

Vol No: 04, Issue: 01

Received Date: August 18, 2020

Published Date: September 24, 2020

Ma-Young Yeom¹

Youn-Ok Cho^{2*}

¹Department of Food and Nutrition, Duksung Women's University, Seoul, 01369, South Korea

²Department of Food and Nutrition, Duksung Women's University, Seoul, 01369, South Korea

Corresponding Author:

Youn-Ok Cho*

33, Samyangro 114 Gill, Dobonggu, Department of Food and Nutrition, Duksung Women's University, Seoul, 01369, South Korea

E-mail: yunokcho@duksung.ac.kr

Preschool Nutrition Education in Korea: How Efforts to Discourage Sugar Intake Affect Dietary Quality and Knowledge, Attitudes, and Behavior Related to Sweets

ABSTRACT

This study aimed to investigate the effectiveness of pre-school nutrition education that discouraged sugar intake with the aims of changing dietary behavior and enhancing dietary quality. Ninety-six preschoolers (aged five) were assigned to one of two groups: the educated group and the non-educated group. The education program was provided for 11 weeks. Nutritional knowledge, dietary attitude, and dietary behavior related to sweets were measured, as well as the nutrition quotient for Korean preschoolers (NQ-P), sugar intake from sweets, and dietary quality. Differences between the educated and non-educated groups were assessed by using Chi-squared, T, or Wilcoxon rank-sum tests and Pearson's correlation coefficients. The educated group had higher scores for nutritional knowledge ($P < 0.001$) and their dietary attitude toward sweets ($P < 0.05$), which were mainly due to the group's higher performance in the high sugar intake segments ($P < 0.05$). There were no differences in dietary behavior concerning sweets or in the adherence to dietary guidelines between the educated and non-educated groups. A higher NQ-P moderation factor score was detected in the educated group ($P < 0.05$), but there was no difference in the NQ-P score between the non-educated and educated groups. Nutrition education aimed at discouraging sugar intake was effective in increasing nutritional knowledge and improving dietary attitude toward sweets and enhanced the subjects' NQ-P moderation factor score.

Keywords: Nutritional assessment; Nutrition education; Nutrition quotient; Nutritional knowledge, Dietary attitude

INTRODUCTION

Children's dietary habits affect their health and help form lifetime diet-related behaviors [1-3]. Public health intervention should be implemented at an early age in order to build a long lasting health diet habits. Snacking is also a plausible contributor to sugar consumption and can affect a child's dietary quality [3-7] as preference is the main predictor of a child's food intake. The consumption of added sugar by children has been on the rise; by 2013, sugar intake from processed foods had reached 10.2 % of preschoolers' total calorie intake [5]. Previous studies have identified that high consumption of sugary foods is a considerable contributor to nutritional problems among preschoolers [4,5]. Shaping dietary habits

through children's food experiences is important to keep in mind when implementing a dietary education program for them [2,8].

An increase in sugar intake is a well-known contributor to obesity as well as cardiovascular and dental disease, and it has been reported that an educational intervention can be an effective approach to improving diet [9-11]. Nutrition education aimed at discouraging sugar intake and providing proper nutritional knowledge may lead to a balanced diet through its development of desirable dietary attitudes and behaviors [12]. Considering preschoolers' characteristics, a program that focuses on the enjoyment of healthy food through hands-on education focusing on their senses can be expected to not only increase nutritional knowledge but contribute to healthy food preferences and intake [13-18]. Also, the effects of education on children intensify when its content is shared with the child's parents [14,19,20].

Because there have been difficulties in assessing dietary quality in children due to their unique characteristics [21-23], the use of appropriate assessment tools to verify the effectiveness of children's nutrition education has been controversial. Recently, several assessment tools, including the nutrition quotient for Korean preschoolers (NQ-P), have been developed to evaluate the nutritional adequacy and quality of preschoolers' diets [24]. This study aimed to investigate the effect of nutrition education targeted to discouraging intake of sugary sweets on nutritional knowledge, dietary attitude and dietary behavior of sweet and nutrition quotient using tools that had been validated for use with this population. The effect of total sugar intake level of preschoolers on these variables also investigated.

SUBJECTS AND METHODS

Subjects and Education

One hundred eighty-eight preschoolers aged five years old were recruited from 10 daycare centers located in Dobong-gu, Seoul, Korea. The sex, age, height, and weight of preschoolers, as well as the dual-income status and education level of their mothers, were determined. Monthly household income was separated into two levels based on a dividing point of 4,000,000 won/month because the average monthly income of city households of more than two people in Korea is reported to be 4,000,000 won/month (Korean Statistical Information Service (KOSIS), 2016) [25]. Because the care giver's characteristics such as education level, dual-income family, household income were not different, 164 preschoolers were divided in two groups: the educated

group(Ed) and the non-educated group (NEd) based on their sex and BMI via convenience sampling after excluding 24 preschoolers due to no consent from parents. The BMI weight categories for preschoolers was adopted from 2017 Korean National Growth Charts for children and adolescents [26]. Underweight was defined by a BMI less than 5th percentile, overweight was defined by a BMI between 85th percentile and 95th percentile, and obesity was defined by a BMI more than 95th percentile. Sixty-eight preschoolers were excluded due to either incomplete diet reports or an unhealthy status during the period in which the educational intervention was implemented. Finally, 96 enrolled preschoolers were included for analysis in two groups: Ed (n = 47) and NEd (n = 49).

