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Association of Eating Behavior related to Sodium Intake with Overall Dietary Attitudes in Korean Children

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한국 일부 초등학생의 나트륨 섭취 관련 식행동과 식태도의 관련성

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ABSTRACT

High sodium intake in many countries has become the leading cause of chronic diseases. This situation requires correct dietary behavior to ensure proper sodium intake in the younger population. The purpose of the present study was to assess eating behavior regarding sodium intake and identify its correlation with common dietary attitudes in children. This cross-sectional study was conducted by surveying 588 elementary school children in Korea. Sodium-related dietary behavior and common eating attitudes were examined through questionnaires, and analyses were conducted by comparing the results between boys and girls. The most undesirable sodium-related dietary behavior in subjects was they 'eat kimchi with every meal' followed by the 'tendency to eat hot and spicy food'. Girls had better dietary behavior regarding sodium intake than boys (P<0.05). However, the common eating attitude between boys and girls was not significantly different. For all subjects, sodium-related dietary behavior and eating attitude showed a significant positive correlation (P=0.0032). The present study shows that a common eating attitude is better when the sodium-related dietary behavior is more desirable in children.

Key words: Sodium, eating behavior, dietary attitude, children

INTRODUCTION

The excessive intake of sodium may be the leading cause of chronic diseases such as hypertension, brain, cardiovascular, and skeletal disease, and cancer. It is certainly one of the most critical problems of nutrition worldwide (Khaw KT *et al* 2004; Li XY *et al* 2012; Nagata C *et al* 2004).

Because traditional Korean meals mainly consist of grains and vegetables with low sodium content, food with high salt content such as *kimchi*, fermented fish and sauces have been highly developed. As a result, Koreans' sodium intake is relatively high, which has been continuously noted as a major nutritional problem. According to the Korea National Health and Nutrition Examination Survey (KNHANES) in 2013, daily sodium intake was 4,012.0 mg, which was three times the adequate intake of 1,500 mg (Ministry of Health and Welfare & Korea Center for Disease Control and Prevention 2014). In a dietary behavior study related to sodium intake, different sodium intake patterns related to age were reported; middle-aged people preferred salty food and soup and had a habit of adding table salt, while the younger generation preferred eating out, ramen, *kimchi*, and soup (Park YS *et al* 2008).

The preference of salty food and high sodium intake is developed by the culture, customs, and eating habits from childhood. It was estimated that most Koreans have a nutritional problem of high sodium intake because of a childhood eating habit of salty food intake that was not corrected (Son SM *et al* 2007). The daily sodium intake of Korean elementary students was 3,126.8 mg, and as many as 86.4% of these children consumed more sodium than goal intake of 2,000 mg (Ministry of Health and Welfare & Korea Center for Disease Control and Prevention 2013). Falkner B & Michael S (1998) reported that children showed a more sensitive reaction to sodium intake in their blood pressure than adults, and therefore, high sodium intake may be a serious health problem in children.

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To effectively promote the sodium reduction policy nationwide, the sodium intake of children should be assessed and proper guidelines must first be developed.

When a nutritional education program based on the knowledge, attitude, and behavior (KAB) model was developed in an effort to reduce sodium intake, knowledge on sodium intake improved and changes in eating attitude resulted in decreased sodium intake (Claro RM *et al* 2012; Papadakis S *et al* 2010). However, access to information is easier by promotion or advertisement in modern society, the culture of catering and eating out is expanding, and use of processed food or ready-to-eat food is on the rise. A previous report has shown that due to these reasons, KAB levels are diverse and intricately linked with environmental factors so that uniform nutrition education is not effective (Lallukka T *et al* 2007; Sarmugam R *et al* 2013). Previous studies assessed KAB levels and analyzed its relevance and various factors to apply in nutritional education (Sheahan SL & Fields B 2008; Webster JL *et al* 2010). Despite the known health issues associated with sodium intake, these studies are insufficient in Korea and there is a significant need for additional research, especially for children before their eating behaviors are fixed.

Therefore, this study was conducted to first, assess the sodium-related dietary behavior in children; and second, identify the correlation between the sodium-related dietary behavior and eating attitudes. This study may be useful for the development of an eating guideline to induce desirable dietary behavior with less sodium intake for children.

