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Effect of nutrition education by childcare teachers on food serving sizes

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ABSTRACT

Purpose: Adequate nutrition is to be provided for normal growth and development during early childhood. Currently, childcare teachers provide lunch to most children in Korea. The purpose of this study was to investigate the portion size provided by teachers and examine the effect of education on food serving size.

Methods: The subjects were childcare teachers (n = 120) in charge of children aged 3–5 years at a daycare center in Hanam-si. The survey was conducted through questionnaires which included questions on the general characteristics of the teachers, their nutritional education status, and the source of nutrition information. In addition, the portion sizes of items on the menu currently provided to children were measured and the data were analyzed. To assess the effectiveness of education in determining serving size, the subjects were randomly equally divided into two groups. In the first group (n = 60) theoretical education on nutrition and serving sizes was given, whereas in the second (n = 60), practical education on these topics was provided.

Results: The difference between the actual portion size of rice and the serving size announced on the menu was observed to decrease along with the increase in the experience of the teacher, although the differences in the main dish and kimchi were higher. The gap between the serving size mentioned in the menu and the portion size distributed widened as the age of the teachers increased. Notably, the difference between the portion size and the serving size of food decreased after both practical and theoretical education. Furthermore, the effect of education on the serving size of the main dishes ($p < 0.001$), side dishes ($p < 0.01$), and kimchi ($p < 0.01$) was observed to be greater in the practical education group than in the theoretical education group.

Conclusion: Regular education should be provided to teachers on the serving sizes mentioned in the menu, as the quantity of food served depends on the experience and age of teachers. In the case of rice, theoretical education alone sufficed to ensure a proper serving size. However, hands-on training on the main and side dishes, and kimchi would be much more helpful.

Keywords: serving size; portion size, child care; food intake; education

INTRODUCTION

The periods of infancy and early childhood are important life stages, in which significant physical and mental development occurs. The foundation for growth and development is formed in preschool children. Thus, malnourished children, especially those under the age of 5, have deficits in cognitive and language skills, and social development later in life [1], which is a hindrance to their educational attainment and the realization of their physical or mental potential [2]. The number of obese preschool children in Korea has been increasing. According to the national health statistics in Korea [3], the prevalence of obesity among children and adolescents aged 6–18 years increased from 9.1% in 2001 to 13.3% in 2016, and the obesity rate among children aged 6–11 years increased from 6.7% in 2001 to 8.2% in 2016. Lanigan et al. [4] reported that most of the excess weight in obese children was gained before the age of five years. It is noteworthy that Sutaria et al. [5] found strong evidence that obese female children had significantly higher odds of depression than normal-weight female children, and this risk persisted in adulthood and adolescents (ages 12–19 years). Ruiz et al. reported similar results according to which obese children were more likely to suffer from psychosocial problems [6]. A balanced and sufficient both quantitatively and qualitatively childhood diet is a must since both undernutrition and overnutrition are risk factors with serious health consequences.

Portion size directly affects energy intake. McGale et al. [1] reported that portion size had a significant effect on children consumption, and larger portion sizes were contributors to obesity [7]. Additionally, Shah et al. [8] suggested the rapid rise in the prevalence of American obesity may be partly because of the consumption of larger portions of food. Studies indicated that over the last several decades American children had consumed increasingly larger portions either at home or outside [9,10]. The Ministry of Food and Drug Safety (MFDS) has suggested a serving size for preschoolers in Korea [11]. The Ministry of Health and Welfare also presented nutritional requirements for children at daycare centers, and issued a food service management manual for child-care centers [12]. Although these tools facilitate the better understanding of the serving size at daycare centers and kindergartens, caregivers are often unaware of its guidelines.

Shah et al. [8] emphasized the need for nutritional education on the serving size by reporting the existence of an association between body mass index and serving size overestimation. Pomeranz and Miller [13] also proposed policies and programs related to the serving sizes for children, considering that they were not clearly communicated. As women's participation in societal activities in Korea increases, the government implements policies to support child rearing and education through the expansion in numbers of childcare facilities. This expansion led to the popularization of food service in various institutions or centers as a part of government policies. Most childcare facilities provide morning snacks, lunch, and afternoon snacks. Furthermore, they implement a dietary plan for lunch and snacks proposed by professional nutritionists with respect to the developmental stage and nutritional needs of infants and young children.

