INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN PROGRESSIVE EDUCATION & DEVELOPMENT

OPEN ACCESS JOURNAL

Vol 13, Issue 2, (2024) E-ISSN: 2226-6348

Evaluating the Performance Levels of Fitness Components among Sports Science Pre-University Students using Estimated VO2max Derived

Siti Zurina Maaruf[1], Siti Zuraida Maaruf[2] & Nur Shakila Izzati Rusli[3]

[1]Kolej Tingkatan Enam, No. 26, Jalan Timun 24/1, Seksyen 24, 40300 Shah Alam, Selangor Darul Ehsan, Malaysia, [2]Department of Art Education, Faculty of Education, Universiti Teknologi MARA, Puncak Alam, Selangor Darul Ehsan, Malaysia, [3]Department of TESL, Faculty of Education, Universiti Teknologi MARA, Puncak Alam, Selangor Darul Ehsan, Malaysia

Emial: g-08367406@moe-dl.edu.my, sitiz610@uitm.edu.my, nshakilaizzati@uitm.edu.my

To Link this Article: http://dx.doi.org/10.6007/IJARPED/v13-i2/21334 DOI:10.6007/IJARPED/v13-i2/21334

Published Online: 23 April 2024

Abstract

This study was conducted to determine the level of cardiovascular endurance fitness among Sports Science pre-university students. The study involved 40 male Sports Science students (N=40) aged between 18 to 20 years old. The assessment tool employed was the PACER 20-meter Multistage Shuttle Run Test. Assessment of cardiovascular endurance fitness level can be conducted by measuring VO2max (ml·kg-1·min-1) as the most accurate score obtained to measure an individual's level of cardiovascular endurance fitness. Therefore, the minimum VO2max (ml·kg-1·min-1) obtained from the PACER 20-meter Multistage Shuttle Run Test conducted indicates that the VO2max (ml·kg-1·min-1) level possessed by the study sample is good and falls within the high-performance range.

Keywords: PACER 20-meter Multistage Shuttle Run Test, VO2max, and Cardiovascular Endurance.

Introduction

The Sports Science curriculum was developed to replace the existing curriculum that has been in use since the STPM examination in 2006. This new curriculum was first implemented in 2012 and it incorporated the revisions proposed by the Malaysian Examination Syndicate (MES) for the existing Malaysian Higher School Certificate Examination. The revision of the Sports Science curriculum involved updating the topics, content, and skills to align with the true concept of Sports Science studies. Sports Science is an interdisciplinary field that combines pure science disciplines, applied science, and social science in physical activities. The main objective of this subject is to understand the concepts of Sports Science and apply them in sports training and healthy lifestyles in line with the

National Sports Policy. The STPM Sports Science discipline covers three parts. The first part consists of sports sociology, sports management, leisure and recreation, and sports nutrition. The second part includes anatomy and physiology, physical fitness, and wellness. Meanwhile, the third part comprises sports psychology, sports coaching, motor behavior, and sports injuries. This subject integrates theory and practical exercises to strengthen candidates' knowledge and understanding. Additionally, the Soft Skills component is also incorporated into the teaching and learning of Sports Science to develop well-rounded individuals in line with the National Education Philosophy and enable candidates to compete globally.

The Concept of Fitness

Physiology experts state that fitness is a condition in which an individual can perform their daily tasks without fatigue, use minimal energy, and have surplus energy that can be utilized during leisure time and in emergencies. Fitness can be defined as the ability to cope with life in a balanced and complete manner. This generally involves social fitness, psychological fitness, and physiological fitness. All of these are determined by one's environment, genetics, and lifestyle.

Overall fitness is the integration of physical, mental, social, spiritual, and emotional components. This fitness can make a meaningful contribution to society. It can also reflect an individual's feelings about life and their ability to function more efficiently. The most popular definition of fitness is as suggested by the American Physical Education Academy (Clarke, 1979). "Fitness is the ability to perform daily tasks efficiently and effectively without excessive fatigue and having enough energy to engage in recreational activities. Furthermore, a physically fit individual should be able to face the challenges of potential emergency situations."

