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Empirically derived major dietary patterns and their associations with overweight in Korean preschool children

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Prevailing dietary patterns and their association with nutritional outcomes are poorly understood, particularly for children in Korea. Our purposes were to identify major dietary patterns and to examine their associations with overweight among young children in Korea. For 1441 preschool children, usual diet was assessed by a FFQ, from which thirty-three food groups were created and entered into a factor analysis. We identified three dietary patterns by relative intake frequency of (1) vegetables, seaweeds, beans, fruits, milk and dairy products (Korean healthy pattern); (2) beef, pork, poultry, fish and fast foods (animal foods pattern); and (3) ice cream, soda, chocolate, cookies and candies (sweets pattern). The Korean healthy pattern was associated with better health status. As compared with the lowest quintile, the multivariate-adjusted OR of the highest quintile for health status inferior or similar to their peers was 0·59 (95 % CI 0·42, 0·84). Likelihood of being overweight was higher among those in the highest quintile (OR 1·77 (95 % CI 1·06, 2·94)) *v.* the lowest quintile regarding the animal foods pattern. These findings suggest that major dietary patterns are predictors of overweight and health status in Korean preschool children.

Dietary patterns: Factor analysis: Overweight: Health status

Improvement of child health is a great concern in Korea since epidemiological evidence has indicated increases of inappropriate eating habits and health risks such as obesity. Obesity among children has increased dramatically in Korea, presenting 2–3 % in the 1970s and 15–20 % in the 2000s[1,2].

Lifestyle factors are well known to be important in the development of obesity besides genetic and other biological factors. One of these lifestyle factors is diet. A number of studies have examined relationships of obesity and diet, mainly focusing on individual nutrients and foods (i.e. energy, fat, milk, vegetables, etc)[3–6], fewer attempts have been made to identify dietary patterns in this regard for children.

Dietary-pattern analysis is useful for dietary recommendation as it allows studying the effect of many foods and their combinations simultaneously. One of the methods that can be used to study dietary patterns is factor analysis. Factor analysis reduces foods into patterns (factors) based on correlations between foods, and each individual receives a factor score for all derived factors[7].

Several studies on dietary patterns have shown associations of child obesity with specific dietary patterns such as sweet foods, meats, low-quality foods, snacks, dairy foods, fruit and vegetables, although the results are not consistent[8–12]. However, these findings have some limitations to be applicable to Koreans since culturally specific dietary patterns are likely to play a role in this matter. Like many other countries, nutrition transition is an ongoing phenomenon in Korea, yet fat intake is still lower and vegetable intake still higher than children from other Asian countries and most Western countries[13]. The unique aspects of diet transition in Korea may exert an influence to some extent in terms of dietary patterns and their association with obesity in children. The present study was an attempt to identify prevailing dietary patterns among Korean young children and to examine their associations with overweight.

Subjects and methods

Subjects

As part of the Practical Approach for Better Maternal and Child Nutrition and Health Study conducted in Korea from June 2001 to June 2005[14], a sample of 1724 Korean preschool-age children was selected by multiple-step sampling. In brief, two districts (Gu) in Seoul and two districts in Uijeongbu city were randomly selected, in which eleven preschools chosen by convenience sampling agreed to participate in the study. At each selected preschool, children were recruited if their caretakers accepted the informed consent. The number of children recruited from each centre ranged from 53 to 251. The present study included 1441 preschool children who had all records on dietary intake, weight and height. Mean age of the children was 5·2 (SD 0·89) years.

Abbreviations: KRW, Korean won.

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Dietary assessment

Usual dietary intake was assessed by a modified version of a semi-quantitative FFQ developed by one of the investigators (S.-Y. O.). Respective correlation coefficients for reproducibility and validity of this instrument ranged 0·6–0·8 and 0·3–0·6 depending upon nutrients[15]. The FFQ contains 100 food items with nine non-overlapping frequency response categories, ranging from 'rarely use' to 'have three or more times per d.' For all foods, the possibility of specifying the use of a small, average or large portion was offered, where a small portion was a portion 50 % smaller than the average, and a large one was 50 % larger. The caretaker was asked to indicate his/her child's average frequency and portion of consuming foods in reference to the preceding month. Using the Computer Aided Nutritional Analysis Program II (CAN PRO II) developed by the Korean Nutrition Society (Seoul, South Korea), the amount of each food item included in the FFQ was converted into g, from which the daily intakes of nutrients were calculated.

