



CARDIOPULMONARY FITNESS SCORES IN STUDENTS OF PRIVATE MEDICAL COLLEGE

Physiology

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ABSTRACT

Introduction: Obesity a major risk factor for many acute and chronic disorders including cardiovascular and cerebrovascular disease and diabetes. **Method:** A total of 40 non obese and 40 obese medical students in age group of 18-22 years who have satisfied inclusion and exclusion criteria and have consented to participate in study were enrolled. Each enrolled subjects BMI was recorded and evaluation of Physical Fitness Test was done by 40mm Endurance test, VO₂ max and physical fitness index **Result:** There was significant difference in Physical Fitness parameters values between obese and non obese students, indicative of decreased physical activity in obese. This indicates implementation of early interventional programs (weight reduction, life style changes and physical exercise) to prevent obesity related cardiovascular sequelae in future.

KEYWORDS

BMI, 40mm endurance test, VO₂ max, physical fitness index

INTRODUCTION

Obesity is a disorder of energy balance affecting wide range of people belonging to diverse ethnic groups, age and socioeconomic status¹. The causes of obesity are manifold that include lack of regular exercise, sedentary habits, over consumption of high calorie foods, and genetic, prenatal and early life factors². Obesity has been found to have a positive correlation with endocrinal dysfunction, lipid profile, hypertension, insulin resistance and morbidity from coronary heart disease in adulthood³. Obesity, if present in adolescence leads to obesity in adult life.

Physical fitness is used in two close meanings: general fitness-a state of health and well-being and specific fitness – the fitness to perform a specific task requiring muscular efforts⁴. It is maintained by healthy life styles, including habitual physical activity. It provides healthy impact on cardio respiratory system. Physical fitness depends on several factors like heredity, environment, socioeconomic status, regular exercise, diet and nutrition, and proper rest⁵.

Cardio respiratory fitness is the ability of the body's circulatory and respiratory systems to supply fuel and oxygen during sustained physical activity. It is a good indicator of how much physical activity you routinely perform. The primary measure of Cardio respiratory fitness (CRF) is VO₂max⁶.

Medical student during the course of the medical education is subjected to different kinds of stressors predominantly the pressure of academics leading to the successful completion of the educational course. Physical & mental fitness are the key to such a successful outcome. Beginning an active lifestyle could significantly reduce mortality from these events⁷. It was therefore thought to evaluate cardiopulmonary efficiency in medical students to determine the physical efficiency in these students and plan suitable strategies if necessary.

MATERIAL AND METHOD

Study Design: 80 Students in the age group 18-22 years were randomly selected to obtain mixed group of students from M.G.M. Medical College and were screened to identify the 1) Non obese group: healthy with BMI < 23 Kg / m² and 2) Study group (obese): healthy with BMI > 23 Kg/m².

Method: Inclusion criteria included 1) Students in the age group of 18-22 years. 2) Students who were obese to their respective age and sex were selected. 3) 40 obese students and 40 non-obese students were selected according to the parameters mentioned. Exclusion criteria were 1) The exclusion criteria comprised of students suffering from any medical ailments. 2) Anxious, apprehensive and uncooperative students. 3) Any history of smoking, addiction of tobacco, use of any

medications to be excluded from the study. Institutional ethical clearance was obtained. Body mass index was calculated as per the formula:

Body mass index = Weight (Kilograms)/Height (Meter)².

The students having BMI of more than the cut-off value for their respective age and sex were designated as the test/obese group (both overweight and obese students to be clubbed together). Identical number of age and sex matched non-obese medical students served as controls. Students were explained about the procedures to be undertaken. A brief personal history was taken and written consent was obtained as per Helsinki declaration modified according to the test protocol

1) The subjects were made to rest for 10 min before undergoing fitness experiment as per standard procedure.

2) Baseline heart rate, Respiration rate and Blood pressure were measured after 10 minute rest in supine position.

