The awareness level and needs for education on reducing sugar consumption among mothers with preschool children

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BACKGROUND/OBJECTIVES: The purpose of this study was to find out the level of knowledge on sugar-related nutrition among mothers with preschool children.
SUBJECTS/METHODS: The study conducted a survey on 350 mothers whose children attended daycare. The dietary lives of the children and the nutritional knowledge of the mothers on sugar were checked. In order to analyze results, SPSS 18.0 was used. ANOVA and t-test were also performed to analyze recognition and educational needs.
RESULTS: When the degree of nutritional knowledge was measured and analyzed, the results showed about 11 average points out of 15. The higher a group's nutritional knowledge, the better the dietary habits and activities were and the activities were more ccommon. The group with a low level of nutritional knowledge consumed more foods with high sugar content, but this difference was not statistically significant. Also the children from the group of mothers that provided nutritional education to their children were more likely to engage in better dietary habits and activities.
CONCLUSIONS: 66.5% respondents did not know about policies to reduce sugar consumption, but most indicated that education on reducing sugar consumption is needed. Therefore, a government-driven search for efficient methods to campaign and publicize sugar reduction is needed in order to continuously provide appropriate education.

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INTRODUCTION

Childhood is an important period when the most growth and development occur and when life habits, such as eating habits and physical activities, are formed [1,2]. One of the characteristics of this period is that the digestive absorption is not fully developed. The absolute amount of nutrient intake is lower than that of adults', but the calories, protein, and water intake needed per kilogram are much larger than that of adults'. Therefore, good eating habits and nutrient intake should become the basis of this period to build a foundation for growth and development throughout life. Preschool childhood is the period from one year after birth to the period before school attendance. Children learn to eat by themselves during this period and their interest in food increases, leading to the formation of individual eating habits. The eating habits and eating activities of their mothers, who are often with them, have a significant effect on children, and there is a strong tendency to watch and follow the parents' actions [3-7]. Healthy eating habits formed during childhood continue throughout adulthood and can prevent adult diseases.

The sugar intake of Koreans in 2010 was 61.4 grams, an increase of 23% from 49.9 grams in 2008. Especially, sugar intake from processed food increased by 41% from 19.3 grams in 2008 to 27.3 grams in 2010. This trend was observed across all ages, but especially in children and teenagers, leading to concerns about them developing adult diseases [8].

Generally speaking, 'sugar' implies simple sugars and consuming food with a lot of simple sugars causes an individual to consume less of other foods that are high in various nutrients, leading to a nutritional imbalance. It could also lead to obesity as the calories gained from sugar can accumulate easily as body fat [8-10].

Home is the first environment one encounters, and since a family forms a community in the same living environment, it develops a unique lifestyle and living behavior. Children become psychologically and emotionally stable in the home as they experience physical and social development and are affected by their environment, especially by the mother who typically spends the most time with them [5,11].

There are many existing studies that have researched food intake for different age groups, but many of them focused on teenagers who can actually purchase food items. There has been little research on preschool children who are affected by their mothers' buying habits. Therefore, this study aims to understand how much the mothers, who are responsible for

their children's diet, are aware of the need to limit sugar consumption. This study also aims to understand how mothers' nutritional knowledge affects children's diet. In addition, by comparing mothers who are aware of the need to limit sugar consumption with mothers who are not, we can investigate the differences in diets according to differences in perception. We will also present the direction of education on reducing sugar consumption for families and institutions.

SUBJECTS AND METHODS

Selection of target sample and the duration of survey

The survey took place from March 17th to April 9th of 2015. We selected five daycare centers located in Bucheon-si and Incheon and surveyed 350 mothers whose children attended the daycare centers. We recovered 287 survey questionnaires out of the 350 administered. After discarding surveys with unsuitable data, we used 250 survey questionnaires as the final analysis data.

Survey protocols, instruments and the process for obtaining informed consent for this study were approved by the institutional review committees of Sookmyung Women's University (Approval No. SMWU-1502-HR-082). All participants gave their written informed consent.

