1143

Differences In Body-fat Percentage Induced By Applying Two Common Bioelectrical Impedance Analysis Instruments

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PURPOSE: Instrumentation is an important factor that influences the accuracy when estimating body fat (%BF). Bioelectrical impedance analysis (BIA) is a simple, relatively inexpensive technique to measure %BF. Hand-to-Hand (H-BIA) and Foot-to-Foot (F-BIA) devices are widely used to assess fitness of body composition. In a study of Japanese men, the mean difference was found between the measured %BF values by applying H-BIA and F-BIA analyzers. This study aimed to investigate if there are differences in %BF estimates measured by the two BIA instruments among middle-school and college students.
METHODS: For study one, 146 (boy=71; girl=75) 6th-grade students (age 11-13 yr) participated. For study two, 49 male college students (age 18-24 yr) were included, with 20 from Kinesiology (KIN) and 29 from Non-KIN majors. All subjects signed the informed consent before intervention. The %BF measures were taken by using Omron H-BIA and F-BIA Analyzers. Pearson's method was used to examine correlations. Differences in variables were tested using independent t-test. Values are presented as means±SD. An alpha level for significance was set at $P \leq 0.05$.
RESULTS: For study one, there was a high relationship between %BF estimates from two devices for girl-group ($r=0.75$, $p<0.001$), but a low relationship for boy-group ($r=0.41$, $p<0.001$). Significant differences between two %BF values ($p<0.001$) were noted only in the boy-group. For study two, a very high relationship was observed between %BF estimates from two devices for KIN group ($r=0.851$, $p<0.0001$), but a low relationship for Non-KIN students ($r=0.226$, $p=0.238$). Significant differences were found between two %BF values measured by H-BIA and F-BIA, with 7.84±4.80%, $t=7.297$ ($p<0.0001$) for KIN group, and 10.19±6.76%, $t=8.117$ ($p<0.0001$) for Non-KIN, respectively.
CONCLUSIONS: Study one results indicated that %BF estimates were much higher by using the H-BIA than the F-BIA in the male middle-school students, but almost identical for the corresponding female students. Study two results indicated that regardless of the male college student's major, %BF estimates were much higher by using the F-BIA than the H-BIA. It is important to consider variability of %BF estimates while using the two different BIA instruments.

1144

Validity Of Ultrasound For Estimating Body Fat Percentage Compared To 4-compartment Model

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Body fat percentage (%BF) can be estimated from subcutaneous fat thickness measured by ultrasound (US). $\%BF_{US}$ has been compared to %BF estimates from laboratory devices such as dual-energy x-ray absorptiometry (DXA) and the Bod Pod; however, comparison to a four-compartment (4C) "gold standard" is lacking.
PURPOSE: This study compared the accuracy of $\%BF_{US}$ to $\%BF_{4C}$.
METHODS: University club sport athletes (72 women, 106 men) participated. Bod Pod, DXA, and bioimpedance spectroscopy were used to measure body volume, bone mineral content, and total body water, respectively, for the 4C model. A-mode US measures were taken at 3 sites to estimate $\%BF_{US}$. All measurements were taken in a single session. Comparisons between $\%BF_{US}$ and $\%BF_{4C}$ were evaluated with Pearson correlation, a paired t-test, and linear regression. Individual errors and bias were evaluated with Bland-Altman plots.
RESULTS: $\%BF_{4C}$ ranged from 15.5% to 42.8% in women and 4.9% to 35.7% in men. $\%BF_{US}$ and $\%BF_{4C}$ were highly correlated for the total sample ($r = 0.930$) as well as for men ($r = 0.866$) and women ($r = 0.867$). Mean difference or constant error (CE) in %BF was ~1% BF with standard error of estimate (SEE) ~3% BF:

Sample	$\%BF_{4C}$	$\%BF_{US}$	CE	SEE	TE
Men (n = 106)	14.2 ± 5.7	14.3 ± 6.2	0.1	2.87	3.09
Women (n = 72)	25.7 ± 6.3	27.4 ± 5.4	1.7*	3.18	3.56
Total (N = 178)	18.8 ± 8.2	19.6 ± 8.7	0.8*	3.04	3.29

Individual errors suggest a slight bias ($r = -0.316$) for $\%BF_{US}$ to be overestimated in lean women and underestimated in fat women, and there is a tendency for heteroscedasticity in men.