Other relevant variables

Trained nutrition major graduate students measured children's height and weight following standard recommended procedures[16]. BMI was calculated using height and weight measures. Respective cut-off points of overweight were the 85th percentile of BMI for specific age and sex group for Korean children[17].

Similar to the variable used in the Korean National Healthy and Nutrition Survey[1], caretakers' perception of peer-compared child general health status was assessed by a question using a five-point Likert scale ranging from 1 for 'relatively very bad' to 5 for 'relatively very good'. For the multiple logistic analyses, the health status variable was dichotomized as 'better than' *v.* 'inferior or similar to' as compared with health status of other children of similar ages in general. The proportion of children whose health status was evaluated as 'inferior or similar to' their peers was 40·5 %.

Nutrition attitude of caretakers was measured by six items to assess degrees of attitude toward serving balanced meals to their families as suggested[18]. Each question used a five-point Likert scale (1 = 'strongly disagree'; 5 = 'strongly agree'). The mean of the six items was used as a measure of nutrition attitude in further analyses. The questionnaire also included a monthly household income question from which respondents had to choose one of the following monthly income ranges: (1) $<1\,000\,000$ Korean won (KRW) (1 000 000 KRW = about US$1000 or €800); (2) $\geq 1\,000\,000$ and $<2\,000\,000$ KRW; (3) $\geq 2\,000\,000$ and $<3\,000\,000$ KRW; (4) $\geq 3\,000\,000$ and $<5\,000\,000$ KRW; (5) $\geq 5\,000\,000$ KRW. In addition, we assessed monthly food expenditure and duration of television watching as continuous variables.

Data collection

The survey instrument had been pre-tested between May and July 2001 and was revised with minor modification. Data for the present study were collected between November 2001 and July 2003. Self-administered questionnaires were distributed to caretakers of the children by mail. As an incentive, a small gift was provided.

Statistical analysis

In order to assess dietary patterns, first, 100 food items were classified into thirty-three food or food groups based on the nutrient profiles of each food item (Table 1). Factor analysis with values of intake frequencies of thirty-three food groups was used to derive dietary patterns with the option of

Table 1. Food groups used in the factor analysis

Food or food group	Food
Korean style of grains	Cooked rice, other cooked grains, curry rice
Noodles	Korean-style noodles, spaghetti/bean sauce noodles
Instant noodles	Ramyun
Rice cakes	Rice cakes
Cereals	Breakfast cereals
Bread	White and dark breads
Fast food	Hamburger, pizza, French fries
Potatoes	Sweet potatoes, potatoes (except French fries)
Organ meat	Soondae (Korean-style sausage), intestine/liver/tripe
Beef	Sliced beef with sauces (Galbi, Bulgogi), beef (loin, tender loin), beef soup/beef broiled down in soya
Pork	Pork (loin, tender loin, shoulder), pork (belly)
Chicken	Chicken (fried), chicken (boiled, braised)
Processed meat	Ham/sausage
Eggs	Eggs, quail eggs
Fresh fish	Pollack/codfish, porgy, Spanish mackerel/hair tail (fried), Spanish mackerel/hair tail (broiled, braised), yellow cracker, mackerel (fried), mackerel (broiled, braised), squid/octopus, crabs, shrimps, clams
Canned fish	Canned tuna/Pacific saury
Fish paste	Fish paste, razor clam flesh
Dried fish	Dried anchovy, dried whitebait
Beans	Soyabean curd (tofu)/curd residue, soya beans (boiled with soya sauce), soyabean milk
Kimchi	Korean cabbage kimchi/seasoned cubed radish roots/young radish kimchi, other kinds of kimchi
Vegetables	Cabbage, radish, beansprouts/mungbean sprouts, cucumber, spinach/mallow, perilla leaves/lettuce/pumpkin young leaves, dried radish leaves, onion, carrots, squash, mushrooms, unripe hot pepper, fernbrake, roots of ballonflower, burdock/lotus root vegetable pickles
Seaweed	Dried laver, sea mustard
Fruits	Apples, pears, mandarin, tomato, persimmon, banana, melon, grapes, peaches, muskmelon, strawberries, kiwi, pineapple
Nuts	Nuts
Fruit juice	Orange juice, tomato juice
Milk	Milk
Dairy products	Yogurt, yogurt drinks, cheese
Ice cream	Ice cream, milkshake
Fats	Butter/margarine, mayonnaise
Sweet drinks	Cocoa, cola/cider, other soft drinks, traditional sweet drinks
Chocolate	Chocolate
Sweet baked goods	Chips, biscuits, sweet bread
Sugary foods	Candies, sugar, jam

