrate intake (g/day) according to energy intake-EER ratio (n = 132).

Food and beverage groups	Lower ratio (n = 33)			Middle ratio (n = 66)			Upper ratio (n = 33)			Total (n = 132)			p-value[†]
	Median	Mean	%	Median	Mean	%	Median	Mean	%	Median	Mean	%	
Grains	58.1	68.5	66.8	114.1	120.1	61.6	162.4	167.3	46.2	113.2	119.0	55.7	0.0001[a;b;c]
Bread	0.0	4.6	4.5	0.0	12.9	6.6	0.0	29.5	8.1	0.0	15.0	7.0	0.0611
Pastries	0.0	4.2	4.1	0.0	9.6	4.9	16.8	19.4	5.4	0.0	10.7	5.0	0.0008[b;c]
Chips and snacks	0.0	0.3	0.3	0.0	2.5	1.3	0.0	11.8	3.3	0.0	4.3	2.0	0.0021[b;c]
Instant noodles	0.0	5.2	5.1	0.0	7.2	3.7	0.0	15.8	4.4	0.0	8.8	4.1	0.4845
Meats	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.1	0.0	0.8354
Seafood	0.0	0.2	0.2	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.6732
Processed meat and seafood	0.0	3.5	3.4	0.0	12.7	6.5	1.9	21.1	5.8	0.0	12.5	5.9	0.0032[a;c]
Ultra-processed meat and seafood	1.5	2.8	2.7	0.1	4.8	2.5	2.7	5.0	1.4	1.5	4.4	2.1	0.5267
Milk	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.1	0.0	0.2231
Cheeses	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.7338
Ice cream	0.0	1.7	1.7	0.0	1.7	0.9	0.0	7.1	2.0	0.0	3.1	1.5	0.0111[b;c]
Eggs	0.0	0.3	0.3	0.0	0.4	0.2	0.0	0.4	0.1	0.0	0.4	0.2	0.9781
Fruits and vegetables	0.6	2.9	2.8	0.5	5.0	2.6	1.9	3.4	0.9	0.6	4.1	1.9	0.4679
Fruits and vegetables in brine or syrup	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.1	0.0	0.1522
Nuts and seeds	0.0	0.1	0.1	0.0	0.0	0.0	0.0	1.4	0.4	0.0	0.4	0.2	0.8354
Sugars	0.0	0.8	0.8	0.0	2.6	1.3	0.0	19.4	5.4	0.0	6.4	3.0	0.0001[b;c]
Confectionery	0.0	0.4	0.4	0.0	1.5	0.8	0.0	5.3	1.5	0.0	2.2	1.0	0.0136[b;c]
Salts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2309
Sauces and condiments	0.0	1.9	1.9	0.0	2.0	1.0	0.1	2.9	0.8	0.0	2.2	1.0	0.3725
Fats and oils	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3651
Plain coffee and tea	0.0	0.0	0.0	0.0	0.5	0.3	0.0	2.2	0.6	0.0	0.8	0.4	0.3510
Soft drinks	0.0	3.7	3.6	0.0	5.2	2.7	0.0	9.6	2.7	0.0	5.9	2.8	0.1010
Juice and sweetened tea drinks	0.0	0.7	0.7	0.0	3.9	2.0	1.7	35.0	9.7	0.0	10.9	5.1	0.0001[b;c]
Blended coffee drinks	0.0	0.7	0.7	0.0	2.1	1.1	0.0	4.3	1.2	0.0	2.3	1.1	0.2407
Total	104.0	102.5	100.0	201.3	195.0	100.0	329.5	362.0	100.0	198.4	213.6	100.0	0.0001[a;b;c]

[†]Significant differences between groups at p-value < 0.05 were determined using the Kruskal-Wallis test; followed by Dunn's post hoc test with Holm-Sidak correction for [a]Lower ratio vs. Middle ratio; [b]Middle ratio vs. Upper ratio; [c]Lower ratio vs. Upper ratio.

Table 7. Food and beverage group distribution of sodium intake (mg/day) according to energy intake-EER ratio (n = 132).

