Diet of children under the government-funded meal support program in Korea

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Abstract

The purpose of this study was to investigate the diet of children under the government-funded meal support program. The 143 children (67 boys and 76 girls) participated in this study among 4th-6th elementary school students receiving free lunches during the summer vacation of 2007 and living in Gwanak-gu, Seoul, Korea. The subjects consisted of four groups supported by Meal Box Delivery (n = 26), Institutional Foodservice (n = 53), Restaurant Foodservice (n = 27), or Food Delivery (n = 37). A three-day 24-hour dietary recall and a self-administered survey were conducted. In addition, the children's heights and weights were measured. The average energy intake of the children was 1,400 kcal per day, much lower than the Estimated Energy Requirements of the pertinent age groups. The results also showed inadequate intake of all examined nutrients; of particular concern was the extremely low intake of calcium. On average, the children consumed eight dishes and 25 food items per day. The children supported by Meal Box Delivery consumed more various dishes and food items than the other groups. The percentage of children preferring their current meal support method was the highest in those supported by Meal Box Delivery and the lowest in those supported by Food Delivery. We requested 15 children among the 143 children participating in the survey to draw the scene of their lunch time. The drawings of the children supported by Institutional Foodservice showed more positive scenes than the other groups, especially in terms of human aspects. In conclusion, the overall diet of children under the government-funded meal support program was nutritionally inadequate, although the magnitude of the problems tended to differ by the meal support method. The results could be utilized as basic data for policy and programs regarding the government-funded meal support program for children from low-income families.

Key Words: Children from low-income families, meal support program, nutritional adequacy, food variety, drawing

Introduction

One out of eight Korean children under the age of 18 lived in relative poverty in 2008 [1]. Many factors can influence the growth of children, but poverty can have a particularly profound effect on it. Poverty has been linked to under-nutrition and nutrient deficiencies, especially in children [2,3].

In Korea, the study regarding the diet of children from low-income families started in the 1970s [4]. More than 20 precedent studies since then have suggested that the diet intake status children differ according to socioeconomic status; children from low-income families have greater possibility to lead to poorer nutritional status than those from higher-income families.

According to the study having analyzed the data from the 2001 National Health and Nutrition Survey, the average energy intake level of children from low-income families was lower than those from higher-income families [5]. The children from low-income families were reported to be lack of such nutrients as protein, calcium, phosphorus, riboflavin as well as energy in the study with elementary students [6]. The school-aged children from low-income families were found to have consumed less milk·dairy products, fruits, and meat·fish·egg·beans than those from higher-income families [7].

The needy children in Korea are provided with free school lunches. They could also get meal support under the government-funded program during holidays and vacation. As of August 2010, 483,567 children have received meal support from local governments by Meal Box Delivery (13.1%), Institutional Foodservice (20.1%), Restaurant Foodservice (28.0%), Food Delivery (14.6%), or other ways (24.1%) [8].

In USA, children from low-income families also could eat free meals through the National School Lunch Program, the School Breakfast Program, and the Summer Food Service Program (SFSP). Among them, SFSP is quite similar to the government-funded meal support program in Korea in that both of the programs are operated during vacation. The nutritional analysis of SFSP menus revealed that the supported lunch meals, on average, met one-third of the Recommended Daily Allowance or Adequate Intake in terms of examined nutrients such as protein, vitamin A, vitamin C, and calcium [9,10].

In Korea, there was a study having reported physical development and dietary behaviors of children supported by Institutional foodservice [11]. However, no studies have been found to report the dietary intake of children under the government-funded meal support program during summer vacation. Therefore, the purpose of this study was to investigate the nutritional adequacy and food variety of the children's diet under the government-funded meal support program during summer vacation.

Subjects and Methods

Dietary recall and survey

Data collection

The subjects of the study were 143 4th-6th elementary school students receiving free lunches from the government and living in Gwanak-gu, Seoul, Korea. Gwanak-gu was selected as the study site because the number of the children under the government-funded meal support program was the highest in Seoul at the time of the study [12].

The subjects consisted of four groups supported by Meal Box Delivery (n = 26), Institutional Foodservice (n = 53), Restaurant Foodservice (n = 27), or Food Delivery (n = 37). The purpose and procedure of the study were explained to each subject or their guardians. The data were collected during summer vacation of 2007.

