

The Analysis of School Children's Food Consumption (10-12 Years) Using Optifood Application in The City of Medan

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Abstract. Food consumption of school children is one of the determinants of nutritional status and learning achievement. Optifood is an application developed by WHO that can describe nutritional intake and produce food formulas that can be used as a guide for a healthy diet, especially during this COVID-19 pandemic. This descriptive study used a cross sectional design. Data was collected by interview using a 24-hour food recall form and food frequency. Data were analyzed using optifood application. The results showed that school children consumed food from the Grains group and grain products (rice and noodles) 7 times a week. The meat, fish and egg group (burgers, fried chicken and eggs) and the savory drinks and snacks group (sweet tea, soft drinks, chatime, chiki, and chitato) 4x a week. School children very rarely eat vegetables and fruit. Consumption of foods that are high in calories and low in fiber in school children can cause problems of overweight and the risk of obesity.

Keywords: Food consumption, School children, Optifood

1 Introduction

The current Covid-19 pandemic has forced several countries to take precautions to save their citizens by implementing a lockdown. Indonesia is one of the countries that has also prevented the spread of COVID-19 by implementing a lockdown in several areas of the country, stopping all social activities by closing schools, companies, entertainment venues, markets, parks, and other social gathering places. The government's activities to close schools require children to carry out the teaching and learning process at home. This condition makes children stay at home more, consume more food and lack of physical activity. Lifestyle and eating pattern like this for a long time can put children at risk overweight and even obesity.

Obesity in children is one of the nutritional problems besides stunting which is currently a concern. The obesity rate in Indonesia is currently quite high. Based on the 2018 Riskesdas data, it shows a figure 21.8 percent for obesity in Indonesia. This figure has continued to increase since Riskesdas 2007 by 10.5 percent and 14.8 percent in Riskesdas 2013[1].

The cause of this obesity problem is the consumption of unbalanced nutrition and low physical activity. So, to overcome this problem, one way is to know the child's eating pattern and improve their eating pattern. School children are a group that must receive attention in terms of food consumption. For school children, food serves to maintain the process of growth and development as well as replace damaged body tissue, obtain energy to carry out daily activities,

and defend the body against various diseases. In addition, adequate food consumption is also related to children's learning abilities while at school which can support their learning achievement. In order for food to function as described previously, the food we consume daily is not just food, but also contains certain nutrients so that it fulfills this function.

Research conducted by Badriyah and Gamal [2], found that there is a relationship between food consumption and nutritional status with student achievement. This shows the importance of food consumption for students which is manifested in their nutritional status. Because to achieve optimal student learning achievement, good and quality food intake is needed.

One way to find out what is consumed by children can use the optifood application. Optifood is a linear programming software that uses mathematical optimization to calculate how to improve and increase diets at the lowest cost using locally available foods. Optifood identifies gaps in current diets, and suggests locally available foods to fill those gaps. Optifood also show the limits of locally available foods in providing essential nutrients. There have been many studies using this optifood application.

However, to respond to this challenge, scientists have developed an approach based on linear programming into a "user-friendly" tool, meaning that it is easier to use, WHO in collaboration with the London School of Hygiene and Tropical Medicine (LHSTM), Food and Nutrition Technical Assistance II Project (FANTA-2) and an information technology company, developed optifood which is a software program designed to facilitate data entry, presentation of output, and management of input and output data storage for modeling food and nutritional intake [3]. Optifood has been used in several countries to assist in overcoming nutritional problems such as in Guatemala, Kenya, Kamboja, Vietnam, including Indonesia.

Actually, there are other applications that can describe the food consumption of a person or group, namely the Nutri Survey, but this application cannot describe the maximum each type of food consumed by a person or group. The optifood application can describe the consumption picture in addition to the average per week also the maximum consumed per week. So based on the description above, the problem in this study is how the description of school children's food consumption (type and frequency) is based on an analysis using the optifood application.

2 Methodology

This descriptive study used a cross sectional design on 156 elementary school children taken from 6 elementary schools in Medan City which were taken by purposive random sampling, namely school children in fourth and fifth grades on the grounds that these children were cooperative in data collection. Food consumption data was collected by means of interviews using food recall and food frequency forms. This eating consumption analysis uses the optifood application. The optifood application analysis process is carried out through three stages called modules, namely module I (check diets), module II (identify draft recommendations), and module III (test draft food-based recommendations).