orthogonal rotation to derive factors. Principal component analysis was used to extract factors. In determining the number of factors to retain, we ran factor solution ranging from two to ten, including food group components with an eigenvalue >1 and examined both the scree plots and interpretability of factors. From these analyses, the three-factor solution was selected. These three factors explained 27·4 % of the total variance of thirty-three food-group variables. Factor loadings were calculated for each food group across the three factors. A factor score was calculated for each subject for each of the three factors, in which intakes of thirty-three food groups were weighted by their factor loadings and summed. The analyses were conducted by using the FACTOR PROCEDURE in SAS (version 8.2; SAS Institute Inc., Cary, NC, USA). The dietary patterns that we used were named according to the food groups loaded most positively on the factor.

The associations of each dietary pattern with overweight and health status were evaluated by multiple logistic regression analysis[7], via the PROC LOGISTIC procedure of SAS (version 8.2, SAS Institute Inc.). Multiple logistic regression models were adjusted for preschool location, household monthly income, and child's age and sex variables. Total energy intake was further controlled for because associations between intakes and outcome variables cannot be considered as primary effects of dietary patterns if they were the results of differences in total energy intake between quintile groups[19]. Duration of television watching, an indirect measure of activity level, was also controlled for in the logistic regression analysis in the case of overweight. OR and their 95 % CI were computed to assess the strength of the associations between dietary patterns and outcome measures[7].

Table 2. Factor-loading matrix for the three dietary patterns and their food or food groups identified in 1441 Korean preschool children*

	Dietary pattern		
Food or food groups	Korean healthy	Animal foods	Sweets
Korean style of grains	0·22	–	–
Noodles	–	0·53	–
Ramyun (instant noodles)	–	0·45	0·21
Cereals	–	–	0·27
Rice cakes	0·21	–	–
Bread	–	–	0·36
Fast foods	–	0·66	–
Potato	0·42	–	–
Beef	0·23	0·50	–
Organ meat	–	0·63	–
Pork	–	0·52	–
Chicken	–	0·58	–
Processed meat	–	0·34	0·23
Eggs	0·31	–	0·24
Fresh fish	0·45	0·52	–
Canned fish	–	0·32	–
Fish paste	0·20	0·45	–
Dry fish (anchovy)	0·50	–	–
Beans	0·59	–	–
Kimchi	0·49	–	–
Vegetables	0·71	–	–
Seaweed	0·60	–	–
Fruits	0·58	–	–
Nuts	0·33	–	–
Fruit juice	0·36	–	0·30
Milk	0·37	–	0·26
Dairy products	0·37	–	0·37
Ice cream	–	–	0·51
Fats	0·26	–	0·22
Sweet drinks	–	0·23	0·55
Chocolate	–	–	0·61
Sweet baked goods	–	–	0·58
Sugary foods	–	–	0·64

* Absolute values $<$ 0·20 are not presented in the table for simplicity.

Results

Table 2 lists factor-loading matrices for the three major dietary patterns. The larger the loading of a given food item to the factor means the greater contribution of that food item to a specific factor. Dietary pattern 1 was identified by higher intakes of vegetables, kimchi (spicy raw vegetables), seaweeds, beans, fruits, milk and dairy products, and was labelled as the 'Korean healthy' pattern. Dietary pattern 2, named as the 'animal foods' pattern, was characterized by high intakes of animal foods such as beef, pork, poultry and fish as well as fast food including hamburgers and pizza. Dietary pattern 3 labelled as the 'sweets' pattern showed high intakes of ice cream, sweet drinks, chocolate, sweet baked goods and sugary foods.

The background characteristics of children according to the quintiles of dietary pattern scores are presented in Table 3. Children with a higher Korean healthy dietary pattern score were more likely to be from the households with higher income and food expenditure, and had mothers with better nutrition attitude. Participants with a higher animal foods pattern score tended to be older and overweight and their households spent more money on buying food. Children with a higher sweets pattern score were from the households with more food expenditure.

