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Eating habits, physical activity, nutrition knowledge, and self-efficacy by obesity status in upper-grade elementary school students

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BACKGROUND/OBJECTIVES: Childhood obesity has increased in recent decades in Korea. This study was designed to examine differences in the eating habits, physical activity (PA), nutrition knowledge, and self-efficacy of children by obesity status.
SUBJECTS/METHODS: Subjects were 5th-grade children from 70 elementary schools in 17 cities nationwide. Two-stage stratified cluster sampling was employed. Survey questionnaire included items related to general characteristics, eating habits, PA, nutrition knowledge and self-efficacy. Excluding incomplete responses, 3,531 data were analyzed using SPSS. Subjects were categorized into overweight·obesity (OW) and normal weight (NW) groups based on body mass index percentiles for age by sex.
RESULTS: A total of 21.5% of subjects was overweight or obese. There were significant differences in gender, perceived stress, perception of body shape, body satisfaction, and interest in weight control between the OW and NW groups ($P < 0.001$). With respect to eating habits, the OW group ate breakfast ($P < 0.05$) and snacks ($P < 0.01$) less frequently, ate bigger meals ($P < 0.001$), and demonstrated less desirable behaviors during meals ($P < 0.05$ in boys) compared to the NW group. The OW group participated in less PA than the NW group, especially boys. OW boys spent less time walking during weekdays ($P < 0.05$) or the weekend ($P < 0.001$), spent more time being sedentary during weekdays or the weekend ($P < 0.001$), and exercised a fewer number of days ($P < 0.01$). For girls, the OW group spent more time being sedentary during the weekend ($P < 0.01$) and exercised a fewer number of days by walking or bicycle riding ($P < 0.05$) than the NW group. Nutrition knowledge was not significantly different between the OW and NW groups. Self-efficacy ($P < 0.01$ in boys), especially PA self-efficacy ($P < 0.01$), was significantly lower in the OW than NW group.
CONCLUSIONS: This study revealed differences in eating habits, PA, and self-efficacy between OW and NW children. Obesity management programs for children need to focus on increasing self-efficacy, modifying eating habits, and increasing PA.

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INTRODUCTION

Childhood obesity is a major public health problem. According to the 2013 Korea National Health and Nutrition Examination Survey (KHNANES), about 10% of children and adolescents (6-18 years) were obese [1]. Among children aged 6 to 11 years-old, 10.2% were overweight and 6.1% were obese in 2013 [1]. A nationwide survey on the health status of children and adolescents reported that the prevalence of overweight or obesity status based on body mass index (BMI) reached 20.6% in elementary school students in 2011, with slight increases each year over the past 3 years [2]. In the United States, the prevalence of overweight or obesity status in children or adolescents is quite high, reaching 35.0% in boys and 35.9% in girls [3].

The effects of childhood obesity are serious, as obese children are more likely to be obese when they become adults. Risks for health problems in later life, such as heart disease and type 2 diabetes mellitus, are also increased in obesity [4,5]. Obese people also might experience impaired social, emotional functioning, and low self-esteem [5]. Therefore, prevention of obesity is needed at an earlier age in life.

Factors associated with childhood obesity include genetics, behaviors (e.g., eating, physical inactivity), skills for behavior modification, and the environment (e.g., food/eating, physical activity) [6-8]. In a study on 5 to 11 years-old children, Yu *et al.* [9] examined adherence to dietary guidelines and risk of obesity. Children in the high adherence to dietary guidelines group were characterized by significantly lower BMI, compared with the low or moderate adherence group. Education

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programs are needed to help children adopt healthy behaviors by modifying eating or physical activity, as well as constructing supportive environments for healthy behaviors. Factors associated with eating or physical activity also need to be identified to help children adopt healthy behaviors. Social Cognitive Theory (SCT) is one of psychosocial theories that attempt to explain health behaviors [10]. SCT suggests the concept of reciprocal determinism, which emphasizes continuous interactions among cognitions, behaviors, and the environment. In SCT, concepts such as knowledge and self-efficacy are cognitions that provide motivation for a particular behavior. Knowledge regarding eating or physical activity is necessary to perform the behavior, although it needs to be combined with skills. Self-efficacy represents the perceived ability to perform the behavior and is known to be important in explaining health behaviors, such as eating and physical activity [11,12].

Many studies have been carried out to examine eating behaviors or physical activity in children; however, these have been done regionally. The purpose of this study was to examine eating habits, physical activity, nutrition knowledge, and self-efficacy of upper-grade elementary school children from a nationwide sample and investigate differences in these characteristics by obesity status. Study findings will provide information for developing nutrition education programs for obesity prevention or management in children.

SUBJECTS AND METHODS

Subjects

This study was a part of large-scale survey to examine dietary life, physical activity and associated factors in elementary school children and adolescents. Subjects for this study were 5th graders from 70 elementary schools selected from a list of schools in 17 cities of Korea, applying the two-stage stratified cluster sampling design. The schools were sampled, taking into account the number of elementary schools in 17 cities and provinces. Study investigators explained the study to the school principals or teachers, and 5th graders from three to four classes from each school were asked to participate in the study. Written informed consent was obtained from parents or guardians for their child's study participation. Students responded to the survey questionnaire by self-report, and 3,655 students participated in the survey in 2013. Data from incomplete responses on major study variables such as height and weight were excluded, and data from 3,531 5th graders out of 3,655 data were used for statistical analysis. This study was approved by the Institutional Review Board of Seoul Women's University (IRB-2013A-1).