Three-day 24-hour dietary recall data were collected to analyze nutritional adequacy and food variety of the children's diet. The trained interviewers recorded the diet consumed by the children for two days and made a follow-up phone call to collect the third day recall day. The children's opinions on meals supported by local governments were collected by a self-administered survey. The children's heights and weights were also measured.

Data analysis

Nutrient intakes were calculated by CAN-PRO [13], a computer-aided nutritional analysis software program developed by the Korean Nutrition Society. The nutrient intakes were compared to the Dietary Reference Intakes for Koreans [14]. To examine nutritional adequacy, the percentages of the children not meeting the dietary recommendations were calculated for selected nutrients; the dietary recommendations for energy and nutrient intake were based on Estimated Energy Requirement (EER) and Estimated Average Requirement (EAR), respectively. The percentages of each nutrient intake out of Recommended Intake (RI) were also analyzed. To assess dietary variety, the mean numbers of consumed dishes and food items were calculated.

The scores for the children's opinions on the meals supported by local governments were 1 point for strongly disagree, 2 points for disagree, 3 points for neutral, 4 points for agree, and 5 points for strongly agree. The scores for the degree of general satisfaction were 1 point for very unsatisfied, 2 points for

unsatisfied, 3 points for satisfied, and 4 points for very satisfied.

The data were analyzed using SAS software [15]. Means, standard deviation, and frequencies were calculated. The significance of difference among groups was analyzed by Chi-square test and one-way ANOVA followed by Duncan's multiple-range test.

Drawing

Data collection

We collected the qualitative data for this study through the children`s drawings. Children often better express their feelings or opinions though their drawings than they are willing or able to do verbally. We asked children to draw the scene of their lunch time and provided them with 48 kinds of crayons and 21 kinds of color pens with a sketch book. To help them with the drawing task, we asked the children questions such as: "How was your feeling when you ate the lunch?", "What did you eat for lunch?", and "Who did you eat lunch with?". A total of 15 children recruited among the 143 children participating in the survey completed drawing.

Data analysis

We investigated emotional, dietary, and human aspects of the children by counting the numbers of colors, dishes, and accompanying persons appearing in the drawings.

Results

General characteristics

The split between boys and girls was almost even. On average, the subjects were 11 years old, with a height of 146 cm, and a weight of 40.6 kg. The height and weight of the children did not significantly differ by meal support method (Table 1).

Nutritional adequacy

The daily nutrient intakes were presented in Table 2. On average, the children consumed 1,400 kcal per day. Significant differences were found in fat and vitamin A consumption by meal support method. The children supported by Meal Box Delivery consumed more fat than the other groups. Additionally, children supported by Meal Box Delivery had a lower percentage of carbohydrate consumption and a higher percentage of fat consumption than the other groups.

The percentages of the children with inadequate daily intake of the examined nutrients were depicted in Fig. 1. The majority of the children, ranging from 89% of those supported by Food Delivery to 100% of those supported by Meal Box Delivery, consumed less energy than EER. The results also showed inadequate intake of all the examined nutrients; of particular

Table 1. General characteristics of children in this study

		Meal support method				Total (n = 143)
		Meal Box Delivery (n = 26)	Institutional Foodservice (n = 53)	Restaurant Foodservice (n = 27)	Food Delivery (n = 37)	
		N (%)				
Gender	Boy	18 (69.2)	17 (32.1)	13 (48.1)	19 (51.4)	67 (46.9)
	Girl	8 (30.8)	36 (67.9)	14 (51.9)	18 (48.6)	76 (53.1)
Person preparing meals	Mother	8 (30.8)	30 (56.6)	11 (40.7)	13 (35.1)	62 (43.4)
	Grandmother	13 (50.0)	7 (13.2)	7 (25.9)	11 (29.7)	38 (26.6)
	Self	4 (15.4)	3 (5.7)	4 (14.8)	8 (21.6)	19 (13.3)
	Father	1 (3.8)	8 (15.1)	1 (3.7)	3 (8.1)	13 (9.1)
	Sibling	0 (0.0)	3 (5.7)	2 (7.4)	2 (5.4)	7 (4.9)
	Others[1]	0 (0.0)	2 (3.8)	2 (7.4)	0 (0.0)	4 (2.8)
		Mean ± SD				
Age (yr)		11.0 ± 0.7	11.1 ± 0.8	11.0 ± 0.8	10.8 ± 1.0	11.0 ± 0.8
Height (cm)		145.4 ± 8.5	145.5 ± 8.1	148.3 ± 8.9	145.3 ± 8.8	146.0 ± 8.5
Weight (kg)		41.0 ± 11.5	39.7 ± 7.6	41.5 ± 11.2	41.0 ± 8.6	40.6 ± 9.3
BMI[2]		19.1 ± 3.8	18.6 ± 2.5	18.7 ± 4.1	19.3 ± 3.3	18.9 ± 3.3