The Korean healthy dietary pattern was associated positively with energy, protein, fibre and micronutrient intakes, but not with fat consumption (Table 4). The animal foods pattern showed positive correlations with energy-generating nutrients, a negative relationship to Ca, and no associations with Fe and antioxidant nutrients. The sweets pattern was correlated positively with energy and fat consumption, but negatively with protein and micronutrients such as Fe, fibre, Ca and antioxidant nutrients.

There was a positive association between the Korean healthy pattern and health status after controlling for potential confounders. Children with the highest quintile had a lower risk of having health status inferior or similar to their peers (OR 0·59 (95 % CI 0·42, 0·84)). Neither the animal foods nor the sweets pattern showed a significant association with health status. Likelihood of being overweight was higher among those in the highest quintile *v.* the lowest quintile (OR 1·77 (95 % CI 1·06, 2·94)) in the animal foods pattern. Overweight risk did not differ by degree of intake in both the Korean healthy and the sweets dietary patterns (Table 5).

Discussion

The dietary pattern approach can summarize complex dietary data into more practical and meaningful information; thus, it is useful in nutrition intervention planning. The present study identified three distinct dietary patterns: the Korean healthy pattern, an animal foods pattern, and a sweets pattern.

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Table 3. Simple characteristics across quintiles (Q) of three dietary patterns in 1441 Korean preschool children

	Quintile of dietary pattern score					
	Q1	Q2	Q3	Q4	Q5	*P* for trend*
n	288	288	289	288	288	
Korean healthy						
Female (%)	47·4	49·3	46·9	49·3	48·3	0·8526
Age (% old)†‡	51·9	52·3	52·6	50·5	54·0	0·7897
Overweight (%)	13·8	16·1	15·1	16·2	19·3	0·1078
Mother's nutrition attitude (% high)†§	38·4	46·2	53·1	58·5	67·3	<0·0001
Household income $>3\times10^6$ Korean won (%)	23·4	33·6	29·1	33·9	35·2	0·0057
Household food expenditure (% high)†‖	48·9	52·9	52·9	54·4	61·9	0·0052
Animal foods						
Female (%)	51·6	56·0	38·7	49·0	46·0	0·0508
Age (% old)†‡	47·9	48·3	49·9	60·3	55·4	0·0037
Overweight (%)	13·8	15·8	12·0	15·6	23·5	0·0050
Mother's nutrition attitude (% high)†§	54·8	54·2	50·5	47·4	56·5	0·7219
Household income $>3\times10^6$ won (%)	29·6	30·1	31·5	32·5	31·3	0·4959
Household food expenditure (% high)†‖	48·0	52·8	46·5	57·7	65·5	<0·0001
Sweets						
Female (%)	50·2	51·6	47·9	45·5	46·1	0·1236
Age (% old)†‡	52·6	53·6	53·6	49·5	51·9	0·5458
Overweight (%)	17·9	15·5	14·8	15·9	16·5	0·7363
Mother's nutrition attitude (% high)†§	52·3	57·0	53·0	50·0	51·1	0·3123
Household income $>3\times10^6$ Korean won (%)	29·5	32·7	31·0	32·9	36·1	0·1239
Household food expenditure (% high)†‖	50·7	50·2	57·8	52·4	61·3	0·0171

* Mantel–Haenszel χ^2 test.
† Subjects were divided into two, high and low, groups based on their scores.
‡ Cut-off point was 5·4 years.
§ High means more positive attitude.
‖ Cut-off point was 5×10^5 Korean won.

The sweets pattern identified in the present study was similar to the snack pattern characterized by a higher consumption of bakery products, sweets, salted snacks and soft drinks in Spanish children[20]. The Korean healthy pattern in the present study, however, differed to some extent from the healthy dietary pattern among children in Western countries although it was similar to the wellbeing diet for Korean adults[21].

One of the differences of dietary patterns between Korean and Western populations appeared to be fish intake. Fish consumption in general was related more positively to the animal foods pattern among Koreans for both children (see Table 2) and adults[21]. Fresh fish, however, also showed a strong association with the Korean healthy pattern (factor loading 0·45), while no such association was found in other types of fish. Higher fresh fish intake was identified only in the healthy or prudent pattern in Western populations[22–24].

