

## **Body Composition and Anthropometric Variables are Associated with Better Physiological and Musculoskeletal Performance in Female Marines**

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**Background:** On 3 December 2015, the Secretary of Defense announced his decision directing that all Combat arms be opened to women across all armed forces. Each branch of the military must implement an integration plan in order to safely and successfully integrate women into ground combat military occupation specialties (MOS). As women enter these MOS, questions remain about optimizing characteristics for injury prevention and performance. The purpose of this study was to assess the body composition and anthropometric characteristics of female Marines from the Marine Corps' Ground Combat Element Integrated Task Force who met a male performance threshold on a battery of physiological and musculoskeletal tests.

**Methods:** Eighty-four female Marines (age=22.62±2.76 yrs, height=163.94±5.72 cm, weight=64.32±7.09 kg) participated in body composition testing utilizing air displacement plethysmography; measurement of arm span and leg length; aerobic capacity and lactate threshold measurement during maximal treadmill testing; anaerobic power and capacity testing during a maximal 30-second cycle sprint; shoulder, torso, and knee strength testing with an isokinetic dynamometer and ankle strength testing with a hand-held dynamometer; balance testing; upper and lower body explosive power and agility testing (medicine ball toss, standing broad jump, pro-agility); and select events from the Marine Corps Physical Fitness Test and Combat Fitness Test (crunches, maneuver under fire, movement to contact). A cohort of male Marines (N=218) underwent the same testing battery and a performance threshold was identified by determining the top 95% of male performance for each variable. The percent of variables that met or exceeded the male Marine performance threshold was calculated for all female Marines, who were split into two groups: met or exceeded male threshold on ≥60% of tests (Group 1: N=42) or met or exceeded male threshold on <60% of tests (Group 2: N=42). After testing for normality, independent t-tests or Mann Whitney U tests assessed differences in anthropometric and body composition variables between groups (p<0.05). Results were reported as mean and standard deviation.

**Results:** Group 1 demonstrated significantly greater height (166.36±5.81 vs 161.53±4.52 cm), weight (67.38±6.68 vs 61.26±6.16 kg), fat free mass (FFM) (51.33±5.01 vs. 45.74±4.27 kg), arm span (65.86±2.82 vs. 64.00±2.90 cm), and leg length (872.95±36.92 vs. 851.17±38.63 mm) compared to Group 2 (all p<0.05). No significant differences were observed for fat mass (16.05±3.79 vs. 15.52±4.17 kg) or body fat% (23.68±4.45 vs. 25.10±5.23%).

**Conclusion:** Female Marines with higher overall fitness demonstrated greater height, weight, FFM, arm span, and leg length. Total weight and FFM may have a more important relationship with better cumulative performance capabilities across a range of variables than fat mass or relative body fat%. According to these results, female Marines should focus on increasing FFM, and training to increase upper body strength; upper and lower body power; and aerobic capacity, as fewer female Marines met the male performance threshold for these characteristics.

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