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Nutrient intake and food consumption of Korean preschool children: a comparison between a daycare meal group and non-daycare meal group using the data from the 2016–2019 Korea National Health and Nutrition Examination Survey

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Conflict of Interest
The authors declare no potential conflicts of interest.

ABSTRACT

BACKGROUND/OBJECTIVES: In Korea, childcare facilities providing food service for 100 or more children are required to employ dietitians, while those serving fewer than 100 children must register with the Center for Children's Foodservice Management to receive dietary guidance from its dietitians. This study compared the dietary intake of children who had daycare meals and those who did not to evaluate the impact of dietitian-managed nutritional services.
SUBJECTS/METHODS: This study analyzed the 24-h recalls from 706 children aged 3–5 yrs using the data from the 2016–2019 Korea National Health and Nutrition Examination Survey. Among them, 578 children had daycare meals, while 128 did not. The differences in energy contributions from meals and snacks, nutrient intake, and the amount and number of servings of various food groups consumed by these two groups were investigated.
RESULTS: The daycare meal group (DMG) showed a significantly higher intake of protein, thiamin, niacin, sodium, potassium, and iron during lunch and higher protein and sodium consumption during snack times after adjusting for the energy intake compared to the non-daycare meal group (NDMG). On the other hand, the DMG consumed less sugar and fat during lunch and snack times and less vitamin C during snack times. The DMG also showed higher consumption of legumes and vegetables but lower consumption of sweets during lunch and in the total daily consumption. The overall dietary quality assessed by the mean adequacy ratio was significantly higher among the DMG than in the NDMG
CONCLUSION: Children were provided with higher-quality meals in daycare settings than in other environments. These results underscore the importance of nutrition management by dietitians. These findings also highlight the need for nutrition education for caregivers, particularly increasing vegetable intake and reducing sugar-sweetened beverage consumption.

Keywords: Child day care centers; food services; nutritional quality; serving size

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Author Contributions

Conceptualization: Han YH, Hyun T; Formal analysis: Han YH; Methodology: Han YH, Hyun T; Supervision: Hyun T; Writing - original draft: Han YH; Writing - review & editing: Hyun T.

INTRODUCTION

Healthy eating in early childhood is essential for the growth and development of children [1]. Dietary habits during this period significantly influence food preferences and overall health throughout later childhood and adulthood [2,3]. On the other hand, several dietary challenges have been reported in young children, including picky eating, low vegetable intake, and increased consumption of sugar and processed foods [4-7].

In 2020, 89.1% of Korean children aged 3–5 yrs attended daycare centers (including kindergartens), spending an average of more than 7 h per day at these facilities [8]. These children were typically provided with lunch and two snacks daily. Therefore, the quality of foods served by daycare centers plays a crucial role in meeting children's nutritional needs and establishing healthy eating behaviors [9].

The "Special Act on the Management of Children's Food Safety," enacted by the Ministry of Food and Drug Safety (MFDS) in Korea, mandates that daycare centers serving fewer than 100 children must register with the Center for Children's Foodservice Management (CCFSM) as of 2021 if they do not employ a dietitian. The CCFSM, established in 2011, had expanded to 236 centers by 2024. Therefore, all daycare centers without a dietitian provide meals according to dietary guidance, including menus, from CCFSM dietitians. These dietitians ensure that meals and snacks meet the children's daily energy and nutrient requirements [10].

Several studies have examined the nutrient intake of Korean preschool children attending daycare centers [11-14]. Most of these studies were conducted over 20 yrs ago and lacked comparative analyses between children who had meals at daycare centers and those who did not. Furthermore, during that period, fewer than 15% of daycare centers and private kindergartens had their menus planned by dietitians [15,16].

A more recent study using 2010–2012 Korea National Health and Nutrition Examination Survey (KNHANES) data compared the children's dietary intake based on the lunch location [17]. This study found significantly higher consumption of legumes, fish, and vegetables during daycare lunches than in lunches at home. This survey, however, was conducted during the early phase of the CCFSM, before its service was available nationwide. The number of CCFSMs grew substantially, from 12 centers in 2011 to 208 in 2016, and reached 227 centers by 2019, covering almost all of Korea's 226 local governments [10]. Childcare statistics from 2016 to 2019 show that daycare centers serving 100 or more children represented less than 8.0% of the total [18]. This suggests that more than 90% of daycare centers likely used menus planned by CCFSM dietitians, while the remaining centers employed their own dietitians. Consequently, the quality of meals in daycare centers was expected to surpass that of meals provided in other settings, such as at home. Nevertheless, no studies have compared the nutrient intake and food consumption of preschool children who had meals at daycare centers with those who ate elsewhere since the CCFSM expanded nationwide.

This study compared the nutrient intake and food consumption of children aged 3–5 yrs who had daycare meals and those who did not to evaluate the impact of dietitian-managed nutritional services. This study investigated the differences in energy contributions from meals and snacks, nutrient intake, and the amount and number of servings of various food groups consumed between these two groups using the data from the 2016–2019 KNHANES. Data from 2020 onwards were excluded from the analysis because of the coronavirus disease 2019 pandemic.

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SUBJECTS AND METHODS

Study participants

This study analyzed the data from the KNHANES conducted from 2016 to 2019. Details of the sampling methods and procedures are described elsewhere [19]. The analysis included children aged 3–5 yrs (n = 1,090) who completed the food intake survey using the 24-h recall method. Children were excluded if they consumed meals on weekends (n = 334), had missing data on height, weight, or household income (n = 41), or had an implausible daily energy intake (n = 9), which was defined as less than 350 kcal, the minimum requirement per meal, or more than 2,800 kcal, twice the estimated energy requirement (EER) [20]. This resulted in a final sample size of 706 children (**Fig. 1**).

Of 706 children, 578 were classified as the daycare meal group (DMG) based on the responses to questions regarding the lunch location and type, indicating they ate at daycare centers and received institutional food service. The remaining 128 children were classified as the non-daycare meal group (NDMG) because they reported eating elsewhere, such as at home, or consuming other types of food, e.g., purchased foods.

The 2018–2019 surveys received approval from the Institutional Review Board (IRB) of the Korea Disease Control and Prevention Agency (2018-01-03-P-A, 2018-01-03-C-A), and written informed consent was obtained from all participants. On the other hand, the 2016–2017 surveys were exempt from IRB approval under Article 2 (1) of the Bioethics and Safety Act and Article 2-2 (1) of its Enforcement Regulations.