Overweight is a public health concern due to its magnitude and increasing trend in Korea. The proportion of overweight ranged 12–24 % depending upon the levels of intake regarding dietary patterns (see Table 3), which corresponds to other reports for Korean children[1,2]. Even though the absolute proportion of either overweight or obese is still lower among Korean children than children in most Western countries[10,11,25], the Korean government will launch the national obesity prevention programme from 2007 due to a rapid increase of obesity incidence. Lee *et al.*[26] estimated a doubled child obesity incidence in 2010 in Korea.

High animal food consumption had been identified as a determinant of overweight in the present study. The high animal foods pattern comprised of more energy and less or similar levels of micronutrients, that is, it represented a less-nutrient-dense diet. A nationwide study in Korea also showed an inverse association of nutrient density with overweight or obesity status[26]. Low-nutrient-dense foods appeared to favour the development of central nervous system insulin resistance that might in part be responsible for leptin resistance, accordingly, promoting pleasurable responses to foods[27]. However, the association between dietary patterns and overweight cannot be fully explained by the nutrient-density issue in the present study. Nutrient density was relatively low in the high sweets dietary pattern, yet no association was found regarding overweight status.

Determinants of obesity in previous studies conducted in Western countries included high consumption of sweet drinks and fruit juices, meats, and a low-quality diet as well as low intakes of fruit and vegetables[8–12]. Among those determinants, sweet foods were likely to be the most frequently noted[8–12], although the relationships between intake patterns and obesity were not consistent. One of the reasons for the conflicting findings would be that dietary patterns are not mutually exclusive, as shown in the factor-loading matrices of dietary patterns in the present study (Table 2). Combinations of dietary patterns may influence overweight status.

The Korean healthy dietary pattern presented a positive association with the caretakers' perception of peer-compared child general health status. It suggests that the empirically derived healthy dietary pattern in the present study was meaningful. The relationships between dietary patterns and measures of health status may need further research since we are not aware of any studies that have examined the association between dietary patterns derived by factor analysis with general health status.

Table 4. Total energy and energy-adjusted nutrient intakes across quintiles (Q) of three dietary patterns in 1441 Korean preschool children (Mean values with their standard errors)

	Quartiles of dietary pattern score									
	Q1		Q2		Q3		Q4		Q5	
Nutrient†	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
n	288		288		289		288		288	
Korean healthy										
Total energy (kJ)*	5251	137·7	5624	138·1	6381	140·2	6946	140·6	9160	140·2
Protein (% energy)*	13·6	0·1	14·5	0·1	14·7	0·1	15·6	0·1	16·7	0·2
Fat (% energy)	28·1	0·4	28·1	0·4	27·2	0·4	28·0	0·4	26·7	0·4
Fibre (g)*	2·9	0·1	3·1	0·1	3·5	0·1	3·8	0·1	5·4	0·1
Fe (mg)*	9·2	0·2	9·5	0·2	9·9	0·2	10·6	0·2	12·8	0·2
Ca (mg)*	596·7	14·5	680·2	14·3	681·8	14·2	771·6	14·2	895·0	15·9
Vitamin A (retinol equivalents)*	550·9	18·3	621·3	18·1	670·9	17·9	807·5	17·9	1072·7	20·1
Carotene (μg)*	1548·7	98·9	1942·2	97·5	2268·8	96·9	2966·8	97·0	4596·1	108·6
Vitamin C (mg)*	70·1	3·6	80·4	3·6	87·9	3·5	104·7	3·5	145·1	3·9
Animal foods										
Total energy (kJ)*	5695	145·6	5586	142·7	6009	144·8	7080	144·8	8938	145·2
Protein (% energy)*	14·3	0·1	14·6	0·1	14·7	0·1	15·2	0·1	16·2	0·2
Fat (% energy)*	26·1	0·4	27·0	0·4	27·5	0·4	27·9	0·3	29·6	0·4
Fibre (g)	3·8	0·1	3·6	0·1	3·8	0·1	3·8	0·1	3·7	0·1
Fe (mg)	10·4	0·2	10·1	0·2	10·4	0·2	10·5	0·2	10·6	0·2
Ca (mg)*	828·5	14·8	783·4	14·5	710·0	14·5	709·1	14·5	586·5	15·8
Vitamin A (retinol equivalents)	82·9	20·9	743·2	20·6	734·4	20·6	729·4	20·5	722·8	22·4
Carotene (μg)	2840·6	115·1	2613·4	113·4	2560·1	113·2	2593·3	112·8	2655·4	123·5
Vitamin C (mg)	103·9	3·9	98·1	3·8	92·9	3·8	100·8	3·8	91·0	4·2
Sweets										
Total energy*	5180	139·3	5641	139·8	6176	136·4	7017	136·0	9201	137·7
Protein (% energy)*	16·4	0·2	15·6	0·1	15·2	0·14	14·5	0·1	13·4	0·2
Fat (% energy)*	26·1	0·4	26·9	0·4	28·1	0·3	27·8	0·3	29·0	0·4
Fibre (g)*	4·4	0·1	4·2	0·1	3·6	0·1	3·4	0·1	3·1	0·1
Fe (mg)*	11·4	0·2	11·1	0·2	10·5	0·2	9·9	0·2	8·9	0·2
Ca (mg)*	746·5	16·9	730·4	15·6	733·9	15·0	732·8	14·9	675·7	17·0
Vitamin A (retinol equivalents)*	828·0	21·3	769·4	20·9	736·3	20·1	702·8	20·0	679·7	22·8
Carotene (μg)*	3267·3	116·1	2933·5	114·0	2608·7	109·4	2398·3	108·8	2081·5	124·1
Vitamin C (mg)*	106·1	4·0	103·8	3·9	91·5	3·7	92·2	3·7	93·8	4·2

