



## **Analysis of Idiopathic Scoliosis and Body Composition According to the Presence of Menarche in Adolescent Female Elementary Students in South Korea**

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### **Dear Editor-in-Chief**

Adolescence is a period of rapid growth in which sexual maturity occurs along with changes in body composition due to a rapid increase in height and weight. In Korea, the average age at which menarche commenced in 2010 was 11.98 years, i.e., three years premature when compared with that reported in the past 40 years (1). As height is an indicator of bone maturation, menarche occurs after the maximum development of the body, and growth is completed approximately 2 years later. In addition, body weight is highly correlated with body fat, and menstruation is maintained when the body fat ratio is approximately 17% (2). Meanwhile, a study on menarche reported that the earlier the menarche, the higher the risk of breast cancer and diabetes (3). However, to date, no studies on the association between a female's menarche and scoliosis have been reported. Considering that hormonal changes during growth, asymmetric musculoskeletal growth, and environment and lifestyle changes are common causes of both idiopathic scoliosis and menarche (4, 5), it is necessary to analyze the relationships between them.

Therefore, we aimed to identify the differences among variables affecting body composition and idiopathic scoliosis according to the presence of menarche in elementary school girls during the growth period.

In this study, 490 elementary school girls in Incheon were interviewed for the presence of menarche and examined for their body compositions and scoliosis. The examination was conducted on students who had agreed from each household after teachers and researchers prepared an official document together.

This study was conducted with the approval of the Incheon National University Institutional Review Board (7007971-202006-005A). For the measurement of body composition (Inbody 720, Inbody, South Korea) and determination of the trend analysis of idiopathic scoliosis, the left and right tilt of the trunk and the pelvic tilt, trunk tilt, and scoliosis angle of the body were measured using 3D vertebral structure analysis (Formetric 4D, Diers Biomedical Solutions, Germany) that can analyze scoliosis and body alignment. The subjects were grade 3–6 elementary school stu-



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dents aged  $12.19 \pm 1.22$  years. For analysis, IBM SPSS 25.0 (IBM Corp., USA) was used.

Of the 490 subjects, 239 (48.8%) experienced menarches, of which 143 (49.5%) were found to have idiopathic scoliosis. The average age of menarche experience was  $11.55 \pm .98$  years, which was lower than 11.98 years in 2010. The analysis of the body composition *t*-test according to the presence of menarche showed significant differences in height, weight, skeletal muscle mass, body fat mass, body mass index, and percent body fat (Table 1). As a result of the *t*-test analy-

sis of scoliosis-related variables according to the presence of menarche, significant differences were found in the scoliosis angle, and pelvic rotation angle (Table 1). According to the analysis of the correlation between the scoliosis angle and body alignment variables according to the presence of menarche, the menarche experienced group had a significant positive association with the scoliosis angle, and frontal plane imbalance, whereas the menarche inexperienced group had a significant positive association with the torsion angle of the trunk (Table 2).

**Table 1:** Results of body composition & spinal variables according to menarche

<i>Variables</i>	<i>Menarche</i>	<i>N</i>	<i>Mean±SD</i>	<i>P</i>
Height (cm)	Yes	239	151.81±7.36	.001
	No	251	137.28±5.95	
Weight (kg)	Yes	239	44.66±9.10	.001
	No	251	32.33±5.76	
Skeletal Muscle Mass (kg)	Yes	239	17.00±2.96	.001
	No	251	12.71±7.54	
Body Fat Mass (kg)	Yes	239	12.35±5.55	.001
	No	251	7.96±7.96	
Body Mass Index (kg/m <sup>2</sup> )	Yes	239	19.29±3.10	.001
	No	251	17.01±2.30	
Percent Body Fat (%)	Yes	239	26.67±7.65	.001
	No	251	24.04±6.88	
Scoliosis (°)	Yes	239	11.97±4.77	.028
	No	251	11.04±4.47	
Sagittal Imbalance (mm)	Yes	239	2.73±1.94	.583
	No	251	2.63±2.06	
Coronal Imbalance (mm)	Yes	239	1.15±.95	.543
	No	251	1.10±.89	
Trunk Torsion (°)	Yes	239	3.96±4.07	.479
	No	251	4.22±3.98	
Pelvis Torsion (°)	Yes	239	1.89±1.39	.497
	No	251	1.97±1.34	
Pelvis Rotation (°)	Yes	239	3.97±2.69	.049
	No	251	3.47±2.96	

Values are Mean±SD

**Table 2:** Results of correlation analysis according to menarche

<i>Variable</i>	<i>Menarche</i>	<i>Sagittal Imbalance</i>	<i>Coronal Imbalance</i>	<i>Trunk Torsion</i>	<i>Pelvis Torsion</i>	<i>Pelvis Rotation</i>
Scoliosis	Yes	.03	.15*	.012	.01	.06
Angle	No	.06	.12	.27**	.01	.16*

Values are Mean±SD, \**P*<0.05, \*\**P*<0.01

The results of this study could serve as educational material for inculcating the habit of regular checkups and for prioritizing health care in elementary schools. However, additional studies are warranted to interpret the significant differences in idiopathic scoliosis and body alignments more appropriately depending on the presence of menarche and the correlation between variables.

### Conflict of interest

The author declares that there is no conflict of interest.

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