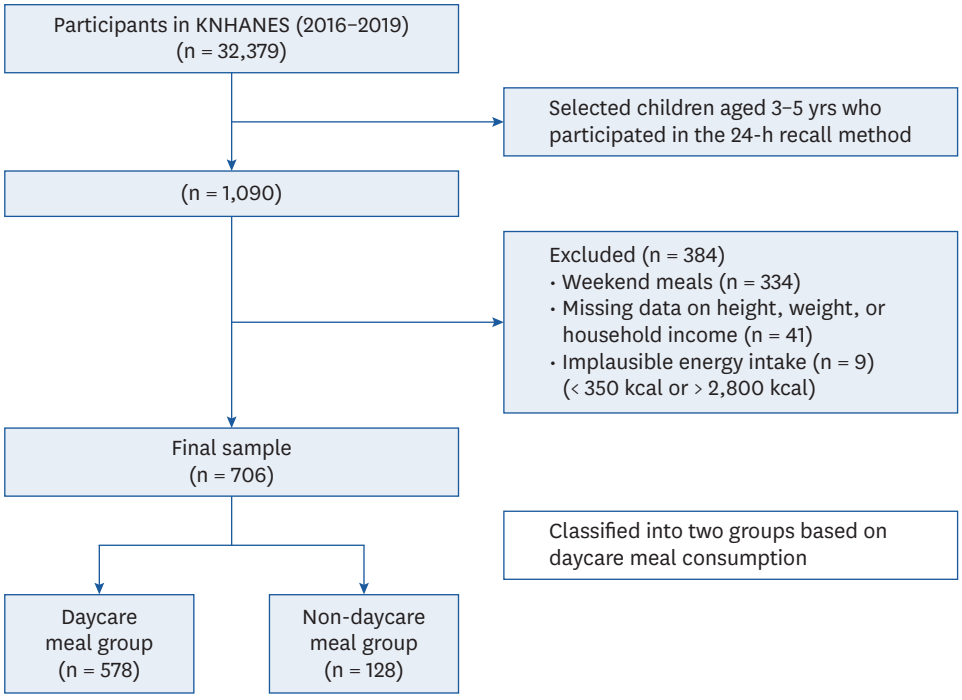

Fig. 1. Flow diagram of participant selection for analysis.
KNHANES, Korea National Health and Nutrition Examination Survey.

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General characteristics

The data on the children's sociodemographic characteristics included age, gender, residential area, household income, height, and weight. Trained personnel measured the height and weight according to standardized protocols. The body mass index (BMI) was calculated by dividing the body weight (kg) by height squared (m^2) and categorized into four groups based on the 2017 Korean National Growth Chart for children and adolescents [21]: underweight (BMI for age < 5^{th} percentile), normal weight (5^{th} ≤ BMI for age < 85^{th} percentile), overweight (85^{th} ≤ BMI for age < 95^{th} percentile), and obese (BMI for age ≥ 95^{th} percentile).

Dietary survey

The dietary survey was conducted using a 24-h dietary recall method. Data on all foods consumed by the children during the day before the survey were collected from their caregivers [19]. Information on the meal times, meal locations, meal types, names and amounts of dishes and foods consumed, daily intakes of energy and nutrients was obtained.

Assessment of energy and nutrient intake

The energy and nutrient intakes during lunch, snacks, and throughout the day were calculated. The distribution of energy intake according to meals and snacks was compared with the recommendations of the MFDS and the National Institute of Food & Nutrition Service (NIFNS) [22]. The recommended distribution of daily caloric intake by meals was 26% for breakfast, 28% for lunch, 26% for dinner, and 20% or less for snacks (5–10% for morning snack and 10–15% for afternoon snack).

The nutrient adequacy ratio (NAR) and the mean adequacy ratio (MAR) were calculated to evaluate the adequacy of nutrient intake [23]. The NAR, the ratio of nutrient intake relative to its recommended nutrient intake (RNI), was determined for nine nutrients for which RNIs have been established: protein, vitamin A, thiamin, riboflavin, niacin, folate, vitamin C, calcium, and iron [20]. If the NAR exceeded 1.0, it was considered 1.0. The MAR was calculated by averaging the NARs for these nine nutrients. The percentage of children consuming less than the estimated average requirement (EAR) for each nutrient was calculated [20].

Assessment of food intake for each food group

The 18 original food groups provided in the KNHANES data were reclassified into 10 categories based on the representative foods for each food group in the recommended dietary pattern [24]. The 10 food categories were grains (including potatoes and starches, chestnuts, and acorn jelly), meat, fish, eggs, legumes (including nuts), vegetables (including mushrooms and seaweed), fruit, milk/dairy products, oils (including sesame seeds), and sweets (including sugar-containing beverages). Seasonings, alcoholic beverages, and other miscellaneous foods were excluded from the food group classification. The quantity of food consumed during lunch, snacks, and throughout the day was calculated for each food group using the tertiary food code in KNHANES. The tertiary food code was derived from the primary food code by assigning the same code to foods that have identical raw materials.

Recommended number of servings and number of servings children consumed for each food group

The recommended dietary pattern was designed to meet the daily nutrient requirements through a balanced combination of foods from six basic food groups: grains, meat/fish/eggs/legumes, vegetables, fruit, milk/dairy products, and oils/sweets [24]. The serving sizes of the representative foods and the recommended number of servings for children, established by

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the MFDS and the NIFNS [22], were used to assess children's food intake. For children aged 3–5 yrs, the average energy content per serving was established as 190 kcal for grains, 50 kcal for meat/fish/eggs/legumes, 7 kcal for vegetables, 25 kcal for fruit, 60 kcal for milk/dairy products, and 23 kcal for oils/sweets. The daily recommended number of servings to meet the EER of 1,400 kcal for children aged 3–5 yrs are as follows: 3.5 servings for grains, 6 servings for meat/fish/eggs/legumes, 10 servings for vegetables, 2 servings for fruit, 4 servings for milk/dairy products, and 4 servings for oils/sweets [22].

The number of servings the children consumed for each food group was calculated by summing the energy intake of food in each food group and dividing by the representative energy value per serving for children aged 3–5 yrs. The percentage of the number of servings consumed by children to the recommended number of servings was then calculated.

Food items contributing to selected nutrients and food groups

The contribution of each food item to the nutrient intake or its respective food group was analyzed to understand the observed differences in nutrient intake and food group consumption between the DMG and NDMG. For each nutrient or food group, the absolute intake of the individual food items and the percentage contribution to total intake were determined. Various types of kimchi, including cabbage kimchi, radish kimchi, and turnip kimchi, were combined and presented as "kimchi," while different types of vegetable oils, such as soybean oil, corn oil, and sesame oil, were grouped and reported as "vegetable oils."

Statistical analysis

Statistical analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA). The KNHANES data were collected using a complex sampling method. All analyses incorporated the sample weights assigned to participants to represent the Korean population. The data are presented as the weighted percentage and SE for the categorical variables, as well as mean and SE for the continuous variables. The differences in the categorical variables, such as general characteristics and daily meal frequency, between the two groups were assessed using the Rao-Scott χ^2 test. The *t*-tests were used to analyze the differences in nutrient intake and food consumption between the two groups, while an analysis of covariance (ANCOVA) was used to examine the differences after adjusting for energy intake. A *P*-value < 0.05 was considered significant.