The education program was provided to members of the educated group of preschoolers for 11 weeks. It was composed of hands-on-education utilizing animations, songs, visual materials, obesity role play, board games, a sweetness test lab, and a cooking lab. The contents of the education program to discourage sugar source food through experiencing of sweetened bread sandwich, carbonated beverages, sweetened milk, sweetened yogurt and yogurt products, and ice cream, which are major sugar food source foods of Korean children aged 3-5 years. The problem with excessive consumption of sugar was experienced by wearing an obese experiencing suit and carrying out tooth decay prevention sticker activities. The amount of sugar in the processed food was taught by making the cubic sugar tower after reading the nutrition label of the processed food. All education program was practiced by the trained nutritionist in daycare center. All nutrition education contents and materials were provided to the parents of the educated group. The details of the educational initiative and program were described in a previous report [27].

Preschoolers in both groups were subdivided into three based on the percentage of energy intake from total sugar intake. Because the dietary reference intake for total sugar in a healthy population is 10-20% of total energy intake, three groups were established: high sugar (HS), or more than 20% of the child's energy intake from the total sugar intake; adequate sugar (AS); 10% to 20% of the child's energy intake from the total sugar intake; and low sugar (LS), less than 10% of the child's energy intake from the total sugar intake [28,29]. The kind and amount of food served at home and pre-school were assessed by plate pictures that were taken before and after eating because caregivers tend to have hard time to report the food the child had. The data on preschoolers' nutritional knowledge of sweets were obtained from preschoolers' responses directly by trained nutritionist. The data on dietary

attitudes and dietary behavior concerning sweets, and the NQ-P of preschoolers were obtained from parents' response through written questionnaire. The study was approved by the Institutional Review Board of Duksung Women's University (2017-004-004). Written informed consent was obtained from the parents of preschoolers.

Nutritional Knowledge, Dietary Attitude, and Dietary Behavior Concerning Sweets

Nutritional Knowledge

All preschooler interviews were conducted using illustrated questionnaires to ensure that the preschoolers understood what was being asked. The survey on nutritional knowledge about sweets was based on those reported previously and modified for preschoolers [30-32]. The following items concerning nutritional knowledge about sweets were assessed: sweet foods, sugar-related health effects, health problems due to sugar over consumption (obesity, cavities, hyperactivity), empty nutrient foods, sugary beverages, processed foods, and measures to consume less added sugar. Responses to each question were given one point for a correct answer and zero points for a wrong answer.

Dietary Attitude and Dietary Behavior

The questionnaire on dietary attitude and sweet-related dietary behavior was based on questionnaires in previous research and was modified for preschoolers [31,32]. The questions on attitude and dietary behavior were similar. For example, a question regarding preference for sweet foods assessed attitude, while questions specific to eating or asking about sweet foods assessed dietary behavior. The questionnaire included queries on the following: typical sweet foods, sweetened processed foods, and beverages, snacking with jams, sweet side dishes, and checking the nutrition label on processed foods. To assess each item response, a five-point Likert scale was used. Scores for the responses, except for those related to checking the nutrition label, were calculated in reverse because the questions examined undesirable dietary attitudes and dietary behaviors concerning sweets such as liking chocolate, candy, or sweetened cereals.

The Nutrition Quotient for Korean Preschoolers (NQ-P)

The nutrition quotient for Korean preschoolers (NQ-P), which was developed by the Korean Ministry of Food and Drug Safety, was verified to evaluate nutrition adequacy and dietary quality [33]. The 14 items in the NQ-P checklist questionnaire were related to three dietary dimensions (balance, moderation, and environment). For balance factors,

intake frequency of bean and bean products, intake frequency of fishes, intake frequency of meats, number of vegetable dishes including kimchi of each meal and intake frequency of milk are checked. For moderation factor, intake frequency of processed meats such as ham and sausage, intake frequency of processed beverage, intake frequency of snacks, sweet and greasy baked products and intake frequency of fast food such as pizza and hamburger. For environment factor, breakfast eating frequency, not moving around while eating, washing hands before meals, efforts to have healthy eating habits and screen time (TV watching, using smart phones or computer game). Three factor scores were calculated based on the relative weights of the questionnaire items. All items were converted to 100 points.

STATISTICAL ANALYSIS

Data were analyzed using the SAS program (Ver.9.4, SAS Institute Inc., Cary, NC, USA). Differences between Ed and NEd were assessed by applying Chi-squared, Fisher's exact, T, or Wilcoxon rank-sum tests as appropriate, and Pearson's correlation coefficients were calculated. Differences were considered statistically significant at $P < 0.05$.

RESULTS

General Characteristics of Preschoolers and Mothers of Preschoolers

General characteristics of the preschoolers and the preschoolers' mothers are summarized in table 1. There were no significant differences in sex ratio or obesity status, as assessed by body mass index (BMI) of the preschoolers in the Ed and NEd groups [33]. Also, there were no differences in education level, dual-income status, or household income status of the mothers of preschoolers in the educated and uneducated groups.

Nutritional Knowledge of Preschoolers on Sweets

The results in table 2 show that the educated group had a higher score for nutritional knowledge of sweets than that of the NEd group ($P < 0.001$). Compared to the NEd group, the Ed group had higher scores for the questions "Which of the following foods taste sweet?" and "Which of the following foods are processed?" ($P < 0.05$), and notably higher scores for the questions "Do sweets offer good nutrition for our bodies?", "Will I get fat if I eat lots of sugar?", "Will I get cavities if I eat a lot of sugar?", "Which of the following is not a role of sweets?" and "Which of the following snack combination has the least added sugar?" ($P < 0.001$). However, the educated group scored lower on the question, "Which of the following foods offers the least nutrients?" ($P < 0.001$).