Survey questionnaire

The survey questionnaire was developed by literature review of the eating habits and physical activity of school-aged children and was then pilot-tested, as described in a previous study [13]. The draft of the questionnaire regarding eating habits, physical activity and related factors (e.g., nutrition knowledge, self-efficacy) was made based on literature review of school-aged children [14-21]. The draft was reviewed by three nutrition professors and pilot-tested with 20 elementary school children to check understanding and wording of sentences. The survey questionnaire was revised based on comments from nutrition experts and results of the pilot testing. The final survey questionnaire included items examining general characteristics, eating habits, physical activity, and factors such as nutrition knowledge and self-efficacy.

General characteristics included items such as age, gender, height, weight, residence area, and perceived stress in daily life. Weight-related variables, including perception of body shape, body satisfaction, and interest in weight control, were also measured using 5-point scales [14]. Body mass index was calculated based on self-reported weight and height. Obesity status was assessed by comparing subjects' BMIs with the BMI for-age percentile by gender [15]. Based on the 2007 Children and Adolescent Physical Growth Standard [15] and categorization of overweight or obesity of children in KHANES [1], 'normal weight' group included children with a BMI less than the 85th percentile, 'overweight' group included those with a BMI between the 85th and 95th percentiles and BMI less than 25, and 'obesity' group included those with a BMI equal to or greater than the 95th percentile or BMI equal to or greater than 25.

Items for eating habits included eating a variety of foods, regular meals, size of meals, frequencies of eating breakfast, eating out, and snacks, behavior during meals, unbalanced diet and types of disliked foods [16-18]. These variables were measured using 5-point scales (variety, regular meals, size of meals) or by asking subjects to record frequencies of their behaviors or to check on the categories. Types of disliked foods were measured by asking subjects to choose three responses from the food categories.

Physical activity was measured based on seven items: frequency of performing at least 30 minutes of physical activity per day, frequency of walking or riding a bicycle, frequency of exercise, time spent walking during weekdays or the weekend, and time spent being sedentary during weekdays or the weekend, based on literature review [19,20] and revision of the pilot test. Items such as frequency of performing at least 30 minutes of physical activity per day and frequency of walking or riding a bicycle were measured based on the number of days that each subject performed each activity per week. Time spent walking was measured using four categories ranging from 'less than 30 minutes per day' to 'more than 2 hours per day'. Time spent being sedentary was measured using categories from 'less than an hour per day' to 'more than 4 hours per day'.

Nutrition knowledge was measured based on 10 items regarding general nutrition (six items) and obesity-related knowledge (four items) [16,18]. General nutrition knowledge included items on balanced meals, roles of food groups (grains, protein foods, fruits and vegetables, dairy foods), and meaning of juices with no sugar added. Obesity-related knowledge included items on definition of obesity, adequate methods of weight control, fruits and energy, and effects of regular exercise. For each nutrition knowledge item, the number and percentage of correct responses by subjects were examined. Total score of nutrition knowledge was the summated score of correct responses for 10 nutrition knowledge items.

Self-efficacy in eating or physical activity was assessed using 10 items [16,17,21]. Six items were related to self-efficacy, including perceived confidence in eating vegetable dishes at meals, choosing baked or steamed foods instead of fried foods, avoiding processed foods for snacks, avoiding sugary snacks or foods, reading nutrition labels, and eating meals without watching TV or playing games. Self-efficacy in physical activity was measured using four items. These included items on perceived efficacy in participating in sports, performing exercise regularly despite being tired or bad weather, walking short distances without a car, and performing exercise during lunch time or break time. Each item was measured on a 4-point scale from 'very difficult' (1) to 'very easy' (4). Total score for self-efficacy was calculated as the summated score of 10 items. Cronbach's α for self-efficacy items was 0.8.

Statistical analyses

Data on 3,531 fifth-graders out of 3,655 children (completion rate: 96.6%) were analyzed using SPSS (PASW Statistics 18.0; SPSS Inc., Chicago, IL, USA). Descriptive statistics including frequency, percentages, mean, and standard deviation were calculated. Subjects were categorized into two groups by obesity status, 'normal weight group' versus 'overweight and obesity group', by comparing subjects' BMIs with BMI for-age percentile by gender [15]. T-test or χ^2-test was used to examine differences in eating habits, physical activity, nutrition knowledge, and self-efficacy by obesity status. In the preliminary analysis, obesity status and other study variables in eating habits or physical activity were significantly different by sex. The study results, including eating habits, physical activity, nutrition knowledge, and self-efficacy by obesity status, were presented separately by sex. Statistical significance was examined at $P < 0.05$.

