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Best-fit index for describing physical perspectives in Sasang typology

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ABSTRACT

Introduction: We examined the best-fit index for describing the constitutional or physical characteristics of Sasang typology for its universal application.
Methods: Ponderal index (PI), body mass index (BMI), and basal metabolic rate (BMR) of the nationwide participants ($n = 1663$; age, 31–60 years) were calculated. We described and analyzed the usefulness of each index for maximizing the differences between Sasang types across age and sex using box plots, Pearson's correlation, and analysis of variance.
Results: We found that the So-Eum, So-Yang, and Tae-Eum Sasang types were significantly ($p < 0.001$) different from each other in terms of PI, BMI, and BMR by the World Health Organization with weight (BMR-WHOw). The BMI was significantly correlated with PI ($r = 0.933$) and BMR-WHOw ($r = 0.577$).
Discussion and conclusion: These study results show that PI, BMR, and BMI have their own clinical values, and could contribute to the study of the pathophysiological mechanism underlying the Sasang typology as the *hypothalamus hypothesis*.

1. Introduction

Sasang typology is a clinical classification scheme that divides people into the following four types: Tae-Yang (TY), So-Yang (SY), Tae-Eum (TE), and So-Eum (SE). This classification system has been used as a basis for type-specific prevention and diagnosis of diseases, and treatment and rehabilitation of patients in traditional Korean personalized medicine for hundred years.[1] These four types have their own unique biopsychological traits, and each type can be considered as a clinical guideline or prototype.[2] Previous studies have demonstrated that each Sasang type has distinctive psychological,[3,4] physical,[3,5–7] and genetic[8,9] features; drug response; and pathophysiological symptoms;[10] in addition, they also show variations in biopsychological traits according to age and sex.[2,11]

In psychological or temperament studies, the traits neuroticism and extraversion as defined as *super factors* by Eysenck,[7] and Temperament and Character Inventory devised by Cloninger[4,12,13] are used a biopsychological basis to understand the temperamental traits of Sasang typology.[2,14] The

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Sasang Personality Questionnaire (SPQ) developed based on these previous studies has an acceptable clinical reliability and validity,[2,4,15–18] with the rank order of SPQ scores (lowest to highest) in the following order: SE < TE < SY.[2,15]

With regard to the physical or constitutional characteristics, each Sasang type showed significant differences in weight, circumference length of the neck or chest,[5] bitragus to submandibular arc length,[19] height-to-width ratio of the face,[20] and body mass index (BMI),[2,3,6] and the number increases in the order of SE, SY, and TE. A previous study using SPQ and BMI confirmed that the Sasang type of a person retains the biopsychological profiles that remain stable across the person's life span and the mind–body characteristics are suggested to be useful for clinical diagnosis.[2]

Although the BMI was originally adopted to quantify the physiological *body shape* of each Sasang type,[3] it can be easily mistaken for measuring the pathological factor of *obesity* of each Sasang type, irrespective of its original intention.[1,3] In Jae-Ma Lee's original book, *The Principle of Life Preservation in Eastern Medicine*, the TE type was described as *tall and big* rather than as *fat and obese*, and the SE type is described as *short and small* rather than *thin and skinny*.[1,3]

> "Sometimes the body shape of Tae-Eum and So-Eum types look similar and it is hard to distinguish these Sasang types. When you are not certain with your Sasang type diagnosis, you should focus on the disease symptoms... The body shape of So-Eum type is short and small yet sometimes large up to 225 cm, and the body shape of Tae-Eum is long and large yet occasionally small as 150 cm." (Differential diagnosis of each Sasang type)

In a previous study on Sasang type-specific pathophysiological symptoms with nationwide sample ($n = 1156$), there were no significant differences in the general health status among Sasang types, and rather, this study highlighted the type-specific pathophysiological mechanisms of Sasang typology.[18] Moreover, because the BMI is sensitive to the social and cultural influences, it has innate difficulties in cross-cultural and cross-ethnic application. For example, Western society has higher obese population and a different standard for obesity when compared with the Eastern countries.[21]

Thus, the clinical and pathophysiological importance of Sasang typology should be thoroughly reinvestigated using various indexes suggested in previous studies such as BMI,[3,6] ponderal index (PI),[2] and basal metabolic rate (BMR),[22] which can be calculated with weight, height, age, and sex. Moreover, these equations can also be used as a complementary or alternative corporal index for Sasang typology because they have different theoretical backgrounds and clinical purpose.

The PI is used to calculate the lean body mass.[23] It is calculated as weight divided by height raised to the power of three in order to measure the density per dimension. The PI is used when the difference in height among study participants is larger. It is also used to adjust the BMI error in the field of pediatrics.

The BMR was developed as a metabolic reference value for nutritional composition of various diets or for diagnosis of hypothyroidism and hyperthyroidism.[24] Various equations using weight, height, age, and sex were suggested for calculating BMR (Table 1). However, because the first developed BMR was Western oriented, the international standard[24] was suggested through more studies of ethnicity,[25] especially on Eastern populations,[26] and women or infants.[27] Considering the fact that BMR uses different equations for different sex and age groups, this study only applied the data of adult participants that share the same equation as that used for those between 31 and 60 years of age.

Table 1 – Equations for the calculating the BMI, PI and BMRs

Measures	Male	Female
Height (H, m)	Height	Height
Weight (W, kg)	Weight	Weight
Age (A, year)		
Body mass index (kg/m^2)[3]	W/H^2	W/H^2
Ponderal index (kg/m^3)[23,28]	W/H^3	W/H^3
Basal metabolic rate (BMR, kcal/day)		
BMR-HB (1919)[30]	13.7516W + 5.0033H – 6.7750A+66.4730	9.5634W + 1.8496H – 4.6756A + 664.0955
BMR-WHOw (1985)[24]	11.6W + 879	8.7W + 829
BMR-WHOwh (1985)[24]	11.3W + 0.16H + 901	8.7W – 0.25H + 865
BMR by Mifflin et al (1990)[25]	9.99W + 6.25H – 4.92A + 5	9.99W + 6.25H – 4.92A – 161
BMR by Liu et al (1995)[26]	13.88W + 0.0416H – 3.43A + 54.34	3.88W + 0.0416H – 3.43A – 58.06

These equations are used for calculating the values in persons between 31 and 60 years of age.
BMI, body mass index; BMR-HB, basal metabolic rate by Harris and Benedict; BMR-WHOw, basal metabolic rate by Word Health Organization/Food and Agricultural Organization/United Nations University with weight; BMR-WHOwh, basal metabolic rate by Word Health Organization/Food and Agricultural Organization/United Nations University with weight and height; PI, ponderal index.

This study tried to find best-fit index for describing physical characters of Sasang typology in combination with SPQ which was used for the previous study of mind-body characteristics of each Sasang types.[2] Based on the clinical data used in previous biopsychological studies of Sasang typology, we identified BMI, PI, BMR of each Sasang type, and compared how well these indexes can distinguish the constitutional or physical characteristics of Sasang typology. Furthermore, a comprehensive comparison of the changes based on sex and age was performed by incorporating various illustration methods. The study provides a better understanding of the pathophysiological mechanisms of each Sasang type and much more useful clinical differentiation tools for the Sasang typology.

2. Methods

2.1. *Participants*

The biopsychological measures of each Sasang type from the study participants ($n = 1663$; age, 31–60 years) were acquired from the Korea Constitutional Multicenter Bank (KCMB).[12,15] The Institutional Review Board of School of Korean Medicine, Pusan National University reviewed and approved this study.