RESULTS

Characteristics of children

Table 1 lists the characteristics of the DMG (n = 578) and NDMG (n = 128) in this study. The proportion of 3- and 5-yrs-old children was similar, each at approximately 32%, while the proportion of 4-yrs-old children was slightly higher at approximately 37%. Approximately half of the children (51.6%) were boys, and most (87.3%) lived in urban areas. The age, gender, residential area, household income, average height, weight, and BMI category distribution were similar in the two groups.

Distribution of energy intake from meals and snacks

Table 2 lists the distribution of energy intake from meals and snacks in the DMG and NDMG. Although approximately 90% of all children consumed three meals per day, this percentage was significantly higher in the DMG (92.3%) than in the NDMG (78.1%) ($P < 0.001$). Among

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Table 1. Characteristics of the daycare meal group and non-daycare meal group

Variables	Total (n = 706)	DMG (n = 578)	NDMG (n = 128)	*P*-value[1)]
Age (yrs)				0.987
3	31.7 (2.0)	31.6 (2.2)	31.9 (4.4)	
4	36.7 (2.1)	36.6 (2.3)	37.2 (5.0)	
5	31.6 (1.8)	31.8 (2.0)	30.9 (4.3)	
Gender				0.384
Boy	51.6 (2.1)	52.4 (2.3)	47.6 (5.1)	
Girl	48.4 (2.1)	47.6 (2.3)	52.4 (5.1)	
Residential area				0.072
Urban	87.3 (2.2)	88.7 (2.1)	80.7 (5.2)	
Rural	12.7 (2.2)	11.3 (2.1)	19.3 (5.2)	
Household income				0.061
Low	6.9 (1.2)	7.2 (1.4)	5.4 (2.4)	
Middle-low	33.7 (2.3)	32.2 (2.6)	40.5 (4.9)	
Middle-high	35.2 (2.1)	34.3 (2.4)	39.6 (4.9)	
High	24.2 (2.0)	26.3 (2.2)	14.5 (3.2)	
Height (cm)	106.1 ± 0.3	106.2 ± 0.3	105.9 ± 0.7	0.722
Weight (kg)	17.9 ± 0.1	17.9 ± 0.1	17.8 ± 0.3	0.765
BMI category[2)]				0.653
Underweight	6.4 (1.1)	6.2 (1.2)	7.4 (2.7)	
Normal weight	79.9 (1.7)	79.4 (1.8)	82.0 (4.0)	
Overweight	7.4 (1.0)	7.5 (1.2)	6.6 (2.3)	
Obesity	6.3 (1.0)	6.8 (1.2)	4.0 (1.6)	

Values are presented as weighted % (SE) or mean ± SE.
All analyses used the sampling weights to account for the complex sample design.
DMG, daycare meal group; NDMG, non-daycare meal group; BMI, body mass index.
[1)]*P*-value was determined by the Rao–Scott χ^2 test or a *t*-test.
[2)]Underweight (BMI for age < 5th percentiles), normal weight (5th ≤ BMI for age < 85th percentiles), overweight (85th ≤ BMI for age < 95th percentiles), and obesity (BMI for age ≥ 95th percentiles) based on the 2017 Korean National Growth Chart [21].

Table 2. Distribution of the energy intake from meals and snacks in the daycare meal group and non-daycare meal group

Variables	Total (n = 706)	DMG (n = 578)	NDMG (n = 128)	*P*-value[1)]
Daily meal frequency				**< 0.001**
1 meal	0.5 (0.3)	0.2 (0.2)	1.7 (1.4)	
2 meals	9.7 (1.2)	7.5 (1.2)	20.2 (3.8)	
3 meals	89.8 (1.2)	92.3 (1.2)	78.1 (3.9)	
Energy intake from meals and snacks (kcal)				
Breakfast	232.7 ± 7.4	224.9 ± 7.9	268.7 ± 19.6	**0.036**
Lunch	323.8 ± 6.5	330.7 ± 6.6	292.2 ± 18.7	0.051
Dinner	352.3 ± 8.4	353.0 ± 8.8	349.3 ± 22.0	0.874
Snacks	472.9 ± 12.3	480.7 ± 13.4	437.3 ± 26.9	0.142
% of energy from meals and snacks				
Breakfast (26%)[2)]	16.7 ± 0.4	15.9 ± 0.4	20.3 ± 1.2	**< 0.001**
Lunch (28%)	24.1 ± 0.4	24.5 ± 0.4	21.8 ± 1.3	**0.048**
Dinner (26%)	25.4 ± 0.5	25.4 ± 0.5	25.5 ± 1.3	0.970
Snacks (20%)	33.9 ± 0.6	34.2 ± 0.7	32.4 ± 1.7	0.329

Values are presented as weighted % (SE) or mean ± SE. Values in bold represent the statistical significance at $P < 0.05$.
All analyses used the sampling weights to account for the complex sample design.
DMG, daycare meal group; NDMG, non-daycare meal group.
[1)]*P*-value was determined using the Rao–Scott χ^2 test or a *t*-test.
[2)]Recommended percentage of energy (Ministry of Food and Drug Safety, National Institute of Food & Nutrition Service [22]).

all eating occasions, snacks contributed the highest energy intake (472.9 kcal, 33.9%). The DMG showed a significantly lower energy contribution from breakfast ($P < 0.001$) but a significantly higher energy contribution from lunch ($P < 0.05$) compared to the NDMG. Children in both groups exceeded the recommended percentage of energy intake from snacks, with no significant difference between the two groups.

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Nutrient intake of children

Table 3 lists the nutrient intake of the DMG and NDMG during lunch, snacks, and throughout the day. The mean daily energy intake of children was 1,381.8 kcal. The DMG tended to have higher energy intake than the NDMG at lunch ($P = 0.051$), snacks, and throughout the day. Consequently, they showed higher intake for most nutrients, with some exceptions, including sugars, fat, and vitamin C. Although the energy intake did not differ significantly between groups, energy-adjusted analyses were also performed to confirm that the differences in nutrient intake were independent of the energy intake. After adjusting for the energy intake, the DMG showed a significantly higher intake of protein ($P < 0.05$), thiamin ($P < 0.001$), niacin ($P < 0.001$), sodium ($P < 0.001$), potassium ($P < 0.001$), and iron ($P < 0.05$) at lunch; protein ($P = 0.001$) and sodium ($P = 0.001$) during snacks; and protein ($P < 0.05$), calcium ($P < 0.05$), sodium ($P < 0.001$), and potassium ($P < 0.001$) throughout the day. In contrast, the NDMG showed a higher intake of sugars at lunch and snacks ($P = 0.001$, $P < 0.05$), fat across all occasions ($P < 0.01$), and vitamin C at snacks and throughout the day ($P < 0.05$).