RESULTS

General characteristics of subjects by obesity status

Mean age of subjects was 10.7 years, and 51.6% were girls (Table 1). About 78.5% of subjects (2,773 children) were categorized into the normal weight (NW) group and 21.5% (758 children) were in the overweight·obesity (OW) group. Distribution of sex was significantly different by obesity status; percentage of boys was higher in the OW group (55.1%) than in the NW group (46.5%, $P < 0.001$). Half of subjects resided in Seoul or Gyeonggi-do·Incheon, and 32.0% resided in Gyeongsang-do. There was no significant difference in residence area between the NW and OW groups. The percentage of those who perceived stress severely or very severely was significantly higher in the OW group than in the NW group ($P < 0.001$).

Body mass index, perception of body shape, body satisfaction, and interest in weight control by obesity status

The mean height and weight of boys were 144.2 cm and 37.0 kg in the NW group as well as 147.9 cm and 52.5 kg in the OW group, respectively ($P < 0.001$, Table 2). The mean height and weight of OW girls were also significantly higher than those of NW girls ($P < 0.001$). Mean BMI was significantly higher in the OW group than in the NW group for both boys and girls ($P < 0.001$).

Table 1. General characteristics of subjects by obesity status

Variables	Obesity status[1]		Total (n = 3,531)
	Normal (n = 2,773)	Overweight & Obesity (n = 758)	
Age	10.7 ± 0.6	10.6 ± 0.6[2]***	10.7 ± 0.6
Sex			
Male	1,290 (46.5)	418 (55.1)[3]***	1,708 (48.4)
Female	1,483 (53.5)	340 (44.9)	1,823 (51.6)
Residence area			
Seoul	487 (17.6)	127 (16.8)	614 (17.4)
Gyeonggi-do · Incheon	899 (32.4)	247 (32.6)	1,146 (32.5)
Chungcheong-do	195 (7.0)	60 (7.9)	255 (7.2)
Jeolla-do	219 (7.9)	56 (7.4)	275 (7.8)
Gyeongsang-do	887 (32.0)	244 (32.2)	1,131 (32.0)
Others (Gangwon-do · Jeju-do)	86 (3.1)	24 (3.2)	110 (3.1)
Daily life stress			
Very severe/Severe	464 (17.0)	173 (23.1)***	637 (18.3)
Average	1,413 (51.8)	394 (52.7)	1,807 (52.0)
Less severe/Not severe	850 (31.2)	181 (24.2)	1,031 (29.7)

*** $P < 0.001$
[1] Normal weight: BMI < 85th percentile for age by gender, Overweight: 85th ≤ BMI < 95th percentile and BMI < 25, Obesity: 95th percentile ≤ BMI or 25 ≤ BMI
[2] Mean ± SD
[3] n (%)

Perception of body shape and body satisfaction were significantly different between the OW and NW groups in both sexes ($P < 0.001$). About 76% of OW girls, compared to 11.7% of NW girls, perceived themselves as 'fat or very fat' ($P < 0.001$). In girls, the proportion of those who were not satisfied with their bodies was higher in the OW group than in the NW group (42.6% vs. 15.5%, $P < 0.001$). Interest in weight control also differed significantly by obesity status, as 56.1% of OW girls and 29.9% of NW girls showed interest in weight control ($P < 0.001$). Results in boys were also similar to those of girls, showing less satisfaction with their bodies and more interest in weight control in OW boys compared to NW boys ($P < 0.001$).

Eating habits of subjects by obesity status

Table 3 presents the eating habits of subjects by obesity status. Subjects ate breakfast 5.9 times per week on average, and frequency of eating breakfast was significantly lower in the OW group than in the NW group in both sexes ($P < 0.05$). Frequency of eating out was not different by obesity status in boys, whereas OW girls ate out less frequently than NW girls ($P < 0.01$). The mean frequency of eating snacks in both sexes was 1.5 times per day in the NW group and 1.3 times per day in the OW group ($P < 0.01$).

About 52% of subjects responded that they eat a variety of foods or eat a variety of foods very often. The percentage of subjects who had a variety of foods was higher in the OW group than in the NW group in both boys and girls ($P < 0.05$). Approximately 64% of subjects ate meals regularly or very regularly. Frequency of eating regular meals was significantly different only in girls, as a higher percentage of NW girls than OW girls ate regular meals ($P < 0.01$). About 70% of subjects

Table 2. Body mass index, perception of body shape, body satisfaction, and interest in weight control of subjects by obesity status

