

Original**School Lunch Program Could Control Snacking Habits and Decreased Energy and Lipid Intakes of 11-year-old Students in Jakarta**

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ABSTRACT There is currently no school lunch program implemented in Indonesian public schools. Under current conditions, children are likely to be susceptible to lifestyle-related diseases as indicated by the increasing prevalence of childhood overweight and obesity year by year due to uncontrollable dietary habit. The purpose of this study was to evaluate the implementation of a school lunch program in a Jakarta public school and its effect on students' nutrition and food intake and habitual patterns. A total of 50 students, 11-year-old 5th graders from two classes, participated in this study. In a crossover study design, the intervention was a school lunch program providing a school lunch meal for one week (5 days), termed School Lunch Week. The control was one week of five regular days (Regular Week). Outcome parameters were the nutrition intake and changes in habits during Regular Week and School Lunch Week for all the children. The results showed a significant decrease in energy and lipid intakes ($p<0.05$) and snacking frequency/day ($p<0.001$) during School Lunch Week. The energy contribution from snack was decreased by 192 kcal/day ($p<0.001$) during School Lunch Week. The implementation of a school meal program could control snacking habits and decrease energy and lipid intakes in schoolchildren. In conclusion, the establishment of a school meal program should be considered in order to foster beneficial dietary habits in Indonesians.

Keywords: Jakarta, snacking habit, school lunch, school meal, childhood nutrition

INTRODUCTION

School life is the beginning of a lifetime health investment for schoolchildren. There are many challenges to establish an early healthy lifestyle in children. Dietary habits that last a significant part of a human life are critically established during childhood. However, unhealthy dietary habits such as high energy and lipid intakes are commonly found in children, which can lead to lifestyle-related disease later in life. According to national basic health research, it was found that 19% of children in Indonesia suffer from overweight and obesity, with Jakarta children having the highest prevalence of 30% (1).

Currently there is no school lunch program implemented in Indonesian public schools, even though school is a perfect place to promote healthy lifestyle and dietary habits through nutrition education and healthy lifestyle modeling (2). Indonesian public elementary schools usually start at 7AM and finish at 2PM with a short first break at 9AM and a longer second break at 12AM. These break times are meant not only to take a rest between learning periods, but also to let the children have their time, for playing or eating to satisfy hunger. With a proper nutrition intervention, children's growth can be boosted and

their health status eventually improved (3,4). A school lunch program, as one nutrition intervention, can help in solving health and nutrition problems in school-age children (5,6). The purpose of this study is to evaluate the implementation of a school lunch program in a Jakarta public school and its effect on children's food habits and nutrition intakes.

METHODS

This study was conducted with a monocentric, controlled, crossover design to assess the efficacy of a school meal program in students at a public school. The study was done in accordance with the Helsinki Declaration and was approved by the Ethical Committee of the Faculty of Medicine, Universitas Indonesia. The study was conducted at a public school in Jakarta in which regular activities of the students were maintained (no special intervention during break time). The location was purposively selected based on the local district education committee's permission: no similar intervention had been conducted at the school and the selected school agreed to be the study site. The subjects were 11-year-old 5th graders who had already been assigned to two classes, with 25 students in each

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class, for a total of 50 students. Inclusion criteria included healthy children of 5th grader who had obtained signed informed consent from their parents. Exclusion criteria were 5th grader suffers any chronic diseases.

The intervention was a school meal program providing school lunch meals during break time for a week (5 days) designated as School Lunch Week. Another week without intervention and with normal activities during break was designated as Regular Week. The lunch menu provided on average 600kcal, about 30% of total energy RDA. School lunch menus were created by the researchers. The menus are shown in Figure 1 and included rice as the staple food, a side dish of plant protein (tempeh, tofu), animal protein (egg,

chicken, beef), and a vegetable dish. Data collection was conducted on students' characteristics and food habits with question items shown in Table 1, anthropometric measurement, and nutrition intakes with 3-day/24-hour recall methods in both Regular Week and School Lunch Week. During School Lunch Week, there was no restriction on what could be consumed on during afternoon break. However, there was a requirement of eating the school lunch meal together in the classroom first before the children could spend the rest of break time as they liked. During Regular Week, the rest of the break time was spent in the students' regular activities. Statistical analysis were conducted with paired Student's *t*-Test ($p<0.05$).