Table 4 presents the nutrient adequacy assessment results in the DMG and NDMG. Although the NAR for most nutrients exceeded 0.7, with an overall MAR of 0.86, a substantial percentage of children consumed nutrients below the EAR, particularly calcium (55.9%), vitamin A (40.0%), vitamin C (40.0%), folate (31.1%), and iron (26.3%). The DMG showed a significantly higher NAR for vitamin A ($P < 0.01$), riboflavin ($P < 0.01$), niacin ($P < 0.05$), folate ($P < 0.01$), and calcium ($P < 0.01$), as well as a higher MAR ($P < 0.01$) than the NDMG. The proportion of children with nutrient intakes below the EAR was higher among the NDMG for all nutrients except vitamin C, with significant differences observed for vitamin A ($P < 0.05$), thiamin ($P < 0.05$), riboflavin ($P < 0.001$), and niacin ($P < 0.05$).

Food items contributing to the selected nutrients

Table 5 lists the top five food items contributing to energy and selected nutrients, their absolute intakes, and their percent contribution to total intake. White rice was the primary source of energy and protein, whereas milk was the primary source of simple sugars, fat, calcium, and potassium. Both white rice and milk consumption were higher among the DMG than the NDMG. The vitamin C intake from strawberries was almost four times higher among the NDMG than the DMG. In addition, the consumption of salt, soy sauce, and kimchi was greater in the DMG than in the NDMG.

Food group intake of children

Table 6 summarizes the mean intakes of food groups in the DMG and the NDMG during lunch, snacks, and throughout the day. Overall, milk/dairy products were the most consumed food group, with a mean intake of 254.8 g, followed by grains (231.8 g), fruit (151.8 g), and vegetables (128.3 g). After energy adjustment, the DMG consumed significantly higher amounts of legumes ($P < 0.001$) and vegetables ($P < 0.001$) and significantly lower amounts of sweets ($P < 0.01$) than the NDMG at lunch and throughout the day. During snack times, the DMG consumed significantly higher amounts of vegetables than the NDMG ($P < 0.001$). In addition, the NDMG showed a higher intake of eggs ($P < 0.05$) at lunch and fruit ($P < 0.05$) during snack times. In contrast, there were no significant differences between the two groups in the mean intakes of grains, meat, fish, milk/dairy products, and oils across any eating occasion.

Number of servings consumed by children

Table 7 lists the number of servings consumed by the DMG and NDMG. Overall, the mean number of servings consumed for each food group was 3.77 for grains, 4.52 for meat/fish/

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Table 3. Nutrient intake of the daycare meal group and non-daycare meal group

Nutrient	Total (n = 706)	DMG (n = 578)	NDMG (n = 128)	*P*-value[1)]	*P*-value[2)]
Energy (kcal)					
Lunch	323.8 ± 6.5	330.7 ± 6.6	292.2 ± 18.7	0.051	-
Snacks	472.9 ± 12.3	480.7 ± 13.4	437.3 ± 26.9	0.142	-
Daily total	1,381.8 ± 19.5	1,389.2 ± 21.6	1,347.5 ± 46.7	0.420	-
Carbohydrate (g)					
Lunch	51.2 ± 1.0	52.5 ± 1.0	45.3 ± 2.5	**0.006**	0.184
Snacks	74.2 ± 2.0	75.6 ± 2.2	68.1 ± 4.2	0.104	0.525
Daily total	214.7 ± 3.0	216.6 ± 3.3	205.9 ± 6.5	0.145	0.144
Sugars (g)					
Lunch	4.8 ± 0.4	4.3 ± 0.4	7.0 ± 1.1	**0.019**	**0.001**
Snacks	38.8 ± 1.1	38.6 ± 1.1	40.1 ± 2.8	0.607	**0.011**
Daily total	55.5 ± 1.2	54.9 ± 1.3	58.2 ± 3.3	0.338	0.085
Protein (g)					
Lunch	12.5 ± 0.3	12.9 ± 0.3	10.5 ± 0.8	**0.008**	**0.031**
Snacks	12.8 ± 0.4	13.4 ± 0.4	10.3 ± 0.8	**< 0.001**	**0.001**
Daily total	47.4 ± 0.8	48.2 ± 0.8	44.1 ± 1.9	0.051	**0.014**
Fat (g)					
Lunch	7.1 ± 0.3	7.0 ± 0.3	7.3 ± 1.0	0.740	**0.005**
Snacks	14.5 ± 0.5	14.5 ± 0.5	14.7 ± 1.2	0.857	**0.008**
Daily total	36.3 ± 0.8	35.9 ± 0.9	38.2 ± 2.1	0.326	**0.002**
Vitamin A (ug RAE)					
Lunch	57.5 ± 2.8	57.6 ± 2.8	56.7 ± 8.3	0.916	0.501
Snacks	162.0 ± 9.9	164.6 ± 10.2	149.9 ± 30.2	0.645	0.959
Daily total	351.9 ± 12.8	360.0 ± 13.5	314.8 ± 33.9	0.212	0.285
Thiamin (mg)					
Lunch	0.23 ± 0.01	0.25 ± 0.01	0.17 ± 0.01	**< 0.001**	**< 0.001**
Snacks	0.25 ± 0.02	0.25 ± 0.02	0.25 ± 0.05	0.992	0.678
Daily total	0.93 ± 0.03	0.95 ± 0.03	0.83 ± 0.05	**0.037**	0.073
Riboflavin (mg)					
Lunch	0.23 ± 0.01	0.23 ± 0.01	0.22 ± 0.02	0.666	0.423
Snacks	0.51 ± 0.02	0.53 ± 0.02	0.46 ± 0.05	0.219	0.524
Daily total	1.25 ± 0.03	1.28 ± 0.03	1.13 ± 0.07	0.059	0.068
Niacin (mg NE)					
Lunch	2.00 ± 0.06	2.10 ± 0.07	1.54 ± 0.12	**< 0.001**	**< 0.001**
Snacks	2.23 ± 0.11	2.23 ± 0.12	2.22 ± 0.31	0.969	0.472
Daily total	8.23 ± 0.19	8.36 ± 0.21	7.61 ± 0.43	0.108	0.156
Folate (μg DFE)					
Lunch	47.5 ± 1.3	49.4 ± 1.4	38.8 ± 3.3	**0.003**	0.065
Snacks	66.3 ± 2.9	65.4 ± 3.0	70.6 ± 9.3	0.598	0.216
Daily total	208.4 ± 4.5	211.2 ± 5.0	195.5 ± 12.8	0.265	0.376
Vitamin C (mg)					
Lunch	7.7 ± 0.6	6.9 ± 0.3	11.1 ± 2.7	0.131	0.067
Snacks	34.5 ± 2.5	30.3 ± 2.1	53.4 ± 10.0	**0.024**	**0.015**
Daily total	61.0 ± 3.1	56.1 ± 2.5	83.7 ± 12.3	**0.029**	**0.015**
Calcium (mg)					
Lunch	64.9 ± 2.4	65.7 ± 2.3	61.2 ± 8.0	0.583	0.758
Snacks	266.5 ± 8.8	273.7 ± 9.4	232.9 ± 24.3	0.120	0.306
Daily total	476.3 ± 11.0	487.8 ± 11.5	423.3 ± 29.6	**0.042**	**0.040**
Sodium (mg)					
Lunch	564.2 ± 14.9	599.5 ± 16.0	401.4 ± 31.9	**< 0.001**	**< 0.001**
Snacks	371.3 ± 15.4	391.4 ± 17.6	278.5 ± 22.5	**< 0.001**	**0.001**
Daily total	1,675.3 ± 37.7	1,727.9 ± 42.3	1,432.0 ± 72.3	**< 0.001**	**< 0.001**
Potassium (mg)					
Lunch	410.7 ± 9.8	438.0 ± 10.4	284.8 ± 18.6	**< 0.001**	**< 0.001**
Snacks	680.4 ± 19.6	699.0 ± 19.9	594.3 ± 57.4	0.083	0.187
Daily total	1,771.2 ± 29.3	1,821.0 ± 30.4	1,541.0 ± 83.8	**0.002**	**< 0.001**
Iron (mg)					
Lunch	1.9 ± 0.1	2.0 ± 0.1	1.6 ± 0.1	**0.005**	**0.046**
Snacks	1.8 ± 0.1	1.8 ± 0.1	2.1 ± 0.3	0.307	0.056
Daily total	7.1 ± 0.2	7.1 ± 0.2	7.2 ± 0.4	0.802	0.310

