Reliability and Validity of an iPad App and 3D Body Scanner to Measure Body Fat

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ABSTRACT

Background: Novel and innovative imaging methods to rapidly estimate body fat percentage (%BF) have made their way into fitness centers and clinicians’ offices. The purpose of this study was to evaluate the test-retest reliability of the %BF estimation from a two-dimensional iPad application (2D APP) and a three-dimensional body scanner (3D SCAN), and compare both imaging methods to the %BF estimation from air displacement plethysmography (Bod Pod). Methods: Seventy-nine adults (37 female, 42 male) varying widely in age (32.9 ± 12.4, 18-65 y) and body mass index (25.0 ± 4.9, 18.2-41.8 kg/m²) volunteered to be measured twice with the 3D SCAN and the 2D APP. A Bod Pod measurement served as the criterion. The 3 testing methods were all completed in the same session lasting about 1 h. Results: Test-retest reliability was excellent for both the 2D APP (ICC = 0.993; 95% CI: 0.989 to 0.996) and the 3D SCAN (ICC = 0.993; 95% CI: 0.989 to 0.995) with the standard error of measurement < 1% BF for both methods. The 3D SCAN tended to underestimate %BF compared to the Bod Pod. Conclusions: Although highly reliable, neither the 2D APP nor 3D SCAN provided valid estimates of %BF compared to the Bod Pod. More research is needed to determine if the algorithms associated with the imaging devices can be modified to improve the accuracy of the %BF estimates.

INTRODUCTION

• Both the Fit3D Body Scanner (3D SCAN) and LeanScreen 2D (2D APP) can be used to estimate body fat percentages (%BF).
• 2D APP is low cost and accessible to anybody with an iOS smart device.
• 3D SCAN is user friendly, commonly found in health centers, and yields fast results.

METHODS

Subjects:
79 subjects (37 female, 42 males, 32.9 ± 12.4, 18-65 y; BMI 25.0 ± 4.9, 18.2-41.8 kg/m²)
Measurement protocol: Each subject was measured twice by the 3D SCAN and 2D APP. A single measurement by the Bod Pod served as the criterion.

RESULTS

Descriptive characteristics of the sample are in Table 1.

<table>
<thead>
<tr>
<th>Table 1. Mean ± SD of the study sample</th>
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<tbody>
<tr>
<td>Age (y)</td>
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<tr>
<td>----------------------------------------</td>
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<tr>
<td>Female (n = 37)</td>
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<tr>
<td>Male (n = 42)</td>
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<td>Total (N = 79)</td>
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SUMMARY AND CONCLUSIONS

• The 3D SCAN was very highly correlated; however, the mean %BF of the app and scanner were significantly different than the Bod Pod with the 2D APP underestimating and the 3D SCAN overestimating %BF.
• Both methods had a systematic bias; overestimating lean participants and underestimate fat participants.
• The 2D APP and 3D SCAN are both very reliable, however, neither provided valid estimates of %BF compared to the Bod Pod.
• More research is needed to test the algorithms associated with imaging devices to see if they can be modified to be more accurate.