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Maternal correlates of vegetable preference and consumption in preschool-aged children

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ABSTRACT

Purpose: Considering the various health benefits of vegetables, it is necessary to identify maternal correlates of vegetable preference and consumption in children for shaping desirable vegetable-related eating habits. This study aimed to investigate the maternal factors related to vegetable preferences and consumption in preschool-aged children.
Methods: This is a cross-sectional study that surveyed 303 mother-child pairs (146 boys, 157 girls) to explore general characteristics, vegetable preferences, and cooked vegetable consumption in mothers and children using a questionnaire method. Maternal correlates of the child's vegetable preference and consumption were tested using a generalized linear model using SAS program.
Results: Mothers' vegetable preferences and consumption were significantly higher than those in their children ($p < 0.001$). Mothers' vegetable preferences showed a significant positive correlation with the vegetable preferences of their children (mother-son, $p < 0.001$; mother-daughter, $p < 0.001$). Additionally, mothers' cooked vegetable consumption showed a significant positive correlation with the cooked vegetable consumption of children (mother-son, $p < 0.001$; mother-daughter, $p < 0.001$). Mothers' vegetable preferences and consumption respectively increased those of their children, in both boys and girls.
Conclusion: Findings that mothers' vegetable preference and consumption correlates of children's vegetable preferences and consumption, indicate the importance of the mothers' role in increasing vegetable consumption in children. Mothers should be aware of the effects of their vegetable eating habits on their children's vegetable consumption and try to develop healthy eating habits. We suggest that the government or local communities provide nutrition education for mothers to adopt healthy eating habits and present information to educate their children on food and healthy dietary habits.

Keywords: vegetable, preference, consumption, child, mother

INTRODUCTION

Vegetables play an important role in diet and nutrition, providing various colors and tastes and serving as sources of vitamins, minerals, dietary fiber, and components that have positive effects on human health [1,2]. Vegetable consumption has been reported to have a strong association with a reduced risk of some cancers, heart disease, stroke, and other

chronic diseases [3-5]. A dietary habit to consume various vegetables from early childhood is very effective in reducing the risk of chronic diseases, such as obesity, diabetes and constipation [6-8]. Therefore, many countries encourage individuals to consume a variety of vegetables in their daily diet [9].

Despite the health and nutritional benefits of vegetables, it has been reported that children dislike vegetables and consume inadequate amounts of vegetables [10-12]. The early years of life are an important period for physical and mental development. The dietary habits shaped during this period are important factors in determining food preferences and nutritional status throughout life [13]. Since those who do not experience certain foods during childhood tend to have low preferences for these foods even as adults, it is very important for children to try and eat various foods from an early age [14,15]. Children's dietary habits are shaped by both environmental input and individual characteristics [16]. The home environment is the first environment to shape children's relationship with food [17]. In particular, mothers' eating attitudes and behaviors have the greatest influence on children's dietary habits, since mothers spend the most time with their children [18,19].

Children's vegetable consumption has been reported to be associated with the home environment, which includes the availability and accessibility of vegetables and parents' vegetable intake [20,21]. The association between parents' vegetable intake and children's consumption has been mostly reported in terms of maternal relations [22-24]. These studies have shown that maternal vegetable intake is associated with children's vegetable consumption. Various studies have focused on the association between maternal and children's vegetable consumption [25,26]. Children's preference for vegetables is a major factor that can influence their intake of vegetables when they eat outside of the home or as they grow older [27]. Considering previous studies on maternal and children's vegetable intake, it remains unclear which maternal factors affect children's vegetable preferences and consumption and whether maternal influence on children's vegetable consumption is different between sons and daughters. Therefore, it is necessary to identify the maternal factors affecting children's vegetable preferences and consumption.

This study aimed to investigate the relationship between children's vegetable preferences and consumption and maternal factors in mother/son pairs and mother/daughter pairs. To thoroughly examine the factors related to children's vegetable preferences and intake, we included the mothers' general sociodemographic factors in addition to the mothers' vegetable preferences and consumption as the maternal factors associated with children's vegetable preferences and intake.

