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Original Article

# Comparisons of physical fitness and body composition among Sasang types with and without body mass index as a covariate

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ABSTRACT

*Background:* The purpose of this study was to examine the difference of physical fitness and body composition among Sasang types with BMI as covariate, which is reported to have influence on physical fitness and body composition.

*Methods:* We measured the physical fitness and body composition of 930 korean female college students, and compared the differences among Sasang type groups with or without considering Body Mass Index (BMI). We evaluated muscle strength, agility, muscle endurance, power and flexibility for the physical fitness, and total body water, protein, muscle mass, mineral, lean body mass and fat mass for the body composition.

*Results:* We got 352 So-Yang (SY), 385 So-Eum (SE), and 193 Tae-Eum (TE) Sasang types, and there were significant differences among Sasang types in height, weight and BMI. The significant differences among TE and SY types were disappeared in muscle strength, total body water, protein when BMI is used as a covariate. In ANOVA, there were significant differences that TE was higher on the mineral and fat mass compared to the SY type and SE type. However it disappeared when we introduced BMI as covariate.

*Conclusion:* The results demonstrated that the BMI should be considered as an important element for studying physical characteristics of Sasang typology.



## 1. Introduction

In Korea, the Sasang typology by Lee Je-Ma groups humans into Tae-Yang (TY), So-Yang (SY), Tae-Eum (TE), and So-Eum (SE) types on the basis of functional differences of internal organs. Each Sasang type has consistent characteristics of physical appearance, physiology, and temperament. Because of these different traits, the diagnosis and treatment of diseases and regimen differ for each Sasang type.[1] The usefulness of the Sasang typology has been recently demonstrated in clinical medicine and in various fields such as nursing,[2] food,[3] architecture,[4] education,[5] literature,[6] and physical education.[7–10] This illustrates the usefulness of the

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characteristics of Sasang typology in multiple aspects of health improvement such as disease treatment and extensive understanding of human beings.

In particular, the application of Sasang types to physical education is very promising. It modifies the stereotyped practical skill teaching method by introducing personal abilities based on temperament and physical characteristics. This requires the development and application of an exercise program that would fit a patient's constitution, temperament, and physical characteristics, according to the Sasang type. Studies conducted to date have reported differences between the Sasang types in body composition and physical fitness;[7,9,11–13] however, they fail to consider differences between the Sasang types in body shape.

According to the record in the *Dong-yi-soo-se-bo-won* for the physical characteristics of each Sasang type, the TE type is normally tall and well built.[1] The physical frame of the TE type is strong and solid. The SE type has a small frame and is thin and weak. People of the SY type are small in stature and have a tidy appearance, resembling the SE type. The body of the TE type is the largest among the Sasang types and the bodies of SE and SY are small and similar to each other.

In the Questionnaire of Sasang Constitution Classification II (QSCCII) used in this study, sections 1–6 are composed of questions on body shape and physique. This questionnaire has demonstrated differences in body shape and physique among the Sasang types. The QSCCII contents are as follows: Question 1, "what is your physique?"; Question 2, "what is your body shape?"; Question 3, "what is the ratio between your upper and lower body in your body shape?"; Question 4, "which of the following types does your body shape belong to?"; Question 5, "which of the following types does your appearance and physique belong to?"; and Question 6, "which of the following types does your chest belong to?"

The differences in body shape among the Sasang types have been recently confirmed objectively by measurements using dual-energy X-ray absorptiometry. Body shape and body mass index (BMI) of the TE type are reportedly the highest among the Sasang types.[7,9,11–15]

Body shape is related to body composition and physical fitness.[16,17] In particular, the BMI (kg/m$^2$), which is used internationally as a measure of obesity, shows a correlation with physical fitness and body composition.[18,19] It has been reported that BMI affects physical fitness.[20–23]

Chae[15,24] reported large differences in BMI among the Sasang types, and subsequently published a series of studies regarding Sasang personality.[25–32] Ko and You[33] reported that the BMI affects physical fitness factors. These studies indicate that the differences in BMI among Sasang types may affect body composition and physical fitness, and that BMI is an important variable in the physical characteristics of the Sasang types. Therefore, it is necessary to confirm the differences in physical fitness among the Sasang types by controlling differences in BMI. The pure effect of an independent variable on a dependent variable can be confirmed by controlling a nuisance factor that could affect the dependent variable using analysis of covariance (ANCOVA).

This study was performed to investigate the effect of BMI on constitution, physical fitness, and body composition by statistically comparing analysis of variance (ANOVA) analysis and ANCOVA analysis for the same study participants.

## 2. Methods

### 2.1. *Participants*

The participants in the present study comprised 930 Korean female college students in their 20s who did not have a specific disease and did not exercise regularly.

We used the QSCCII for the Sasang type classification and measured body composition using a body composition analyzer. A total of 1673 women were initially enrolled; however, participants who insincerely responded to the QSCCII, body composition analysis, and physical fitness measures were excluded in the analysis. In addition, participants who were not classified into a Sasang constitution type were excluded. The estimate of the power according to the sample size was performed using the G*-power program.[34] Power (1-β err prob) was 0.999 in the ANOVA and ANCOVA analyses. All participants in this study submitted informed, written consent.

### 2.2. *Method*

#### 2.2.1. *Sasang type categorization*

The Sasang types were classified, based on QSCCII. The QSCCII is a constitution classification questionnaire developed by Kim et al.[35] It is composed of 121 self-report items,

**Table 1 – Methods for measuring physical fitness**

| Factors | Method for the measurements |
|---|---|
| Grip strength | Grip strength was measured using a Smedley dynamometer (TKK 5401, Japan). The participants griped the dynamometer with four fingers, except the thumb, and controlled the width of the handle. The arms were naturally lowered. Maximum strength was applied to the dynamometer without touching the body. |
| Agility | Tapping was measured by pressing a number for 10 seconds using an automatic count, pen tapping-type equipment (Casio HS-3V, China). |
| Muscular endurance | The participants lay on a mattress with knees bent at a 90° angle. Fingers were interlinked behind the head. On the command "go", they began raising the upper body forward to touch the elbows, and then lowered back to the floor (Casio HS-3V, China). |
| Power | The participants stood on a long jump mat (NISPO NJM-425, Taiwan), with the legs spread 10–20 cm apart. The individual then jumped, using the rebound of the body, arms, and legs. The length was measured from the board to the closest body part. |
| Flexibility | The participants sat on a measuring apparatus with the legs straightened so that both soles touched the perpendicular plane (Spotop VIC-E-112, Korea). The individuals then slowly bent over and pushed the apparatus with the middle fingers. |