Variables	Boys (n = 1,708)		Girls (n = 1,823)		Total (n = 3,531)
	Normal (n = 1,290)	Overweight & Obesity (n = 418)	Normal (n = 1,483)	Overweight & Obesity (n = 340)	
Height	144.2 ± 6.5	147.9 ± 6.7[1)]***	145.3 ± 6.6	148.6 ± 6.9***	145.6 ± 6.8
Weight	37.0 ± 5.8	52.5 ± 7.6***	36.4 ± 5.9	50.2 ± 7.0***	39.9 ± 8.7
Body mass index (kg/m^2)	17.7 ± 2.0	23.9 ± 2.3***	17.1 ± 1.9	22.7 ± 2.1***	18.7 ± 3.2
Perception of body shape					
Very thin/Thin	416 (32.2)	2 (0.5)[2)]***	375 (25.5)	1 (0.3)***	794 (22.6)
Normal	741 (57.4)	81 (19.5)	925 (62.8)	79 (23.4)	1,826 (51.9)
Fat/Very fat	133 (10.3)	333 (80.0)	173 (11.7)	258 (76.3)	897 (25.5)
Body Satisfaction					
Not satisfied at all	27 (2.1)	31 (7.4)***	39 (2.6)	34 (10.0)***	131 (3.7)
Not satisfied	114 (8.9)	78 (18.7)	191 (12.9)	111 (32.6)	494 (14.0)
Average	419 (32.6)	213 (51.1)	592 (40.0)	147 (43.2)	1,371 (38.9)
Satisfied	463 (36.0)	69 (16.5)	466 (31.5)	40 (11.8)	1,038 (29.5)
Satisfied very much	264 (20.5)	26 (6.2)	192 (13.0)	8 (2.4)	490 (13.9)
Interest in weight control					
Not at all	244 (18.9)	5 (1.2)***	148 (10.0)	2 (0.6)***	399 (11.3)
Not interested	283 (22.0)	54 (12.9)	268 (18.1)	13 (3.8)	618 (17.5)
Average	514 (39.9)	185 (44.3)	624 (42.1)	134 (39.5)	1,457 (41.3)
Interested	175 (13.6)	119 (28.5)	310 (20.9)	129 (38.1)	733 (20.8)
Interested very much	73 (5.7)	55 (13.2)	133 (9.0)	61 (18.0)	322 (9.1)

*** $P < 0.001$
[1)] Mean ± SD
[2)] n (%)

Table 3. Eating habits of subjects by obesity status

Variables	Boys (n = 1,708)		Girls (n = 1,823)		Total (n = 3,531)
	Normal (n = 1,290)	Overweight & Obesity (n = 418)	Normal (n = 1,483)	Overweight & Obesity (n = 340)	
Breakfast frequency (times/week)	6.1 ± 1.7	5.9 ± 1.8[3)]*	5.9 ± 1.8	5.6 ± 2.0*	5.9 ± 1.8
Frequency of eating out (times/week)	1.2 ± 1.0	1.2 ± 0.9	1.2 ± 0.9	1.0 ± 0.8**	1.2 ± 0.9
Frequency of eating snacks (times/day)	1.5 ± 1.2	1.3 ± 0.9**	1.5 ± 1.0	1.3 ± 0.9***	1.5 ± 1.0
Variety of foods					
Do not eat a variety of foods at all	25 (1.9)	5 (1.2)[4)]*	15 (1.0)	3 (0.9)*	48 (1.4)
Do not eat a variety of foods	161 (12.5)	31 (7.4)	181 (12.2)	21 (6.2)	394 (11.2)
Average	439 (34.2)	139 (33.3)	548 (37.0)	127 (37.5)	1,253 (35.6)
Eat a variety of foods	457 (35.6)	146 (35.0)	517 (34.9)	134 (39.5)	1,254 (35.6)
Eat a variety of foods very often	203 (15.8)	96 (23.0)	220 (14.9)	54 (15.9)	573 (16.3)
Regular meals					
Very irregular	20 (1.6)	5 (1.2)	6 (0.4)	4 (1.2)**	35 (1.0)
Irregular	68 (5.3)	24 (5.8)	94 (6.4)	15 (4.4)	201 (5.7)
Neither irregular nor regular	378 (29.4)	118 (28.3)	425 (28.8)	124 (36.7)	1,045 (29.7)
Regular	526 (41.0)	190 (45.6)	593 (40.1)	131 (38.8)	1,440 (41.0)
Very regular	292 (22.7)	80 (19.2)	359 (24.3)	64 (18.9)	795 (22.6)
Size of meals					
Very small/ small	165 (12.9)	8 (1.9)***	286 (19.5)	15 (4.5)***	474 (13.5)
Adequate	898 (70.0)	252 (60.4)	1,053 (71.9)	258 (76.8)	2,461 (70.3)
Large/very large	220 (17.1)	157 (37.6)	126 (8.6)	63 (18.8)	566 (16.2)
Behavior during meals					
Just eating	287 (22.6)	110 (26.6)*	243 (16.6)	61 (18.2)	701 (20.1)
Conversation with family members	681 (53.7)	207 (50.0)	880 (60.2)	183 (54.6)	1,951 (56.1)
Playing games or watching TV	239 (18.8)	89 (21.5)	278 (19.0)	78 (23.3)	684 (19.7)
Reading a book or others	62 (4.9)	8 (1.9)	61 (4.2)	13 (3.9)	144 (4.1)
Unbalanced diet					
Yes	562 (43.6)	161 (38.5)	672 (45.3)	115 (33.8)***	1,510 (42.8)
No	728 (56.4)	257 (61.5)	811 (54.7)	225 (66.2)	2,021 (57.2)

