Research Paper

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Assessment of Relation Between Physical Stress and Physicalfitness Using Step Tool in Female Adults

Management

KEYWORDS : Physical Fitness, Haemoglobin (Hb), Blood Pressure (B.P.), Lean Body Mass (LBM), Basal Metabolic Rate (BMR), Body Mass Index (BMI), Total Energy Expenditure (TEE), Pulse Pressure

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ABSTRACT

Physical fitness is the potential capacity of an individual for making adequate functional adjustments to increase metabolic demands. One obvious approach to evaluate physical fitness is the physical work capacity of an individual. It can be influence by age, sex, body size etc. The study was carried out on 30 female college going postgraduate students. Physical work capacity measured basing on activity time by using step test. During Step test highly correlation and regression was observed in heart rates and systolic B.P. Great variations were observed in BMR and BMI. And highly significant correlation was observed between Hb level and activity time. From this study we conclude that poor performance by all the subjects may be due to poor food and nutrient intake.

INTRODUCTION

Physical fitness is a general state of health and well-being and, more specifically, the ability to perform aspects of sports or occupations. Physical fitness is generally achieved through correct nutrition, (Tremblay, 2010) moderate-vigorous physical activity, (De groot, 2010) exercise and rest, (Malina, 2010). It is a set of attributes or characteristics seen in people and which relate to the ability to perform a given set of physical activities.

Muscular fitness has been defined as "muscular strength and power and other properties of muscle that contribute to its mass and quality" (McCartney, et al., 2007). Now a day's most of the young adults are leading sedentary life and work styles. They spent their time in studying, social networking and fast food indulging is more compared to their attention to sports, games etc among college going youth to build up and maintain their muscle strength.

Physical stress and physical fitness has been called a global epidemic by the World Health Organization (world health organization, 2000). The prevalence of physical stress and physical fitness is especially dramatic in economically developed and developing countries (Wang and Lobstein, 2006) and not only in adults but also in children and adolescents.

For covering a large population in a field condition, the step test occupies the first place of preference. There are many variants of step tests. The famous ones are Harvard step and parizkova's modification. The ability to carry on stepping with out faltering and speedy recovery are the two criteria usually used. It has a limited application as it is poorly standardized and does not permit easy calibration of the amount of work performed. The time taken to run a specific distance is used routinely to evaluate aerobic capacity based on reasonable notion that the distance one is able to run is determined by the ability to maintain a high steady rate of O2 consumption which in turn is based on one's maximum capacity to generate energy aerobically.

The heritability of predisposition for a high body mass index (BMI) or body fat content is between 25 and 40% (Bouchard et al., 1997), which suggests that other factors such as environmental factors may also play a critical role. According to Bouchard et al.,(1997) both the family environment and genetic predisposition influence the development of body fat content and distribution. Other important factors include lifestyle factors such as physical activity (PA), nonsmoking, high-quality diet, sedentary activities and normal weight (Pronk etal, 2004) Lifestyle factors are also important in the description of the obesogenic environment that is based on the four pillars family, sport and leisure time, eating behavior and social education (wabitsch, 2004).

REVIEW OF LITERATURE

Knight et al., (2014) conducted a study to test the validity of the prediction equation for VO_2max from the STEP tool for use with adults older than 65 years. Forty participants completed both the predictive self-paced VO_2max stepping protocol from the STEP tool, and a maximal graded exercise treadmill test with breath-by-breath analysis of expired gases. Tests were completed in random order, and participants rested between tests until blood pressure returned to baseline.The average age of the sample was 43±14 years. There was a strong relationship between predicted VO_2max from STEP and direct measures of VO_2max from the maximal treadmill test in the present study ($r=.78$, $p<0.001$). Bland-Altman analysis demonstrated statistical agreement between tests, although there was systematic overestimation of 6.4 mL/kg/min. It was concluded that STEP is an evidence-based cardiorespiratory fitness assessment and exercise prescription tool appropriate for use by various health professionals in clinical practice. The prediction equation for VO_2max from the STEP tool is valid for use with adults 18 to 85 years of age. However, more research is warranted to explore age corrections to the prediction algorithm among younger adults.

Carlos et al., (2012) conducted a study to use of step tests for the assessment of exercise capacity in healthy subjects and in patients with chronic lung diseases. The results revealed shorter protocols with a high stepping rate would sem to be more appropriate for assessing exercise related oxygen desaturation in chronic lung diseases. Symptom limited testing would be more appropriate for evaluating exercise tolerance.

Basing on literatue, the purpose of this study was to evaluate the relationship between physical stress and physical fitness in relation to different parameters by using step tool test in female adults.

