

Apr 16th, 11:00 AM - 2:00 PM

# Thoracic Gas Volume in Athletes and Non-Athletes

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Savard, Sara; Tubb, Samuel C.; Neuenschwander, Shem; Swedorski, Caleb T.; and Crommett, April D., "Thoracic Gas Volume in Athletes and Non-Athletes" (2014). *The Research and Scholarship Symposium*. 44.

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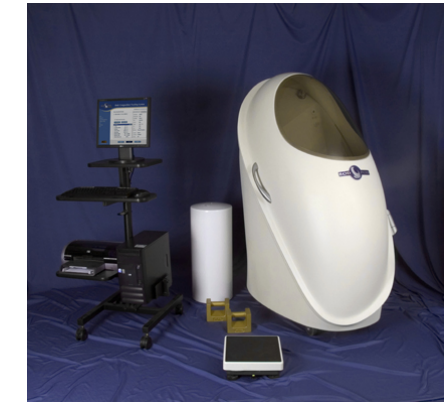
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# Thoracic Gas Volume in Athletes and Non-Athletes

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## ABSTRACT

The purpose of this study was to analyze the predicted thoracic gas volume versus measured thoracic gas volume in college students, comparing NCAA collegiate athletes versus non-athletes using the Bod Pod. Forty-four college students, both males and females, athletes and non-athletes, completed a body composition test to obtain the predicted thoracic gas volume. The participants were then instructed by the Bod Pod software through the measured thoracic gas volume test. Due to low statistical power, the athletes and non-athletes were unable to be compared, however, results of a two sample t-test showed that there was a statistically significant difference between measured thoracic gas volume and predicted thoracic gas volume within the population as a whole. The average predicted thoracic gas volume was 3.66 liters  $\pm$  0.103 while the measured thoracic gas volume was 4.02 liters  $\pm$  0.165. The significance statistical p value was measured at  $p \leq 0.001$ . Therefore, we concluded there was a significant difference between the predicted and measured thoracic gas volumes of the population.

## INTRODUCTION

Body composition in its simplest form is a two-part component of our overall health and fitness. It can be broken up into measuring a body fat mass component and a body fat-free mass component. In its most detailed form, the Bod Pod can measure body fat, fat-free mass, water, mineral and protein. Having a higher fat-free body component is important because it reduces the risk of obesity which, in turn, reduces the risk of developing type 2 diabetes, coronary artery disease, hypertension, obstructive pulmonary disease, as well as some forms of cancer. Because of these health risks, the body should have a lower body fat percentage; however, not having enough body fat can also lead to problems. The body requires a particular amount of fat in order to maintain normal physiological functions, such as cell membrane formation, storing metabolic fuel, transportation and storage of fat-soluble vitamins, and the formation of adipose tissue. Lipids are also important for proper functioning of the reproductive system, nervous system, and the menstrual cycle. Having low body fat can affect the body's immune system, as well as potentially cause diseases like cystic fibrosis. Therefore, it is important that body fat is measured accurately so that health risks can be determined.

## PURPOSE AND HYPOTHESIS

The purpose of this study was to analyze the predicted thoracic gas volume versus measured thoracic gas volume in college students, comparing NCAA collegiate athletes versus non-athletes using the Bod Pod. The hypothesis was that there would be a significant difference between measured and predicted thoracic gas volume in athletes but not in non-athletes.

## SUBJECTS

Forty-four students (n = 44) volunteered for the study composing of twenty NCAA varsity athletes and twenty-four non-athletes. The varsity athletes were ten male athletes, six of which played soccer and four ran cross-country. The remaining athletes were ten female soccer players. These sports were chosen because at the time of the study they were currently in season. The non-athlete population consisted of fifteen males and nine females. The average age of the population was 20 years old  $\pm$  2 years, ranging between 18 – 22 years old.



## EXPERIMENTAL PROCEDURES

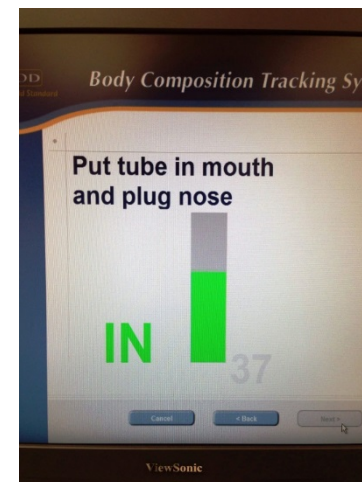
Permission to use in-season athletes was obtained from the coaches before the athletes were contacted to participate in the study. The athletes were then asked to volunteer for the study via e-mail. Non-athletes were contracted through a campus-wide e-mail asking for participants with the criteria that they did not participate in inter-collegiate or intramural sports. Once participants volunteered for the study, guidelines for testing in accordance with Bod Pod specifications was communicated with the participant. Prior to testing, each participant was asked to fill out a survey indicating gender, age, and extracurricular activities. IRB approval was obtained before testing began.

### Body Composition Test

Subjects' height was measured by a stadiometer to the nearest centimeter and weight was measured to the nearest .001 kilogram. All participants were required to wear a swim cap provided by Bod Pod and to follow standard protocol for Bodpod testing such as removing all jewelry. After all requirements were met, they entered the Bodpod chamber. The standard protocol for Bodpod testing was followed for each participant.

### Measured Thoracic Gas Volume Test

Following the Body Composition test, predicted thoracic gas volume was calculated using the Bodpod standard factory equations and was recorded. The participants were then asked to follow the standard protocol for measuring thoracic gas volume using Bodpod instructions provided on the computer screen. The measurements were not accepted as valid unless they met the criteria of having a merit < 1 and an Airway Pressure < 35cm H<sub>2</sub>O. If a participant did not meet these criteria, their results were not used in the data analysis. These guidelines are standard for Bodpod measured thoracic gas volume and for research purposes.



## STATISTICAL ANALYSIS

The power of the two sample t-test comparing athletes versus non-athletes was too low for meaningful use so the data was analyzed as one group. We compared the predicted and measured results of the combined population using a two sample t-test. Comparing the predicted and measured thoracic gas volumes of the combined samples resulted in a higher power, with  $p = 0.392$ . The p-value used for significance was  $p \leq 0.05$ .

## RESULTS

- We altered our original purpose to compare the measured TGV to the Bod Pod's predicted TGV of the whole population, combining the athlete and non-athlete populations.
- Average predicted thoracic gas volume = 3.66 liters  $\pm$  0.103
- Average measured thoracic gas volume = 4.02 liters  $\pm$  0.165
- P-value  $\leq 0.001$
- Comparing measured TGV and predicted TGV showed that there was a statistically significant difference; the measured TGV was much higher than the Bod Pod's predicted TGV

## CONCLUSIONS

- The Bodpod is used to help predict risk for cardiovascular disease by identifying unhealthy body composition.
- The Bodpod did not accurately predict thoracic gas volume in athletes or non-athletes.
- We conclude that all Bodpod body composition tests should include the actual thoracic gas volume measurement and not use the predicted option.