

## Relationship between somatotype and body composition in college track-and-field athletes

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### Abstract

Although, estimating body composition is important in track-and-field athletes in training, convenient and accurate methods for athletes have not yet been established. Meanwhile, somatotyping has been used for the assessment of athletes' physiques. The purpose of this study was to investigate the utility of somatotyping for estimating body composition by clarifying relations of somatotype components and body composition indexes in college athletes. Measurements were made in thirty-one male college track-and-field athletes (18-22 yr) two times each, at 13-month intervals. We measured weight, height, breadth and girth measurements, skinfold thicknesses (SF), and bioelectrical impedance (BI). Three somatotype components (i.e. endomorphy, mesomorphy and ectomorphy) were determined depending on the Heath-Carter anthropometric method. Body mass index (BMI;  $\text{kg}\cdot\text{m}^{-2}$ ), and fat mass index (FMI;  $\text{kg}\cdot\text{m}^{-2}$ ) and fat-free mass index (FFMI;  $\text{kg}\cdot\text{m}^{-2}$ ) (i.e. fat mass and fat-free mass standardized by height), calculated from both SF and BI, were used as body composition indexes. The relation between somatotype and body composition was analyzed for all two measurements. Mesomorphy and ectomorphy were significantly related to BMI. FMI and FFMI by SF were more accurate than by BI in relation with somatotype components. High correlations were obtained in the endomorphy vs. FMI, mesomorphy vs. FFMI, and ectomorphy vs. FFMI relations. No matter what estimation method for body composition was used, each somatotype component was significantly related to body composition. These findings in the present results suggest that anthropometric somatotype rating would be useful for estimating body composition in track-and-field athletes in training.

**KEY WORDS :** Skinfold thickness, Bioelectrical impedance, BMI, Fat mass index, Fat-free mass index

### Purpose

In track-and-field events, i.e. running, jumping and throwing, athletes should have a body fitting for their event characteristics to attain higher performance<sup>1)</sup>. Therefore, estimating body composition is important in assessing the progress of performance potential or physical condition in athletes in training. A two-component model that divided whole body mass into fat mass (FM) and fat-free mass (FFM) has been generally used to estimate body composition<sup>2)</sup>. Although, skinfold thickness (SF) or bioelectrical

impedance (BI) methods used widely in a field of sports training are easy and convenient methods, predictive equation using these methods made from non-athletes would be inapplicable to athletes with highly-trained physical performance level. Consequently, convenient and accurate estimation methods for athletes have not yet been established. Meanwhile, anthropometric somatotyping has been used for the assessment of athletes' physiques, which is easy and correct measure<sup>3)</sup>. If somatotype is greatly related to body composition, somatotyping would be useful for assessing body composition. Previous

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studies showed significant relationship between somatotype and body composition in college-aged women<sup>4, 5, 6</sup>). Thorland et al. investigated body composition and somatotype characteristics of junior Olympic athletes<sup>1</sup>). However there is no study that relationship between both indexes for athletes was clarified.

The purpose of this study was to investigate the utility of somatotyping for estimating body composition by clarifying relations of somatotype components and body composition indexes based on both SF and BI in college athletes.

## Methods

### 1) Subjects

Thirty-one male college track-and-field athletes (18-22 yr) participated in this study, two times each, at 13-month intervals.

### 2) Anthropometric measurements

Weight, height, two biacromial breadths (humerus and femur), two girths (fixed upper arm and calf) and five skinfold thicknesses (SF; biceps, triceps, subscapular, suprailiac and medial calf) were measured on the right side of the body and by trained investigator according to standard techniques. Bioelectrical impedance (BI) was measured using a generator<sup>7)</sup> (TP-202K, Toyo Physical, Fukuoka, Japan).

### 3) Somatotype

Somatotype was described depending on three somatotype components (i.e. endomorphy, mesomorphy and ectomorphy) which were determined according to the Heath-Carter anthropometric method<sup>3)</sup>.

### 4) Body compositions

Estimating body composition was made by both SF described by Lohrman<sup>8)</sup> and BI. Body mass index (BMI;  $\text{kg}\cdot\text{m}^{-2}$ ), and fat mass index (FMI;  $\text{kg}\cdot\text{m}^{-2}$ ) and fat-free mass index (FFMI;  $\text{kg}\cdot\text{m}^{-2}$ ) (i.e. fat mass and fat-free mass standardized by height)<sup>9, 10)</sup>, calculated from both SF and BI (FMI-SF, FMI-BI, FFMI-SF and

FFMI-BI, respectively), were used as body composition indexes.

## 5) Statistics

All data are presented as mean $\pm$ SD. A paired t-test was used to compare two variables. A Pearson's correlation coefficient was employed to test the relationship between two variables. Statistical significance was accepted at  $p<0.05$ .

## Results and discussions

### 1) Comparison of evaluation method

(SF vs. BI relation; Table 1)

Although present evaluation methods using SF and BI are estimated from different principle, there was no significant difference between body composition indexes evaluated by both. These results would show that the values estimated from both methods were proper.

Table 1. Body composition indexes in college athletes.

|  | SF             | BI             |
|--|----------------|----------------|
| FMI ( $\text{kg}\cdot\text{m}^{-2}$ )  | 3.2 $\pm$ 0.8  | 3.0 $\pm$ 0.7  |
| FFMI ( $\text{kg}\cdot\text{m}^{-2}$ ) | 18.2 $\pm$ 1.2 | 18.4 $\pm$ 1.2 |

SF: Skinfold thickness, BI: Bioelectrical impedance, FMI: Fat mass index, FFMI: Fat-free mass index.

