



## Research Article

## Factors Affecting Underweight and Obesity Among Elementary School Children in South Korea

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## SUMMARY

**Purpose:** The purpose of the study was to determine factors associated with underweight and obesity in elementary school children in Korea.

**Methods:** Study participants included 4,895 children attending 59 elementary schools across Korea. Children were grouped into underweight [ $< 5\%$  body mass index (BMI)-for-age], normal weight ( $5\%$ – $85\%$  BMI-for-age), and overweight/obese ( $\geq 85\%$  BMI-for age). The questionnaire included demographic characteristics, health status, and diet and exercise behavior of children, and environmental characteristics of schools.

**Results:** Twelve percent of the children were overweight or obese. The results showed that demographic (age and gender), health status (atopic dermatitis and poor subjective health), and the characteristics of diet and exercise (unbalanced diet and diet experiences) were associated with underweight ( $p < .05$ ), while demographic (age and gender), health status (poor subjective health), behavioral characteristics (fast food consumption and diet experiences), and school environmental characteristics (rural area) were associated with overweight/obesity ( $p < .05$ ).

**Conclusions:** Programs and interventions to reduce underweight and overweight/obesity in Korean elementary schools must consider behavioral and environmental characteristics of children.

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## Introduction

Childhood obesity is a major public health concern in Korea that has increased during the last decade in Korea [1,2]. In Korea, prevalence of overweight or obesity ranges from 16.7% to 22.5% among elementary school children [3,4]. Obese children have increased risk of hypertension, diabetes mellitus, hyperlipidemia, asthma, depression, low self-esteem, and low quality of life [5–7]. Unhealthy eating patterns such as frequent fast food and soft drink consumption contribute to the increased prevalence of obesity among children and adolescents in Korea [8]. Researchers contend that school health education and/or policy (e.g., ban soft drink vending machines in schools) are required to promote healthy eating among children and adolescents and decrease obesity [9].

Many studies have investigated childhood obesity [5–7,10], and underweight in children [11,12]. Prevalence of underweight ranges from 3.6% to 21.6% among children in Korea [11,12]. Kim [12] reported that poverty is associated with children being either overweight/obese or underweight compared to those from middle income families [12]. Others found that underweight children preferred fried food more than normal weight children, while overweight boys preferred a high protein and high fat diet compared to normal and underweight children [13]. Dietary habits, body image perception, physical activity, and TV viewing/computer use were significantly associated with body mass index (BMI) among elementary school children in Korea [14]. Wahi et al [15] argued that contextual factors (education, income, and unemployment) influence lifestyle risk factors (breast feeding, obesity, dietary intake, tobacco use, activity pattern, and psychosocial stress) of parents, especially mothers who will provide home environment to children and contribute to childhood overweight/obesity. A few studies examined lifestyle factors associated with underweight and overweight/

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obesity simultaneously in children in Korea [13], although they only included dietary patterns in the study and did not consider environmental or contextual factors. Similarly, studies that investigated underweight in children are rare, particularly using nationally representative samples [11,12]. Therefore, the current study sought to describe the prevalence of underweight and overweight/obesity among elementary school children, and to clarify factors associated with underweight and overweight/obesity simultaneously, considering multiple factors including demographic, health status, diet and exercise, and school environmental characteristics.

The purpose of this study was to estimate the prevalence of underweight and overweight/obesity, and to analyze factors associated with underweight and overweight/obesity among elementary school children recruited nationally across Korea.

## Methods

### Study design

An observational, cross-sectional study design was used.

### Participants

A convenience sample of elementary school children voluntarily participated in this study. An official document was sent to all elementary schools throughout Korea through local offices of education, which was solicited to take part in the study. Fifty-nine schools responded to the official document and participated in this study. Study participants included 4,895 children attending third and sixth grades of participating schools. These schools are distributed across the country, including six metropolitan cities and five provinces (Do).

