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Mothers' Dietary Behaviors are Associated with Nutritional Status in their Children

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Abstract

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Mothers play an important role in establishing eating habits in children thus understanding the influence of mothers' eating habits on children is important for children's lifelong health and nutrition. The aim of this study was to identify eating behavior patterns of mothers based on their dietary behaviors and examine the overall effect on children's dietary intake. Subjects were sampled from the Korean National Health and Nutrition Examination Survey (KNHANES, 2007-2010). All mothers with children 6-18 years of age were selected using household information. A total of 2,585 pairs were selected for analysis. Eating behavior patterns consisting of dietary behaviors of

mothers included eating-out frequency, family meal frequency, family breakfast status, and meal skipping status. Based on frequency of desirable dietary behaviors practiced, the type of eating behavior pattern followed by mothers was identified as healthy and unhealthy patterns. Generalized Linear Model was used to compare mean intakes of food groups and nutrients in mothers and children by mothers' eating behavior patterns. Percentage of individuals consuming nutrients below the Estimated Average Requirement (EAR) were observed by Chi-square test. Children were observed by sex and age group – younger boys and girls in the 6-11yr age group and older boys and girls in the 12-18yr age group. Mothers following a healthy pattern had higher intake of grains, meat·fish·beans·eggs and vegetables than mothers of unhealthy pattern. Younger boys had significantly higher intakes of grains and vegetables while older girls showed higher fruits and lower oils·fats·sugars consumed when their mothers followed a healthy pattern. Among children whose nutrients were below EAR, the proportion of older boys whose vitamin C and niacin intakes were below EAR was significantly smaller when mothers followed a healthy pattern compared to boys whose mothers had an unhealthy pattern.

Younger boys tended to resemble mothers' dietary intake the most, where both showed higher grains and vegetable intake and lower riboflavin nutrient when mothers followed a healthy pattern. As these results suggest, healthful dietary behaviors practiced by mothers may induce positive dietary intakes in children that can enhance their overall nutritional status. Studies that explore the effect of mothers' dietary behaviors not just limited to nutritional status of children but also on health indicators are recommended in the future.

Keywords: Mother, Children, Family, Dietary behavior, Nutrient intake

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Table of Contents

List of Tables

List of Figure

I. INTRODUCTION

The role of mothers is perceived to be influential in establishing food-related environment in households, which serves as an important determinant in understanding and assessing their own as well as family members' dietary intake. Mothers are the primary food purchaser and meal preparer at home irrespective of their working status (Valentine, 1999) and tend to prioritize health and nutritional value when making food choices for their children, which is an important motivation factor that influences their children's diet quality (Alderson and Ogden, 1999).

However, consumption trends have dramatically changed over the past few decades, paralleled with economic growth. Married women in the workforce continue to rise, which is one of the reasons that has contributed to increase of eating-out practices and fewer family meals in the household (Cho *et al.*, 2011). Convenience, followed by preference to eat-out by family members and lack of meal preparation time are the main reasons to why eating away from the home is often preferred by individuals (Ministry of Gender Equality and Family,

2010). Although several literatures have stated that children's eating behaviors are to a great extent acquired in family settings, the increasing trend of less parental involvement especially in regard to food-related behaviors can have adverse effects on their children's diet quality. As children's eating habits established early on in childhood are known to carry on through adulthood (Kelder *et al.*, 1994), the nutritional involvement mothers have on children is critical since mothers tend to spend more time with their children than fathers do, which includes for eating (Dubas and Gerris, 2002).

Regular family meals are associated with healthful dietary intakes due to availability of healthful foods such as vegetables and the overall enhancement of interpersonal dynamics such as positive communication between family members that thus promote desirable dietary intakes in children (Berge *et al.*, 2013, Fulkerson *et al.*, 2008). A substantial number of studies have shown evidence that parent involvement is imperative in guiding children to adopt healthful eating lifestyles as children may emulate parents' behaviors. A study on frequent family meals showed positive association with children's nutrient intakes such as magnesium, potassium, iron, zinc, vitamin B6

and folate and higher intakes of calcium-rich foods, dietary fiber and vegetables in both sexes (Burgess-Champoux *et al.*, 2009), which has implications for healthful dietary quality.

Although individual dietary behaviors and their respective association with children's intake has been studied, to date there are no studies examining the combined dietary behavior effect of mothers on children's intake especially with specificity to eating-out frequency, family meal and family breakfast regularity, and meal skipping routines. Moreover, the association of mothers' dietary behaviors and children's nutritional status is not well understood in Korean populations due to limited existing studies. Therefore, based on literature reviews on various dietary behaviors such as family meals that have shown to be a significant contributor and predictor of healthful dietary intakes in children, this study seeks to observe the trend in mothers and children's dietary intakes by comparing their food group and nutrient intakes between eating behavior patterns determined from mothers' self-responses on dietary behaviors. These dietary behaviors include eating-out frequency, family meal frequency, family breakfast status, and meal skipping status of mothers. The objectives of this study are

as follows:

1. Define mothers as followers of healthy and unhealthy patterns from eating behavior patterns identified by combinations of mothers' dietary behaviors;
2. Compare dietary intake in mothers between healthy pattern and unhealthy pattern mothers;
3. Compare children's dietary intake between those whose mothers follow a healthy pattern and an unhealthy pattern; and,
4. Observe dietary intake trends in children by sex and age group.

II. LITERATURE REVIEW

Several studies that compared parents' and children's dietary intake have reported similarities in their eating patterns. For example, a longitudinal study found that parents' intake can be significant predictors of children's nutrient intake especially between mothers and children. The closeness in intake between parents and children was shown to have higher correlations when those parents reported to eat more meals at home (Oliveria *et al.*, 1992).

From Prior and Limbert' s study that observed adolescents' perception of their parents on family meals, adolescents' responded that they believed their parents influenced the food choices at family meals and further reported that they felt the foods available at home were healthy and in variety. The authors suggested that adolescents' attitude toward family meals can be improved depending on their view of other family members' behaviors (Prior and Limbert, 2013). Furthermore, children generally tend to perceive their mothers as having healthier diets than they themselves do; when they perceived mothers with higher vegetable intakes and less energy dense foods,

these intake patterns were reflected in children as well (Prichard *et al.*, 2012). Such result suggests that dietary behaviors of mothers may serve as a useful indicator to assess children's intake because what children perceive of their parents appears to influence their own food choices.

Other than family meals, parental breakfast eating has been shown to be a predictor of breakfast intake in adolescents. Keski-Rahkonen et al reported that children with parents who often skip breakfast also had a tendency to skip breakfast themselves thus likely reflecting unintended influence of parental behavior on children. Regular breakfast skippers were more likely to be moderately associated with psycho-social factors that are health compromising such as smoking, frequent alcohol intake and sedentary lifestyle (Keski-Rahkonen *et al.*, 2003). Concerning the benefits of breakfast consumption that includes improvement in cognition and daily micronutrients in children (Adolphus *et al.*, 2013), regular family breakfast is known to lower the risk of obesity and increase intakes of fruit, whole grains and fiber in the diet. It is noteworthy that health risks associated with meal skipping is not just confined to breakfast skipping but also on the

overall irregularity of meal intake, which as a consequence may induce poor health. In fact, irregular meals have been reported to be possibly associated with risk factors of metabolic syndrome (Sierra-Johnson *et al.*, 2008), which is not an exception in children from a long term perspective as low meal frequencies in childhood predicts low meal frequencies in late adolescence and adulthood (Pedersen *et al.*, 2013).

The dietary behaviors of mothers are part of the food environment that children are exposed to, which may influence their eating habits directly or indirectly. Some of the direct measures may be through parental control through restricting food intake or verbal pressure to eat (Brown and Ogden, 2004, Birch *et al.*, 2001). However, some of the indirect cues are believed to be embedded in children's observed learning of parents' actions of intake that result from repeated exposure of situations that make availability and access of certain foods more common and familiar to children than other foods. In fact, foods available at home are suggested to often reflect parents' food preferences (Birch and Fisher, 1998). The precise mechanism of children's intake induced by maternal dietary behaviors is not fully understood because of the multiple personal, behavioral, and socio-

environmental factors (Neumark-Sztainer *et al.*, 2003) that shape family meal structures, parenting style, and general home eating patterns (Golan *et al.*, 2004) that thus give a unique food identity at the individual and household level.

III. METHODS

1. Study subjects and general characteristics

This study was based on data from the Korean National Health and Nutrition Examination Survey (KNHANES) (2007 to 2010), which was a cross-sectional and nationally represented survey carried out by the Korean Centers for Disease Control and Prevention (KCDC, 2010). Among eligible subjects who had dietary data, all subjects with missing data on family-related variables (i.e. household ID) were first excluded. Subjects were further excluded if total caloric intake was less than 500kcal or higher than 5000kcal to avoid individuals with implausible intake; if they had a history of diagnosis or treatment of hypertension, hyperlipidemia or diabetes; and if they had any missing anthropometric and socio-demographic data. Among eligible subjects, women were matched with only their eldest child, which led to further elimination of children if mothers happened to have more than one child. As shown in figure 1, the total subject match for every child with his/her respective mother was 2,585 pairs.