Table 1: General characteristics of Preschoolers and Mothers of preschool. 1)Number of preschoolers, 2)percentage of preschoolers, 3)NS: not significant by Chi-square or Fisher's exact test, 4)Underweight was defined as BMI < 5th percentile, overweight was defined as 85th percentile < BMI < 95th percentile, and obesity was defined as BMI > 95th percentile by 2017 Korean National Growth Charts for children and adolescents.

Variables		Non-educated (n = 49) ¹⁾		Educated (n = 47) ¹⁾		Total (n = 96) ¹⁾		P - value	
		n ¹⁾	% ²⁾	n	%	n	%		
Characteristics of preschoolers									
	Boys	27	55.10	24	51.06	51	53.13	NS ³⁾	
	Girls	22	44.90	23	48.94	45	46.88		
	total	49	100	47	100	96	100		
BMI (kg/m ²)	Underweight ⁴⁾	Boys	1	2.04	0	0.00	1	1.04	NS
		Girls	1	2.04	0	0.00	1	1.04	
	Normal	Boys	21	42.66	18	38.30	39	40.63	NS
		Girls	15	30.61	18	38.30	33	34.38	
	Overweight	Boys	2	4.08	3	6.38	5	5.21	NS
		Girls	2	4.08	2	4.26	4	4.17	
	Obesity	Boys	3	6.12	3	6.38	6	6.25	NS
		Girls	4	8.16	3	6.38	7	7.29	
	total	49	100	47	100	96	100		
Characteristics of mothers of preschoolers									
Education level	≤ High school	13	26.53	10	10.42	23	23.96	NS	
	≥ College	36	73.47	37	78.72	73	76.04		
	total	49	100	47	100	96	100		
Dual- income	Yes	29	59.18	26	55.32	55	57.29	NS	
	No	20	40.82	21	44.68	41	42.71		
	total	49	100	47	100	96	100		
Household income (10,000/ month)	< 400	23	46.94	27	57.45	50	52.08	NS	
	≥ 400	26	53.06	20	42.55	46	47.92		
	total	49	100	47	100	96	100		

Table 2: Frequency and percentage of preschoolers having correct nutritional knowledge of sweets by educated and non-educated groups. ¹⁾ Number of preschoolers, ²⁾Number of correct answers (% of correct answers) answered by preschoolers; *P < 0.05,*** P < 0.001 by Chi-squared test, ³⁾Total scores are means ± standard deviations; ***P < 0.001 by T-test.

Items	Non-educated (n = 49) ¹⁾		Educated (n = 47) ¹⁾		P - value
1. Which of the following food taste sweet?	38	(77.55) ²⁾	44	(93.62)	0.026*
2. Does the sweets offer good nutrition in our bodies?	14	(28.57)	37	(78.72)	<0.001***
3. Will I get fat if I eat lots of sugar?	4	(8.16)	25	(53.19)	<0.001***
4. Will I get cavities if I eat a lot of sugar?	26	(53.06)	44	(93.62)	<0.001***
5. Will I get hyperactive if I eat a lot of sugar?	47	(95.92)	46	(97.87)	0.582
6. Which of the followings is not the role of sweets?	16	(32.65)	41	(87.23)	<0.001***
7. Which of the following food offer the least nutrients?	39	(79.59)	20	(42.55)	<0.001***

8. Which of the following drink offer the most sugar?	45	(91.84)	45	(95.74)	0.429
9. Which of the following food is the processed food?	39	(79.59)	44	(93.62)	0.045*
10. Which of the following snack combination is the least likely to eat added sugar?	31	(63.27)	45	(95.74)	<0.001***
Total mean scores	6.10 ± 1.21 ³⁾		8.32 ± 1.22		<0.001***

Table 3: Mean scores for dietary attitudes to sweets among preschoolers by educated and non-educated groups. ¹⁾Number of preschoolers, ²⁾R: Reverse score, ³⁾Values are means ± standard deviations answered by mothers of preschoolers; *P < 0.05, ** P < 0.01, ***P < 0.001 by T-test.

Items	Non-educated (n = 49) ¹⁾			Educated (n = 47) ¹⁾			Total (n = 96) ¹⁾			P - value
	Mean	±	SD	Mean	±	SD	Mean	±	SD	
1. Liking chocolate, candy and jelly (R) ²⁾	1.76	±	0.80 ³⁾	2.43	±	0.90	2.08	±	0.91	<0.001***
2. Liking sweet cookies, sweetened bread and cakes (R)	2.33	±	0.94	2.72	±	0.83	2.52	±	0.91	0.031*
3. Liking sweet cereals (R)	3.47	±	0.89	3.32	±	0.75	3.40	±	0.83	0.376
4. Preference of sweetened beverage to water (R)	3.02	±	1.09	3.26	±	1.07	3.14	±	1.08	0.290
5. Preference of sweetened milk to white milk (R)	3.08	±	1.11	3.40	±	1.12	3.24	±	1.12	0.160
6. Preference of sweetened yogurt to plain yogurt (R)	2.39	±	0.93	2.55	±	0.90	2.47	±	0.92	0.379
7. Liking snacks with jam, honey, syrup and whipped cream (R)	3.27	±	1.04	3.23	±	0.89	3.25	±	0.96	0.874
8. Liking sweet side dishes (R)	3.04	±	0.89	3.26	±	0.71	3.15	±	0.81	0.194
9. Craving processed sweet snacks (R)	2.80	±	1.02	2.98	±	0.85	2.89	±	0.94	0.342
10. Checking the nutrition label of processed food	3.43	±	0.98	3.36	±	1.03	3.40	±	1.00	0.745
Mean	2.86	±	0.42	3.05	±	0.53	2.95	±	0.48	0.049*

Table 4: Mean scores related to dietary behavior toward sweets among preschoolers by educated and non-educated groups. ¹⁾Number of preschoolers ²⁾R: Reverse score ³⁾Values are means ± standard deviations answered by mothers of preschoolers; ** P < 0.01 by T-test.

