Gender Differences of Body Composition Across Four Different Forms of Assessment

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This project was completed for academic purposes only. While it contains a research component, its sole purpose is to demonstrate academic progress.

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Introduction

The present study aimed to evaluate the differences in body composition, specifically body fat percentage (BF%), fat-free mass (FFM), and body mass index (BMI), across four forms of assessment. It was hypothesized that male subjects, on average, would display consistently lower BF% when compared to females across four body composition data collection methods, and results would be highly correlated between the four.

The BOD POD acted as the present study's gold standard due to it being one of the most accurate methods of assessing BF% (Collins et al., 1999). It was assumed that women would have a higher BF% than men on average. According to Robergs and Roberts (1997), a healthy range of body fat for women is 20% to 25%, and a healthy range of body fat for men is 10% to 15%. A BF% over 20% for men and 30% for women is considered an indication of obesity. Additionally, Akindele et al. (2016) suggested that as BMI increases there is a corresponding increase in the BF%. Females are more likely to report BF% higher than their BMI but this concept is flipped for males meaning they will report lower BF% than their BMI.

Table 1. PROJECT TIMELINE

Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Chose topic. Wrote choice lab proposal.	Wrote methods. Collected pilot data.	Edited methods after pilot study. Began dat a collection.	Continued data collection. Outlined poster.	Analyzed data and results. Responded to professor feedback.	Submit poster template to library.

Methods

Eight males and eight females participated as subjects. In order to participate in the present study, it was requested that subjects not exercise for at least 8 hours, eat for at least 4 hours, nor drink any fluids for at least 4 hours prior to testing. Subjects were also required to wear appropriate clothing for BodPod testing and follow specific instructions for each assessment tool whilst assessments were being conducted (Table 1). All subjects were emailed the list of required criteria at least 24 hours ahead of their scheduled testing time.

Table 2.	Min	Max	Mean	SD
Age (yrs)	19	23	20.63	0.96
Height (m)	1.55	1.86	1.71	0.10
Weight (kg)	54.20	95.20	75.81	14.09

Independent variables were included by administering identical criteria for each participant to follow and using the same equipment for each part of data collection (Table 2). The dependent variables involve data collected from each participant, including BMI, BF%, and FFM% (Figure1; Table 3). Data was dependent on age, height, weight, and whether the individual's activity level was categorized as normal or athletic. Data was analyzed using both Excel and SPSS Software (Table 1, 2, 3, 4).

Figure 1. Assessment Tools

BodPod

Enter subject data and calibrate BodPod via prompts. Ensure subject is wearing proper clothing. Tell subject to enter BodPod, breathe normally, and sitting as still as possible. Follow prompts until data collection is done.

Bodystat 1500

Enter subject data. Instruct subject to lie flat on the table for 3 minutes while breathing normally. Connect electrodes to right hand and right foot. Start analyzer.

Omron HBF 306-C

Enter subject data. Instruct subject to grip device with hands on electrodes. Hold arms at 90° away from body until data is collected.

Omron HBF 514-C

Enter subject data. Instruct subject to step on scale and hold device at 90° away from body. Stand on scale until weight flashes, data is collected, and weight returns.

Results

1=BodPod; 2=Omron HBF 514-C; 3=Omron HBF 306-C; 4=Bodystat 1500

Table 3. Descriptive Statistics

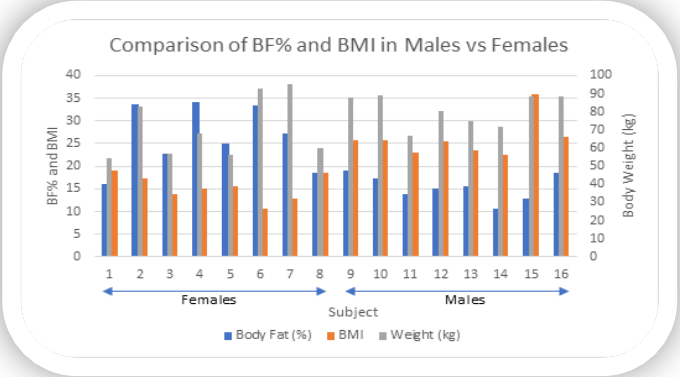
	Females				Males			
Assessment Tool	1	2	3	4	1	2	3	4
BF%	26.4	34.3	24.9	26.7	15.4	21.0	12.9	13.4
BF% Range	16 –34	26–44	17 - 34	18 –33	10 –19	15– 25	6–18	8- 18
FFM%	73.6	65.6	75.1	73.3	84.6	79.0	87.1	86.6
FFM% Range	65– 84	55–73	65–82	66–81	80 –89	74– 84	81–93	81– 91

Table 4. Correlations & Regression

		BF% (2)	BF% (3)	BF% (4)
BF% (1)	r-value	0.897**	0.880**	0.912**
	Sig. (2T)	0.003	0.004	0.002
	R^2-value	0.805	0.774	0.833

**Correlation is significant at the 0.01 level; data collected from 8 females

Figure 2. Subject BF%, BMI, and Mass



Discussion

Higher levels of BF% indicate greater amounts of adipose tissue storage, but hormones of the endocrine system influence where the adipose tissue is stored. Hormone deficiency inhibits proper endocrine function, contributing to increased BF% and raises the risk of obesity in men and women (Solomon and Bouloux, 2006). Individuals with greater amounts of FFM% tend to have higher VO_{2max} values and better anaerobic capabilities. Therefore, individuals with higher FFM% often perform better than those with greater BF%.

Men, regardless of activity level, displayed lower averages of BF% and FFM% than females, which is concurrent with the hypothesis and literature (Table 3) (Roberg and Roberts, 2007). When body composition is driven by muscle mass, males have lower BF% relative to total mass (Akindele et al, 2016). Figure 1 displays this relationship and shows that the opposite is true in females; as body mass increases, BF% increases. Thus, females have a lower BMI in relation to body mass than males. According to Bredella (2017), men tend to carry more lean mass compared to females and men tend to collect adipose tissue around their abdomen whereas women collect the most adipose tissue near both their hips and thighs.

In the females, the BodPod was shown to be a strong predictor of BF% measured by the other three forms of assessment with R^2-values all above 0.774 (Table 4). The significant correlations between each form of assessment suggest that the BodPod may be the gold standard for measuring BF% (Collins et al., 1999). However, in the males, BodPod assessments showed no statistical significance with the BF% measured by any of the other forms of assessment. Therefore, the results for the males within this study call into question the accuracy and precision of these four tools. This discrepancy may be attributed to the fact that most of the male subjects were not categorized as athletes while the majority of the females were. Additionally, most male subjects were assessed early in the data collection process, thus, researchers may have become more accurate and precise in terms of operating the equipment possibly skewing actual results. Accuracy of BF% and FFM% were highly reliant on subject adherence to the established criteria for each form of assessment.

References

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