Figure 1. School lunch menus for one week

Table 1. Questions for student's characteristics and food habits

Question items
1. Who does meal preparation at home?
2. Is your mother living with you? If yes, what does she do? (Occupation)
3. Who influences you to buy snacks? (Multiple answers)
4. Do you usually bring a lunch box from home?
5. Do you eat breakfast every day?
6. What do you eat for breakfast?
7. How many times do you buy snacks in one day? (Frequency)
8. What kind of snacks do you usually buy/eat? (Multiple answers)
9. What kind of beverages do you usually buy/drink? (Multiple answers)
10. Let's review what you had to eat yesterday! (Food recall)

RESULTS

There were 48 children who completed the study. Data for two children were dropped due to their absences during the study and incomplete data collection. The school lunch program was conducted during the second break, the last break before the children finish the school day and then go home or go for extra-curricular activities. The subjects were 11-year-old students (5th graders in two classes, 5A and 5B) of one Jakarta public school with a total of 50 students. Of the total, two students dropped out due to incomplete data. Table 2 shows the BMI information of the subjects. The average BMI (kg/m^2) of all students was 18.1 ± 2.9 with average BMI of boys and girls were 17.9 ± 2.9 and 18.4 ± 3.2 , respectively. Figure 2 shows subjects' BMI categories percentages (%) whereas in boys and girls were 56 and 70 normal, 20 and 22 overweight, 12 and 4 obese, and

12 and 4 underweight, respectively. Table 3 shows the results of the subjects' basic characteristics and food habits in percentage. For question "Who does meal preparation at your home?", the percentages were 87.5% mother, 2.1% grandparents, 8.3% housekeeper, and 2.1% take-out food. For question "What is your mother's occupation?", the percentage of their occupations were 36% stayed-home housewives and 64% working mothers (entrepreneur, private employee, government official, etc). For question "Who influences you to buy/have snacks?", the multiple answers show 68.4% came from friends, 35% siblings or relatives, 28.9% TV commercials, 28.1% parents, and 7% from online advertisements. For question "Do you usually bring a lunch box to school?", 58% responded No and 42% responded Yes.

Table 2. BMI information of the subjects (n=48)

BMI information	BMI (kg/m^2)
	mean \pm SD
All student (n=48)	18.1 ± 2.9
Boys (n=22)	17.9 ± 2.9
Girls (n=26)	18.4 ± 3.2

Data are shown in mean \pm SD

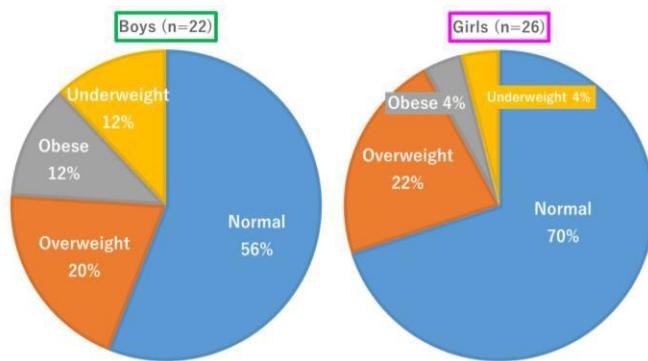


Figure 2. Subject's BMI categories percentage

Table 3. Subject's basic characteristics and food habits in percentage (n=48)

No	Subjects' characteristics and food habits	Percentage (%)
1.	Who does meal preparation at your home?	
	- Mother	87.5
	- Grandparents	2.1
	- Housekeeper	8.3
	- No one, eating take-outs	2.1
2.	What is your mother's occupation?	
	- Stay-home housewives	36
	- Working mothers (entrepreneur, private employee, government official, etc)	64
3.	Who influences you to buy/have snacks? (Multiple answers)	
	- Friends	68.4
	- Siblings, relatives	35.1
	- Parents	28.1
	- TV commercials	28.9
	- Online advertisements	7
4.	Do you usually bring a lunch box to school?	
	- Yes	42
	- No	58

