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Nutrient Intakes of School-Age Children in Selected Schools in Davao City, Philippines

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ABSTRACT

Adequate nutrition during childhood is vital for proper growth and development. However, nutrient intakes of Filipino school-age children are shown to be inadequate. This study assessed the nutrient intakes among school-age children from districts with the highest malnutrition rate in Davao City, Philippines. Using 3-day food records, dietary intake data were collected from a representative sample of 165 schoolchildren (aged 10-12 years) from six public schools in Poblacion, Paquibato, and Marilog districts. The nutrient intakes were calculated from the indicated food quantities, and the USDA food composition table was used as the primary database. These were compared with the 2015 Philippine Dietary Reference Intake values. Intake of total energy (102.56%), protein (165.11%), and some micronutrients reached the required amounts. On the other hand, inadequacies in several nutrients were identified: lipid intake was 49.01% of the recommended level, carbohydrate at 91.68%, dietary fiber at 53.16%, vitamin C at 54.98%, folate at 67.69%, vitamin E at 43.48%, vitamin D (IU) at 89.20%, calcium at 48.93%, and iron at 53.70%. Excess intakes of sodium (683.07%) and vitamin B12 (520.74%) were also reported. These findings suggest the need for targeted intervention programs that address nutrient inadequacies among Filipino school-age children.

Keywords: macronutrient intake, micronutrient intake, nutrient inadequacy, school-age children, 3-day food record

INTRODUCTION

The inadequacy of nutrient intakes is of increasing public health concern. According to UNICEF (2020), the undernutrition of children has been attributed to nearly half of all child deaths globally. UNICEF (2023) reports that many school-age children do not consume nutritious and balanced diets. The insufficiencies in nutrients among children have been well documented, with pronounced prevalence in Southeast Asia (Fiorentino et al., 2016; Caswell et al., 2018; Campos Ponce et al., 2019; Magee & Mccann, 2019). In low- and middle-income countries, the consumption of nutrient-rich foods such as fruits, vegetables, and animal products among school-age children remains low.

Likewise, urbanization heightened the incidence of nutritional inadequacies due to consumption of foods from convenience and fast foods that are high in glycemic indexes, fats, and sugars (Fiorentino et al., 2016; Caswell et al., 2018). Moreover, rising access to fast foods and processed foods influence the preferences of Filipino school-age children (Siy Van et al., 2021) that may contribute to the high prevalence of inadequate intakes was highest for iron, calcium, vitamin C, folate, zinc, and total fat (Denney et al., 2018). As a result, one of the consequences is suboptimal cognitive development, which hinders development into healthy and productive adults (Denney et al., 2018; Wieringa et al., 2019). The programs associated with addressing these inadequacies are often focused on only one or a few micronutrients. With the absence of a national protocol and guidelines to address chronic malnutrition (Garg et al., 2016), there is a greater need for a holistic approach to developing nutrition-specific interventions to address these deficiencies (Wieringa et al., 2019). Nonetheless, some efforts have focused on national policy and government scale-up and the development of nutrient-rich food products (Garg et al., 2016; Soriano et al., 2020). For instance, Davao City was the first to implement the Act for Salt Iodization Nationwide Law (Davao City Information Office, 2018). Effective food fortification strategies for children will help deliver significant nutrients.

In a few studies, most of the nutrient-deficient schoolchildren and adolescents came from poor families and rural areas (Angeles-Agdeppa et al., 2019a; Angeles-Agdeppa et al., 2019b; Mak et al., 2019). In the 2018 Expanded National Nutrition Survey (ENNS) conducted by the Food and Nutrition Research Institute [FNRI], undernutrition was still more prevalent among children in rural areas. In contrast, overweight/obesity was more prevalent among children in urban areas (FNRI, 2020b). In a recent report of the FNRI (2020a), it was found that the prevalence of stunting and overweight/obesity was higher

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among school-age children in Davao City (25.7% and 14.5%, respectively) compared to the respective national average prevalence of 24.6% and 11.6% (Davao City Agriculturist Office, 2016). Underweight and stunting were more prevalent among school-age children from poor areas in Davao City. However, research on the nutrient intake of school-age children in the Philippines is scarce.