METHODS

Participants

This study was performed among mothers with children from 3 to 5 years of age. Participants were recruited through kindergartens located in Chungnam, South Korea. Data were collected in June 2019. Of 350 applicants, those with food allergies or any disease that could affect vegetable consumption in mothers or children were excluded (n = 47). Finally, 303 pairs of mothers and children were enrolled in this study. The study was approved by the Institutional Review Board of Kongju National University (KNU_IRB_2019-28). Written informed consent was obtained from all mothers.

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Measures and variables

The mothers completed three parts of a survey: characteristics of their children and themselves, the vegetable-related perceptions of their children, and their children's and their own vegetable preferences and consumption. Participant characteristics consisted of the child's sex, age, body weight, height, and activity (children's characteristics), as well as maternal age, body weight, height, education level, employment status, and number of family members (mothers' characteristics). Body mass index (BMI) was calculated as body weight (kg) divided by squared height (m^2).

Vegetable-related perceptions

The vegetable-related perceptions of children consisted of 5 questions: degree of liking cooked vegetables, reasons for liking cooked vegetables, reasons for disliking cooked vegetables, disliked color of vegetables, and disliked texture of vegetables. The reasons for liking or disliking cooked vegetables were classified as taste, color, and texture. The possible disliked colors of vegetables were green, red, white, black, purple, and other, and the possible disliked textures of vegetables were squashy, slippery, stiff, tough, and crunchy.

Vegetable preferences

For the vegetable preferences of mothers and children, vegetables were classified into four categories: leafy vegetables, root and stem vegetables, fruit vegetables, and mushrooms. Vegetables in the four vegetable groups were selected if they were subject to frequent and high consumption, based on the Korea National Health and Nutrition Examination Survey [28]. Leafy vegetables included leaf lettuce, lettuce, napa cabbage, leek, spinach, chard, and mallow (n = 7); root and stem vegetables included carrot, radish, onion, green onion, bean sprouts, mung bean sprouts, and sweet potato (n = 7); fruit vegetables included eggplant, cucumber, pumpkin, bell pepper, tomato, and strawberry (n = 6); and mushrooms included oak mushroom, winter mushroom, and oyster mushroom (n = 3). All preference questions for the 23 vegetables were composed on a 5-point Likert scale: 1 = dislike very much, 2 = dislike, 3 = moderate, 4 = like, 5 = like very much. The average values of the four vegetable groups and of the overall preferences were calculated using the preference value of each vegetable.

Cooked vegetable consumption

The cooked vegetable consumption of mothers and children consisted of 2 questions: consumption frequency and consumption amount per meal. The consumption frequency of cooked vegetables was composed on a 4-point Likert scale: 1 = 1–2 times/week, 2 = 3–4 times/week, 3 = 5–6 times/week, 4 = every day. The amount of cooked vegetable consumption per meal was composed on a 5-point Likert scale: 1 = do not eat at all, 2 = eat just a little, 3 = only eat what I like, 4 = eat all sometimes, 5 = eat all. Finally, cooked vegetable consumption was calculated by multiplying the consumption frequency value and the value of consumption amount per meal.

Statistical analysis

The results are presented as the means ± standard deviations for continuous variables and as frequencies for noncontinuous variables. The difference in vegetable-related perception between boys and girls was tested using the χ^2 test. Differences and correlations among vegetable preferences and consumption between mothers and children were verified using a paired t-test and Pearson's partial correlation test. Covariates included the child's characteristics for age, BMI, and activity level and the maternal characteristics for age, BMI,

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education level, employment status, and number of family members. Maternal correlates of the child's overall vegetable preference and cooked vegetable consumption were tested using a generalized linear model. Statistical Analysis System (SAS) program version 9.4 (SAS Institute Inc., Cary, NC, USA) was used for all statistical analyses. All significance testing was performed with an α-level of 0.05.

