IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG

An International Open Access, Peer-reviewed, Refereed Journal

"A STUDY TO EVALUATE CARDIO-RESPIRATORY FITNESS USING QUEENS COLLEGE STEP TEST IN COLLEGE GOING STUDENTS: AN OBSERVATIONAL STUDY"

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ABSTRACT

Background: Evaluation of cardiorespiratory fitness in terms of maximum oxygen uptake (VO2max) is restricted to within the laboratory because of its exhausting and difficult experimental protocol. It is therefore desirable to find a simple procedure for evaluation of VO2max in population studies, especially in the field and in the absence of a well-equipped laboratory. Among various indirect protocols the Queen's College step test or QCT is the simplest one, but its applicability has not yet been explored in an Indian population.

Aim of the study: The aim of this study was therefore to assess the cardiorespiratory fitness level in college going student.

Methodology: A total of 322 college going student, adult male(n=161) and female (n=161) around age group of 18-23 was taken as convenient sample. Then VO2max was measured using QCT.

Result: In present study it was found that mean value of VO2max for male was 44.97± 6.823ml kg/min and that of female was 36.133 ± 3.56 ml kg/min.

Conclusion: These study showed that, majority of the students have average Cardio-Respiratory fitness. Majority of Male students fell under category of good and average Cardio-Respiratory fitness. Majority of female students had average Cardio-Respiratory fitness. Moreover male students have higher percentage in good range of Vo2max when compared to female students suggesting that male were having more Cardio-Respiratory fitness than females. There were very few students who were having excellent range of Vo2max concluding that very few students is indulged in regular physical activity.

Keyword: Queen's college step test, cardio-respiratory fitness, VO2max.

INTRODUCTION

The main function of respiratory and circulatory system is to supply the tissue of the body with oxygen and cardio-respiratory fitness has been defined by Holmgren[1967]. [1] The cardio-respiratory systems involves a chain of integrated processes which are concerned with- 1] the ventilation of the lungs,2] the diffusion of oxygen from the lungs into the blood,3] the transport of the oxygen by the blood,4] the diffusion of oxygen from the blood into the tissues. Cardiorespiratory fitness means body's cardiovascular (circulatory) and respiratory systems function together, especially during exercise or work, to ensure that adequate oxygen is supplied to the working muscles to produce energy. [3] VO2max is internationally accepted parameter and is the first choice in measuring a person's cardio respiratory status [4] . VO2 max is the maximum amount of oxygen a person can intake and the value does not change despite an increase in workload over time period. The VO2max can be estimated using maximal or sub maximal tests, by direct or indirect methods. [5] The direct measurement of VO2max requires an extensive laboratory, specialized equipments and considerable physical effort and motivation. These considerations increase the importance of sub maximal exercise test to predict VO2max from performance during walking or running or from heart rate during or immediately after exercise.[6] To generalize, heart rate to predict VO2max is simple and valid.[5] Exercise tests represent an important clinical tool to evaluate cardio respiratory fitness and to predict future adverse cardiovascular events. Numerous clinical investigations have established a strong association between cardio respiratory fitness and mortality. [7] Among various indirect protocols Queen' s college step test or QCT is the simplest one, but its applicability has not yet been explored in Indian population. [3] The work rate in a step test is determined by the product of the step height and the step frequency, whereas the amount of work done directly proportional to the number and duration of the work duration. [1]

Students are future of country, so they must be physically fit and mentally alert. They exercise less frequently and are subjected to different kinds of stress mainly due to heavy academic work load. It is important to measure and analyze their physical fitness for their own benefit and improvement to maintain healthy lifestyle. The present study is was aimed to find out cardiorespiratory fitness in college going student.

METHODOLOGY

This study was observational study conducted by Shrimad Rajchandra College of physiotherapy in Uka Tarsadia university in Bardoli, Gujarat. The study was carried out from December 2021 to February 2022. It includes apparantely healthy males and females between the age of 18-23 with normal BMI. Sampling method used was convenient sampling method. Those student suffering from any acute or chronic illness, any musculoskeletal or locomotor conditions, cardio-respiratory conditions and person who have undergone any type of surgery were excluded.