Physical Fitness Based on Health

The components of Physical Fitness Based on Health consist of aerobic capacity, flexibility, muscle endurance, muscle strength, and body composition. The content in this field exposes students to exercises and physical training to improve fitness levels. Through this field, students understand the physiological functions of the body and the effects of exercise on personal performance and health. This field also provides guidance to students on systematically and consistently engaging in fitness activities to enhance fitness and overall well-being.

Cardiovascular Endurance

The most important component for an individual is the level of cardiovascular endurance and fitness. Physiologically, cardiovascular endurance is the ability, resilience, and efficiency of the heart muscles to work. Cardiovascular endurance is aerobic fitness, aerobic power, or aerobic endurance because this component of physical fitness involves the aerobic energy system. To determine an individual's aerobic fitness level, one can take a resting heart rate (RHR) reading. A low resting heart rate (RHR) indicates good heart fitness (Baumgartner et.al., 2003). Johnson and Nelson (1986) define cardiovascular endurance as endurance involving the heart muscles, blood vessels, and lungs. In other words, it is the ability of the respiratory system and the circulatory system to supply the body's cells and organs with the required oxygen for long-term work. According to Safrit (1995), maximum endurance and capacity of the heart muscles are indicators and measurements of cardiovascular function. Cardiovascular endurance is the most important component in human physiological profiles

because it involves aerobic and anaerobic endurance. Cardiovascular fitness depends on the efficient combination of blood vessels, heart, and lungs.

Strenuous activities require efficient heart and lung capacity because such situations require a lot of energy and only oxygen-rich blood flow enables the muscles to perform these activities (Hashim & Salamuddin, 2013; Gunathevan, 2012; Johnson & Nelson, 1986). Cardiovascular endurance (aerobic fitness) is the ability of the heart, lungs, and blood to supply oxygen to muscle groups and the ability of muscle groups to use oxygen to produce energy to continue working. Aerobic exercise tests are often used to objectively assess aerobic capacity. That is the amount of oxygen consumption during physical activity and is also known as V02max. To classify an individual's level of cardiovascular endurance fitness, V02max (ml·kg-1 · min-1) obtained from maximum and submaximum exercise tests is used. Maximum oxygen intake is usually considered the best indicator for an individual's cardiovascular endurance and fitness. In the context of this study, researchers define cardiovascular endurance as the ability of the heart to supply oxygenated blood to body cells and organs optimally and efficiently to enable work to be performed over a long period. The test used to assess the cardiovascular endurance component is the PACER 20-meter Multistage Shuttle Run with a reliability value of 0.93 (Baumgartner et.al., 2003; Johnson & Nelson, 1986).

Age Differences in Physical Activities and Cardio-respiratory Fitness

It was discovered that there is a substantial decline of physical fitness among adolescent in a Canadian setting since 1981 to 2022 (Brunet et.al., 2022). Research performed on young adolescent revealed that males have twenty to twenty five percent greater cardio-respiratory fitness (Rowland, 2023). The primary cause of this scenario is the increase of lean body mass and other gender related factors. This is supported by preceding research which identified that in the growing up process, absolute VO2 max in young adolescent increases within the same rate until they are twenty years old.

Research Background

The research aims to assess the level of cardiovascular endurance fitness among selected Sports Science students at a Form 6 College in Shah Alam, Selangor. Despite concerted efforts from the students, some of them still do not achieve the desired level of fitness. Therefore, this study seeks to identify and evaluate the cardiovascular endurance performance of each student after the physical fitness teaching and learning sessions and practical sessions. The findings of this study are expected to serve as a guide for all students, teachers, and lecturers to assess cardiovascular endurance performance. It can also help improve training methods by applying principles that emphasize the frequency of training, intensity, duration, and variety of exercises.