Cooking is actually carried out at each daycare center or kindergarten, and the meal is served by a caregiver. As the number of children in after-school classes in daycare centers and kindergartens increases, the responsibility of early-childhood education institutions for children's health and nutrition has become even more prominent. The need for the provision of nutrition education has thus been ever-increasing. However, insufficient education or

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support for childcare teachers' dietary guidance was also reported [14-18]. Lee and Oh [14] established that the portion size of kindergarten menus did not satisfy the serving size of nutritionists' recommendation. Moreover, it was found that teachers did not have accurate knowledge about the serving size at the time of food distribution. The distribution of food was mainly experience-based, or was in smaller amount than requirement by intending to minimize leftover. According to the results of earlier studies, childcare teachers believe that dietary guidance is essential in infants and young children nutrition, but they feel difficulties because of a lack of knowledge and confidence in practical use of dietary guides [15,16]. Meta-analysis was performed on few studies, which had investigated the effect of nutrition education on serving size [17]. The study found that 64.1% of teachers in childcare facilities had never received any education related to serving sizes. Therefore, it is necessary to understand the actual situation of childcare teachers' knowledge on the portion size of lunch and snacks and to explore the effect of nutritional education on the serving size in childcare institutions.

To achieve a realistic effect, nutrition education should be delivered in a much more comprehensive way than only fragmentary information dissemination. Nutrition education is much more effective when it systematically connects theory, research, and practice related to behavior than when it focuses only on nutritional information [19-21]. In the education intervention study of Pomerleau et al. [21], positive practical behavior patterns were consistently achieved by face-to-face education. However, when non-face-to-face education using telephone or computer was conducted, the practical favorable behavioral changes from this education were less significant. Although many people have the willingness to act based on the received educational information, it is still very difficult to act according to their intentions. Behavior-focused education bridges people's "willingness to act" gaps and helps them actually change and maintain these positive shifts over time. Therefore, in the case of education on serving size, we tried to examine the difference between theoretical and practical education.

The childcare teacher generally forms children's food preferences and food intake and, thereby, contributes to the formation of eating habits in infancy. Childcare teachers must be fully aware of the importance of meals and the serving size at each age. They should ensure that high-quality meals and snacks are provided according to the age and individual characteristics of children. The purpose of this study was to understand the current status of the portion size of lunch menus implemented by childcare teachers in daycare centers who are in charge of children aged 3–5 years. Additionally, we investigated whether the portion size in menus meets the requirements for the serving size recommended through theoretical or practical education. This study was also intended to provide basic data for the development and operation of effective educational materials and programs for nutrition and health of infants and young children in the future.

METHODS

Subjects

The subjects of this study were 120 females aged between 20 and 40 years. They were enrolled through public announcements at daycare centers or kindergartens registered with the Children's Food Service Management Support Center in Hanam, Gyeonggi-do (June 2–October 31, 2017). Of the 80 facilities included, 16 had been established more than a year earlier, whereas

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64 were new. The research protocol was approved by the Institutional Review Boards of the Bioethics Review Committee of Gachon University (1044396-201612-HR-106-01).

Setting the food serving size

The serving size of food was established based on the guidelines for group feeding for infants and toddlers developed by the MFDS [11]. Considering age, the serving size of rice was set at 100 g for the3-year-old, 130 g for the 4-year-old, and 160 g for the 5-year-old children. For the main dishes provided with meat, fish, eggs, and legumes, beef bulgogi was used during the educational course, with a serving size set at 45 g. For side dishes, which consisted of vegetables, bean sprouts were used at a serving size set at 35 g. The serving size of kimchi (including kkakdugi) was 20 g.

Educational intervention

The subjects were childcare teachers who had never received any nutrition program education related to the provision of an adequate food serving size. The participants were randomly assigned in a blinded fashion to provide either practical or theoretical education. An investigator visited the daycare center, distributed questionnaires, checked the portion size of the menu, and provided education on the serving size of the food. Next, the investigator revisited the center one month later to measure the post-served size.

