Background: The skeletal muscle volume is closely related to physical functions, and it increases rapidly during growth stage\(^1\)). There is increasing interest in the use of bioelectrical impedance analysis to assess body composition. However, less information about the applicability for predicting the muscle volume of children is available from previous studies.

Objective: To investigate whether segmental bio-electrical impedance analysis is usefulness for predicting the total and segmental skeletal muscle volumes of junior high school students.

Methods: Nineteen healthy Japanese children (10 boys and 9 girls, mean age 14.1 yr) volunteered under permission of their parents to participate in this study. Contiguous MRI images with a 1-cm slice thickness were obtained from the first cervical vertebra to the lateral malleoli. The volume of skeletal muscle was calculated from the summation of digitized cross-sectional area for every body segment, i.e., arm, trunk, thigh and lower leg, with the separation between segments based on anatomical landmarks visible in the scanned images. The electrical impedance of each of 9 segments (right and left side of forearm, upper arm, thigh and left and trunk) was measured by a bio-electrical impedance apparatus (500\(\mu\)A, 50kHz). An impedance index (BI index: \(L^2/Z\)) for each segment was calculated as the ratio of the segment length squared (\(L^2\)) to the impedance (Z).

Results: The MRI-measured total volume of skeletal muscle was 19819.2 cm\(^3\) for boys and 13931.3 cm\(^3\) for girls. For each segment, the volume of skeletal muscle was significantly correlated with BI index with the correlation coefficients of 0.760 to 0.952 (\(p \leq 0.01\)). Stepwise multiple regression analysis selected the BI index of the upper arm as a significant independent variable for predicting the total skeletal muscle volume (\(R^2 = 0.885, \text{ SEE } = 1255.3 \text{ cm}^3\)).

Conclusion: The present study indicates that bio-electrical impedance analysis is useful for assessing the total and segmental skeletal muscle volumes of adolescents.


Keywords: Muscle, Children, Bioelectrical Impedance Analysis