The socio-demographic data were self-reported in the general questionnaire. In mothers, the educational level was determined by three categories based on their graduation status; elementary or junior high school, high school, and college education or higher. Household income was asked through four quartiles that represented, low, low-middle, upper-middle, and high class and their employment status was indicated as 'yes' or 'no'. Weight status was determined using BMI based on the cut-off points for underweight, normal, and overweight or obese set at <18.5, 18.5-23, and ≥23kg/m^2 respectively, which is slightly different from the WHO BMI classification. Whereas in children, sex specific BMI-for-age in the growth chart for Korean children (Moon *et al.*, 2008) was used as reference. BMI-for-age percentile with cut-off criteria was established at <5 and ≥85 percentiles to observe for underweight, normal and overweight distributions.

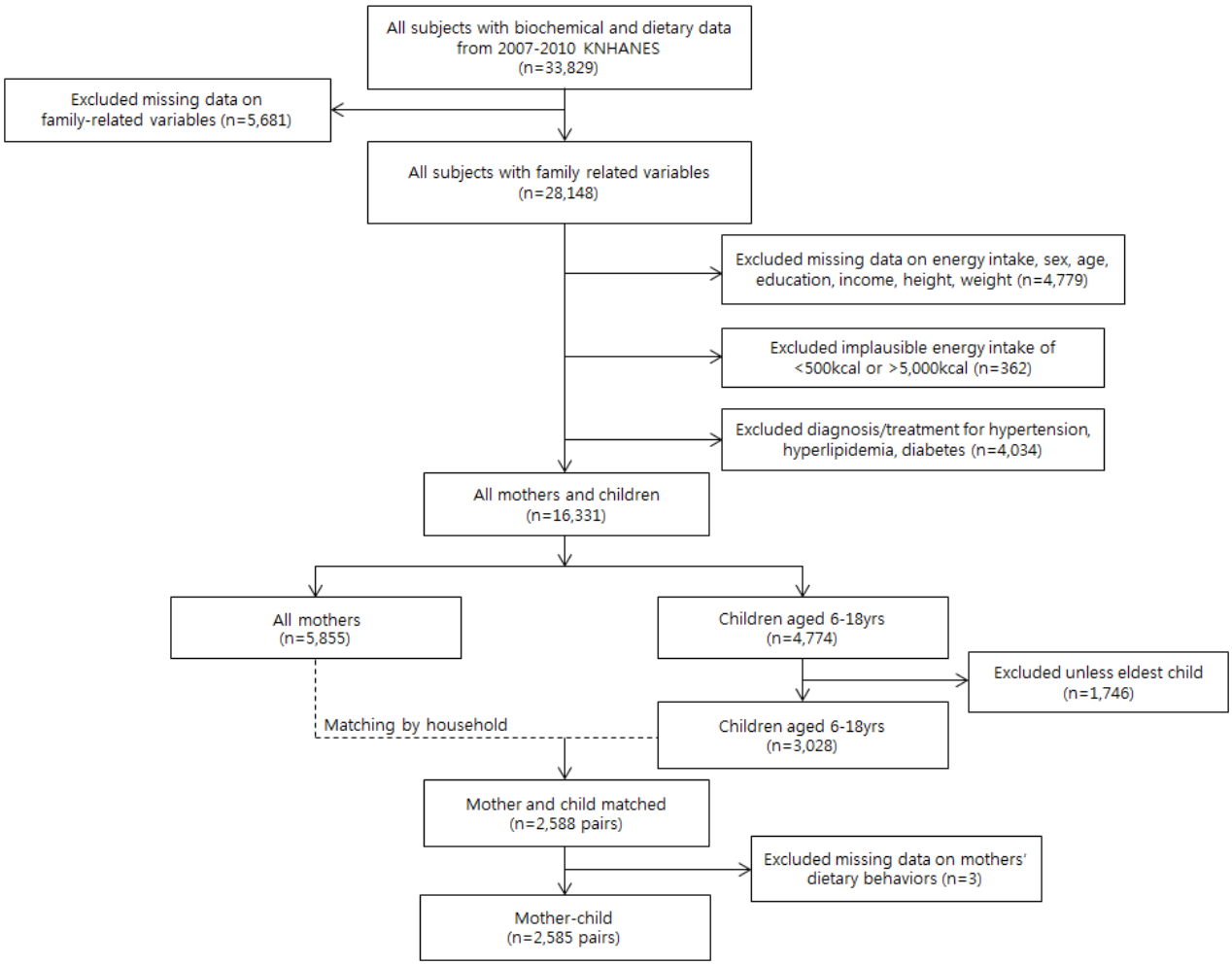

Figure 1. Flow diagram illustrating selection of subjects.

2. Dietary assessment

The Korean National Health and Nutrition Examination Survey (KNHANES) used for this study is a nationally representative and cross-sectional survey that has employed a stratified, multistage probability sampling design. The population-based survey is divided into general health, health examination, and dietary survey, of which the latter consists of participants' general questionnaire, 24-hour recall data and food frequency questionnaire. Subjects were selected from KNHANES IV (2007-2009) and part of KNHANES V (2010) to conduct this study (KCDC, 2009, KCDC, 2010). As KNHANES is an annually conducted survey, there are revisions of interview questions and response options for the purpose of improving the quality of the survey. Since eating-out frequency, regularity of family meals, family breakfast status and meal skipping status are the four dietary behaviors that are focused in this study, few adjustments had to be made to account for necessary changes in the variables provided by the primary data source (discussed in page 15).

As for dietary intake assessment in this study, 24-hour recall data

from the dietary survey component of KNHANES was utilized for analysis of food groups and nutrients consumed by subjects as described below:

i) Intake of food groups

To evaluate children's nutritional status, the mean servings of food groups consumed by children were compared between mothers' eating behavior pattern (how this independent variable was determined is explained in page 15). The food groups in this study were based on the Food Guidance System (FGS) established by the Dietary Reference Intakes for Koreans, which is composed of the following six food groups; 1) Grains, 2) Meat, Fish, Eggs, and Beans, 3) Vegetables, 4) Fruits, 5) Milk and Dairy products, and 6) Oils, Fats, and Sugars (The Korean Nutrition Society, 2010). Due to variations in estimated energy requirement across sex and age group, the FGS, having taken such difference into account, provides recommended serving sizes for each food group. Therefore, the different servings recommended for each food group in children and mothers were accounted for in the data

analysis step of this study.

ii) Intake of nutrients

Nutrient intakes in children were also compared between mothers' eating behavior patterns after converting all 24-hour recall data to usual intake in order to adjust for within-person variations. In reference to Kim et al's study, the absolute nutrient values from one day intake for each child were converted to usual intakes using C-SIDE (Software for Intake Distribution Estimation) developed by the Center for Survey Statistics and Methodology of Iowa State University (version 1.02, 1996) (Kim *et al.*, 2011). To assess the risk of nutrient deficiency, the percentage of children consuming nutrients below the EAR was compared between mothers' eating behavior patterns.

3. Determining eating behavior patterns of mothers

Dietary behaviors of mothers were obtained from the general questionnaire component of the dietary survey. Mothers' frequency of eating-out was assessed by the question "In the past year, how often did you eat-out (including delivery food, take-out food, school meals, etc)?" KNHANES IV had predefined categories of responses including "≥3/day," "1/day," "1-6/week," "1-3/month," and "≤1/day" while KNHANES V responses were "≥2/day," "1/day," "5-6/week," "3-4/week," "1-2/week," "1-3/month," and "≤1/day." These responses were combined and largely re-grouped as, "1≤/week" (more than once a week) and "≤3/month" (three times or less a month) for this study.

Question on family meals required multiple answers because of different mealtimes in a day. Both KNHANES IV and V assessed family meals with the question "In the past year, did you regularly have meals with your family (one or more family members)?" This question was asked for breakfast, lunch, and dinner respectively, of which response options were "Yes" and "No." Subjects answered

“Yes” if family meals were consumed for four or more days on average on a weekly basis. The questions asking for family intake of breakfast, lunch and dinner by KNHANES were combined into one dietary behavior because this study seeks to observe the overall family meal intake. Therefore, to assess family meal frequency, the responses for each meal (breakfast, lunch, dinner) that mothers answered were classified in a way that where mothers responded “Yes” to at least two of any breakfast, lunch and dinner were categorized as “≥2/day” and those that answered “No” to at least two in any of the aforementioned meals were categorized into the “≤1/day” group. The family breakfast variable was also separately observed in this study based on the “Yes” and “No” responses.

Mothers’ meal skipping status was determined in a similar manner as the question on family meal frequency. Both KNHANES had questions concerning meal skipping status divided into six compartments that required “Yes” or “No” answers on whether breakfast, lunch, or dinner had been skipped two days before being administered the survey. The same question was asked for one day prior to filling out the survey. These six different questions were

combined into one new variable so that the overall meal skipping status of mothers could be determined. Mothers who indicated having skipped at least one meal in the past one or two days were defined as meal skippers in this study.

Once mothers were regrouped as explained earlier using their responses for each dietary behavior, the four dietary behaviors were combined together to create a new variable by the name *eating behavior patterns,* which consist of mothers following a *healthy pattern* and an *unhealthy pattern*. To determine which eating behavior patterns are practiced by mothers, 'Desirable (D)' and 'Undesirable (U)' indicators were first assigned to mothers depending on the type of dietary behaviors they followed (Table 1). Mothers who stated as eating-out less often, not skipping any meals, having regular breakfast with their family or having frequent family meals were regarded as having a desirable dietary behavior, whereas responses that were contrary to the aforementioned were regarded as undesirable. From the D and U coded responses of dietary behaviors, a total of 16 different combinations of mothers were possible. From these combinations, mothers were finally categorized into two groups with

respect to the frequency of desirable indicators per combination – mothers were defined as followers of either healthy pattern or unhealthy pattern. Assigning combinations of mothers into respective eating behavior patterns was achieved in a way that a fairly balanced proportion of subjects, whom with as many desirable indicators of dietary behaviors represent the healthy pattern (3 or more desirable dietary behaviors) while those with relatively fewer desirable indicators of dietary behavior responses are grouped into the comparatively less healthy, unhealthy pattern (2 or less desirable dietary behaviors).