This study aimed to determine the nutrient intakes of school-age children from districts with the highest malnutrition rate in Davao City, Philippines. Areas with the highest incidence of malnutrition were selected because the study seeks to recommend interventions targeting specific nutrient inadequacies among malnourished children. These particular districts generally have higher unemployment rates and numbers of identified poor children, contributing to the poor nutrient intakes and malnutrition status, as presented in the 2018 ENNS where inadequacies were more prevalent among children from the poorest households (FNRI, 2020a). Hence, the results of this study target to fine-tune the dietary recommendations and policies for school-age children in these poverty-stricken areas. Therefore, the data will help design policy interventions on nutrition education and school feeding programs in primary schools. Furthermore, the findings can direct government agencies and research institutions to develop food-based recommendations and public health strategies to address the issue of nutrient inadequacies among school-age children in Davao City, Philippines.

METHODOLOGY

Study Population

The study selected school-age children, specifically fifth-grade students aged 10-12 years, in six primary schools in Davao City, Philippines. According to data obtained from the Davao City Agriculturist Office (2016) and Davao City Planning and Development Office (2016), the top three administrative districts with the highest malnutrition rate in their respective legislative districts were Poblacion (5.16%), an urban area, and Paquibato (13.41%) and Marilog (7.95%), which are rural areas. The number of identified poor children aged 9-12 years old in Marilog, Paquibato, and Poblacion districts comprised 13.7%, 10.9%, and 7.8%, respectively, of the total number of poor children surveyed (Department of Social Welfare and Development, 2016). The highest number of identified poor children at 1,370 was under the Marilog district. These districts were selected because the results of this study target to fine-tune the dietary recommendations and policies for school-age children in these poverty-stricken areas. From each of the three districts, two primary schools were randomly selected. These schools include Kapitan Tomas Monteverde Sr. Elementary School and Teodoro Palma Gil Elementary School in Poblacion District, Paradise Embac Elementary School, and A.L. Navarro Elementary School in Paquibato District, and Salaysay Elementary School and Marilog Central Elementary School in Marilog District. With the assistance of the school principal and the fifth-grade head adviser, one section from each participating school was identified through random selection. A total representative sample of 165 students who had undergone the vegetable gardening curriculum was selected. According to the central limit theorem, as the sample size becomes sufficiently large ($n \geq 30$), the sample distribution approaches normality and thus statistical inferences become reliable (Lehmann, 1999; Kwak & Kim, 2017). The sample size was calculated using power analysis with the following specifications: effect size = 0.3, alpha error = 0.05, and power = 0.95. The minimum total sample size is 122, and the higher sample size used in the study increases the reliability of inferences as shown in a similar study (Calumba et al., 2023). Moreover, school-based feeding and gardening programs were prohibited during the project implementation to avoid bias, specifically to ensure that the food consumed was prepared and/or bought by the household.

Data Collection

Household socio-demographic data including age, sex, educational attainment, and household size were collected using a pre-tested questionnaire administered to the parents/legal guardians of the child. All questionnaires were translated into the local dialect. The study was conducted following the Declaration of Helsinki (World Medical Association, 2018). The research objective was thoroughly explained, and written informed consent was obtained from the parents/guardians of the participating children prior to the data collection conducted from 2017 to 2018. Data were appropriately managed to ensure privacy and anonymity.

The dietary intake information was collected using the 3-day food record. This method was recently reported to be superior to the gold standard 7-day dietary assessment as it provides comparable results and can save time and cost (Chandrashekarappa et al., 2020). It has been commonly used in practical settings and is reported to be an acceptable dietary assessment tool (Yang et al., 2010) and standard for the validation of a developed food frequency questionnaire (Morel et al., 2018). The researchers and teachers from the participating schools explained the questionnaire to the parents/guardians with emphasis on proper measuring units, and the parent/guardian accompanying the child was asked to record all foods and drinks consumed by the child for the past three days during breakfast, lunch, dinner, and snacks. The respondents were asked to indicate the amount consumed using food utensils (e.g., measuring cups for rice; number of pieces for bread, individual fruits and vegetables, eggs, hotdogs, and root crops; number of packs for noodles, juice, and powdered milk; amount in kilograms for meat; number of spoons for powdered food products; and number of cans/bottles for canned goods and soft drinks and other beverages). Emphasis was placed on providing sufficient information to estimate the portion sizes. Food description details such as added ingredients were collected for each food recalled. The questionnaires were brought home, while some participants answered the survey during face-to-face meetings. The elderly respondents were assisted in answering the survey questions. Upon retrieving the questionnaires from the respondents, the answers were validated by the team.