Values are presented as mean ± SE. Values in bold represent the statistical significance at $P < 0.05$.
All analyses used the sampling weights to account for the complex sample design.
DMG, daycare meal group; NDMG, non-daycare meal group.
[1)]*P*-value was determined by a *t*-test.
[2)]*P*-value was determined by ANCOVA after adjusting for the energy intake on each occasion (lunch, snack, and daily total).

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Table 4. Nutrient adequacy assessment results in the daycare meal group and non-daycare meal group

Nutrient	NAR				EAR	Percentage of children consuming below the EAR			
	Total (n = 706)	DMG (n = 578)	NDMG (n = 128)	*P*-value[1]		Total (n = 706)	DMG (n = 578)	NDMG (n = 128)	*P*-value[2]
Protein	1.00 ± 0.00	1.00 ± 0.00	0.99 ± 0.01	0.079	15 g	0.3 (0.2)	0.0 (0.0)	1.7 (1.2)	-
Vitamin A	0.74 ± 0.01	0.76 ± 0.01	0.65 ± 0.04	**0.008**	230 ug RAE	40.0 (2.3)	37.6 (2.5)	50.7 (5.9)	**0.040**
Thiamin	0.97 ± 0.00	0.97 ± 0.00	0.95 ± 0.01	0.062	0.4 mg	6.2 (1.1)	5.2 (1.2)	10.8 (2.7)	**0.030**
Riboflavin	0.98 ± 0.00	0.99 ± 0.00	0.94 ± 0.02	**0.003**	0.5 mg	4.3 (0.9)	2.5 (0.8)	12.6 (3.2)	< **0.001**
Niacin	0.88 ± 0.01	0.89 ± 0.01	0.84 ± 0.02	**0.013**	5 mg NE	17.7 (1.6)	16.1 (1.8)	25.1 (3.8)	**0.020**
Folate	0.86 ± 0.01	0.87 ± 0.01	0.81 ± 0.02	**0.006**	150 μg DFE	31.1 (1.9)	29.6 (2.2)	38.1 (4.6)	0.089
Vitamin C	0.76 ± 0.01	0.75 ± 0.01	0.76 ± 0.03	0.930	30 mg	40.0 (2.1)	40.9 (2.4)	35.8 (4.4)	0.320
Calcium	0.71 ± 0.01	0.73 ± 0.01	0.62 ± 0.03	**0.003**	470 mg	55.9 (2.2)	54.0 (2.3)	64.8 (5.5)	0.079
Iron	0.89 ± 0.01	0.89 ± 0.01	0.87 ± 0.02	0.237	5 mg	26.3 (2.0)	25.2 (2.2)	31.1 (5.0)	0.262
MAR	0.86 ± 0.01	0.87 ± 0.01	0.83 ± 0.02	**0.005**					

Values are presented as mean ± SE or weighted % (SE). Values in bold represent statistical significance at $P < 0.05$.
All analyses used the sampling weights to account for the complex sample design.
DMG, daycare meal group; NDMG, non-daycare meal group; NAR, nutrient adequacy ratio; EAR, estimated average requirement; MAR, mean adequacy ratio.
[1]*P*-value was determined by a *t*-test.
[2]*P*-value was determined by the Rao–Scott χ^2 test.

Table 5. Food items contributing to the selected nutrients in the daycare meal group and non-daycare meal group