RESULTS

General characteristics

Table 1 shows child and maternal characteristics. The average age of the children was 4.7 years, and the weight, height, and BMI were 19.0 kg, 108.9 cm, and 15.8 kg/m^2, respectively. The activity level of the children was active (44.6%) or very active (40.9%). The average age of the mothers was 37.4 years, and the weight, height, and BMI were 57.8 kg, 161.6 cm, and 22.2 kg/m^2, respectively. The education level of the mothers was the highest completion of college or university (74.9%). Approximately half (53.5%) of the mothers had jobs, and the rest were full-time housewives. The number of family members was the highest at 4 (54.1%).

Vegetable-related perceptions

There were no significant differences between sons and daughters in vegetable-related perceptions, as shown in **Table 2**. Approximately 60% of children liked cooked vegetables at a degree of liking of moderate or more. The major reason for both liking and disliking cooked vegetables was because of taste at 61.5% and 66.1%, respectively. The most disliked color and texture were green and tough (26.4% and 35.3%, respectively).

Vegetable preferences

Vegetable preferences of mother/son and mother/daughter pairs are shown **Table 3**. All preferences among the four vegetable groups were significantly higher in mothers than in

Table 1. Child and maternal characteristics

Characteristics	Child (n = 303)	Mother (n = 303)
Age (yrs)	4.7 ± 0.8	37.4 ± 4.4
Body weight (kg)	19.0 ± 3.5	57.8 ± 7.6
Height (cm)	108.9 ± 7.9	161.6 ± 4.6
Body mass index (kg/m^2)	15.8 ± 1.7	22.2 ± 2.8
Boys	146 (48.2)	
Activity		
Not so active	6 (2.0)	
Moderate	38 (12.5)	
Active	135 (44.6)	
Very active	124 (40.9)	
Education level		
Middle school or lower		3 (1.0)
High school		49 (16.2)
College or university		227 (74.9)
Graduate school or higher		24 (7.9)
Employment status		
Unemployed, full-time housewife		141 (46.5)
Number of family members		
3 or under		63 (20.8)
4		164 (54.1)
5 or more		76 (25.1)

Values are presented as mean ± SD or number (%).

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Table 2. Cooked vegetable-related perception of child

Perceptions	Total (n = 303)	Boy (n = 146)	Girl (n = 157)	p-value[1)]
Degree of liking cooked vegetable				0.625
Dislike very much	14 (4.6)	9 (6.2)	5 (3.2)	
Dislike	107 (35.3)	52 (35.6)	55 (35.0)	
Moderate	110 (36.3)	53 (36.3)	57 (36.3)	
Like	55 (18.2)	26 (17.8)	29 (18.5)	
Like very much	17 (5.6)	6 (4.1)	11 (7.0)	
Reasons for liking cooked vegetable				0.851
Taste	112 (61.5)	52 (61.2)	60 (61.9)	
Colors	12 (6.6)	7 (8.2)	5 (5.2)	
Textures	30 (16.5)	13 (15.3)	17 (17.5)	
Others	28 (15.4)	13 (15.3)	15 (15.5)	
Reasons for disliking cooked vegetable				0.188
Bad taste	80 (66.1)	39 (63.9)	41 (68.3)	
Colors	22 (18.2)	9 (14.8)	13 (21.7)	
Textures	19 (15.7)	13 (21.3)	6 (10.0)	
Disliked color of vegetable				0.102
Green	80 (26.4)	38 (26.0)	42 (26.8)	
Red	45 (14.9)	18 (12.3)	27 (17.2)	
White	15 (5.0)	8 (5.5)	7 (4.5)	
Black	56 (18.5)	20 (13.7)	36 (22.9)	
Purple	33 (10.9)	18 (12.3)	15 (9.6)	
Others	74 (24.4)	44 (30.1)	30 (19.1)	
Disliked texture of vegetable				0.430
Squashy	87 (28.7)	44 (30.1)	43 (27.4)	
Slippery	25 (8.3)	12 (8.2)	13 (8.3)	
Stiff	38 (12.5)	16 (11.0)	22 (14.0)	
Toughness	107 (35.3)	46 (31.5)	61 (38.9)	
Crunchy	18 (5.9)	11 (7.5)	7 (4.5)	

Values are presented as number (%).
[1)]p-value is by χ^2 test.

children ($p < 0.001$). The overall preference for vegetables was 4.3 out of 5 for mothers and 3.4 out of 5 for children ($p < 0.001$). Regarding vegetable preference, 16 out of 23 vegetables for sons and 20 vegetables for daughters showed a significant positive correlation between the paired mother and child ($p < 0.05$). The overall vegetable preference showed significant positive correlations between mother and son and between mother and daughter ($p < 0.001$).