Data Analysis

A descriptive analysis was carried out in this study.

The most consumed foods of the participating school-age children were identified. They were classified into various food groups: meats/poultry/fish products, grains and grain products, eggs and milk products, vegetables, fruits, and sweetened beverages. The frequency of intake of the top twenty most consumed foods was also recorded. This refers to the number of times a specific food was consumed by 165 schoolchildren over three days.

The observed nutrient intakes were calculated from the 3-day food record using the food composition tables developed by the United States Department of Agriculture (USDA) (2019) as the primary database since it is more comprehensive and widely accepted globally, as well as the PhilFCT from the FNRI (2015) for specific food items not found in the USDA database. Each food intake was calculated for energy (kcal), protein (g), lipid (g), carbohydrate by difference (g), dietary fiber (g), vitamin C, thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, vitamin A (retinol activity equivalent or RAE), vitamin A (IU), vitamin E, vitamin D (IU), and vitamin K, calcium, iron, magnesium, phosphorus, potassium, sodium, and zinc, wherein all vitamins and minerals were calculated in mg. The mean macronutrient and micronutrient intakes were obtained and plotted in Microsoft Excel. Nutrient intake data were assessed against the 2015 Philippine Dietary Reference Intake Recommended Energy/Nutrient Intake (REI/RNI) values. From this, the nutrient inadequacies and excessive intakes were determined from the % nutrient intake as follows, where 100% signifies adequate intake.

$$\% \text{ Nutrient intake} = \left(\frac{Average\ nutrient\ intake}{Recommended\ nutrient\ intake}\right) \times 100 \qquad (1)$$

RESULTS AND DISCUSSION

Household Characteristics

The socio-demographic characteristics of the 165 participating households are shown in Table 1. The respondents who answered this part of the questionnaire were either household heads or guardians of schoolchildren aged 10-12 years old. The majority of the interviewed household representatives were below 40 years old (53%) and predominantly female (76%) because their husbands were at work and some were stay-at-home mothers. Among the interviewed households, almost half had a college-level education. Also, the majority of the households had at least 5 members.

Commonly Consumed Foods

The most consumed food items are listed in Table 2, while the top twenty foods consumed in the largest quantities are presented in Table 3. Rice, which was identified as the most consumed food and the primary carbohydrate source in the diet of school-age children, is a staple in the Philippines (Lapada, 2019). Meanwhile, protein intake is primarily sourced from consuming fresh meat (fish, chicken, pork, and beef), processed meat products, eggs, and milk. In addition, several food items listed (e.g., powdered chocolate drink, canned sardines, hotdog, dried fish, noodles, and corned beef) are processed products. In general, processed foods pose a concern among consumers because of higher saturated fat, sugar, and salt (Petit et al., 2019; Bleiweiss-Sande et al., 2020). The consumption of highly processed food has also been associated with childhood obesity, especially among low-income children, and is also linked with lower dietary quality (Bleiweiss-Sande et al., 2020). The consumed fruit and vegetable are banana and eggplant, respectively. Although children consume a combination of green leafy vegetables (e.g., Malabar spinach or 'alugbati' and pechay), fruit, vegetables (e.g., eggplant and squash), and starchy vegetables (e.g., potato), the amount and variety of these in the diet are limited and is similar to the trend for fruits. According to the respondents, the food consumption of children is driven mainly by accessibility and convenience.

Table 1. Socio-demographic profile of parent/guardian of the school-age children (n=165).

Characteristics	%
Age	
Below 40 years old	53
40 to 49 years old	32
50 to 59 years old	11
Above 59 years old	4
Sex	
Male	24
Female	76
Educational attainment	
Elementary	16
High school	35
College	48
Others	1
Household size	
Less than 5 persons	39
At least 5 persons	61

Table 2. Commonly consumed foods by school-age children, 10-12 years old, in selected schools in Davao City based on the 3-day food record.

