The Effect of Nutrition Education on School-Aged Children’s Consumption Pattern, Knowledge and Practice in Bringing Well-Balanced Menu for Lunch

Adelwais Febriati Yurni and Tiurma Sinaga

Community Nutrition Department, Bogor Agricultural University, Bogor, West Java, 16680 Indonesia
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Summary This study aimed to analyze the effect of nutrition education on the consumption pattern, knowledge, and practice in bringing a well-balanced menu (WBM) for lunch among school-aged children. The study was quasi-experimental research using one group with pre- and post-test. Subjects were 52 students in fifth grade at SDN Babakan Dramaga 04, Bogor. The study was conducted from February to April 2017 and nutrition education was provided twice in 2 wk. The first post-test for nutritional knowledge was done 1 wk after the nutrition education, while the evaluation of the practice of bringing WBM for lunch was conducted 2 wk after the intervention. The second and third post-tests were performed every 2 wk after that. The knowledge of balanced nutrition increased after the intervention. The initial nutritional knowledge was significantly different from those of the first and second post-tests with p values of 0.003 and 0.01, respectively. Subjects showed an improvement in the practice of bringing a well-balanced menu for lunch after the nutrition education intervention. It was also shown that carbohydrate intake at the third post-test was related to nutritional status after the intervention. The practice of bringing WBM for lunch should be continued by students and monitored by physical education teachers. Parents, especially mothers, should support their children by providing balanced and nutritious food at home.

Key Words balanced nutrition, consumption pattern, nutrition education, school-aged children

The dietary patterns of school-age children tend to be high in snacks and low in vegetables (1). This leads to lower nutritional intake. Basic Health Research Data from the Ministry of Health 2010 showed that 41.2% of school-age children consume energy below the minimum requirement (<70% RDA) and result in malnutrition (2). Based on Basic Health Research Data from the Ministry of Health 2013, 11.2% of children aged 5–12 y experienced wasting, whereas 18.8% are obese (3). This proves that Indonesia is facing a double nutritional burden.

The solution to reducing the nutrition problem is a nutrition guide for a balanced diet. However, the community has a lack of knowledge about balanced nutrition. The research conducted by Achadi et al. (4) shows that 90% of children assume the basic four is balanced nutrition.

The difference between balanced nutrition and basic four is the type and amount of food consumed. This is important to note because, in the current era of globalization, there is an increase in the portion of foods that contain lots of fat, it is known as the western diet (5). Western diets contribute to obesity in children as well as the consumption of fast food (6, 7). Obese children have a high risk of remaining obese in adulthood with high morbidity as well as making it difficult to prevent it (8).

The nutrition guide of a balanced diet needs to introduce to children through nutrition education. Nutrition education, which announces in school-age children, can change knowledge and attitudes towards food effectively (9). Nutrition education is supposed to increase knowledge that will strengthen practice and attitude of balanced nutrition. Balanced nutrition practices are expected to reduce nutritional problems among children by seeing their eating habits. One way to improve children’s eating habits is through the school feeding program. The school feeding program has been applied and noticed in developed countries. However, Indonesia has not implemented school feeding evenly, so it modifies with the homemade menu.

Nutrition education about balanced nutrition for school-age children is held to produce the best quality of future generations. It is also important to instill a new paradigm replacing the basic four paradigm that is not in line with the current problems. Therefore, the researcher is interested in examining the effect of nutrition education on the knowledge and practice of bringing a balanced diet to school-age children.

The study aims to analyze the effect of nutrition education on the consumption pattern, knowledge, and practice in bringing a well-balanced menu for lunch among school-aged children.
balanced menu is to optimize the growth and development of children in order to have a healthy and high-quality life as well as reduce malnutrition.

School-age children are expected to have a good diet since childhood after receiving nutrition education, thus able to maintain their nutritional status. Additionally, they can easily inform their families, especially parents, about balanced nutrition. Finally, parents can choose the right food in accordance with the principles of balanced nutrition.

**MATERIALS AND METHODS**

The study was conducted using a quasi-experimental design with one group pre and post-test. This research was carried out at SD Negeri Babakan Dramaga 04, Dramaga, West Bogor. The location of the study was selected by purposive sampling with the consideration that there was no school feeding program. The study held on February–April 2017. The samples are 52 students in grade 5th of elementary school students.

The research is divided into three stages. The first step is to test the balanced nutrition knowledge questionnaire and take preliminary data, such as the characteristics of the sample and anthropometric measurements. Validity and reliability were obtained based on Cronbach’s alpha >0.6. The knowledge questionnaire has alpha Cronbach 0.696.