Cooked vegetable consumption

The cooked vegetable consumption of mother/son and mother/daughter pairs are shown **Table 4**. Cooked vegetable consumption, along with consumption frequency and consumption amount, were significantly higher in mothers than in children ($p < 0.001$). The cooked vegetable consumption showed significant positive correlations between mother and son and between mother and daughter ($p < 0.001$).

Maternal correlates of vegetable preferences and consumption

Maternal correlates of the child's overall vegetable preference and cooked vegetable consumption are shown in **Table 5**. The overall maternal preference for vegetables increased the overall vegetable preference of sons by 0.482 (confidence interval, CI, 0.087 to 0.878; $p = 0.018$). While the maternal education level decreased the cooked vegetable consumption of sons by −1.923 (CI, −3.659 to −0.186; $p = 0.030$), maternal cooked vegetable consumption increased by 0.519 (CI, 0.352 to 0.686, $p < 0.001$). Maternal BMI and overall vegetable preference increased the overall vegetable preference of daughters by 0.057 (CI, 0.014 to

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Table 3. Vegetable preference of paired mother and child

Vegetables	Mother/son				Mother/daughter			
	Mother (n = 146)	Son (n = 146)	p-value[1]	Correlation coefficient[2]	Mother (n = 157)	Daughter (n = 157)	p-value[1]	Correlation coefficient[2]
Leafy vegetables	4.2 ± 0.6	3.2 ± 0.9	< 0.001	0.301**	4.1 ± 0.6	3.1 ± 0.8	< 0.001	0.301**
Lettuce	4.5 ± 0.6	3.1 ± 1.1	< 0.001	0.274*	4.4 ± 0.7	3.2 ± 1.1	< 0.001	0.279*
Leaf lettuce	4.5 ± 0.6	3.4 ± 1.1	< 0.001	0.103	4.5 ± 0.7	3.4 ± 1.1	0.001	0.316**
Napa cabbage	4.4 ± 0.6	3.3 ± 1.0	0.019	0.124	4.4 ± 0.7	3.4 ± 1.0	0.631	0.362**
Leek	4.2 ± 0.8	2.7 ± 1.0	< 0.001	0.230	4.2 ± 0.8	2.8 ± 1.0	< 0.001	0.213
Spinach	4.1 ± 0.8	3.5 ± 1.1	< 0.001	0.187	4.1 ± 0.9	3.5 ± 1.0	< 0.001	0.273*
Chard	3.6 ± 1.0	2.8 ± 1.0	< 0.001	0.377**	3.6 ± 1.0	2.7 ± 0.9	< 0.001	0.536***
Mallow	3.9 ± 0.9	3.0 ± 1.0	< 0.001	0.478***	3.9 ± 0.9	2.9 ± 1.0	< 0.001	0.557***
Root and stem vegetables	4.4 ± 0.5	3.5 ± 0.7	< 0.001	0.342**	4.3 ± 0.5	3.6 ± 0.7	< 0.001	0.342**
Carrot	4.2 ± 0.9	3.6 ± 1.1	< 0.001	0.402***	4.1 ± 0.8	3.8 ± 1.0	< 0.001	0.414***
Radish	4.3 ± 0.7	3.4 ± 1.0	0.421	0.377**	4.3 ± 0.7	3.6 ± 1.0	0.035	0.286*
Onion	4.6 ± 0.6	3.2 ± 1.1	< 0.001	0.318**	4.5 ± 0.6	3.1 ± 1.1	< 0.001	0.263*
Green onion	4.3 ± 0.8	2.7 ± 1.0	< 0.001	0.365**	4.2 ± 0.8	2.5 ± 1.1	< 0.001	0.245*
Bean sprouts	4.4 ± 0.7	4.0 ± 1.0	< 0.001	0.135	4.3 ± 0.8	4.0 ± 0.9	< 0.001	0.455***