Food and beverage groups	Lower ratio (n = 33)			Middle ratio (n = 66)			Upper ratio (n = 33)			Total (n = 132)			p-value[†]
	Median	Mean	%	Median	Mean	%	Median	Mean	%	Median	Mean	%	
Grains	7.7	15.8	2.3	11.6	27.3	2.2	16.4	81.8	3.8	11.4	38.0	2.9	0.0059[a;c]
Bread	0.0	43.4	6.4	0.0	118.1	9.5	0.0	240.1	11.2	0.0	129.9	9.8	0.1232
Pastries	0.0	30.7	4.5	0.0	71.7	5.8	52.0	136.0	6.3	0.0	77.5	5.8	0.0062[b;c]
Chips and snacks	0.0	3.4	0.5	0.0	27.0	2.2	0.0	113.9	5.3	0.0	42.8	3.2	0.0026[b;c]
Instant noodles	0.0	127.1	18.8	0.0	121.9	9.8	0.0	405.1	18.9	0.0	194.0	14.6	0.6285
Meats	31.7	38.4	5.7	49.3	60.7	4.9	68.4	83.3	3.9	48.3	60.8	4.6	0.0062[a;b;c]
Seafood	0.0	19.1	2.8	0.0	36.4	2.9	0.0	21.2	1.0	0.0	28.3	2.1	0.7884
Processed meat and seafood	0.0	15.1	2.2	0.0	205.4	16.5	3.3	178.7	8.3	0.0	151.1	11.4	0.0455[c]
Ultra-processed meat and seafood	213.5	240.3	35.5	12.4	387.8	31.1	460.8	508.5	23.7	213.5	381.1	28.7	0.1322
Milk	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.1	0.0	0.8	0.1	0.2231
Cheeses	0.0	3.8	0.6	0.0	3.4	0.3	0.0	15.1	0.7	0.0	6.4	0.5	0.7247
Ice cream	0.0	14.0	2.1	0.0	18.5	1.5	0.0	72.6	3.4	0.0	30.9	2.3	0.0110[b;c]
Eggs	0.0	33.4	4.9	0.0	34.7	2.8	0.0	34.4	1.6	0.0	34.3	2.6	0.9984
Fruits and vegetables	1.0	5.0	0.7	0.6	6.2	0.5	1.4	14.8	0.7	1.0	8.0	0.6	0.7403
Fruits and vegetables in brine or syrup	0.0	1.1	0.2	0.0	0.0	0.0	0.0	2.6	0.1	0.0	0.9	0.1	0.1554
Nuts and seeds	0.0	0.8	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.8354
Sugars	0.0	0.5	0.1	0.0	0.2	0.0	0.0	0.7	0.0	0.0	0.4	0.0	0.0001[b;c]
Confectionery	0.0	0.3	0.0	0.0	4.9	0.4	0.0	14.8	0.7	0.0	6.2	0.5	0.0140[b;c]
Salts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.7	1.4	0.0	7.7	0.6	0.2298
Sauces and condiments	0.0	74.7	11.0	0.0	101.3	8.1	10.2	101.8	4.7	0.0	94.8	7.1	0.3969
Fats and oils	0.0	3.8	0.6	0.0	4.2	0.3	0.0	0.0	0.0	0.0	3.0	0.2	0.3257
Plain coffee and tea	0.0	0.0	0.0	0.0	0.5	0.0	0.0	2.4	0.1	0.0	0.8	0.1	0.3510
Soft drinks	0.0	2.6	0.4	0.0	2.7	0.2	0.0	4.4	0.2	0.0	3.1	0.2	0.2340
Juice and sweetened tea drinks	0.0	1.6	0.2	0.0	8.8	0.7	12.0	76.3	3.6	0.0	23.9	1.8	0.0001[b;c]
Blended coffee drinks	0.0	1.4	0.2	0.0	3.5	0.3	0.0	6.1	0.3	0.0	3.6	0.3	0.2381
Total	695.1	676.1	100.0	1055.6	1245.1	100.0	1759.4	2148.6	100.0	1133.1	1328.7	100.0	0.0001[a;b;c]

[†]Significant differences between groups at p-value < 0.05 were determined using the Kruskal-Wallis test; followed by Dunn's post hoc test with Holm-Sidak correction for [a]Lower ratio vs. Middle ratio; [b]Middle ratio vs. Upper ratio; [c]Lower ratio vs. Upper ratio.

Table 8. Food and beverage group distribution of free sugar intake (g/day) according to energy intake-EER ratio (n = 132).