Both educations were repeated twice on the same day, and the total training time was similar between the groups. Education was carried out using actual plates, food distribution tools, food (rice, main dishes, side dishes, and kimchi), and handouts in the practical training group. After explaining the reason for eating the serving size at the time of visit, the portion size was measured by placing the usual amount of food on a plate. The serving size presented at the time of education was based on the age of the child in charge, and the teacher in charge of mixed age education was based on the serving size of the youngest child. The participants were then guided to recognize the weight difference between the portion size and the serving size recommended by the MFDS. The results were not disclosed after the measurement. The theoretical education was conducted through handouts produced by the Hanam City Public Health Center. The material contained life-size photos of the serving size for the age group of 3–5-year-old children. The investigator instructed the subjects to learn the full size of the menu visually and then apply it when serving later and measuring the actual portion size, approximating it as much as possible. Both groups were revisited a month later and were asked to re-serve the food, which was weighed. Then, the participants were informed of the results. The portion size provided by the teacher was measured and the difference was compared with the serving size in the MFDS, which was next statistically analyzed as the effect of nutrition education intervention. The difference value (g) was calculated as the portion size minus the serving size.

Statistical analysis

The number of study subjects was calculated using the G*power3.1 program, considering the numerical value to obtain statistically significant results with power of 0.8 and significance level of 0.05. SPSS version 25.0 (IBM Corp., Armonk, NY, USA) was employed to analyze the collected data for the evaluation of the food serving size provided by childcare teachers. One-way analysis of variance (ANOVA) was further performed to determine the significance of appropriate meal distribution according to the social experiences and careers of childcare teachers. A post-hoc test using Duncan's multiple range test was conducted for each subgroup. Repeated measure ANOVA was applied to verify the effect of theoretical and practical education and dietary practice on the serving size of food.

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RESULTS

General characteristics

Table 1 represents the general characteristics of the study subjects. Private daycare centers accounted for 76.7%, which was the highest percentage, followed by national and public daycare centers with 20%, and workplace daycare centers with 3.3%. The most common class in charge was of 5-year—old children (34.2%), followed in a descending order by 4-year-old (33.3%) and 3-year-old (26.7%) children, a 4–5-year-old mixed class (5%), and a 3–4-year-old mixed class (0.8%). The teachers with 6-year or higher experience constituted the highest percentage (30%), followed by those with 2–4 years of experience (27.5%), 2 years of experience or less (22.5%), and 4–6 years of experience (20%). By age, the ones in their 20s accounted for the highest percentage of 57.5%, followed by those in their 40s with 24.2% and those in their 30s with 18.3%.

Dietary guidance status for preschool children

Table 2 represents the dietary guidance status of preschool children. The most common response for the portion size was "taking into account individual characteristics (age, weight, preference, etc.)" with 74.2%, followed by "specialized books (serving size of food for infants and toddlers)." "as much as infants and toddlers want" was 1.7% and "prepacked meals according to the standard amount of daycare center" was 0.8%. When it comes to children's picky eating, "let them eat a little" was the most common at 79.2%, "explain why they should eat and instruct them to eat all of them" at 12.5%, and "respect children's opinions" at 8.3%.

As for effective dietary education methods, "regular parental education" was the most common at 44.1%, "distributing educational materials to parents through home communication" at 41.7%, and "inducing active parental participation in school meals" at 14.2%. Regarding nutrition counseling for families with infants and young children, "consultation using conversation notes" was the most common at 51.7%, followed by "distribution of parent education materials through home communication" at 20.8%. The proportion of infants and toddlers receiving direct counseling was 19.2% and "others" was 8.3%.