Research content and methods

General characterization of target sample

For the general status of the target sample, we investigated whether or not the mothers were employed and the types of jobs they performed. We also checked the ages of the children attending the day care centers.

About dietary life of children

To investigate the children's habits and activities related to diet, we used 13 questions with a Likert-type five-point scale. They ranged from 'Not likely at all' (1 point) to 'Very likely' (5 points). Higher points reflected better dietary lifestyles.

Questions about knowledge on nutrition related to sugar

To evaluate the mothers' knowledge about sugars, we used 15 questions with 'yes' or 'no' as answers. One point was given for each correct answer and no point was given for incorrect answers. The total was 15 points.

About the actual consumption of food sources of sugar

Food sources of sugar were divided into 24 groups: five groups of cooked foods and 5 types (cookies, drinks, candies and chocolates, bread, milk and milk products) of processed foods separated into 19 groups according to existing research on food consumption by infants, children, and teenagers [12] as well as a list of sugar-added food, focusing on high consumption frequency. Those 24 food groups were compared with each other. The frequency of consumption was calculated based on a week's consumption.

Interests in and demand for reducing sugar consumption

To investigate the interest in reducing sugar consumption and the need for education, we used ten questions to determine the interest in policies and the need for education.

Statistical analysis

The results were statistically analyzed using SPSS 18.0. The target sample's general characteristics, their interests in and their need for sugar consumption reduction were expressed in frequencies and percentages. Likert's five point system was used to calculate the average values for children's dietary lifestyle and eating habits. For significance testing, t-test was performed between the means of two independent groups and ANOVA was performed when comparison between the means of more than two groups was necessary. Scheffe method was used for post-hoc analysis.

RESULTS

General characteristics

As shown in Table 1, 70.4% mothers were employed and 29.7% were not. Therefore, employed mothers comprised more than double the number of mothers without jobs. In terms of the types of jobs, office workers were the highest with 35.4% mothers, followed by professional workers with 21.7%, public workers with 19.4%, and service workers with 10.3%. The number of children by age was highest for three and four year olds with 26.1%, followed by five year olds with 20.1%, and six year olds with 13.3%. The average age of children was 4.7 ± 1.437.

Mothers' nutritional knowledge relating to sugars

Table 2 shows mothers' nutritional knowledge relating to sugars listed by statement. Of the statements on mothers' nutritional knowledge relating to sugars, the statement, 'diabetes patients should never consume any sugar' had the highest number of correct answers with 94.4% mothers, followed by 'there is no sugar in sugar-free juice,' correctly answered by 92.8% mothers. On the other hand, the statement, 'the brain

Table 1. General characteristics

Categorization		N (%)
Whether or not the mother has a job	Has a job	175 (70.3)
	Doesn't have a job	75 (29.7)
	Total	250 (100.0)
Type of job the mother has	Office worker	62 (35.4)
	Service worker	18 (10.3)
	Public worker	34 (19.4)
	Professional	38 (21.7)
	Others	23 (13.1)
	Total	175 (100.0)
Age of the child	1	6 (2.4)
	2	14 (5.6)
	3	65 (26.1)
	4	65 (26.1)
	5	50 (20.1)
	6	33 (13.3)
	Older than 7	17 (6.4)
	Mean ± SD	4.7 ± 1.437

Table 2. Nutritional knowledge relating to sugars   N (%)

