TO DETERMINE THE ASSOCIATION OF CARDIO-RESPIRATORY FITNESS WITH ANTHROPOMETRIC CHARACTERISTICS IN COLLEGIATE ATHLETES

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INTRODUCTION

Cardio-respiratory fitness can be used as a health measurement and it also helps in prescribing physical exercises (Duncan et al, 2005). VO2 max is an important determinant and primary criterion for measuring cardio-respiratory fitness (Berkey et al, 2000). VO2 max is the capacity of an individual to consume maximal oxygen and is considered as the most important determinant of athletes’ fitness (Thompson et al, 2009). VO2 max is the ability of an individual to perform moderate to high intensity exercise for the prolonged period of time (Katch et al, 2011). There are various methods of measuring VO2 max either direct or indirect (Kumar & Agrahari, 2012). There are various field tests also to measure VO2 max which are convenient, reliable and cost effective (Kumar & Sharma, 2011). The gold standard indirect method of measuring VO2 max is Treadmill test. There are various treadmill tests in which Bruce Treadmill testing is one and so much reliable (Katch et al, 2011). VO2 max is found to be increased with aerobic exercises (Katch et al, 2011), high altitude (Wilhite et al, 2013), consumption of pre-exercise sports drink (Kumar & Agrahari, 2012). It decreases with consumption of alcohol (Montoye et al, 1980), smoking (Hirsch et al, 1985) and tobacco (Kumar & Sharma, 2011). BMI, % body fat and hip-waist ratio are the important determinant of body composition and physical fitness (Katch et al, 2011). All these determinants are considered as anthropometric characteristic measures of an individual and considered as the measurement of fat mass of the body.

The purpose this present study was to determine the relationship of cardio-respiratory fitness (VO2max) with anthropometric characters such as BMI, hip-waist ratio and % body fat in collegiate athletes. A total of 100 healthy collegiate athletes with mean age of 19.51 years were voluntarily participated in this study. The mean weight (kg), height (mtr), BMI, hip-waist ratio and % body fat of all the subjects were 52.29, 1.62, 19.81, 1.16 and 14.07 respectively. The VO2 max was measured by Bruce treadmill test and the mean VO2 max was 56.65 ml/kg/min. the Pearson’s correlation test were applied between these variables and statistical significant relation were found between BMI and Vo2 max as well as between % body fat and VO2 max but statistical insignificant relation found between hip-waist ration and VO2 max. Therefore the finding of the present research suggests that VO2 max is directly associated with BMI and % body fat.

METHODOLOGY

Total 100 male collegiate athletes aged between 18-25 years were randomly selected from total of 275 volunteers for this correlation study. The age of subjects were recorded from their birth certificate which is being submitted to their college. The data were collected in the evening session at room temperature. Subjects were asked to fill & return the consent form for their voluntary participation. The study was approved by institutional ethics committee of Saaii College of Medical Science & Technology, Kanpur, India.

Procedure:

Anthropometric Measurements:

Height, weight, BMI, Hip-Waist Ratio and percent body fat of each subject was measured using...
standard technique and were measured in triplicate with the mean value used as criterion. The height was measured using a stadiometer to the nearest 0.1 cm during inspiration. Weight was measured by digital standing scales to the nearest 0.1 kg. Hip & Waist measurement was done by standard measuring tape to the nearest 0.1 cm and Percent body fat was measured after determining the BMI using the formula (Womersly & Durnin, 1977):

For males = 1.34 X BMI - 12.47

**VO2 Max:**

VO2 max was measured by the standard treadmill test using Bruce protocol. The subjects were asked to report 30 minutes before the test. They consumed nothing, but well hydrated, from 2 hours prior to the test. VO2 max was recorded in ml/kg/min.

**Statistical Analysis:**

Mean, standard deviation, standard error and percentile were used to prepare summary statistics. Karl Pearson’s correlation coefficient (r) was used to determine the association between different variables. The statistical analysis was done on SPSS v16.00. A 5% confidence level was used to determine statistical significance.

**RESULTS**

A total of 100 male individuals participated in present study with the mean age of 19.51 (+1.69) years, mean height 1.62 (+0.06) mts, mean weight 52.29 (+6.57) kg, mean hip measurement 85.42 (+5.33) cm and mean waist measurement 73.96 (+6.57) cm, as shown in table 1. Mean BMI of all individuals were 19.81 (+2.20), mean hip-waist ratio were 1.16 (+0.07), mean % body fat were 14.07 (+2.95) and mean VO2 max (ml/kg/min) were 56.65 (+3.74), as shown in table 1.