3) 40mm Endurance Test (Flack's Air-Force Manometer Test): The subject was asked to take a deep inspiration, close the nostrils and blow into the mercury manometer to raise the pressure to a level of 40mm Hg. Care was taken so as avoid the use of cheeks to maintain the level of 40mm. During this event, the pulse was noted & was not allowed to increase till the breaking point. The maximum time the subject can hold the breath was noted.⁸

4) Determination of VO₂ max (maximum aerobic power) It is also called as the maximum oxygen uptake or maximum oxygen consumption. Harvard step test (HST) was used as an exercise test for evaluation of maximal aerobic power. The pulse was measured for one complete minute immediately after exercise. Body weight was obtained from Body weight scale & pulse rate was joined in the Astrand's Ryhming Nomogram to obtain the value of VO₂ max⁹.

5) Determination of Physical Fitness Index (PFI) PFI was calculated by measuring heart rate after performing Harvard step test (HST) which is a common method used to assess cardio respiratory fitness. It is based on the heart rate recovery following a given work load of 5 minutes. The subject was instructed to step up and down on a 51 cm high bench for 5 minutes or up to exhaustion. Exhaustion is defined as the time when the subject cannot maintain the stepping rate for 15 seconds when the rate of stepping is set at 30 cycles per minute. Each cycle constituted 1 step up and 1 step down. Immediately at the end of this protocol, the subject was asked to sit down. The pulse was counted between 1 to 1.5 minutes, 2 to 2.5 minutes and 3 to 3.5 minutes¹⁰. Fatigue index was calculated as follow:

$$\text{Fatigue index} = \frac{\text{duration of exercise in sec} \times 100}{2 \times (\text{sum of pulse counts during recovery})}$$

If Fatigue index score is below 50, it is interpreted as poor, between 50-80 as average and above 80 as good.

Statistical analysis: Results were analyzed by using Unpaired Student T-test with "P" value < 0.05 for significance.

RESULTS AND DISCUSSION

80 subjects (group A non obese n=40) and (group B obese n=40) that have satisfied the inclusion and exclusion criteria were selected.

Table 1: Comparison of height , weight ,B.M.I. in groups

Groups	Height (mean+SD)	Weight (mean+SD)	BMI (mean+SD)
Group A	165.80±9.12	57.98±9.32	20.572±2.391
Group B	163.70±8.81	76.48±10.60	29.00±3.284

Table-1 The two groups for the study were similar in age in terms of basic characteristics. Group A and Group B showed significant difference in Weight and BMI (p<0.001), no significant difference in Height.

Table 2: Physical Fitness parameters in obese and non obese groups

Parameters	Group A (non obese)	Group B (obese)	t-value	P value
Supine (mm of Hg)	118.65±7.73	131.30±7.74	7.3117	0.0001 (HS)
Systolic BP	77.65±4.68	87.10±4.01	9.6932	
Diastolic BP				0.0001 (HS)
Resting pulse(bpm)	68.8 ±2.30	77.20±5.61	4.3788	0.0004(HS)
Respiratory Rate(pm)	13.10±1.66	14.30±1.49	1.6971	0.1069(NS)
40 mm Endurance test (in sec)	42.90±2.64	37.80±3.82	3.4692	0.0027(HS)
VO2 max(ml/Kg/min)	56.00±2.87	48.30±5.14	4.1349	0.0006 (HS)
Fatigue index	64.20±4.64	56.20±5.05	3.6893	0.0017 (HS)

Table -2 Shows comparison of Physical Fitness parameters as follows:
 1. Group B subjects showed highly significant increase in systolic BP and diastolic BP (p<0.0001) when compared to Group A in changes from the observed values.

2. Group B subjects showed highly significant increase in resting pulse rate (p<0.0001) and non significant respiratory rate (0.1069) when compared to Group A in changes from the observed values.

3. Group B subjects showed highly significant decrease in 40 mm Endurance test (p<0.0027), VO2 max (0.0006), and Fatigue index (0.0017) when compared to Group A in changes from the observed values.

Table 3: Classification of obesity based on measurement of BMI according to WHO 11

Normal --	18.5-22.9
Average Overweight	-- > 23
At risk --- --Increased	23-24.9
Obese –I – Moderate	---25-29.9
Obese – II Severe	>30

Discussion:

Physical inactivity is the fourth leading risk factor for global mortality. These diseases have been strongly associated with unhealthy lifestyles habits, including inappropriate nutrition, lack of exercise, smoking, alcohol consumption, caffeine overuse and improper sleeping habits.