[1] Others included grandfathers and relatives.
[2] BMI (Body Mass Index) = Weight (kg)/ Height (m^2)

Table 2. Children`s daily nutrient intakes

	Meal support method				Total (n = 143)	P[1]
	Meal Box Delivery (n = 26)	Institutional Foodservice (n = 53)	Restaurant Foodservice (n = 27)	Food Delivery (n = 37)		
	Mean ± SD					
Energy (kcal)	1,473 ± 375	1,329 ± 383	1,427 ± 388	1,431 ± 417	1,400 ± 391	0.396
CHO (g)	204 ± 53	202 ± 55	220 ± 62	226 ± 54	212 ± 56	0.176
Protein (g)	61 ± 36	49 ± 14	50 ± 14	50 ± 20	52 ± 22	0.091
Fat (g)	48 ± 16[b]	37 ± 15[a]	40 ± 15[a]	36 ± 19[a]	39 ± 17	0.022
Vitamin A (μg RE)	482.0 ± 180.0[ab]	545.7 ± 296.0[b]	485.9 ± 187.6[ab]	390.2 ± 211.0[a]	482.6 ± 243.2	0.029
Thiamin (mg)	0.9 ± 0.3	1.0 ± 0.7	1.0 ± 0.4	0.9 ± 0.5	1.0 ± 0.5	0.832
Riboflavin (mg)	0.9 ± 0.3	0.9 ± 0.4	0.8 ± 0.3	0.8 ± 0.5	0.9 ± 0.4	0.539
Niacin (mg)	12.8 ± 5.6	11.1 ± 4.1	11.0 ± 3.7	10.4 ± 4.3	11.2 ± 4.4	0.197
Vitamin C (mg)	45.7 ± 23.6	44.3 ± 19.4	55.8 ± 27.1	42.0 ± 25.9	46.1 ± 23.8	0.114
Calcium (mg)	349.7 ± 1523.9	338.2 ± 134.8	343.9 ± 160.5	327.6 ± 199.7	338.6 ± 160.2	0.955
Iron (mg)	9.1 ± 3.6	7.9 ± 2.6	8.5 ± 2.7	8.4 ± 3.7	8.4 ± 3.1	0.469
% Calorie from						
CHO	55.8 ± 5.8[a]	61.2 ± 5.0[b]	61.8 ± 5.4[bc]	64.6 ± 8.4[c]	61.2 ± 6.8	< 0.001
Protein	16.2 ± 6.0[b]	14.8 ± 2.0[ab]	14.2 ± 2.0[a]	13.8 ± 2.8[a]	14.7 ± 3.3	0.032
Fat	29.1 ± 5.0[c]	24.7 ± 5.0[b]	24.6 ± 5.1[b]	21.3 ± 7.3[a]	24.6 ± 6.2	< 0.001

[1] P-value by ANOVA
[abc] Different superscript letters in the same row mean significant difference among groups by Duncan`s multiple range test at $\alpha = 0.05$.

concern was the extremely low intake of calcium. At most, only 12% of the children supported by Meal Box Delivery consumed the amount of EAR or more for calcium. The percentage of the children with inadequate daily intake of protein was the lowest among all the examined nutrients. Additionally, the percentage of the children with inadequate daily intake of vitamin C was significantly different among the four groups by meal support method.

The children supported by Meal Box Delivery tended to have more nutritional lunches than the other groups; they consumed significantly more protein and niacin than the other groups. There were significantly different percentages of energy intake from carbohydrate, protein, and fat by meal support method. The children supported by Meal Box Delivery also had a lower percentage of carbohydrate consumption than the other groups (Table 3).