Table 1. General characteristics of the subjects

Characteristics	Classification	No. (%)
Type of work	National and public daycare centers	24 (20.0)
	Private daycare centers	92 (76.7)
	Daycare center at work	4 (3.3)
Children's age of class	3 years old	32 (26.7)
	4 years old	40 (33.3)
	5 years old	41 (34.2)
	3–4-year-old mixed class	1 (0.8)
	4–5-year-old mixed class	6 (5.0)
Education	Nursery Teacher education center	4 (3.3)
	College	82 (68.4)
	University	34 (28.3)
Working experience	< 2 years	27 (22.5)
	2–4 years	33 (27.5)
	4–6 years	24 (20.0)
	> 6 years	36 (30.0)
Age	20s	69 (57.5)
	30s	22 (18.3)
	40s	29 (24.2)
Total		120 (100.0)

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Table 2. Dietary guidance status for preschool children

Characteristics	Classification	No. (%)
Determination of portion size	Referring to the specialized book (serving size of food for infants and toddlers)	28 (23.3)
	At the teacher's discretion, considering individual characteristics (age, weight, preference, others)	89 (74.2)
	According to the standard amount of the daycare center where you work, put it on a plate in advance	1 (0.8)
	As much as the infant wants	2 (1.7)
Meal guidance regarding undesirable eating behavior	Explain why you should eat and instruct them to eat them all	15 (12.5)
	Let them eat some	95 (79.2)
	Allow to eat next time and respect the opinions of infants and young children	10 (8.3)
Nutritional education for parent	Regular parent education	53 (44.1)
	Distribution of educational materials to parents through home correspondence	50 (41.7)
	Encouraging parents to actively participate in lunch distribution	17 (14.2)
Types of counseling for picky infants	Direct consultation with parents of infants and toddlers	23 (19.2)
	Counseling using a conversation notebook	62 (51.7)
	Distribution of educational materials to parents through home correspondence	25 (20.8)
	Others	10 (8.3)
Total		120 (100.0)

Table 3. Acquisition of serving size of food and dietary education information

Characteristics	Classification	No. (%)
Whether information on serving size and dietary education has been obtained	Yes	106 (88.3)
	No	14 (11.7)
Source of information on serving size and dietary education		
Professional books (nutrition and health-related booklets)	Yes	81 (67.5)
	No	39 (32.5)
Broadcast media (TV, newspaper) or Internet sites	Yes	90 (75.0)
	No	30 (25.0)
Specialized institutions such as children's food service management support centers and public health centers	Yes	105 (87.5)
	No	15 (12.5)
Total		120 (100.0)

Acquisition of serving size and dietary education information

Table 3 displays data of the main routes for obtaining information on the serving size of food and dietary education for the subjects included in the study. More than 88.3% of the respondents had experience in obtaining information in the question of whether to obtain information on serving size and dietary education. Approximately 87.5% obtained information on serving size and food education through specialized agencies such as child service management support centers or public health centers, followed by "broadcast media (TV or newspapers) or internet sites" (75%), and "specialized books (nutrition- and health-related booklets)" (67.5%).

Difference between the portion size and the serving size before receiving education

There was a significant difference in the amount of kimchi distributed according to the experience of teachers (**Table 4**). The portion size of kimchi was closest to the serving size for teachers with 2–4 years of experience. The group with less than 2 years of teaching experience, less than 4 and 6 years of teaching experience, and with more than 6 years of teaching experience had higher scores than the group with 2–4 years of teaching experience. As the teacher's experience increased, the difference between the portion size and the serving size for rice showed a tendency to decrease, and the difference for the main dishes had a tendency to increase.

Table 5 shows the differences in portion size and serving size by teacher's age group. The portion size of kimchi was found to be higher among teachers in their 30s and 40s than those in their 20s. The portion size of rice showed a tendency to decrease with increasing age.

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Table 4. Differences between the portion size and the serving size according to teachers' experience before education (unit: g)

Food items[1)]	< 2 yrs (n = 27)	2–4 yrs (n = 33)	4–6 yrs (n = 24)	> 6 yrs (n = 36)	F
Rice	31.15 ± 19.33	25.45 ± 16.95	24.42 ± 13.46	20.56 ± 15.24	2.163
Main dish	12.59 ± 7.36	13.88 ± 9.40	15.21 ± 8.46	17.78 ± 8.99	2.116
Side dish	16.81 ± 6.86	15.48 ± 7.95	17.21 ± 7.28	18.28 ± 6.26	0.904
Kimchi	9.07 ± 3.60[b2)]	6.73 ± 4.32[a]	10.54 ± 4.28[b]	10.22 ± 4.58[b]	5.195[*3)]