Statements	Percentage of right answers
Sugar is a small molecule that dissolves in water to produce sweet taste.	211 (84.4)
Sugar provides 9kcal of energy per gram.	93 (37.2)
Glucose is a form of sugar that circulates in blood streams.	226 (90.4)
The brain only uses glucose as its energy source.	72 (28.8)
Sugar in a natural food is digested and absorbed much quicker than sugar in processed food.	115 (46.0)
There is a type of sugar in milk.	203 (81.2)
There is sugar in natural food such as fruit, honey, sweet potato, and squash.	230 (92.0)
There is no sugar in sugar-free juice.	232 (92.8)
Food that sticks to teeth is a greater cause for cavities than the total amount of sugar intake.	193 (77.2)
If one eats too much sugar, the excessive sugar will accumulate as fat.	217 (86.8)
Diabetes patients should never consume any sugar.	236 (94.4)
Excessive consumption of sugar can lead to diabetes and cardiovascular diseases.	230 (92.0)
WHO recommends consuming less than 10% of total calorie as sugar.	203 (81.2)
There is no limit to the sale and advertisement of high-calorie-low-nutrient food in Korea.	92 (36.8)
It is required to indicate the amount of sugar in nutritional values table for food.	206 (82.4)

only uses glucose as its energy source' had the lowest number of correct answers 28.2%. When the degree of nutrition knowledge was measured and analyzed, the results showed 11.01 average points out of 15. We separated the mothers into two groups based on the average points they received for nutrition knowledge. One group contained 152 people with points lower than the average (5-11), and the other group contained 98 people with points higher than the average (12-14). We compared and analyzed the dietary habits and activities of the children of mothers in both groups, the mothers'

interests in reducing sugar consumption and the demand for education according to the mothers' nutrition knowledge.

Children's dietary habits and activities according to their mothers' nutritional knowledge relating to sugar

Table 3 shows the children's dietary habits and activities according to their mothers' nutritional knowledge relating to sugar. For statement 4 (always wash hands before eating), the group with a high level of nutritional knowledge had 3.89 points compared to 3.65 points in the group with a low level of nutritional knowledge. This difference was statistically significant ($P < 0.05$). For statement 6 (eat fresh fruit as a snack), the group with a high level of nutrition knowledge had 3.99 points compared to 3.72 points in the group with a low level of nutrition knowledge. This difference was statistically significant ($P < 0.05$). For statement 10 (eat processed food every day), the group with a high level of nutrition knowledge had 3.85 points compared to 3.61 points in the group with a low level of nutrition knowledge. This difference was statistically significant ($P < 0.05$). These results imply that the higher a group's nutritional knowledge, the better its dietary habits and activities and the more common the practice of activities such as 'always wash hands before eating,' 'eat fresh fruit as a snack,' and 'eat less processed food.'

The actual consumption of food sources of sugar according to mothers' nutrition knowledge relating to sugar

Table 4 shows the results from analyzing the actual consumption of food sources of sugar according to mothers' nutritional knowledge relating to sugar. The group with a low level of nutritional knowledge consumed more foods high in sugar content, but this difference was not statistically significant.

Mothers' nutrition education on reducing sugar consumption

Table 5 explores whether or not the mothers provide education on reducing sugar consumption to their children. The number of mothers who provided frequent nutrition education to their

Table 3. Dietary Habits and activities according to sugar-related nutrition knowledge   Mean ± SD

	Statements	Nutritional Knowledge relating to sugars		t (*P*-value)
		Low level group	High level group	
1	Have regular meals three times a day.	3.95 ± 0.92	3.94 ± 0.87	0.130 (0.897)
2	Eat breakfast.	3.96 ± 1.00	3.86 ± 1.04	0.789 (0.431)
3	Eat with the family.	3.84 ± 0.86	3.88 ± 0.91	-0.310 (0.757)
4	Always wash hands before eating.	3.65 ± 0.89	3.89 ± 0.80	-2.129 (0.034)
5	Eat with a good posture.	3.39 ± 0.85	3.44 ± 0.89	-0.453 (0.651)
6	Eat fresh fruit as snack.	3.72 ± 0.78	3.99 ± 0.71	-2.783 (0.006)
7	Eat vegetables for every meal.	3.39 ± 0.93	3.40 ± 0.89	-0.083 (0.934)
8	Eat food rich in protein such as fish, meat, bean products, and eggs at least once a day.	4.03 ± 0.82	4.17 ± 0.73	-1.442 (0.151)
9	Drink at least a glass of milk every day.	3.47 ± 1.14	3.26 ± 1.16	1.426 (0.155)
10	Eat processed food every day.	3.61 ± 0.85	3.85 ± 0.89	2.102 (0.037)
11	Do not eat food high in cholesterol or animal fat.	3.26 ± 0.81	3.18 ± 0.75	0.798 (0.426)
12	Do not eat salty food or consume MSG.	3.66 ± 0.96	3.83 ± 1.00	-1.339 (0.182)
13	Do not consume sweet food.	2.82 ± 0.85	2.93 ± 0.89	-0.945 (0.346)