Significance of the Study

This study holds its own significance in assisting various parties in improving the performance of Form 6 Sports Science students in terms of cardiovascular endurance and fitness. Among its contributions are:

i. Assisting pre-university Sports Science students in understanding their actual cardiovascular endurance performance.

ii. Establishing performance norms for cardiovascular endurance fitness for Sports Science students in Malaysia based on the PACER 20-meter Multistage Shuttle Run test.

iii. Providing exposure to students by engaging in activities to enhance aerobic capacity within the range of 65-85% of Maximum Heart Rate (MHR).
iv. Providing exposure to students by engaging in activities to enhance aerobic capacity designed based on the FITT principle (Frequency, Intensity, Time, Type) and within the range of 65-85% of Maximum Heart Rate (MHR).
v. Assisting pre-university Sports Science lecturers, IPGM lecturers, and coaches in Malaysia in assessing cardiovascular endurance fitness performance based on established norms.
vi. Serving as a reference for future researchers interested in studies related to the cardiovascular endurance performance of players in other sports.

Research Objectives

The study on the level of cardiovascular endurance fitness among Sports Science pre-university students is conducted based on the PACER 20-meter Multistage Shuttle Run test Baumgartner& Jackson (1999) aiming to achieve the following objectives:
i. Determine the PACER 20-meter Multistage Shuttle Run test scores of Sports Science pre-university students based on age groups.
ii. Determine the PACER 20-meter Multistage Shuttle Run test scores of Sports Science pre-university students based on gender (male).
iii. Serve as a reference for future researchers interested in studies related to the cardiovascular endurance performance of students in the Prudential FITNESSGRAM® test battery issued by the Cooper Institute for Aerobics Research (1992), including push-ups, curl-ups, trunk lift, and other body mass index (BMI) tests.

Methodology

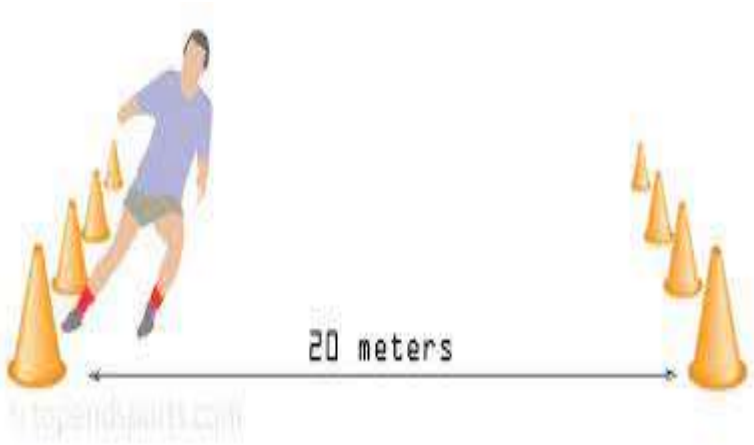
The study adopted the "ex-post facto" experimental design, which is concise yet with high internal validity (Chua, 2006). This design is also a cross-sectional study, where the researcher only needs to conduct the test once through a post-test, simplifying the data collection process from a large and diverse sample (Cicciarella, 1997; Golding et.al., 1989).

Sample

The study sample consisted of 40 Sports Science pre-university students enrolled in the STPM Sports Science subject. The sample includes students aged between 18 and 20 years old.

Research Instrument

The level of physical fitness is measured based on the physical fitness test introduced by Prudential FITNESSGRAM® (Cooper Institute for Aerobics Research, 1992) and the measurement procedure updated by (Baumgartner & Jackson, 1999). The researcher selected only one type of test with high reliability (r):
i. PACER - 20-meter Multistage Shuttle Run Test (r = 0.93)



Data Analysis, Results and Discussion

Table 1

Distribution of Sports Science pre-university students by Age Group

Age group	**Numbers**	**Percentage**
18	12	30
19	18	45
20	10	25
Total	**40**	**100**

Table 2

Descriptive Statistical Analysis of Minimum Score and Standard Deviation of the Study for 18-Year-Old Sports Science Students at Form 6 College in Shah Alam, Selangor

Age of 18-Year-Old			
Fitness Testing	N	Min	Standard Deviation
PACER	12	27.47	3.15

Table 3

Descriptive Statistical Analysis of Minimum Score and Standard Deviation of the Study for 19-Year-Old Sports Science pre-university students.

