



Intra-Rater Reliability of Diagnostic Ultrasound in Measuring Subcutaneous Adipose Tissue in Males Versus Females

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INTRODUCTION

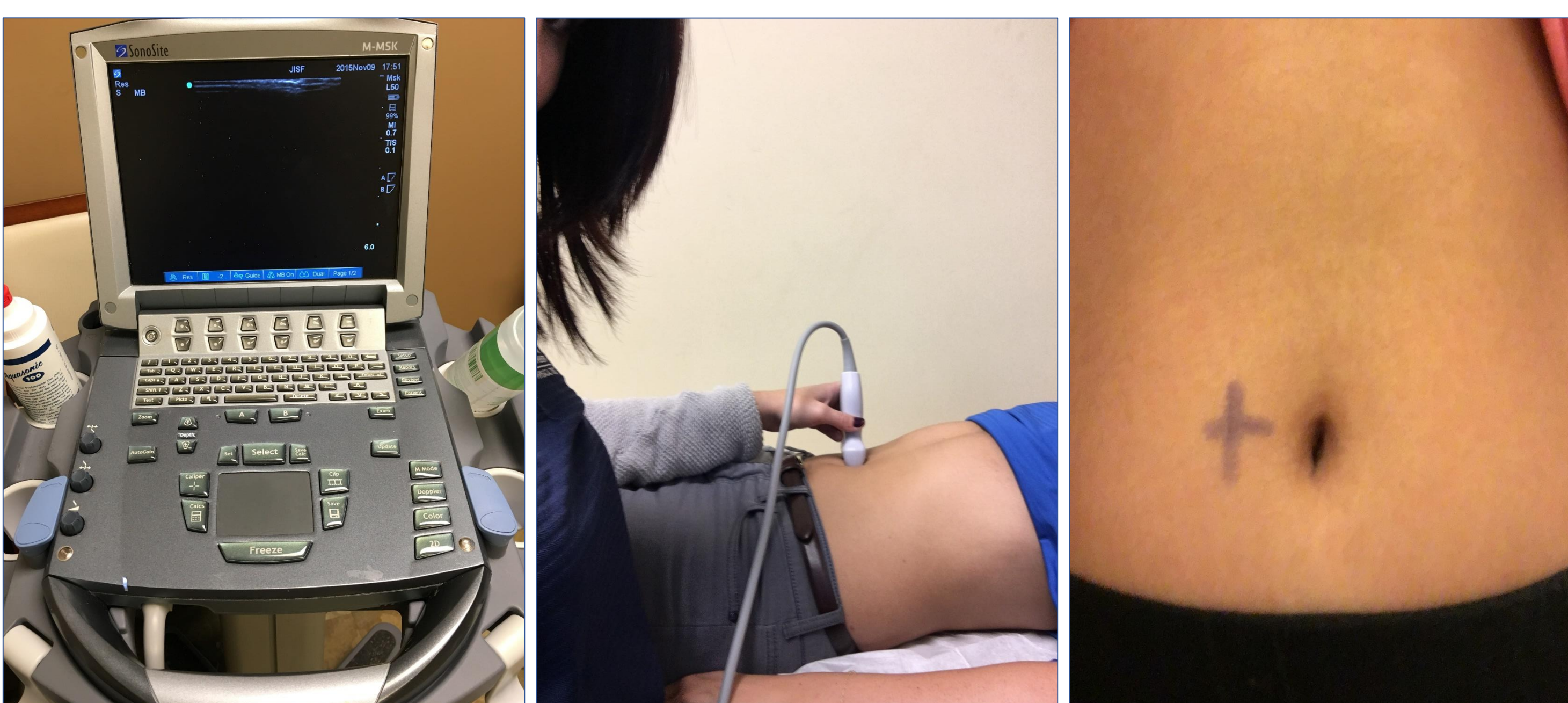
Obesity is a chronic and dangerous health condition in today's population that predisposes millions of people to serious health disorders and premature death (Racette, Duesinger, & Deusinger, 2003). In the United States, the prevalence of overweight and obese individuals remains a serious public health problem, as more than one third of adults and 17% of youth in the United States are obese (Ogden, Carroll, Kit, & Flegal, 2014). This major public health challenge requires the need for implementation of assessment tools and interventions in order to aid in the prevention and treatment of obesity. Several body fat assessment methods exist with varying levels of reliability. It is necessary to assess diagnostic ultrasound as a tool for the assessment of body fat in the clinical setting with regards to variations in males versus females.

