Research Article

Effect of BMI and nutritional status on physical fitness index in response to short term moderate intensity exercise in sedentary young adults

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Abstract

Introduction: The current study was conducted to see the relationship between nutritional status of an individual, its body mass index and its physical performance so as to improve the physical fitness of low body mass index subjects bringing their better performance. The study was carried out in 58 young healthy sedentary medical students who were asked to perform short term limited duration exercise on bicycle ergograph. Each subject served as its own control. Subjects were introduced a pretested questionnaire for assessing nutritional status, Cardiorespiratory profile, status of nervous system, physical activity and related problems, history of past and present illness to find out any condition affecting physical performance of the subject. Physical activity level was assessed by different tests assessing their flexibility, coordination, Equilibrium, agility, strength and endurance. Physical activity Rating scale and VO2 max was used to assess the physical fitness. Physical fitness index was calculated using the formula. Pearson's correlation coefficient was to determine the relation between BMI and Nutritional status score. Pearson's correlation coefficient also determined the relation between nutritional status score and physical fitness index. Observed data revealed that subjects with poor nutritional status and obese subjects had lower level of physical fitness score. Physical fitness score was found to have a significant negative correlation with BMI in underweight and overweight subjects. It could thus be concluded that population having normal body mass index showed greater improvement in aerobic work capacity of study population which shows that sedentary medical students need proper nutrition, education and physical exercise to go a long way.

Keywords: BMI, nutritional status, physical fitness index.

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INTRODUCTION

Life style, nutritional habits and training volume have positive influence on the risk factors to prevent atherosclerotic heart disease later in life. The poor physical fitness of an individual may be due to poor body composition or inadequate supplementation of diet or lack of physical exercise. Though sufficient information is not available on the extent of changes observed in different systems in untrained Indian subjects but the evidence heavily favours that population or individual with high level of physical activity tend to have a lower prevalence of asymptomatic coronary artery disease. Physical fitness of an individual depends on the amount of oxygen which can be transported by the body to working muscles and the efficiency of muscles to use that oxygen, hence aerobic capacity has been widely considered to be reliable and valid indicator of Cardiorespiratory fitness [1].An exercise program conducted three to five times/week, for twenty to sixty minutes per session, at an intensity of about 50% to 85% VO2 max has been shown to cause appropriate Cardiorespiratory function effects. In order to obtain health related fitness, knowledge of nutrition is essential. There are certain standards by which the person is able to evaluate the effectiveness of his diet and analyse his body composition so as to reduce the

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incidence of health related problems. The quality of each nutrient thought to meet the needs of practically all healthy persons is stated the Recommended Dietary Allowance (RDA) while the daily value is a standard used in nutrition Labeling. Physical activity constitutes the most variable part of the energy expenditure side of the energy balance equation being 5% to 40% of the daily energy expenditure[2,3] Epidemiological evidence suggests an inverse association between physical activity and body weight, with body fat being more favorably distributed in those who are physically active[4].A recent study examined the relationship of body fatness to the different components of energy expenditure. Data showed that that body fatness was inversely related to "non basal energy expenditure. In this sense, the level of physical activity is a permissive factor for obesity[5]. The present study was therefore undertaken among untrained male medical students analyzing their nutritional status and discussing their correlation with their body mass index and Physical fitness Index.

MATERIAL AND METHOD

The present study was conducted out in the department of Physiology, Gandhi Medical College, Bhopal during January 2010-March 2011.Fifty eight asymptomatic healthy male medical students aged 19.707±1.22 were included in the study to perform short term limited duration exercise on bicycle ergograph after the approval from the human research ethical committee of the institute and obtaining informed consent from the participants or their parent/guardian. Each subject served as its own control. Only those students were included in the study who were not having any known respiratory, neuromuscular, cardiac or endocrine disorder. And the subjects who developed any kind of discomfort during training schedule were excluded from the study. Subjects were introduced a pretested questionnaire for assessing nutritional status, Cardiorespiratory profile, status of nervous system, physical activity and related problems, history of past and present illness to find any condition affecting physical performance of the subject. The subjects were called two days prior to exercise for physical anthropometry, assessment of nutritional status, determination of physical fitness, and for detailed clinical and Cardiorespiratory examination. The parameters measured were