Mung-bean sprouts	4.3 ± 0.8	3.5 ± 1.2	0.259	0.443***	4.3 ± 0.8	3.8 ± 1.0	0.235	0.446***
Sweet potato	4.6 ± 0.6	4.1 ± 1.2	< 0.001	0.122	4.5 ± 0.6	4.3 ± 0.8	< 0.001	0.270*
Fruit vegetables	4.2 ± 0.6	3.4 ± 0.8	< 0.001	0.369**	4.3 ± 0.6	3.6 ± 0.8	< 0.001	0.369**
Eggplant	3.7 ± 1.2	2.6 ± 1.1	0.009	0.356**	4.0 ± 1.0	2.8 ± 1.2	< 0.001	0.213
Cucumber	4.5 ± 0.7	3.4 ± 1.2	0.066	0.286*	4.5 ± 0.7	3.7 ± 1.2	0.083	0.397***
Pumpkin	4.2 ± 0.8	3.4 ± 1.2	0.166	0.241*	4.3 ± 0.8	3.4 ± 1.1	0.757	0.381***
Bell pepper	3.9 ± 1.0	2.7 ± 1.1	0.002	0.429***	3.8 ± 1.0	2.8 ± 1.2	0.011	0.397***
Tomato	4.3 ± 0.8	3.7 ± 1.3	0.029	0.414***	4.3 ± 0.8	4.1 ± 1.1	< 0.001	0.179
Strawberry	4.7 ± 0.6	4.7 ± 0.8	< 0.001	0.174	4.7 ± 0.6	4.8 ± 0.6	< 0.001	0.234*
Mushrooms	4.3 ± 0.8	3.0 ± 1.1	< 0.001	0.426***	4.4 ± 0.7	3.3 ± 1.2	< 0.001	0.426***
Oak mushroom	4.2 ± 1.1	2.9 ± 1.2	< 0.001	0.387***	4.4 ± 0.8	3.2 ± 1.3	0.004	0.314**
Winter mushroom	4.4 ± 0.8	3.1 ± 1.3	0.001	0.431***	4.4 ± 0.8	3.4 ± 1.3	0.068	0.433***
Oyster mushroom	4.4 ± 0.8	3.1 ± 1.2	< 0.001	0.404***	4.4 ± 0.8	3.2 ± 1.3	< 0.001	0.413***
Overall vegetables	4.3 ± 0.5	3.4 ± 0.8	< 0.001	0.379***	4.3 ± 0.5	3.4 ± 0.7	< 0.001	0.379***

Values are presented as mean ± SD. Degree of liking vegetables: 1 = dislike very much, 2 = dislike, 3 = moderate, 4 = like, 5 = like very much.
[1]p-value is by paired t-test. [2]Correlation coefficient by Pearson's partial correlation test adjusted for child and maternal characteristics.
*p < 0.05, **p < 0.01, ***p < 0.001.

Table 4. Cooked vegetable consumption of paired mother and child

Variables	Mother/son				Mother/daughter			
	Mother (n = 146)	Son (n = 146)	p-value[1]	Correlation coefficient[2]	Mother (n = 157)	Daughter (n = 157)	p-value[1]	Correlation coefficient[2]
Consumption frequency[3]	2.7 ± 1.1	2.2 ± 1.1	< 0.001	0.607***	2.6 ± 1.1	2.1 ± 1.0	< 0.001	0.512***
Consumption amount per meal[4]	4.0 ± 1.1	3.0 ± 1.1	< 0.001	0.209*	4.2 ± 1.0	3.1 ± 1.0	< 0.001	0.315***
Total consumption	11.0 ± 5.9	7.4 ± 5.4	< 0.001	0.563***	11.2 ± 5.9	7.1 ± 5.0	< 0.001	0.421***

Values are presented as mean ± SD. Cooked vegetable consumption = consumption frequency × amount of consumption.
[1]p-value is by paired t-test. [2]Correlation coefficient is by Pearson's partial correlation test adjusted for child and maternal characteristics. [3]Consumption frequency of cooked vegetables: 1 = 1–2 times/wk, 2 = 3–4 times/wk, 3 = 5–6 times/wk, 4 = everyday. [4]Amount of cooked vegetable consumption per meal: 1 = don't eat at all, 2 = eat just a little, 3 = only eat what I like, 4 = eat all sometimes, 5 = eat all.
*p < 0.05, ***p < 0.001.