Food group	Most consumed food
Meats/Poultry/Fish Products	Fish, chicken, pork, beef, canned sardines, hot-dog, dried fish, corned beef, beef loaf
Grains and Grain Products	Rice, bread, noodles
Eggs and Milk Products	Eggs and milk (liquid, milk powder)
Vegetables	Eggplant, string beans, Malabar spinach, pechay, water convolvulus, squash, carrots, bottle gourd, sweet potato, potato
Fruits	Banana, apple, durian, mango, papaya
Sweetened Beverages	Powdered chocolate drink

Table 3. Frequency of intake of the top twenty most consumed foods of school-age children, 10-12 years old, in selected schools in Davao City based on 3-day food record (n=165).

Rank	Food	Frequency of intake in 3 days*	Mean frequency of intake per respondent per day
1	Rice	1326	2.7
2	Fish	383	0.8
3	Egg	253	0.5
4	Milk	201	0.4
5	Bread	170	0.3
6	Banana	160	0.3
7	Chicken	123	0.2
8	Eggplant	121	0.2
9	Powdered chocolate drink	116	0.2
10	Canned sardines	107	0.2
11	Pork	104	0.2
12	Hotdog	97	0.2
13	Dried fish	85	0.2
14	Beef	83	0.2
15	Noodles	77	0.2
16	String beans	49	0.1
17	Sweet potato	46	0.1
18	Corned beef	44	0.1
19	Malabar spinach	38	0.1
20	Pechay	37	0.1

*Values are the number of times the food is consumed across the 165 children during a single 3-day food record.

Macronutrient Intakes

In this study, a 3-day food record was used to estimate the nutrient intake of the participants. Data collection on nutrient intake through food records and questionnaires is more feasible than biomarkers which require laboratory analyses (Wieringa et al., 2019).

The mean energy and protein intake reached the required levels at 102.56%, and 165.11%, respectively. Most of the school-age children had insufficient lipid, carbohydrate, and dietary fiber intakes which met only 49.01%, 91.68%, and 53.16% of the recommended levels, respectively (Figure 1). The participants consume mostly protein-rich foods as listed in Tables 2 and 3, including fresh meat (fish, chicken, pork, and beef), processed meat products, eggs, and milk. The limited consumption of fruits and vegetables may have contributed to the low dietary fiber intake, which can lead to poor digestive health and an increase in both blood glucose and cholesterol levels (Korczak et al., 2017). Households with more than five members, living in rural areas, and with poor income status are more commonly engaged in vegetable gardening and growing fruit-bearing trees (FNRI, 2020a). However, the present results show that the consumption of fiber-rich fruits and vegetables among school-age children was low despite the majority of the households having more than five family members, and the districts selected as contributing a total of 32.4% to the number of identified poor children in Davao City. Previous research identified