Each statement was measured by 5-point scale ranging from 1(no) to 5 (everyday).
Values from statement 10 were inversely applied.

Table 4. Consumption of different types of food according to nutrition knowledge   Mean ± SD

| | Nutritional knowledge relating to sugars | | t (P-value) |
	Low level group	High level group	
Marinated meat (Bulgogi, Galbi)	1.20 ± 0.98	1.30 ± 1.13	-0.719 (0.473)
Fried chicken with Sauce or stir-fried chicken	0.67 ± 0.68	0.78 ± 0.89	-1.008 (0.315)
Beef boiled down in soy sauce	0.79 ± 1.11	0.79 ± 1.08	-0.041 (0.967)
Stir-fried anchovies	2.29 ± 1.81	2.10 ± 1.76	0.823 (0.411)
Tteok-bokki	0.43 ± 0.72	0.43 ± 0.67	0.051 (0.960)
Biscuits	1.59 ± 1.30	1.46 ± 1.50	0.695 (0.488)
Crackers	2.00 ± 1.37	1.72 ± 1.61	1.384 (0.168)
Sweet Cereal	1.00 ± 1.32	0.97 ± 1.18	0.710 (0.479)
Soda	0.61 ± 0.98	0.43 ± 0.70	1.600 (0.111)
Juice or fruit-flavored beverages	1.38 ± 1.43	1.29 ± 1.37	0.446 (0.656)
Sports drinks	0.38 ± 0.82	0.30 ± 0.89	0.648 (0.518)
Candies	1.90 ± 1.53	1.60 ± 1.50	1.525 (0.129)
Caramel	1.14 ± 1.56	0.76 ± 1.21	2.133 (0.034)
Jelly	1.45 ± 1.52	1.32 ± 1.34	0.708 (0.479)
Chocolate	1.31 ± 1.23	1.41 ± 1.34	-0.556 (0.579)
Plain bread	1.37 ± 1.36	1.00 ± 1.03	2.425 (0.016)
Red bean paste or cream bread	0.57 ± 0.83	0.41 ± 0.72	1.572 (0.117)
Muffins or Cakes	0.70 ± 0.84	0.71 ± 0.98	-0.129 (0.897)
Processed milk (not plain milk)	1.00 ± 1.58	0.66 ± 1.21	1.890 (0.060)
Yakult	1.27 ± 1.63	1.50 ± 1.72	-1.066 (0.288)
Drinking yogurt	1.15 ± 1.65	1.05 ± 1.54	0.472 (0.638)
Yogurt to be eaten with a spoon	1.62 ± 1.54	1.72 ± 1.62	-0.472 (0.638)
Ice-cream (with milk)	1.03 ± 1.13	0.85 ± 0.87	1.431 (0.154)
Popsicles (without milk)	0.47 ± 0.91	0.39 ± 0.68	0.755 (0.451)

Table 5. Nutrition education to the children on reducing sugar consumption

Categories		N (%)
Nutrition education	Offered	117 (47.0)
	Not offered	132 (53.0)
	Total	249 (100.0)
Frequency of nutrition education	At every meal or snack time	24 (20.9)
	Once or twice per day	10 (8.7)
	Three or four times a week	8 (7.0)
	Irregularly	67 (58.3)
	Others	6 (5.2)
	Total	115 (100.0)

children was 47% and the number of mothers who did not was 53%, showing that more than 50% of mothers do not provide education on reducing sugar consumption. When the respondents who admitted to providing nutrition education were asked about the frequency of the education on reducing sugar consumption, most, 58.3% responded 'irregularly,' followed by 20.9% responding with 'at every meal or snack time,' 8.7% answering 'Once or twice per day,' and 7% replying 'three or four times a week.' We separated the mothers into two groups depending on whether or not they educated their children on reducing sugar consumption, and performed a comparison analysis on children's dietary habits and activities, mothers' nutritional knowledge relating to sugar, actual consumption of food sources of sugar, interest in reducing sugar consumption and demand for education.