MATERIALS AND METHODS

1. Subjects

The objective and intent of this study was fully explained to elementary school children in 4^{th} to 6^{th} grades in Chungnam, Korea and 588 participated in this study. This study was conducted as a cross-sectional survey by interviewing students one-on-one by an expert nutritionist for 20 to 30 minutes from May 1 to 25, 2012. This study was conducted in compliance with the Helsinki Declaration.

2. Instruments

The survey tool used in this study was reconstructed (for the objectives of the study) by referring to previous studies (Lee OH *et al* 2010; Lee SK *et al* 2010). The questionnaire was completed through modification and supplemented based on a preliminary survey conducted with a subset of 30 students from April 9 to 13, 2012. The questionnaire was composed of the following categories including demographics, sodium-related dietary behavior and common eating attitudes.

There were 11 general information items on the subjects, such as gender, age, height, weight, and family members, in addition to the age, height, and weight of their father and mother. The family member question referred to their father, mother, grandfather, grandmother, brothers and sisters for subjects to make appropriate choices. The remaining questions were presented in a subjective answer format.

There were 14 questions asking which sodium-related dietary behavior increased sodium intake and 1 question asking which one decreased sodium intake. All of the questions had 5 Likert scales of “very much so”, “yes”, “average”, “no”, and “absolutely no”. For the 14 questions asking about what increased the sodium intake, each answer of “very much so”, “yes”, “average”, “no”, and “absolutely no” was assigned 1, 2, 3, 4 and 5 points, respectively. For the one question asking about what decreased sodium intake, the points were assigned in reverse order. Higher points indicated more desirable dietary behavior related to sodium intake. Reliability analyses of the sodium intake related dietary behavior resulted in 0.73 for Cronbach's α and more than 0.7 for α in each question.

There were 12 questions used to assess common eating attitudes with each having 5 Likert scales of “very much so”, “yes”, “average”, “no”, and “absolutely no”. The points assigned to “very much so”, “yes”, “average”, “no”, and “absolutely no” were 5, 4, 3, 2 and 1, respectively. Higher points indicated a more desirable eating attitude. Reliability analyses of the eating attitude resulted in 0.79 for Cronbach's α and more than 0.7 for α in each question.

3. Statistical Analysis

The frequency, percentage, average, and standard deviation were computed for all of the data from the survey using the SAS Program (Ver. 9.3, SAS Institute Inc., Cary, NC, USA). Student’s *t*-test was conducted for the differences by gender in the dietary behavior related to sodium intake and common eating habit and tested for significance. Pearson's partial correlation test adjusting for age, gender, and body mass index was conducted for the correlation of average points between two variables and tested for significance by the correlation

coefficient (r). All of the statistics were analyzed for significance with $P<0.05$.

RESULTS

1. General Characteristics

The general characteristics of the subjects are shown in Table 1. There were 331 boys (56.3%) and 257 girls (43.7%). The average age of all of the subjects was 11.1 years with an average weight and height of 39.7 kg and 145.3 cm, respectively. There were no significant difference in age and height between boys and girls. However, the body weight and body mass index of the boys were significantly higher than those of the girls ($P<0.01$, $P<0.05$).

2. Dietary Behavior related to Sodium Intake

The results of dietary behavior related to sodium intake of both boys and girls are shown in Table 2. The girls scored higher and had more desirable dietary behavior with less appetite for hot and spicy food (2.6 for boys vs. 2.9 for girls,

Table 1. General characteristics of the subjects

Variables	Boys (n=331)	Girls (n=257)	Total (n=588)	*P*-value
Age (years)	11.1±0.8[1)]	11.0±0.8	11.1±0.8	0.074
Weight (kg)	40.6±9.6	38.6±8.5	39.7±9.2	0.006
Height (cm)	145.8±8.3	144.7±8.1	145.3±8.2	0.108
Body mass index (kg/m^2)	19.0±3.4	18.3±3.1	18.7±3.3	0.014

[1)] Mean±S.D. Adapted from previous study by Shin YS *et al* 2015.