PURPOSE

The purpose of this study was to determine if a difference exists in the intra-rater reliability of diagnostic ultrasound between males and females when measuring subcutaneous adipose tissue.

RESEARCH QUESTION

"Is there a difference in intra-rater reliability using diagnostic ultrasound to measure subcutaneous adipose tissue in males versus females?"



DEMOGRAPHICS OF PARTICIPANTS

- **Total Number of Participants:** 50 (25 Males, 25 Females)
- **Ethnicity Range:** 87% Caucasian, 8% Hispanic, 6% African American, 4% Asian

	Range	Average
Age	18-57 years old	28 years old
Height	61-75 inches	67.89 inches
Weight	105.4-257 pounds	162 pounds

METHODS

- The diagnostic ultrasound device used was a Sonosite M-MSK model with a linear transducer frequency of 5-12 MHz.
- Data collection was performed at an off-campus medical office with the aim to obtain participants that were more representative of a typical patient population
- Two sites were measured on each participant (males: abdomen and thigh; females: abdomen and calf)
- Each site was strategically marked prior to measuring with the diagnostic ultrasound machine
- Each site was measured 3 separate times
- Data was recorded and body fat percentages were calculated and provided to each participant as an estimate of their body composition.
- The researcher performing the measuring remained blind to the results while the second researcher recorded the data.

2 Site Location	Sex	Where to mark and measure
Abdomen	M/F	A mark is made 5 cm adjacent to right side of the umbilicus
Thigh	M	The mid-point of the anterior surface of the thigh, midway between the patella and the inguinal fold
Calf	F	A point on the medial surface of the calf, at the level of the largest circumference. A tape measure will be used to determine this point.

DATA ANALYSIS

To determine intra-rater reliability, the intraclass correlation coefficient (ICC) was calculated due to the high correlation between the two values. A high ICC is indicative of a high intra-rater reliability. Specifically, the ICC used was **ICC (3,1)** or model 3, which incorporates a repeated measures of analysis design method. A p-value was also calculated in order to determine the significance of the results and defined as $\alpha=0.05$. Both the ICC (model 3) and p-value were calculated using a **SPSS Version 23 statistics program**.

RESULTS

ICC of Total Tested Sites

Measurement site	Site 1 (abdomen)	Site 2 (thigh & calf)
ICC	.991*	.992*
Sample size	n=50	n=50

ICC of Tested Sites for Males

Measurement site	Site 1 (abdomen)	Site 2 (thigh)	Site 1 & 2
ICC	.983*	.953*	.996*
Sample size	n=25	n=25	n=25

ICC of Tested Sites for Females

Measurement site	Site 1 (abdomen)	Site 2 (calf)	Site 1 & 2
ICC	.994*	.989*	.994*
Sample size	n=25	n=25	n=25

Note: *Statistically significant value where $\alpha=0.05$, confidence interval = 95%

DISCUSSION

- The two sites measured for females resulted in an ICC of .994, indicating high intra-rater reliability.
- In males, the two sites resulted in a high ICC of .996, a value greater than the ICC for combined sites in females.
- Although the overall ICC when incorporating the two sites for males was higher than for females, the ICC for the individual sites were both lower than for the sites of females. This indicates a higher reliability when measuring the abdomen and calf individually in females than when measuring the abdomen and thigh individually in males.
- **Ultimately, the results demonstrate a slightly higher ICC in males than in females when using the combined sites ICC. This implies that when using diagnostic ultrasound to measure subcutaneous adipose tissue, the intra-rater reliability may be greater in males than in females.**
- Despite the higher ICC value in males when compared to females, the difference in the two values were not found to be significant as they differed by only .002.
- Further research is required in order to address the limitations of this study including the participant population used (primarily students), errors by the researcher with regards to pressure used and amount of gel used, and failure of the diagnostic ultrasound machine to obtain necessary depths.

*References used are available upon request.