

## Relationship of Aerobic Capacity and Rating of Perceived Exertion Among Male and Female Collegiate Athletes

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### Abstract

**Context:** Fitness is a very important part of our life and for fitness aerobic exercises are very common such as walking, dancing, cycling, and swimming. The aerobic capacity is also considered as cardiorespiratory endurance or VO<sub>2</sub> max. **Aims:** The relationship of anaerobic exercise with rate of perceived exertion has been previously documented in athletes, but there was a paucity of researches on the relationship of aerobic capacity with RPE among collegiate athletes in India. Therefore the purpose of this study was to find the relationship between aerobic capacity and rating of perceived exertion among male and female collegiate athletes. Furthermore, the present research work had also compared the rating of perceived exertion between males and females collegiate athletes. **Settings and design:** A total of 100 participants with 50 male and 50 female between the age group of 18 and 25 with no history of recent injury or any disease and substance abuse, who volunteered to participate were selected for this study. **Methods and material:** The VO<sub>2</sub> max of all participants was measured by Rockport 1 mile walk test and then the rate of perceived exertion (RPE) was reported using Borg scale. **Statistical analysis used:** Pearson's correlation were applied between VO<sub>2</sub> max and RPE. **Results:** The mean VO<sub>2</sub> max and mean RPE of all participants were 58.22 (±6.79) (ml/kg/min) and 11.93 (±1.41) respectively. **Conclusions:** The finding of the present study reveals that a person's rating of perceived exertion is not dependent on his or her maximal oxygen consumption or VO<sub>2</sub> max as there is no relation seen between VO<sub>2</sub> max and RPE of an individual.

**Keywords:** Aerobic Capacity; VO<sub>2</sub> Max; Rockport 1 mile walk test; Rate of perceived exertion; Borg scale.

### Introduction

Aerobic activity involves the activity with presence of oxygen. The common aerobic activities are walking, dancing, swimming, etc. that include continuous or rigorous respiration.<sup>1</sup> The best way to determine the aerobic capacity is calculating the VO<sub>2</sub> max. VO<sub>2</sub> max is also considered as cardiorespiratory fitness, which is an important component

of health-related physical fitness because its higher level enhances the ability to sustain moderate – to high-intensity exercise for prolonged periods of time, while lower levels elevate the risk of various disease conditions such as coronary artery disease, high blood pressure, stroke, obesity, and type 2 diabetes.<sup>2</sup> Cardiorespiratory endurance exercises help the body to become more efficient and better able to cope with physical challenges.<sup>3,4</sup> We can measure VO<sub>2</sub> max with different techniques either performed in the laboratory or in the field. Laboratory test are much accurate and have higher validity than the field test. But the tests performed for VO<sub>2</sub> max in the laboratory are much more expensive and cannot be performed for everyday practice. On the other hand, field test is much cheaper and can be performed on daily basis.<sup>5,6</sup>

Ratings of perceived exertion (or “effort and exertion”) are important complements to

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physiological measurements. Of all single indicators of the degree of physical strain, perceived exertion is one of the most informative. It integrates a great amount of information, with cues from the peripheral muscles and joints, cardiovascular and respiratory functions, and the central nervous system.<sup>7</sup> Rating of perceived exertion (RPE) has been widely used for determining the intensity of resistance exercise because it is related to physiological markers of the stress response to exercise.<sup>8</sup> The guidelines of the American Heart Association (AHA) and the American College of Sports Medicine (ACSM) recommended monitoring cardiovascular responses to resistance exercise, including the heart rate (HR), blood pressure (BP), and perceived exertion, and using the RPE to set the intensity of strength training in both young and older adults.<sup>9</sup> However, physicians, physical therapists, and medical staff engaged in rehabilitation are largely unfamiliar with the use of the RPE for adjusting the intensity of resistance exercise.<sup>10</sup> The relationship of anaerobic exercise with rate of perceived exertion has been well documented in athletes. As well as the relationship of aerobic capacity with rate of perceived exertion has also been done previously among elite athletes in many countries<sup>10</sup>, but there is a paucity of researches on the relationship of aerobic capacity with RPE among collegiate athletes in India. Therefore the purpose of this study is to find the relationship between aerobic capacity and rating of perceived exertion among the male and female collegiate athletes. Furthermore, the present research work will also compare the rating of perceived exertion between males and females collegiate athletes.