1. Body weight- The weight of each subject were recorded on the same platform beam balance, bare footed with the minimum of clothings on the body. The subject was made to stand erect on the centre of the platform without touching anything else. Weights were recorded in kilograms up to the accuracy of 100 gms, the zero error was minimized to maximum. Machine was checked repeatedly from time to time to avoid error
2. Height –Using a vertical measuring rod, height was measured without shoes and the subject made to stand on a flat floor with feet parallel and with heels, buttocks, shoulders and back of head touching the rod. The head was held perfectly erect with lower border of the orbit in the same horizontal plane as the external auditory meatus and arm hanging at the sides in a natural manner. A wooden block was gently lowered to make contact with pressure just to crush the hair and the reading was taken.

Body Mass Index was calculated as follows

BMI= Weight in kgs/(Height)2 in meters The respondents were subjected to standardized oral questionnaire based on 24 hr Recall method. This method involved use of oral questionnaire based on 24 hr Recall method. This method involved use of oral questionnaire containing questions regarding the amount and frequency of food items consumed in the previous 24 hours. In the present study, the overall pattern of eating along with 24 hours recall of cooked food actually consumed was noted and calorie intake was computed by a standard calorie chart as recommended by ICMR(1968).A pretested questionnaire, was introduced in relevance to dietary history containing 16 questions (No. 1-16) to evaluate nutritional status. Depending on the answers given by the respondents, a scoring scale was developed to classify them in various categories.

For Assessment of Physical Fitness

Prior to the introduction of physical training schedule the physical fitness level of study population was assessed by testing the following parameters. Flexibility, Coordination, Equilibrium, Agility, Strength, Endurance Depending on the answers given by the respondents, a scoring scale was developed to classify them in various categories in revelance to their physical fitness measurements.

PRE – EXERCISE SCHEDULE

1. Choice of load: One day prior to exercise, testing subjects were called to the department and the maximal load at which would cycle on the bicycle ergograph was determined.
2. Age adjusted maximal heart rate was calculated by the formula HR max (±10bpm)=220-age A mean max HR is calculated for the study group.
3. Determination of maximum and submaximal load: The subjects were asked to exercise on the bicycle ergograph with different loads keeping the speed at 60rpm.The maximum heart rate

achieved with each load was recorded. A maximum load was noted till the subject attained his exhaustion point.

In the present study the maximal load found out was 5 kg with a maximum heart rate of 170 beats/min. The submaximal load which was 85% of the maximal load was found out to be 4.3 kg at a heart rate of about 144beats/minute after repetitive 3 kg load for 10 minutes. During the exercise session, the subjects pedaled the bicycle at the rate of 60 revolutions/minute for 10 minutes. It is documented in the literature that at this rate there is lowest oxygen uptake and greater mechanical efficiency. This rate was kept fixed throughout the exercise session.

EXERCISE SCHEDULE

The subjects were asked to report at the department by 8.30 A.M. Subjects were explained the whole procedure in detail and were motivated prior to the start of exercise. They were told to report immediately if they felt any discomfort, fatigue or dizziness. Subjects rested in supine position for 15 minutes before the start of exercise.

PHYSICAL FITNESS INDEX DETERMINATION

Physical fitness was calculated by the given formula Physical fitness index(PFI) = Duration of exercise in seconds x 100/5.5 x pulse Count(1-1.30' after exercise)

STATISTICAL ANALYSIS

Statistical analysis was performed by SSPS 13.0 software. Results are expressed as mean± standard deviation. Student 't' test was used to compare the Parameters between the control and test groups. The correlations were assessed by Pearson correlation.