0.100; p = 0.010) and 0.688 (CI, 0.437 to 0.939; p < 0.001), respectively. Maternal vegetable consumption increased the vegetable consumption of daughters by 0.372 (CI, 0.239 to 0.505; p < 0.001). Maternal correlates of the child's overall vegetable preference and cooked vegetable consumption according to maternal employment are shown in **Table 6**. The mothers' preference for and consumption of vegetables significantly increased the children's preference and consumption, respectively, in both employed and unemployed mothers.

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Table 5. Maternal correlates of child's vegetable preference and cooked vegetable consumption

Variables	Son (n = 146)						Daughter (n = 157)					
	Vegetable preference			Cooked vegetable consumption			Vegetable preference			Cooked vegetable consumption		
	Estimate	95% CI	p-value	Estimate	95% CI	p-value	Estimate	95% CI	p-value	Estimate	95% CI	p-value
Maternal variables	R^2 = 0.133		0.118	R^2 = 0.309		< 0.001	R^2 = 0.364		< 0.001	R^2 = 0.287		< 0.001
Age	−0.008	−0.052, 0.036	0.727	−0.069	−0.252, 0.114	0.455	−0.001	−0.030, 0.029	0.970	−0.071	−0.245, 0.102	0.419
Body mass index	−0.020	−0.082, 0.043	0.529	−0.085	−0.397, 0.228	0.593	0.057	0.014, 0.100	0.010	−0.094	−0.342, 0.153	0.452
Education level	0.021	−0.327, 0.369	0.906	−1.923	−3.659, −0.186	0.030	0.026	−0.210, 0.261	0.830	0.838	−0.537, 2.213	0.230
Employment status												
Employed (ref.)												
Unemployed	−0.050	−0.370, 0.269	0.754	0.186	−1.426, 1.799	0.820	−0.168	−0.419, 0.084	0.188	−1.091	−2.576, 0.393	0.148
Number of family members	0.096	−0.140, 0.331	0.420	0.138	−1.016, 1.293	0.813	−0.077	−0.282, 0.128	0.455	0.599	−0.519, 1.716	0.291
Overall vegetable preference	0.482	0.087, 0.878	0.018	−0.044	−2.040, 1.952	0.965	0.688	0.437, 0.939	< 0.001	1.014	−0.534, 2.562	0.197
Cooked vegetable consumption	0.005	−0.030, 0.039	0.790	0.519	0.352, 0.686	< 0.001	0.015	−0.007, 0.036	0.180	0.372	0.239, 0.505	< 0.001

Values are presented as estimates and 95% CIs by generalized linear model.
CI, confidence interval.

Table 6. Maternal correlates of child's vegetable preference and cooked vegetable consumption according to maternal employment status