Table 4 shows the results of food related habits during Regular Week and School Lunch Week in percentages. For question “Do you eat breakfast every morning?” was separated into three categories of having breakfast every morning, some mornings, and no breakfast, with results during Regular Week and School Lunch Week were 58.3% and 62.5% have breakfast every morning, 37.5% and 35.4% some mornings, and 4.2% and 2.1% no breakfast, respectively. For question “What do you eat for breakfast?” shows the breakfast food patterns, which

were separated into categories of milk + bread, porridge, and rice + dish(es). During Regular Week, students’ breakfast was 67.3% rice + dish(es), 27.2% milk + bread, and 5.5% porridge. During School Lunch Week, breakfast was 60.7% rice + dish(es), 30.4% milk + bread, and 8.9% porridge. For question “How many times do you buy/have snacks in a day?” was separated into categories of snacking frequency from 1 – 6 times. Further analysis of snacking frequency is shown in detail on Figure 3.

Table 4. Food related habits during Regular Week and School Lunch Week in percentage (n=48)

No	Food related habits	Regular Week (%)	School Lunch Week (%)
1	Do you eat breakfast every morning?		
	- Yes, every morning	58.3	62.5
	- Sometimes	37.5	35.4
	- No, no breakfast habit	4.2	2.1
2	What do you eat for breakfast?		
	- Milk + bread	27.2	30.4
	- Porridge	5.5	8.9
	- Rice + dish(es)	67.3	60.7
3	How many times do you buy/have snacks in a day?		
	- 1 times	4.1	8.3
	- 2 times	18.8	31.3
	- 3 times	43.8	29.2
	- 4 times	25	20.8
	- 5 times	6.3	10.4
	- 6 times	2.0	0

Figure 3 shows the average daily snacking frequency. During Regular Week, snacking frequency for one day was 3.2 ± 1.0 times and it was decreased to 2.9 ± 1.1 in School Lunch Week ($p < 0.05$). Figure 4 shows the snack patterns for question “What kind of snacks do you usually buy/eat?”. Snack patterns during Regular Week include 44% fried foods, 14% coconut rice, 8% noodles, 7% sweet bread, 7% meatballs, 4% seblak, 5% macaroni, 4% soto, 3% porridge, 2% shumai, and 2% other. Snack patterns during School Lunch Week include 52% fried foods, 15% coconut rice, 8% noodles, 5% meatballs, 3% seblak, 4% macaroni, 2%

soto, 4% porridge, 4% cilok, and 3% others. Figure 5 shows beverages patterns for question “What kind of beverages do you usually buy/drink?”. Beverages patterns during Regular Week include 33% sweet tea, 22% milkshake powder, 10% flavored milk, 10% ice sweet milk, 7% mixed ice, 7% ice cream, 3% tea beverages, 3% jelly drink, 3% juice powder, and 2% other. Beverages patterns during School Lunch Week include 33% sweet tea, 22% milkshake powder, 4% flavored milk, 17% ice sweet milk, 10% mixed ice, 5% ice cream, 3% tea beverages, 2% jelly drink, 2% juice powder, and 2% other.

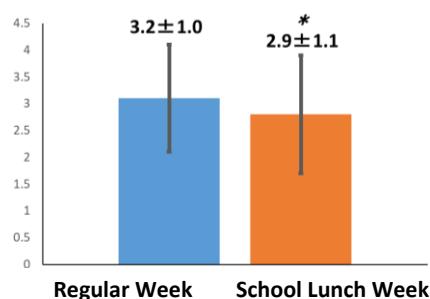


Figure 3. Daily snacking frequency (mean \pm SD) (n=48)