## Materials and Methods

A total of 100 participants with 50 male and 50 female were randomly selected for this study. Initially, a total of 150 collegiate athletes (83 male and 67 female) between the age group of 18 and 25 with no history of recent injury or any disease and substance abuse, who volunteered to participate were selected for this study. All the participants first filled and submitted the written informed consent form and then they qualified PAR-Q for further participation. Out of these 150 participants only 100 (50 male and 50 female) were randomly selected with chit system for participation in this study.

The selected participants were asked to present on a prescribed date and time. Only ten people were asked to report at a particular date and time.

The subjects were asked to report at least 30 min before the testing and asked not to ingest any food or caffeine within 3 hours of testing. The entire test was performed either in the morning or in the evening session. The environment temperature for the field test was maintained at 25 degrees Celsius. The height (cm), weight (kg) and resting heart rate (bpm) of all participants were recorded by using stadiometer, digital weighing machine and polar heart rate monitor respectively. Thereafter, the  $VO_2$  max of all participants were measured by Rockport 1 mile walk test<sup>11</sup> and then the rate of perceived exertion was reported using Borg scale.<sup>7</sup>

### Rockport 1 Mile Walk Test

This test is being used to measure  $VO_2$  max.

Equipment required:

Smooth and level marked one -mile track

Stopwatch

Pulse oximeter

The participants performed by walking as fast as possible for one mile. After walking one mile, immediately the pulse rate was measured.

Scoring:  $VO_2$  max can be calculated by the formula-

Females-  $VO_2$  max =  $139.168 - (0.388 \times \text{Age}) - (0.077 \times \text{weight in lb.}) - (3.265 \times \text{walk time in minutes}) - (0.156 \times \text{heart rate})$ .

Males-  $VO_2$  max =  $139.168 - (0.388 \times \text{Age}) - (0.077 \times \text{weight in lb.}) - (3.265 \times \text{walk time in minutes}) - (0.156 \times \text{heart rate}) + 6.318$ .

### Rating of Perceived Exertion

The Borg scale is used for rating of perceived exertion. Perceived exertion is how hard the subject feel like his body is working. Borg scale was given to subject which is having ranges from 6 to 20, where 6 means "no exertion at all" and 20 means "maximal exertion".

Subject described level of exertion was noted.

Mean, SD, standard error and percentile were used to prepare summary statistics. Karl Pearson tests were used to determine the correlation between aerobic capacity and RPE and test were used to determine the mean differences of RPE between the both groups (males and females). The statistical analysis was done on SPSS v 16.00.

## Results

A total of 100 individuals (50 males and 50 females) were participated in present study where mean

age 19.18 ( $\pm 1.42$ ) years, mean height 1.71 ( $\pm 0.18$ ) cm, mean weight 63.86 ( $\pm 12.10$ ) kg, mean  $VO_2$  max 60.25 ( $\pm 7.73$ ) ml/kg/min and mean RPE 11.72 ( $\pm 1.55$ ) of males are shown in table 1.

Mean age 19.96 ( $\pm 1.60$ ) years, mean height 1.62 ( $\pm 0.16$ ) cm, mean weight 49.28 ( $\pm 3.49$ ) kg, mean  $VO_2$  max 56.19 ( $\pm 5.00$ ) ml/kg/min and mean RPE 12.14 ( $\pm 1.24$ ) of females are shown in Table 2.

Mean  $VO_2$  max 58.22 ( $\pm 6.79$ ) (ml/kg/min) and mean RPE 11.93 ( $\pm 1.41$ ) of all individuals are shown in Table 3.