Variables	Employed (n = 162)						Unemployed (n = 141)					
	Vegetable preference			Cooked vegetable consumption			Vegetable preference			Cooked vegetable consumption		
	Estimate	95% CI	p-value	Estimate	95% CI	p-value	Estimate	95% CI	p-value	Estimate	95% CI	p-value
Boys	74 (45.7)						72 (51.1)					
Maternal variables	R^2 = 0.170		0.008	R^2 = 0.283		< 0.001	R^2 = 0.262		0.001	R^2 = 0.286		< 0.001
Age	−0.019	−0.055, 0.017	0.304	−0.056	−0.227, 0.114	0.514	0.009	−0.027, 0.045	0.617	−0.034	−0.211, 0.144	0.708
Body mass index	0.033	−0.016, 0.081	0.187	0.062	−0.207, 0.330	0.651	0.010	−0.045, 0.066	0.717	−0.260	−0.541, 0.020	0.068
Education level	0.068	−0.208, 0.344	0.624	0.189	−1.393, 1.771	0.814	0.032	−0.279, 0.343	0.839	−0.817	−2.188, 0.554	0.240
Number of family members	0.052	−0.184, 0.288	0.664	0.304	−0.898, 1.506	0.619	0.046	−0.156, 0.249	0.649	0.157	−0.881, 1.196	0.765
Overall vegetable preference	0.600	0.268, 0.931	< 0.001	1.203	−0.622, 3.027	0.195	0.607	0.325, 0.890	< 0.001	0.625	−0.955, 2.204	0.435
Cooked vegetable consumption	0.001	−0.025, 0.027	0.958	0.447	0.304, 0.589	< 0.001	0.009	−0.017, 0.035	0.487	0.413	0.273, 0.552	< 0.001

Values are presented as estimates and 95% CIs by generalized linear model. Percentages of boys and girls were not significantly differ between employed and unemployed mothers.
CI, confidence interval.

DISCUSSION

The present cross-sectional study was conducted to investigate the maternal correlates of children's vegetable preferences and consumption in mother/son and mother/daughter pairs. As the main results, children's vegetable preferences and consumption were significantly lower than those of their mothers, but the correlations between mother and child were significantly positive in both sons and daughters. Moreover, mothers' vegetable preferences and consumption respectively increased those of their children.

Considering the nutritional and health benefits of vegetables, we need to increase the preference for and consumption of vegetables from childhood. Children's taste preferences change with growth and age [29,30]. Children are known to prefer salty and sweet tastes and dislike innately sour and bitter tastes [31]. In this study, the main reason for both like and dislike of cooked vegetables was found to be taste, indicating that a certain taste of vegetables is liked, while a certain taste is disliked. Vegetables contain a variety of compounds that affect taste. Previous studies have reported that children do not consume certain vegetables because of their unique taste [32]. Raggio and Gámbaro [33] reported that the main factors identified regarding children's low intake of vegetables were food color, texture, and taste. Other studies have also demonstrated that children overall do not like green leafy vegetables [34,35]. In this study, along with vegetable flavor or taste, the color of vegetables most disliked by both sons and daughters was green, and the texture that was most disliked was toughness. As exposure to these characteristics from childhood can lead to imbalanced or picky eating, efforts and strategies are required to reduce the unfavorable characteristics of vegetables in the preparation of meals and recipes.

Vegetables are consumed in cooked form rather than raw through meals in South Korea. As shown in the current study, children disliked vegetables because of their toughness. Cooking has been found to increase children's affinity for vegetables, since it alters sensory properties such as flavor and texture [36]. Therefore, as with different vegetable preferences, vegetable consumption was examined in this study as cooked vegetables that are actually consumed forms. Vegetable preferences and consumption, as expected, were significantly lower in children than in their mothers. Various studies [37-39] have reported that the more exposure to a certain food, the greater preference for and consumption of that food. Our results may deduce that children have less experience with and exposure to vegetables than mothers have. Of the 23 vegetables, more than 5% of the children did not consume 12 vegetables, including chard, mallow, leaf lettuce, and leek (data not shown). Even with vegetables that children dislike or that are difficult to eat or encounter, children need to see their mother eating them through eating together, choosing customized cooking methods for children, or inducing a self-interest in vegetables through cooking activities rather than unconditionally excluding vegetables.

The association between mothers' and children's vegetable consumption has been continually reported [40-42]. Our results were consistent with previous studies indicating that the mothers' vegetable preferences are a positive factor for children's vegetable preferences [22,23]. A study of mother-child pairs with children aged 3–10 years [23] found that when mothers do not consume vegetables because they do not like them, their children are less exposed to vegetables, therefore lowering the children's preferences for vegetables. This result indicates that mothers' vegetable consumption is closely related to children's

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vegetable preferences. Previous research demonstrated that one of the best predictors of the quantity of vegetables that children will consume is how much they like them [43]. Our results show the possibility that children's vegetable preferences and consumption may resemble their mothers', respectively, and therefore the importance of the mothers' role in shaping the children's eating habits for vegetables.

