Interpretation of Adiposity Indicators in NJCAA Female Athletes

Elizabeth A. Easley, Ariana L. Bachini, Sarah H. Sellhorst

University of South Carolina Lancaster, Lancaster, SC

ABSTRACT

BACKGROUND: Body mass index (BMI) and waist circumference (WC) are commonly used as quick, noninvasive indicators of adiposity. However, these measures can misrepresent the obesity or nutritional status of an individual. This is particularly true in athletes. Thus, it is important to have rapid, noninvasive, and portable methods of body composition measurement available. The purpose of this study was to determine if differences in BMI and WC between NJCAA female athletes with a healthy body fat percent (HBF) and those who are considered overfat (OBF). METHODS: Fourteen NJCAA female student-athletes at a two-year university participated in this study during the preseason. Height (cm) and weight (kg) were measured, and body mass index was calculated. Waist circumferences (cm) were measured at the narrowest part of the trunk between the xiphoid process and the umbilicus in triplicate and averaged. Tetrapolar BIA was conducted using the RJL Systems Quantum X. The participants were divided into either the HBF group (n=8, BF <32.0%) or the OBF group (n=6, >32.0%). Independent sample t-tests were used to compare BMI and WC means between groups. The level of significance was set at 0.05. RESULTS: There were significant differences between groups in BMI (HBF, 21.50 ± 1.64 kg/m^2 vs. OBF, 24.22 ± 1.58 kg/m^2, p=0.004) and WC (HBF, 67.62 ± 3.15 cm vs. OBF= 71.83 ± 3.82 cm, p=0.021). DISCUSSION: While it is not surprising that differences exist between the two groups in BMI and WC, the clinical interpretation of these values may be unexpected. The mean BMI for each group fell within the normal or healthy range of 18.5-24.9 kg/m^2. Similarly, the WC average for the HBF group would be categorized as very low risk per ACSM standards (<71 cm) and the WC average for OBF group would be categorized as low (70-89 cm). Furthermore, given that the mean BMI for the OBF group was in the healthy range, the obesity status of some of these athletes was incorrectly classified. This often occurs when BMI misclassifies athletes due to high fat-free mass; however, it may be even more detrimental when it indicates that an athlete is healthy when they are actually overfat and/or under lean. This further confirms the need for body composition measures in a young, apparently healthy, athletic population.

Supported by the Research and Productive Scholarship Grant.

INTRODUCTION

It is well known that Body Mass Index (BMI) and waist circumference (WC) can misrepresent an individual's obesity status. Despite this fact, these anthropometric measures are still often used due to their quick, noninvasive nature and the simplicity/availability of the equipment required (scale, stadiometer, tape measure).

Athletes and young women are two groups that are commonly misclassified utilizing these methods, therefore the purpose of this study was to determine if differences existed in BMI and WC between female athletes with a healthy body fat percentage and those who were considered overfat.

METHODS

Participants

Fourteen traditional-age (18-25 y) NJCAA student-athletes from a predominantly 2-year rural, commuter-based university campus participated in this study.

Exclusion criteria included: pregnant individuals, individuals with pacemakers or implanted cardioverter devices, those that had exercised in the last 8 hours, those that had consumed alcohol in the last 12 hours, etc.

Anthropometric Measures

Height was measured in cm using a portable stadiometer (Seca model 213, Hamburg Germany).

Weight was measured in kg using a digital scale (BeFour model PS7700, Saukville, WI).

Body mass index was calculated in kg/m^2.

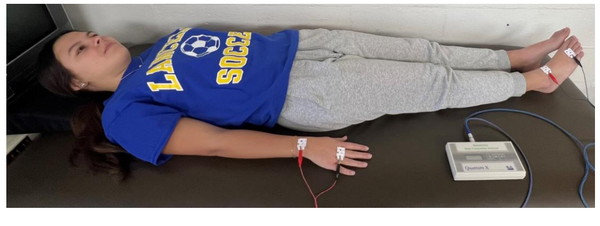
Waist circumferences were measured at the narrowest point between the xiphoid process and the umbilicus. Wrist circumferences were measured distal to the styloid process of radius and ulna to estimate frame size. These circumferences were measured in in triplicate and averaged.

Body Composition Measurement

Body fat percentage was measured by tetrapolar BIA (RJL Systems, Quantum X, Clinton Township, MI).

Participants were divided into two groups based on their body fat percentage.

Healthy Body Fat Group (HBF) = ≤ 32.0% BF
Overfat Group (OBF) = > 32.0% BF



Data Analysis

Means and standard deviations were determined for each group.

Independent sample t-tests were used to compare BMI and WC between the groups using SPSS version 29.

This study was supported by the USC Lancaster Research and Productive Scholarship Grant

RESULTS

Table 1. Subject Demographics

	HBF (n = 8) Mean ± Std Dev	OBF (n = 6) Mean ± Std Dev
Age (yr)	18.50 ± 0.53	19.67 ± 2.25
Height (cm)	162.18 ± 4.43	164.43 ± 5.58
Weight (kg)	56.56 ± 4.91	65.50 ± 5.67
Body Fat (%)	26.51 ± 2..44	33.75 ± 1.29

Table 2. BMI and Waist Circumferences Between Groups

	HBF (n = 8) Mean ± Std Dev	OBF (n = 6) Mean ± Std Dev
BMI (kg/m^2)	21.50 ± 1.64	24.22 ± 1.58
Waist Circumference (cm)	67.62 ± 3.15	71.83 ± 3.82

Significant differences existed between groups in both BMI (p=0.004) and waist circumference (p=0.021).

CONCLUSIONS

The OBF group had a significantly higher BMI and WC when compared to the HBF; however, the means for both groups fell within normal or low risk ranges for these variables.

This is critically important given that BMI and WC are often used as quick, surrogate measures of body composition or obesity status. In taking a closer look at the OBF group, only two participants had BMI values > 24.9 kg/m^2, classifying them as overweight. The other four participants in the OBF group had BMI values that misclassified their obesity status when compared to their body fat results.

This confirms the need for body composition measures to classify obesity status in young, athletic populations as opportunities for appropriate intervention could be missed.

These results are based on preliminary data, and we look forward to investigating these variables as our sample size grows. Future studies should also consider collecting information on nutrition and other health behaviors.

REFERENCES

Clark, M.K. & Dillon, J.S. (2011). BMI misclassification, leptin, C-reactive protein, interleukin-6 in young women with differing levels of lean fat mass. *Obesity Research & Clinical Practice, 5*(2): e85-e92