Table 2. Eating behavior related to sodium intake of the subjects

Variables	Boys (n=331)	Girls (n=257)	Total (n=588)	*P*-value
Tend to eat hot and spicy foods	2.6±1.1[1)]	2.9±1.2	2.8±1.2	0.002
Like to take mid night snack	3.4±1.2	3.5±1.1	3.4±1.2	0.053
Eat snacks more than meals	4.0±1.1	4.0±1.0	4.0±1.0	0.654
Tend to eat salty foods	3.4±1.1	3.6±1.2	3.5±1.1	0.098
Eat salted fish, salted food, and dried fish everyday	3.8±1.0	3.9±1.0	3.9±1.0	0.049
Must need soup when I have a meal	3.4±1.2	3.6±1.2	3.5±1.2	0.041
Frequently eat fast food such as hamburger, chicken, and pizza	3.6±1.0	3.8±1.1	3.7±1.0	0.139
Eat *kimbab*, *tukbokki*, and noodles more than cooked rice	3.7±1.1	3.8±1.0	3.7±1.1	0.286
Eat out frequently with family	3.6±1.0	3.7±1.0	3.6±1.0	0.552
Eat bacon, ham, and sausages everyday	3.9±1.1	4.1±1.2	4.0±1.0	0.132
Drink soup all when I eat noodles	3.1±1.2	3.5±1.1	3.2±1.2	<0.001
Eat fruits and vegetables everyday[2)]	3.3±1.2	3.4±1.1	3.3±1.2	0.139
Must eat *kimchi* when I have a meal	2.6±1.3	2.6±1.3	2.6±1.3	0.742
Must eat with sauce (ketchup, mayonnaise) when I eat ham and sausages	3.2±1.4	2.9±1.3	3.1±1.3	0.031
Eat fried food, pan cake, and *sashimi* with soy sauce and red pepper paste	3.1±1.4	2.9±1.4	3.0±1.4	0.161
Total mean	3.4±0.5	3.5±0.5	3.4±0.5	0.015

[1)] Mean±S.D., Score: completely agree (1)~completely disagree (5).
[2)] Score is opposite.

P<0.01), frequency of eating fermented fish, pickled vegetable or dried seafood (3.8 for boys vs. 3.9 for girls, P<0.05), preference for soup or stew with each meal (3.4 for boys vs. 3.6 for girls, P<0.05), and preference for soup with noodles (3.1 for boys vs. 3.5 for girls, P<0.001) than boys. However, boys had a greater desire in sauce when they eat ham or sausage with 3.2 points, while girls scored 2.9 (P<0.05). Overall, girls had a more desirable sodium-related dietary behavior with 3.5 points, while boys scored significantly lower with 3.4 points (P<0.05).

3. Eating Attitudes

The result of eating attitudes of the subjects by gender is shown in Table 3. Boys scored higher in degree of pleasure in eating (4.1 for boys vs. 4.0 for girls, P<0.05), and girls scored higher in the decision for purchasing foods containing less salt (3.2 for boys vs. 3.4 for girls, P<0.05). However, the average points in the eating attitudes did not result in a significant difference with 3.4 points for both.

4. Relation Between Dietary Behavior related to Sodium Intake and Eating Attitudes

The relevance between the dietary behavior related to sodium intake and eating attitude adjusted for age, gender, and body mass index of the subjects is shown in Fig. 1. A significant positive correlation was found between the two variables so that if sodium-related dietary behavior was desirable, the common eating attitude was determined to be good (P=0.0032).

DISCUSSION

Proper early childhood eating habit education in regards to sodium intake is important because high sodium intake causes a variety of health problems. Therefore, this study was an assessment of dietary behavior related to sodium intake for 588 elementary school children and analyzed the correlation with common eating attitudes. The results showed that girls had better dietary behavior related to sodium intake compared to boys, and there was no significant difference in the eating attitudes for both boys and girls. The dietary behavior related to sodium intake was significantly and positively correlated with common eating attitude such that as a more desirable dietary behavior related to sodium intake occurred, the common eating attitude was also found to be good.