Table 1. Classification of mothers' eating behavior patterns using their dietary behaviors responses

Dietary behaviors	n (%)	Desirable (D) or Undesirable (U)
Eating-out		
≤ 3 times/month	1,485 (57.4)	D
≥ 1 time/week	1,100 (42.6)	U
Meal skipping		
Yes	818 (31.6)	U
No	1,767 (68.4)	D
Family meals		
More than twice/day	935 (36.2)	D
Once or less/day	1,650 (63.8)	U
Breakfast with family		
Yes	1,734 (67.1)	D
No	851 (32.9)	U
Frequency of 'Desirable (D)' indicator:		
4	581 (22.5)	Healthy pattern
3	895 (34.6)	
2	412 (15.9)	Unhealthy pattern
1	418 (16.2)	
0	279 (10.8)	
Total (Healthy+Unhealthy)	2,585 (100)	

4. Children's dietary intake

Recommended servings of food groups and amount of nutrients suggested by the Dietary Reference Intakes for Koreans vary in children by age group and sex in order to meet the body's energy and nutrient requirement that comes with growth and development. Therefore, the children sampled for this study were inspected for any significant difference in dietary intakes by sex and age group; 6-11years (younger age group) and 12-18years (older age group). This step was necessary to determine if dietary intakes of children need be stratified by sex and age group when analyzed by mothers' eating behavior patterns.

5. Statistical analysis

All general characteristics such as socio-demographic data, dietary behavior distributions, and nutrients intakes below EAR were analyzed by chi-square tests in mothers and children. The mean intakes of food groups and daily nutrients among mothers and children compared between mothers' individual dietary behaviors and eating behavior patterns were analyzed by Generalized Linear Model (GLM) adjusted for children's age, mothers' age, education level, and employment status. Mothers' mean intakes were also analyzed by GLM with the same covariates adjusted but not for children's age. When simply comparing daily nutrient intake between different dataset sources in children (Table 4), T-test was used without adjusting any variables. In this study, the level of significance was determined at α=0.05 for all statistical analyses performed by using the Statistical Analysis System (SAS, version 9.3, Cary, NC, USA).

IV. RESULTS

1. Comparing general characteristics between subjects: Sampled vs Original

i) Mothers

Table 2 compared the distribution of subjects' socio-demographic and dietary behaviors between mothers sampled (n=2,585) for this study and women aged 19 and above coming from the bigger pool of sample from the same dataset of KNHANES whose data such as implausibly high or low energy intakes and medical condition statuses were not eliminated regardless of marital or children status (n=8,419). Apart from employment status, significant differences were observed in all socio-demographic and dietary behavior components; the sampled mothers were relatively younger, had higher education level, higher household income, less overweight, ate out more often, had more regular family meals, more likely to have breakfast with the family and not skip meals compared to women from the original dataset.

Table 2. Comparing socio-demographic and dietary behaviors between mothers and female subjects from KNHANES (2007-10)

	Mothers in this study (n=2,585)	Women in KNHANES (n=8,419)	p[a]
	n (%)	n (%)	
Age			
25-39 yr	1352 (52.3)	3448 (41)	<0.001
40-62	1233 (47.7)	4971 (59)	
Education level (graduated)			
Elementary/Junior high	241 (9.3)	2489 (29.6)	
High school	1391 (53.8)	3286 (39)	<0.001
College and above	953 (36.9)	2644 (31.4)	
Household Income			
<25th percentile	154 (6.0)	883 (10.5)	
25-50th percentile	620 (24.0)	2167 (25.7)	<0.001
50-75th percentile	8998 (34.7)	2657 (31.6)	
>75th percentile	913 (35.3)	2712 (32.2)	
Employment status*			
Yes	1324 (51.3)	4422 (52.7)	0.228
No	1255 (48.7)	3970 (47.3)	
BMI status			
Underweight (<18.5 kg/m^2)	131 (5.1)	449 (5.3)	
Normal (18.5-<23)	13813 (53.4)	3900 (46.3)	<0.001
Overweight, obese (≥23)	1073 (41.5)	4070 (48.3)	
Eating-out			
≥1/week	1485 (57.5)	4641 (55.1)	0.038
≤3/month	1100 (42.5)	3778 (44.9)	
Meal with family			
Once or none/day	935 (36.2)	3632 (43.1)	<0.001
Twice or more/day	1650 (63.8)	4787 (56.9)	
Breakfast with family			
Yes	1734 (67.1)	5122 (60.8)	<0.001
No	851 (32.9)	3297 (39.2)	
Meal skipping			
Yes	818 (31.6)	2943 (35)	0.002
No	1767 (68.4)	5476 (65)	

*n=6 missing in sampled data, n=27 missing in original KNHANES data.
[a] χ^2 test. Statistically different: P<0.05.

ii) Children

The children in table 3 showed that there were more of younger children (6-11years) among the sampled subjects. The dataset that the children were sampled from included those with or without medical conditions and all energy intakes. However, other socio-demographic data and dietary behaviors did not show statistically significant differences between the two datasets (Table 3). As one of the main interests of this study is to observe children's intake, the daily nutrients consumed were also compared (Table 4), which showed statistically significant differences in all macro- and micro-nutrients. The sampled children had higher iron, sodium, potassium and most vitamin nutrients of greater intake in comparison to the children of the bigger pool that they were sampled from.

Table 3. Comparing socio-demographic and dietary behaviors between children from different dataset sources of KNHANES (2007-10)

	Children in this study (n=2,585)	Children in KNHANES (n=5,477)	p[a]
	n (%)	n (%)	
Age			
6-11 yr	1257 (48.6)	2984 (54.5)	<0.001
12-18	1328 (51.4)	2493 (45.5)	
Sex			
Male	1304 (50.4)	2868 (52.4)	0.107
Female	1281 (49.6)	2609 (47.6)	
BMI status			
Underweight	149 (5.8)	308 (5.6)	
Normal	1965 (76)	4143 (75.6)	0.843
Overweight, obese	471 (18.2)	1026 (18.7)	
Eating-out			
≥1/week	2536 (98.1)	5366 (98)	0.964
≤3/month	49 (1.9)	111 (2)	
Meal with family			
Once or none/day	962 (37.2)	1932 (35.3)	0.090
Twice or more/day	1623 (62.8)	3545 (64.7)	
Breakfast with family			
Yes	1855 (71.8)	3962 (72.3)	0.590
No	730 (28.2)	1515 (27.7)	
Meal skipping			
Yes	741 (28.7)	1615 (29.5)	0.450
No	1844 (71.3)	3862 (70.5)	

[a] χ^2 test. Statistically different: P<0.05.

Table 4. Comparing daily nutrient intakes between children from different dataset sources of KNHANES (2007−10)

	Children in this study (n=2,585)	Children in KNHANES (n=5,477)	p[a]
	Mean±SD	Mean±SD	
Total energy(kcal)	1698±588.1	1849±735.7	<0.001
Carbohydrate(g)	285.6±103.8	295±114.4	0.002
Protein(g)	61.2±26.8	65.3±31.5	<0.001
Fat(g)	34.3±21.5	45.3±28.3	<0.001
Calcium(mg)	451.1±274	485.3±303.2	<0.001
Phosphorous(mg)	1036.4±401.7	1074.8±449.6	0.001
Iron(mg)	13.2±8.5	11.2±8.3	<0.001
Sodium(mg)	4530.3±2983.1	3634.1±2101	<0.001
Potassium(mg)	2830.4±1309.1	2398.1±1129.2	<0.001
Vitamin A(μg RE)	797±823.7	644.89±925.4	<0.001
Thiamin(mg)	1.1±0.6	1.3±0.7	<0.001
Riboflavin(mg)	1.1±0.3	1.2±0.6	<0.001
Niacin(mg NE)	14.4±6.8	13.8±7.3	0.002
Vitamin C(mg)	108.1±102.4	84.9±91.9	<0.001
Percent of Energy			
Carbohydrate(%)	67.8±11.1	64.6±9.3	<0.001
Protein(%)	14.4±3.8	14.1±3.5	0.004
Fat(%)	17.8±7.7	21.3±7.6	<0.001

[a]T−test. Significantly different: P<0.05.

2. Mothers' dietary behavior on children' intake

Before looking at children's dietary intakes by mothers' eating behavior patterns, the dietary behaviors that constitute the eating behavior patterns of mothers were individually analyzed to observe for associations with children's intake after adjusting for children's age.

i) Eating-out frequency

Intake of oils·fats·sugars was significantly higher in children when mothers ate out often, which was defined by more than once a week, compared to mothers that ate out three times or less in a month (Table 5). In other food groups, children consumed similar servings regardless of mothers' eating-out frequency. No statistical difference between mothers' eating-out subgroups was observed with regard to percentage of children consuming nutrients below EAR.

ii) Family meal frequency

Children whose mothers had regular family meals (at least twice a day) had higher grains and vegetables in their diet compared to those whose mothers had just one or even no meal with the family (Table 6). As for nutrient intake, children whose intakes were below EAR were significantly lower when mothers had more regular family meals.

iii) Family breakfast status

The higher intake of food groups in children whose mothers were family breakfast eaters were observed in grains, meat·fish·eggs·beans, vegetables and fruits (Table 7). Iron, vitamin A, thiamin, riboflavin and vitamin C nutrient intakes that were below EAR were significantly lower among children whose mothers ate breakfast with their family.

iv) Meal skipping status

Children whose mothers had not skipped any meals in the last two days before being administered the survey had significantly higher

intakes of grains, vegetables, and fruits but lower oils·fats·sugars than in children whose mothers that skipped meals (Table 8). However, a statistically significant difference between nutrient intake distributions by EAR was not observed.