The second stage is to conduct nutrition education interventions for 2 wk. The intervention was given twice, which is once a week. The duration of one meeting is 30–45 min. Nutrition education contains the introduction of nutrients and food portions in a day, a variety of foods, clean and healthy lifestyle, and sports or physical activities. The method used is lectures and discussions through the poster, the illustrated story-books, the song, and the game cards. Post-test 1 knowledge was given at the end of the nutrition education intervention, while post-test 2 was at the end of the study. Post-test 2 was done to measure long-term memory.

The third stage is to monitor the practice of bringing a balanced menu for lunch. Baseline, which shows habits of lugging lunch, carried out before giving nutrition education intervention. The practical test is to support the school feeding program, however, this study allowed samples to bring their own and evaluate the menu. Post-test 1 conducted 2 wk after the intervention, while post-test 2 and post-test 3 performed sequentially every 2 wk. The post-test also complemented by presenting nutritional counseling regarding the selection of diverse foods for samples who did not bring a balanced menu. Samples are expected to convey nutritional counseling to parents, consequently, in the next post-test, the samples bring lunch with a balanced menu. Samples who have carrying a balanced menu given the motivation to keep up with the various food in the next post-test.

**Statistical analysis.** Processing data used Microsoft Office Excel 2007 and analyzed using SPSS for Windows 16.0. Nutritional status data processed using WHO Anthroplus 1.0.4. Data on energy and nutrient intake are processed using Nutrisurvey 2007. Statistical analysis carried out includes Paired Sample t-test and Spearman Correlation tests. The different tests used Paired Sample t-test with p = 0.05 and it applied to test on knowledge, food consumption, nutritional status, and practice of bringing a balanced menu before and after nutrition education interventions. Spearman correlation worked to see the relationship between food consumption and nutritional status.

**RESULTS AND DISCUSSION**

**Nutritional status**

Nutritional status is the state of health which influenced by nutrient intake, food absorption, and use of nutrients in the past of a person (10). Nurmasyita et al. (11) showed differences in BMI before and after nutrition education interventions (p = 0.001). The result is contrary to the research conducted by Anindita (12) that there was no change in the nutritional status of the sample during 2 mo of the study because they did not monitor their weight. There was a significant relationship between nutritional status and frequency of eating in school-age children (13).

Table 1 shows that 73.1% of the samples had normal nutritional status both in baseline and post-test. Samples with obesity reduced after repeated weighing at the end of the study. Paired Sample t-test confirmed a difference between nutritional status (p = 0.016) before and after the intervention. It proves that eating a well-balanced menu continuously has an impact on nutritional status.

**Consumption pattern**

Food Consumption is one of the factors that affect children’s nutritional status. Consumption pattern data include snacking habits in school and breakfast habits.

School-age children consume lots of snacks, particularly snacks purchased at school. Energy contribution from snack is 31.1% and protein is 27.4% (14), thus affect the consumption pattern. Sample, who consumes snacks every day, is 51.9% and all of the samples have different frequency of snacking. Healthy snacks, which can be bought in a clean, safe, and far from pollution, improve the health status of the sample.

Roadside vendors (38.5%) and school canteens
(36.5%) are the main choices for buying food. Roadside traders are the closest places to pollution, such as dust from the road and motor vehicle fumes compared to school canteens, which located in the area of the school. Roadside vendors sell snacks that are more varied so that they attract the attention of school-age children. Children tend to eat snacks because they do not have breakfast. They are having breakfast with low quality (44.6%) and gain <15% AKG (15). Breakfast affects the increasing consumption of energy and other nutrients in school-age children (16) and needs to be planted from school age (15). The results of this study indicate that all samples have applied breakfast habits with different frequencies. Based on Table 2, most of the sample (53.8%) consume breakfast with a rare frequency because of wake up late morning and do not want to eat breakfast, while 46.2% of the samples consume breakfast every day.

The most commonly consumed carbohydrate food source are rice, noodles, bread, and dumplings. The source of protein consumed is eggs and chicken, while tofu and tempeh are rarely eaten by the sample. The most commonly consumed vegetables and fruits are carrots, kale, spinach, citrus, papaya, and melon.

Knowledge of balanced nutrition

After being given nutrition education interventions, the sample’s knowledge increased (12, 17). Dwiriani et al. (18) revealed that nutrition education increased the score of nutrition knowledge by 28.6. Increased knowledge is expected to change nutritional behavior (19). An Increasing knowledge score after nutrition education interventions could not necessarily improve the practice of eating samples (18). According to Contento (20), nutrition education that focuses on attitudes or practices is more effective than just focusing on knowledge.