Items	Non-educated (n = 49) ¹⁾			Educated (n = 47) ¹⁾			Total (n = 96) ¹⁾			P-value
	Mean	±	SD	Mean	±	SD	Mean	±	SD	
1. Eating chocolate, candy, jelly (R) ²⁾	2.47	±	0.94 ³⁾	3.02	±	1.01	2.74	±	1.01	< 0.01 **
2. Eating sweet cookies, sweetened bread and cakes (R)	3.31	±	0.96	3.38	±	0.85	3.34	±	0.90	0.68
3. Eating sweet cereals (R)	3.67	±	0.88	3.53	±	0.78	3.60	±	0.83	0.40
4. Eating sweetened beverage rather than water (R)	3.69	±	0.98	3.79	±	0.98	3.74	±	0.98	0.64
5. Eating sweetened milk rather than white milk (R)	3.84	±	0.90	3.85	±	0.98	3.84	±	0.93	0.94
6. Eating sweetened yogurt rather than plain yogurt (R)	3.16	±	1.05	3.43	±	0.83	3.29	±	0.95	0.18
7. Eating snacks with jam, honey, syrup and whipped cream (R)	3.71	±	0.84	3.79	±	0.72	3.75	±	0.78	0.65
8. Eating sweet side dishes (R)	3.22	±	0.85	3.28	±	0.68	3.25	±	0.77	0.74
9. Eating processed sweet snacks (R)	3.82	±	0.88	3.98	±	0.71	3.90	±	0.80	0.32
10. Purchasing processed food after checking the nutrition label	3.47	±	0.96	3.38	±	1.03	3.43	±	0.99	0.67
Mean	3.44	±	0.44	3.54	±	0.54	3.49	±	0.49	0.30

Dietary Attitude of Preschoolers toward Sweets

Table 3 shows that the mean score for preschoolers' dietary attitude on sweets was higher in the educated group ($P < 0.05$). Compared to the NEd group, the Ed group also had higher scores for the statement, "I like chocolate, candy, and jelly" ($P < 0.001$) and "I like sweet cookies, sweetened bread, and cakes" ($P < 0.05$). However, there were no differences in the preschoolers' preferences for sweetened beverages, milk and milk products, snacks, and side dishes between the Ed and NEd groups. Also, there was no difference in the scores for checking processed foods' nutrition labels between the two groups.

Dietary Behavior of Preschoolers concerning Sweets

The results in table 4 show that there were no differences in

the mean scores for dietary behavior relating to sweets or for most of the individual questions related to dietary behavior concerning sweets between the two groups. However, the Ed group scored higher in responses to the statement, "I eat chocolate, candy, and jelly" ($P < 0.01$) as compared to those of the NEd group.

The Nutrition Quotient for Korean Preschoolers (NQ-P) of Preschoolers

The results in table 5 show that the Ed group had a higher NQ-P moderation factor score than that of the NEd group ($P < 0.05$), but there were no differences in the NQ-P balance and environmental factors between the two groups.

Table 5: Nutrition quotient for preschoolers (NQ-P) among preschoolers by educated and non-educated groups. 1)Number of preschoolers, 2)Values are means \pm standard deviations answered by mothers of preschoolers; * $P < 0.05$ by T-test, 3)Each group(balance, moderation, environment) score = \sum (item x weight within each),4) R: reverse score, 5)NQ-P score; sum of each group(balance, moderation, environment) score.

Items	Non-educated (n = 49) ¹⁾			Educated (n = 47) ¹⁾			Total (n = 96) ¹⁾			P - value
	Mean	SD	SE	Mean	SD	SE	Mean	SD	SE	
1. Intake frequency of beans and bean products	16.56	± 5.25 ²⁾		15.98	± 4.74		16.27	± 4.99		0.57
2. Intake frequency of fish	12.00	± 4.45		12.10	± 4.28		12.05	± 4.35		0.91
3. Intake frequency of meats	20.79	± 4.07		21.07	± 4.21		20.93	± 4.12		0.73
4. Number of vegetable dishes including kimchi at each meal	2.21	± 1.10		2.06	± 1.05		2.14	± 1.07		0.48
5. Intake frequency of white milk	8.42	± 3.15		8.42	± 3.35		8.42	± 3.23		0.99
Balance Score³⁾	59.99	± 11.64		59.62	± 8.61		59.81	± 10.22		0.86
6. Intake frequency of snacks, sweet and greasy baked goods (R) ⁴⁾	13.68	± 5.79		15.31	± 4.95		14.48	± 5.43		0.14
7. Intake frequency of processed meats such as ham and sausage(R)	13.55	± 4.41		13.06	± 5.49		13.31	± 4.95		0.62
8. Intake frequency of processed beverages (R)	12.53	± 6.99		14.92	± 7.64		13.70	± 7.37		0.11
9. Intake frequency of fast foods such as pizza and hamburger 3-4 times per week (R)	12.72	± 3.71		14.54	± 4.22		13.61	± 4.05		0.02*
Moderation Score	52.47	± 11.78		57.83	± 13.98		55.10	± 13.12		0.04*
10. Not moving around while eating	17.91	± 7.10		19.68	± 6.42		18.77	± 6.80		0.20
11. Efforts to have healthy dietary habits	8.52	± 1.70		8.20	± 1.71		8.36	± 1.70		0.35
12. Washing hands before meals	9.29	± 2.31		9.03	± 2.52		9.16	± 2.40		0.60
13. Breakfast eating frequency every day	34.10	± 10.74		34.77	± 10.27		34.45	± 10.44		0.76
14. Screen time (TV watching, using smart phones or computer game) (R)	3.35	± 2.50		3.49	± 2.18		3.42	± 2.34		0.76
Environment Score	68.99	± 20.44		75.16	± 14.31		72.01	± 17.88		0.09
NQ-P Score⁵⁾	59.99	± 10.26		62.98	± 7.47		61.46	± 9.09		0.10

