ORIGINAL ARTICLE

Compared cardiorespiratory endurance and musculoskeletal legs explosive power in students of Tsinghua University Beijing China and University of Sindh Pakistan

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Abstract

Objective: To assess the health-related physical fitness status of students and the attributes of performance in terms of endurance and power.

Method: The cross-sectional study was conducted at University of Sindh, Jamshoro, Pakistan, and Tsinghua University, Beijing, China, during academic session of January 2012 to December 2013, and comprised an equal number of male and female students aged 18-23 years. Prior to the assessment, physical activity readiness questionnaire was filled by all the subjects, while standardised health-related physical fitness criterion was used to make comparisons in terms of oxygen consumption. .

Result: There were 600 subjects in all; 300(50%) at each of the two centres, and at both centres, there were 150(25%) boys and 150(25%) girls. Both for power and endurance, mean values of Chinese students were significantly better than their Pakistani counterparts ($p<0.05$).

Conclusion: Chinese students had better health-related physical fitness levels than Pakistani students of either gender.

Keywords: Endurance, Power, Health, Fitness, Physical, Physiological. (JPMA 68: 852; 2018)

Introduction

Cardiorespiratory fitness is probably the most important aspect of physical fitness because of its importance to good health and optimal physical performance. Those who possess reasonable amounts of fitness have a decreased risk for heart disease, reduced risk of premature death and improved quality of life. Regular cardiovascular exercises promotes fitness and provides additional health and wellness benefits that extend well beyond reducing risks for diseases.[1] Wellness and healthy lifestyle behaviours are vital for individuals of all ages. Presently, regular involvement in moderate and vigorous levels of exercise is essential for adolescents in order to have improved physical fitness and to enjoy exercise benefits.[2] Musculoskeletal symptoms are a major cause of acute, chronic and recurrent pain in children and adolescents, significantly affecting the psychosocial status and considered a public health problem.[3] Musculoskeletal discomfort (MSDs), such as low back pain, osteoarthritis and widespread pain, are highly prevalent in the adult population.[4] MSDs also contribute to a substantial burden of disease at middle and older ages.[5] The World Health Organisation (WHO) specified that cardiovascular disease (CVD) is the leading cause of death worldwide, accounting for 17.3 million deaths in 2008 and that indicated 30% of all deaths worldwide.[6] Noticeably increasing prevalence of CVDs and MSDs were reported as a risk factor in many countries with emerging economies. Due to rapid economic growth and socio-demographic changes in aging population, China and Pakistan are also experiencing those infectious and chronic diseases, including CVDs and musculoskeletal pain.[7] It also greatly results in disability and adjusted life year loss and prevalence of CVD has become an excessive burden for China.[8] In Pakistan, Framingham Heart Study indicated that the CVD results were more than 100,000 deaths per year, i.e. 12% of all-cause mortality.[9] There is significantly higher prevalence of cardiorespiratory diseases risk factors in Pakistani adults, where 29% of men are smokers, 18% suffer from hypertension and 13% have elevated cholesterol levels.[10] Although ageing of the population is an important contributing factor, such health consequences are also probably large as a result of the drastic changes in lifestyle caused by Pakistan's and China's economic boom over the past two decades that have resulted in increased obesity and physical inactivity among the younger segments.[11] Health

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related physical fitness (HRPF), determined by constitutional factors, suggests that up to 50% disparity of fitness might be attributable to inherited aspects.[12] HRPF consists of endurance strength/power, flexibility and body composition. Generally, adolescents have low physical fitness (mainly low cardiorespiratory endurance fitness and low muscular power or strength) which is recognised as a sturdy predictor of both cardiorespiratory and musculoskeletal causes of mortality and any other well-established risk factor.[13] It has been specified that the developing countries faced double the burden of infectious diseases, infant mortality, malnourishment and emerging epidemic of CVDs.[13] A study reported that clustering of unhealthy lifestyle practices has very important implications for both public health practitioners as well as for clinicians. It is well known that the risk of developing CVD multiplies manifold when related lifestyle risk factors coexist compared to their individual risks.[14] Musculoskeletal conditions are prevalent and their impact is pervasive. They are the most common cause of severe long-term pain and physical disability, and they affect hundreds of millions of people around the world. They significantly affect the psychosocial status of affected people as well as their families and careers.[15] China and Pakistan both nations are facing complications of hypertension, overweight, obesity, heart diseases, low back pain, body weakness, emotional stress, depression, loss of self-esteem, insomnia and increased risks of CVDs and musculoskeletal fragility as a result of physical inactivity among the young members of population. The current study was planned to HRPF status of Chinese and Pakistani students related to endurance and power.