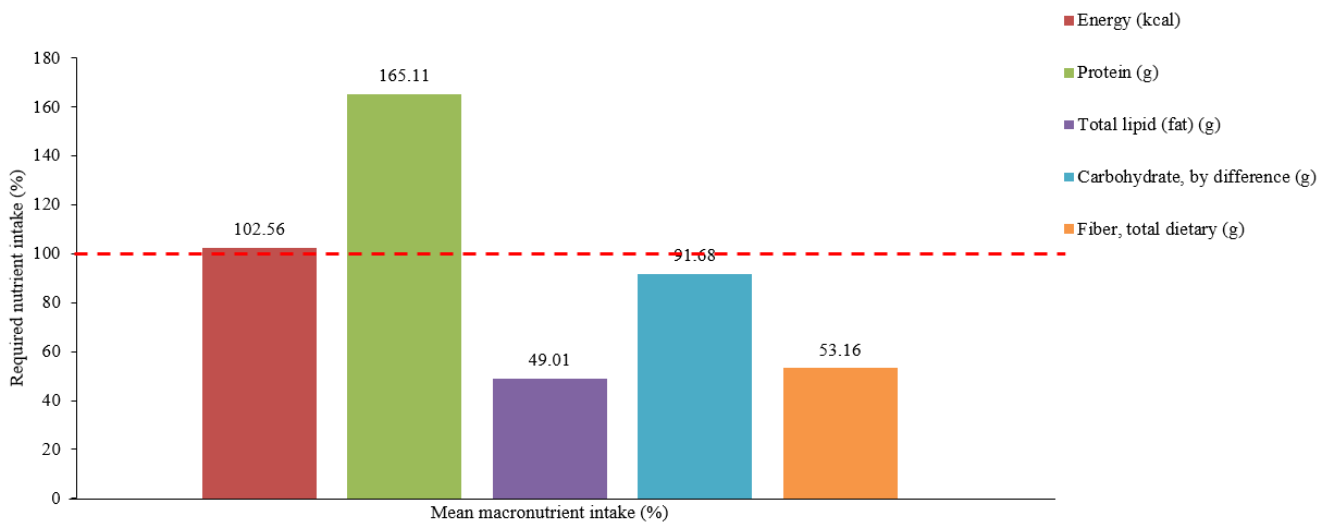

Figure 1. Mean energy and macronutrient intakes among school-age children, 10-12 years old in selected schools in Davao City based on 3-day food record.
*The red dashed line denotes 100% adequacy. Data falling below the red broken line equate to the inadequacy of a certain nutrient, while just above or beyond the line signifies either sufficient or overconsumption of a nutrient.

affordability as a significant factor affecting the purchasing decisions of Filipino children while in school. Highly processed foods were found to be cheaper than healthier local alternatives sold in the school perimeter (Reeve et al., 2018). School-age children may be more exposed to fast food and convenience food (Bleiweiss-Sande et al., 2020). Moreover, lower consumption of vegetable food preparations was associated with a decline in income among fisher households in Davao Gulf, corresponding to higher consumption of processed food (Joquiño et al., 2021).

Micronutrient Intakes

The results demonstrated that school-age children were at the highest risk of inadequate intakes of vitamin C, folate, vitamin E, vitamin D (IU), calcium, and iron. The top three micronutrient inadequacies were iron (53.70%), calcium (48.93%), and vitamin E (43.48%). On the other hand, Figure 2 and Figure 3 report that children had very high intakes of sodium (683.07%) and vitamin B12 (520.74%).

The mean vitamin C intake was below the standard recommendations (54.98%). Vitamin C deficiency is common among populations with low fruit and vegetable intake (WHO & FAO, 2004). In the present study, the school-age children consumed very minimal amounts of these food groups (Table 3), which could be a contributing factor. Vitamin C is considered to have functional roles in the immune system and can help prevent respiratory infections in children from developing countries (Vorilhon et al., 2019). Vitamin C deficiency was more prevalent among Filipino schoolchildren in urban areas, suggesting a significant difference in the diet between urban and rural regions (Angeles-Agdeppa et al., 2019a).

School-age children from the present sample also exhibited folate inadequacy with a mean intake of 67.69% of the recommendation. Some sources of folate include beans, nuts, and dark green leafy vegetables (Caswell et al., 2018), which are not abundantly consumed by the study population. The most consumed food, white rice, is low in folate (WHO & FAO, 2004). In the Philippines where rice is a staple and the consumption of legumes and green leafy vegetables are usually low, there is a higher chance of sustaining deficiencies in folate intakes (Allen, 2008). Similar to the trend for vitamin C, the inadequacy of folate was reported to be higher in urban areas (Angeles-Agdeppa et al., 2019a). Folate was previously shown to play a crucial role in preventing neural tube defects (Allen, 2008; Magee & Mccann, 2019). Also, poor folate status was associated with impaired memory and learning and poor cognitive performance among school-age children (Gupta et al., 2017).

Another nutrient inadequacy observed among children is vitamin E (43.48% intake compared to the recommended amount). Vitamin E is a major fat-soluble antioxidant obtained exclusively from the diet and is naturally present in plant-based diets and animal products. Vegetable oils are the primary dietary source of vitamin E and other foods where vitamin E is present include seeds and nuts, meat, and bread (WHO & FAO, 2004; Weber et al., 2019). Furthermore, vitamin E deficiency is primarily due to inconsistent dietary fat absorption and metabolism. Also, since vitamin E is lipid-soluble, its higher intakes are correlated with a lower incidence of cardiovascular diseases (WHO & FAO, 2004; Kemnic & Coleman, 2019).