MATERIAL AND METHODS:

In the present study 30 female post graduate and PhD students were selected from Acharya N.G.Ranga Agricultural University. And all the subjects were in the age group of 20 to 30 years. The

data collected on Socio Economic status of selected subjects was assessed through a structured schedule developed by Thimmayamma et al (1987). Body composition such as total body fat (BF), lean body mass (LBM) and total body water (BW). BMI and Basal metabolic rate (BMR) were measured using body composition measuring equipment "Bioelectrical Impedance" named as "Body stat. The heart rates were monitored on a online polar heart monitor throughout the exercise period and recovery time. And the physical fitness was tested in lab conditions with the help of step test to identify maximal performance of an individual . The parameters studied are Heart Rate, B.P., Pulse, Energy Expenditure and Body composition such as total body fat (BF), lean body mass (LBM) and total body water (BW) BodyMassIndex and BasalMetabolicRate based on activity time. All the data was expressed through mean and standard deviation. Significance changes in each parameter during step test was assessed through F-test, multiple correlations and multiple regressions.

RESULTS AND DISCUSSION:

4.1 Family particulars of subjects:

Information pertaining to family background of selected subjects was analyzed and presented. All the subjects were from nuclear family (100 per cent) and majority had four (33 per cent) or five (30 per cent) members in family with maximum two male (40 per cent) and two female (37 per cent) members. Most of the subjects were unmarried (87 per cent) and doing post graduation (87 per cent). Family income of subjects ranged mostly (30 per cent) between one and half to two lakhs. This was followed by one to one and half lakh (20 per cent).

4.2 Grouping of subjects as per activity time in step test

The subjects were grouped as per activity time of step test.

Table1: Grouping of subjects as per Activity time in Step test

Time ranges (mt)	*Subjects*		
Step test :	*No*	*Per cent*	*Mean ± SD*
1 – 2	17	57	1.52 ± 0.27
>2 – 3	6	20	2.45 ± 0.25
>3 – 4	5	17	3.83 ± 0.23
>4 -5	2	6	5.00 ± 0.00

The AT during step test for majority of subjects (57 per cent) was between 1 to 2 mt followed by> 2 to 3 mt (20 per cent), > 3 to 4 mt (17 per cent) and > 4 to 5 mt (7 per cent). The details are listed in Table 2

4.3 Changes in parameters during step test basing on activity time

Changes observed in parameters such as AT, TEE, recovery time, B.P, pulse rate, BMR, Hb level, body composition

Table 2:Change in parameters of subjects during Step test, basing on activity time

Parameters	**Activity Time Ranges(mt)**				**Correlation**	**Regression**
	1.0 – 2.0 (17)	**> 2 – 3 (6)**	**>3 – 4 (3)**	**>4 - 5 (4)**		
Heart rates during test period (bpm) :						
Rest	83 ± 6.77	83 ± 6.99	83 ± 1.55	79 ± 3.94	-0.189	-0.659
1	153 ± 12.3	155 ± 13.4	150 ± 4.42	169 ± 10.8	0.358	0.827
2	169 ± 17.7	168 ± 8.77	168 ± 2.13	176 ± 6.04	0.6033**	2.405*
3	-	192 ± 0.00	180 ± 6.48	186 ± 4.37	0.8850**	-0.517
4	-	-	188 ± 5.65	192 ± 2.58	0.9169**	3.067**
5	-	-	188	194 ± 3.56	0.8135**	1.4
AT	1.5 ± 0.27	2.5 ± 0.25	3.8 ± 0.23	5	-	
Heart rates (bpm) during Recovery (mt) :						
1	129 ± 15.27	132 ± 21.27	123 ± 7.54	143 ± 8.09	0.2606	-0.139
2	118 ± 11.36	120 ±17.82	117 ± 6.36	131 ± 7.52	0.2877	0.116
3	109 ± 11.09	110 ± 13.97	112 ± 7.77	123 ± 5.90	0.3485	0.248
B.P Systolic (mm Hg) :						
Before	107 ± 7.39	101 ± 3.38	113 ± 1.88	112 ± 2.87	0.2731	-0.795
After	128 ± 7.77	119 ± 6.65	134 ± 2.82	137 ± 4.60	0.3946*	0.545
B.P Diastolic (mm Hg) :						
Before	65 ± 7.96	70 ± 2.21	69 ± 0.22	74 ± 5.29	0.243	0.652
After	80 ± 10.9	72 ± 4.16	73 ± 0.94	78 ± 6.57	-0.1575	-1.634
Pulse rate (bpm) :						
Before	84 ± 11.9	86 ± 12.26	59 ± 6.36	97 ± 16.34	0.0395	0.657
After	133 ±17.57	118 ± 4.48	125 ± 2.35	144 ± 5.25	0.1242	-1.592
BMR (K.cal / 24Hr)	1321 ± 70.3	1205 ± 125.3	1412 ± 122.6	1329 ± 129	0.1258	-
BMI	22.8 ± 3.4	21 ± 3.09	22 ± 1.83	20 ± 2.12	-0.729	-
Body composition (Per cent) :						
LBM	71 ± 12.1	69 ± 4.5	74 ± 1.7	75 ± 3.25	-0.317	-
Fat	29 ± 4.9	31± 4.4	26 ± 1.7	25 ± 3.32	0.2993	-
Body water	51 ± 4	53 ± 4.8	54 ± 1.5	55 ± 1.2	0.3248	-
Hb (g/dl)	11 ± 1.3	10 ± 2.3	14 ± 0.46	13 ± 1.25	0.5195**	-
PFI	Poor	Poor	Poor	Poor	-	
F = 21.01939**		* Significance at 5%,		** Significance at 1%		
AT : Activity time (mt)		- Negative correlation & regression				