The energy and nutrient intakes from lunches were assessed as percentages of EER or RI (Fig. 2). The children consumed about 21% to 25% of EER at lunch. Even though the overall intakes from Meal Box Delivery were still low, children
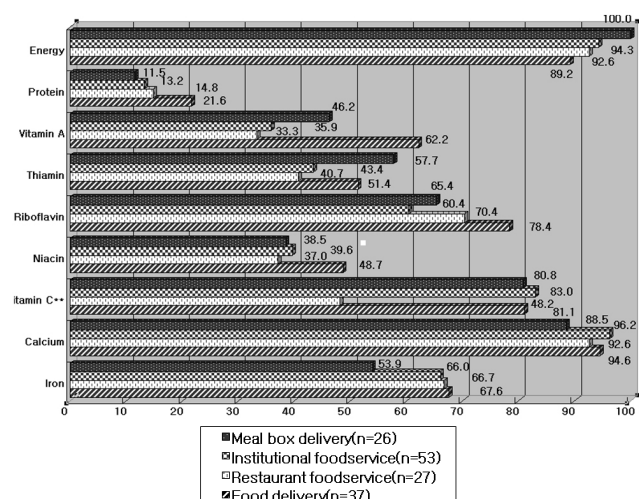
Fig. 1. Percentages of children with inadequate daily intakes of nutrients[1]
(Unit: %)
[1] Energy were analyzed which were less that the Estimated Energy Requirements were pertinent to the groups' gender, age, height, weight and physical activity. The other nutrients were analyzed which were less that the Estimated Average Requirements were pertinent to the groups' gender, age. ** The mean values were significantly different among groups between inadequate and adequate children by Chi-square test at $\alpha = 0.01$.

Fig. 2. Energy and nutrient intakes at lunch as percentage of Estimated Energy Requirements and Recommended Intakes
(Unit: %)
[1] The number was 142, one less than the number in the result of daily intake, because one child supported by Food Delivery had not eaten lunch at all during the data collection period. *, **, *** The mean values were significantly different among groups by ANOVA at $\alpha = 0.05$, $\alpha = 0.01$, $\alpha = 0.001$ respectively. [abc] Different superscript letters in the same nutrient mean significant difference among groups by Duncan's multiple range test at $\alpha = 0.05$.

supported by Meal Box Delivery consumed significantly more protein and niacin than the other groups. As noted earlier, the percentage of RI was the lowest in calcium intake among all the examined nutrients.
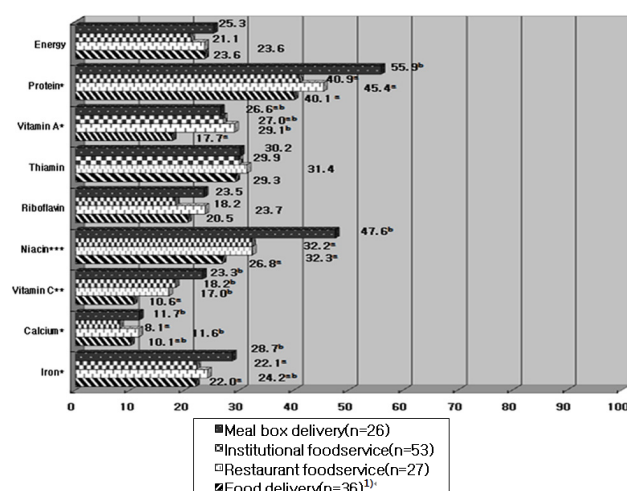
Dietary variety

The numbers of dishes and food items were summarized in Table 4. On average, children consumed eight dishes and 25 food items per day. The children supported by Meal Box Delivery consumed 14 food items at lunch. That number was more than twice for those supported by Food Delivery.