General characteristics, interest in reducing sugar consumption, and demand for education according to whether or not nutrition education is provided

Table 6 shows interest in reducing sugar consumption, and demand for education according to the provision of nutrition education. In terms of the interest in reducing sugar consumption, 42.6% of the group that provided nutrition education was interested compared to only 25.8% of the group that did not provide nutrition education. This difference was statistically significant (P < 0.05). Of the people who admitted to knowing about the government's 'reducing sugar consumption' policy, 69.1% of the group that provided nutrition education and 49.1% of the group that did not indicated that they had experienced education and campaigns related to reducing sugar consumption. This difference between the groups was statistically significant (P < 0.05). When asked for appropriate topics for educational institutions offering education on reducing sugar consumption, both groups answered that 'relationship between sugar intake and health' and 'Information on food with sugar' are appropriate.

Regarding the form of education, 60.3% of the group that provided nutrition education answered 'playful education by a teacher at an institution,' 18.1% answered 'nutrition education by a professional nutritionist,' 11.2% answered 'education through media,' and 9.5% answered 'dinner table talk by the mother.' In the group that did not provide nutrition education, 66.2% answered 'playful education by a teacher at an institution,' 14.6% answered 'nutrition education by a professional nutritionist,'

Table 6. General characteristics, interest in reducing sugar consumption, demand for education N (%)

		Nutrition education to the children		Total	χ² (P-value)
		Offered group	Not offered group		
Interest in reducing sugar consumption	Yes	49 (42.6)	34 (25.8)	83 (33.6)	7.822 (0.004)
	No	66 (57.4)	98 (74.2)	164 (66.4)	
	Total	115 (100.0)	132 (100.0)	247 (100.0)	
Education experience on reducing sugar consumption	Yes	56 (50.5)	47 (35.6)	103 (42.4)	
	No	6 (5.4)	7 (5.3)	13 (5.3)	5.713 (0.057)
	Don't know	49 (44.1)	78 (59.1)	127 (52.3)	
	Total	111 (100.0)	132 (100.0)	243 (100.0)	
Appropriate topics for educational institutions offering education on reducing sugar consumption	General characteristics about sugar	2 (1.7)	4 (3.1)	6 (2.4)	
	Relationship between sugar intake and health	71 (61.2)	69 (52.7)	140 (56.7)	
	Information on food with sugar	27 (23.3)	32 (24.4)	59 (23.9)	2.850 (0.583)
	Ways to reduce sugar intake	14 (12.1)	24 (18.3)	38 (15.4)	
	Others	2 (1.7)	2 (1.5)	4 (1.6)	
	Total	116 (100.0)	131 (100.0)	247 (100.0)	
The appropriate foam of nutrition education	Nutrition education by a professional nutritionist	21 (18.1)	19 (14.6)	40 (16.3)	
	Playful education by a teacher at an institution	70 (60.3)	86 (66.2)	156 (63.4)	
	Education through media	13 (11.2)	9 (6.9)	22 (8.9)	2.294 (0.682)
	Dinner table talk by the mother	11 (9.5)	15 (11.5)	26 (10.6)	
	Others	1 (0.9)	1 (0.8)	2 (0.8)	
	Total	116 (100.0)	131 (100.0)	247 (100.0)	

Table 7. Dietary habits and activities according to whether or not nutrition education has been provided Mean ± SD