Data pertaining to changes observed in step test for different time periods is tabulated in table 2. AT ranged between 1.5 (1 - 2, >2-3 and >3-4) to 5(> 4 -5) mt among various subjects the PFI was poor among all the subjects.

Initially the heart rate of subjects was similar during rest period in all subjects of 1 mt to 5 mt AT. While lower (79 bpm) heart rate was observed in subjects who exercised for more than 4 mt. Increase in trend was similar in >3-4 and >4-5 AT group. Highest heart rate (194 bpm) was noticed in subjects who performed activity for more than 4 mt. When AT was less, the withdrawal from step test was early. Highest significant (1 per cent) correlation was observed with respect to heart rate from second minute of step test. The regression was also significant (5 per cent) on second minute step test and high significance (1 per cent) in regression was noticed on 4 mt of step test

Initially, heart rate during recovery was dissimilar (ranged between 129 and 143 bpm) but after rest except in subjects who performed more than 4 mt (123 bpm) AT had a similar trend (109 – 112 bpm).

The systolic B.P ranged between 101 mm Hg (>2 -3 mt AT) and 113 mm Hg (>3-4 mt AT). Following step test increase (18 to 21) was observed in subjects who performed activity for less than 4 mt. While higher systolic B.P was noticed (137 mm Hg) in subjects who performed the activity for more than 4 mt. Similar difference was noticed with respect to initial diastolic B.P, following exercise. Lowest diastolic (65 mm Hg) B.P. was observed in 1 to 2 mt AT group and highest (74 mm Hg) was observed in subjects with AT more than 4 mt. After step test, a greater increase in heart rate was observed in lower AT (1-2 mt) group. In the rest of the group, diastolic B.P increased 2 to 4 mm Hg.

Initially lowest (59 bpm) pulse rate was observed in subjects who performed activity for 2 to 4 mt. While highest (97 bpm) was observed in group who performed activity for >4 mt. After exercise lowest pulse rate (118 bpm) was observed in 2 to 3 mt AT group highest (144 bpm) was observed in subjects who performed activity for more than 4 mt.

A high fluctuation in BMR was observed among subjects performing activity for various periods. The BMR ranged between 1205 K.Cal / 24 hr (>2 to 3 mt) and 1412 K.Cal / 24 hr (> 3 to 4 mt).

The BMI of subjects was close among various groups and ranged between 20 (>4 to 5 mt) and 22 (1 to 2 mt and > 3 to 4 mt).

The LBM was proportionate to AT and ranged between 68 (1 to 2 mt) and 75 (> 4 to 5) per cent. A fluctuation in fat per cent was observed with increase in AT. The fat per cent ranged between 9 (1 to 2 mt) and 31 (>2 to 3 mt) per cent The per cent body water increased with increase in AT. Initially, the per cent body water was 51(<2mt AT) and increased to 55 percent (>4mt AT).

The Hb level ranged between 10 g / dl (> 2 to 3 mt) to 14 g / dl (>3 – 4 mt) and highly significant (1 per cent) correlation was observed between Hb level and AT.

CONCLUSION

The physical performance was analyzed through Step test and results of step test indicated that the performance during the step test was altered by various parameters such as BMI, BMR, systolic, diastolic B.P and pulse rate before and after exercise, Hb level, heart rates during test period and body composition by all the subjects. PFI analysis revealed poor performance by all the subjects; this may be due to poor food and nutrient intake.

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