The Relationship of Maximal Aerobic Capacity and Body Fat Percentage in Athletes and Non-Athletes

Author: Sandra Mendoza and RJ Williams
Sponsor: Judy R. Wilson, Ph.D. KINE 4400
Cardiovascular Research Laboratory, The University of Texas at Arlington, Arlington, TX;

INTRODUCTION: Maximal oxygen consumption (VO₂max) is the maximum capacity of the body to transport and utilize oxygen during incremental exercise. The relative units are expressed as milliliters of oxygen per kilogram of body weight per minute (ml/kg/min) and the absolute rate is liters of oxygen per minute (L/min). Body Fat percentage is the total mass of fat divided by the total body mass, and multiplied by 100%. It is expressed as a percent value. Research shows that athletes tend to have a lower body fat percentage and a higher VO₂max as compared to non-athletes.

PURPOSE: The purpose of this study was to evaluate the VO₂max values of male athletes vs non-athletes and assess body fat percentage.

METHODS: Nine male UTA students volunteered to participate in this study, four tennis athletes (M; age 20.5 ± 1.5 yrs) and five non-athletes (M; 23 ± 2.4 yrs). Each subject had body fat percentage assessed using the BOD POD. Each subject performed a graded exercise test on the treadmill, using the Bruce protocol, with increasing speed and elevation until exhaustion. Each test heart rate (HR) and rate of perceived exertion (RPE) were recorded along with the VO₂ values that were measured by the metabolic cart. The alpha level for significance was set at p<0.05.

RESULTS: The results of this study indicate that athletes have a higher VO₂max than non-athletes, which agrees with published research. The VO₂max values that were measured by the metabolic cart for athletes was 57.35 ± 1.93 ml/kg/min and 40.45 ± 8.93 ml/kg/min in the non-athletic group which resulted in a significant difference (p = 0.03). The body fat percentage in athletes was 11.9 ± 2.6% and 27.5 ± 7.8% in the non-athletic group which also resulted in a significant difference (p = 0.001). The inverse correlation between VO₂max and body fat percentage was negative (r = -0.61) for the athletic group and (r = -0.96) for the non-athletes group. The time on the treadmill of the athletic group was 15.07 ± 1.02 min, and non-athletes 19.1 ± 5.6 min; p = 0.37 and RPE: athletes (194 ± 0.5) and non-athletes (176 ± 0.72; p = 0.045).

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All participants were current students at the University of Texas at Arlington between the ages of 19 and 28 years old. The Bod Pod was used to analyze body fat composition. Participation in this study required subjects to come in only one time, complete the body fat measurement and Bruce Protocol. During the visit, the consent document was reviewed with the subject, and then signed. Basic information such as age, height, activity level, weight, were entered into the Bod Pod software. The subject sat in the Bod Pod for roughly 3 minutes while calculations were recorded. Participants then went to the treadmill for the Bruce Protocol which was also performed in the UTA MAC Kinesiology labs. Participants completed the Bruce Protocol where RPE, Heart Rate, time, and VO₂max were recorded. The subject's condition was monitored throughout the test and they were asked if they could keep going every stage until close to exhaustion. Once the subject gave us the “hand wiggle” the test was ended and treadmill put into recovery mode. The speed and incline of the treadmill were slowed and lowered considerably where the subject continued to walk down until the heart rate returned to a normal level <120 bpm. The maximal values were used for data analysis.

CONCLUSIONS: The VO₂max differences may be attributed to the amount of exercise training, and percent body fat.

This study indicated that athletes have a higher VO₂max than non-athletes, which agrees with published research. Body fat percentage was lower in athletes than non-athletes. The inverse correlation between the two variables also agrees with published research. The VO₂max differences may be attributed to the amount of exercise training, and percent body fat.