Body Composition Evaluation of Elementary School Students Using Bioelectrical Impedance Analysis in South Korea

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Dear Editor-in-Chief

Obesity is an emerging social problem worldwide. The WHO defines obesity as a disease and emphasizes that it should be actively managed (1). Not only adult obesity but also childhood obesity is currently increasing rapidly in South Korea. According to a Ministry of Education Student Health Examination, the obesity rate increased by 1% every year from 15.1% in 2015 to 19% in 2019 over the past five years, and the latest survey showed a 3.9% increase from 15.1% in 2019 to 19% in 2021 (2). These results indicate that childhood and adolescent obesity rates are rapidly increasing.

Unlike adult obesity, which represents increase in the size of adipocytes, childhood and adolescent obesity is characterized by increases in the number of adipocytes as well as the size of adipocytes (3). As a result, it is known that approximately 80% of obesity in children and adolescents is transformed into adult obesity and is highly likely to cause cardiometabolic complications such as hypertension, diabetes, hyperlipidemia and cardiovascular disease (4, 5). For instance, obese children had higher risk of metabolic syndrome occurrence compared to normal children (6).

In this respect, accurate evaluation of body composition is important as the first step for the prevention and treatment of obesity in children and adolescents. Therefore, this study was conducted to investigate the difference of body composition according to age-dependent growth pattern and sex for elementary school children in South Korea in 2019.

Overall, 971 students (aged 10-13 yr) including 519 boys and 452 girls were enrolled from elementary schools located in Incheon Metropolitan City in South Korea. We assessed body composition including body weight, skeletal muscle mass, body fat mass, BMI, and percent body fat using Inbody 370 (Biospace, Seoul, South Korea).

This study was conducted with the approval of the Incheon National University Institutional Review Board (Permission number: 7007971-201612-003-01).

The results of this study are presented in Table 1. We found that body weight, skeletal muscle mass, body fat mass, and percent body fat was increased as the grade went up in both boys and girls. The levels of skeletal muscle mass were higher in boys than girls so that the reason why boys showed higher levels of body weight and BMI than girls could be explained. Body fat mass showed a tendency to increase along with growth in both boys and girls until the age of 12 yr and did not show any difference between boys and girls. However, at the age of 13 yr, girls had clearly higher levels of body fat mass than boys. In addition, girls also showed higher levels of percent body fat than boys.

Table 1: Results of body composition according to age and gender

Age (yr)	n	Height (cm)	Weight (kg)	Skeletal Muscle Mass (kg)	Body Fat Mass (kg)	Body mass index (kg/m²)	Percent Body Fat (%)
Boys							
10	155	136.99±0.46	34.45±0.62	13.27±0.16	8.78±0.39	18.64±0.42	25.06±1.31
11	124	143.10±0.53	39.41±0.83	15.10±0.24	10.50±0.53	19.09±0.31	25.10±0.79
12	139	150.05±0.63	45.47±0.93	18.33±0.40	11.32±0.59	19.96±0.30	23.46±0.80
13	101	156.31±0.78	49.12±1.08	20.62±0.42	10.85±0.64	19.85±0.36	21.04±0.87
Girls							
10	131	135.21±0.97	31.76±0.52**	11.88±0.16***	8.25±0.31	17.15±0.20**	24.80±0.58
11	111	143.86±0.64	40.14±3.11	14.25±0.23*	9.49±0.41	17.75±0.25**	24.68±0.74
12	118	149.68±0.55	41.74±0.69**	17.20±0.97	10.71±0.42	18.54±0.24***	24.83±0.64
13	92	155.50±0.65	48.44±1.10	18.36±0.31***	13.81±0.69**	19.96±0.38	27.10±0.80***

Values are Mean ± SEM, $P<0.05$, **$P<0.01$, ***$P<0.001$ vs. boys at same age

These results appeared to be gender differences due to the effects of sex hormones. The average menarcheal age of female students was about 12 yr (7, 8). Taken together, it is assumed that clear differences in body fat mass and percent body fat were shown at the age of 13 years in girls. Therefore, it is considered desirable for follow-up studies to identify differences in sex hormones by age using blood tests. Since this study was conducted with elementary school students in some regions, it has a limitation which is difficult to represent the average of the body compositions of all children in South Korea. However, given the recent increases of obesity in children, the results of this study may be used as basic data for future studies related to growth, development, and obesity in children and adolescents.

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Conflict of interest

The author declares that there is no conflict of interest.

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