*Significantly different at $p < 0.05$

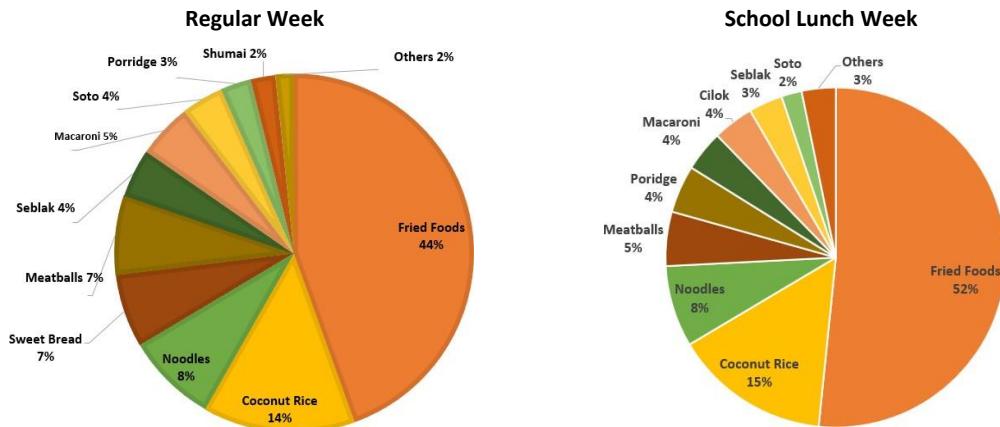
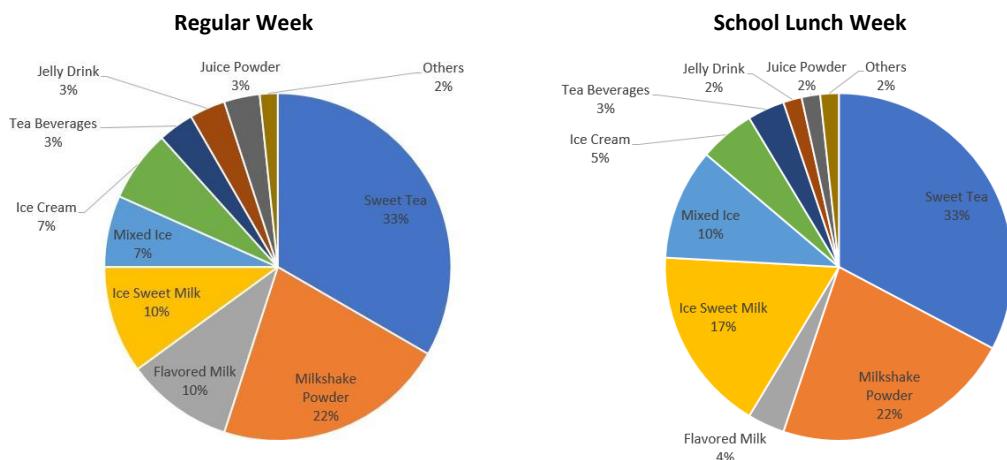
**Figure 4. Snack patterns during Regular Week and School Lunch Week****Figure 5. Beverage patterns during Regular Week and School Lunch Week**

Table 5 shows energy and nutrient intakes per day during Regular Week and School Lunch Week. There were significant decreases in both energy and lipid intakes during School Lunch Week ($p<0.05$). Protein, carbohydrate, and fiber intakes remained unchanged.

Figure 6 shows calorie contribution from breakfast, lunch, dinner, and snack. There was a significant increase in calorie contribution from lunch ($p<0.001$), also a significant decrease in calorie contribution from Snack ($p<0.001$) during School Lunch Week.

Table 5. Nutrient intakes during Regular Week and School Lunch Week (n=48)

Nutrient Intakes (per day)	Regular Week (mean±SD)	School Lunch Week (mean±SD)
Energy (kcal)	1852±328	1709±297*
Protein (g)	55±16.5	53±13.6
Lipid (g)	74±18.6	67±16*
Carbohydrate (g)	240±66	223±47
Fiber (g)	6±2.7	6.4±2.5

*Significantly different at $p<0.05$

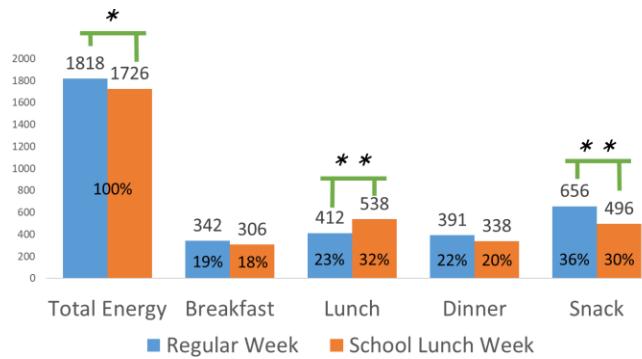


Figure 6. Daily caloric contribution from breakfast, lunch, dinner, and snack (n=48)
Significantly different at * $p<0.05$ and ** $p<0.001$, respectively