	Statements	Nutrition education to the children		t (P-value)
		Offered group	Not offered group	
1	Have regular meals three times a day.	4.06 ± 0.844	3.85 ± 0.945	1.864 (0.063)
2	Eat breakfast.	4.02 ± 0.974	3.83 ± 1.042	1.438 (0.152)
3	Eat with the family.	3.95 ± 0.808	3.77 ± 0.938	1.591 (0.113)
4	Always wash hands before eating.	3.89 ± 0.818	3.61 ± 0.888	2.546 (0.012)
5	Eat with a good posture.	3.56 ± 0.855	3.27 ± 0.846	2.770 (0.006)
6	Eat fresh fruit as snack.	3.89 ± 0.752	3.77 ± 0.780	1.271 (0.205)
7	Eat vegetables for every meal.	3.45 ± 0.895	3.33 ± 0.930	1.031 (0.304)
8	Eat food rich in protein such as fish, meat, bean products, and eggs at least once a day.	4.24 ± 0.762	3.95 ± 0.794	2.955 (0.003)
9	Drink at least a glass of milk every day.	3.44 ± 1.192	3.33 ± 1.117	0.759 (0.449)
10	Eat processed food every day.	2.27 ± 0.805	2.32 ± 0.927	-0.403 (0.687)
11	Do not eat food high in cholesterol or animal fat.	3.29 ± 0.791	3.17 ± 0.777	1.192 (0.234)
12	Do not eat salty food or consume MSG.	3.80 ± 0.993	3.66 ± 0.956	1.167 (0.244)
13	Do not consume sweet food.	2.92 ± 0.832	2.82 ± 0.898	0.952 (0.342)

Table 8. Sugar-related nutrition knowledge according to whether or not nutrition education has been provided Mean ± SD

	Statements	Nutrition education to the children		t (P-value)
		Offered group	Not offered group	
1	Sugar is a small molecule that dissolves in water to produce sweet taste.	0.85 ± 0.354	0.84 ± 0.367	0.301 (0.764)
2	Sugar provides 9kcal of energy per gram.	0.37 ± 0.484	0.38 ± 0.487	-0.183 (0.855)
3	Glucose is the form of sugar that circulates in blood streams.	0.94 ± 0.238	0.87 ± 0.336	1.883 (0.061)
4	The brain only uses glucose as its energy source.	0.28 ± 0.452	0.30 ± 0.458	-0.232 (0.817)
5	Sugar in a natural food is digested and absorbed much quicker than sugar in processed food.	0.44 ± 0.498	0.48 ± 0.501	-0.652 (0.515)
6	There is a type of sugar in milk.	0.85 ± 0.354	0.77 ± 0.421	1.669 (0.096)
7	There is sugar in natural food such as fruit, honey, sweet potato, and squash.	0.94 ± 0.238	0.96 ± 0.192	-0.805 (0.422)
8	There is no sugar in sugar-free juice.	0.93 ± 0.253	0.92 ± 0.266	0.224 (0.823)

Table 8. continued

	Statements	Nutrition education to the children		t (P-value)
		Offered group	Not offered group	
9	Food that sticks to teeth is more of a cause for cavities than the total amount of sugar intake.	0.77 ± 0.423	0.78 ± 0.416	-0.208 (0.835)
10	If one eats too much sugar, the excessive sugar it will be accumulated as fat.	0.90 ± 0.305	0.84 ± 0.367	1.327 (0.186)
11	Diabetes patients should never consume any sugar.	0.97 ± 0.182	0.92 ± 0.266	1.452 (0.148)
12	Excessive consumption of sugar can lead to diabetes and cardiovascular diseases.	0.91 ± 0.281	0.92 ± 0.266	-0.280 (0.779)
13	WHO recommends consuming less than 10% of total calorie as sugar.	0.79 ± 0.406	0.83 ± 0.381	-0.620 (0.536)
14	There is no limit to the sale and the advertisement of high-calorie-low-nutrient food in Korea.	0.38 ± 0.489	0.36 ± 0.481	0.464 (0.643)
15	It is required to indicate the amount of sugar in nutritional values table for food.	0.88 ± 0.326	0.78 ± 0.416	2.125 (0.035)