CONCLUSION: In general, the $\%BF_{US}$ errors are low and bias is small, suggesting that A-mode ultrasound is a valid field measure of %BF for young adult athletes. Accuracy appears to be better in men than women.

1145

The Effects Of Hydration On Anthropometric Reports Generated By The Fit3D Body Scanner

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ABSTRACT: Features of body composition such as waist circumference and body fat percent are used to assess cardiometabolic risk. The Fit3D ProScanner employs camera technology and a patented algorithm to generate anthropometric reports, which are claimed to be unaffected by hydration status.
PURPOSE: To test the influence of hydration on Fit3D outputs.
METHODS: We enrolled 14 subjects (9 males, 5 females) to undergo body composition testing before and after fluid ingestion using the Fit3D ProScanner. To

account for test-retest variability, subjects received 2 fasted scans and 2 hydrated scans, and we recorded the average values from each pair of tests. Dependent variables exported were bodyweight, waist circumference (WC), waist circumference max (WCM), fat mass (FM), body fat percent (BF%), and body shape rating (BSR). Fasted scans occurred in the morning following a 12-hour fast of both food and fluids. Between fasted and hydrated scans, subjects consumed 20 oz of water. Two-tailed paired-samples t-tests estimated differences in each dependent variable before and after water consumption. Simple linear regressions tested the influence of height, weight, and BMI on observed changes.
RESULTS: Subjects were 24.0 ± 4.5 yr, had a height of 65.9 ± 4.5 in, and a fasted BMI of 25.5 ± 6.8 kg/m^2. During the pre-hydration scan, bodyweight was 160.4 ± 58.6 lbs, WC was 33.0 ± 5.3 in, WCM was 33.5 ± 5.7 in, FM was 30.3 ± 8.1 lbs, BF% was 23.2 ± 7.5%, and BSR was 64.0 ± 12.8. Between fasted and hydrated scans, bodyweight increased by 0.8 ± 0.7 lb (P = 0.002), WC increased by 0.2 ± 0.3 in (P = 0.008), WCM increased by 0.2 ± 0.3 in (P = 0.034), and BSR exhibited a trending decrease of 3.1 ± 5.5 (P = 0.052). Nonsignificant increases were observed in FM (1.6 ± 5.0 lb; P = 0.246) and BF% (1.0 ± 2.6%; P = 0.186). Neither height nor BMI predicted the amount of change in any dependent variable (P > 0.180). Fasted bodyweight was correlated with the change in WCM (β = -0.037; P = 0.014), but no other dependent variable (P > 0.350).
CONCLUSIONS: Some Fit3D parameters exhibit sensitivity to hydration status. As height, weight, and BMI did not influence these changes, the effects of hydration appear to be consistent across body types. Practitioners using the Fit3D system to analyze body composition should consider incorporation of a standardized hydration protocol prior to testing.

1146

Comparison Of Electrical Impedance Myography And Dual X-ray Absorptiometry To Estimate Body Composition