DISCUSSION

The study results show that 32% boys and 26% girls were overweight and obese, which was close to national basic health research data (1). This indicates that the data from this study are representative of the actual population. There were study results which can show that school meal program have favorable impacts in schoolchildren.

Food habits of the children in terms of bringing a lunch box was that more than half of the children didn't bring one have the habit, which explains the habit of buying food during break time. From the mother's occupation result, assuming that one third of mothers are working at home and the remaining two thirds are working mothers, it is understandable that meals may not always be prepared at home and that bringing a lunch box to school is less prevalent. Bringing a lunch box meal from home usually tended to provide adequate daily nutrition for the children (7). A lunch box meal can also become one good tool to prevent excessive intake of sugar, lipids, and sodium from fast foods (7-9). For both reasons, a lunch box meal is an option to establish favorable dietary habits which is effective if a school meal program remains unimplemented.

The habit of having breakfast might be related with the habit of bringing lunch meal box. Once breakfast is skipped, easy to develop the habit of skipping breakfast, and it is very likely to have a correlation with more frequent snacking during the day (10). Another study on skipping breakfast in children and adolescents found that skipping breakfast was associated with overweight/obesity and highly associated in children with working mothers (11). However, in our study it was found that having breakfast at home was already a regular habit. This might be another reason why the children didn't have the habit of bringing a lunch box from home aside from the mothers' occupation status, because the children were already eating breakfast at home before school. In other words, the snacking frequencies might be influenced by something other

than breakfast habits, which is likely due to the fact that there is no school meal program to satisfy children's hunger during the school day.

Since bringing lunch from home is an option and there is no school meal program, children satisfy their hunger by buying foods and drinks from the food stalls in the area around the school. There are many factors that affect snacking habits. About 70% of snacking influence comes from friends, which also explains the impact that peer pressure can have on snacking habits. Despite no difference found in snacking patterns, the snacking frequency showed a significant decrease during School Lunch Week. Seventy percent of the children were snacking 3-4times on a usual day. This became less frequent, dropping to 1-3times on a School Lunch Week. This shows that the school lunch can help in controlling the snacking habit and in reducing daily snacking frequency. Studies in countries like Vietnam show the effectiveness of a school lunch in reducing snacking frequencies and total energy from snacks (12).

As for the snacking patterns, half of the snack patterns was fried foods. It doesn't matter that the size of fried foods had changes. Although fried foods was 10% higher during School Lunch Week, the decrease of total energy and lipid intake during the day of School Lunch Week could be marked by lower fried foods intake. Fried foods itself are easy to prepare, in terms of food safety and efficiency, and can be served as quickly as possible (13-15). This means that anybody can prepare fried foods, including meal prepper at home, much likely that the source of fried foods during School Lunch Week came from home. For the beverages patterns, the most popular drink was sweet tea, followed by milkshake powder drink. These drinks are also fast and easy drinks to prepare and are accessible to the children. The classification of snack can be separated into quality and composition (13-15). Higher quality snacks has richer nutrients than low quality snacks, for example an apple and a glass of milk compared with

fried foods and sweets (13–15). Children usually consume lower or no quality foods because the foods are easily accessed either in the school or at home (13–15).

A previous study found that school meal programs and nutrition education for school – children can provide adequate intake of energy, protein, carbohydrate, and fiber (16). In our study, it was found that energy and lipid intakes were decreased during School Lunch Week. Moreover, when the energy contribution from breakfast, lunch, dinner, and snacks were compared, it was found that during School Lunch Week, energy from lunch was increased and energy from snacks was decreased. These results show the favorable effects of school lunch in controlling energy and lipid intakes and also the energy contribution especially from snacks. School-based nutrition intervention programs are effective in establishing favorable dietary habits in children (16–18). In this case, a school meal program was proven effective even though it was conducted for only one week.

