COMPARISON OF A-MODE AND B-MODE ULTRASOUND FOR MEASUREMENT OF SUBCUTANEOUS FAT

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ABSTRACT

Background: With lower cost devices and technological advancements, ultrasound has been undergoing a resurgence as a method to measure subcutaneous adipose tissue. Amplitude (A-mode) ultrasound produces a spike at the interface between subcutaneous fat and muscle, while brightness (B-mode) ultrasound produces an image of the underlying tissues. Purpose: This study aimed to determine if a low-cost, low-resolution A-mode ultrasound designed specifically for body composition assessment could produce subcutaneous fat thickness measurements comparable to an expensive, high-resolution B-mode device. Methods: Subcutaneous fat thickness was measured on 41 participants (21 female, 20 male; 29.6 ± 11.0 y; BMI 25.3 ± 5.1 kg/m²) at 7 different sites (chest, subscapula, mid-axilla, triceps, abdomen, suprailiac, and thigh) with two different devices: a 2.5 MHz A-mode ultrasound (BodyMetrix BX2000), and a 12 MHz B-mode ultrasound (GE NextGen LOGIQ e R7). Results: Pearson correlation coefficients between the two ultrasound devices exceeded 0.80 (P < 0.001) at all measurement sites. Mean differences in fat thickness were not significantly different between the devices (P > 0.05) with the exception of the triceps site (P = 0.021); however, the mean difference at this site (0.53 mm) was not clinically relevant. The variability between devices was greatest at the abdomen, the site with the greatest thicknesses. However, Bland-Altman plots revealed no systematic bias. Conclusions: The BodyMetrix BX2000 is a low-cost, A-mode ultrasound with software specifically designed to measure subcutaneous fat thickness.

METHODS

Subjects: 40 subjects (20 males, 21 females, 29.6 ± 11.0 y; BMI 25.3 ± 5.1 kg/m²) estimated from Jackson & Pollock 7-site A-mode equation.

Measurement sites: Chest, subscapula, mid-axilla, triceps, abdomen, suprailiac, and thigh. Anatomical landmarks are consistent with those described by Jackson and Pollock and Jackson et al.

Measurement protocol: Each site was measured with the A-mode device, and then with the B-mode device.

Equipment:
1) A-mode ultrasound: BodyMetrix BX2000 at 2.5 MHz with BodyView Pro software
2) B-mode ultrasound: NextGen LOGIQ eR7 and 12L-RS linear array transducer at 12MHz; on-screen calipers

Examiners: Four examiners, two each for A-mode and B-mode; each blinded to the measurements of the others

Statistical Analyses:
1) means ± SD calculated for each site
2) Repeated-measures ANOVA: mean differences between A-mode and B-mode
3) Pearson correlation coefficients
4) Visual inspection of plots

RESULTS

1. Pearson correlation coefficients exceeded 0.80 (P<0.001) between A-mode and B-mode at all sites.
2. No significant mean differences between A-mode and B-mode (P>0.05) with the exception of the triceps site (P=0.021); however, the magnitude of difference was small (-0.53mm) and not clinically meaningful (Table 1).
3. Variability was greatest at the abdomen, the site with the greatest thickness, however Bland-Altman plots revealed no systematic bias (Figure 1).
4. Individual measurements are shown in Figure 1.

SUMMARY and CONCLUSIONS

Both A-mode and B-mode ultrasound are equally capable of providing measurements of subcutaneous fat thickness with an accuracy of < 1 mm at most sites. The limiting factor of the lower resolution A-mode ultrasound is not selecting the correct equation. With a strong relationship and insignificant mean differences the lower resolution A-mode ultrasound provides measurements of subcutaneous fat thickness similar to the higher resolution B-mode machine.

REFERENCES
1. Wagner DR. Ultrasound as a tool to assess body fat. JObes. 2013;Article ID 280713.