The division of these three stages because each of these modules will carry out a different analysis process [4]. Module I is executed after the entry list of food compositions (obtained from food recall). Module I was carried out to determine whether possible solution could be generated from the data on food intake and eating patterns of the target group. Module I also specifically examine size limits of food types, food groups, and food subgroups, to ensure that sufficient food choices are obtained to form a diet model and ensure that some individuals from the target group can consume them. Module II was carried out to identify the best food sources

and food groups of micronutrients in the available diet that can be increase to address the nutritional problem “problem nutrient” in Module III. This test begins by conducting an analysis without adding any food before testing the FBR design. This is done to provide a basic diet that will be compared with different alternative FBRs. This basic diet can be used to compare nutrient levels when testing each FBR to assess whether the percentage RNI of each nutrient being discussed in the worst scenario is significantly increased compared to existing practice. In this study, we look at the consumption picture from the results of optifood analysis in Module I, namely the results of diet analysis.

3 Result and Discussion

3.1 Result

The students in this study were mostly male as many as 67.3 people (67.3%) and most of the students had pocket money around Rp. 1000 to Rp. 10,000, - as many as 94 people (60.3%). More clearly can be seen in the following table.

Table 1. Student Frequency Distribution Based on Characteristics

No.	Characteristics of student	n (=156)	%
1	Sex		
	Male	105	67,3
	Female	51	32,7
2	Allowance (Rp)		
	1.000 - 10.000	94	60,3
	11.000 - 20.000	56	35,9
	21.000 - 30.000	6	3,8

The food recall data that has been processed using the nutrition survey application are then arranged by grouping food types such as the frequency of daily food consumption equalized to food consumption per week according to the rules in the optifood application [5] as seen in Table 2. This table shows that the equalization of daily consumption becomes consumption a week is based on the percentage of subjects who eat food. Example: Eggs, if in one group of students it is found that 40% of students consume eggs, the maximum egg consumption in a week according to Table 2. is five times.

Table 2. Maximum Food Frequency in a Week based on Percentage of Food Consumption per day

Percentage of Subjects Consuming Food (%)	Equalized Weekly Maximum Intake Frequency (times)
0 - 5	1
6 - 12	2
13 - 22	3
23 - 34	4
35 - 47	5
48 - 65	6
66 - 100	7

The results of the optifood analysis for the portion of food consumed every week by school boys aged 10-12 years showed that on average school children consumed food in the Grains and grain products group with a frequency of 7 times a week. The types of food from the Grains and grain products group are rice and noodles. Because rice is a staple food for school children. Meanwhile, noodles are another staple food that children often consume both at home and at school as one of the snacks chosen by students. Chung, Lee, and Cho [6] in their publication stated that based on the 2001-2002 NHANES data in America, it is shown that the 9–18-year age group ranks the highest in noodle intake, that is 353.0 g, followed by the order of 19-50 years with 333.5 g, aged 51-70 years with 280.4 g, older. from 71 years with 252.3 g, and 1-8 years with 221.5 g. Based on gender, men consume more noodles than women. Other than that, currently in overcoming the problem of stunting, consumption of various staple food sources is a good choice. So that the noodles which are also a staple food can be an option. One study showed that consumption of milk and fortified noodles was associated with a reduced chance of stunting in Indonesian children [7].

Meat, fish and eggs, beverages and Savory snacks are consumed 4 times a week. In this food group, the types of food most often consumed by school children are chicken and eggs. The type of chicken that is often consumed by school children, apart from fried chicken from the home menu, is also fast food with a menu of fried chicken options, which is a type of snack food most often consumed by children. Eggs are also a favorite food for school children, apart from being processed eggs from the home menu for school children, they also often eat snacks with egg rolls. This snack food that comes from fast food can indeed contribute calories for the nutritional needs of school children.

However, because fast food has unbalanced nutrients (high-calorie foods that contain more fat, cholesterol, salt and sugar and less vitamins, minerals and other nutrients), if consumed in excess it can cause obesity. Such as the findings in a study that looked at the effect of fast-food consumption on the health of school children (9-13 years) showed that 100 percent of school children aged 9 years were found to be obese grade 1 (mild obesity). School children aged 10 years, 11 years and 13 years respectively amounted to 42.8%; 8.6%; and 8.3% were found to be obese grade 3 (severe obesity). Among school children aged 12 years, 36.3% were obese level 2 (moderate obesity). The Savory snacks group is consumed by schoolchildren with savory foods such as chiki and chitato.

It was also found that the food group for Fruits and Vegetables was consumed only 2 times a week. This shows that this school boy rarely consumes vegetables and fruit. It can clearly be seen in Table 3 and Table 4 below.

