A PRELIMINARY STUDY ON FITNESS LEVEL AMONG THE WHEELCHAIR TENNIS PLAYERS

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Abstract: *The aim of this study was to determine the physical fitness profiles among the disabled wheelchair tennis players. A total of 10 male national wheelchair tennis players (n=10) aged from 15-45 years old were recruited and performed Illinois agility test, 20-seconds wheelchair push-up test, 20-meter dash, handgrip strength test, and arm crank ergometer test. The data presented as mean ± SD (standard deviation). The mean value of Illinois agility test was 32.25 ± 2.35 with 60% below average and 40% above average. The mean for 20-seconds wheelchair push-up test was 29 ± 5 repetitions as 50% of the subjects were above average, 40% were below average and 10% were average. The results of 20-meter dash showed that the mean value was 6.85 ± 0.72 seconds. The mean for left handgrip strength test was 39.5 ± 11.7 kg while the mean for right handgrip strength was 40.2 ± 11.1 kg. About 10% of the subjects were above average, 10% were in average rank, while another 80% were below average for the left handgrip strength test. For the right handgrip strength, 10% classified as above average, 20% were average, and another 70% were below average. All of the subjects were able to finish an arm crank ergometer test as the mean value of the test was 103 ± 25 RPM. Based on the findings, agility, muscular strength, power and muscular endurance reveals that subjects are within the normal range. The future study able to compare the body composition along with anthropometric profiles of wheelchair tennis playersfor evaluating the relationship between body composition, anthropometric and sporting performance.*

Keywords: Fitness profile, national wheelchair tennis players, disability, Illinois agility test, 20s wheelchair push ups.

INTRODUCTION

Wheelchair tennis for athletes with a disabilityhad been included into Paralympic Games at the Summer Paralympic in 1992 which was taking place in Barcelona. It was initially opened only for men with spinal injuries. However, as the sport grew, the competition is now open to all men and ladies' quadriplegia criteria. As regard with the nature of wheelchair tennis sport, fitness components, especially health related fitness seem to be crucial on giving the competitive advantage to the lifters. In Malaysia, performances of national disabled wheelchair tennis were generally a bit impressive but yet far from consistent.

Muscular strength, muscular endurance, body composition, cardiorespiratory endurance and flexibility mentioned by Winnick & Short (1999) as the health related fitness components while skill related fitness consists of agility, coordination, balance, power, reaction time and speed. Rationally, not all of those components link directly to wheelchair tennis performance. However, most of the components were associated which the development of each component can boost the others. For example, the growth of speed can enhance the muscular strength and endurance. Therefore, the creativity of coach to implement good variation or combination during training might improve athletes performance.

In general, level of fitness differ between individual with and without disability. It largely determined by factors that cannot be altered such as age, gender, and lesion level. However, changeable factors such as activity level and body mass play an additional role (Janssen, Dallmeijer, Veeger, & Van der Woude, 2002). Several studies supported the inference that muscular strength is major importance to the physical performance of individual in wheelchairs (Davis, Kofsky, Kelsey, & Shephard, 1981). As regards with the nature of wheelchair

tennis event, it suggests that some specific physical fitness may confer a competitive advantage to the expression of maximal strength among the wheelchair tennis.Despite the fast growing popularity of the sport, not much studieshas been conducted to verify the specific physical fitness factors which can confer to success in wheelchair tennis.

Spinal cord injury (SCI) is a devastating injury resulting in the loss of somatic and autonomic nervous system function. The higher the level and the more complete the SCI, the more widespread will be the loss of function. The frequent causes of damage are accident, violent trauma, and disease such as spina bifida and poliomyelitis (Janssen, Dallmeijer, Veeger, & Van der Woude, 2002).Amputation can be defined as the surgical, congenital, or spontaneous removal of a limb or projecting body part. It usually suffered following accident, disease, and sometimes because the lack of limb at birth which called congenital amputation (DePauw & Gavron, 2005).The bench press, dumbbell press, flexed arm hang, extended arm hang, handgrip strength, isometric push-up, push-up, curl-up, modified curl-up, pull-up, modified pull-up, and trunk lift are all measures of musculoskeletal function, primarily muscular strength and endurance. Although each of these test items can be justified on the basis of logical validity, no specific level of strength and endurance has been identified as critical for health.The seated push-up, reverse curl, and 40-m push/walk also assess muscular strength and endurance and are most appropriate for individuals with certain types of physical disabilities. Bases for specific standards for these items come from their relationship to activities of daily living (ADLs) (Plowman & Corbin, 1994).therefore the purpose of the study is to investigate the physical fitness profiles among the national disabled wheelchair tennis players.