A major source of sodium intake in western diets is mainly in processed food. However, in developing countries, it is mostly related to the addition of salt while food is being prepared (Anderson CAM *et al* 2010; Brown IJ *et al* 2009; Garriguet D 2007). In the KNHANES over the last 12 years,

Table 3. Dietary attitudes of the subjects

Variables	Boys (n=331)	Girls (n=257)	Total (n=588)	P-value
Have a pleasant meal	4.1±0.8[1)]	4.0±0.9	4.1±0.8	0.022
Have a balanced meal	3.6±1.1	3.5±1.1	3.5±1.1	0.074
Have a meal with family over once a day	4.0±1.1	4.1±1.1	4.1±1.1	0.471
Check nutrition facts when I buy processed food	3.0±1.2	2.9±1.2	3.0±1.2	0.637
Aware quantity of salt in food	3.1±1.2	3.0±1.2	3.0±1.2	0.298
Eat vegetable dishes as much as possible	3.5±1.2	3.4±1.2	3.5±1.2	0.595
Eat meat once a day	3.1±1.2	2.9±1.2	3.0±1.2	0.174
Want to have a right snack habits	3.6±1.2	3.7±1.2	3.6±1.2	0.177
Prefer whole grain than white rice	3.0±1.3	3.1±1.4	3.0±1.4	0.396
Try to eat 5 nutrients whenever I have a meal	3.4±1.1	3.3±1.1	3.3±1.1	0.779
Think my health will be improved when I eat unsalted food	3.3±1.2	3.3±1.2	3.3±1.2	0.828
Intend to buy unsalted food	3.2±1.1	3.4±1.1	3.3±1.1	0.029
Total mean	3.4±0.7	3.4±0.6	3.4±0.6	0.732

[1)] Mean±S.D., Score: completely disagree (1)～completely agree (5).

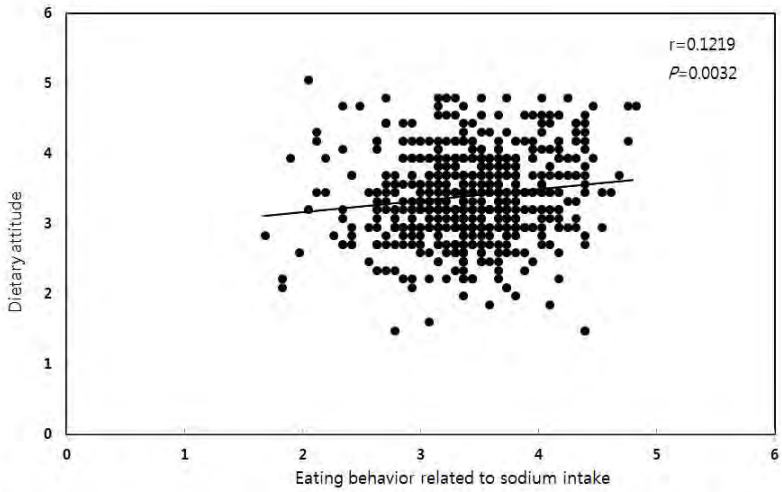

Fig. 1. Correlation between eating behavior related to sodium intake and dietary attitude of the subject adjusted for age, gender, and body mass index.

major sources of sodium intake were *kimchi* (22.8~31.7%), noodle and dumplings (10.5~13.8%), soup (10.2~13.8%), and stew (8.5~11.2%). Excessive sodium intake is closely related to traditional food such as *kimchi*, fermented sauce, and salted and fermented fish (Kim YS & Paik HY 1987). In addition, the younger generation frequently dines out or prefers take-out food and ramen, which shows more westernized eating characteristics of excessive sodium intake (Park YS *et al* 2008). Therefore, in this study on children, there were 15 questions to assess dietary behavior based on sodium intake, and related not only to salt added in food preparation but also processed food (Table 2).