Age of 19-Year-Old			
Fitness Testing	N	Min	Standard Deviation
PACER	18	26.41	2.99

Table 4

Descriptive Statistical Analysis of Minimum Score and Standard Deviation of the Study for 20-Year-Old Sports Science pre-university students.

Age of 20-Year-Old			
Fitness Testing	N	Min	Standard Deviation
PACER	10	23.98	3.38

Table 5
Norms of Raw Scores for PACER Test among Sports Science pre-university students

Achievement Level	**Age group**		
	18	19	20
Excellent	4(33.33)	3 (16.66)	3 (30)
Very Good	2 (16.66)	4 (22.22)	4 (40)
Good	3 (25)	2 (11.11)	1(10)
Moderate	2 (16.66)	4 (22.22)	1(10)
Poor	1 (8.33)	5 (27.77)	1(10)
Total	**12**	**18**	**10**

Discussion and Conclusion

The study on the level of cardiovascular endurance fitness among Sports Science pre-university students, was analyzed descriptively based on minimum scores and standard deviations to address each research question formulated by the researcher. The norms established were based on raw scores obtained from 40 Sports Science students at pre-university level. The research findings indicate that the PACER - 20-meter Multistage Shuttle Run test is suitable for assessing the level of cardiovascular endurance fitness among Sports Science pre-university students, as it has high validity and reliability. Overall, the research findings show differences in the performance of cardiovascular endurance fitness based on the age of Sports Science pre-university students. The research findings successfully address each research question posed.

Cardiovascular Endurance Component

Establishing norms for tests based on the cardiovascular endurance component using the PACER - 20-meter Multistage Shuttle Run test for Form 6 Sports Science students in Shah Alam, Selangor, recorded an improvement in achievement scores at the excellent level for the age groups of 18, 19, and 20 compared to other age groups. It can be said that age is one of the primary factors that influences the cardiovascular endurance of each student. These findings are consistent with studies by (Hashim, 2016). He also suggesting that age affects one's physical fitness performance. Following the research findings, it is suggested that the cardiovascular endurance fitness level test and these reference norms should be used as a guide for coaches, teachers, and lecturers as one of the methods to assess the cardiovascular endurance fitness level of Form 6 Sports Science students in Shah Alam, Selangor. It can also be used to measure their cardiovascular endurance fitness in other sports at various levels. A solid assessment tool can produce Form 6 Sports Science students in Shah Alam, Selangor, who are fit, healthy, and capable of making quality contributions to the team and, ultimately, capable of facing the challenges of the country at a higher level.

In conclusion, the researcher has successfully developed a more standardized, robust, suitable, and accurate reference norm in terms of testing procedures, measurements, and assessments based on appropriate tests to assess the level of cardiovascular endurance fitness for Form 6 Sports Science students in Shah Alam, Selangor. The findings of this study are supported by Baumgartner and Jackson (1999), stating that the assessment process will be more meaningful and effective if the assessment procedures provided are reliable and valid for the sample. This statement was later reinforced by Hashim (2004; 2015) that the instruments used must measure what is intended to be measured as it will produce reliable and standardized data that are not questionable.

Acknowledgement
This paper is part of Geran Penyelidikan Fakulti, UiTM Cawangan Selangor (DUCS Fakulti) (Project Code 600 -UiTMSEL (PI. 5/4) (119/2022). We thank authors who provided insight and expertise that greatly assisted the research.

Corresponding Author
Siti Zuraida Maaruf
Department of Art and Design Education, Faculty of Education, Universiti Teknologi MARA, Puncak Alam, Selangor Darul Ehsan, Malaysia
Email: sitiz610@uitm.edu.my

References

AAHPERD. (1985). *Health Related Physical Fitness Test Manual*. Reston:Virginia

Hashim, A. (2004). Pengukuran Kecergasan Motor. Tanjung Malim: Quantum Books.