* For these variables, there was a significant group difference ($P<0·05$). Otherwise, there was no statistically significant group difference.
† Adjusted for age and sex for energy and age, sex and total energy for other nutrients.

The present study results should be interpreted in consideration of the following limitations. First, foods provided by childcare centres may not have been considered by the dietary intake assessment done by caretakers. Second, the factor analysis method has the limitation that investigators must make subjective decisions. This method is data specific; thus, results may not be replicated across populations. The present study used duration of television watching as a proxy for activity,

Table 5. Comparison of quintiles (Q) with lowest quintile (Q1) for each dietary pattern by overweight and health characteristics in 1441 Korean preschool children*
(Adjusted odds ratios and 95 % confidence intervals)

	Compared with Q1†								
	Q2 (*n* 288)		Q3 (*n* 289)		Q4 (*n* 288)		Q5 (*n* 288)		
	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI	*P* for Wald χ^2
Korean healthy									
Overweight	1·34	0·82, 2·20	1·19	0·72, 1·96	1·37	0·83, 2·26	1·43	0·87, 2·34	0·6434
Health status‡	0·69	0·49, 0·97	0·78	0·56, 1·10	0·73	0·52, 1·02	0·59	0·42, 0·84	0·0475
Animal foods									
Overweight	0·83	0·51, 1·35	0·66	0·39, 1·10	1·01	0·63, 1·64	1·77	1·06, 2·94	0·0039
Health status‡	1·12	0·80, 1·58	1·47	1·05, 2·07	1·09	0·77, 1·54	1·13	0·80, 1·60	0·2184
Sweets									
Overweight	1·25	0·81, 1·94	0·92	0·59, 1·45	1·04	0·66, 1·62	1·01	0·65, 1·59	0·7236
Health status‡	0·96	0·68, 1·35	1·15	0·82, 1·62	0·82	0·58, 1·16	1·07	0·76, 1·50	0·3771

* OR adjusted for household income, preschool location, and child's age, sex and total energy intake, and duration of television watching (only for overweight).
† *n* 288 in Q1.
‡ 40·5 % Children's health status was inferior or similar to their peers.

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which may not fully represent the activity level of children. Nutrient intakes of children estimated by a semi-quantitative FFQ may not represent their absolute intakes since it was developed for the use of assessing relative intake levels. Moreover, the aetiology of overweight is complex; thus, the dietary-pattern models used in the present study may not have considered other confounding factors that might be responsible for the study results. Finally, the fact that the present study was based in a convenience sample recruited from urban areas may preclude generalizing the results of the study to children in rural areas in Korea.

Nevertheless, the dietary-pattern analysis of the present study on the basis of a considerable number of children from a homogeneous age group is meaningful since no other studies have examined the issue of dietary patterns in relation to health outcomes among children in Korea. Consequently, these results have important implications for overweight prevention nutrition education targeting children.

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