introduction

Fast, reliable and low cost method of body composition assessment is valuable in sports medicine to determine whether the alteration in body weight is due to body fat or muscle tissue changes.

There are various methods for fat and lean mass assessment, however, all of them have different limitations. The most common field method is the skinfold thickness measurement technique, yet it is time consuming and requires experienced personal.

Near infrared spectroscopy (NIR), which is based on the principles of light absorption and reflectance, has been proposed as a potential technique for non-invasive body composition assessment.

methods

Six young, healthy, physically inactive females aged from 20 to 26 years participated in the study. To assess the reliability of the NIR method, anthropometric and skinfold thickness data were obtained by reference methods and compared with NIR.

The measurements were performed on three sites on the subject’s dominant arm: opisthenar (the back of the hand), forearm, and biceps (8-12 measurements per site).

A tungsten halogen lamp (Avilight-HAL, Avantes BV, NL) was used as a light source. An optical fiber (FC-UV600-2-ME-1.5x80, Avantes BV, NL) delivered the light to the skin, while another fiber (FCRL-7UV200-2-ME-1.5, Avantes BV, NL) collected and transmitted reflected light to the spectrometer (Avaspec-2048-USB2, Avantes BV, NL).

The near-infrared region of the electromagnetic spectrum was used because of the low absorbance of other tissue chromophores, as well as an easy distinguishable absorption profile of fats in this range.

The thickness of the subcutaneous adipose tissue (SAT) was measured at the same body sites by the ultrasound in B-mode (Sonosite Titan, 10-5MHz, Sonosite Inc., Bothell, WA, USA).

The body mass index (BMI) and body fat percentage (TFB) were calculated based on the data from skinfold thickness measurement and anthropometry.

The data processing was performed in MatLab (vers.5.3, MathWorks Inc., Natick, Massachusetts). To determine whether the NIR signal is proportional to the amount of body fat, the correlation analysis has been carried out.

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results

In the obtained absorption spectra, the peak of 935nm with its minimum at 940nm wavelength was observed. The difference between the minimum and maximum (NIR signal) varied in persons with different body composition (Fig.3a) and in body sizes with different SAT thickness (Fig.3b).

The results also showed that the NIR signal obtained from the biceps (\(\text{NIR}_{\text{bic}}\)) has high significant correlations: \(r = 0.804\) (between \(\text{NIR}_{\text{bic}}\) and BMI), and \(r = 0.785\) (\(\text{NIR}_{\text{bic}}\) and TBF).

Although only the tendency has been observed for inter-subject correlation with other measurement sites.

conclusion

The absorption difference between 935nm and 940nm could be used as a reliable parameter for SAT thickness estimation. NIR spectroscopy could be used as a tool for body composition assessment.

To increase reproducibility of inter-subject measurements, the further improvement of method is required.

References