Hashim, A. (2015). Pengujian, pengukuran, dan penilaian pendidikan jasmani. Bandar Baru Bangi: DUBOOK.

Baumgartner, T. A., & Jackson, A. S. (1999). Measurement for evaluation in physical education and exercise science (6th ed.). Dubuque, IA: Wm. C. Brown.

Baumgartner, T. A., Jackson, A. S., Mahar, M. T., & Rowe, D. A. (2003). Measurement for Evaluation in Physical Education and Exercise Science (7th ed.). New York, NY: McGraw-Hill.

Brunet, M., Chaput, J.-P., & Tremblay, A. (2022). The association between low physical fitness and high body mass index or waist circumference is increasing with age in young adolescents: The Quebecen Forme Project. International Journal of Obesity, 1-7.

Chua, Y. P. (2006). Kaedah Penyelidikan Buku 1. Kuala Lumpur: Mc Graw Hill (M) Sdn. Bhd.

Cicciarella, C. F. (1997) *Research in Physical Education, Exercise Science, and Sport*: An Introduction. Scottsdale, AZ: Gorsuch Scarisbrick.

Cooper Institute for Aerobics Research. (1999). *FITNESSGRAM® Test Administration Manual*. (6nd ed.) Champaign, IL: Human Kinetics

Cooper Institute. (1992). *The Prudential FITNESSGRAM®: Test Administration Manual*. Dallas: Cooper Institute for Aerobics Research

Corbin, C. H., & Lindsey, R. (1988). *Concepts of physical fitness with laboratories* (6nd ed.). Dubuque, Iowa: Wm.C.Brown.

Corbin, C. B., Lindsey, R., Welk, G. J., Corbin, W. R. (2001). *Concepts of physical fitness and wellness* (4thed). Dubuque, Iowa: Mc Graw Hill Publishers.

Golding, L. A., Meyers, C. R., & Sinning, W. E. (1989). *The Y's way to physical fitness.* Rosemont, IL:YMCA of America

Gunathevan, E. (2012). Obesiti, kandungan lemak abdominal, daya tahan kardiovaskular dan literasi aktiviti fizikal dalam kalangan pelajar Semenanjung Malaysia [Obesity, abdominal fat content, cardiovascular endurance, and physical activity literacy among students in Peninsular Malaysia]. (Doctoral dissertation, Fakulti Pendidikan, Universiti Kebangsaan Malaysia).

Johnson, B. L., & Nelson, J. K. (1986). *Practical Measurement for Evaluation in Physical Education* (4thed.). Louisiana State University: Burgess.

Hashim, M. J., & Salamuddin, N. (2013). Perbandingan Ujian Bleep dan Ujian Larian 2.4 km dalam menentukan tahap kecergasan daya tahan kardiovaskular pemain ragbi bawah

18 tahun MSSM Kedah Darul Aman. In Prosiding International Sports Science Conference (pp. 7-16). Universiti Malaysia, Sabah (UMS).

Hashim, M. J., Saif, M. F., & Salamuddin, N. (2013). Norma kecergasan fizikal guru pelatih Major Pendidikan Jasmani Institut Pendidikan Guru [Physical fitness norms for physical education trainee teachers majoring in Physical Education at the Teachers' Institute]. Paper presented at the International Sports Science Students Conference, Universiti Malaya, Kuala Lumpur, November 28-29.

Hashim, M. J. (2016). Menilai Tahap Kecergasan Fizikal Pemain Bola Speak MSKPPM Negeri Kedah (Kategori Veteran). Jurnal Sains Sukan & Pendidikan Jasmani, FSSKJ, UPSI, 5(1), 49-64.

Rowland, T. (2023). Children's Exercise Physiology. Champaign, IL: Human Kinetics

Safrit, M. (1995). *Complete Guide to Youth Fitness Testing*. Champaign, IL: Human Kinetics.