Finally, vitamin D (IU) intakes were slightly insufficient in the study population with a mean value of 89.20%. Vitamin D is a fat-soluble vitamin referring to ergocalciferol (vitamin D2) and cholecalciferol (vitamin D3). Vitamin D in 1 µg is equivalent to 40 International Units (IU), which is used as the standard unit for Vitamin D

content in food products (Pludowski et al., 2018). Although vitamin D deficiency is an increasing public health concern, information on its prevalence in low-middle income countries is not widely available. In the Philippines, the vitamin D supply is primarily obtained from pelagic fishes, such as tuna (Cashman et al., 2019). The insufficient intake may be surprising as the children's fish consumption is relatively high. However, the most common fish species consumed by the participating children may not be high in vitamin D. Moreover, it is reported that vitamin D deficiency has adverse effects on bone metabolism and immune function (Pludowski et al., 2018). Aside from diet, skin exposure to sunlight can already provide daily vitamin D needs (WHO & FAO, 2004).

The calcium intake was only almost half (48.93%) of the recommended amount. Surprisingly, calcium intake is insufficient given that milk is the fourth most consumed food. Still, the high prices of milk and dairy products especially in urban areas may be a likely factor that can constrain its accessibility (Fiorentino et al., 2016; Angeles-Agdeppa et al., 2019a). In a recent study, the prevalence of calcium inadequacy among Filipino schoolchildren and adolescents was 92-94% (Angeles-Agdeppa et al., 2019a). Calcium, along with iron and zinc, is designated as a "problem nutrient" as deficiencies can cause severe issues in the growth and development of children (Goyena et al., 2019). Low dietary calcium has been associated with hypocalcemia and low bone mineral density (Fiorentino et al., 2016).

Insufficient iron intake was also highly prevalent in children with a mean value of 53.70% compared to the recommended levels. This poor intake was similar to previous studies on Filipino children (Denney et al., 2018; Angeles-Agdeppa et al., 2019a; Angeles-Agdeppa et al., 2019b; Goyena et al., 2019; Mak et al., 2019). Inadequacy of iron intake was also shown to be higher for 10-12 years old (Angeles-Agdeppa et al., 2019a), which is the age group in the current study. The poor intake of iron and the abovementioned calcium is common among Filipino children because of the low amount and diversity of foods that are rich in these nutrients (Mak et al., 2019). Leafy vegetables and other vegetables, largely indigenous ones, as well as fruits that have a high ascorbic acid content, help enhance the absorption of iron in the body. The low consumption of these foods, especially among poor households, puts them at a higher risk of iron deficiency (Hönicke et al., 2006). The 2018 ENNS describes the higher prevalence of anemia in children from poor households (FNRI, 2020b). Iron deficiency is the most common cause of anemia worldwide. Iron and calcium are also poorly absorbed by the body due to the excessive intake of phytate from grains, particularly rice (Table 3) (Bhargava, 2016). Studies have reported associations among iron deficiency, iron deficiency anemia, and poor cognitive development in children (WHO, 2017). Thus, insufficient iron intake may impair school attendance and performance. It is also a risk factor for poor vitamin A status (Fiorentino et al., 2016).

On the other hand, it was found that children have sufficient or high intake of the following micronutrients: thiamin (vitamin B1), riboflavin (vitamin B2), niacin, vitamin B6, vitamin B12, vitamin A, and vitamin K (Figure 2) magnesium, phosphorus, potassium, sodium, zinc (Figure 3).

The excessive sodium intake (683.07%) obtained is comparable to a recent report indicating 893 mg sodium per day among Filipino schoolchildren aged 10-12 years (Angeles-Agdeppa et al., 2019a). As shown in the 3-day food record of the respondents, this high sodium intake can be attributed to the frequent consumption of processed and salty foods, such as canned sardines, dried fish, and noodles (Table 3). In a previous study, dried-salted sardine samples in the Philippines exceeded the recommended salt content for dried fish products (Simora et al., 2016). The high consumption of processed foods may be due to the geographical location of the respondents. Urban residents have easier access to manufactured foods and fast foods, which have higher sodium content, than rural residents (Mizéhoun-Adissoda et al., 2017; Siy Van et al., 2021). Moreover, as some of the respondents stated, the money they earn from selling harvested crops is used to buy rice and food products such as those mentioned above, which are relatively cheaper. Excess sodium intake has been widely associated with a higher risk of cardiovascular diseases (Petit et al., 2019) hence sodium intake during childhood needs to be regulated to prevent hypertension and other diseases in the life course (Leyvraz et al., 2018).