In this study, the most undesirable dietary behavior related to sodium intake was that they 'eat *kimchi* with every meal' followed by the 'tendency to eat hot and spicy food'. These results demonstrate (and it coincides with a continuous assessment) that a major sodium source for Koreans is *kimchi* as well as soybean paste, soy sauce, and red pepper paste. *Kimchi* and red pepper paste are not only high in sodium but also very spicy. The daily intake of such food from childhood could be contributing to a tendency to eat hot and spicy food later in adulthood. Although the study subjects were young children without fixed preferences in dietary behavior, it is important to consider that their dietary behavior related to sodium intake was very similar to that of adults with excessive sodium intake dietary behavior. Because *kimchi* is known to have various positive health effects as a traditional Korean food, it is important to develop a low-sodium kimchi and foods with natural flavor that avoid strong seasoning for children.

In this study, it was found that girls had more desirable dietary behavior related to sodium intake than boys. This result is in agreement with previous findings of other studies (Oakes ME & Slotterback CS 2001; Parmenter K *et al* 2000; Turrell G 1997). Conclusive results of dietary behavior related to sodium intake by gender are elusive because there have been few studies. However, the result of this study showed that boys prefer more hot and spicy food than girls, and the frequency of fermented fish and pickled vegetable intake was higher for boys than girls. The intake of soup and noodles was also higher in boys. The differences of eating behaviors on salty foods between boys and girls may be effected by many factors besides sodium intake. However, considering that frequent intake of these foods induces high sodium intake, selective and intensive eating guidance, especially for boys, is required to improve these dietary behaviors.

Based on the KAB model that improved nutritional knowledge results in improved attitude and better behavior, there are nutritional counseling and education programs simply focused on teaching sodium-related knowledge (Grimes CA *et al* 2009; RaÈsaÈnen M *et al* 2001; Zhang J *et al* 2013). However, it is more important to induce overall desirable dietary behavior than simply lessons to establish good eating habits (Sheahan SL & Fields B 2008). It has been reported that nutrition education based on social cognitive theory may be more effective in reducing sodium intake when considering personal and environmental factors (Anderson ES *et al* 2007; Hearn MD *et al* 1998). This study included not the correlations of factors on the sodium intake of children but the

analyses of correlation between dietary behavior related to sodium intake and common eating attitude, and found a significant and positive correlation. Because this was conducted using in cross-sectional study method, the accurate correlation of causal-effect between the factors was not interpreted. In addition, the reliability was actually low from the regression analysis of the two factors (data not shown). This may be because there are numerous factors in the correlation of dietary behavior related to sodium intake and common eating attitude, which requires future studies using longitudinal analysis including a variety of factors.

The results of this study can be interpreted to indicate that common eating attitude may be good enough as a dietary behavior related to sodium intake that is more desirable. It has been reported in various studies that sodium-related KAB is significantly related, which means that sodium-related eating attitude is better with more nutritional knowledge related to sodium intake and leads to proper dietary behavior related to sodium intake (Claro RM *et al* 2012; Papadakis S *et al* 2010). Furthermore, if good dietary behavior is learned in childhood, it can lead to proper sodium intake, pleasurable dining experiences and balanced nutrition intake with a positive attitude (Birch LL 1998; Contento IR 1991).

This study has the following limitations. First, it was a cross-sectional study and it cannot explain the correlation between the dietary behavior related to sodium intake and common eating attitude accurately, even though they were correlated. Second, there could be possible error from self-reported evaluation by children in spite of numerous questions to assess the correlation and its reliability. A similar study using longitudinal analysis is needed, including 24-hour urine analyses to assess accurate sodium intake. Most studies that assess the KAB state regarding sodium intake were conducted on adult subjects whose eating habit was already fixed such that the effect on sodium intake reduction may be insignificant. This study was conducted on children to assess their dietary behavior related to sodium intake and demonstrated a significant correlation to common eating attitude and provided greater significance as an effective tool in inducing proper eating habits in children. These results can be used in nutritional guidance with synergistic effects both for sodium reduction and desirable eating habit in children.

CONCLUSION

In this study, girls had more desirable dietary behavior related to sodium intake than boys. Dietary behavior related to sodium intake was significantly and positively correlated with common eating attitudes, which indicated that common eating attitude was important with a more desirable dietary behavior related to sodium intake. As a result, it is very important to help children with proper dietary behavior related to sodium intake in their early years in order for them to lead healthy lives with improved dietary behavior related to sodium intake.

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