Method and Material

The cross-sectional study was conducted at University of Sindh, Jamshoro, Pakistan (USOP), and Tsinghua University, Beijing, China (TUBC), during the academic session of January 2012 to December 2013, and comprised an equal number of male and female students aged 18-23 years. Approval was obtained from the institutional ethics committees of the two universities which additionally recommended self-rated comparable criteria to determine the differences in the performance of the two sets of university students who volunteered to participate in the study. Prior to the assessment, physical activity readiness questionnaire (PAR-Q) was filled by every participant. Observation sample technique was used in line with literature.[16]

The oxygen consumption level (VO_{2max}) using step test (ST) was measured through 3-minute aerobic cardiorespiratory fitness to assess on how quickly the heart rate returned to normal after exercise. ST was conducted on 12-inch-high stepper box and stepping (up-up and down-down) alternatively maintained a steadiness of 24 steps for males and 22 for females pacing per minute on the box. Conversion was done of recovery heart rate to beat per minute (bpm) maximal oxygen uptake VO_{2max} in ml/kg/min was estimated by McArdle process.[17] Normative percentile of VO_{2max} were measured in line with an earlier study.[18] Low levels of cardiorespiratory and muscular fitness are recognised as important markers of fitness status and predictors of cardiorespiratory disease and muscular complications.[19] The musculoskeletal legs' explosive power was assessed by standing long jump (SLJ) to analyse the lower-limb power efficiency. SLJ, also called the standing broad jump (SBJ). The participants were asked to stand behind the starting line, with feet together, and to push off vigorously and to jump forward as far as possible. The distance was measured from the take-off line to the point where the back of the heel nearest to the take-off line landed on the mat or non-slippery floor. The test was repeated twice, and the best score was retained (in cm).[20] The tests were analysed by HRPF criterion reference protocols. Criterion-referenced protocols or assessments are designed to measure student performance against a fixed set of predetermined criteria. The HRPF criterion reference evaluate and compare the performance of the test - takers with absolute criterion scales of selected variable (step test and standing long jump). HRPF protocols determine the cardiorespiratory fitness or aerobic capacity, body composition, and muscular fitness (i.e., muscular strength/ power, endurance, and flexibility. Select a criterion measure, as well as field tests, of the fitness component (e.g., VO_{2max} as the criterion measure step test, 1-mile run/walk and Progressive Aerobic Cardiovascular Endurance Run [PACER] as the field tests for cardiorespiratory fitness. Set the standards or cut-off or self-rated criterion scores according to the relationship determined (i.e., determine the point or level on which a fitness parameter is associated with an increased risk of a disease outcome or risk factors of the disease and validate or cross-validate using additional measures of selected samples.[21]

Characteristics of the study sample by age and gender were presented as means and standard deviation. Gender comparisons were performed by independent

sample t-test and a bivariate correlation analysis. Multiple regressions were performed to examine the association between the cardiorespiratory and legs' explosive power tests. All statistical analyses were performed using SPSS 20, and the level of significance was set at <0.05. The comparison of gender clusters was interpreted individually (male versus male and female versus female). The comparable criteria consisted (not accepted level=very poor, poor, below average - 30%; and accepted level = average, above average, good, excellent - 70%).

Result

There were 600 subjects in all; 300(50%) at each of the two centres, and at both centres, there were 150(25%) boys and 150(25%) girls. Both for power and endurance, mean values of Chinese students of either gender were significantly better than their Pakistani counterparts (p<0.05) (Tables 1-2).

Table-1: Comparison of Step test and standing long Jump of students of TUBC and UOSP of both genders.