Food and beverage groups	Lower ratio (n = 33)			Middle ratio (n = 66)			Upper ratio (n = 33)			Total (n = 132)			p-value[†]
	Median	Mean	%	Median	Mean	%	Median	Mean	%	Median	Mean	%	
Grains	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000
Bread	0.0	0.0	0.0	0.0	1.3	5.8	0.0	0.0	0.0	0.0	0.6	1.8	0.0443[a]
Pastries	0.0	1.6	15.0	0.0	2.8	12.4	0.4	6.6	8.6	0.0	3.5	10.6	0.0030[b;c]
Chips and snacks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.3	0.0	0.3	0.9	0.0039[b;c]
Instant noodles	0.0	0.5	4.7	0.0	0.6	2.7	0.0	1.8	2.3	0.0	0.8	2.4	0.4392
Meats	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000
Seafood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000
Processed meat and seafood	0.0	0.6	5.6	0.0	2.1	9.3	0.0	3.2	4.2	0.0	2.0	6.0	0.1923
Ultra-processed meat and seafood	0.7	1.0	9.3	0.0	1.4	6.2	0.0	1.4	1.8	0.0	1.3	3.9	0.4922
Milk	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000
Cheeses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000
Ice cream	0.0	0.7	6.5	0.0	0.3	1.3	0.0	1.3	1.7	0.0	0.6	1.8	0.0059[b;c]
Eggs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000
Fruits and vegetables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000
Fruits and vegetables in brine or syrup	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2231
Nuts and seeds	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000
Sugars	0.0	0.8	7.5	0.0	2.6	11.5	0.0	19.4	25.3	0.0	6.4	19.3	0.0001[b;c]
Confectionery	0.0	0.3	2.8	0.0	0.8	3.5	0.0	4.3	5.6	0.0	1.6	4.8	0.0111[b;c]
Salts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000
Sauces and condiments	0.0	1.0	9.3	0.0	0.9	4.0	0.0	1.3	1.7	0.0	1.0	3.0	0.4077
Fats and oils	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000
Plain coffee and tea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0000
Soft drinks	0.0	3.5	32.7	0.0	5.0	22.1	0.0	9.2	12.0	0.0	5.7	17.2	0.0980
Juice and sweetened tea drinks	0.0	0.2	1.9	0.0	3.4	15.0	10.9	24.2	31.6	0.0	7.8	23.6	0.0001[a;b;c]
Blended coffee drinks	0.0	0.5	4.7	0.0	1.4	6.2	0.0	2.8	3.7	0.0	1.5	4.5	0.2381
Total	7.3	10.7	100.0	16.7	22.6	100.0	58.9	76.7	100.0	19.3	33.1	100.0	0.0001[a;b;c]

[†]Significant differences between groups at p-value < 0.05 were determined using the Kruskal-Wallis test; followed by Dunn's post hoc test with Holm-Sidak correction for [a]Lower ratio vs. Middle ratio; [b]Middle ratio vs. Upper ratio; [c]Lower ratio vs. Upper ratio.

Regarding sodium intake, a similar proportional increase in energy intake-EER ratio was observed. Individuals in the lower ratio group reported an average sodium intake of 676.1 mg/day, which nearly doubled in the middle ratio group at 1245.1 mg/day and nearly tripled in the upper ratio group at 2148.6 mg/day. Ultra-processed meat and seafood, primarily hotdog, ham, and meatloaf, were the

largest contributors of sodium in all ratio groups (23.7% - 35.5%), with the upper ratio group consuming twice as much sodium as the lower ratio group. Interestingly, while total sodium intake varied significantly across the ratio groups, no significant differences were found for its top food contributors. This suggests that the differences are attributed to other food sources and that the ratio groups had similar amounts of sodium intake from ultra-processed meat and seafood. Instant noodles were ranked as the second largest source of sodium in both the lower (18.8%) and upper (18.9%) ratio groups, whereas processed meat and seafood occupied this position in the middle ratio group (16.5%). Compared with the other groups, the upper ratio group had significantly higher sodium intake from processed foods such as pastries, confectionery, chips and snacks, juice and sweetened tea drinks, and ice cream. An additional analysis showed that participants who exceeded the sodium intake limit were in the middle (7.6%) and upper (9.8%) ratio groups.

