



Analysis of Correlation between Spine Deformation and Body Composition in Elementary School Students with Adolescent Idiopathic Scoliosis

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Dear Editor-in-Chief

Recently, obesity has emerged as a serious social problem. In 2015, the global childhood obesity rate reached 5%, and in some countries, childhood obesity is trending to exceed the growth rate of adult obesity (1). Being overweight or obese before puberty leads to an increased risk of type 2 diabetes and cardiovascular disease (2), as well as several orthopedic complications (3). In particular, adolescent idiopathic scoliosis (AIS) of unknown cause is known as an orthopedic spinal deformity with a prevalence of about 5.2% (4). The higher the body mass index (BMI) of AIS patients, the greater the thoracic kyphosis angle (5), and AIS girls are twice as likely to be obese compared to healthy controls (6). Conversely, AIS patients had lower body weight and lower BMI than controls (7, 8). As such, contradictory results for AIS and obesity have been reported, but most of them were simply comparative studies with the control group. However, for correct weight management and prevention of spinal deformity in adolescence, a correlation analysis between obesity and spinal deformity is required. Therefore, we aimed to provide basic data on body composition that should be considered

when improving and preventing spinal deformity by analyzing the correlation between body composition and spinal deformity targeting elementary school students with AIS.

For this study, 453 male ($n=232$) and female ($n=221$) elementary school students (13.95 ± 2.43 degrees, 11.21 ± 1.21 years, 144.61 ± 9.92 cm, 39.53 ± 10.92 kg) were diagnosed with mild AIS between 11 and 20 degrees in orthopedic surgery. All subjects participated in the study after reading and signing the consent form approved by the Institutional Review Board of Incheon National University.

For three-dimensional measurements of the spine and pelvis, surface tomography was performed using a raster stereoscopic imaging method using a spinal structure analyzer (Formetric 4D, DIERS International GmbH, Germany). For accurate measurements, the underwear and top were removed so that the three landmarks, C7, and both posterior superior iliac spine could be seen. This method measures the body surface contour through the halogen lamp, so it is non-invasive, has no risk of radiation exposure, and enables fast and accurate measurements. All measured



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data, the mean and standard deviation were calculated using the SPSS 25.0 (IBM Corp., Armonk, NY, USA). The correlation between the spine deformation and body composition was analyzed through the Pearson correlation, and the significance level was set to $P < .05$. As a result of the correlation analysis, there was no significant correlation between the scoliosis angle and body composition. However, in the

case of lumbar lordosis, there was a significant positive correlation between fat mass ($P = .002$) and body fat percentage ($P = .000$). Similar to the previous study (5), the thoracic kyphosis angle showed a significant positive correlation with BMI ($P = .000$). In addition, there was a significant positive correlation with fat mass ($P = .000$) and body fat percentage ($P = .000$) (Table 1).

Table 1: Correlation between body compositions and spine deformation

Variables	Mean±SD	1	2	3	4	5	6
1. Scoliosis (°)	13.95±2.43	1					
2. Lordosis (°)	35.43±8.12	.055	1				
3. Kyphosis (°)	43.25±9.31	.076	.427**	1			
4. Fat mass (kg)	10.02±5.73	.016	.143**	.415***	1		
5. Fat percentage (%)	24.19±8.18	-.011	.167***	.363***	.878***	1	
6. BMI (kg/m ²)	18.79±4.82	.003	.079	.294***	.601***	.483***	1

*, $P < .05$, **, $P < .01$
 Note. BMI; body mass index

When the results are taken together, there was no correlation between the scoliosis angle and body composition related to obesity. However, the angle of thoracic kyphosis and lumbar lordosis increased as body fat and BMI increased. This suggests the importance of proper weight management in adolescents for preventing spinal deformity as well as AIS patients.

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Conflict of interest

The author declares that there is no conflict of interest.

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