The Effect of Total Sugar Intake Level of Preschoolers on NQ-P, Nutritional Knowledge, Dietary Attitude, and Dietary Behavior Related to Sweets

Table 6 summarizes NQ-P, nutritional knowledge, dietary attitude, and dietary behavior related to sweets based on three different levels (low [LS], adequate [AS], and high [HS]) of total sugar intake. The educated group had a higher level

of nutritional knowledge of sweets ($P < 0.01$) than that of the NEd group at all sugar intake levels. The Ed group showed a higher score for dietary attitude on sweets than that of the NEd group at the HS intake level ($P < 0.05$), but this difference was not detected at the LS and AS intake levels. There were no differences in NQ-P results between the Ed and NEd groups at all sugar intake levels.

Table 6: NQ-P, nutritional knowledge, dietary attitude, and dietary behavior related to sweets by three levels of total sugar intake among preschoolers by educated and non-educated groups. ¹Number of preschoolers, ²LS (low total sugar intake segment) : 10% energy intake ratio of total sugar intake, AS (adequate total sugar intake segment) : 10~20% energy intake ratio of total sugar intake, HS (high total sugar intake segment) : $\geq 20\%$ energy intake ratio of total sugar intake, ³Values are means \pm standard deviations answered by mothers of preschoolers; * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$ by Wilcoxon rank-sum test.

	Non-educated			Educated			Total			P - value
	LS (n=10) ¹⁾²⁾			LS (n=19) ¹⁾²⁾			LS(n= 29) ¹⁾²⁾			
Dietary quality										
NQ-P score	62.45 ³⁾	\pm	13.49	57.59	\pm	9.27	59.26	\pm	10.92	0.194
Knowledge, attitude, behavior on sweets										
Nutritional knowledge	6.10	\pm	0.99	8.16	\pm	1.26	7.45	\pm	1.53	0.002**
Dietary attitude	2.95	\pm	0.46	2.90	\pm	0.63	2.92	\pm	0.57	0.649
Dietary behavior	3.53	\pm	0.41	3.53	\pm	0.60	3.53	\pm	0.53	0.909
	AS(n=21) ¹⁾²⁾			AS(n=14) ¹⁾²⁾			AS(n= 35) ¹⁾²⁾			P-value
Dietary quality										
NQ-P score	58.14	\pm	11.35	60.84	\pm	9.55	59.22	\pm	10.60	0.701
Knowledge, attitude, behavior on sweets										
Nutritional knowledge	6.05	\pm	1.40	8.43	\pm	1.02	7.00	\pm	1.71	< 0.001 ***
Dietary attitude	2.91	\pm	0.31	3.19	\pm	0.45	3.02	\pm	0.39	0.073
Dietary behavior	3.40	\pm	0.36	3.56	\pm	0.45	3.46	\pm	0.40	0.471
	HS(n=18) ¹⁾²⁾			HS(n=14) ¹⁾²⁾			HS(n= 32) ¹⁾²⁾			P-value
Dietary quality										
NQ-P score	60.78	\pm	11.23	61.18	\pm	6.49	60.95	\pm	9.32	0.125
Knowledge, attitude, behavior on sweets										
Nutritional knowledge	6.17	\pm	1.15	8.43	\pm	1.40	7.16	\pm	1.69	< 0.001 ***
Dietary attitude	2.74	\pm	0.51	3.12	\pm	0.41	2.91	\pm	0.50	0.024*
Dietary behavior	3.43	\pm	0.55	3.55	\pm	0.59	3.48	\pm	0.56	0.367

Correlations among NQ-P, Nutritional Knowledge, Dietary Attitude, Dietary Behavior Concerning Sweets

Table 7 summarizes the correlations detected among NQ-P, nutritional knowledge, dietary attitude, and dietary behavior regarding sweets. In both the Ed and NEd groups, there were no significant differences in the patterns of the association among NQ-P, nutritional knowledge, or dietary behavior regarding sweets. In both the Ed and NEd groups, NQ-P was highly correlated

with dietary attitude, and dietary behavior pertaining to sweets; however, nutritional knowledge of sweets was not significantly correlated with dietary attitude or dietary behavior relating to sweets. In contrast, there was a high association between dietary attitude and dietary behavior in connection with sweets in both the Ed and NEd groups.

Table 7: Correlations among NQ-P, nutritional knowledge, dietary attitude, and dietary behavior on sweets among preschoolers by educated and non-educated groups. ¹⁾Number of preschoolers, ²⁾*p< 0.05, ***p< 0.001 for Pearson's correlation coefficient.