Nutrient	Rank	Total (n = 706)			DMG (n = 578)			NDMG (n = 128)		
		Food	Mean	%[1]	Food	Mean	%	Food	Mean	%
Energy (kcal)	1	White rice	401.7	30.5	White rice	408.5	29.4	White rice	370.4	27.5
	2	Milk	121.3	9.2	Milk	124.7	9.0	Milk	105.3	7.8
	3	Bread	65.8	5.0	Bread	65.6	4.7	Cookies	77.3	5.7
	4	Cookies	47.9	3.6	Beef	47.5	3.4	Bread	66.9	5.0
	5	Beef	46.0	3.5	Cookies	41.6	3.0	Egg	46.4	3.4
Simple sugars (g)	1	Milk	8.5	15.4	Milk	8.8	16.1	Milk	7.2	12.4
	2	Fruit drink	3.2	5.8	Yogurt	3.3	6.0	Fruit drink	4.9	8.4
	3	Apple	3.1	5.6	Apple	2.9	5.3	Apple	4.1	7.0
	4	Yogurt	3.0	5.5	Fruit drink	2.9	5.2	Bread	3.2	5.6
	5	Bread	2.9	5.2	Bread	2.8	5.1	Cookies	2.7	4.7
Protein (g)	1	White rice	7.2	15.2	White rice	7.3	15.2	White rice	6.7	15.2
	2	Milk	5.7	12.0	Milk	5.8	12.1	Milk	4.9	11.2
	3	Egg	3.6	7.6	Egg	3.5	7.3	Egg	4.0	9.1
	4	Pork	3.2	6.8	Pork	3.4	7.1	Chicken	3.3	7.5
	5	Beef	3.1	6.5	Beef	3.2	6.6	Beef	2.6	5.8
Fat (g)	1	Milk	6.1	16.9	Milk	6.3	17.5	Milk	5.4	14.1
	2	Vegetable oil	4.6	12.6	Vegetable oil	4.5	12.5	Vegetable oil	5.0	13.1
	3	Beef	3.6	9.9	Beef	3.7	10.3	Cookies	3.8	9.9
	4	Egg	2.5	6.8	Egg	2.4	6.7	Beef	3.1	8.0
	5	Cookies	2.3	6.2	Pork	2.1	6.0	Egg	2.7	7.1
Vitamin C (mg)	1	Strawberry	10.7	17.6	Strawberry	7.1	12.7	Strawberry	27.3	32.6
	2	Tangerine	6.8	11.1	RTE cereal	6.8	12.2	Fruit drink	9.5	11.4
	3	Fruit drink	6.8	11.1	Tangerine	6.3	11.2	Tangerine	9.1	10.9
	4	RTE cereal	6.3	10.3	Fruit drink	6.2	11.0	SSB	5.8	7.0
	5	Orange	3.4	5.6	Orange	3.5	6.3	Kiwi	4.8	5.7
Calcium (mg)	1	Milk	204.8	43.0	Milk	210.4	43.1	Milk	178.6	42.2
	2	Yogurt	31.7	6.6	Yogurt	34.4	7.1	Cheese	20.1	4.7
	3	Cheese	19.0	4.0	Cheese	18.8	3.9	Yogurt	19.0	4.5
	4	Anchovy	15.3	3.2	Anchovy	17.5	3.6	Egg	17.1	4.0
	5	Egg	15.0	3.2	Egg	14.6	3.0	Cookies	13.1	3.1
Sodium (mg)	1	Salt	353.4	21.1	Salt	374.2	21.7	Salt	257.7	18.0
	2	Soy sauce	210.8	12.6	Soy sauce	223.0	12.9	Soy sauce	154.3	10.8
	3	Kimchi	128.6	7.7	Kimchi	136.1	7.9	Kimchi	93.9	6.6
	4	Soybean paste	100.3	6.0	Soybean paste	112.3	6.5	Bread	72.2	5.0
	5	Milk	76.7	4.6	Milk	78.4	4.5	Milk	69.0	4.8
Potassium (mg)	1	Milk	267.2	15.1	Milk	274.4	15.1	Milk	234.2	15.2
	2	White rice	163.4	9.2	White rice	165.9	9.1	White rice	152.3	9.9
	3	Potato	60.5	3.4	Potato	64.6	3.5	Strawberry	64.3	4.2
	4	Banana	52.5	3.0	Banana	55.8	3.1	Potato	41.2	2.7
	5	Pork	51.6	2.9	Pork	54.4	3.0	Egg	40.7	2.6

All analyses used the sampling weights to account for the complex sample design.
DMG, daycare meal group; NDMG, non-daycare meal group; RTE, ready-to-eat; SSB, sugar-sweetened beverage.
[1]Percentage of the intake from each food among the total food consumed in each nutrient.

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Table 6. Mean intake of food groups in the daycare meal group and non-daycare meal group (g/day)

Food group	Total (n = 706)	DMG (n = 578)	NDMG (n = 128)	*P*-value[1)]	*P*-value[2)]
Grains					
Lunch	62.3 ± 1.5	63.0 ± 1.5	59.0 ± 4.2	0.378	0.498
Snacks	60.6 ± 3.0	63.3 ± 3.3	47.9 ± 5.9	**0.021**	0.139
Daily total	231.8 ± 4.4	233.2 ± 4.9	225.5 ± 10.2	0.504	0.924
Meat					
Lunch	18.6 ± 1.3	19.1 ± 1.2	16.2 ± 4.8	0.551	0.931
Snacks	4.5 ± 0.7	4.8 ± 0.8	3.0 ± 1.6	0.304	0.593
Daily total	59.9 ± 2.7	60.0 ± 2.9	59.5 ± 7.2	0.954	0.811
Fish					
Lunch	22.4 ± 1.4	23.0 ± 1.4	20.0 ± 4.9	0.561	0.754
Snacks	3.6 ± 0.5	3.9 ± 0.6	2.3 ± 1.4	0.267	0.380
Daily total	55.0 ± 3.6	57.4 ± 4.1	43.9 ± 6.7	0.082	0.102
Eggs					
Lunch	6.9 ± 0.8	6.1 ± 0.8	10.7 ± 2.3	0.054	**0.025**
Snacks	3.4 ± 0.8	3.8 ± 1.0	1.4 ± 0.8	0.062	0.095
daily total	28.8 ± 1.6	28.0 ± 1.7	32.5 ± 4.6	0.355	0.265
Legumes					
Lunch	7.8 ± 0.7	9.0 ± 0.8	1.9 ± 0.6	**< 0.001**	**< 0.001**
Snacks	9.5 ± 1.8	10.5 ± 2.0	4.6 ± 4.6	0.241	0.370
Daily total	26.7 ± 2.6	29.2 ± 2.9	15.0 ± 5.6	**0.026**	**0.036**
Vegetables					
Lunch	53.3 ± 1.8	59.2 ± 2.0	25.9 ± 3.3	**< 0.001**	**< 0.001**
Snacks	13.7 ± 1.4	16.1 ± 1.6	2.3 ± 1.2	**< 0.001**	**< 0.001**
Daily total	128.3 ± 4.7	138.3 ± 5.0	82.1 ± 9.0	**< 0.001**	**< 0.001**
Fruit					
Lunch	5.6 ± 1.0	4.5 ± 0.9	10.6 ± 3.6	0.101	0.058
Snacks	114.7 ± 7.2	109.2 ± 7.5	140.5 ± 19.2	0.123	**0.035**
Daily total	151.8 ± 8.2	146.2 ± 8.8	177.5 ± 19.8	0.144	0.075
Milk/dairy products					
Lunch	7.0 ± 1.6	5.1 ± 1.2	15.8 ± 6.5	0.102	0.060
Snacks	198.9 ± 8.0	204.5 ± 8.5	172.9 ± 21.8	0.179	0.383
Daily total	254.8 ± 9.3	261.9 ± 9.8	221.9 ± 25.5	0.141	0.169
Oils					
Lunch	2.4 ± 0.1	2.4 ± 0.1	2.0 ± 0.6	0.536	0.900
Snacks	1.0 ± 0.1	1.1 ± 0.1	0.5 ± 0.4	0.224	0.394
Daily total	6.1 ± 0.3	6.1 ± 0.3	6.2 ± 0.9	0.981	0.718
Sweets					
Lunch	7.3 ± 1.7	2.2 ± 0.5	30.6 ± 9.4	**0.003**	**0.002**
Snacks	49.5 ± 3.9	49.1 ± 4.3	51.2 ± 9.0	0.830	0.611
Daily total	67.4 ± 4.3	60.2 ± 4.4	100.9 ± 13.9	**0.005**	**0.003**