Table 5. Children's intake of food groups and nutrients by mothers' eating-out frequency

	Mothers' eating-out frequency				
	≥1/week (*n*=1,485)		≤3/month (*n*=1,100)		
	Mean±SD	%[a]	Mean±SD	%	*p*
Food group					
Grains (servings)	3.22±1.3	103	3.16±1.3	101.50	0.121[c]
Meat, Fish, Eggs, Beans	3.46±2.5	89.4	3.31±2.3	86.10	0.067
Vegetables	5.59±3.9	93.9	5.65±4.3	94.60	0.898
Fruits	1.59±2.5	123.9	1.52±1.5	116.10	0.561
Milk & Dairy products	1.12±1.2	56.2	1.04±1.1	52.00	0.109
Oils, Fats & Sugars	5.85±5.1	150.2	5.41±5.1	137.90	0.011
	n	%[b]	n	%	
Usual intake					
Calcium	1236	83.2	914	83.1	0.924[d]
Phosphorous	135	9.1	98	8.9	0.873
Iron	561	37.8	405	36.8	0.618
Vitamin A	333	22.4	274	24.9	0.141
Thiamin	189	12.7	132	12	0.579
Riboflavin	391	26.3	307	27.9	0.371
Niacin	291	19.6	223	20.3	0.670
Vitamin C	488	32.9	339	30.8	0.271

[a]Percent of intakes were compared to the recommended serving.

[b]Percent of subjects <EAR.

[c]Food group intakes (serving) were compared by GLM analysis adjusted for children's age.

[d]Usual intake <EAR by chi-square test.

Table 6. Children's intake of food groups and nutrients by mothers' family meal frequency

	Mothers' family meal frequency				
	≤1/day (*n*=935)		≥2/day (*n*=1,650)		
	Mean±SD	%[a]	Mean±SD	%	*p*
Food group					
Grains (servings)	3.19±1.3	99.2	3.2±1.3	104.2	0.022[c]
Meat, Fish, Eggs & Beans	3.37±2.4	82.2	3.4±2.3	91.3	0.105
Vegetables	5.49±4.2	88.3	5.68±4	97.5	0.012
Fruits	1.4±2.3	100.9	1.65±2.6	131.7	0.069
Milk & Dairy products	1.08±1.2	54.2	1.09±1.1	54.5	0.305
Oils, Fats & Sugars	6.1±5.6	147.4	5.42±4.8	143.5	0.167
	n	%[b]	n	%	
Usual intake					
Calcium	781	83.5	1369	83	0.715[d]
Phosphorous	100	10.7	133	8.1	0.025
Iron	391	41.8	575	34.9	0.004
Vitamin A	253	27.1	354	21.5	0.001
Thiamin	139	14.9	182	11	0.005
Riboflavin	298	31.9	400	24.2	<0.001
Niacin	225	24.1	289	17.5	<0.001
Vitamin C	331	35.4	496	30.1	0.005

[a]Percent of intakes were compared to the recommended serving.

[b]Percent of subjects <EAR.

[c]Food group intakes (serving) were compared by GLM analysis adjusted for children's age.

[d]Usual intake <EAR by chi-square test.

Table 7. Children's intake of food groups and nutrients by mothers' family breakfast status

	Mothers' family breakfast status				
	Yes (*n*=1,734)		No (*n*=851)		
	Mean±SD	%[a]	Mean±SD	%	*p*
Food group					
Grains (servings)	3.22±1.3	104.2	3.15±1.3	98.6	0.007[c]
Meat, Fish, Eggs & Beans	3.44±2.3	91.1	3.3±2.5	81.7	0.021
Vegetables	5.73±4.1	97.6	5.4±4.2	87.2	0.003
Fruits	1.65±2.6	129.7	1.4±2.3	102	0.023
Milk & Dairy products	1.09±1.2	54.5	1.09±1.2	54.3	0.499
Oils, Fats & Sugars	5.5±4.9	143.9	6±5.5	147.1	0.278
	n	%[b]	n	%	
Usual intake					
Calcium	1440	83	710	83	0.805[d]
Phosphorous	144	8.3	89	10.5	0.072
Iron	622	35.9	344	40.4	0.025
Vitamin A	382	22	225	26.4	0.013
Thiamin	198	11.4	123	14.5	0.028
Riboflavin	442	25.5	256	30.1	0.014
Niacin	541	31.2	286	33.6	0.217
Vitamin C	319	18.4	195	22.9	0.007

[a]Percent of intakes were compared to the recommended serving.

[b]Percent of subjects <EAR.

[c]Food group intakes (serving) were compared by GLM analysis adjusted for children's age.

[d]Usual intake <EAR by chi-square test.

Table 8. Children's intake of food groups and nutrients by mothers' meal skipping status

	Mothers' meal skipping status				
	Yes (*n*=818)		No (*n*=1,767)		
	Mean±SD	%[a]	Mean±SD	%	*p*
Food group					
Grains (servings)	3.07±1.4	97.5	3.25±1.3	104.6	0.002[c]
Meat, Fish, Eggs & Beans	3.34±2.6	85.5	3.42±2.3	89.2	0.279
Vegetables	5.24±4	86.5	5.78±4.1	97.7	0.006
Fruits	1.3±2.3	99.9	1.68±2.6	130.2	0.007
Milk & Dairy products	1.11±1.2	55.5	1.09±1.1	53.9	0.381
Oils, Fats & Sugars	6.1±5.5	153.8	5.47±4.9	140.8	0.010
	n	%[b]	n	%	
Usual intake					
Calcium	675	82.5	147	83.5	0.546[d]
Phosphorous	78	9.5	155	8.8	0.528
Iron	303	37.0	663	37.5	0.815
Vitamin A	190	23.2	417	23.6	0.836
Thiamin	107	13.1	214	12.1	0.487
Riboflavin	213	26.0	485	27.5	0.453
Niacin	171	20.9	343	19.4	0.376
Vitamin C	266	32.5	561	31.8	0.696

[a]Percent of intakes were compared to the recommended serving.

[b]Percent of subjects <EAR.

[c]Food group intakes (serving) were compared by GLM analysis adjusted for children's age.

[d]Usual intake <EAR by chi-square test.

3. Mothers' general characteristics and dietary intakes by their eating behavior patterns

Table 9 shows the general characteristics of mothers. The education level, employment status and age of mothers demonstrated some association with the type of eating behavior pattern followed – mothers that reported to be following a healthy pattern were more likely to have received college or higher education ($p=0.029$), be unemployed ($p<0.001$), and relatively younger ($p<0.001$) than mothers that followed an unhealthy pattern. However, a statistically significant difference between mothers' eating behavior patterns was not observed for BMI status or household income.

Table 10 and 11 shows mothers' food group intake and nutrient intake respectively when compared between eating behavior patterns as established earlier (refer to Table 1). Mothers with healthy pattern showed significantly greater intakes of grains, meat·fish·eggs·beans and vegetables compared to mothers of unhealthy pattern. Riboflavin was the only nutrient that showed significantly lower intake ($p<0.017$) in healthy pattern mothers although significantly fewer mothers

demonstrated to consume below EAR for this same nutrient when following a healthy pattern ($p<0.038$). However, other nutrients did not show significant intake differences between eating behavior patterns.

Table 9. General characteristics of mothers by their eating behavior patterns

	Healthy pattern n (%)	Unhealthy pattern n (%)	p^a
Age			
25−39 yr	824 (55.8)	528 (47.6)	<0.001
40−62	652 (44.2)	581 (52.4)	
Educational level			
Elementary/Junior high school	126 (8.5)	115 (10.4)	
High school	776 (52.6)	615 (55.4)	0.029
University or higher	574 (38.9)	379 (34.2)	
Household Income			
<25th percentile	79 (5.4)	75 (6.8)	
25−50th	371 (25.1)	249 (22.4)	0.243
50−75th	510 (35.6)	388 (35)	
>75th	516 (34.9)	397 (35.8)	
BMI status			
<18.5 (kg/m^2)	76 (5.1)	55 (5)	
18.5−<23	795 (53.8)	586 (52.8)	0.822
≥23	605 (41)	468 (42.2)	
Employment status*			
Yes	665 (45.2)	659 (59.5)	<0.001
No	807 (54.8)	448 (40.5)	

[a] χ^2 test. Statistically different: $P<0.05$.

*n=6 missing

Table 10. Mothers' food group intake by their eating behavior patterns

	Healthy pattern (*n*=1,476)		Unhealthy pattern (*n*=1,109)		
	Mean±SD	%[a]	Mean±SD	%	*p*[b]
Grains (servings)	3.04±1.2	101.2	2.59±1.2	86.4	<0.001
Meat, Fish, Eggs & Beans	3.36±2.4	84.1	3.06±2.3	76.4	0.001
Vegetables	8.39±4.9	119.9	7.26±5.1	103.8	<0.001
Fruits	2.18±3.1	109.1	1.94±2.8	97	0.072
Milk & Dairy products	0.38±0.7	38.4	0.41±0.75	40.7	0.354
Oils, Fats & Sugars	4.45±3.4	111.4	4.65±3.9	116.2	0.125

[a]Percent of intakes were compared to the recommended serving.