Pearson's Correlation was applied between  $VO_2$  max and RPE which is shown in Table 4. t test were applied between the both groups (male and female) to determine the mean difference of RPE which is shown in Table 5.

## Discussion

The study was design to find the relationship between aerobic capacity and rating of perceived exertion among the male and female collegiate athletes and to compare the rating of perceived exertion between males and females collegiate athletes.

Statistical insignificant correlation (0.023) was found between aerobic capacity and RPE which leads to the null hypothesis of the study. It suggests that RPE has not any correlation with the  $VO_2$  max which is quiet inconsistent with the findings of Chen et al. (2002)<sup>12</sup>, and Habibi et al. (2014)<sup>13</sup>, which suggests that RPE has highest correlation with the  $VO_2$  max.

**Table 1:** Mean age, height, weight,  $VO_2$  max and RPE of males

	N	Minimum	Maximum	Mean	Std. Deviation	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Age	50	18.00	23.00	19.18	0.20	1.42
Height	50	157.50	190.50	1.71	1.15	8.18
Weight	50	45.00	98.00	63.86	1.71	12.10
$VO_2$ max	50	43.21	71.00	60.25	1.09	7.73
RPE	50	9.00	14.00	11.72	0.21	1.55

**Table 2:** Mean age, height, weight,  $VO_2$  max and RPE of females

	N	Minimum	Maximum	Mean	Std. Deviation	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Age	50	18.00	24.00	19.96	0.22	1.60
Height	50	152.40	176.00	1.62	0.69	4.91
Weight	50	45.00	57.00	49.28	0.49	3.49
$VO_2$ max	50	42.97	64.99	56.19	0.70	5.00
RPE	50	10.00	14.00	12.14	0.17	1.24

**Table 3:** Mean  $VO_2$  max and RPE of all individuals

	Mean	Std. Deviation	N
$VO_2$ max	58.22	6.79	100
RPE	11.93	1.41	100

**Table 4:** Correlation between  $VO_2$  max and RPE.

		$VO_2$ max	RPE
$VO_2$ max	Pearson Correlation	1	.023
	Sig. (2-tailed)		.820
	N	100	100
RPE	Pearson Correlation	.023	1
	Sig. (2-tailed)	.820	
	N	100	100

Statistical no differences were found in Rate of perceived exertion between male and female collegiate athletes. It suggests that the exercise performed at same intensity will require same effort for both males and females as the intensity of exercise increases, level of exertion will increases at the same rate for both males and females. More will be the exercise intensity more will be the exertion for both male and female collegiate athletes. This finding is contradicting with the findings of Garcin et al. 2005<sup>14</sup>, who showed that the female runners perceived exercise as being harder, felt that they could endure less and had higher heart rate values than males for a given absolute velocity ( $km.h^{-1}$ ) whereas there were no difference between males and females for a given relative velocity

**Table 5: *t* test for mean difference of RPE between both groups (males and females)**

		<i>t</i> -test for Equality of Means						
		T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
RPE	Equal variances assumed	-1.492	98	0.139	-0.42000	0.28147	-0.97856	0.13856
	Equal variances not assumed	-1.492	93.605	0.139	-0.42000	0.28147	-0.97889	0.13889

(%vVO<sub>2</sub> max). Moreover, the female runners perceived exercise as lighter and felt that they could endure more than the males for a given absolute time period (in s) whereas there was no difference between males and females for a given relative time period (%tlim), therefore they explained that the same exercise intensity or duration corresponded to higher %vVO<sub>2</sub> max and lower %tlim for the females compared to the males.

## Conclusion

The finding of the present study reveals that a person's rating of perceived exertion is not dependent on his or her maximal oxygen consumption or VO<sub>2</sub> max as there is no relation seen between VO<sub>2</sub> max and RPE of an individual.

Also there is no difference found in rating of perceived exertion between males and females collegiate athletes. Therefore the aerobic exercise intensity on which athletes will perform, remain the same for both males and females.

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