Non-educated (n = 49)¹⁾	NQ-P score	Nutritional knowledge	Dietary attitude	Dietary behavior
NQ-P score	1			
Nutritional knowledge	0.19	1		
Dietary attitude	0.33* ²⁾	0.14	1	
Dietary behavior	0.54***	0.26	0.57***	1
Educated (n = 47)¹⁾	NQ-P score	Nutritional knowledge	Dietary attitude	Dietary behavior
NQ-P score	1			
Nutritional knowledge	0.26	1		
Dietary attitude	0.53***	0.12	1	
Dietary behavior	0.63***	0.12	0.65***	1

DISCUSSION

The results show that nutrition education aimed at discouraging sugar intake increased the preschoolers' nutritional knowledge of sweets but failed to improve dietary behavior pertaining to them. Although there is no mandatory regulation to discourage the intake of sugar dietary reference intakes for Koreans which is government dietary guideline, is less than 10% energy intake ratio of added sugar and 10~20% energy intake ratio of total sugar. Mean scores for nutritional knowledge and dietary attitudes to sweets of Ed group was higher than those of NEd groups while there was no difference in dietary behavior toward sweets between Ed and NEd groups as a whole. The results of the present study are consistent with those previous studies, in which there was an increase in nutrition knowledge of sweets with a four- to five-week nutrition education intervention for preschoolers but no improvement in dietary behavior concerning them [15,31,34]. In other studies, an eight-week nutrition education intervention for elementary school children showed that an increase in nutrition knowledge led to an improvement in dietary attitude as well as diet-related behavior [35]. On the question of "Which of the following foods offer the least nutrients?" both the Ed and NEd groups had a low correct answer rate, presumably because they may not have been able to distinguish nutrient content from caloric content. Because the effects of nutrition knowledge can vary with age, it is necessary to provide a "hands-on" education program to change the

dietary behavior of preschoolers. The lack of change in dietary behavior vis-a-vis sweets observed in this study is consistent with the findings of Ahn et al., in which there was no change in behavior regarding a healthy food that the preschoolers disliked; however, it was possible to change the attitudes connected to perception after providing nutrition education [36].

Because there were no differences in dietary attitude toward sweets between Ed and NEd groups in LS and AS segment but Ed group showed an increased dietary attitude toward sweets in HS segment, we suggest nutrition education may lead to an improvement of dietary attitude toward sweets effectively in preschoolers whose sugar intake level is high. Although our study indicated no change in the totality of dietary behavior, dietary behavior relating to typical sweet foods, such as chocolate, candy, and jelly, improved in the Ed group. Considering that sweetness is children's favorite taste, and it is easy to follow an action guide, it may be necessary to design a nutrition education program for preschoolers that has a simplified action plan rather than one focused on knowledge to change the dietary behaviors of preschoolers.

In the present study, the NQ-P score in the Ed group was 62.98, higher than the 60.64 and 58.50 scores obtained in the Korea national and Daejeon regional surveys, respectively, whereas that of the NEd group was 59.99, which was not significantly different from those of the Korea national and Daejeon region surveys[24,36]. The

grade of the NQ-P score in the Ed group was higher than that of the NEd group as well as those included in the Korea national and Daejeon regional surveys [24,37]. This higher NQ-P in the Ed group is thought to be the result of the nutrition education intervention. That effect was particularly obvious in the NQ-P moderation dimension. The Ed group score for moderation was 57.83, which was higher than that of the NEd group (52.47) as well as those of the Korea national (51.49) and Daejeon regional (50.20) surveys. Among the NQ-P moderation factors, as compared to the NEd group, the Ed group had higher scores in those factors relating to preschoolers choosing food themselves, such as the "intake frequency of fast foods such as pizza and hamburger." They also tended to have higher scores in the "intake frequency of snacks, sweet and greasy baked goods" and the "intake frequency of processed beverages," although the differences in those items were not statistically significant due to the large standard deviation. The factors considered to be highly related to the preparation of meals such as the "intake frequency of processed meats" did not show any significant difference between the two groups [24,37]. In addition, research on snack intake among preschoolers indicates an increased consumption of sugary snack types, such as sweetened baked goods and processed beverages [38,39]. Related intervention should be implemented in early childhood to affect the moderation dimension [24,37]. Thus, it is suggested that nutrition education for preschoolers should be focused on snacks and beverages rather than meals because sweetened baked goods and processed beverages were shown to be a major source of sugar.

Although there was no statistical difference between the two groups due to the large standard deviation in the environmental dimension, the grade of the Ed group was very good (75.16), a higher one than that of the NEd group (68.99) as well as those of the Korea national (71.66) and Daejeon regional (65.0) surveys. In addition, previous studies have shown that the practicing dietary guidelines score was highest in the normal body weight group and lowest in the overweight group. However, there was no difference in overweight status between the two groups [40-43]. In this study, the nutrition education intervention did not affect dietary quality, dietary behavior, nor the dietary attitude toward sweets at the LS and AS intake levels. Still, it did improve dietary attitude relating to sweets at the HS intake level. Thus, it would be effective to apply a customized education method that considers

both individual weight and nutritional status in early childhood.

Compared to the NEd group, the Ed group had significantly higher scores for the practicing dietary guidelines question, "Do you have breakfast every day?" Thus, this study's nutrition education intervention did not improve all aspects of the practice of dietary guidelines among preschoolers. However, improving preschoolers' dietary habits is a possibility because "having breakfast every day" might be an easy first step for preschoolers. Thus, to improve dietary quality, nutrition education for preschoolers should be composed of a specific action guide rather than the provision of nutritional knowledge. In addition, since short-term education did not produce changes in dietary behaviors in previous studies, and as repeated learning for six months is helpful at the preschooler level, it is suggested that long-term education (six months or more) is required to produce changes in preschoolers' dietary quality [16-18].

Moreover, previous research has emphasized the importance of the environment in changing dietary habits. Considering that it is difficult for preschoolers to manage their diet, it is necessary to strengthen the home education environment of preschoolers so that they can more easily practice healthy eating [13,19,20]. Because there were no differences between groups in the association patterns among NQ-P, practicing dietary guidelines, nutritional knowledge of sweets, and dietary behavior regarding sweets, nutrition education intervention is not thought to affect the association patterns of dietary quality, nutritional knowledge of sweets, and dietary behavior concerning sweets.