[b]Food group intakes (serving) were compared between eating patterns by GLM analysis adjusted for mothers' age, education level, and employment status.

Table 11. Mothers' nutrient intake by their eating behavior patterns

	Healthy pattern (n=1,476)		Unhealthy pattern (n=1,109)			
	Mean±SD	%<EAR	Mean±SD	%<EAR	p[b]	p[c]
Energy(kcal)[a]	1718.7±366.2	-	1697.7±367.7	-	0.2035	-
Carbohydrate(g)	289.1±67.2	-	285.6±67.1	-	0.2688	-
Protein(g)	62.3±17	-	61.5±17.5	-	0.2992	-
Fat(g)	35.4±14.5	-	34.9±14.5	-	0.3831	-
Calcium(mg)	465.5±170.2	67.1	455.4±164.5	69.3	0.1474	0.235
Phosphorous(mg)	1052.6±264.5	1.8	1036.1±264.1	2.2	0.1498	0.545
Iron(mg)	13.7±5.2	28.7	13.4±5.2	31	0.1675	0.207
Vitamin A(RE)	839.7±386.9	11.3	818.8±402.3	12.9	0.1924	0.221
Thiamin(mg)	1.17±0.34	21.5	818.8±402.3	21.6	0.4458	0.964
Riboflavin(mg)	1.12±0.35	41.2	1.16±0.33	45.3	0.0172	0.038
Niacin(mg)	14.7±4.1	22	1.08±0.35	24.4	0.1016	0.152
Vitamin C(mg)	113.52±50.3	18.2	109.9±48.3	19.9	0.0878	0.274

[a]All nutrient intakes were converted to usual intake using C-SIDE.

[b]Nutrient intakes were compared between healthy and unhealthy pattern by Generalized linear model adjusted for energy intake (except the energy model), mother's educational level, employment status, and age.

[c]Percent of mothers whose intake was below EAR was compared by chi-square test.

4. Children's dietary intake by age group and sex

i) Age group

In table 12, the younger age group of children was more likely to be overweight, eat out more often, have more regular family meals, have breakfast with family and not skip any meal compared to children of older age group. When adjusted for sex, servings of food groups as well as the percentage of servings consumed compared to the recommended serving were all significantly different between age groups (Table 13). However, significant difference in the actual amount of nutrients consumed was not noted (Table 14).

Table 12. Children's general characteristics and dietary behaviors by age group

	6−11 yr (*n*=1,257)	12−18 yr (*n*=1,328)	*p*[a]
	n (%)	n (%)	
Sex			
Male	628 (50)	676 (50.9)	0.632
Female	629 (50)	652 (49.1)	
BMI status			
Underweight	54 (4.3)	95 (7.1)	
Normal	960 (76.4)	1005 (75.7)	0.004
Overweight, obese	243 (19.3)	228 (17.2)	
Eating−out			
≥1/week	1242 (98.8)	1294 (97.4)	0.011
≤3/month	15 (1.2)	34 (2.6)	
Meal with family			
Once or none/day	183 (14.6)	779 (58.7)	<0.001
Twice or more/day	1074 (85.4)	549 (41.3)	
Breakfast with family			
Yes	1092 (86.9)	763 (57.5)	<0.001
No	165 (13.1)	565 (42.5)	
Meal skipping			
Yes	789 (15)	552 (41.6)	<0.001
No	1068 (85)	776 (58.4)	

[a] χ^2 test. Statistically different: $P<0.05$.

Table 13. Children's intake of food groups by age group

	6–11 yr (*n*=1,257)		12–18 yr (*n*=1,328)			
	Mean±SD	%[a]	Mean±SD	%	*p*[b]	*p*[c]
Grains (servings)	2.89±1.1	105.3	3.48±1.5	99.6	<0.001	0.003
Meat, Fish, Eggs & Beans	3.05±2	101.7	3.72±2.7	75.1	<0.001	<0.001
Vegetables	5.04±3.61	100.8	6.16±4.5	88	<0.001	<0.001
Fruits	1.75±2.6	175.3	1.38±2.4	68.8	0.001	<0.001
Milk & Dairy products	1.21±1.09	60.5	0.97±1.2	48.7	<0.001	<0.001
Oils, Fats & Sugars	4.56±4.04	152.1	6.71±5.79	138.1	<0.001	0.006

[a]Percent of intake compared to the recommended serving.

[b]Food group intake (serving) was compared between age group by GLM analysis adjusted for children's sex.

[c]Percent of recommended intake was compared between age group by GLM analysis adjusted for children's sex.

Table 14. Children's nutrient intake by age group

	6-11 yr (*n*=1,257)	12-18 yr (*n*=1,328)	*p*[a]
	Mean±SD	Mean±SD	
Total energy(kcal)	1901.5±477.5	1885.8±482.4	0.395
Carbohydrate(g)	303.5±77.4	301±78	0.641
Protein(g)	67.7±21.2	67.3±21.3	0.764
Fat(g)	47.2±17.8	46.9±17.8	0.832
Calcium(mg)	507.8±188.5	502.8±183.9	0.344
Phosphorous(mg)	1109.8±315.1	1105.1±310.7	0.762
Iron(mg)	12.2±6.2	12±5.9	0.435
Sodium(mg)	3783.4±1346.7	3731.2±1450.4	0.465
Potassium(mg)	2512.5±775.2	2503.7±797	0.716
Vitamin A(μg RE)	758.6±513.3	758.2±577.4	0.985
Thiamin(mg)	1.3±0.4	1.3±0.4	0.485
Riboflavin(mg)	1.3±0.4	1.3±0.4	0.957
Niacin(mg NE)	14.3±4.9	14.2±4.9	0.582
Vitamin C(mg)	93.4±49.7	92.8±51.6	0.717
Percent of Energy			
Carbohydrate(%)	64.2±7	64.1±6.7	0.949
Protein(%)	14.2±2.6	14.3±2.6	0.800
Fat(%)	22.1±5.3	22.2±5.2	0.737

[a]GLM analysis adjusted for children's sex and energy intake. Statistically different: $P<0.05$.

ii) Sex

Socio-demographic characteristics and dietary behaviors among children did not appear to show any significant difference when compared between sexes (Table 15). When children's age was adjusted, all food groups, except for milk and dairy products, showed that intakes were significantly different between sexes and that percentage of servings consumed compared to the recommended amounts also varied in most of the food groups (Table 16). As for nutrient intake, boys consumed significantly higher total energy intake, carbohydrate, iron and sodium than girls (Table 17).

Therefore, based on the age group and sex related differences observed in children's dietary intake, children's food group and daily nutrients consumed were stratified by sex and age group when comparing their dietary intakes between mothers' eating behavior patterns.

Table 15. Children's general characteristics and dietary behaviors by sex

	Boys (n=1,304)	Girls (n=1,281)	p[a]
	n (%)	n (%)	
Age group			
6−11	628 (48.2)	629 (49.1)	0.632
12−18	676 (51.8)	652 (50.9)	
BMI status			
Underweight	72 (5.5)	77 (6)	
Normal	973 (74.6)	992 (77.4)	0.089
Overweight, obese	259 (19.9)	212 (16.6)	
Eating−out			
≥1/week	1274 (97.7)	1262 (98.5)	0.128
≤3/month	30 (2.3)	19 (1.5)	
Meal with family			
Once or none/day	473 (36.3)	489 (38.2)	0.318
Twice or more/day	831 (63.7)	792 (61.8)	
Breakfast with family			
Yes	944 (72.4)	911 (71.1)	0.471
No	360 (27.6)	370 (28.9)	
Meal skipping			
Yes	357 (27.4)	384 (30.0)	0.144
No	947 (72.6)	897 (70.0)	

[a] χ^2 test. Statistically different: P<0.05.

Table 16. Children's intake of food groups by sex

	Boys (n=1,304)		Girls (n=1,281)			
	Mean±SD	%[a]	Mean±SD	%	p[b]	p[c]
Grains (servings)	3.5±1.4	99.9	2.88±1.2	104.9	<0.001	0.001
Meat, Fish, Eggs & Beans	3.78±2.5	89.9	2.99±2.2	86.1	<0.001	0.117
Vegetables	6.06±1.6	100.9	5.16±3.8	87.4	<0.001	<0.001
Fruits	1.57±2.7	123.3	1.54±2.4	117.8	0.759	0.508
Milk & Dairy products	1.18±1.3	58.9	0.99±1.1	49.8	<0.001	<0.001
Oils, Fats & Sugars	5.99±5.1	139.5	5.33±5.1	150.4	0.007	0.032

[a]Percent of intake compared to the recommended serving.

[b]Food group intake (serving) was compared between gender by GLM analysis adjusted for children's age.

[c]Percent of recommended intake was compared between gender by GLM analysis adjusted for children's age.