Mean ± SD indicates the difference between the serving size of food and the portion size.
[1)]Serving size of each food item: rice 100 g for 3-year-old, 130 g for 4-year-old 160 g for 5-year-old; main dish 45 g; side dish 35 g; kimchi 20 g.
[2)]Different superscript letters indicate the comparison with significant differences between the serving size of food and the portion size by Duncan's multiple range test.
[3)]Values in statistically significant differences are indicated by an asterisk ($^{*}p < 0.05$).

Table 5. Differences between the portion size and the serving size according to teachers' age before education (unit: g).

Food items[1)]	20s (n = 69)	30s (n = 22)	40s (n = 29)	F
Rice	27.35 ± 17.62	22.00 ± 14.43	21.93 ± 15.37	1.550
Main dish	13.96 ± 8.66	17.05 ± 9.51	16.03 ± 8.42	1.289
Side dish	16.84 ± 7.63	17.95 ± 6.60	16.97 ± 7.08	0.280
Kimchi[2)]	8.06 ± 4.18[a2)]	10.45 ± 4.44[b]	10.41 ± 4.64[b]	4.381[*3)]

Mean ± SD indicates the difference between the serving size of the food and the portion size.
[1)]Serving size of each food item: rice, 100 g for the 3-year-old, 130 g for the 4-year-old, and 160 g for the 5-year-old; main dish, 45 g; side dish, 35 g; kimchi, 20 g.
[2)]Different superscript letters indicate the comparison with significant differences between the serving size of food and the portion size by Duncan's multiple range test.
[3)]Values in statistically significant differences are indicated by an asterisk ($^{*}p < 0.05$).

Effect of nutrition education on the serving size

The data of the effect of nutrition education on the serving size are presented in **Table 6**. No significant difference was found in the teaching method (theoretical or practical education). Both theoretical and practical group showed a smaller difference between the portion size and the serving size after the educational intervention. The difference before and after the education was significant in all menus. Interaction effects of the teaching method*intervention were in the main dish, side dish, and kimchi portion sizes. No significant difference was established in the rice portion size.

DISCUSSION

In this study, educational intervention was conducted to identify the portion size for children and the effect of nutrition education on the serving size distributed by childcare teachers at daycare centers in Hanam-si. Additionally, data of the teacher's perception about the serving size were collected through the survey. As a result of the survey, we found that 88.3% of the teachers had experience in acquiring information about the serving size, but only 23.3% of them actually applied it to the portion size. Nutritional education on food services is found to be a support system for childcare teachers. However, according to the 2022 Childcare Program Guide

Table 6. The effect of nutrition education on the serving size (unit: g)

Food items[1)]	TE (n = 60)		PE (n = 60)		F		
	Before	After	Before	After	Teaching method (TE/PE)	Educational intervention (Before/After)	Teaching method intervention
Rice	25.38 ± 14.46	13.30 ± 15.36	24.73 ± 18.69	11.05 ± 17.41	0.352	52.399[***2)]	0.202
Main dish	13.42 ± 8.07	10.20 ± 8.10	16.63 ± 9.24	2.37 ± 2.64	3.867	65.566[***]	63.566[***]
Side dish	16.35 ± 7.14	6.53 ± 5.84	17.58 ± 7.03	4.05 ± 3.83	0.516	279.888[***]	7.091[*]
Kimchi	8.38 ± 4.41	3.70 ± 3.08	9.75 ± 4.45	2.33 ± 2.13	0.000	236.063[***]	12.046[*]

Mean ± SD indicates the difference between the serving size of food and the portion size of food served.
TE, theoretical education; PE, practical education.
[1)]Serving size of each food item: rice 100 g for 3-year-old, 130 g for 4-year-old, 160 g for 5-year-old; main dish 45 g; side dish 35 g; kimchi 20 g.
[2)]Statistically significant differences at $^{*}p < 0.05$ and $^{***}p < 0.001$, respectively.