Similar patterns were observed for free sugar intake. Those in the lower ratio group had a mean free sugar intake of 10.7 g/day, those in the middle ratio group had twice the amount at 22.6 g/day, and those in the upper ratio group had seven times more at 76.7 g/day. The top food contributors to free sugar intake were juice and sweetened tea drinks for the upper ratio group (31.6%), and soft drinks for the lower (32.7%) and middle (22.1%) ratio groups. Aside from these food sources, it is important to note that sugar was consumed almost 20 times more by the upper ratio group than its lower counterpart. Furthermore, most participants who exceeded the free sugar intake limit were in the middle (11.4%) and upper (12.9%) ratio groups, with some in the lower ratio group (6.0%).

The appendix shows the food and beverage group distribution of protein and total fat intakes based on energy intake-EER ratio. A pattern of increased intake in the higher ratio group was observed. Regarding percentage contribution, even young adolescents with low energy ratios met the required intake.

4. Discussion

This study provides an overview of the energy and nutrient intake of young adolescents in Manila. These findings revealed inadequacies in energy and carbohydrate intakes, along with excessive sodium and free sugar intake. A great majority of both male and female participants consumed less than their EER. In contrast, about one-fifth consumed amounts far in excess of the allowable level for sodium, while one-third consumed beyond the free sugar limit. Low energy intake was due to limited variety of carbohydrate sources, whereas high energy intake was attributed to increased consumption of sugary and salty foods, such as sugar-sweetened beverages, sugar, ultra-processed meat and seafood, and instant noodles.

In this study, food and beverage groups were categorized based on the extent and purpose of food processing, and food groups high in salt or sugar were further emphasized. Studies in which energy and nutrient intakes were analyzed by food and beverage group in detail are limited, let alone those that involved modern

food and beverage group categorization. We applied this approach in our study to provide new insights into the diets of Filipino adolescents, which is shaped by today's highly commercialized food system. Accordingly, original local data were derived from demographically popular but less studied food and beverage groups, such as instant noodles, juice and sweetened tea drinks, and pastries. Finally, a systematic estimation of free sugar intake according to food and beverage groups was adopted, a method not previously reported locally. All these features contribute to the uniqueness and strength of this study.

The nutritional status of the study population differed from the national data. Combining both sexes, the prevalence of stunting among the participants was 11.4%, whereas that of while overweight/obesity was 22.1%. Regarding public health significance, stunting is of medium concern; however, overweight/obesity is of very high concern [33]. Compared with result of the national survey, the prevalence of stunting among 10 - 12-year-olds was 24.9% in 2018, a significant decrease from the previous record of 32.4% in 2015. The prevalence of overweight and obesity increased significantly from 10.8% to 14.2% in the same year [34]. In fact, across the adolescent subgroups, the biggest rise and highest prevalence were observed among 10 - 12-year-olds. Both national prevalence rates are of high public health significance [33]. The difference between our local and national data highlights the influence of food environment on consumption patterns. Moreover, it raises serious concerns about the implications of the ongoing double burden of malnutrition in the country, which is similarly observed in smaller communities though with reverse trends.

On average, our participants consumed 1532.1 kcal per day, closely aligning with the 1526.2 kcal/day reported in the 2013 NNS [10]. However, this intake was below the recommended daily energy intake of 2060 kcal and 1980 kcal prescribed by the FNRI for males and females, respectively [31]. Compared with the results from other Southeast Asian countries, energy intake in this study was similar to that of Vietnamese boys and girls in urban areas but lower than that of their Malaysian counterparts [35] [36]. In addition to other low-and middle-income countries (LMICs), the recorded mean energy intake in this study was low and considerably lower than that of European adolescents who consumed over 2000 kcal per day and met their daily energy requirements [37] [38].

Lack of variety in food contributes to inadequate nutrient intake [38] [39]. Among these inadequacies is overall low energy intake. Similar to the 2013 NNS, our study revealed that grains, particularly rice, were the predominant source of energy and carbohydrates. Because of the dependence on grains as the main carbohydrate source, a reduction in its intake directly lowers overall energy consumption. Additionally, nearly half of our study population did not meet the AMDR for carbohydrates, suggesting that carbohydrate intake was not only limited in diversity but also in quantity. Those with low-carbohydrate diets tended to have reduced fiber and vitamin C intakes and higher protein, fat, and cholesterol intakes [40], and a meta-analysis established links to increased mortality that are

attributed to low-carbohydrate diets [41]. Fruits and vegetables are not only rich sources of carbohydrates and fiber, but also have low to medium glycemic index, which helps sustain blood glucose levels [42].