Values are presented as mean ± SE. Values in bold represent statistical significance at $P < 0.05$.
All analyses used the sampling weights to account for the complex sample design.
DMG, daycare meal group; NDMG, non-daycare meal group.
[1)]*P*-value was determined using a *t*-test.
[2)]*P*-value was determined by ANCOVA after adjusting for the energy intake on each occasion (lunch, snack, and daily total).

eggs/legumes, 4.73 for vegetables, 3.00 for fruit, 3.28 for milk/dairy products, and 4.91 for oils/sweets. Children's consumption exceeded the recommended number of servings of grains (108%), fruit (150%), and oils/sweets (123%). By contrast, the consumption of meat/fish/eggs/legumes, vegetables, and milk/dairy products was below the recommended number of servings, reaching only 75%, 47%, and 82%, respectively. When analyzed according to daycare meal consumption, the DMG consumed significantly more servings of legumes ($P = 0.001$) and vegetables ($P < 0.001$) than the NDMG.

Most children did not meet the recommended number of servings of vegetables, with a significantly higher proportion among the NDMG (98.1%) than the DMG (93.0%). In addition, more than half of the children failed to meet the recommended number of servings for most food groups, except for grains among the DMG and fruit among the NDMG.

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Table 7. Number of servings consumed by the daycare meal group and non-daycare meal group

Food group	Recommended number of servings[1]	Number of servings consumed				Percentage of children consuming below the recommended number of servings			
		Total (n = 706)	DMG (n = 578)	NDMG (n = 128)	*P*-value[2]	Total (n = 706)	DMG (n = 578)	NDMG (n = 128)	*P*-value[3]
Grains	3.5	3.77 ± 0.07 (108)[4]	3.79 ± 0.07 (108)	3.68 ± 0.16 (105)	0.515	47.3 (2.2)	46.0 (2.4)	53.2 (4.8)	0.188
Meat/fish/eggs/legumes	6	4.52 ± 0.13 (75)	4.56 ± 0.15 (76)	4.32 ± 0.32 (72)	0.501	76.4 (1.8)	76.9 (1.9)	74.0 (4.6)	0.550
Meat		2.37 ± 0.10	2.39 ± 0.12	2.25 ± 0.24	0.590				
Fish		0.63 ± 0.04	0.61 ± 0.04	0.71 ± 0.12	0.460				
Eggs		0.89 ± 0.05	0.87 ± 0.05	1.00 ± 0.14	0.368				
Legumes		0.63 ± 0.04	0.69 ± 0.05	0.36 ± 0.08	**0.001**				
Vegetables	10	4.73 ± 0.14 (47)	5.00 ± 0.15 (50)	3.45 ± 0.27 (35)	< **0.001**	93.9 (1.0)	93.0 (1.1)	98.1 (1.2)	**0.029**
Fruit	2	3.00 ± 0.15 (150)	2.92 ± 0.17 (146)	3.37 ± 0.37 (168)	0.257	51.2 (2.1)	52.8 (2.3)	43.6 (4.7)	0.076
Milk/dairy products	4	3.28 ± 0.12 (82)	3.37 ± 0.14 (84)	2.85 ± 0.29 (71)	0.102	65.5 (2.2)	64.0 (2.5)	72.5 (4.9)	0.135
Oils/sweets	4	4.91 ± 0.20 (123)	4.68 ± 0.19 (117)	5.95 ± 0.69 (149)	0.075	55.1 (2.2)	55.3 (2.5)	54.4 (5.2)	0.878

Values are presented as mean ± SE or weighted % (SE). Values in bold represent the statistical significance at $P < 0.05$.
All analyses used the sampling weights to account for the complex sample design.
DMG, daycare meal group; NDMG, non-daycare meal group.
[1]Ministry of Food and Drug Safety, National Institute of Food & Nutrition Service [22].
[2]*P*-value was determined using a *t*-test.
[3]*P*-value was determined using the Rao–Scott χ^2 test.
[4]Percentage of the recommended number of servings consumed

Food items contributing to the selected food groups

Table 8 lists the top five food items contributing to the selected food groups with their absolute intakes and their percent contribution to the total intake. The foods contributing to legumes were similar between the two groups, but the DMG had higher tofu and soymilk intakes. Among the DMG, the major contributors to vegetable intake were kelp broth and kimchi. For the sweet food group, sugar-sweetened beverages (SSBs), including fruit drinks and carbonated drinks, were the main contributors.

Table 8. Food items contributing to the selected food groups in the daycare meal group and non-daycare meal group

Food group	Rank	Total (n = 706)			DMG (n = 578)			NDMG (n = 128)		
		Food	Mean (g)	%[1]	Food	Mean (g)	%	Food	Mean (g)	%
Legumes	1	Tofu	13.2	49.5	Tofu	14.9	51.0	Soy milk	7.4	49.2
	2	Soy milk	10.1	37.8	Soy milk	10.7	36.6	Tofu	5.3	35.4
	3	Soybean	1.0	3.7	Soybean	1.1	3.6	Fried tofu	0.9	5.8
	4	Fried tofu	0.5	2.1	Fried tofu	0.5	1.6	Soybean	0.7	5.0
	5	Pea	0.3	1.1	Pea	0.3	1.1	Kidney bean	0.4	2.6
Vegetables	1	Kimchi	22.6	17.2	Kelp broth	24.6	17.3	Kimchi	16.7	20.2
	2	Kelp broth	21.7	16.5	Kimchi	23.9	16.9	Onion	10.8	13.1
	3	Onion	12.7	9.7	Onion	13.2	9.3	Kelp broth	8.5	10.2
	4	Tomato	8.5	6.5	Tomato	9.9	7.0	Vegetable broth	8.1	9.9
	5	White radish	6.8	5.2	White radish	7.4	5.2	Carrot	4.9	5.9
Fruit	1	Apple	27.9	18.2	Apple	26.0	17.6	Strawberry	38.5	21.6
	2	Mandarin	22.3	14.5	Mandarin	20.8	14.0	Apple	36.5	20.5
	3	Strawberry	15.1	9.8	Banana	16.0	10.8	Mandarin	29.0	16.3
	4	Banana	15.1	9.8	Watermelon	15.0	10.1	Pear	15.2	8.5
	5	Watermelon	13.8	9.0	Peach	12.6	8.5	Persimmon	12.8	7.2
Sweets	1	Fruit drink	33.8	47.0	Fruit drink	30.0	45.9	Fruit drink	51.0	50.2
	2	Other SSB	13.5	18.7	Other SSB	13.8	21.0	Carbonated drink	22.4	22.0
	3	Carbonated drink	10.7	14.9	Carbonated drink	8.2	12.6	Other SSB	12.1	11.9
	4	Vegetable drink	3.5	4.9	Vegetable drink	3.3	5.1	Vegetable drink	4.5	4.4
	5	Jelly	2.5	3.5	Jelly	2.5	3.8	Jelly	2.8	2.8

All analyses used the sampling weights to account for the complex sample design.
DMG, daycare meal group; NDMG, non-daycare meal group; SSB, sugar-sweetened beverage.
[1]Percentage of the intake from each food among the total food consumed in each food group.