Healthy active living benefits both individuals and society in many ways, for example, by increasing productivity, improving morale, decreasing absenteeism, and reducing health care costs. Other benefits include improved psychological well being, physical capacity, self esteem and the ability to cope with stress. It is well established that regular moderate or vigorous intensity exercise will lower the risk and symptoms associated with co morbidities of obesity. This trend is present in all societies, rich and poor, developed and developing countries.12 The present education system has helped to improve the education standards. But, the non active sedentary stressful life has made the youth physically unfit. Now, the time has come to consider about the physical fitness and exercise in the adult age group. Realizing this fact, educationalists have recommended minimal physical exercise in the curriculum.5 Physical Fitness Index scores are useful measure of fitness for strenuous exercises. Physical fitness has three main aspects: static fitness (absence of disease), dynamic fitness (ability to perform strenuous work) and motor skill fitness. Of these three, dynamic fitness is very important and can be measured by the Harvard Step Test.13 Aerobic capacity or maximum oxygen uptake capacity (VO2 max) has been widely considered to be reliable and valid measure of cardio respiratory fitness14. Hence we studied these parameters in our institute.

Conclusion : There was significant difference in the Physical Fitness parameters (40 mm Endurance test , VO2 max , and Fatigue index) values between obese and lean subjects. This paves the way for implementation of early interventional programs (weight reduction, life style changes, and physical exercises) to prevent the onset of obesity related cardiovascular sequelae in the future by early intervention.

References:

- Irani F, Shinde PU, Heena Kausar GH, 'Evaluation of autonomic function in obese and non obese medical students' IJMSPH 2014; Vol 3, 6: 142.
- Ebbeling CB, Pawlak DB, Ludwig DS. Childhood obesity: public health crisis, common sense cure. Lancet 2002; 360: 473-482
- Venkatnarayan KM, Campagna AF, Imperatore G. Type 2 diabetes in children: a problem lurking from India? Indian Pediatr 2001; 38: 17
- Karandikar MS, Prasad NB, Asit Kumar. Assessment of Cardiopulmonary Efficiency Levels in a Student Population. International Journal of Scientific and Research Publications. 2014 may; 4(5) ISSN 2250-3153.
- Khodnapur JP, Bagali SC, Mullur LM, Dhanakshirur GB, Aithala M. Role Of Regular Exercise On Vo2 max And Physiological Parameters Among Residential And Non residential School Children Of Bijapur IJBAR (2012) 03(05).
- Ross, Robert, Blair, Steven N. Arena, Ross Church, Timothy S. et al. "Importance of Assessing Cardiorespiratory Fitness in Clinical Practice: A Case for Fitness as a Clinical Vital Sign: A Scientific Statement From the American Heart Association". Circulation. 134 (24): e653-e699.
- Paffenberger R.S. ,Kampert JB, Lee IN, Hyde RT, Leung RW, Wing AL: Changes in physical activity and other life way patterns influencing longevity. Med Sci Sports Exec; 1994; 26: 857-865.
- Proceedings of physiological society, July 8, 1922.
- Astrand PO, Rodahl K, Dahl H, Stromme S. Test book of work Physiology. 4th ed, 1960. p 281.
- Karandikar MS, Prasad NB, Asit Kumar. Assessment of Cardiopulmonary Efficiency Levels in a Student Population. International Journal of Scientific and Research Publications. 2014 may; 4(5) ISSN 2250-2153.
- World Health Organization .Obesity; preventing and managing the global epidemic. Geneva: WHO 1998.
- Rao CR, Darshan BB, Das N, Rajan V, Bhogun M, Gupta A. Practice of physical activity among future doctors: A cross sectional analysis. Int J Prev Med. 2012 May; 3 (5) :365-369.
- Sengupta P, Sahoo S. A fitness assessment study among young fishermen of coastal areas of East Midnapore District of West Bengal, India South East Asia Journal of Public Health 2011; 1: 28-34.
- Das KK, Dhundasi SA. Physical fitness: a longitudinal study among muslim children of Bijapur (Karnataka). Indian J Physiol Pharmacol. 2001; oct; 45 (4): 457- 62.