AEROBIC CAPACITY OF WHEELCHAIR BASKETBALL PLAYERS DURING ARM CRANK ERGOMETRY VS TREADMILL

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Introduction

It is difficult to determine the aerobic capacity of wheelchair athletes by the accepted standards and methods of testing. The levels of disability and the associated functionality of the individual as well as wheelchair design itself impacts the measure of VO_2 peak. VO_2 peak is the maximum volume of O_2 that a person's body can transport to tissue during incremental exercise. At the current time VO_2 peak is the best indicator of physical fitness of an individual.

Purpose

The purpose of this study was to differentiate the VO_2 peak between the arm crank ergometer and the VO_2 peak obtained for paraplegic subjects while pushing a wheelchair on a treadmill

Methods

The subjects were asked to report to the Exercise Science Research Laboratories on two separate days. The duration on each day ranged from 30 to 90 minutes, depending on the type of testing that was being conducted. Each subject was asked to avoid caffeinated beverage drinks, eat a light meal, wear athletic clothing, and refrain from strenuous exercise on the days prior to the experiment. The subjects sat in their sport chair in front of the arm crank ergometer (ACE) (SciFit Pro 1) wearing a heart rate monitor (Polar T31 Coded Transmitter with Belt, New York) around their chest. A plastic mask fit over their nose and mouth to collect the exhaled air during the exercise so that the amount of oxygen consumed could be measured to determine the aerobic capacity using a portable VO_2 (K4, b2)(Cardio Pulmonary Diagnostic Equipment, Italy) device strapped around their waist. The subjects warmed up for 2 minutes with light resistance. The ergometer resistance was then set to increase by 10 watts (W) every two minutes until exhaustion. The subject was asked what their rate of perceived exertion (RPE) was every two minutes. The cranking rate was set with a metronome at 60 rpm. On a separate day (after 48 to 72 hours to recover from muscle fatigue), the maximal aerobic treadmill (TM) (Fitnex Bionex Treadmill)(Fitnex Fitness Equipment) test was conducted using the same K4 b^2 device and a heart rate monitor. The subject performed the test on the treadmill using their own sports wheelchair. The wheelchair was fixed to the TM using a cable arm connected to the wheelchair beneath the seat and to the posts of the TM. This secured the chair so that when the subject could no longer keep the cables slack indicating the subject are keeping pace with the protocol, the subject could simply stop wheeling and the wheels would continue to turn with the moving TM while it is slowed (Knectle and Kopfli, 2001).

Methods (cont'd)

The protocol began with a TM speed of 5 mph and an incline of 1%. The incline was increased by 0.5% every 2 minutes and subjects were asked to rate the perceived exertion (RPE). This process was continued until the subject could no longer maintain slack in the cable which indicates that the subject has reached their VO_2 peak. To ensure their safety, mats were placed at the foot of the TM and subjects were asked to wear a bicycle helmet during the test. A cable with the U-clamp was hooked onto the TM and wheelchair to prevent subject from falling off the TM. When any of the indicators mentioned above (i.e. slack is lost) the subjects was be deemed to have reached their VO_2 peak and cannot proceed with further testing. In this fashion the integrated of the test counter balanced structure was maintained. Heart rate, VO_2 peak , V_E (expired minute ventilation) and RPE data was collected. All data collected was statistically analyzed using SPSS ver. 16. Significance was set at $p<0.05$.*

Figure A – Arm Crank Ergometer

Figure B – Treadmill

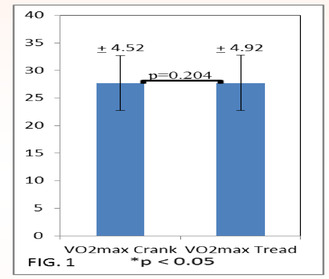
Results

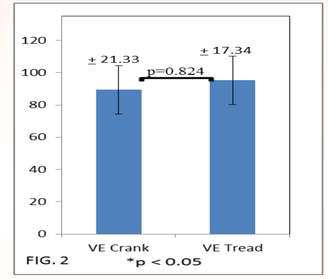
Table 1 – Anthropometric Data

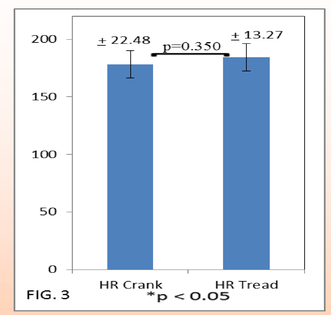
SUBJECT DEMOGRAPHIC			
n = 8	ANTHROPOMETRIC	MEAN	SD
	AGE (yrs.)	23.25	± 3.49
	HEIGHT (cm)	171.92	± 10.99
	WEIGHT (kg)	70.53	± 10.66

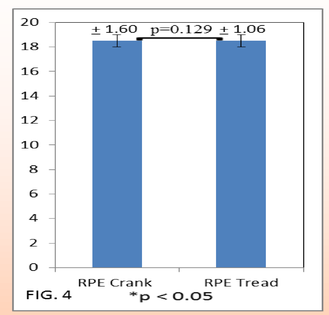
Results (cont'd)

FIG. 1: VO_2 peak for ACE distribution of 27.72 ± 4.52 ml/kg/min; VO_2 peak for TM distribution of 27.75 ± 4.92 ml/kg/min. p=0.204.
FIG. 2: V_E for ACE distribution of 89.45 ± 21.33 L/min; V_E for TM distribution of 95.24 ± 17.34 L/min. p=0.824.
FIG. 3: HR for ACE distribution of 178.25 ± 22.48 bt/min; HR for TM distribution of 184.37 ± 13.27 bt/min. p=0.350.
FIG. 4: RPE for ACE distribution of 18.5 ± 1.60; RPE for TM distribution of 18.5 ± 1.06. p=0.129.









Conclusions

The results suggest that there are significant differences between the TM testing and the ACE testing for VO_2 peak, V_E, and HR other than for reported RPE. Future studies should compare both genders on VO_2 peak in ACE and TM in a larger population. Future testing will seek a statistical power of 0.8 to validate the study. This will provide information on the number of subjects required for the test. G-Power statistical software will be used to make the calculation. Currently there are not enough wheel chair athletes on campus to get the statistical power required to meet the 0.8 statistical power.