

# Body Composition Before and After a Moderate Intensity Aerobic Exercise using Circumference and Segmental Multifrequency Bioelectrical Impedance

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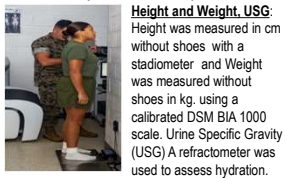
## INTRODUCTION

Frequent military physical training warrants a Department of Defense (DoD) body fat% circumference equations and bioelectrical impedance (BIA) methods measurement after training to measure its impact on body fat percentage (BF%). Recently, several military services have included BIA as a primary and alternate method to measure body composition. Previous research has shown that BF% has significantly decreased before and after exercise in BIA models due to a change of body water that causes a variance of bioimpedance. Furthermore, to our knowledge there is no study measures the decrease in BF% in circumference measurements after an exercise session. It is important to see if regular military training such as jogging/running for distances over a 1 mile could impact these body composition measures.

**Purpose:** The purpose of this study is to measure the impact of a moderate intensity aerobic training of 1.5-mile jog/run on the body fat percentage (BF%) of direct segmental multifrequency bioelectrical analysis (DSM BIA) methods up to 500Khz and 1000Khz and the DoD Circumference Method.

## METHODS

Participants were (majority active-duty service members) that were able to received medical care in the military healthcare system in the Washington, District of Columbia (DC) Metropolitan area.



**Height and Weight, USG:** Height was measured in cm without shoes with a stadiometer and Weight was measured without shoes in kg, using a calibrated DSM BIA 1000 scale. Urine Specific Gravity (USG) A refractometer was used to assess hydration.



**Circumference Method:** A tape measure made of non-stretchable material: Fiberglass.  
**Males:** Neck circumference at the point just below larynx (Adam's apple) and perpendicular to long axis of the neck.  
**Abdomen:** circumference against the naval (belly button) and parallel to the floor.  
**Females:** Neck: same as males.  
**Waist:** minimal abdominal circumference: halfway between the naval (belly button) and the end of the sternum.  
**Hips:** Measured at the side around the hips at the greatest protrusion of the gluteal muscles (Buttocks)



**Direct-Segmental Multifrequency (DSM) BIA:** DSM BIA: up to 500 kHz and up to 1000kHz models were used to measure BF% and total body water (tbw) in kg using the DSM BIA 1000. Subjects stood barefoot on marked footprints on the DSM-BIA machine. Two electrodes were in contact with each foot and hand through the base and the handgrips on the instruments. During the assessment, subjects stood completely still with their arms away from their torsos and slightly bowed. Scanning took less than 1 minute to complete. The subjects repeated the testing procedure 3 times consecutively and the average of 3 measurements of body fat % was used for the final measurement for each DSM-BIA instrument.

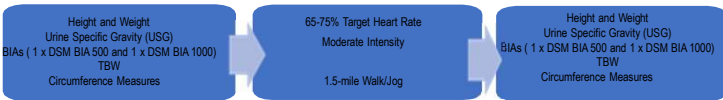


Figure 1: Data Collection Procedure

**Data Analysis:** The percent change scores in BF% measurements were analyzed before and after the exercise to indicate any positive or negative change over time. The level of significance was p<.05. BF% measured with mean and SD.

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## RESULTS

Table 1

Subject Measures Pre-Exercise

Measures	Total (n=62)	Males (n=25)	Females (n=37)	p Values
Age (yrs)	41.79±14.39	38.8±11.4	43.7±15.95	0.18
Height (cm)	169.45±9.50	176.31±8.11	164.81±7.37	0.001***
Weight (kg)	78.46±16.04	85.12 ± 14.28	73.19± 15.74	0.006**
USG	1.02±.016	1.02±.015	1.02±.016	0.94

Note. Data are in mean ± SD. USG: Urine Specific Gravity.