Table 9. Consumption of different types of food according to whether or not nutrition education has been provided   Mean ± SD

	Nutrition education to the children		t (P-value)
	Offered group	Not offered group	
Marinated meat (Bulgogi, Galbi)	1.25 ± 0.10	1.23 ± 0.96	0.115 (0.909)
Fried chicken with Sauce or stir-fried chicken	1.25 ± 0.08	0.76 ± 0.68	-1.049 (0.296)
Beef boiled down in soy sauce	1.25 ± 0.11	0.81 ± 1.06	-0.319 (0.750)
Stir-fried anchovies	2.26 ± 0.17	2.16 ± 1.78	0.503 (0.616)
Tteok-bokki	0.45 ± 0.07	0.41 ± 0.64	0.388 (0.698)
Biscuits	1.57 ± 0.13	1.59 ± 1.33	0.393 (0.695)
Crackers	1.88 ± 0.12	1.86 ± 1.57	-0.035 (0.972)
Sweet Cereal	1.01 ± 0.10	1.07 ± 1.40	-0.388 (0.698)
Soda	0.55 ± 0.09	0.52 ± 0.77	0.255 (0.799)
Juice or fruit-flavored beverages	1.23 ± 0.12	1.44 ± 1.48	-1.219 (0.224)
Sports drinks	0.28 ± 0.06	0.42 ± 0.98	-1.314 (0.190)
Candies	1.83 ± 0.14	1.77 ± 1.54	0.346 (0.730)
Caramel	0.98 ± 0.13	1.04 ± 1.45	-0.178 (0.859)
Jelly	1.44 ± 0.12	1.30 ± 1.55	0.355 (0.723)
Chocolate	1.40 ± 0.11	1.32 ± 1.29	0.433 (0.666)
Plain bread	1.14 ± 0.10	1.30 ± 1.33	-1.001 (0.318)
Red bean paste or cream bread	0.50 ± 0.07	0.51 ± 0.82	-0.109 (0.913)
Muffins or Cakes	0.87 ± 0.09	0.56 ± 0.75	2.593 (0.010)
Processed milk (not plain milk)	0.78 ± 0.12	0.95 ± 1.58	-0.941 (0.347)
Yakult	1.03 ± 0.11	1.67 ± 1.93	-3.159 (0.002)
Drinking yogurt	1.01 ± 0.14	1.18 ± 1.70	-0.873 (0.384)
Yogurt to be eaten with a spoon	1.60 ± 0.15	1.74 ± 1.52	-0.703 (0.483)
Ice-cream (with milk)	0.91 ± 0.07	1.03 ± 1.20	-0.961 (0.337)
Popsicles (without milk)	0.41 ± 0.07	0.47 ± 0.86	-0.554 (0.580)

10.6% answered 'dinner table talk by the mother,' and 6.9% answered 'education through media.'

Children's dietary habits and activities according to whether or not nutrition education was provided

Table 7 shows the differences in children's dietary habits and activities according to whether or not they received nutrition education. For statement 4 (always wash hands before eating), the group that received nutrition education scored 3.89 points while the group that did not receive nutrition education scored 3.61 points. The difference was statistically significant ($P < 0.05$). For statement 5 (eat with a good posture), the group that

received nutrition education scored 3.56 points while the group that did not receive nutrition education scored 3.27 points. The difference was statistically significant ($P < 0.05$). For statement 8 (eat food rich in protein such as fish, meat, bean products, and eggs at least once a day), the group that received nutrition education scored 4.24 points while the group that did not receive nutrition education scored 3.95 points. The difference was statistically significant ($P < 0.05$). In other words, the children of the group of mothers that provide nutrition education to their children are more likely to engage in better dietary habits and activities such as always washing hands before eating, eating with a good posture, and eating food rich in protein

such as fish, meat, bean products, and eggs at least once a day.