Ethical clearance was obtained by Ethical committee of university before data collection. Sample size was calculated and 322 students were selected from different branches of Uka tarsadia university. Out of 322 students 161 were male students and other 161 were female students.

322 students were recruited after taken informed consent from the students.Prior explanation about the aim and purpose of the study, test procedure, method of testing and instructions on how to perform test were given. All participants were tested under similar laboratory conditions in comfortable environment. They were instructed not to indulge in any activities before the test and not to have heavy meals/tea/coffee at least two hours prior. Detailed history was taken and clinical examination was done to rule out cardio-respiratory and musculoskeletal illnesses. Physical activity readiness (PAR-Q) questionnaire was taken prior to the testing.

Demographic data of the students were collected prior to the test. The anthropometric data including age, height, weight was noted and Body Mass Index [BMI] was calculated as body weight in kilograms divided by square of height in meter, using Quetelet index.

Subjects were asked to rest 5 minutes prior to the test and resting pulse rate was measured. Vo2max was estimated using Queen's college step test indirectly. Individuals stepped to a four-step cadence ("up-up-down-down") using a tool of 16.25 inches height. Stepping was done for 3 minutes at the rate

of 24 steps/min for male and 22 steps/min for female set by the metronome. After completion of test, radial pulse was measured for 15 seconds (5-20 sec). Fifteen second pulse rate was converted into beats per minute by pulse rate*4.

Following equation were used to estimate Vo2max:

For Male: VO_2 max : 111.33-[0.42*pulse/min]

For Females –VO_2 max : 65.81-[0.1847*pulse/min]

The data was collected, compiled and analyzed. Analysis was done using descriptive statistics like frequency, percentage, mean and standard deviation.

RESULTS & ANALYSIS

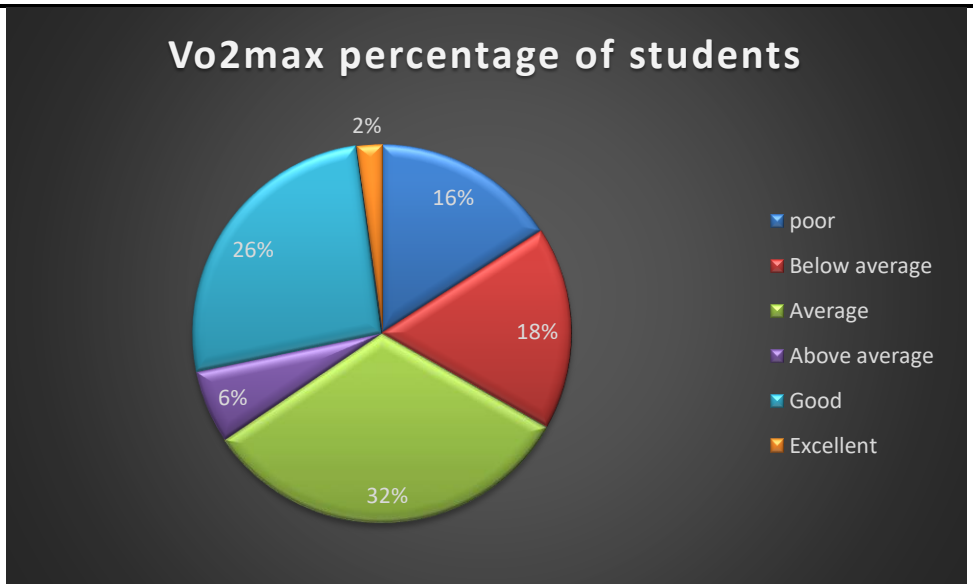
Table 1: Shows Physical characteristics and Vo_2max in UKA TARSADIA UNIVERSITY Students (Mean ± SD)

Vo_2max SCORING	**NUMBER OF STUDENTS**	**PERCENTAGE(%)**
Poor	20	12%
Below average	12	7%
Average	41	26%
Above average	17	11%
Good	64	40%
Excellent	7	4%