Based on Fig. 1, the nutritional knowledge increased from baseline to post-test 1 and decreased in post-test 2. The average knowledge in the baseline, post-test 1, and post-test 2 were 77.6±13.7 as a fair category, 83.9±10.0 as a good category, and 83.5±9.1 as a good category. In the post-test 2, there was no sample with poor category of knowledge.

The Paired Sample t-test showed a difference between the baseline and post-test 1 (p=0.003; p<0.05) and post-test 2 (p=0.01; p<0.05). This result is compatible with Sari (21) and Zulaekah (22), which showed an increase in knowledge after the intervention using animation media and booklets. Research conducted in elementary school children in Semarang stated that there was a difference from the knowledge after being given nutrition education through comics (23). Another study, conducted nutrition education interventions for 2 elementary schools in Semarang, presented that nutrition education effects on children’s knowledge of balanced nutrition (24).

Studies with healthy lifestyle interventions carried out in elementary school children in South Africa can improve knowledge and self-efficacy, but do not change the consumption pattern of children (25). Research conducted at 3 elementary schools in Korea showed an increase in short-term knowledge was better in the group given intervention in the form of lectures or discussions compared to groups with intervention in the form of direct training (26).

As the post-test 1 of nutrition knowledge increasing present that the sample understands the nutrition education which has been given for short-term time. Nevertheless, the post-test 2 decreased because of the sample forget some of the material in long–term memory. The samples need to recall their memories through some review or continuous study in nutrition education for their long-term memories. Therefore, it will increase the
post-test 2.

**Practice in bringing A well-balanced menu**

The sample is bringing a well-balanced menu as an application of the intervention. A balanced menu is categorized based on the visual suitability of My Plate.

Based on Fig. 2, there is an improvement to the menu from the baseline, post-test 1, and post-test 2. In the baseline data, the samples brought a low-quality menu, such as rice with fried noodles, fried rice, and rice with animal side dishes (fried chicken and omelet). Only 3.8% of the samples carry fruit and 15.4% of them carry vegetables. This illustrates that they are still lack of the practice of a well-balanced menu. The portion of rice brought by the sample is inappropriate with My Plate. Most samples carry rice with the same portion as the large box of lunch. After being given nutrition education interventions, there were 7.7% of the samples carrying a well-balanced menu suitable for My Plate. In the post-test 1, there was an increase in the number of samples that brought fruit as one of the balanced menus, namely 11.5%. This is because the speaker motivates the sample to consume fruits and vegetables appropriate to the recommended portion. Strong motivation will increase fruit and vegetable consumption in school-age children (27). Animal side dishes (73.1%) are more consumed compared to vegetable dishes (21.2%). A total of 15.4% of samples brought and consumed vegetables in the post-test 1. Menus taken in the post-test 1 included white rice with side dishes in the form of nuggets, fried chicken, omelet, fried rice with eggs, and fried noodles with egg. The types of vegetables and fruits brought by the sample include spinach, sautéed carrots, sautéed beans, sautéed long beans, oranges, papaya, and bananas. The portion of rice brought is the same as the size of the lunch box (150–200 g) which is more than the portion of vegetables. The portion of vegetables is 1–2 rice bowl on average (20–25 g). The animal side portion is 1 slice of fried chicken (45 g) and 1 piece of omelet (55 g). The portion of fruit is 1 orange (55 g), 1 large piece of papaya (110 g), and 1 piece of Ambon banana (60 g).

Based on Fig. 2, the sample who bring a well-balanced menu increases in the post-test 2 (21.1%). The sample who bring vegetables and fruit in a well-balanced menu also increased to 40.4% and 46.2%. As many as 82.7% of the sample consumed animal dishes. 92.3% of the sample brought drinking water from home, while the rest bought drinking water at a shop near the school. Some sample still carry lunch with white rice and fried noodles. The sample consumed fried rice with chicken and vegetables (carrots and caisim), white rice with side dishes (fried chicken, omelet, tuna fish, oreg tempeh, and fried tofu), vegetables such as sauteed kale, vegetable soup, spinach, cucumber, and capcay. The types of fruit brought by the sample are papaya, banana, orange, and melon. The portion of rice, vegetables, animal dishes, and fruit brought by the sample in the post-test 2 is not different from the portion in the post-test 1. The sample begins to bring vegetable dishes with 2 tablespoons of oreg tempeh (22 g) and 1–2 small tofu and fried tempeh (25 g).