Mothers' nutrition knowledge relating to sugars according to whether or not nutrition education was provided

Table 8 shows the differences in mothers' nutrition knowledge relating to sugars according to whether or not they provided nutrition education to their children. For statement 15 (it is required to indicate the amount of sugar in a nutritional values table for food), the percentage of right answers for the group that provided nutrition education was 88%, with 78% for the group that did not provide nutrition education. The difference was significantly different. However, there was no statistical significance for the other statements.

The actual consumption of food sources of sugar according to whether or not nutrition education was provided

Table 9 shows the actual consumption of food sources of sugar according to whether or not nutrition education was provided. The group that provided nutrition education consumed muffins or cakes 0.67 times a week compared to 0.56 times a week for the group that did not provide nutrition education. The group that provided nutrition education consumed Yakult 1.03 times a week compared to 1.67 times a week for the group that did not provide nutrition education.

DISCUSSION

In order to understand the awareness on the need to reduce sugar consumption and the demand for education for mothers with preschool children, this study selected and surveyed 350 mothers whose children attended daycare centers in Bucheon-si and Incheon. We analyzed 250 of the collected questionnaires. Of the 250 mothers, 70.3% were employed and 29.7% were not. Most of the mothers were office workers, with 35.4% mothers, followed by 21.7% professionals, 19.4% public workers, and 10.3% service workers.

The lowest score for the nutritional knowledge of mothers was five, the highest score was 14, and the average was 11.012. The statement with the highest percentage (94.4%) of right answers was 'diabetes patients should never consume any sugar.' The statement with the lowest percentage (36.8%) of right answers was 'there is no limit to the sale and the advertisement of high-calorie-low-nutrient food in Korea.'

Analyzing the actual consumption of food sources of sugar according to mothers' nutrition knowledge, the group with a low level of nutrition knowledge consumed more foods that are high in sugar, but the difference was not statistically significant. In a 2010 study by the Korea Health Industry Development Institute, children from the ages of one to six consumed milk products once, biscuits, crackers, and cookies 0.7 times, and bread 0.2 times per week [13]. However, in this study, children consumed biscuits, crackers, and cookies the most, followed by candies, chocolate, milk and milk products. The differences seem to stem from the fact that our survey took place during a limited period of time in spring while the study by the Korea Health Industry Development Institute also looked at the frequency of food consumption for each season. Considering the fact that the consumption of milk products was

much higher during the summer, the differences in the results of the two studies are likely to stem from differences in the time periods [14].

When asked if education on reducing sugar consumption was regularly offered, 50.5% of the group that provided nutrition education indicated awareness of the nutrition education while only 35.6% of the group that did not provide nutrition education was aware of the nutrition education. Regarding appropriate topics for education by institutions on reducing sugar consumption, the majority of mothers suggested the 'relationship between sugar intake and health,' and the preferred method of education was 'playful education by a teacher at an institution.' Rather than nutrition education by a professional nutritionist, receiving education through a dinner table talk by the mother, or being educated through the media, education by a teacher at an institution, where their children spend most of the time, was the most preferred option, which seems to be related the fact that more than 50% of the mothers have jobs.

The mothers' level of nutritional knowledge was found to affect their children's dietary habits and activities. Many studies on nutritional knowledge, attitude, and eating habits show that as the level of nutritional knowledge increases, dietary attitude and habits improve. However, the results are inconsistent, leading to difficulties in identifying a correlation between nutritional knowledge and eating habits. However, for preschool children, with whom parents have a lot of influence, mothers have the highest influence on everything related to eating habits. There is a study showing that the higher the mothers' willingness to practice what they know about nutrition and their demand for nutrition education, the better their children's dietary life becomes. Therefore, the level of the mothers' nutrition knowledge has a positive effect on their children's eating habits.

This study was limited in scope as the survey was conducted only in Bucheon-si and Incheon. Moreover, the study did not take into account the variability of food consumption that follow seasonal changes due to the short period of time involved. There needs to be further research with a different time period and one that compares the changes according to the season. There should also be additional research following continuous publicity and education about reducing sugar consumption to identify changes in perception.

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