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DISCUSSION

The MFDS and the NIFNS established age-appropriate serving sizes and the recommended number of servings from six food groups for children [22]. An analysis of children's food intake revealed significant discrepancies between the recommended and consumed servings across food groups. Fruit consumption exceeded the recommendations by 50%, whereas vegetable consumption reached only 47% of the recommendations, with 93.9% of children failing to meet the recommended vegetable intake. These findings corroborate previous studies indicating fruit as the most preferred food group and vegetables as the least preferred [25-27]. The low vegetable consumption is not unique to Korean children. For example, 85% of Canadian children aged 4–5 yrs also failed to meet the daily vegetable recommendations [28]. It is notable that the DMG showed significantly higher vegetable consumption during lunch, snacks, and throughout the day than the NDMG. Higher vegetable consumption among children attending daycare centers has been reported [17,29-31]. Although it is somewhat disappointing that kelp broth was the most consumed vegetable item among the DMG, they exhibited greater diversity in their vegetable consumption than the NDMG. On the other hand, fruit consumption was higher among the NDMG than the DMG and a significant difference was observed during snack time. The NDMG consumed more strawberries, apples, and mandarins than the DMG.

Although the protein intake was adequate (NAR = 1.00), the consumption of meat/fish/eggs/legumes reached only 75% of the recommended servings, with an unbalanced emphasis on meat. Fish, eggs, and legumes were consumed in less than one serving. Although young children often dislike legumes [25-27], they are a valuable source of plant-based protein, dietary fiber, B vitamins, and minerals. The DMG consumed more legumes, including tofu and soy milk, than the NDMG.

The consumption of oils/sweets group exceeded the recommended number of servings, reaching 117% and 149% among the DMG and NDMG, respectively. The NDMG showed a significantly higher consumption of sweet foods at lunch and throughout the day. The top four contributors to sweet group consumption were SSBs, with higher intake among the NDMG. These findings are consistent with previous research that reported higher SSB consumption at home than in daycare settings [30,32].

The NDMG exhibited a higher intake of simple sugars during lunch and snack times. A study analyzing the sugar content of lunches served at 12 daycare centers in 2008 reported an average sugar intake of approximately 2.2 g per child, with no significant difference based on the presence of a dietitian [33]. This study, however, found that the sugar intake from daycare lunches among the DMG increased approximately twofold to 4.3 g, while the NDMG consumed a significantly higher amount of 7.0 g. Previous research has identified milk/dairy products, fruit, and SSBs as the major sources of simple sugars among Korean preschool children [34]. Bread and cookies were identified as additional contributors to the sugar intake. Although the sugar intake from milk and fruit showed inverse associations with obesity [35], the high consumption of SSBs, including fruit drinks, has been linked to an increased risk of obesity in preschool children [36-38]. Thus, sugar reduction strategies should focus on specific food groups, particularly SSBs.

Although the DMG had higher intakes of most micronutrients, their higher sodium intake was a concern. This can be attributed to the traditional Korean dietary pattern, which

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includes rice accompanied by soup and kimchi, major sodium sources for Koreans [39]. A study analyzing CCFSM menus [40] showed that more than 90% of 1,716 lunch menus included soup, and more than 97% included kimchi, indicating the need for sodium reduction in soup and kimchi.

These findings were consistent with previous research showing that children consuming lunches at childcare facilities have higher intakes of essential nutrients and healthier foods, such as vegetables, legumes, fish, and milk, while consuming fewer high-fat, high-sugar foods than home meals [17,29-31,41-43]. By contrast, some studies identified concerns regarding excessive sodium, fat and sugars, with insufficient vegetables, fruit, and fiber in daycare menus [44-48]. These findings emphasize the importance of establishing and following comprehensive food service guidelines in childcare settings.

In the present study, lunch provided 24.5% and 21.8% of the daily energy intake among the DMG and NDMG, respectively, both below the recommended 28%. In contrast, snacks contributed 34.2% and 32.4% for the DMG and NDMG, respectively, exceeding the recommended 20%. These findings highlight the need to rebalance the energy distribution between lunch and snack times. However, it should be noted that this study did not measure either the energy content of the dietitian-planned menus or the actual amount of food provided to children.

Providing the appropriate portion sizes in daycare centers are crucial, besides having menus planned by dietitians. Previous studies have shown that teachers, typically responsible for serving lunches in daycare centers, often served smaller portions than recommended or menu-planned quantities [49,50]. This may arise from efforts to minimize the waste of less preferred foods, affecting the children's nutrient intake. Future research comparing dietitian-planned menus, the actual served portions, and children's consumption can help identify specific stages for improvement.

The higher dietary quality observed among the DMG can be attributed to the positive impact of dietitians, especially of the CCFSM, in meeting children's nutritional requirements and promoting healthy eating behaviors. CCFSM dietitians play a critical role in menu planning and food service management. Moreover, they provide nutrition education, targeting children and their parents to encourage healthy food choices, as well as teachers and daycare staff to support the provision of nutritious meals. These results suggest that the nationwide expansion of the CCFSM has enhanced the quality of food consumption among the DMG, even though a small number of children in this study may not have received meals managed by the CCFSM because the mandatory CCFSM registration for small daycare centers did not begin until 2021.

To the best of the authors' knowledge, this is the first study to determine whether young children adequately consume various food groups by calculating the number of servings for each food group based on the recommended guidelines using the representative population data. Furthermore, this study provided a detailed analysis of specific food items contributing to nutrient and food group consumption between the two groups. Nevertheless, several methodological limitations warrant consideration. Dietary data obtained from a single 24-h dietary recall may not represent the usual intake of children. In addition, parent or caregiver reports of children's dietary intake may contain inaccuracies because they may not directly observe all meals and snacks consumed throughout the day.

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In conclusion, the DMG showed significantly higher protein, sodium, and potassium intake at lunch and throughout the day than the NDMG. The DMG also showed a significantly higher consumption of legumes and vegetables and a lower consumption of sweets at lunch and throughout the day than the NDMG. Furthermore, the overall dietary quality assessed by the MAR was significantly higher in the DMG than in the NDMG. These results underscore the importance of nutrition management by dietitians. These findings also highlight the need for nutrition education for caregivers of young children, particularly increasing vegetable intake and reducing SSB consumption.

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