Table 3. Children`s nutrient intakes at lunch

	Meal support method				Total[1] (n = 142)	$P^{2)}$
	Meal Box Delivery (n = 26)	Institutional Foodservice (n = 53)	Restaurant Foodservice (n = 27)	Food Delivery (n = 36)		
	Mean ± S.D.					
Energy (kcal)	514 ± 162[b]	404 ± 163[a]	464 ± 162[ab]	461 ± 157[ab]	450 ± 164	0.037
CHO (g)	69 ± 20	62 ± 22	70 ± 23	72 ± 20	67 ± 22	0.177
Protein (g)	23 ± 9[b]	16 ± 7[a]	18 ± 7[a]	16 ± 8[a]	18 ± 8	0.002
Fat (g)	15 ± 6[b]	10 ± 6[a]	13 ± 7[ab]	12 ± 9[ab]	12 ± 7	0.017
Vitamin A (μg RE)	163.2 ± 75.9	158.7 ± 138.9	167.2 ± 110.0	104.0 ± 72.4	147.3 ± 111.0	0.057
Thiamin (mg)	0.3 ± 0.1	0.3 ± 0.3	0.3 ± 0.1	0.3 ± 0.2	0.3 ± 0.2	0.990
Riboflavin (mg)	0.3 ± 0.1	0.2 ± 0.1	0.3 ± 0.1	0.2 ± 0.1	0.2 ± 0.1	0.054
Niacin (mg)	6.1 ± 2.7[b]	3.8 ± 1.7[a]	3.8 ± 2.1[a]	3.4 ± 2.3[a]	4.1 ± 2.3	< 0.001
Vitamin C (mg)	19.5 ± 9.9[c]	14.6 ± 10.0[bc]	13.6 ± 15.1[ab]	8.5 ± 8.3[a]	13.7 ± 11.2	0.001
Calcium (mg)	103.1 ± 47.1[b]	69.0 ± 37.2[a]	98.4 ± 65.0[b]	87.0 ± 52.0[ab]	85.4 ± 50.5	0.013
Iron (mg)	3.4 ± 1.2[b]	2.7 ± 1.1[a]	2.9 ± 1.3[ab]	2.6 ± 1.1[a]	2.8 ± 1.2	0.022
% Calorie from						
CHO	54.7 ± 6.7[a]	62.7 ± 6.0[b]	60.5 ± 6.0[b]	64.2 ± 11.1[b]	61.2 ± 8.3	< 0.001
Protein	17.7 ± 2.8[c]	16.3 ± 2.4[bc]	15.4 ± 4.4[ab]	14.0 ± 4.0[a]	15.8 ± 3.6	< 0.001
Fat	26.4 ± 4.6[b]	21.4 ± 5.9[a]	24.5 ± 7.6[bc]	21.6 ± 9.8[a]	23.0 ± 7.4	0.014

[1] The number was 142, one less than the number in the result of daily intake, because one child supported by Food Delivery had not eaten lunch at all during the data collection period.
[2] *P*-value by ANOVA
[abc] Different superscript in the same row mean significant difference among groups by Duncan's multiple range test at $\alpha = 0.05$.

Table 4. Food variety of children's diet

		Meal support method				Total	$P^{1)}$
		Meal Box Delivery	Institutional Foodservice	Restaurant Foodservice	Food Delivery		
		Mean ± SD					
		(n = 26)	(n = 53)	(n = 27)	(n = 37)	(n = 143)	
Daily intake	No. of dishes	9.2 ± 2.4[b]	8.3 ± 1.8[ab]	7.9 ± 2.2[a]	7.5 ± 2.5[a]	8.2 ± 2.2	0.021
	No. of food items	30.1 ± 5.6[c]	27.3 ± 5.7[c]	23.5 ± 5.6[b]	19.5 ± 7.2[a]	25.1 ± 7.2	< 0.001
		(n = 26)	(n = 53)	(n = 27)	(n = 36)	(n = 142[2)])	
Lunch intake	No. of dishes	3.6 ± 1.0[b]	2.4 ± 0.8[a]	2.2 ± 0.9[a]	2.2 ± 0.9[a]	2.5 ± 1.0	< 0.001
	No. of food items	13.8 ± 2.9[c]	10.4 ± 2.1[b]	7.7 ± 3.3[a]	6.5 ± 3.6[a]	9.5 ± 3.9	< 0.001

[1] *P* -value by ANOVA
[2] The number was 142, one less than the number in the result of daily intake, because one child supported by Food Delivery had not eaten lunch at all during the data collection period.
[abc] Different superscript letters in the same row mean significant difference among groups by Duncan's multiple range test at *α* = 0.05.

Table 5. Children's opinions on meals under the government-funded meal support program

	Meal support method				Total (n = 143)	$P^{1)}$
	Meal box Delivery (n = 26)	Institutional Foodservice (n = 53)	Restaurant Foodservice (n = 27)	Food Delivery (n = 37)		
	Mean ± SD					
I enjoy eating lunch[2]	4.0 ± 0.9[b]	3.4 ± 0.9[a]	3.4 ± 0.9[a]	3.8 ± 0.9[ab]	3.6 ± 0.9	0.048
I look forward to lunch time[2]	3.8 ± 0.9[b]	3.0 ± 1.0[a]	2.9 ± 0.8[a]	3.3 ± 1.0[a]	3.2 ± 1.0	0.002
I am satisfied with supported meals[3]	3.4 ± 0.6	3.3 ± 0.5	3.3 ± 0.6	3.4 ± 0.7	3.3 ± 0.6	0.734