Conversely, participants with high energy intake were characterized by great sodium consumption. Those in the middle and upper energy intake-EER ratio groups had mean sodium intakes much higher than the national data for 10 - 12-year-olds at 893.3 mg [10]. The present study revealed that ultra-processed meat and seafood, instant noodles, and processed meat and seafood were the top three contributors to sodium intake.

High free sugar intake was also observed in participants with high energy intakes. The upper ratio group had the highest free sugar intake for all food and beverage groups except ultra-processed meat and seafood. The top three dietary sources of free sugars in this study were juice and sweetened tea drinks, sugars, and soft drinks.

Ultra-processed meat and seafood group was the primary source of dietary sodium, with intake more than doubling among high energy consumers. However, despite being the largest contributor to sodium intake, no significant differences were observed among the three ratio groups for this food group. This suggests that variations in overall sodium intake could be influenced by other dietary sources. In the U.K., processed meat products contain as much as 2800 mg of sodium per 100 g, with bacon having the highest sodium content [43]. Similarly, a study across five countries identified bacon, salami, cured meat, and ham as the largest contributors to sodium intake [44]. In the Philippines, hotdogs are the most commonly consumed ultra-processed meat among schoolchildren [45].

Instant noodles, following ultra-processed meat and seafood, were one of the top contributors of sodium in the diet of young adolescents in our study. Sodium in the form of salt or monosodium glutamate (MSG) is incorporated in noodles, broth, and seasoning components of an instant noodle [46] [47]. A comparison of sodium contents of instant noodles from several countries revealed a wide range of sodium levels in these products, 249 - 7584 mg/100 g as sold, indicating the viability of low-sodium options. However, the study also revealed that products sold in middle-income countries contained significantly higher sodium levels than those sold in high-income countries [48]. This emphasizes the need to enforce product reformulation as a nutritional intervention.

Juice and sweetened tea drinks, and soft drinks were the top and third largest sources of free sugars in adolescent diets, respectively, in the present study. Soft drinks are widely recognized for their high sugar content, and fruit juices are often perceived as healthier alternatives [49]. In the present study, soft drink consumption increased gradually as energy ratio increased, with the upper energy ratio group approximately three times higher than that of lower energy ratio group. However, in the case of juice and sweetened tea drinks, we observed that the upper ratio group consumed 120x more than the lower energy ratio group. This is concerning given that the upper energy ratio group consumed twice the overall daily

free sugar intake of the lower ratio group through their intake of juice and sweetened tea drinks alone. There is a common belief that juices are a healthier choice than soft drinks or sodas, and this belief is perhaps influenced by the marketing of these products. One study revealed that people underestimated the sugar content of fruit juices and smoothies by 48% and overestimated that of carbonated drinks by 12% [50]. Meanwhile, an analysis of fruit juices marketed for children found that 64% of these products contain at least half of the recommended maximum daily sugar intake for children in the U.K., whereas 42% contain an entire day's worth of sugar [51].

The dietary shift observed locally and globally was also observed in our study, as evidenced by the top food sources. In analyzing dietary patterns, certain food and beverage groups often emerge as probable contributors to health outcomes [52]. Processed foods are often criticized because they contain high amounts of sodium and free sugars. However, it is also important to determine their nutritional value. Analyses show that processed foods contribute 52% - 75% of energy, saturated fat, added sugars, and sodium to the American diet, as well as 34% - 65% of dietary fiber, calcium, potassium, iron, and vitamins D and B-12 [52]. It is undeniable that industrial processing has enhanced food availability and accessibility, making it an integral part of our modern food system. Therefore, nutritional recommendations for processed foods should be carefully balanced to account for both the health implications and reality of such foods shaping the food environment.

Given that overall low energy intake coexists alongside increased sodium and free sugar intakes among high energy consumers, targeted recommendations would be more effective. Young adolescents with low energy intake should consider increasing their portion size of energy-dense, nutrient-rich foods such as corn, oatmeal, potato, and taro. On the other hand, those with high energy intake from salty or sugary foods should reduce their consumption and opt for low-sodium or unsweetened varieties [53].