Table 3. continued

Variables	Boys (n = 1,708)		Girls (n = 1,823)		Total (n = 3,531)
	Normal (n = 1,290)	Overweight & Obesity (n = 418)	Normal (n = 1,483)	Overweight & Obesity (n = 340)	
Foods that they dislike[1)]					
Grains and starches	31 (2.4)[5)]	14 (3.3)	37 (2.5)	9 (2.6)	91 (2.6)
Meat	34 (2.6)	11 (2.6)	47 (3.2)	3 (0.9)	95 (2.7)
Fish	144 (11.2)	37 (8.9)	188 (12.7)	33 (9.7)	402 (11.4)
Eggs	38 (2.9)	13 (3.1)	48 (3.2)	12 (3.5)	111 (3.1)
Beans	282 (21.9)	83 (19.9)	407 (27.4)	70 (20.6)	842 (23.8)
Vegetables	390 (30.2)	107 (25.6)	425 (28.7)	76 (22.4)	998 (28.3)
Fruits	33 (2.6)	9 (2.2)	21 (1.4)	3 (0.9)	66 (1.9)
Dairy products	86 (6.7)	15 (3.6)	137 (9.2)	18 (5.3)	256 (7.3)
Seaweeds	167 (12.9)	54 (12.9)	193 (13.0)	35 (10.3)	449 (12.7)
Others[2)]	54 (4.2)	18 (4.3)	66 (4.5)	15 (4.4)	153 (4.3)

* $P<0.05$, ** $P<0.01$, *** $P<0.001$
[1)] Plural responses
[2)] Shellfish, soybean paste, greasy foods, spicy foods, etc.
[3)] Mean ± SD
[4)] n (%)
[5)] Number in ( ) is the percentage of subjects out of total subjects in each group.

ate meals of adequate size. The proportion of those who responded size of meals as 'large' or 'very large' was significantly higher in the OW group than in the NW group in both boys and girls ($P < 0.001$). With respect to behavior during meals, 56.1% of subjects had conversations with family members while 19.7% played games or watched TV. Behavior during meals was significantly different by obesity status only in boys, with a higher percentage of NW boys than OW boys having conversations with family members ($P < 0.05$).

About 43% of subjects responded that they ate an unbalanced diet (Table 3). The percentage of girls who ate an unbalanced diet was lower in the OW group (33.8%) than in the NW group (45.3%, $P < 0.001$), although there was no significant difference in boys. Disliked foods were not significantly different by obesity status.

Physical activity of subjects by obesity status

Results regarding physical activity of subjects are shown in Table 4. In boys, six out of seven variables for measurement of physical activity were significantly different between the OW and NW groups. In contrast, frequencies of 'sedentary activity during weekend' ($P < 0.01$) and 'walking or riding a bicycle' ($P < 0.05$) were statistically different in girls by obesity status. Twenty-three percent of OW girls spent 3 or more hours per day being sedentary during the weekend, whereas 16.7% of NW girls did so during the weekend ($P < 0.01$).

One-third of subjects participated in at least 30 minutes of physical activity per day for 5 to 7 days a week, and 36% of OW boys compared to 46.7% of NW boys participated in physical activity (≥ 30 minutes/day) for 5 to 7 days a week ($P < 0.001$). The percentage of those who exercised three or more times per week was lower in OW boys than in NW boys ($P < 0.01$).

About 60% of OW boys spent less than 1 hour walking during weekdays or the weekend, and these percentages were significantly higher than those in NW boys ($P < 0.05$ during weekdays, $P < 0.001$ during weekend).

With respect to sedentary activity, 11.9% and 19.2% of subjects spent 3 or more hours per day being sedentary during weekdays and the weekend, respectively (Table 4). About 28% of OW boys, compared to 18.2% of NW boys, spent 3 or more hours per day being sedentary during the weekend ($P < 0.001$). Similarly, a higher percentage of OW boys than NW boys spent time being sedentary during weekdays ($P < 0.001$).

Nutrition knowledge and self-efficacy of subjects by obesity status

Total score of nutrition knowledge (possible score**:** 0-10) was 8.2 on average (Table 5). Mean score of general nutrition knowledge (six items) was 4.8 out of 6 (80 out of 100), and obesity knowledge score (four items) was 3.4 out of 4 (85 out of 100). Total score or subscale score (general nutrition or obesity) of nutrition knowledge was not significantly different between the OW and NW groups in both sexes (Table 5).

When examined by each nutrition knowledge item, only about half of subjects responded correctly regarding 'meaning of balanced diets', and 'meaning of juice with no sugar added' (not shown in Table). Compared to NW boys, OW boys were more knowledgeable regarding 'meaning of balanced diets' ($P < 0.05$) and 'eating amount of fruits' ($P < 0.01$). Compared to NW girls, OW girls were more knowledgeable regarding 'eating amount of fruit' ($P < 0.01$), 'meaning of juice with no sugar added' ($P < 0.05$), and less knowledgeable regarding 'adequate weight control methods' ($P < 0.01$, not shown in Table).

Total score of self-efficacy was 31.9 (possible score: 10-40), which was 79.8 out of 100 (Table 5). Score for eating self-efficacy (six items, possible score: 6-24) was 19.2, and score for physical activity self-efficacy (four items, possible score: 4-16) was 12.6, on average. Total self-efficacy score ($P < 0.01$) and physical activity self-efficacy score ($P < 0.001$) were significantly lower in OW boys than in NW boys. In girls, physical activity self-efficacy score was significantly lower in OW girls than in NW girls ($P < 0.01$). However, there was no significant difference in eating self-efficacy score between the OW and NW groups in both sexes (Table 5).