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INTRODUCTION: With obesity rates at an all-time high and still on the rise, it is becoming increasingly important for individuals to have access to accurate and inexpensive means of monitoring their body composition. Unfortunately, reliable, and accurate methods, such as dual x-ray absorptiometry (DXA) scans, can be expensive and are not widely available to the general population. The handheld device Skulpt uses electrical impedance myography to estimate percent body fat (%BF) and may offer an affordable solution. This device has shown promise in normal weight individuals but may be less accurate in overweight and obese individuals.
PURPOSE: The purpose of this study is to compare %BF measurements between the Skulpt and a DXA scan in normal weight, overweight, and obese subjects. We hypothesized that as body mass index (BMI) increases, the difference between %BF estimates from the Skulpt and a DXA scan will increase, with the Skulpt underestimating %BF.
METHODS: Participants ages (18-59) were grouped into one of three BMI weight categories: normal weight, overweight, and obese. All participants had their %BF measured by DXA. They also completed a 24-site full body (FB) scan and a 3-site quick scan (QS) using the Skulpt. A 3-way mixed ANOVA was used to determine if there were significant differences between method, gender, and BMI category.
RESULTS: In men, regardless of BMI category, there were no significant differences in %BF between the three methods. In females, there were significant differences between QS and DXA *(p <0.001)* as well as FB and DXA *(p<0.001)* with Skulpt underestimating %BF by 3.74% for the QS and 2.76% for FB. Regardless of gender, there was no significant difference among scan type for the normal weight or overweight category. In the obese category, both QS *(p <0.001)* and FB *(p =0.019)* significantly differed from DXA with the QS underestimating %BF by 4.41% and the FB underestimating by 2.76%. There was no significant difference between the QS and FB measurements in the obese category *(p =0.058)*.
CONCLUSION: The results of this study indicate that compared to DXA, the Skulpt underestimates %BF in females. These results also indicate that in obese individuals regardless of gender, the Skulpt underestimates %BF.

1147

Comparison Of Percent Body Fat Measurement By Other Methods To Dual X-ray Absorptiometry

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Body composition is an important metric for evaluating health and fitness. There are several methods of assessing body composition i.e. bioelectrical impedance (BIA), air displacement plethysmography (Bod Pod), and hydrostatic weighing (HW) and dual X-ray absorptiometry (DXA) which is most preferred due to its test-retest reliability.
PURPOSE: To assess the comparability of percent body fat measured by Bod Pod, BIA, HW to DXA.
METHODS: Thirty-nine (21 males and 18 females) students at a Hispanic majority college in Texas (age 25.62 ± 18 years; BMI 26.13±3.37 kg/m^2) participated. Percent body fat was measured by Bod Pod, BIA, DXA and HW using standard laboratory protocols. The result of fat percent from HW was estimated by Siri and Brozek equations. BIA was measured in standard (Std) and athletic (Ath) modes denoted herein as BIA (Std) and BIA (Ath). Agreement of the other measures of body composition with DXA was assessed by Repeated measures ANOVA with Dunnett's multiple comparisons test, Pearson correlation and Bland-Altman analysis. Significance was defined at 0.05 alpha.
RESULTS: Compared to DXA (mean percent body fat=30.21), body fat measured by all other methods significantly underestimated percent body fat (mean ± standard error of mean difference) is as follows BIA (Std) (26.74±0.783%, p<0.05); Bod Pod (25.04±0.41%, p<0.05); HW (Siri) (22.77±0.89%, p<0.05); BIA (Ath) (22.76±0.64%, p<0.05); HW (Brozek) (22.28±0.89%, p< 0.05). Pearson correlation coefficient with DXA followed is as follows: Bod Pod r=0.96, p<0.05; BIA (Ath) r=0.91, p<0.05; BIA (Std) r=0.85, p<05; HW (Siri) r= 0.82, p<0.05; HW (Brozek) r=0.81, p<0.05. Compared to DXA, bias or mean difference, standard deviation (SD) of bias and 95% limits of agreement (LoA) by Bland-Altman analysis respectively as follows; Bod Pod (bias -5.151, SD of bias 2.555, LoA (-10.160 to -0.143); BIA (ath) bias -7.444, SD of bias 4.005, LoA (-15.290 to 0.406)}; BIA (std) {bias -3.462, SD of bias 4.891, LoA (-13.050 to 6.124)}; HW (Siri) {bias -7.431, SD of bias 5.502, LoA (-18.210 to 3.353)}; HW (Brozek) {bias -7.923, SD of bias 5.510, LoA (-18.720 to 2.876)}.
CONCLUSION: Bod Pod, BIA (Std), BIA (Ath), HW (Siri) and HW (Brozek) underestimates body fat compared to DXA.

1148

Agreement Between Body Mass Index And Percent Body Fat In Resistance Trained Men And Women