A school lunch program can improve the daily nutrition contribution based on the RDA of children 11 years old. One third of the RDA intake can be provided by the school lunch and our lunch meal provided on average 600kcal/day. The energy contribution from Lunch was increased to 32% because there is a lunch meal to provide adequate energy despite there was common picky eater problem of some of the children didn't finish the provided lunch meal, not finishing the vegetable or not liking the tofu or tempeh we provided for them. School lunch was served at break time and it was mandatory to eat the school lunch meal first before students could go on to other activities such as playing with friends or even buying additional snacks. As for the additional snacks the children might buy after eating the school lunch meal, it can be assumed that the children didn't buy fried foods as snacks, by the reason of the decrease in their lipid intake. Excess energy intake in school – children mostly results from snacking habits, despite its one purpose to satisfy hunger and eventually to meet energy and nutrient intakes (12, 19). With no school meal program, during the longer break time children will satisfy their hunger through uncontrolled snacking. Some of the children usually consumed fast food from fast food restaurant chains with their family outside school time or during weekends.

There was no significant difference in protein intake. It already met the protein recommendation for daily protein intake. The recommendation for protein intake in Indonesia includes three portions of animal protein like fish, meat, egg, milk, etc and three portions of plant protein like beans, bean products like tofu, tempeh, and fermented soybean like oncom (20). The lunches in this study included either one portion of animal protein or one portion of plant protein, which contributed at least 30% of RDA.

There is a reason why a school meal program is not established yet. Ninety percent of Indonesian schools are public schools. The school management is under the Ministry of Education. Even now, the government is still struggling to provide universal education in all areas of Indonesia. Inequality and social disparities are still high. Funding for education is one of the problems, not to mention funding for a school meal program. However, if a school meal program is provided/introduced at targeted area like Jakarta at the beginning, other areas may follow this example and may start school meal programs as well. There are methods on how to establish a school meal program, one example being the Japanese school meal program. The Japanese school meal program includes the employment of at least one licensed registered dietitian/nutrition teacher to help create 200 different menus/year that meet the dietary reference intakes and have high consideration and give priority to locally sourced food and introduce national food culture and tradition (21–22). The dietitian will work in the school kitchen or work at a district kitchen to serve several schools simultaneously (21–22). On the stakeholder level, it might be necessary to have legal developments for a school meal program in Indonesia. In Japan, Shokuiku Basic Act involves the promotion of nutrition education throughout the life cycle, including the school lunch program (22). Since it starts at an early age, it may also be a positive force in instilling healthy food habits during childhood (22).

This study has the limitation that the school meal program could be implemented for only one week (five days). It was not possible to see the longer-term effects of the school meal program like changes in breakfast habits, snacking influence resources, the timely period of snacking, and the nutritional status of the children themselves: their BMI status. A longer period such as one month or two months might change on these variables, especially when a decline in overweight and obesity is the target. In conclusion, a school meal program could control the snacking habits and decrease energy and lipid intakes in Jakarta school-children and the establishment of school meal program should be considered.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