Table 4. Physical activity of subjects by obesity status

Variables	Boys (n = 1,708)		Girls (n = 1,823)		Total (n = 3,531)
	Normal (n = 1,290)	Overweight & Obesity (n = 418)	Normal (n = 1,483)	Overweight & Obesity (n = 340)	
At least 30 minutes of physical activity per day (days/week)					
No	121 (9.4)	38 (9.2)[1)]***	213 (14.5)	46 (13.7)	418 (11.9)
1-2	203 (15.8)	104 (25.3)	426 (29.0)	89 (26.5)	822 (23.5)
3-4	361 (28.1)	121 (29.4)	476 (32.4)	118 (35.1)	1,076 (30.7)
5-6	333 (26.0)	91 (22.1)	258 (17.5)	60 (17.9)	742 (21.2)
7	265 (20.7)	57 (13.9)	98 (6.7)	23 (6.8)	443 (12.7)
Walking or riding a bicycle (days/week)					
No	228 (17.8)	85 (20.5)	268 (18.2)	56 (16.5)*	637 (18.1)
1-2	55 (4.3)	14 (3.4)	55 (3.7)	20 (5.9)	144 (4.1)
3-4	55 (4.3)	20 (4.8)	52 (3.5)	21 (6.2)	148 (4.2)
5-6	385 (30.0)	120 (29.0)	443 (30.0)	107 (31.5)	1,055 (30.0)
7	559 (43.6)	175 (42.3)	657 (44.5)	136 (40.0)	1,527 (43.5)
Time spent walking during weekdays (hours/day)					
< 30 min	220 (17.1)	89 (21.3)*	293 (19.8)	71 (20.9)	673 (19.1)
30 min ≤ < 1 hour	466 (36.2)	164 (39.2)	586 (39.6)	138 (40.6)	1,354 (38.4)
1 hour ≤ < 2 hours	296 (23.0)	89 (21.3)	325 (22.0)	73 (21.5)	783 (22.2)
2 hours ≤	305 (23.7)	76 (18.2)	276 (18.6)	58 (17.1)	715 (20.3)
Time spent walking during the weekend (hours/day)					
< 30 min	232 (18.0)	96 (23.0)***	341 (23.0)	85 (25.1)	754 (21.4)
30 min ≤ < 1 hour	373 (29.0)	151 (36.2)	520 (35.1)	125 (37.0)	1,169 (33.2)
1 hour ≤ < 2 hours	307 (23.8)	83 (19.9)	353 (23.8)	61 (18.0)	804 (22.8)
2 hours ≤	376 (29.2)	87 (20.9)	267 (18.0)	67 (19.8)	797 (22.6)
Sedentary activity during weekdays (hours/day)					
< 3	1,140 (88.8)	342 (82.2)***	1,327 (89.6)	293 (86.2)	3,102 (88.1)
3 ≤	144 (11.2)	74 (17.8)	154 (10.4)	47 (13.8)	419 (11.9)
Sedentary activity during the weekend (hours/day)					
< 3	1,051 (81.8)	300 (71.9)***	1,235 (83.3)	261 (77.0)**	2,847 (80.8)
3 ≤	234 (18.2)	117 (28.1)	247 (16.7)	78 (23.0)	676 (19.2)
Number of days for exercise (times/week)					
No	38 (3.0)	26 (6.4)**	62 (4.2)	20 (6.1)	146 (4.2)
1	71 (5.6)	31 (7.6)	122 (8.3)	28 (8.5)	252 (7.3)
2	262 (20.7)	86 (21.1)	435 (29.6)	105 (31.8)	888 (25.6)
3 ≤	896 (70.7)	264 (64.9)	850 (57.9)	177 (53.6)	2,187 (63.0)

* $P< 0.05$, ** $P< 0.01$, *** $P< 0.001$
[1)] n (%)

Table 5. Nutrition knowledge and self-efficacy of subjects by obesity status

Variables	Boys (n = 1,708)		Girls (n = 1,823)		Total (n = 3,531)
	Normal (n = 1,290)	Overweight & Obesity (n = 418)	Normal (n = 1,483)	Overweight & Obesity (n = 340)	
Nutrition Knowledge					
General nutrition knowledge score[1)]	4.8 ± 0.8[8)]	4.9 ± 0.8	4.8 ± 0.8	4.9 ± 0.8	4.8 ± 0.8
Obesity knowledge score[2)]	3.4 ± 0.8	3.4 ± 0.8	3.5 ± 0.8	3.5 ± 0.7	3.4 ± 0.8
Nutrition knowledge total score[3)]	8.2 ± 1.2	8.3 ± 1.3	8.3 ± 1.2	8.4 ± 1.2	8.2 ± 1.2
Self-efficacy[4)]					
Eating self-efficacy score[5)]	19.1 ± 3.1	19.2 ± 2.9	19.4 ± 3.1	19.6 ± 3.0	19.2 ± 3.0
Physical activity self-efficacy score[6)]	13.0 ± 2.3	12.1 ± 2.4***	12.5 ± 2.3	12.1 ± 2.2**	12.6 ± 2.3
Self-efficacy total score[7)]	32.1 ± 4.6	31.2 ± 4.7**	31.9 ± 4.6	31.7 ± 4.6	31.9 ± 4.6