\* p <.05, \*\* p <.01, \*\*\*p<.001

Body Composition measured before and after a 1.5-mile exercise with CM Total: Before (29.25±11.4 BF%), After (29.16±11.14), p=.71, d=0.05, Males: Before (M=19.84, SD=6.45), After (M=20, SD=6.22), p = .59, d=-0.11, Females: Before (M=35.2, SD=9.46), After (M=35.34, SD=9.36), p = .50, d=-0.11. DSM BIA 500 Total: Before (M=28.40, SD=9.34), After (M=28.1, SD=9.50), p <.05, d=0.35, Males: Before (M=21.75, SD=7.05), After (M=21.3, SD=6.91), p <.05, d=0.71, Females: Before (M=32.89, SD=7.94), After (M=32.66, SD=8.22), p=.19, d=0.22.

Total body water mass measured before and after a 1.5-mile exercise with tbw Total: Before (41.19±9.29kg) and after (41.38±9.21kg), p=.12, d=0.28, Males (48.68±8.56kg) and after (48.68±8.53kg), p=.99, d= 0.002, Females (35.13±5.67kg) and after (36.44±5.78kg), p<.05, d=0.63.

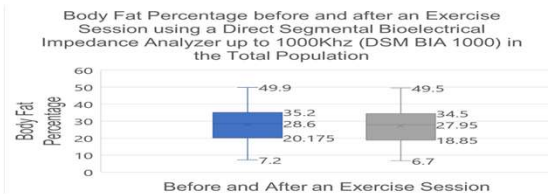


Figure 2: Note. n=62. Results were taken with the same sample at one session, body fat percentages were taken three times in each method and the mean is represented. The exercise session consists of a 1.5-mile moderate intensity based on a 65-75% target heart rate walk/jog. DSM BIA 1000=Direct Segmental Multifrequency Bioelectrical Impedance up to 1000KHz. The results are significant, the effect was large (p <.05, d = 0.9).

## RESULTS

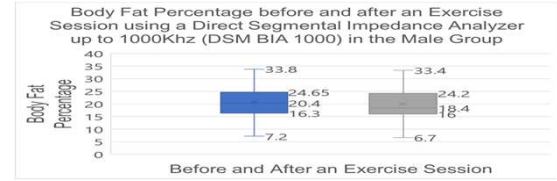


Figure 3: Note. n=25. Results were taken with the same sample at one session, body fat percentages were taken three times in each method and the mean is represented. The exercise session consists of a 1.5-mile moderate intensity walk/jog based on a 65-75% target heart rate walk/jog. DSM BIA 1000=Direct Segmental Multifrequency Bioelectrical Impedance up to 1000KHz. The results are significant, the effect was large (p <.05, d = 0.53).

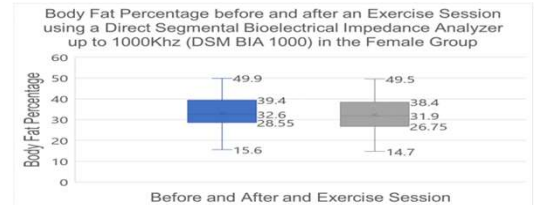


Figure 4: Note. n=37. Results were taken with the same sample at one session, body fat percentages were heart rate walk/jog. DSM BIA 1000=Direct Segmental Multifrequency Bioelectrical Impedance up to 1000KHz. The results are significant taken three times in each method and the mean is represented. The exercise session consists of a 1.5-mile moderate intensity based on a 65-75% target, the effect was large (p <.05, d = 0.94).

## CONCLUSION

BF% measured by CM was not significantly different before and after a 1.5-mile jog. BF% was significantly lower after a 1.5-mile jog in BIA DSM 500 in the total and male groups but not in the female group. BF% was significantly lower after a 1.5-mile jog in BIA DSM 1000 in all groups: total, male and female. TbW was not significantly different before and after the 1.5-mile jog in the total and male groups but was significantly different in the female group with potentially more sweat loss.

## PRACTICAL APPLICATIONS

With potential rounding up and down with body fat % recording, there is a potential 1% decrease in BF% after activity that could affect pass or fail ratings with BIA measures. More research with increased duration and intensity is needed to measure this impact for CM. Planning should be implemented with an avoidance of physical activity of moderate intensity of approximately 20-30 minutes measured immediately (within 5 minutes) before a BF% with DSM BIA methods. There was no impact on CM measurements for BF%.

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