Table 3. Servings per week of food group consumed by school boys of age 10-12 Years

No.	Food Group	Average Servings week	Low Servings week	High Servings week
1	Bakery & breakfast cereals	2	0	4
2	Beverages (non-dairy or blended dairy)	28	0	56
3	Composites (mixed food groups)	13	0	26
4	Dairy products	4.5	0	9
5	Fruits	11	0	22
6	Grains & grain products	82	0	164
7	Legumes, nuts, seeds	10	0	20
8	Meat, fish & eggs	29,25	0	58.5
9	Savory snacks	28	0	56
10	Sweetened snacks &desserts	17.5	0	35
11	Vegetables	6	0	12
12	Snacks	7.5	0	15
13	Staples	1.5	0	3

Table 4. Servings per week of the sub-group of food consumed by school boys aged 10-12 years

Food Sub Group	Food Group	High Servings week	High Servings week of food group
MyFoods Special Bakery	Bakery & breakfast cereals	4	4
Brewed tea, herbal infusions (w/wo sugar or milk)	Beverages (non-dairy or blended dairy)	34	56
Chocolate beverage or powder mix (nondairy)	Beverages (non-dairy or blended dairy)	19	56
Sugar-sweetened beverages (soda, processed or artificial juices)	Beverages (non-dairy or blended dairy)	3	56
Grain's products/fillings (sandwiches, burgers, samosas, enchiladas)	Composites (mixed food groups)	26	26
Sweetened dairy products/desserts (flan, custard, sweetened yoghurt, ice cream)	Dairy products	9	9
MyFoods Special Fruits	Fruits	10	22
Vitamin C-rich fruit	Fruits	12	22
Enriched/fortified grains and products, whole or refined	Grains & grain products	16	164
MyFoods Special Grains	Grains & grain products	22	164
Refined grains and products, unenriched/unfortified	Grains & grain products	126	164
Nuts, seeds, and unsweetened products	Legumes, nuts, seeds	20	20
Blood, bloods sausage	Meat, fish & eggs	6	58.5
Eggs	Meat, fish & eggs	17	58.5
Poultry, rabbit	Meat, fish & eggs	29	58.5
Processed meat	Meat, fish & eggs	10.5	58.5
MyFoods_Special Savory Snacks	Savory snacks	56	56
MyFoods_Special Sweetened Snacks and Desserts	Sweetened snacks & desserts	35	35
Condiment vegetables	Vegetables	3	12
MyFoods_Special Vegetables	Vegetables	9	12

Overview of food consumption for school girls aged 10-12 years is almost the same as for school boys. These school girls also eat the Grains & grain products group most often with a frequency of 7 times a week. The types of food most often consumed by school girls are rice and noodles. Rice is a daily staple food for school children with a menu of white rice and fried rice, and the most commonly consumed noodles are instant noodles, meatball noodles and fried noodles. These noodles are consumed by children both at home and at school as a main meal or snack.

This school girl also often consumes foods from the Meat, fish & eggs group with a frequency of 6 times a week such as fish, eggs and meat with a menu of meat balls, beef jerky, and burgers. Apart from that, foods in the Beverages (non-dairy or blended dairy) and Savory snacks are also often consumed by school girls, which is 4 times a week such as sweet tea, chatime-based drinks, various drink menus from the Starbuck type.

The Fruits group was consumed 3 times a week, while the Vegetables group was consumed only once a week. In addition, this school girl also consumes the Sweetened snacks & desserts

group 3 times a week, such as bread, cake, toast, pastries and molen. The consumption of these sugary snack foods can contribute a large number of calories to the daily calorie needs of school girls. Research conducted on school children in Italy regarding the consumption of Beverages and snacks at school and away from school [8] showed that there was a significant relationship between consumption of sugary drinks, snacks, milk-based drinks compared to low-carbohydrate drinks, fruits and vegetables. And they consume it more outside of school.

When compared with the food consumption of school boys, these girls consume less vegetables. This can clearly be seen in Tables 5 and 6.