Table 17. Children's nutrient intake by sex

	Boys (n=1,304)	Girls (n=1,281)	p[a]
	Mean±SD	Mean±SD	
Total energy(kcal)	1913.4±484.5	1873±474.7	0.032
Carbohydrate(g)	305±78.3	299.3±77	0.031
Protein(g)	68.1±21.3	66.8±21.2	0.111
Fat(g)	47.7±17.9	46.4±17.6	0.051
Calcium(mg)	510±184.8	500.4±187.4	0.345
Phosphorous(mg)	1117.4±311.8	1097.2±313.6	0.100
Iron(mg)	12.4±6.3	11.8±5.7	0.015
Sodium(mg)	3808.1±1413.8	3704.1±1386.2	0.043
Potassium(mg)	2535±776.8	2480.5±795.3	0.106
Vitamin A(μg RE)	772±550	744.6±544	0.218
Thiamin(mg)	1.3±0.4	1.3±0.4	0.146
Riboflavin(mg)	1.3±0.4	1.3±0.4	0.383
Niacin(mg NE)	14.3±4.9	14.1±4.8	0.178
Vitamin C(mg)	93.8±50.2	92.3±51.1	0.487
Percent of Energy			
Carbohydrate(%)	64.1±6.8	64.2±6.9	0.626
Protein(%)	14.2±2.5	14.3±6.9	0.532
Fat(%)	22.2±5.2	22.1±5.3	0.513

[a]GLM analysis adjusted for children's age and energy intake. Statistically different: P<0.05.

5. Children's dietary intake by mothers' eating behavior patterns

The general characteristics of children in table 18 showed that mothers of healthy pattern tended to have children of the younger age group, have children who have regular family meals including breakfast, and also had children who were likely to not skip meals.

Table 18. General characteristics of children by mothers' eating behavior patterns

	Total (n=2,585)	Healthy pattern (n=1,476)	Unhealthy pattern (n=1,109)	
	n (%)	n (%)	n (%)	p[a]
Age (yr)				
6−11	1257 (48.6)	803 (63.9)	454 (36.1)	<0.001
12−18	1328 (51.4)	673 (50.7)	655 (49.3)	
Sex				
Male	1304 (50.4)	739 (50.1)	565 (50.9)	0.658
Female	1281 (49.6)	737 (49.9)	544 (49.1)	
BMI status				
Underweight	149 (5.8)	79 (5.4)	70 (6.3)	
Normal	1965 (76)	1123 (76.1)	842 (75.9)	0.539
Overweight, obese	471 (18.2)	274 (18.5)	197 (17.8)	
Eating−out				
≥1/week	2536 (98.1)	1443 (97.8)	1093 (98.6)	0.143
≤3/month	49 (1.9)	33 (2.2)	16 (1.4)	
Meal with family				
Once or none/day	962 (37.2)	374 (25.3)	588 (53.0)	<0.001
Twice or more/day	1623 (62.8)	1102 (74.7)	521 (47.0)	
Breakfast with family				
Yes	1855 (71.8)	1214 (82.3)	641 (57.8)	<0.001
No	730 (28.2)	262 (17.8)	468 (42.2)	
Meal skipping				
Yes	741 (28.7)	295 (20.0)	446 (40.2)	<0.001
No	1844 (71.3)	1181 (80.0)	663 (59.8)	

[a] χ^2 test. Statistically different: P<0.05.

i) Food groups

Intake pattern of food groups differed between sexes in the younger age group (6−11years) as presented in table 19. Younger boys appeared to consume more grains ($p<0.001$) and vegetables ($p<0.001$) when their mothers followed a healthy pattern compared to younger boys with mothers of unhealthy pattern. Although the intake of these two food groups showed to be positively associated in younger boys whose mothers followed a healthy pattern, no association could be drawn for older boys (older age group, 12−18years). Meanwhile, girls of older age group with mothers having healthy pattern were positively associated with intake of fruits ($p<0.028$) and negatively associated with oils·fats·sugars ($p<0.039$). Boys of the same age group did not appear to show any association with mothers' eating behavior patterns (Table 20).

Table 19. Food group intake of children aged 6−11yr by mothers' eating behavior patterns

	Healthy pattern (*n*=1,476)		Unhealthy pattern (*n*=1,109)		
	Mean±SD	%[a]	Mean±SD	%	*p*[b]
Boys (*n*=628)					
Grains (servings)	3.23±1.2	107.8	2.87±1.05	95.7	<0.001
Meat, Fish, Eggs & Beans	3.47±2.06	115.5	3.16±2.25	105.3	0.062
Vegetables	5.59±4.07	111.9	4.62±3.26	92.4	0.001
Fruits	1.9±2.77	189.8	1.78±2.8	177.3	0.587
Milk & Dairy products	1.26±1.14	63.1	1.32±1.13	66.2	0.533
Oils, Fats & Sugars	4.86±3.86	162.1	5.04±4.4	168.2	0.630
Girls (*n*=629)					
Grains (Serving)	2.68±0.94	107.3	2.69±1.1	107.5	0.687
Meat, Fish, Eggs & Beans	2.7±1.7	90.1	2.84±2.08	94.5	0.358
Vegetables	5.02±3.6	100.3	4.54±2.93	90.8	0.105
Fruits	1.79±2.63	179.4	1.39±2	139.3	0.080
Milk & Dairy products	1.1±1.05	55	1.19±1.05	59.7	0.233
Oils, Fats & Sugars	4.24±3.5	141.5	4.11±3.53	136.9	0.788

[a]Percent of intakes were compared to the recommended serving.

[b]Food group intakes (serving) were compared between healthy and unhealthy pattern by GLM analysis adjusted for mothers' age, educational level, employment status and children's age.

Table 20. Food group intake of children aged 12−18yr by mothers' eating behavior patterns

	Healthy pattern (*n*=1,476)		Unhealthy pattern (*n*=1,109)		
	Mean±SD	%[a]	Mean±SD	%	*p*[b]
Boys (*n*=676)					
Grains (serving)	3.89±1.54	97.3	3.84±1.52	96.1	0.896
Meat, Fish, Eggs & Beans	4.17±2.63	69.5	4.2±2.83	70	0.869
Vegetables	6.97±4.53	99.6	6.67±4.86	95.3	0.370
Fruits	1.49±2.74	74.7	1.13±2.29	56.7	0.241
Milk & Dairy products	1.05±1.32	52.7	1.1±1.36	55.1	0.522
Oils, Fats & Sugars	6.76±5.77	112.6	7.22±5.78	120.3	0.343
Girls (*n*=652)					
Grains (Serving)	3.12±1.27	104.1	3.03±1.28	101	0.443
Meat, Fish, Eggs & Beans	3.33±2.34	83.2	3.13±2.61	78.2	0.485
Vegetables	5.66±3.97	80.9	5.27±4.29	75.2	0.304
Fruits	1.66±2.56	82.9	1.21±1.99	60.7	0.028
Milk & Dairy products	0.86±1.06	42.9	0.87±1.13	43.7	0.481
Oils, Fats & Sugars	5.92±5.04	148.1	6.92±6.42	173.1	0.039

[a]Percent of intake compared to the recommended serving.

[b]Food group intake (serving) was compared between healthy and unhealthy pattern by GLM analysis adjusted for mothers' age, educational level, employment status and children's age.

ii) Nutrients

As observed in table 21, mothers with healthy pattern had sons in the younger age group whose protein ($p<0.031$), phosphorous ($p<0.004$) and riboflavin ($p<0.002$) intake was significantly lower than in boys with mothers of unhealthy pattern. Unlike the boys in the younger age group, significant results in usual intake of nutrients did not appear in either sex of older age group and in girls of younger age group. Children whose usual intakes were below EAR were presented in percent form for each micronutrient in tables 21 and 22. The larger the percent gets indicates a greater proportion of children with nutrient deficiencies. From the result, vitamin C ($p<0.041$) and niacin ($p<0.049$) were the only nutrients less than EAR in older boys whose mothers followed a healthy pattern that were significantly lower than boys whose mothers had an un healthy pattern (Table 22). A significantly greater proportion of boys had vitamin C and niacin intakes that did not meet EAR when their mothers followed an unhealthy pattern. Significant associations in usual intake of nutrients between mothers' healthy and unhealthy patterns were not observed in adolescent girls and younger aged children of both sexes.

Table 21.1 The nutrient intake of children aged 6−11yr by mothers' eating behavior patterns

	Healthy pattern (*n*=1,476)		Unhealthy pattern (*n*=1,109)			
	Mean±SD	%<EAR	Mean±SD	%<EAR	p^b	p^c
Boys (*n*=628)						
Energy(kcal)[a]	1906.7±480.1	−	1939.8±493.1	−	0.462	−
Carbohydrate(g)	304.4±77.4	−	309.1±80.9	−	0.840	−
Protein(g)	66.7±20.7	−	69.9±21.6	−	0.031	−
Fat(g)	47.3±17.3	−	48.3±18.3	−	0.838	−
Calcium(mg)	495.6±184.6	78.1	528.2±191.2	72.9	0.052	0.140
Phosphorous(mg)	1083.1±304.2	8.2	1156±333.5	7.2	0.004	0.664
Iron(mg)	12.3±6.3	16.3	12.7±6.1	16.5	0.724	0.948
Vitamin A(RE)	761.4±513	9.4	791.8±501.3	11.9	0.783	0.334
Thiamin(mg)	1.28±0.4	2.3	1.31±0.49	3.4	0.605	0.413
Riboflavin(mg)	1.23±0.39	14.5	1.33±0.47	9.8	0.002	0.081
Niacin(mg)	10.1±4.8	12.8	14.6±4.9	13.1	0.444	0.890
Vitamin C(mg)	89.7±44.7	6.4	98.3±52.5	5.1	0.092	0.505

[a]All nutrient intakes were converted to usual intake using C−SIDE.

[b]Nutrient intakes were compared between healthy and unhealthy pattern by GLM adjusted for energy intake (except the energy model), mother's educational level, employment status, age and children's age.

[c]Percent of people whose intake are below EAR is compared by chi−square test.