** $P< 0.01$, *** $P< 0.001$
[1)] Score of six items (possible score: 0-6), including items regarding meaning of balanced meals, roles of food groups (grains, protein foods, fruits and vegetables, dairy foods), and meaning of juices with no sugar added.
[2)] Score of four items (possible score: 0-4), including items regarding definition of obesity, adequate methods of weight control, fruits and energy, and effects of regular exercise.
[3)] Total score of 10 items (possible score: 0-10)
[4)] Each item was measured by 4-point scales ranging from 1 (very difficult) to 4 (very easy). The higher score indicates that subjects had higher self-efficacy.
[5)] Score of six items (possible score: 6-24), including self-efficacy in eating vegetable dishes at meals, choosing baked or steamed foods instead of fried foods, avoiding processed foods for snacks, avoiding sugary snacks or foods, reading nutrition labels, and eating meals without watching TV or playing games.
[6)] Score of four items (possible score: 4-16), including self-efficacy in participating in sports, performing exercise regularly despite being tired or bad weather, walking a short distance without a car, and performing exercise during lunch time or break time.
[7)] Total score of 10 items (possible score: 10-40)
[8)] Mean ± SD

For each self-efficacy item, none of the six eating self-efficacy items was significantly different between the OW and NW groups in both sexes (not shown in Table). In contrast, OW boys scored significantly lower in all physical activity self-efficacy items, including 'participating in sports', 'performing exercise regularly despite being tired or bad weather', 'performing exercise during lunch or break time' ($P < 0.001$) and 'walking a short distance without a car' ($P < 0.05$) compared to NW boys (not shown in Table). OW girls also scored significantly lower in two of the physical activity self-efficacy items: 'participating in sports' ($P < 0.001$) and 'walking a short distance without a car' ($P < 0.05$, not shown in Table).

DISCUSSION

This study examined eating habits, physical activity, nutrition knowledge, and self-efficacy of 5th graders, as well as investigated if these variables were different by obesity status. Overweight or obese children constituted 21.5% of subjects (24.5% of boys and 18.7% of girls) in this study. The results of the 2013 KNHANES [1] showed that 16.3% of children aged 6-11 years were overweight or obese. The percentage of overweight or obese children was higher in boys than in girls in the current study, similar to the findings of the 2013 KNHANES [1]. In a study on upper-grade elementary school children, Baek & Yeo [22] found that obese children constituted 31.4% of subjects, which was higher than that reported in the current study. Lee *et al.* [23] reported that obese children constituted 20.5% of subjects while mean BMI of obese children was 24.2, similar to the current study. In a study on 6th grade children, Park [24] found that obese children constituted about 39% of boys, compared to 20% of girls. Cho *et al.* [25] reported that the relatively low prevalence of obesity in school-aged girls might be interpreted as a rapid increase in height compared to weight in girls.

The study results show that weight-related variables, such as perception of body shape, body satisfaction, and interest in weight control differed significantly by obesity status in both sexes ($P < 0.001$). Especially, girls in the OW group were less satisfied with their bodies and more interested in weight control compared to those in the NW group. This finding was similar to the results of previous studies [25,26]. In a study of Cho *et al.* [25], about 23% of boys and 16% of girls perceived themselves as fat, and a higher percentage of girls than boys wanted to lose weight. Park *et al.* [26] reported that overweight children wanted to have a lower body weight than normal body weight. A study on elementary school students [27] also revealed that about half of obese children tried to lose weight, suggesting a high prevalence of weight control experience in children. In our study, approximately 20% of normal weight children were also interested in weight control.

Results of prior studies suggest that subjects need to improve their eating habits, such as eating a variety of meals and eating regularly. In this study, boys or girls in the OW group showed less desirable eating habits, such as eating breakfast less frequently and eating large meals, compared to the NW group. Kim *et al.* [28] reported that some obese children skipped breakfast in order to lose body weight. However, breakfast provides energy for daily activities and schoolwork for elementary school children and the habit of eating breakfast needs to be formed during childhood. Study results also showed that the size of meals was significantly larger in children of the OW group compared to the NW group. Thus, nutrition education for obesity prevention or management of children is important, especially eating adequate amounts as well as eating breakfast regularly.

In this study, overweight·obese children were more likely to eat a variety of foods and less likely to have an unbalanced diet compared to normal weight children. This result was contrary to our expectation and might be due to overweight·obese children or their parents being more cautious about their dietary behaviors. Similar to the current study, previous studies [23,29] found that more elementary school children who ate an unbalanced diet were in the normal weight group than in the obesity group. Foods that children disliked were mainly vegetables, beans, seaweeds, and fish in the current study. Nutrition education for children should help children eat a variety of foods by tasting new foods and suggesting recipes using foods that they dislike.