Table 5. Servings per week of Food Group Consumed by school girls aged 10-12 years

No.	Food Group	Average Servings week	Low Servings week	High Servings week
1	Bakery & breakfast cereals	4.3	0	8.6
2	Beverages (non-dairy or blended dairy)	25.5 12	0	51
3	Composites (mixed food groups)	3	0	24
4	Dairy products	10	0	6
5	Fruits	86	0	20
6	Grains & grain products	5.5	0	162
7	Legumes, nuts, seeds	50	0	11
8	Meat, fish & eggs	27	0	100
9	Savory snacks	17.7	0	54
10	Sweetened snacks & desserts	5	0	35.5
11	Vegetables	3	0	6
12	Snacks	11.5	0	23
13	Staples	1	0	2

Table 6. Servings per week of sub-group of food consumed by school girls of age 10– 12 Years

Food Sub Group	Food Group	High Servings week	High Servings week of food group
Enriched/fortified bread, whole or refined grain	Bakery & breakfast cereals	0.4	8.6
MyFoods_Special Bakery	Bakery & breakfast cereals	5	8.6
Sweetened bakery products, unenriched/unfortified	Bakery & breakfast cereals	3.2	8.6
Brewed tea, herbal infusions (w/wo sugar or milk)	Beverages (non-dairy or blended dairy)	38	51
Chocolate beverage or powder mix (nondairy)	Beverages (non-dairy or blended dairy)	13	51
	Composites (mixed food groups)	24	24
Grain's products/fillings (sandwiches, burgers, samosas, enchiladas)	Grains & grain products	6	6

Sweetened dairy products/desserts (flan,custard, sweetened yoghurt, ice cream)		5	20
MyFoods_Special Fruits	Fruits	15	20
Vitamin C-rich fruit	Fruits	32	162
Enriched/fortified grains and products, whole or refined	Grains & grain products	33	162
MyFoods_Special Grains	Grains & grain products	97	162
Refined grains and products, unenriched/unfortified	Grains & grain products	11	11
Nut, seeds, and unsweetened products	Grains & grain products	7	100
Blood, bloods sausage	Legumes, nuts, seeds	19	100
Eggs	Legumes, nuts, seeds	6	100
Fish without bone	Meat, fish & eggs	59	100
Poultry, rabbit	Meat, fish & eggs	9	100
Processed meat	Meat, fish & eggs	54	54
MyFoods_Special Savory Snacks	Meat, fish & eggs	35.	35.5
MyFoods_Special Sweetened Snacks and Desserts	Meat, fish & eggs	5	6
Condiment vegetables	Meat, fish & eggs	5	6
MyFoods_Special Vegetables	Savory snacks	1	6
	Sweetened snacks & desserts	5	
	Vegetables		
	Vegetables		

Overview of the consumption of school children who generally eat more foods that are high in calories, fat and protein but low in fiber can cause them to be at risk for obesity. If we look at the description of the food groups consumed by school children, they are very frequent (consumption > 7 times a week) for staple foods. Likewise for food sources of protein. They rarely (only 1-2 times a week) eat vegetables and fruit. At this school age, the intake of all nutrients must be met in accordance with the needs and in balance to achieve maximum growth and good learning achievement.

School children's diet is actually still under the responsibility of the mother as the person who manages and provides food for her family. However, if mothers can manage food for their children well, it is possible that this obesity problem can be prevented. As research conducted by Bahatheg (2021) [9] conducted in three countries namely Saudi Arabia, UK, and, Turkey found that most parents care about their children's nutritional intake and prepare meals at home (96.1%) during the lockdown and sixty-three percent showed that children did not gain weight. This means that if parents pay attention to their children's food intake and provide food at home properly and adequately, they can prevent children from eating snacks, most of which are high-calorie foods. (Like fast food).

The high consumption of high-calorie foods in school children is partly due to the ease of ordering food, namely through an on-line food ordering application, which is currently widely offered. This application is the result of current technological developments. So that without having to leave the house the children can easily get the food they want through this application which can be downloaded via the android phone owned by this schoolchild.

The ease of ordering food through online applications today can affect a person's diet and nutritional status. This is evidenced by a study conducted by Harahap, Aritonang, and Lubis [10] which showed that there was a relationship between the frequency of ordering food online

and obesity ($p < 0.001$) and there was no relationship between the type of food and obesity ($p = 0.099$) in college students. Medan Area University.

Efforts to overcome obesity is also a WHO program. Efforts made by WHO to overcome this obesity problem are by making an "Implementation Plan to End Obesity in Children". These activities include; WHO encourages countries to implement policies to address the environment in which children grow up today, which can increase the risk of obesity. They should aim to reduce consumption of cheap, packaged, energy-dense and low-nutrient food and drink, and support healthier food and drink choices. They should promote greater physical activity through games and sports, to reduce the time children spend on sedentary screen-based activities" [11].

4 Conclusion

Based on the results of the study, it can be concluded that school children more often consume foods that are high in calories, fat and protein but low in fiber, namely foods from the staple food group, protein sources, and calorie and sweet drinks, as well as sweet and savory snacks. This pattern of food consumption can cause over weight and even obesity in school children which can have an impact on their health and learning achievement.

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