Ultimately, promoting balanced diets and healthy food choices is essential to navigating these dietary shifts. At the same time, a comprehensive strategy geared towards transforming the food landscape would benefit a larger population. The Philippine Department of Finance (DOF) reported that the Sugar-Sweetened Beverage (SSB) Tax, implemented in 2018, was able to see a 6.5% reduction in the consumption of such products based on data from Euromonitor [54]. Expanding this policy to other food products could show similar outcomes. A study exploring different key considerations (political economy, tax model design, nutrient model profile, and dietary data) for a possible food tax modelling framework in the Philippines found that, under the current food and political landscape, implementing a broader food tax is feasible [55]. Meanwhile, stricter FOPL and warning labels are being advocated by health organizations in the Philippine context to encourage healthy food choices [56] [57].

Although this study contributes to the understanding of energy and nutrient

contributions of food and beverage groups, it is important to acknowledge its limitations. The study participants were recruited from public schools in an urban setting. Since public schools accommodate the majority of the student population (88.8% of total enrollments) [58], our data largely reflects the diet of young Filipino adolescents in this setting. It does not account for the dietary patterns of private school students and out-of-school youths, who are inherently more difficult to trace. Second, the timing of data collection coincided with the typhoon season, potentially limiting food accessibility, which may have affected overall energy intake. Conversely, it could have also increased the consumption of ready-to-eat foods, such as deli meats and canned goods, owing to restricted mobility. Third, the recollection of food and beverage consumed could be subject to social desirability and recall bias. Moreover, adolescents often underreport rather than overreport their dietary intake, possibly lowering the energy intake from socially undesirable foods such as sweet and fried foods [59]. Finally, despite the known underconsumption of iron and calcium, we did not further analyze these nutrients to maintain the focus on sodium and free sugars in processed foods. Future research could be improved by considering seasonal variations in food consumption and analyzing additional nutrients using the same food grouping approach.

5. Conclusion

This study highlights energy and nutrient intake patterns among young adolescents in Manila, revealing insufficient energy and carbohydrate consumption alongside excessive sodium and free sugar intake. Most participants consumed less than their EER, while some exceeded sodium and free sugar limits. Low energy intake was attributed to the limited variety of carbohydrate food sources, whereas high intake was driven by high consumption of sugary and salty foods. This study elaborated on the insufficient energy intake of most young adolescents. It also highlighted the top food sources of energy, carbohydrates, sodium, and free sugars, that could be targeted for intervention towards young adolescents with low or high energy intake, respectively. Education programs to foster nutritional literacy and facilitate practices and attitudes in choosing healthy food and beverages should be developed to meet the needs of young adolescents facing the double burden of malnutrition.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

Table A1. Food and beverage group distribution of protein intake (g/day) according to energy intake-EER ratio (n = 132).

Food and beverage groups	Lower ratio (n = 33)			Middle ratio (n = 66)			Upper ratio (n = 33)			Total (n = 132)		
	Median	Mean	%	Median	Mean	%	Median	Mean	%	Median	Mean	%
Grains	4.7	5.1	15.9	8.2	8.8	17.5	12.0	13.0	18.5	8.0	8.9	17.6
Bread	0.0	0.8	2.5	0.0	1.9	3.8	0.0	4.8	6.8	0.0	2.3	4.5
Pastries	0.0	0.6	1.9	0.0	1.1	2.2	2.0	2.5	3.6	0.0	1.3	2.6
Chips and snacks	0.0	0.0	0.0	0.0	0.3	0.6	0.0	1.2	1.7	0.0	0.5	1.0
Instant noodles	0.0	0.8	2.5	0.0	1.2	2.4	0.0	2.5	3.6	0.0	1.5	3.0
Meats	6.7	9.2	28.8	12.3	13.7	27.2	16.3	16.8	24.0	11.3	13.3	26.3
Seafood	0.0	4.8	15.0	0.0	6.1	12.1	0.0	3.7	5.3	0.0	5.2	10.3
Processed meat and seafood	0.0	2.1	6.6	0.0	4.3	8.5	1.3	4.3	6.1	0.0	3.7	7.3
Ultra-processed meat and seafood	3.7	4.0	12.5	1.6	6.7	13.3	6.4	8.2	11.7	3.1	6.4	12.6
Milk	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.0
Cheeses	0.0	0.1	0.3	0.0	0.1	0.2	0.0	0.2	0.3	0.0	0.1	0.2
Ice cream	0.0	0.6	1.9	0.0	1.0	2.0	0.0	4.2	6.0	0.0	1.7	3.4
Eggs	0.0	3.2	10.0	0.0	3.3	6.6	0.0	3.2	4.6	0.0	3.3	6.5
Fruits and vegetables	0.0	0.3	0.9	0.1	0.8	1.6	0.4	0.9	1.3	0.1	0.7	1.4
Fruits and vegetables in brine or syrup	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Nuts and seeds	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.6	0.9	0.0	0.2	0.4
Sugars	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Confectionery	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.2	0.3	0.0	0.1	0.2
Salts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sauces and condiments	0.0	0.1	0.3	0.0	0.2	0.4	0.0	0.6	0.9	0.0	0.3	0.6
Fats and oils	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plain coffee and tea	0.0	0.0	0.0	0.0	0.2	0.4	0.0	0.7	1.0	0.0	0.3	0.6
Soft drinks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Juice and sweetened tea drinks	0.0	0.1	0.3	0.0	0.3	0.6	0.0	2.0	2.9	0.0	0.7	1.4
Blended coffee drinks	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.2	0.3	0.0	0.1	0.2
Total	27.6	32.0	100.0	45.2	50.3	100.0	64.9	70.1	100.0	46.5	50.6	100.0