[1] *P*-value by ANOVA
[2] Scale of 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree
[3] Scale of 1 = very unsatisfied, 2 = unsatisfied, 3 = satisfied, 4 = very satisfied

Table 6. Children's preference of meal support methods

	Meal support method				Total (n = 143)	$P^{1)}$
	Meal Box Delivery (n = 26)	Institutional Foodservice (n = 53)	Restaurant Foodservice (n = 27)	Food Delivery (n = 37)		
	N (%)					
Meal Box Delivery	21 (80.8)	5 (9.4)	11 (40.7)	5 (13.5)	42 (29.4)	
Institutional Foodservice	1 (3.8	23 (43.4)	0 (0.0)	3 (8.1)	27 (18.9)	
Restaurant Foodservice	2 (7.7)	8 (15.1)	5 (18.5)	9 (24.3)	24 (16.8)	< 0.001
Food Delivery	2 (7.7)	12 (22.6)	7 (25.9)	18 (48.6)	39 (27.3)	
Others[2]	0 (0)	5 (9.4)	4 (14.8)	2 (5.4)	11 (7.7)	

[1] *P*-value by Chi-square test
[2] Others included 'the food which a mother made' and 'no preference'.

Table 7. Analysis results of children's drawings

	Meal support method				Total (n = 15)
	Meal box delivery (n = 4)	Institutional foodservice (n = 4)	Restaurant foodservice (n = 4)	Food delivery (n = 3)	
	Mean ± SD				
No. of colors	12.5 ± 1.5	11.5 ± 3.4	5.5 ± 0.9	8.3 ± 0.3	9.5 ± 1.2
No. of dishes	4.0 ± 1.0	4.3 ± 0.8	4.0 ± 0.9	2.7 ± 0.9	3.8 ± 0.4
No. of accompanying persons	2.0 ± 0.4	7.5 ± 3.3	1.3 ± 0.3	1.3 ± 0.8	3.1 ± 1.1

Opinions on meals

The children's opinions on meals under the government-funded meal support program were represented in Table 5. The children supported by Meal Box Delivery tended to strongly agree on the 'I look forward to lunch time' questions.

The majority of the children, except those supported by Restaurant Foodservice, wanted to receive the same type of meal support as the current method during the next vacation. The percentage of children preferring their current support method was the highest in those supported by Meal Box Delivery and the lowest in those supported by Food Delivery (Table 6).

Drawing of lunch time scene

On average, the children supported by Meal Box Delivery or Institutional Foodservice used more than ten colors whereas those
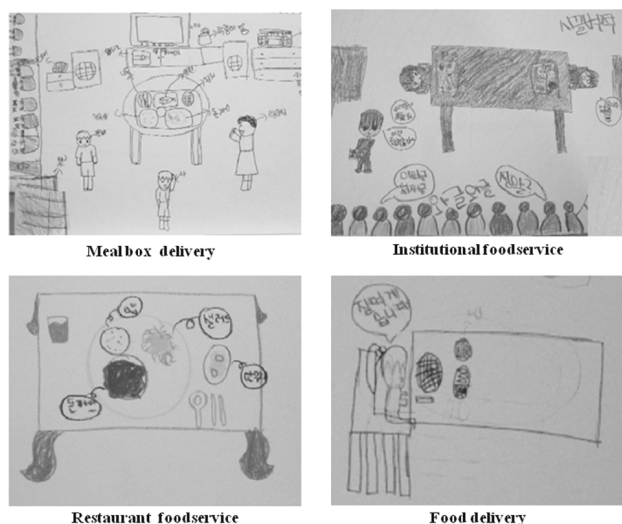
Fig 3. Examples of children's drawing of lunch time scene

supported by Restaurant Foodservice used only six colors in their drawings. The average number of dishes appearing in the children's drawings was four. The children supported by Food Delivery or Restaurant Foodservice drew only one accompanying person on average. However, the children supported by Institutional Foodservice featured eight persons in the drawings on average (Table 7). Examples of the drawings were shown in Fig. 3.