RESULTS

We enrolled 58 subjects for this study. Out of them 25.87% are underweight, 56.89% are the normal weight subjects and 17.24% are overweight. Characteristic of the study population and its classification according to BMI are depicted in (Table I and II).Classification of the study population has been done based on pre exercise calorie intake as per ICMR guidelines (Table III).According to this criteria, 24.13% of the study population fell into category of fair nutritional status. Only 15 subjects was consuming < 64% of the recommended calorie intake. Regarding the correlation of BMI and Calorie intake score, it is evident from (table IV) that subjects with low calorie intake were underweight. Nutritional status is known to affect physical fitness of the individual. Study population was also classified on the basis of Nutritional scores obtained from the questionnaire filled by the respondents. 51.75% subject were classified having score< 75%.(Table V).Regarding the Correlation of BMI and Nutritional status score, it is evident from the (table VI) that subjects with poor nutritional scores were underweight. The subjects with nutritional score> 25 were also classified obese on the basis of BMI. Both under nutrition and over nutrition adversely affect the physical performance of the Subject. Assessment of pre exercise physical fitness of study population was done by testing their flexibility, coordination, Equilibrium, agility, strength and Endurance. Based on the score developed 20.68% subjects secured poor physical fitness score. Majority of the subjects (33%) were classified as having fair physical fitness scores. (Table no VII). A Correlation has been made Between NSS and PFS (Table VIII), which shows that subjects with high Nutritional status were negatively correlated with their PFS which is found to be statistically significant. An attempt has been made to correlate physical fitness score obtained by a battery of tests applied and the body mass index (Table IX). The observations indicated a positive correlation between physical fitness score and BMI in the range of 18.04-24.29 kg/m2. The observation revealed a negative correlation between above parameters when BMI values were higher and lower than normal (15.69-28.55 kg/m2)

Table 1: Characteristic of study population

Number	58
Age (Years)	19.707±1.22
Height (cm)	172.44±6.78
Weight (km)	61.181±13.70
BMI (kg/m^2)	20.357±3.83

Table 2: Classification of study population based on BMI

Group	No. of Cases	Percentage	Body Mass Index (kg/m^2) mean ± S.D.
I <18 (Underweight)	15	25.87	16.58±1.061
II 18-22.9 (normal weight)	33	56.89	19.90±1.385
III ≥23to 24.9 (overweight)	10	17.24	27.52±1.70
Total	**58**	**100%**	**20.357±3.83**

Subjects were divided into three groups depending on new BMI cut off point for Indian population by Indian government.17.24% cases were having weight above the standard for that age and sex.BMI≥23to 24.9 kg.m2.

Table 3: Classification of study population based on pre exercise calorie intake score

Group based on % RDA	No. of cases	Percentage	Calorie intake score Mean ± S.D.	Body Mass Index (kg/m²) Mean ± S.D.
I (<64%) Poor)	15	25.86%	1580	15.22
II (65-74%) (Fair)	14	24.13%	1747.86±86.92	19.02±2.55
III (75-84%) (Good)	20	34.48%	1986.3±67.61	20.67±2.42
IV (>85%) (Excellent)	9	15.51%	3200±75.44	22.60±2.382

Recommended dietary allowance for the sedentary males in the age range of 16-19 years as per ICMR (1968) is 3000 kcals and 2420 kcals for > 20 years. According to this criteria, 24.13% of the study population fell into category of fair nutritional status. Only 15 subjects was consuming < 64% of the recommended calorie intake.

Table 4: Correlation of bmi and calorie intake score

Group	Calorie intake score	BMI (kg/m²)	'r'	'p'
I n=15 (Poor)	1580	15.22	0.980	0.001
II n=14 (Fair)	1747±86.92	19.02±2.55	0.523	0.01
III n=20 (Good)	1986.3±67.61	20.67±2.42	0.518	0.02
IV n=9 (Excellent)	2900±75.44	22.66±2.38	0.920	0.001

It is evident from the above table, that subjects with low intake were underweight. Nutritional Status is known to affect physical fitness of the individual.

