Obesity has recently emerged as a global health concern. Patients with metabolic syndrome, which is associated with clinical disorders based on abdominal obesity, including atherogenic dyslipidemia, hypertension, and hyperglycemia and/or insulin resistance, are now recognized as a high-risk group for cardiovascular diseases (CVD).\(^1\)\(^2\)

BIA is widely accepted as a safe, rapid, low cost and reliable technique for measuring BF% and is currently being used at home and in medical health checkups for screening and in the measurement of an individual’s body composition. Recent reports have demonstrated that BF% is closely associated with CVD risk factors such as hypertension, dyslipidemia, and abnormal glucose metabolism.\(^3\)\(^4\)\(^6\)\(^7\)

One major concern with the use of BIA is that it is an indirect measure of body composition. BIA is based on the principle that electric current flows at different rates through the body according to its tissue composition; for example, fat impedes electric current more than protein.\(^2\)\(^4\)\(^6\)\(^7\) A number of predictive equations derived from empirical data have been developed for the estimation of BF% using BIA of tissue impedance and reactance. These data vary, however, according to age, ethnic group, and body shape. It is therefore necessary to choose from several validated equations to find the one that is best suited to the population being studied.\(^2\) Furthermore, variability in consumption of food or drink, exercise, existence of edema in the extremities or ascites, skin temperature, menstrual cycle and menopause can affect BF%.\(^2\) Differences among the equipment used may also affect this analysis. All these factors make it impossible to have a “universal equation” for use in all populations\(^6\) and for this reason, BIA should only be considered as an option for body composition analysis in healthy individuals or in patients with no fluid imbalance or body shape abnormalities, who have a BMI between 16 and 34 kg/m\(^2\).\(^7\) Furthermore, appropriate equations (age-, sex- and ethnic-group-specific) should be used.

Yamashita et al recognized these limitations and performed their measurements of BF% under controlled conditions. Measurements were performed on Japanese males in the fasted state before work in the morning using the same body composition analyzer. This instrument has previously been validated for use in a Japanese population.\(^5\) Using a method similar to their protocol, my group has also performed general health checkups among company employees (males) and demonstrated that individual counseling for diet and exercise significantly reduced BF% as well as BMI, WC, and blood pressure levels.\(^8\) It is therefore important that investigators who use BIA to measure BF% assess subjects in the fasted state and use similar methods as those reported here.\(^5\)

An interesting aspect of this study is that Yamashita et al report lower BIA cutoff points in the detection of CVD risk factors in current smokers than in nonsmokers.\(^5\) This unique...
method of determining cutoff points according to smoking status (current, ever or nonsmoking) should be considered in future clinical investigations.

It may be necessary to assess the distribution of body fat, particularly visceral fat, as distinguished from a simple assessment of obesity. A new method of BIA was recently reported by Ryo et al, who have developed an abdominal BIA method to noninvasively estimate visceral fat area (eVFA), and they showed that eVFA presumed by abdominal BIA correlated significantly with VFA determined by CT. This correlation was stronger than correlations between VFA determined by CT and WC, BMI and BF% with weight measured by the conventional BIA method. Okauchi et al used this abdominal BIA method in 2,870 Japanese (males: 2,322; females: 548) and demonstrated that in the receiver-operating characteristic curve, the cutoff points for predicting the prevalence of ≥1 CVD risk factors were 25 kg/m² and 28 kg/m² for BMI and 85 cm and 95 cm for WC in males and females, respectively.

It is very interesting to compare these cutoff points with the data presented by Yamashita et al in this issue of the Journal. In their study, the cutoff points for detecting the prevalence of ≥2 risk factors were 22.7 kg/m² for BMI, 81.4 cm for WC, and 20.3% for BF%; those for detecting the presence of 3 risk factors in current smokers were 24.9 kg/m², 87.8 cm, and 23.7%, respectively, and 23.3 kg/m², 83.9 cm, and 22.3% for BMI, WC and BF%, respectively, in nonsmokers. The results from these 2 papers may become the model for future clinical cohort studies or intervention trials using BIA.

Studies seeking better parameters for assessment of disease recently reported that phase angle (PA), a parameter of BIA, was a prognostic marker for survival in several clinical conditions including chronic obstructive pulmonary disease, heart failure, and cancer, suggesting that PA is a recognized parameter in the estimation of both body composition and function. PA, an indicator based on reactance and resistance obtained from BIA, is independent of regression equations, although it is lower in women and in individuals who are not physically active, and decreases with age.

In summary, Yamashita et al show that in middle-aged Japanese male workers, BF% measured by BIA could detect the presence of 2 or more CVD risk factors more accurately than BMI, and suggest that current smokers have lower BIA cutoff points than nonsmokers for detecting individuals with CVD risk factors. Although further study is necessary to confirm the significance of their measurements of BF%, the method of determining cutoff points according to smoking status (current, ever or nonsmoking) should be considered in future clinical investigations.

References