Discussion

This study investigated the diet of 143 children under the government-funded meal support program in Korea during the summer vacation of 2007. On average, the subjects were 11 years old, with a height of 146 cm, and a weight of 40.6 kg. These figures were less than those of the 2005 National Health and Nutrition Survey of the pertinent age group, which reported that an average height for boys was 150.3 cm and 151.3 cm for girls, while the average weight for boys was 46.2 kg and 43.3 kg for girls [16].

On average, the energy intake was 1,400 kcal per day, which means the children consumed less than EER, which is 1,900 kcal for boys and 1,700 kcal for girls in the pertinent age group [14]. This amount of energy consumption was a little bit higher than that (1,348 kcal) reported by a previous study dealing with students of ages and socio-economic status similar to those of this study [17].

The results showed inadequate intake of all the examined nutrients. Especially, calcium intake seemed to be the biggest problem. Previous studies have also shown low calcium intake of children living in both urban [6] and rural areas [18]. A US study reported that 93% of urban children from low-income families had failed to meet Adequate Intake levels of calcium [19].

According to the previous studies, milk and dairy products, which are the main sources of calcium, were available less frequently in low-income families compared with higher-income families [6,7,20]. Calcium is a vital element for healthy bones and teeth. Inadequate calcium intake during the growth period leads children to growth delay [21]. Therefore, the meal support program needs to pay attention to calcium supply in the meals or snacks for the children from low-income families.

The percentages of energy intake at lunch from carbohydrates, proteins, and fats were 61.2%, 15.8%, and 23.0%, respectively in this study. In a study evaluating the nutrient intakes of children living in urban areas [22], the result showed a lower percentage of energy from carbohydrate and a higher percentage of energy from fat than those of this study; the percentage of those was 54.9%, 15.7%, and 31.0%, respectively. However, our findings were similar to the results of another previous study conducted with low-income children living in rural areas [17], which reported that the percentage of energy intake from carbohydrates, proteins, and fats was 60.8%, 15.9%, and 23.4%, respectively.

The association of percentage of energy intake from carbohydrate, protein, and fat with socioeconomic status was shown in other studies conducted in other countries. It was reported that the children from low-income families in Northeastern Thailand consumed lower percentage of energy from fat and a higher percentage of energy from carbohydrate than the children from high-income families [23]. In Taipei, Lyu *et al.* [20] also reported that sons from low-income families had lower percentage from protein as part of their energy intake than sons from higher-income families.

The results from this study showed that the percentages of energy intake from carbohydrate, protein, and fat were different by meal support method. Children supported by Institutional Foodservice, Restaurant Foodservice, and Food Delivery consumed higher percentage of energy from carbohydrate than children supported by Meal Box Delivery.

In order to assess the food variety of the meals, the numbers of dishes and food items were calculated. On average, the children consumed eight dishes and 25 food items per day. Especially, those supported by Food Delivery showed lack of variety in food items. Although our findings showed a remarkably lower number than that reported in elementary school children (32 food items) [24], the numbers of food items were higher in children supported by Meal Box Delivery or Institutional Foodservice than the other groups. This kind of difference might have been caused by the fact that the menus of Institutional Foodservices (17.4%) [25] or Meal Box Delivery (32.0%) [26] were planned more frequently by a specialist than the other groups.

The drawings by the children appeared to be a useful method for identifying their underlying feelings or opinions. Several studies [27,28] have suggested that the proper method to collect qualitative information about children's feelings or opinions are their drawings. Although drawing has not been used widely in

food and nutrition research in Korea, the drawing method has been used in food education in Japan [29].

The atmosphere of each drawing was very different by meal support method. The children supported by Institutional Foodservice were thought to eat lunches with excitement among friends. However, the drawing of children supported by Food Delivery did not show many accompanying persons. According to a previous study [29], children eating alone ate less-balanced meals, mainly only with staple dishes. They were also less likely to have an appetite before meals, to enjoy eating their meals, and to be healthy. A previous study also indicated that the children eating meals with friends or family were more satisfied than those eating meals alone [25]. The drawings of the children supported by Institutional Foodservice showed more positive scenes than the other groups, especially in terms of human aspect.

Although the sample size of this study was small, it was the first reported study to investigate the diet of children under the government-funded meal support program in Korea. The results of this study could be used as useful and important information to develop and plan nutritional policy and programs for children from low-income families under the government-funded meal support program. Further studies about dietary patterns and food-related behaviors are needed to improve low-income children's nutrition status in Korea.

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