**Pearson’s Correlation** were applied between VO2 max, BMI, H/W ratio and % body fat which is shown in table 2.

**DISCUSSION**

The purpose of the present study was to determine the association of VO2 max with the anthropometric characteristics or body stature like, BMI, H/W ratio and % body fat.

Statistically significant correlation (-0.22) found between BMI and VO2 max, which suggests that BMI is indirectly proportional to VO2 max. A person who is having lower BMI is supposed to have a greater VO2 max. The finding of this study is supported by the finding of Pribis et al, 2010 &

<table>
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<th>Table 1 Mean age, height, weight, hip measurement, waist measurement, BMI, hip-waist ratio, % body fat and VO2 max</th>
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<td>VO2 Max</td>
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<th>Table 2 Correlation between VO2 max, BMI, H/W ratio and % body fat</th>
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<td><strong>BMI</strong></td>
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**. Correlation is significant at the 0.01 level (2-tailed)**

**. Correlation is significant at the 0.05 level (2-tailed)**
Dagan et al, 2013, which worked on the association of BMI with VO2 max and suggested that an appropriate lower but within the range BMI is always essential for having a good VO2 max. Statistical significant correlation (-0.26) were found between % body fat and VO2 max, which again suggest that % body fat is also indirectly proportional to VO2 max. It means a person having lower body fat percent will be having a better VO2 max and this finding is in consistent with the findings of Pribis et al, 2010 & Dagan et al, 2013, which emphasized on the correlation of body fat percent with maximum oxygen consumption (VO2 max) and concluded that % body fat plays an important role in altering VO2 max as more is the body fat less is the VO2 max and vice versa. There is statistical insignificant correlation (0.12) were found between H/W ratio and VO2 max, which suggests that H/W ratio has not any influence on the VO2 max which is quite inconsistent with the findings of Dagan et al., 2013, which suggests that H/W ratio has negative correlation with the VO2 max means lower the H/W ratio better the VO2 max.

In spite of the relation between VO2 max and body stature we have also found the interrelation between anthropometric components. There was statistical significant correlation (0.97) found between BMI and % body fat which suggests that BMI is directly proportional with the body fat percentage and it can also be suggested that if a person is having more BMI, his/her body fat percent will be greater. This finding is also supported by the findings of Flegal et al, 2009 & Ranasinghe et al, 2013, who also suggested that BMI has direct relation with body fat percent and if a person’s BMI is more than normal than that person can be considered as obese. Inter-correlation between other parameters of anthropometric characteristics was found statistically insignificant, like between BMI and H/W ratio (-0.16), between H/W ratio and % body fat (-0.17). Which suggests that BMI has no relation with hip-waist ratio which is inconsistent with the findings of Ranasinghe et al, 2013, who found that BMI has correlation with hip-waist ratio. Furthermore, it is also found in the present study that hip-waist ratio is not related with body fat percent, which is inconsistent with the findings of Ranasinghe et al, 2013, who suggested that hip-waist ratio is directly related with the percent body fat.

CONCLUSION

The finding of the present study reveals that a person’s maximum oxygen consumption or VO2 max is very much dependent upon his/her BMI. An adequate and minimum BMI is essential for having higher VO2 max. Therefore, in order to increase VO2 max one should have to decrease their weight to minimize BMI and hence improve VO2 max. This finding can help athletes, coaches, Physiotherapists, Team managers etc. to give emphasis on athletes’ body weight and always keep try to minimize BMI and hence improve VO2 max.

Moreover, the findings of the present study also reveal that VO2 max is dependent on a person’s body fat percent. Increase body fat is always detrimental for person fitness as well as VO2 max. It actually causes a decreased cardio-respiratory fitness or VO2 max, which is an essential component of overall fitness. Therefore this finding is also helpful for the athletes, coaches, Physiotherapists, team managers etc. to give emphasis on athletes’ body fat and always keep try not to increase body fat. A proper exercise program and healthy diet is needed for maintain and decreasing body fat and weight. Therefore, we can concluded that, for having a better VO2 max one should control on his/her body weight and body fat percent because increase in any of the both can lead to decreased in VO2 max.

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