Table 5: Classification of study population based on pre exercise nutritional status

Group	No. of cases	Percentage	Nutritional status Score Mean ± S.D.	
I (<64%) (Poor)	14	24.13	16.14±1.34	16.34±1.36
II (65-74%) (Fair)	16	27.58	22.34±1.070	18.62±1.54
III (75-84%) (Good)	19	32.75	25.78±0.630	20.77±2.30
IV (>85%) (Excellent)	9	15.54	27.27±2.42	28.33±0.707

Study population was classified on the basis of nutritional scores obtained from the questionnaire filled by the respondents. 51.71% subjects were classified having score < 75%

Table 6: Correlation of BMI and nutritional status score

Group Based on NSS	NSS	BMI (kg/m2) Mean ±S.D	' r'	'p'
I n=14 (poor)	16.14 ±1.34	16.34±1.36	0.694	0.05
II n=16 (fair)	22.34± 1.07	18.62±1.54	0.480	0.02
III n=19 (Good)	25.78±0.63	20.77±2.30	0.728	0.001
IV n=9 (Excellent)	27.27±2.42	28.33±0.70	0.800	0.001

NSS-Nutritional Status Score It is evident from the above table that subjects with poor nutritional score were under weight.The subjects with nutritional score> 25 were also classified obese on the basis of BMI. Both under nutrition and over nutrition adversely affect the physical performance of the subject.

Table 7: Classification of study population based on pre exercise physical fitness score.

Group	No of cases	Percentage	Physical Fitness score Mean±S.D.	Body Mass Index (kg/m²) Mean±S.D.
I <10 (Poor)	12	20.68	5.75±2.2	22.12±6.43
II 10-15 (Fair)	19	32.75	12.58±2.00	20.69±3.6
III 15-20 (Good)	14	24.13	19.5±0.824	19.40±1.36
IV >21 (Excellent)	13	22.44	22.38±1.19	19.43±0.543

Assessment of Pre exercise physical fitness of study population was done by testing flexibility, co-ordination, Equilibrium, agility, strength and Endurance, Based on the score developed20.68% subject secured Poor, Physical fitness score. Majority of the subjects (33%) were classified as having fair physical fitness scores.

Table 8: Correlation of NSS with PFS

Group based on NSS	NSS Mean ± SD	PFS Mean ± S.D.	R Between NSS and PFS
I n=14 <64%	16.14±1.34	9.28±2.92	-0.800 P 0.001
II n=16 65-74%	22.34±1.07	17.17±4.72	0.773 P 0.01
III n=19 75-84%	25.78±0.63	18.63±4.49	0.886 P 0.10
IV n=9 >85%	27.27±2.42	6.44±4.09	-0.868 P 0.001

PFS – Physical Fitness Score

It is evident form the above table that subject with high nutritional status were negatively correlated with their PFS which is found to be statistically significant.

Table 9: Correlation of bmi and physical fitness score

Group (based on PFS)	PFS	BMI(kg/m2 Mean±S.D.	' r'	'p
I n=12 (poor)	5.75±2.20	22.12±6.43	−0.827	0.001
II n= 19 (fair)	12.58 ± 2.00	20.69± 3.60	+0.525	.05
III n=14 (Good)	19.5±0.824	19.40±1.36	+0.464	.05
IV n=13 (Excellent)	22.38±1.19	19.43±0.54	−0.788	.001

PFS=Physical fitness score

An attempt has been made to correlate physical fitness score obtained by a battery of tests applied and the body mass index. The observations indicated a positive correlation between Physical fitness score and BMI in the range of 18.04-24.29 kg/m2. The observation revealed a negative correlation between above parameters when BMI values were higher and lower than normal(15.69-28.55kg/m2).