Maternal education level was a negative predictor for only a son's vegetable consumption in our study. Children's vegetable preferences and consumption are influenced by maternal and family socioeconomic factors. The mothers' education level has been reported as a predictive factor of vegetable consumption for mothers themselves and for their preschool-aged children [44,45]. However, one study found no significant differences in vegetable consumption in children aged 4 to 14 regardless of their mothers' education level [46]. A higher education level is linked to an increased income level and the achievement of a higher socioeconomic status. In addition, parents who are close to their children and spend time with them provide more desirable and healthier food options to their children. In this study, the maternal correlates of children's vegetable preferences and consumption were analyzed according to the mother's employment because the time spent with the children was not surveyed. As a result, the maternal preference and consumption for vegetables significantly increased the children's preference and consumption, respectively, without a difference between employed and unemployed mothers. These results show that the maternal education level may affect the children's vegetable consumption independent of the maternal employment status. The correlation of maternal education level with children's food consumption showed a different pattern for each food type. Children's vegetable consumption did not change according to maternal education levels, whereas the consumption of sugar-sweetened beverages and sweets showed a significant negative correlation with mothers' education level [46,47]. Thus, it seems difficult to produce a consistent conclusion regarding children's vegetable consumption according to mothers' education level, because not only the education level but also the mothers' socioeconomic factors and children's intake of foods other than vegetables affects children's vegetable consumption. Considering the study results in which the mothers' education level had a significant negative relationship with their children's vegetable consumption, further detailed studies are recommended to examine the relationship between parents' education level and children's vegetable intake, to include an extensive look at the factors influencing children's vegetable consumption.

Interestingly, maternal BMI was a positive predictor of daughters' vegetable preferences. Wang et al. [24] reported no significant difference in the servings per day of vegetables and fruits consumed by children according to the obesity degree of the mothers (normal, BMI $< 25\ kg/m^2$; overweight, $25\ kg/m^2 \leq BMI < 30\ kg/m^2$; obesity, $BMI \geq 30\ kg/m^2$). Furthermore, a relationship analysis in the study between mothers' BMI and their children's intake of fruits and vegetables revealed that only mothers with a BMI lower than $25\ kg/m^2$ showed a significant positive correlation between mothers' BMI and the intake of fruits and vegetables in children. In this study, the mean BMI of mothers was $22.2\ kg/m^2$, which was in the normal range, and the ratio of overweight and obesity with a BMI of $23\ kg/m^2$ or higher was low (15.5%; not shown in the data). The finding that mothers' BMI level was not high in the present study is a main difference compared to previous studies. For this reason, systematic studies with more subjects on food intake in children and their mothers with varying degrees of obesity are needed in the future.

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Several limitations of this study need to be addressed. First, the study results are difficult to generalize because the current study examined small samples of subjects from only a few regions. Further studies with larger sample groups are suggested to ensure the validity of the study and to derive more in-depth variables related to mothers-children vegetable intake. Second, due to the lack of previous investigations of the factors affecting children's vegetable consumption, such as food accessibility, food utilization, early feeding, and family feeding practices, some findings of this study were discussed without additional information. Despite these limitations, the present study can make contributions to the current literature as a study focusing on both the preferences and consumption of vegetables in parent-child pairs and as baseline data in Korea, as no studies regarding this subject have been previously reported.

SUMMARY

In this study, the maternal correlates of children's vegetable preferences and cooked vegetable consumption were investigated in mother/son pairs and mother/daughter pairs. In conclusion, mothers' vegetable preferences and consumption had a significant positive correlation with their children's respective vegetable preferences and consumption, in both sons and daughters. Therefore, mothers should be aware of the importance of how their vegetable eating habits affect their children's vegetable consumption. In addition, to promote vegetable consumptions of mothers, local communities may provide nutrition education programs such as importance of vegetable consumption and strategies to increase children's vegetable consumption.

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