METHODOLOGY

Sample: The subjects of present study consisted of 10 national wheelchair tennis (10 male athletes). They were between 15 and 49 years old. The subjects were recruited through National Sports Council of Malaysia and Malaysian Paralympic Council that is responsible on managing the national disabled athletes.

INSTRUMENT

Illinois agility test is a popular method of measuring the athlete's agility (Getchell, 1979). For the purpose of the study, a modified version is used to suit the wheelchair users. Instead of lying down on the floor the subject be on the wheelchair at the "Start" cone. The assistant gives the command "GO" and starts the stopwatch. The subjectaccelerates his wheelchair and negotiates the course around the cones following the course.The assistant stops the stopwatch and records the time when the subject passes the "Finish" cone. 2 trials were given.

The wheelchair push-up which also known as seated push-up was the first of the four tests specifically designed for people with physical disabilities. It was included in the Brockport Physical Fitness Test (BPFT) battery primarily for wheelchair users (Winnick & Short, The Brockport Physical Fitness Test Manual, 1999).The test measures upper body strength and endurance. The procedures of 20-seconds wheelchair push-up are thesubjectsat on the wheelchair with his or her back straight and comfortable. The wheelchair brakes were locked to avoid movement during the test and safety belt had been unhooked to allow the subject to lift up for the test. The subjectplaced both hand on the arm rests and holding the wheelchair.The subject took a deep breath in and then start pushing up or lifting the body up slowly, locked the elbows, and lifted the hips off the seat and afterwards gradually lower it back down to the seat. Subject finished this test within 20 seconds. The score determined by the repetitions been recorded for each subject.

The 20-meter dash test used to measure speed. However, the modification had been done for wheelchair user which was mentioned by Winnick & Short (1985). Therefore, this test had been useful to assess muscular strength of the subjects. It was also related to power as it was a combination of muscular strength and speed. The test required muscles to contract rapidly to overcome significant resistance (Horvat, Kalakian, & Sargent, 1996).The subjects placed themselves behind the starting line while waiting for the signal. A starting line and finishing line had been mark with cones visible to the subjects.The tester stood at the finish line (20 meters from the start line) and gave the "Ready-Go" signal. Enough space had been provided for subjects to slow down safely at the end of each sprint.Once the signal was given, the subjects pushing their wheelchair as fast as they can from the start line through the finish line.The timing was stopped when the front wheels cross the finish line.The time was recorded to the nearest one-tenth second.

The purpose of handgrip strength test was to measure the maximum isometric strength of the hand and forearm muscles. Static handgrip strength is a good predictor of total upper body isokinetic strength and that a substantial relationship exists between grip strength and habitual physical activity for individuals with spinal cord injury (SCI) (Winnick and Short 1999). The subjects seated with straight-back on the wheelchair. Takei digital handgrip dynamometerwas held in the hand to be tested, with the arm at right angles and the elbow by the side of the body.The subjectsadjusted the handle of the dynamometer so that it fits with their hands.The base rest on heel of palm, while the handle rest on middle of four fingers.When ready the subject squeezed the

dynamometer with maximum isometric effort, which maintained for about five seconds. No other body movement is allowed. Subject had been strongly encouraged to give a maximum effort.All subjects finished with their dominant hand first and then continued with the other hand with three trials given to each subject. The scores had been recorded to the nearest kilogram (kg) by reading the score on the face of the dynamometer. The mean of the three trials served as the criterion measure for each hand.

The arm crank ergometer test was a pass or fail test item. A subject considered as pass if he or she could stay within 15 minutes. The main fitness component for the test was muscular endurance. The test had been conducted using Monark Rehab Trainer model 881E which are arm and leg ergometer that provided with a belt brake.The subject sat on the wheelchair comfortably with the ergometer placed on a table suit with their hand level.The wheelchair brakes had been locked to avoid unnecessary movement during the test. The subject grips the handles and starts to rotate when the tester giving the instruction once the functions key had been set. They finished this test within 15 minutes. All of the score had been recorded as total pedal revolutions and then converted into pedal revolutions per minute (RPM) as the results.

DATA ANALYSIS

Statistical Package for the Social Sciences (SPSS) version 24 was used to analyse the data of the present study. The demographic variables such as age group, race, sport participation and level of education of the subjects were summarized using the descriptive statistics. The descriptive statistics such as percentage, frequencies, mean, and standard deviation were used to describe above mentioned demographic variables. The same statistics used to analyse all the fitness test results. The data were presented as mean ± SD (standard deviation).