Thus, the results show that the nutrition education intervention to discourage sugar intake was effective in increasing nutritional knowledge of and dietary attitude toward sweets, but it failed to improve dietary behavior concerning sweets. Because the Ed group did not show improvement in the NQ-P, it appears that the nutrition education intervention did not improve general dietary quality. However, there was an improvement in the NQ-P moderation factor. In the Ed group, NQ-P had the highest association with changes in dietary attitude toward sweets, followed by those for dietary behaviors. The limitations of this study are as follows. Because the subjects of education program are preschoolers with no knowledge on food and nutrition, testing on their nutritional knowledge or dietary attitude was impossible before education. Thus,

a lack of pre-testing was the limitation which makes the conclusions statistically weaker. There was a seasonal limit to increase the consumption of ice cream and beverages which is major source of sugar among preschoolers in summer. There was no study on mothers of preschoolers' dietary habit which may affect the dietary behavior of children because dietary habit may not be associated with nutritional knowledge.

Therefore, in order to improve dietary attitude and dietary behavior toward sweets among preschoolers, it is suggested as follows. First, the contents of nutrition education program for preschoolers should be composed of simplified action guide rather than the knowledge-based approach. Second, the methods of nutrition education program for preschoolers should be the repeated, long-term and participation-centered approach to lead the behavior change in preschoolers. Third, it is necessary to strengthen the education environment extended to the family.

STATEMENT OF ETHICS

The study was approved by the Institutional Review Board of Duksung Women's University (2017-004-004). Written informed consent was obtained from the parents of preschoolers.

ACKNOWLEDGEMENTS

This research was supported by a grant from Duksung Women's University (3000003364) who provided funding for the cost of research assistance

DECLARATION OF INTEREST STATEMENT

The authors declare no potential conflicts of interests.

REFERENCES

1. Kang M, Shin JE, Kwon K, Song S. (2019). Contribution of foods to absolute nutrient intake and between-person variations of nutrient intake in Korean preschoolers. *Nutr Res Prac.* 13:323-332.
2. Ventura AK, Worobey J. (2013). Early influences on the development of food preferences. *Curr Biol.* 23:R401-408.
3. Sin EK, Lee YK. (2005). Evaluation of food and nutrient intake of preschool children in day-care centers. *J Korean Soc Food Sci Nutr.* 34:1008-1017.
4. Korea Ministry of Food and Drug Safety. (2014). Increased sugar in take through processed foods trend. Accessed January 17, 2019. https://www.mfds.go.kr/brd/m_99/list.do.
5. Korea Ministry of Food and Drug Safety. (2016). Excessive the intake of sugars of one in two (46.3%) in children and adolescent. Accessed January 17, 2019. https://www.mfds.go.kr/brd/m_99/list.do.
6. Lim HJ. (1999). A study on the food habit and the evaluation of nutrient intake of preschool children in Pusan. *J Korean Soc Food Sci Nutr;* 28: 1369 - 1379.
7. Son SM, Park SH. (1999). Nutritional status of preschool children in low income urban area: Anthropometry and dietary Intake. *Korean J Community Nutr.* 4:123-131.
8. Mc Cullough FS, Yoo S, Ains worth P. (2004). Food choice, nutrition education and parental influence on British and Korean primary school children. *Int J Consum Stud.* 28:235-244.
9. Te Mlrenga L, Mallard S, Mann J. (2013). Dietary sugars and body weight: systematic review and meta-analyses of randomized controlled trials and cohort studies. *BMJ;* 346:e7492.
10. Te Morenga L, Howatson AJ, Jones RM, Mann J. (2014). Dietary sugars and cardiometabolic risk: systematic review and meta-analyses of randomized controlled trials of the effects on blood pressure and lipids. *Am J Clin Nutr.* 100:65-79.
11. Kim JG, Cheon CW, Lee DC, Baik BJ. (2001). Relationship between dietary habits and dental caries experience in preschool children. *J Korean Acad Pediatr Dent.* 28:271-280.
12. Jeong N, Kim K. (2009). Nutrition knowledge and eating behaviors of elementary school children in Seoul. *Korean J Community Nutr.* 14: 55-66.
13. Griffin TL, Jackson DM, McNeill G, Alcott LS, MacDiarmid JI. (2015). A brief educational intervention increases knowledge of the sugar content of foods and drinks but does not decrease intakes in Scottish children aged 10-12 years. *J Nutr Educ Behav.* 47:367-373.
14. Parmer SM, Salisbury-Glennon J, Shannon D, Struempfer B. (2009). School gardens: An experiential learning approach for a nutrition education program to increase fruit and vegetable knowledge, preference, and consumption among second-grade students. *J Nutr Educ Behav.* 41:212-217.