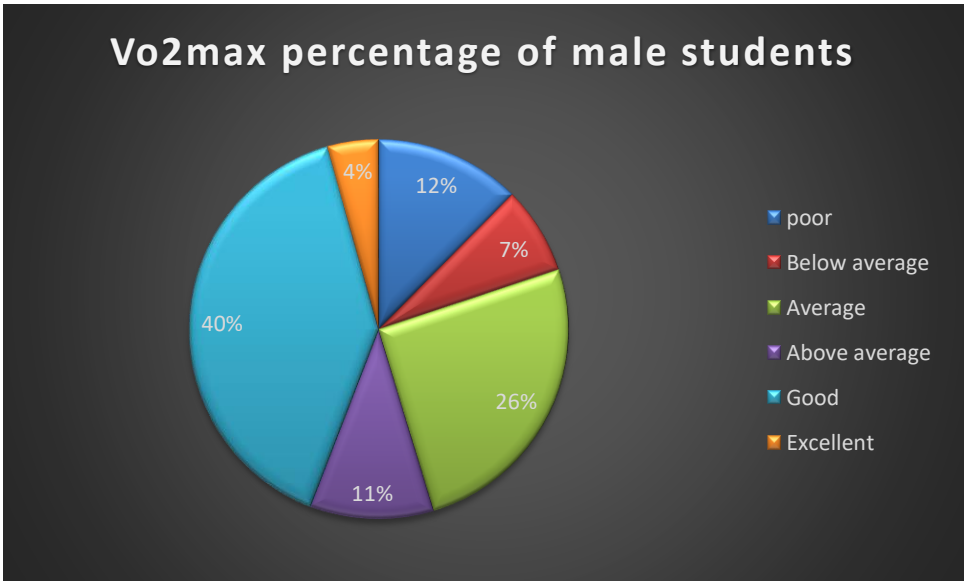
Table 2 : Vo2max score in male students

	No. of Subjects	**Age(Y)**	**Height (cm)**	**Weight (kg)**	**BMI**	**Vo_2max**
Male	161	20.503 ±2.414	168.26±9.205	167.93 ±8.114	22.122 ±2.77	44.97 ±6.823
Female	161	20.543±1.55	156.91±6.79	52.10±7.11	21.20±1.60	36.133±3.56
Total	322	20.24±1.48	162.46±7.62	57.41±7.02	21.64±1.60	40.565±7.012

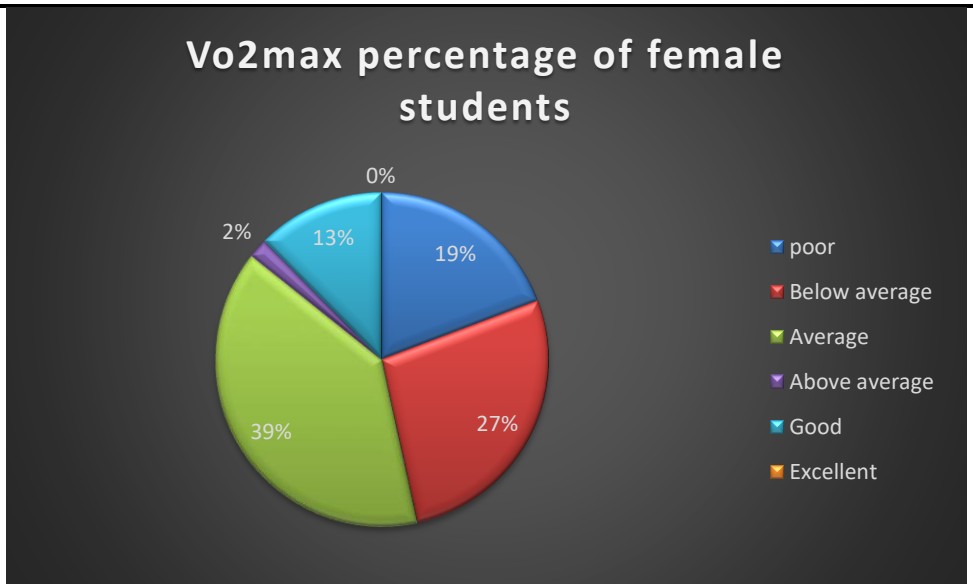
Table 3: Vo2max score in female students