The mean intake of vitamin B12 was also beyond the recommended level, with the lowest and highest average values per school being 353.8 to 662.9%, respectively. Vitamin B12, which is necessary for cognitive development in children, is primarily obtained from animal-source foods (Venkatramanan et al., 2016). As shown in Table 3, the participating school-age children consumed many animal-based foods such as meat, fish, and poultry, contributing to the high intake of this vitamin. Moreover, early diagnosis of abnormally high vitamin B12 intakes is essential in preventing possible diseases (Andrès et al., 2013).

The observed nutrient inadequacies can be linked to the socioeconomic status of the three districts. Poblacion and Marilog districts had higher percentages of unemployed individuals at 13.7% and 13.5%, respectively, compared to the 12% city average. Also, the number of identified poor children aged 9-12 years old from the three participating districts reached 32.4% of the total number surveyed in Davao City in 2016. This information can be associated with one study showing how unemployment can increase the risk of malnutrition as employment is one of the social factors influencing human health (Sia et al., 2019). With accessibility and convenience identified as primarily influencing the food consumption of the school-age children, the high numbers of unemployed and identified poor children in the said districts and consequently poor socioeconomic status may have translated into low access to healthier food, affecting the children's nutrient intakes. This is especially common among poor households as 78.4% of the poor population in Davao City are food insecure. Also, food insecurity is more prevalent among households with more than five members (FNRI, 2020a), which is the case of 60% of the respondents in this study (Table 1). Lastly, despite the agricultural nature of the rural districts, this study shows that the children consumed

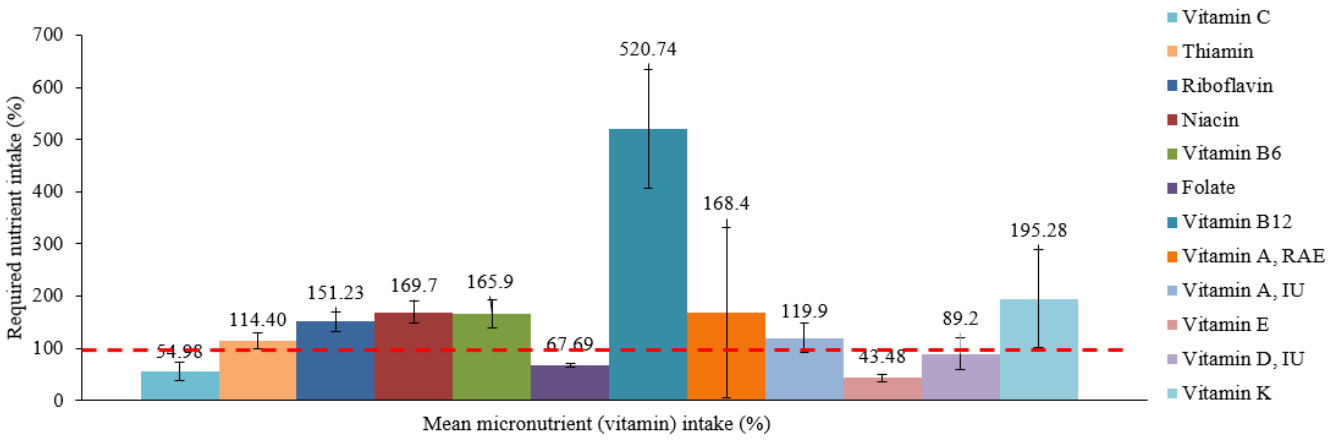

Figure 2. Mean micronutrient (vitamin) intakes among school-age children, 10-12 years old in selected schools in Davao City based on 3-day food record.
*The red dashed line denotes 100% adequacy. Data falling below the red broken line equate to the inadequacy of a certain nutrient, while just within or beyond the line signifies either sufficient or overconsumption of a nutrient.