DISCUSSION

The study was planned to assess the benefits of short term exercise in fifty eight untrained sedentary male medical students who were classified on the basis of BMI. The study was conducted considering that short duration physical activity has beneficial effect on physical fitness of the subjects. The study comprised of normal, overweight and obese young adults which as per the Health ministry of India has reduced the diagnostic cut-offs for body Mass index (BMI) to 23 kg/m2 as opposed to 25 kg/m2 globally to fight the battle against obesity.[6,] we have used the recent cut offs in this study. In this study we found that subjects with low calorie intake were under weight. Previous studies have shown that the level of physical activity is a permissive factor for obesity.[7,8] Epidemiological evidence suggests an inverse association between physical activity and body weight, with body fat being more favorably distributed in those who are physically active. On correlating BMI and calorie intake(table 4), a highly significant correlation was found between these parameters in study group with mean BMI 15.22(r 0.980) and 22.66±2.38(r 0.92).This suggests that heavy loads of calories coupled with sedentary habits result in obesity and poorphysical work performance because sedentary habits cannot burn surplus calories. This finding correlates well with the work of [9.] Based on Preexercise nutritional status assessment(table 5), 24% subjects were found to have poor Nutritional score (NSS < 64%, 16.14±1.34) and low BMI (16.34±1.36),15% overweight subjects (BMI 28.33 ± 0.71) had NSS (27.27±2.42). Subjects with (BMI 20.77 ±2.30) were33%,

classified as having desirable nutritional status NSS (75-84%, 25.78±6.30). A positive Correlation could be established between NSS and BMI(table 6).Similar result was observed among[10.] Assessment of Preexercise physical fitness of study population revealed that 20.68% subjects were classified as having poor physical fitness(score< 10) and 33% as fair physical fitness score (10-15) respectively. 24% had good fitness scores (15-20).On correlating BMI with physical fitness score, data revealed that increase or decrease in relative body weight above the desired for that age and sex are associated with poor physical fitness. The result of the study coincided With that of[(11).] Their study comprised of seventy students (age 12-16 years).They also reported negative correlation with BMI and Physical fitness scores. Poor physical fitness in these subjects may be due to poor body composition, inappropriate nutrition and physical inactivity. Undernutrition, Overnutrition and appropriate nutrition, are all major factors in the pathogenesis of and prevention of various diseases. Correlation of nutritional status score (table 8) with physical fitness score established a significant negative correlation in over nourished Group(r=-0.86:,r=-0.33).A positive correlation was found between these parameters in other Groups. The observed data suggest that, desired nutritional status is essential to have a desired Physical fitness and work performance. Obesity decrease physical fitness level.

REFERENCES

1. Nixon PA. Orien, Stein DM., Exercise testing in children Ped Pulmonol 1988 5: 107-122.
2. Calles –Escandon, J and E.S Horton.1992.The thermogenic role of exercise in the treatment of morbid obesity A critical evaluation. American journal of Clinical Nutrition 55:533S- 537S.
3. Poehlman, E.T. 1989.A review: Exercise and its influence on resting energy metabolism in Man. Medicine and Science in Sports and Exercise 21 :515-25.
4. Di Pietro L.1995. Physical activity, body weight and adiposity: An epidomological perspective. In Exercise and Sport Sciences Reviews, vol. 23, ed. J.O. Holloszy, 275-303.Baltimore: Williams and Wilkins.
5. Rising, R *et al*. 1994. Determinants of total energy expenditure: Variability in physical activity. American Journal of Clinical Nutrition 59: 800-804.
6. I government in.mht, India reworks obesity guidelines, BMI lowered, Published on 11/26/2008-12:40:52 PM, accessed at 9.00 p.m. on 17/11/2009.
7. Rimm, A. A, and P.L. White. 1979.Obesity: Its risks and hazards. In Obesity in America, U.S Department of Health, Education and Welfare. NIH Publication No 79-359.
8. Schulz,L,O, and D.A Schoeller.1994.A compilation of total daily energy expenditures and Body weights in healthy adults. American Journal of Clinical Nutrition 60: 676 -81.
9. Buskirk, E.R. *et al*. 1963.Energy balance of obese patients during weight reduction: Influence of diet restriction and exercise. Annals of New York academy of Science 110 (part II) : 918-40.
10. Houtkooper L.B, and S.B. Going 1994. Body composition: How should it be measured? Does It affect performance?.Sports Science Exchange vol.7, no 5.Barrington,IL: Gatorade Sports Science Institute.
11. Kusal. K. Das *et al* (2001).Physical fitness: A longitudinal study among Muslim children of Bijapur (Karnataka).Indian J Physiol Pharmacol 45(4): 457-462.

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