Performing regular physical activity is important for obesity prevention in children. However, the results of the current study showed that the frequency or duration of physical activity was not sufficient to prevent obesity, especially in girls. Only one-third of boys and one-fourth of girls performed physical activity (at least 30 minutes per day) for 5 or more days per week. In addition, more than half of subjects spent less than 1 hour per day walking. This suggests that the level of physical activity might not be sufficient for weight loss for the majority of children compared with the dietary guidelines for Korean children, which recommend physical activity for at least 1 hour per day [30].

This study shows that the frequency or duration of physical activity was significantly different between the OW and NW groups, especially in boys. Similarly, previous studies [31,32] reported that boys are more involved in physical activity than girls. In the current study, time walking during weekdays or the weekend was significantly lower in OW boys compared to NW boys, although there was no significant difference in girls. In addition, time spent being sedentary during weekdays (in boys) or the weekend (in both sexes) was significantly higher in OW children than in NW children. Especially, 28% of boys and 23% of girls in the OW group spent 3 or more hours per day being sedentary during the weekend. Chung *et al.* [33] also reported that obesity is related to increased TV viewing and screen time. Dietary guidelines for Korean children also recommend that children limit TV watching or playing computer games to less than 2 hours per day [30]. A previous study [34] reported that obese children hold negative attitudes toward physical education and participate less in physical activity compared to normal weight children. Baek [6] reported that obese children do exercise frequently, although they do not exercise vigorously or enjoy it and prefer being sedentary. Clearly, obesity is the result of modern lifestyles, such as irregular physical activity and being sedentary. Physical Activity Guidelines in the US also suggest that children perform at least 1 hour of physical activity per day [35]. Thus, obesity programs

for children need to focus on strategies to increase physical activity by providing practical tips, encouraging fun and easily-done activities in daily life. In addition, strategies to replace sedentary activities (e.g., TV watching, computer games, using mobiles) might be employed to prevent childhood obesity.

In this study, subjects scored 82 out of 100 for nutrition knowledge, with no significant difference by obesity status in both sexes. In a study on upper-grade elementary school students, Kim *et al.* [36] reported a nutrition knowledge score of 7.5 out of 10. You *et al.* [37] reported a nutrition knowledge score of 7.1 out of 10 in sixth graders. Thus, the nutrition knowledge of subjects in this study was slightly higher than those reported in previous studies [36,37]. The current study supports the findings of Park *et al.* [27], who reported that nutrition knowledge was not significantly different between normal weight and obese children. Nutrition knowledge items in this study consisted of items on general nutrition and obesity knowledge. Only two items related to nutrition knowledge, weight control method and fruits and energy were significantly different by obesity status, suggesting the need to provide information on these areas.

This study revealed that self-efficacy for physical activity as well as total self-efficacy was significantly higher in NW boys than in OW boys. More specifically, NW boys showed greater confidence in four items related to physical activity than OW boys. Normal weight girls also showed more confidence in physical activity than OW girls. This finding suggests the importance of self-efficacy in explaining obesity or healthy behavior (e.g., physical activity). Studies regarding self-efficacy in obese children [38,39] found that children show difficulty in psychosocial adaptation and perceive their appearance or ability to perform physical activity more negatively as degree of obesity increases. In a study examining health-related physical fitness, Lee *et al.* [40] found that health-related physical fitness decreased as the degree of obesity increased in children. Contrary to our expectation, perceived confidence in eating behaviors were not significantly different by obesity status in boys or girls. This finding is contrary to a previous study on self-efficacy for nutrition behavior [41]. This might be partly explained by the relatively high score of eating self-efficacy in both NW and OW children. Subjects in this study might feel that healthy eating behaviors (e.g., eating vegetables at meals, avoiding processed foods, checking nutrition labels and choosing healthy snacks) are quite easy. This study suggests that obesity prevention programs for children need to focus on self-efficacy, especially increasing perceived confidence in performing exercise or increasing physical activity.

This study used a large and representative sample from 17 cities in Korea and examined variables related to obesity in 5th grade children, which is the strength of this study. There are, however, some limitations in this study. The data were collected by the self-report method, and we cannot exclude the possibility that some subjects responded in socially desirable ways for some variables such as self-efficacy and eating behaviors. This study also did not employ complex sampling design analysis. Thus, design effects of the survey sample could not be considered and the results of this study should be interpreted with caution.

In summary, this study suggests that OW children are less satisfied with their bodies and are more interested in weight control. Overweight or obese children compared to NW children, especially boys, participated in physical activity less and were more sedentary. Healthy eating habits, such as eating breakfast and an adequate meal size, were viewed as less desirable in OW children. Nutrition knowledge was not significantly different between OW and NW children, whereas self-efficacy for physical activity was lower in OW children than in NW children. Therefore, education program for obesity prevention in children need to emphasize increased confidence in performing exercise or physical activity. Education programs should also focus on providing practical tips for increasing physical activity and modifying eating behaviors. In addition, education programs need to include topics of body image, body satisfaction, and adequate methods of weight control.

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CONFLICT OF INTEREST

The authors declare no potential conflicts of interests.

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