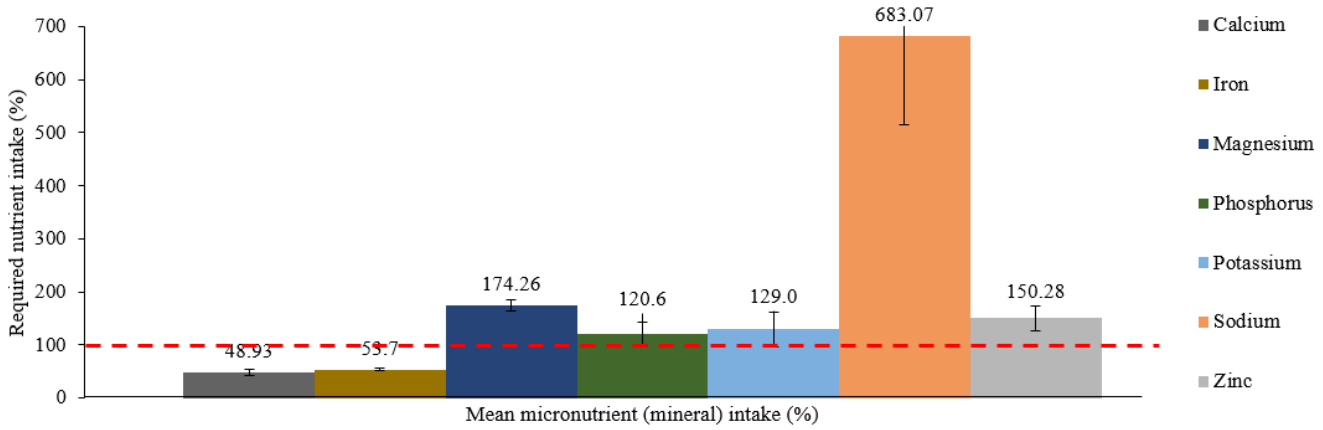

Figure 3. Mean micronutrient (mineral) intakes among school-age children in selected schools in Davao City based on 3-day food record.
*The red dashed line denotes 100% adequacy. Data falling below the red broken line equate to the inadequacy of a certain nutrient, while just within or beyond the line signifies either sufficient or overconsumption of a nutrient.

several processed food products, which are reportedly more affordable than healthier food options in school (Reeve et al., 2018). Processed foods were increasingly consumed among Davao Gulf fishers' children from low-income households to substitute home-prepared meals (Joquiño et al., 2021).

This study has some limitations. The information presented was limited to the children's food intake declared by their parents or guardians. There may be other possible sources of nutrients that were not taken into account and under- or over-reporting could be plausible. Therefore, there is a likelihood of day-to-day variations in the food and nutrient intakes of the participants, including differences in weekday and weekend consumption, as the data describe only the short-term average. The results obtained were also analyzed using the USDA food composition tables, but the use of PhilFCT as the primary database must be considered in future studies. Further, future research may focus on the transition in nutrition in the Philippine setting especially during a pandemic or when challenging environmental stressors are present. These efforts become more important during a health crisis where children are vulnerable, so their nutritional requirements must be met to prevent health disparities in the future.

CONCLUSION AND RECOMMENDATION

The findings of this study show that the mean intake of lipid, carbohydrate, dietary fiber, vitamin C, folate, vitamin E, vitamin D (IU), calcium, and iron of school-age children from districts with the highest malnutrition rate in Davao City, Philippines, were below the recommended levels. As diet is a significant factor contributing to malnutrition, there is a stronger need for interventions to improve dietary practices (i.e., home gardening and consumption of indigenous fruits and vegetables) and consequently the nutritional status of Filipino children. This

study recommends increasing the awareness of the benefits of consuming a wide variety of food items among children, especially in marginalized areas. Further, the findings can be used to formulate and implement policies and programs that are more inclusive to improve the growth and health outcomes of school-age children in Davao City. A national but targeted food fortification program is recommended to address nutrient deficiencies, especially among children in low-income households. The present study highlights the need for broader and sustained support for home gardening, existing food fortification programs, nutrition education, research efforts, and other initiatives to improve the nutrition of school-age children, especially from areas with high malnutrition rates and poverty incidence.

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