Graph 1: Vo2max percentage of physiotherapy students



Graph 2:- Vo2max percentage of male physiotherapy students



GRAPH 3:- : Vo2max percentage of female physiotherapy students

Mean values of VO2max for males (44.97±6.823ml/Kg/min) and females (36.133±3.5671 ml/Kg/min) were compared, which was found significantly higher in males than in females .

When the study participants were categorized as per the fitness scale it was observed that more males fell under good and excellent category whereas more females were in average and below average category.

From this study we can tell that students in Uka tarsadia university fell under average and good category of Cardio-Respiratory fitness. It has also been observed that very few students has excellent range of Cardio-Respiratory Fitness.

DISCUSSION

The maximum oxygen uptake [VO2 max], an internationally accepted parameter to evaluate the cardio respiratory fitness reflects the amount of oxygen utilized by working muscles during maximal exercise. It is the best index of aerobic capacity and gold standard for cardio respiratory fitness. Thus measure of maximum oxygen consumption offer insight into ability of cardiovascular, respiratory and muscular system to deliver and utilize oxygen. During exercise, up to a point the increase in oxygen consumption is proportionate to energy expended and all the energy needs are met my aerobic process. So in a person, the more is the maximum oxygen consumption capacity [VO2max], the more will be his/her aerobic capacity. VO2max is the measure of the functional limit of the cardio-respiratory system and the single most valid index of maximal exercise capacity.

The purpose of our study was to assess cardio-respiratory fitness in terms of maximum aerobic capacity (VO2max) in males and females students of Uka tarsadia University. The present study showed that the mean value of VO2max for males was significantly higher than for females.

Among 161 male students 40% male students has good Vo2max range while 12% student has poor Vo2max range, 7% below average, 26% has average, 11% above average and only 4% male student has a excellent range of vo2max. Among 161 female students 13% female students has good Vo2max range,19% has poor Vo2max range, 27% has below average, 39% has average and 2% has above average range of Vo2max. There was no female who has excellent range of fitness.

Our study concluded that majority of the male students fall in the category of good and average vo2max suggests that their cardiorespiratory fitness is good. There were only 4% students who were having excellent range of Vo2max suggesting that very few students were physically active. Whereas female students has average range of Vo2max suggesting that they have average cardiorespiratory fitness. Only 12% female student has good range of vo2max suggesting that female are less active and have more sedentary lifestyle as compared to male students.

Bibek koju et al. in their study concluded that male students have higher vo2max when compared to female students. Reason given by them was that female have lower muscle mass as compared to male student. More the muscle mass is involved in exercise, greater the contribution of muscle pump to venous return and in turn cardiac output. Increase in regular physical activity or exercise may help in increasing muscle mass as well as VO2max. Therefore, a suggestion to reduce body fat percentage by the help of increased physical activity or exercise would help to decrease health risks in young adults.

Limitation of the study was Physical activity of students were not assessed. Moreover students with normal BMI were taken, a different group of BMI would give better scenario to these study.

CONCLUSION

These study showed that, majority of the students have average Cardio-Respiratory fitness. Majority of Male students fell under category of good and average Cardio-Respiratory fitness. Majority of female students had average Cardio-Respiratory fitness. Moreover male students have higher percentage in good range of Vo2max when compared to female students suggesting that male were having more Cardio-Respiratory fitness than females. There were very few students who were having excellent range of Vo2max concluding that very few students is indulged in regular physical activity. Regular physical activity in daily living and adding it to the curriculum can increase their Cardio-Respiratory fitness and can also yield better performance in their academic activity.

CONFLICT OF INTEREST

There is no conflict of interest.

ETHICAL APPROVAL

Ethical approval was taken.

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