REFERENCES

- 1) Ministry of Health, Republic of Indonesia: Basic Health Research 2018 (in Indonesian)
- 2) UNSCN, United Nations System Standing Committee on Nutrition. Schools as a System to Improve nutrition. A New Statement for School-Based Food and Nutrition Intervention. 2017.
- 3) Das JK, Lassi ZS, Hoodbhoy Z, Salam RA. Nutrition for the Next Generation: Older Children and Adolescents. *Ann Nutr Metab* 72(Suppl 3):56–64. 2018.
- 4) Branca F, Piwoz E, Schultink W, Sullivan LM. Nutrition and Health in Women, Children, and Adolescent Girls. *BMJ* 351(Suppl1): 27-31. 2005.
- 5) Oostindjer M, Wang Q, Aschemann-Witzel J, Skuland SJ. Are School Meals a Viable and Sustainable Tool to Improve the Healthiness and Sustainability of Children's Diet and Food Consumption? A Cross-National Comparative Perspective. *Critical Reviews in Food Science and Nutrition* 57:18.3942-3958. 2016.
- 6) Miyawaki A, Lee JS, Kobayashi Y. Impact of the School Lunch Program on Overweight and Obesity among Junior High School Students: a Nationwide Study in Japan. *J Public Health* 41(2): 362 – 370. 2019.
- 7) Roberts-Gray C, Briley ME, Byrd-Williams CE, Sweitzer SJ, Sharma SV, Palafox MR, Hoelscher DM. Efficacy of the Lunch is in the Bag intervention to increase parents' packing of healthy bag lunches for young children: a cluster-randomized trial in early care and education centers. *Int J of Behav Nutr Phys Act* 13:3. 2016
- 8) Fisk CM, Crozier SR, Inskip HM, Godfrey KM, Cooper C, Robinson SM, and The Southampton Women's Survey Study Group. Influences on the quality of young children's diets: the importance of maternal food choices. *Br J Nutr* 105(2): 287 – 296. 2011
- 9) Nathan N, Janssen L, Sutherland R, Hodder RK, Evans CEL, Booth D, Yoong SL, Reilly K, Finch M, and Wolfenden L. The effectiveness of lunchbox interventions on improving the foods and beverages packed and consumed by children at centre-based care or school: a systematic review and meta-analysis. *Int J of Behav Nutr Phys Act* 16:38. 2019
- 10) Wüenstel JW, Kowalkowska J, Wądołowska L, Slowinska MA, Niedzwiedzka E, Kurp L. Habitual Eating of Breakfast, Consumption Frequency of Selected Food and Overweight Prevalence in Adolescents from Various Age Groups. *Dev Period Med* 19(2):193-201. 2015.
- 11) Koca T, Akcam M, Serdaroglu F, Dereci S. Breakfast habits, dairy product consumption, physical activity, and their associations with body mass index in children aged 6–18. *Eur J Pediatr*. 176(9): 1251 – 1257. 2017
- 12) Thao Nguyen Thi. A Study of energy intake by children with and without school lunch in Hanoi. Thesis – Jumonji Universiy 2018. (in Japanese)
- 13) Ishak SIZS, Shohaimi S, Kandiah M. Assessing the children's views on foods and consumption of selected food groups: outcome from focus group approach. *Nutr Res Pract* 7(2): 132 – 138. 2013.
- 14) Adair LS, Popkin BM. Are child eating patterns being transformed globally? *Obes Res* 13:1281– 1299. 2005.
- 15) Wurtman J, Wurtman R, Berry E, Gleason R, Goldberg H, McDermott J, Kahne M, Tsay R. Dexfenfluramine, fluoxetine, and weight loss among female carbohydrate cravers. *Neuropsychopharmacology* 9:201–210. 1993
- 16) Oosthuizen D, Oldewage-Theron WH, Napier C. The Impact of a Nutrition Programme on the Dietary Intake Patterns of Primary School Children. *S Afr J Clin Nutr* 24(2):75-81. 2011
- 17) Sabinsky, MS, Toft U, Sommer HM, Tetens I. Effect of implementing school meals compared with packed lunches on quality of dietary intake among children aged 7–13 years. *J Nutr Sci* 8(3):1- 9. 2019
- 18) Tanaka N & Miyoshi M. School lunch program and health promotion among children in Japan. *Asia Pac J Clin Nutr.* 21(1):155-158. 2012
- 19) Butteinheim A, Alderman H, Friedman J. Impact Evaluation of School Feeding Programmes in Lao People's Democratic Republic. *J Dev Eff.* 3(4):520- 542. 2011
- 20) Ministry of Health, Republic of Indonesia. Guideline for Balance Nutrition. Jakarta. 2014 (in Indonesian)
- 21) Kaneda M, Yamamoto S. The Japanese School Lunch and Its Contribution to Health. *Nutr Today*, 50(6):268-272. 2015.
- 22) Durkin AR, Callahan EA, Kaneda M, Yamamoto S. The Japan That Japanese Don't Know: The School Lunch Program. Asian Nutrition and Food Culture Center, Jumonji University, Japan. 2016