Table A2. Food and beverage group distribution of total fat intake (g/day) according to energy intake-EER ratio (n = 132).

Food and beverage groups	Lower ratio (n = 33)			Middle ratio (n = 66)			Upper ratio (n = 33)			Total (n = 132)		
	Median	Mean	%	Median	Mean	%	Median	Mean	%	Median	Mean	%
Grains	0.5	0.6	2.1	0.8	0.9	1.8	1.1	2.0	2.3	0.8	1.1	2.1
Bread	0.0	0.3	1.0	0.0	1.1	2.2	0.0	2.6	3.0	0.0	1.3	2.4
Pastries	0.0	1.1	3.8	0.0	2.8	5.7	4.8	5.4	6.3	0.0	3.0	5.6
Chips and snacks	0.0	0.1	0.3	0.0	1.3	2.6	0.0	5.3	6.2	0.0	2.0	3.8
Instant noodles	0.0	1.6	5.6	0.0	2.2	4.5	0.0	7.8	9.1	0.0	3.4	6.4
Meats	4.3	7.4	25.9	6.6	12.1	24.6	18.9	21.8	25.3	7.2	13.4	25.2
Seafood	0.0	0.7	2.4	0.0	0.9	1.8	0.0	0.7	0.8	0.0	0.8	1.5
Processed meat and seafood	0.0	1.4	4.9	0.0	3.8	7.7	1.9	4.6	5.3	0.0	3.4	6.4
Ultra-processed meat and seafood	3.5	5.0	17.5	1.2	8.2	16.7	7.3	11.0	12.8	3.6	8.1	15.2
Milk	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.1	0.2
Cheeses	0.0	0.1	0.3	0.0	0.3	0.6	0.0	0.3	0.3	0.0	0.2	0.4
Ice cream	0.0	0.7	2.4	0.0	1.0	2.0	0.0	4.9	5.7	0.0	1.9	3.6
Eggs	0.0	2.5	8.7	0.0	2.6	5.3	0.0	2.4	2.8	0.0	2.5	4.7
Fruits and vegetables	0.0	0.1	0.3	0.0	0.3	0.6	0.0	0.1	0.1	0.0	0.2	0.4
Fruits and vegetables in brine or syrup	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Nuts and seeds	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sugars	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Confectionery	0.0	0.1	0.3	0.0	0.2	0.4	0.0	0.7	0.8	0.0	0.3	0.6
Salts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sauces and condiments	0.0	0.1	0.3	0.0	0.3	0.6	0.0	1.2	1.4	0.0	0.5	0.9
Fats and oils	5.0	6.6	23.1	9.0	10.4	21.2	9.9	12.6	14.6	8.8	10.0	18.8
Plain coffee and tea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Soft drinks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Juice and sweetened tea drinks	0.0	0.1	0.3	0.0	0.2	0.4	0.0	1.7	2.0	0.0	0.6	1.1
Blended coffee drinks	0.0	0.1	0.3	0.0	0.4	0.8	0.0	0.6	0.7	0.0	0.4	0.8
Total	25.8	28.6	100.0	48.3	49.1	100.0	79.9	86.1	100.0	48.5	53.2	100.0