RESULTS

Table 1 below reveal the anthropometric and fitness characteristics of the subjects.

Table 1. Anthropometric and Fitness characteristics of the subjects

Nu	Characteristics	Mean	SD
1	Age (years)	24	11
2	Weight (kg)	50.20	8.58
3	20-seconds wheelchair push up test (sec)	29	5
4	Illinois Agility test (modified) (secs)	32.25	2.35
5	20-meter dash	6.85	0.72
6	Arm-crank ergometer (RPM)	103	25
7	Handgrip strength test (left)	39.5	11.7
8	Handgrip strength test (Right)	40.24	11.1

The mean value of the subjects for the 20-m wheelchair push up test was 29 ± 5 repetitions. Despite no data available for normative value of this test, based on the findings This is because, it might be influenced by the functional health concern, because there is subject who can hold and do repetition more compare to the other subject. From the finding, those who score below average in 20-seconds wheelchair push-up test indicate that they are less strength than those average and above average.

The mean values of the subjects' performance in Illinois agility test (modified) was 32.25s ± 2.35s.Despite no data available for normative value of this test for the disabled populations. In this test, the shorter the duration to complete the test the more agility profile of the subject.Thus, subjects who score above average in Illinois agility test which is 40% can be classified as less agility than those below average which is 60%.

The results for the 20-meter dash test show that the mean values for the subjects were 6.85 ± 0.72 seconds. As the test was the different type of dash and the different type of muscles involved, the results cannot be comparednor classified using the normative value of sprint test for normal people. The arm crank ergometer test that been conducted was a pass / fail test item. A subject considered as pass if he or she could stay within 15 minutes. The main fitness component for the test was muscular endurance.

The results expose that all of the subjects completed the required 15 minutes. The total pedal revolutions were obtained and converted into pedal revolutions per minute (RPM) to present the results. The mean among the subjects for this test was 103 ± 25 RPM.

The mean value for handgrip strength test had been calculated based on the three trials given for both left and right hands. The mean for left handgrip strength was 39.5 ± 11.7 kg while the mean for right handgrip strength was 40.2 ± 11.1 kg. Based on the normative values provided by Davis & Roscoe (2005), 10% of the subjects were above average, 10% were in average rank, while another 80% were below average for their left handgrip strength. For the right handgrip strength, only 10% ranked as above average, 20% were average, and another 70% were rated as below average.

DISCUSSION

Performance of Illinois agility test showed that all of the subjects have average of 32.25s. The nature of the test was similar to their sport's discipline which is their agility. It is not suitable to use normal people norms for this test as they differ in physical characteristics. Thus, there is no data available for normative value for Illinois agility test for wheelchair athletes. The 20-seconds wheelchair push-up revealed that half of the subjects completed above average with more than 29 repetitions that show they have greater strength than the subject who in average and below average score. There is no datafor normative value of wheelchair push-up but onlynormative value for normal population is available which is not suitable to be used for wheelchair population. Performance of 20-meter dash showed that most of the subject completed the test not more than 10 seconds with one of them performed only 5.88 seconds. Considering the way they must performed the test, most of the subjects shows the good performance. However, the performance cannot be classified as there was no normative data available for this test.

Handgrip strength test performance showed a mixed performance. Nevertheless, performance for both hand showed more than half of the subjects were in below average rank. Muscular endurance test of arm crank ergometer shows that all of the subjects were able to finish within 15 seconds. Most of the subjects performed very well with the average pedal revolution of more than 60 and even beyond 135 times per minute. Based on the tests performance, muscular strength, power and muscular endurance of the subjects could be mostly categorized as average and above average. Although no detailed information gathered specifically regarding frequency, intensity, and content of the training, athletes and coaches reported that most of the athletes had been involved more than four years. Besides that, according to their coach most of the subjects train about 18 hours every week, focusing more to the strength and power training.

The results of the present study might do not accurately translate the performance of the subjects due to some limitations such as the lack of normative values for the subjects population and the validity and reliability concern of some physical fitness test. However, an adequate findings had been obtained to accomplish the objectives of the study. It can be used as a relevant findings to provide both coaches and athletes with insights on improving and optimizing performance. For example, it can be utilized as the evaluation of training progression and the construction of training approach and variety. In addition, it might be beneficial for talent identification programmes for wheelchair tennis. It is important to begin the implementation of long term development for this sport.

CONCLUSION

The main goal of an athlete is to win the competition and the key of achieving this goal is by improving. The recommendations to reach the goal generally with improving of physical fitness level, proper training plan and appropriate nutritional intakes. Hence, these element are essential for the enhancement of performance.

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