The sample that brought provisions in accordance with the visual of MyPlate did not change from post-test 2 to post-test 3. Generally, the menu that was taken was the same between post-test 3 and post-test 2. Fruit consumption in post-test 3 was 40.4%, while vegetable consumption increased to 55.8%. Fruit and vegetable consumption is still low in school-age children (28, 29). The diversity of the menu brought by the sample increased from baseline to post-test 3, but the number and portion of the menu had not been improved.

The school provides a canteen so students can buy snacks. The school canteen still presents snacks that are not diverse. There is no seller of fruit or fruit juice in the school canteen. Based on observations, the school canteen sells food such as chicken noodles, meatballs, chikis, fried snacks, dumplings, cikol, and cold drinks (iced tea). This results in a lack of consumption of vegetables and fruit. A canteen that does not sell a variety of foods is also one of the factors that cause difficulty to change the practice of bringing a well-balanced diet.

Based on Table 3, the average energy intake in baseline was 577.8 kcal. Energy intake decreases when...
The PAIRED Sample t-test results showed a significant difference between the baseline post-test 1 energy intake (p = 0.000; p < 0.05) and the baseline with post-test 2 energy intake (p = 0.001; p < 0.05). Baseline with post-test 3 energy intake did not have a significant difference (p = 0.094; p > 0.05). Average baseline protein intake of 17.7 g decreased to 16.0 g in post-test 1. Post-test 2 and post-test 3 protein intake increased by 17.2 g and 18.5 g, respectively. The results of the PAIRED Sample t-test showed no significant differences in protein intake baseline with post-test 1 (p = 0.158; p > 0.05), post-test 2 (p = 0.641; p > 0.05), and post-test 3 (p = 0.573; p > 0.05).

The average baseline fat intake is 23.8 g. Sample fat intake decreased in post-test 1 to 17.1 g. Post-test 2 and post-test fat intake 3 amounted to 18.2 g and 20.6 g. The results of the PAIRED Sample t-test showed that there was a significant difference between fat intake baseline and post-test 1 (p = 0.001; p < 0.05) and baseline with post-test 2 (p = 0.017; p < 0.05), while the baseline and post-test fat intake 3 (p = 0.189; p > 0.05) did not have a significant difference. PAIRED Sample t-test results on sample carbohydrate intake showed a significant difference between baseline and post-test 1 (p = 0.000; p < 0.05) and baseline with post-test 2 (p = 0.006; p < 0.05), whereas there was no significant difference between the baseline and post-test 3 (p = 0.122; p > 0.05). The results of different tests on sample fiber intake showed significant differences between baseline and post-test 1 (p = 0.010; p < 0.05) and post-test 3 (p = 0.23; p < 0.05).

Carbohydrate intake in post-test 3 from the well-balanced menu taken by the sample (p = 0.038; r = 0.289) and post-test carbohydrate adequacy level 3 (p = 0.034; r = 0.294) were significantly associated with nutritional status after the intervention. The results of this study conflict with Regar & Sekartini (30) which states that there is no relationship between carbohydrate, fat, and energy intake with nutritional status, but there is a significant relationship between protein intake and nutritional status.

In conclusion, this research represents that the nutritional knowledge of the sample increased after being given nutrition education interventions. The practice of bringing a balanced menu sample improved from baseline, post-test 1, post-test 2, and post-test 3. A total of 28.8% of the samples brought a well-balanced menu suitable to the visual of My Plate in the post-test 3. The level of energy, protein, and fat adequacy in post-test 3 are in a good category, while the level of carbohydrates and fiber adequacy are in a poor category. The results of the PAIRED Sample t-test showed a significant difference between energy, fat, carbohydrate, and fiber intake in baseline with post-test 1 and post-test 2 (p < 0.05). The results showed no significant differences in protein intake baseline and post-test (p > 0.05).

The Spearman correlation test showed that the intake and level of adequacy of carbohydrates in post-test 3 correlated significantly with nutritional status after the intervention.

Parents, especially mothers, should support their children by providing balanced food. The school canteen needs to produce a variety and nutritious foods. Therefore, children can choose healthy foods and sustain them until adulthood. The practice of bringing a well-balanced menu can be continued to carry at school. Further research should be observing the practice of bringing a well-balanced menu with a longer time, which is more than 1 mo.

Disclosure of state of COI
Tiumra Sinaga is a lecturer at Bogor Agricultural University. The authors confirm they have no conflicts of interest.

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