A total of 11,800 survey sheets were distributed (200 questionnaires for each school) and 5,022 questionnaires were returned (42.6%). After exclusion of 127 questionnaires with incomplete answers, questionnaires from 4,895 students (41.5%) were used in the study. Before data collection, a health teacher in each school was asked to select three classes from the third and sixth grades respectively and requested to collect data from all students in the selected classes. Eligibility criteria included those who were able to read and understand the Korean language and were enrolled in the third or sixth grades of participating schools. For the logistic regression analysis, a post hoc power analysis was performed using G-Power 3.1.9. The odds ratio for unbalanced diet of underweight group assuming a binomial distribution was 1.4, with a  $P(Y = 1 | X = 1) H_0 = 0.2$ , where 99.4% power was produced with 4,182 participants (combining underweight [ $n = 330$ ] and normal weight groups [ $n = 3,852$ ]) and an  $R^2$  of .16 ( $\alpha = .05$ ).

### Ethical considerations

No human subjects approval statement was obtained. However, the study was approved by the principals and administrators of the participating schools and the Korean Federation of Teachers' Association, and the research team applied every ethics measure possible to ensure protection of the participants. Data collection was performed after obtaining written consent from parents who allowed their children to participate in the study, and verbal assent was obtained from the participating children. Participants were informed that they could withdraw from the study at any time without any penalty, and anonymity and confidentiality were maintained throughout the study.

### Instruments

The instruments included demographic characteristics, health and disease conditions, diet and exercise, and environmental characteristics of schools. Health and disease characteristics included diagnosis of allergic diseases, perception of subjective health, and BMI of children. Students were asked whether they were diagnosed with asthma, allergic rhinitis, and atopic dermatitis by a physician. These were recorded dichotomously (1 = yes, 0 = no). Children's perception of subjective health was measured with nominal scale (1 = good/very good, 0 = poor/very poor). BMI was calculated based on self-reported weight and height ( $\text{kg}/\text{m}^2$ ). Students were asked to report their height and weight to the nearest 0.1 cm and 0.1 kg. Children were classified into three BMI groups according to Korean age-specific and gender-specific BMI percentiles [16]. Overweight/obesity was defined as at or greater than the 85th percentile BMI-for-age, normal weight was defined as at or greater than the 5th percentile and less than the 85th percentile BMI-for-age, and underweight was defined as less than the 5th percentile BMI-for-age.

Characteristics of diet and exercise included eating habits (6 questions), exercise frequency (1 question), and diet experiences (1 question). Questions on eating habits included eating breakfast daily, consuming fruits/vegetables daily, unbalanced diet (picky eating), whether fast food serves as a snack or a meal, frequency of fast food consumption, and most frequently consumed (favorite) snack type. An ordinal scale was used for fast food consumption (1 = never, 2 = 1–2 times per month, and 3 = once or more than once per week). Nominal scales were used for reasons for fast food consumption (1 = as a snack, and 2 = as a meal), and favorite snack type during the past month (1 = pizza/hamburger/cookies and 2 = fried food [fried chicken/French fries]), while all other variables were measured using dichotomous scales (1 = yes, 0 = no). Exercise frequency was designated using ordinal scale (1 = daily, 2 = 4–5 times per week, 3 = 2–3 times per week, and 4 = rarely), while diet experiences was dichotomous (1 = yes, 0 = no).

Environmental characteristics of schools included school location (metropolitan, urban, and rural), frequencies of serving fast food (pizza, hamburger, and fried chicken) at school lunch, and sales of soft drinks within schools whether in vending machines or in school cafeteria. Frequencies of serving fast food at school lunch was measured using an ordinal scale (1 = less than once per week, and 2 = equal to or more than once per week), while soft drinks sales in schools was measured using a nominal scale (1 = vending machines, 2 = school cafeteria, and 3 = do not sell).

Questions on diet and exercise and environmental characteristics were developed and modified by the researchers after a pilot study and consultation with expert committee. The expert committee included three professors in nursing and education and 10 health teachers. The pilot test was performed with 50 students who did not participate in the current study.

### Data collection

After obtaining permission from principals of participating schools, the principal investigator met with health teachers of the participating schools at the group meeting sessions for the national health campaign program, explained the study purpose, and requested their assistance for data collection. Mail packets were delivered to health teachers, including survey instructions, questionnaires, and parental consent forms. Health teachers sent out school newsletters with parental consent forms, explaining the purpose of the study. After obtaining consent forms, questionnaires were distributed to eligible students with verbal instructions in the class. Students return completed questionnaires to health teachers

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