### 2) Somatotype of athletes

(Fig. 1)

Somatotype of track and field athletes was distributed over the Mesomorphy-Ectomorphy range, which means that subjects were well-muscled athletes.

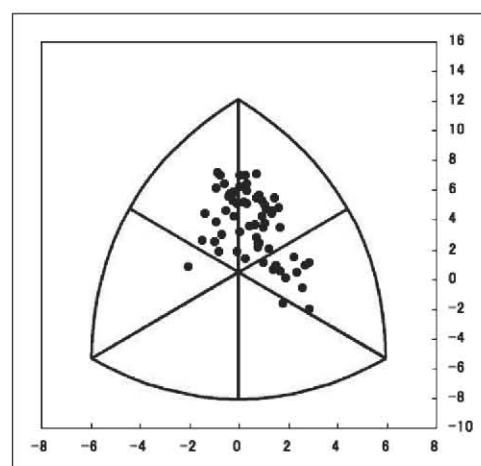


Fig. 1. Somatochart in college track-and-field athletes.

### 3) Somatotype vs. body composition relation (Fig. 2)

The relations of each somatotype component and body composition index are shown in Fig. 2, and significant correlations of  $p < 0.001$  level are demonstrated by straight line. Significant relationships were found between BMI, and mesomorphy (positive) and ectomorphy (negative). FMI and FFMI-SF were more accurate than -BI in relation with somatotype

components. High correlations were obtained in the mesomorphy vs. FFMI (positive) and ectomorphy vs. FFMI (negative) relations in both -SF and -BI. On the other hand, endomorphy was highly related to FMI-SF but weakly related to FMI-BI. These results for athletes could be consistent with previous studies for students<sup>4, 5, 6</sup>.

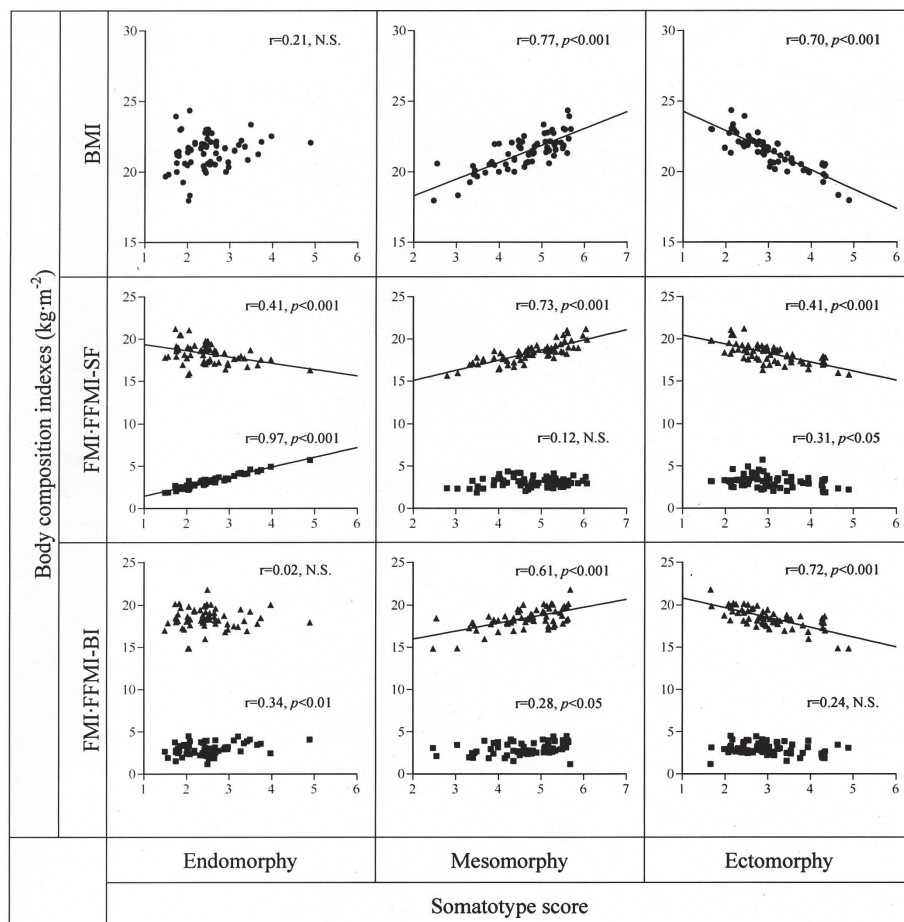


Fig.2. Relationship between body composition indexes and three somatotype components. Body composition index vs. endomorphy in left column, mesomorphy in middle column and ectomorphy in right column, respectively. Somatotype score vs. body mass index (BMI) in upper line, fat free mass index (FMI) and fat-free mass index (FFMI) by skinfold thickness (SF) in middle line, and by bioelectrical impedance (BI) in bottom line, respectively. ●: body mass index, ■: Fat-free mass index, ▲: Fat mass index.

Although somatotype and body composition by SF are calculated from anthropometric measurements, by BI is evaluated from different principle of measurement. Nevertheless, no matter what estimation method for body composition was used, strong relation was obtained between somatotype and body composition. Consequently, these results would support our hypothesis that anthropometric somatotype rating

would be useful for estimating body composition in athletes in training.

### Conclusions

We investigated the relation between somatotype and body composition in college track-and-field athletes. No matter what estimation method for body

composition was used, strong relation was obtained between both indexes. Mesomorphy and ectomorphy were highly related to FFMI in particular. These findings in the present study suggest that anthropometric somatotype rating would be useful for estimating body composition in athletes in training.

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