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[22], child nutrition is an optional subject for the subjects acquiring the level 2 qualification as a childcare teacher among 26 subjects in the field of childcare knowledge and skills. Previous studies have shown that health education for childcare teachers working in daycare centers or childcare centers is fragmentary, and teachers are lacking practical knowledge about health management of infants and young children [17,23]. It can thus be considered that there are few opportunities for education and obtaining nutritional information.

Portion size has been found to affect food intake, especially in children [24,25]. Smith et al. [24] revealed that portion size affected the food intake of Chinese children aged 4–6 years. Older children increase more their food intake with the increase in the portion size than younger children. Of course, considerable energy intake is required for the normal growth and development of children [25]. However, repeatedly eating large amounts of food leads to excessive energy intake, and hence possibly to obesity in childhood [26]. Appropriate food distribution in educational institutions greatly affects the nutritional intake of infants and young children. Lee and Oh [27] pointed out that childcare teachers thought they were distributing the right serving size, but they did not know the exact amount of food. Accordingly, there was a difference between the perception of the appropriate serving size and the actual portion size.

In this study, the more experienced teachers distributed a serving size of rice that was closer to the recommended, but the main dish and kimchi showed a tendency for a different serving size. Before nutrition education, the portion size provided to children was different from the serving size. The difference was within 20–30 g for rice, 12–18 g for the main and side dishes, and 9–10 g for kimchi. Since the average serving size of rice provided by the MFDS is approximately 130 g, the difference between 20 and 30 g in this study, which is 20%–25% more than the serving size.

Studies have shown that providing nutrition education enable primary children caregivers to meet the nutritional intake standards [28]. Nutrition education on the serving size had the effect of controlling the portion size in this study. We analyzed the effect of education on the serving size by dividing participants into a theoretical and a practical education group. We found significant changes that the application of both educational methods contributed to significant changes in the distribution of the portion sizes for rice, the main and side dishes, and kimchi. In addition, in the main course, side dish, and kimchi menu, the interaction effect between teaching method and educational intervention was significantly showed. As the demand for education in cases, such as the opening of a new daycare center, hiring new childcare teachers, and changing the age of the class in charge, is expected to increase, nutrition education on the serving size is essential regardless of whether it is obtained by theoretical or practical educational courses. However, when considering the effect of the interaction, practical education using real food for the main and side dishes, and kimchi is more important. In the case of rice, we consider that theoretical education through handouts or models (depending on the specific situation) is efficient in terms of time and cost.

Since this study was conducted with the participation of childcare teachers of children aged 3–5 years at registered facilities at the Children's Meals Management Support Center in Hanam-si, Gyeonggi-do, there is a limitation to generalizing its results nationwide. In addition, since only one-time training was conducted, and there was no follow-up period after the education, the continuity of the training effect could not be observed. Although many children's food service management support centers are providing education on proper

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food distribution for teachers, follow-up studies need to be conducted by sampling childcare teachers from a wider area. Education on proper food distribution should be provided nationwide and in a continuous manner. In facilities that are not registered and managed by the children's meal service management support center, this aim can be realized by the provision of educators and educational materials at childcare information support centers or by childcare teacher maintenance training.

SUMMARY

The purpose of this study was to investigate the portion size currently provided by teachers and examine the effect of education on the food serving size. The subjects were childcare teachers who were in charge of children aged 3–5 (n = 120). The subjects were randomly divided into two groups, a theoretical education group (n = 60) and a practical education group (n = 60). The portion size currently provided to children was measured. The difference between the portion size and the serving size for rice decreased as the teacher's experience increased, but the difference for the main side dish increased. The difference between the portion size and the serving size of food provided was smaller after both practical and theoretical education courses. The effect of education on the amount of the main side dishes ($p < 0.001$), side dishes ($p < 0.01$), and kimchi ($p < 0.01$) was observed to be greater in the interaction effect of both education modes. In conclusion, these results suggest that regular education need to be provided to teachers on the serving size of food. The theoretical education alone could be effective for the acquisition of a correct perception on the serving size for rice. However, hands-on training for the main side dishes, side dishes, and kimchi would be much more helpful.

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