			TUBC		UOSP				
Variable	**Gender**	**N**	**Mean**	**SD**	**Mean**	**SD**	**t-value**	**95% CI**	**P Value**
StepTest (ml/kg/min)	Male	150	51.65	6.76	49.63	9.77	2.01	0.11-3.93	0.03*
	Female	150	52.14	6.81	47.48	8.41	5.27	2.92-6.40	0.00**
Standing long Jump (M)	Male	150	2.21	0.19	1.92	0.31	9.45	0.22-0.34	0.00**
	Female	150	1,66	0.18	1.56	0.23	3.87	0.04-0.13	0.00**

Correlation is significant at < 0.001** (2 - tail) level.
TUBC: Tsinghua University, Beijing, China.
UOSP: University of Sindh, Pakistan.

Table-2: Comparison of self- rated comparable criterion reference percentile of Endurance and Power of students of TUBC and UOSP of both genders.

Assessment	**VO2max. Cardiorespiratory Endurance**				**Musculoskeletal Explosive legs Power**			
	TUBC	**UOSP**	**TUBC**	**UOSP**	**TUBC**	**UOSP**	**TUBC**	**UOSP**
Rating	**Male v/s Male**		**Female v/s Female**		**Male v/s Male**		**Female v/s Female**	
Excellent	10.70%	16.70%	32.70%	14.70%	8.30%	2.70%	11.30%	16.70%
Good	30%	29.3	54%	41.3	14%	5.30%	9.30%	8%
Above Average	35.30%	14%	12%	21.30%	13.30%	6%	19.30%	8%
Average	19.30%	34.70%	1.30%	18%	11.30%	6.70%	18.70%	12.70%
Accepted level	95%	95%	100%	95%	48%	21%	59%	45%
Below Average	4.70%	0%	0%	0%	14%	6.60%	20.70%	18%
Poor	0%	4.70%	0%	0.70%	12%	10%	16%	29.30%
Very Poor	0%	0.70%	0%	4%	26%	62.70%	4.70%	7.30%
Not Accepted level	5%	5%	0%	5%	52%	79%	41%	55%

TUBC: Tsinghua University, Beijing, China.
UOSP: University of Sindh, Pakistan.

Discussion

VO_{2max}, an internationally accepted parameter to evaluate cardiorespiratory fitness, reflects the amount of oxygen utilised by working muscles during maximal exercise. It is the best index of aerobic capacity and gold standard for cardiorespiratory fitness. Thus measure of maximum oxygen consumption offer insight into ability of cardiovascular, respiratory and muscular systems to deliver and utilise oxygen. During exercise, up to a point the increase in oxygen consumption is proportionate to energy expended and all the energy needs are met by aerobic process. So, in a person, the more is the maximum oxygen consumption capacity, the more will be his/her aerobic capacity. VO_{2max} is the measure of the functional limit of the cardiorespiratory system and the single most valid index of maximal exercise capacity.[22] The evaluation of endurance and power of adolescent's fitness is probably the most important aspect of physical fitness because of its vitality to good health and optimal physical performance. This study revealed that the endurance levels of Chinese students of either gender were statistically significant than

Pakistani students. A study examined women's level of cardiovascular fitness and found that the faster the walk, the greater was the improvement in cardiovascular fitness.[23] The power subsidised to ease and reduced muscular exertion promotes successful performance, and lowers susceptibility to some sorts of injuries, musculoskeletal hitches, pains and disorders. SLJ performed with strength and control has been shown to be strongly correlated with mean hip and lumbar bone mass accretion.[24] A study revealed a negative association between SLJ and total cholesterol in overweight/obese male adolescents.[25] Some studies have suggested that achieving 60 min or more of moderate-vigorous physical activity daily is associated with a healthier cardiorespiratory fitness level in adolescents, independently of their adiposity status.[26] The numerical facts portrayed that the females performances were better than males of the two campuses. The outcomes identified that male's lower limb power tendencies were complex than females. Chinese females were more conscious about their physical health than males.

Conclusion

Both for power and endurance, Chinese students of either gender were significantly better than their Pakistani counterparts.

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