Table 21.2 The nutrient intake of children aged 6−11yr by mothers' eating behavior patterns

	Healthy pattern (*n*=1,476)		Unhealthy pattern (*n*=1,109)			
	Mean±SD	%<EAR	Mean±SD	%<EAR	p^b	p^c
Girls (*n*=629)						
Energy(kcal)	1902±482.1	−	1848.7±444.4	−	0.147	−
Carbohydrate(g)	304.2±79.2	−	294.3±69.3	−	0.413	−
Protein(g)	68.1±21.9	−	66.3±20.1	−	0.991	−
Fat(g)	47.2±18.3	−	45.7±16.9	−	0.880	−
Calcium(mg)	513.6±193.3	310 (75.4)	496.5±181.9	170 (78.0)	0.619	0.473
Phosphorous(mg)	1118.8±319.2	18 (4.4)	1090.8±301.4	14 (6.4)	0.869	0.267
Iron(mg)	12±6.2	69 (16.8)	11.9±6	31 (14.2)	0.623	0.402
Vitamin A(RE)	758.4±552.7	40 (9.7)	717.9±445.9	22 (10.1)	0.522	0.886
Thiamin(mg)	1.31±0.45	9 (2.2)	1.26±0.37	9 (4.1)	0.383	0.165
Riboflavin(mg)	1.27±0.39	31 (7.5)	1.27±0.43	16 (7.3)	0.346	0.927
Niacin(mg)	14.3±4.9	90 (21.9)	14±4.9	45 (20.6)	0.866	0.715
Vitamin C(mg)	94.4±51.6	29 (7.1)	92.8±51.1	17 (7.8)	0.888	0.734

[a]All nutrient intakes were converted to usual intake using C−SIDE.

[b]Nutrient intakes were compared between healthy and unhealthy pattern by GLM adjusted for energy intake (except the energy model), mother's educational level, employment status, age and children's age.

[c]Percent of people whose intake are below EAR is compared by chi−square test.

Table 22.1 The nutrient intake of children aged 12−18yr by mothers' eating behavior patterns

	Healthy pattern (*n*=1,476)		Unhealthy pattern (*n*=1,109)			
	Mean±SD	%<EAR	Mean±SD	%<EAR	p^b	p^c
Boys (*n*=628)						
Energy(kcal)[a]	1937±497.5	−	1877.8±469.1	−	0.150	−
Carbohydrate(g)	307.2±75.6	−	300.5±80.3	−	0.526	−
Protein(g)	69.4±22.7	−	67±20.1	−	0.779	−
Fat(g)	48.8±20.1	−	46.7±15.7	−	0.780	−
Calcium(mg)	516.5±186.1	91.1	507.3±178.3	92.4	0.905	0.529
Phosphorous(mg)	1138.2±308	15.3	1108.6±305.3	19.8	0.931	0.125
Iron(mg)	12.1±6.2	56.5	12.6±6.6	55.6	0.051	0.822
Vitamin A(RE)	777.3±598.3	43.8	764.8±574.4	42.6	0.608	0.743
Thiamin(mg)	1.35±0.47	25.4	1.31±0.43	25.50	0.968	0.959
Riboflavin(mg)	1.3±0.41	54.5	1.29±0.42	55.60	0.383	0.763
Vitamin C(mg)	14.8±5.1	43.2	14.1±4.7	50.8	0.430	0.049
Niacin(mg)	96±49.7	32	93.2±55	39.5	0.969	0.041

[a]All nutrient intakes were converted to usual intake using C−SIDE.

[b]Nutrient intakes were compared between healthy and unhealthy pattern by GLM adjusted for energy intake (except the energy model), mother's educational level, employment status, age and children's age.

[c]Percent of people whose intake was below EAR was compared by chi−square test.

Table 22.2 The nutrient intake of children aged 12–18yr by mothers' eating behavior patterns

	Healthy pattern (n=1,476)		Unhealthy pattern (n=1,109)			
	Mean±SD	%<EAR	Mean±SD	%<EAR	p^b	p^c
Girls (n=629)						
Energy(kcal)	1897.1±490.4	–	1828±466.7	–	0.091	–
Carbohydrate(g)	303.8±83.1	–	292.1±72.2	–	0.713	–
Protein(g)	67.4±21.7	–	65.2±20.3	–	0.891	–
Fat(g)	46.8±16.5	–	45.4±18.3	–	0.515	–
Calcium(mg)	497.4±187.7	88	489.3±183	87.4	0.713	0.811
Phosphorous(mg)	1099.6±316.9	4	1071.8±310.5	6.4	0.624	0.159
Iron(mg)	11.7±5.5	57.4	11.7±5.2	60.4	0.160	0.426
Vitamin A(RE)	759.6±614.3	29.1	729.9±517.5	28.5	0.863	0.863
Thiamin(mg)	1.3±0.42	16	1.25±0.44	19	0.642	0.303
Riboflavin(mg)	1.29±0.47	28.5	1.21±0.4	32.5	0.105	0.269
Vitamin C(mg)	14.1±4.8	46.3	13.7±4.7	43.9	0.942	0.529
Niacin(mg)	90.5±51.9	27.3	91.2±49.8	31	0.543	0.301

[a]All nutrient intakes were converted to usual intake using C-SIDE.

[b]Nutrient intakes were compared between healthy and unhealthy pattern by GLM adjusted for energy intake (except the energy model), mother's educational level, employment status, age and children's age.

[c]Percent of people whose intake was below EAR was compared by chi-square test.

V. DISCUSSION

Results from this study that showed significantly higher intake of vegetables and grains in children whose mothers had regular family meals, and higher vegetables and fruits in children whose mothers had frequent breakfast with the family, shows consistency with similar studies that also observed higher intake for those same food groups. Although most studies have associated family meals with increase in calcium-rich foods, the intake of calcium or milk and dairy product intakes did not seem to shift in children sampled for this study. A reasonable explanation to the high calcium intake distribution below EAR compared to other nutrients (>70% and >80% in younger and older age groups respectively) is reflected from very low servings of milk and dairy products as shown by food group intake results. In fact, the Korea Health Statistics reported that vegetables are the main source of calcium in Koreans' diet (KCDC, 2008), which demonstrates the high deficiency prevalence of the nutrient. Very low intake level of calcium has consistently been reported in Korean population for decades, which is a health concern since younger populations require adequate calcium stores for optimal peak bone mass to avert the risk of osteoporosis in adulthood (Story and Stang, 2005). Arcan et al

reported that parental dairy intakes predict the intake of dairy foods in daughters (Arcan *et al.*, 2007), and that frequent family breakfast was associated with increased milk products in adolescents' diet (Larson *et al.*, 2013), which implicates that parents' dairy consumption reinforced by positive dietary behaviors are important to improve calcium status in children.

When children's dietary intake was compared between mothers' eating-out frequencies, eating-out frequency seemed to be the least effective predictor of children's intake relative to the other dietary behaviors of interest in this study. Contrary to expectation that undesirable eating-out behaviors, in this case referring to regular eating-out behaviors, would induce more negative dietary intakes in children, intake of food groups such as grains, vegetables and fruits were shown to be meeting the recommended servings regardless of how frequent mothers ate away from home. Other than oils·fats·sugars, none of the food groups or nutrient distribution below EAR showed significant results. An explanation to this phenomenon is attributable to the nature of the food place accessed; although frequent dining out especially in regard to fast food has been reported to be associated with several negative health consequences (Bahadoran *et al.*, 2013, Pereira *et al.*, 2005), the utilization of full-service restaurants are

suggested to improve the intakes of vegetables (Larson *et al.*, 2013). Therefore, rather than the mere frequency of eating away from home that mothers practice, the type of restaurants children are often exposed to when accompanied by mothers may be a more precise method of measuring children's dietary intake.

Higher intake of fruits and lower intake of oils·fats·sugars in adolescent girls (older age group) and higher intake of grains and vegetables but lower protein, phosphorous and riboflavin intake in younger boys whose mothers had a healthy pattern was observed from the results. The relatively lower protein, phosphorous and riboflavin consumed in boys whose mothers followed a healthy pattern is suggested to be not a nutritional concern because percentage of energy derived from protein was 14%, which is within range of KDRI recommendation, and phosphorous and riboflavin intake were only slighter greater than recommended amounts (1,000mg and about 1mg respectively).

Based on findings of this study, there is no clear explanation to why boys of younger age group were particularly influenced by their mothers' eating behavior patterns while girls of the same age group

were not. A study by Hursti and Sjödén showed that younger boys tend to be pickier with food compared to girls or children of older age groups (Hursti and Sjödén, 1997). If this were a similar problem in the subjects of this study, the possibility of mothers' act of monitoring their sons to improve their food intake is an area that cannot be confirmed but only suggested as mothers' feeding strategies such as verbal encouragement have been shown to induce positive effects on children's food intake (Faith *et al.*, 2004).

As for the influence shown more on girls of older age group, this phenomenon can partly be explained through a study by Eisenberg et al that found family mealtime to act as a protective factor in adolescents in regard to various indicators of adolescent health and well-being. The authors suggested that adolescent girls in particular may be more sensitive to family environment cues that involve social interactions, which may contribute in the shaping of children's behavioral and emotional health (Eisenberg *et al.*, 2004). Mothers' responses to family meal and family breakfast (two of four dietary behaviors comprising mothers' eating behavior pattern in this study) that meet the family connectedness/interaction criterion in the

context of eating could explain for the positive association of fruit intake and negative association in oils·fats·sugars among adolescent girls with mothers following a healthy pattern. Adolescent girls placing nutritional value as an important component of family meals more so than boys (Prior and Limbert, 2013) offers another perspective to significant food group intakes shown in adolescent girls but not in adolescent boys from results.