15. Hong MA, Choi MS, Han YH, Hyun T. (2010). Effect of nutrition education program developed by a Public Health Center on preschool children's nutrition knowledge and dietary habits and the parent's dietary attitudes. *Korean J Community Nutr.* 15:593–602.
16. Fildes A, van Jaarsveld CH, Wardle J, Cooke L. (2014). Parent-administered exposure to increase children's vegetable acceptance: a randomized controlled trial. *J Acad Nutr Diet.* 114:881-888.
17. Sullivan SA, Birch LL. (1990). Pass the sugar, pass, the salt: experience dictates preference. *Dev Psychol.* 26:546-551.
18. Lee SJ, Chung KM. (2015). Effect of an exposure program to vegetables to increase young children's vegetable consumption. *Korean J Psychol.* 20:425-444.
19. Vargas-Garcia EJ, Evans CEL, Prestwich A, Sykes-Muskett BJ, Hooson J, et al. (2017). Interventions to reduce consumption of sugar-sweetened beverages or increase water intake: evidence from a systematic review and meta-analysis. *Obes Rev.* 18:350-363.
20. Van de Gaar VM, Jansen W, van Grieken A, Borsboom GJJM, Kremers S, et al. (2014). Effects of an intervention aimed at reducing the intake of sugar-sweetened beverages in primary school children: a controlled trial. *Int J Behav Nutr Phys Act.* 11:98-101.
21. Choi Y, You Y, Go KA, Tserendejid Z, You HJ, et al. (2013). The prevalence of obesity and the level of adherence to the Korean dietary action guides in Korean preschool children. *Nutr Res Pract.* 7:207-215.
22. Kim HY, Kwon S, Lee JS, Choi YS, Chung HR, et al. (2012). Development of a Nutrition Quotient (NQ) equation modeling for children and the evaluation of its construct validity. *Korean J Nutr.* 45:390-399.
23. Kim JH, Jung YH. (2014). Evaluation of food behavior and nutritional status of preschool children in Nowon-gu of Seoul by using nutrition quotient (NQ). *Korean J Community Nutr.* 19:1–11.
24. Lee JS, Kang MH, Kwak TK, Chung HR, Kwon S, et al. (2016). Development of nutrition quotient for Korean preschoolers (NQ-P): Item selection and validation of factor structure. *J Nutr Health.* 49:378-394.
25. Korean Statistical Information Service. (2017). Statistics Korea: Average monthly income & expenditure (real, urban excl.1 person and farm). Accessed May 9, 2019. <http://kosis.kr/eng/search/search List.do>.
26. Korea Centers for Disease Control and Prevention. (2018). Development of the 2017 Korean national growth charts for children and adolescents. Accessed January 21, 2019. <http://www.cdc.go.kr>.
27. Yeom MA, Cho YO. (2019). Nutrition education discouraging sugar intake results in higher nutrient density in diets of pre-school children. *Nurt Res Pract.* 13:434-443.
28. World Health Organization. (2015). WHO Guideline: Sugars Intake for Adults and Children. WHO report.
29. Korea Ministry of Health and Welfare, The Korean Nutrition Society. (2015). 2015 Dietary reference intakes for Koreans. Ministry of Health and Welfare, Korea.
30. Han HM, Lee SS. (2008). A nutrition education program development and the application for the elementary students: focused on sugar intake education. *J Korean Pract Arts Educ.* 21:111-131.
31. Kim MJ. (2011). Exploration of maternal parenting and child-feeding style dimensions perceived by elementary schoolers and middle schoolers and correlation between maternal parenting dimensions and child's food behaviors. *J Korean Soc Food Sci Nutr.* 40:544-556.
32. Yeom MA, Cho YO. (2016). Evaluation of a nutrition education program designed to reduce sugar intake in preschool children. *J Korean Diet Assoc.* 22:179-192.
33. Korea Ministry of Food and Drug Safety. (2013). Developing a Nutrition Education Model for Reducing Sugar Intake. Accessed May 9, 2019.
34. Kim MH, Kim NH, Yeon JY. (2018). Development and evaluation of the children's sugars intake reduction program. *Korean J Food Nutr.* 31:335-344.
35. Lee OH, Chang SO, Park MJ. (2008). Comparison of nutrition knowledge, dietary attitude and dietary habit in elementary school children with and without nutrition education. *J Korean Soc Food Sci Nutr.* 37:1427-1434.
36. Ahn Y, Ko SY, Kim KW. (2009). Evaluation of a nutrition education program for elementary school children. *Korean J Community Nutr.* 14:266-276.

-
37. Lee HJ, Kim JH, Song S. (2019). Assessment of dietary behaviors among preschoolers in Daejeon: using nutrition quotient for preschoolers (NQ-P). *J Nutr Health*. 52:194-205.
 38. Lee HS, Kwon SO, Yon M, Kim D, Lee JY, et al. (2014). Dietary total sugar intake of Koreans: based on the Korea National Health and Nutrition Examination Survey (KNHANES), 2008–2011. *J Nutr Health*. 47:268-276.
 39. Yeoh Y, Kwon S, Lee Y. (2014). Menu pattern and food diversity of snack menus provided by child care information centers in Seoul. *J Nutr Health*. 47:443-451.
 40. Bae JM, Kang MH. (2016). Age difference in association between obesity and nutrition quotient scores of preschoolers and school children. *J Nutr Health*. 49:447-458.
 41. Boo MN, Cho SK, Park K. (2015). Evaluation of dietary behavior and nutritional status of elementary school students in Jeju using nutrition quotient. *J Nutr Health*. 48: 335-343.
 42. Kim JR, Lim HS. (2015). Relationships between children's nutrition quotient and the practice of the dietary guidelines of elementary school students and their mothers. *J Nutr Health*. 48: 58-70.
 43. Min SH. (2018). Evaluation of dietary behavior among preschooler in Jecheon area using nutrition quotient for preschoolers. *Korean J Food Cook Sci*. 34:413-423.

Copyright: Cho YO, et al. ©2020. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Citation: Cho YO. (2020). Preschool Nutrition Education in Korea: How Efforts to Discourage Sugar Intake Affect Dietary Quality and Knowledge, Attitudes, and Behavior Related to Sweets. *Mathews J Nutr Diet*. (4)1: 02.