Most studies on parent–child dietary intake have noted that mothers and daughters tend to show similar intake patterns (Cooley *et al.*, 2008, Smolak *et al.*, 1999). Differences in methodologies may not make findings from this study directly comparable with others but it is noteworthy that the subjects of this study were all ethnically Korean. As eating environment and attitudes about food are shaped by multitude of factors, the possibility of ethnic and cultural factors associated with eating behaviors could have influence on results.

Mothers' eating behavior patterns of this study partly expresses the family food environment as mothers play an influential role in establishing food environments in households. Although family environment including family meals have been defined in a variety of

ways, considerable studies reported that family meals or parental breakfast intake improved dietary quality among their children (Keski-Rahkonen *et al.*, 2003, Scaglioni *et al.*, 2008, Golan *et al.*, 2004), which were in agreement with the results of this study.

Limitations of the study included the fact that cross-sectional data was used for analysis, which needs to be considered when interpreting results as causal relationships cannot be inferred. Moreover, nutrient intake was based on a single dietary recall, which may undermine the actual usual intake despite the fact that one-day data had been converted into usual intake. Some misclassification might have influenced the results since all questionnaires were self-administered. There is a high possibility that children's dietary intake data relied on mothers' responses especially in children of the younger age group. Therefore, the precision of results shown may be attenuated by response bias as mothers may under- or over-estimate intakes of their children and in themselves due to recall errors or from internal inclinations to give socially desirable answers. Despite the several limitations mentioned, this study provides an interesting perspective in the association between maternal dietary behavior and children's

nutritional aspects. One of the strengths of this study lies in the use of a large sample size that is nationally representative of the Korean population.

Since women tend to be the primary food preparer, nutrition programs should target mothers to educate on the importance of fostering healthy food environments at home. Some of the goals of these interventions should include emphasis on regular family meals with desirable portion sizes based on KDRI recommendations of various food groups, education on making wise food purchasing decisions to improve the availability of healthful foods at home so that children can easily access and naturally grow to accept healthy foods from an early age, and provide insight on learning to effectively communicate with their children about healthful foods while emphasizing on the importance of prioritizing family meals. Also, regardless of the taste preferences especially manifested in young children, healthy food consumption such as fruits and vegetables are increased as long as those foods are available at home (Neumark-Sztainer *et al.*, 2003). Therefore, regular family meals accompanied by expanding healthful food supplies at home, children may naturally pick

up on healthful eating habits. As stated in the American Heart Association's guide to caregiver responsibilities for children's nutrition, parents should set a good example with the "do as I do" rather than "do as I say" attitude in respect to food-related behaviors in the presence of children (Gidding *et al.*, 2006).

VI. SUMMARY AND CONCLUSION

This study examined the association between mothers' dietary behaviors and children's nutritional status. Subjects with dietary data were obtained from the Korean National Health and Nutrition Examination Survey conducted from 2007 to 2010. A total of 2,585 mothers were matched with their eldest child of 6-18years of age by household. Mothers' dietary behaviors composed of eating-out frequency, family meal frequency, family breakfast status and meal skipping status. Mothers who responded to eating-out three times or less in a month, having at least two family meals on a daily basis, having regular breakfast with the family, and not skipping meals were regarded as those with 'desirable' dietary behaviors while mothers' responses otherwise were considered as followers of 'undesirable' dietary behaviors. Based on the frequency of desirability for each dietary behavior, mothers' eating behavior patterns – healthy and

unhealthy – were determined, which was used to assess food group and nutrient intakes in mothers and children. The main results of the study are as follows:

1) Eating behavior patterns that included healthy pattern and unhealthy pattern followers consisted of 1,476 and 1,109 mothers respectively.

2) In mothers' own dietary intake, mothers following a healthy pattern had higher intakes in grains, meat·fish·eggs·beans and vegetables but lower riboflavin intakes compared to those of the unhealthy pattern.

3) In healthy pattern mothers, younger boys (6–11yr) had significantly higher intake of grains and vegetables whereas older girls (12–18yr) had significantly higher fruits and lower oils·fats·sugars in their diet. Although lower protein, phosphorous and riboflavin in older boys (12–18yr) was observed, these were within range of recommended amounts.

4) Younger boys showed the greatest similarity in trend of dietary

intake with mothers – both showed significantly higher grains and vegetables and lower riboflavin consumed when mothers followed a healthy pattern.

Overall, a considerably favorable intake of healthful food groups was observed in children whose mothers followed a healthy pattern. Most importantly, the intake pattern observed in children showed that regardless of how significantly higher or lower servings of food groups were consumed when mothers had a healthy pattern, children's intakes were close in meeting recommended amounts as specified by the Korean Food Guidance System compared to intakes in children whose mothers had an unhealthy pattern. Therefore, it may be implied that mothers with several desirable dietary behaviors can induce more healthful dietary intakes in their children.

However, as causal relationship between mothers' dietary behavior and children's dietary intake cannot be deduced as mentioned earlier in the discussion section, it is recommended that similar research in the future implement a longitudinal design to better explain the direction of

association between mothers and children. A qualitative perspective, of whereby trained researchers that observe mothers' habitual dietary behaviors, may be a more accurate approach to collect data rather than solely relying on mothers' self-responses due to possible report biases. It is suggested that by combining such qualitative strategies, the missing gaps that hinder understanding of the relationship between mothers and children as well as the different dietary intakes shown in children by sex and age groups of this study could be clarified. With a more comprehensive understanding on mother and child dynamic with regard to dietary behaviors in mothers, assessing nutritional status of children may be helpful. Future studies that look into children's health indicators and its relationship with dietary behaviors of mothers are recommended in order to determine whether dietary behaviors of mothers can be used as possible predictors of certain health outcomes in children.

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국문초록

아이의 식습관 형성에는 엄마의 역할이 매우 중요함으로, 자녀의 영양상태와 건강에 영향을 미치는 엄마의 식습관에 대한 이해가 필요하다. 따라서 본 연구는 국민건강영양조사 자료를 이용하여 엄마의 식행동 패턴에 따른 자녀의 영양상태를 분석하였다. 엄마의 식행동 패턴은 여러 식행동 지표에 대해 본인이 응답한 것을 이용하여 '바람직한 식사패턴' 과 '바람직하지 않은 식사패턴'으로 구분하였다. 본 연구에서 사용한 식행동 지표는 외식빈도, 가족과 함께 하는 식사 여부 및 빈도, 그리고 결식 여부이다. 본 연구의 대상자는 국민건강영양조사 (2007~2010년도)에 참여한 가구 중 첫째 자녀의 연령이 6~18세인 가구로 하였으며, 이들 가구의 엄마와 첫 째 자녀를 가구별로 매칭하여 분석하였다. 통계분석에서 엄마의 식행동 패턴에 따른 엄마 및 아이의 평균 식품군 섭취횟수 및 영양소 섭취량은 일반선형화모델을 이용하여 분석하였고, 대상자의 인구사회학적 특성과 자녀의 평균 필요량 미만 섭취의 영양소 분포는 카이스퀘어 검정을 이용하여 분석하였다. 본 연구결과를 살펴보면 '바람직한 식사패턴' 군의 엄마들이 그렇지 않은 군의 엄마들보다 교육수준이 더 높았고, 일을 하지 않는 비율이 높았으며, 젊은 연령대가 많은 것으로 나타났다. 자녀들의 식품군 섭취를 비교하면 6-11세 남아의 경우 엄마가 '바람직한 식사패턴'군 일 때의 엄마가 그렇지 않은 군에 있는

남아에 비해 곡류와 채소류의 섭취가 더 높았다. 12-18세 여아의 경우 엄마가 '바람직한 식사패턴'군 일 때 과일섭취는 높은 반면, 유지 및 당류의 섭취는 유의적으로 낮은 것으로 나타났다. 한편, 자녀들의 영양소 섭취량 비교에서는 엄마가 '바람직한 식사패턴'군인 6-11세 남아의 단백질, 인, 그리고 리보플라빈의 섭취가 그렇지 않은 군에 비해 더 낮은 것으로 나타났다. 각 영양소를 평균 필요량 미만으로 섭취하는 자녀들의 비율을 살펴보면 엄마가 '바람직한 식사패턴'군인 12-18세 남아의 경우 비타민 C와 나이아신을 평균 필요량 미만으로 섭취하는 비율이 그렇지 않은 군에 비해 유의적으로 낮은 것으로 나타났다. 특히 엄마가 '바람직한 식사패턴'군인 6-11세 남아의 곡류, 채소류, 리보플라빈 영양소 섭취가 높은 것으로 나와, 엄마의 식사섭취와 가장 비슷한 것으로 나타났다. 결론적으로 본 연구를 통해 엄마가 좋은 식행동을 할 경우 아이들의 채소류, 곡류, 및 과일류의 섭취가 더 높은 것을 볼 수 있으며 특히 12-18세 여아의 경우 유지 및 당류를 더 적게 섭취를 하는 것으로 관찰되었다. 그러므로, 엄마의 평상시 식행동과 자녀의 영양상태와 관련성이 있다고 사료된다. 향후 연구에서는 엄마의 식행동이 자녀의 영양상태뿐 아니라 건강지표에 미치는 영향을 살펴 볼 것을 제안한다.

주요어: 엄마, 자녀, 가족, 식행동, 영양소섭취량

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