

Physical Fitness Profiles Among National Powerlifters With Disabilities

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Abstract The aim of this study was to investigate the physical fitness profiles among the national powerlifters with disabilities. A total of eight national powerlifting athletes (3 females and 5 males) were recruited and performed 1-RM bench press test, 20-seconds wheelchair push-up test, 50-meter dash, handgrip strength test, and arm crank ergometer test. The mean value of 1-RM bench press test was 1.78 ± 0.58 with all of the subjects classified as above average. The mean for 20-seconds wheelchair push-up test was 26.00 ± 8.50 repetitions as 75% of the subjects were above average, 12.5% were average, while another 12.5% were below average. The results of 50-meter dash showed that the mean value was 17.35 ± 4.72 seconds. The mean for left handgrip strength test was 38.86 ± 12.95 kg while the mean for right handgrip strength was 37.12 ± 12.77 kg. About 25% of the subjects were above average, 50% were in average rank, while another 25% were below average for the left handgrip strength test. For the right handgrip strength, 12.5% classified as above average, 50% were average, and another 37.5% were below average. All of the subjects were able to finish an arm crank ergometer test as the mean value of the test was 100.50 ± 25.57 RPM. Based on results, muscular strength, power and muscular endurance reveals that subjects are within the range. The future research could incorporate body composition evaluation and anthropometric profiles among powerlifters with disabilities for better understanding of sporting performance.

Keywords: physical fitness profiles; fitness test; powerlifters with disabilities.

INTRODUCTION

Powerlifting for athletes with a disability had been included into Paralympic Games at the second edition in 1964 that took place in Tokyo. It was initially opened only for men with spinal injuries. However, as the sport grew, the competition is now open to all athletes with cerebral palsy, spinal injuries, lower limb amputees and *les autres* who meet the minimal disability criteria. Women competed in this sport for the first time in Sydney in 2000. Powerlif-

ting is governed by the IPC and coordinated by the IPC Powerlifting Technical Committee, founded in 1989. This sport is currently one of the fastest growing disability sports that practiced in 115 countries by more than 5000 ranked competitors (IPC Powerlifting, 2010).

As regard with the nature of powerlifting sport, fitness components, especially health related fitness seem to be crucial on giving the competitive advantage to the lifters. In Malaysia, performances of national powerlifters with disabilities were generally a bit of impressive but yet far from consistent. Besides that, there were rarely heard about the freshly face that can emulate the aging lifters.

International sports competition for disabled individual exist in the International Paralympic Committee (IPC), which provides competitive opportunities for individual with disability from the beginner to elite level. Powerlifting is one of nine sports that serve by IPC. Powerlifting is contests of muscular strength and power where lifters are divided into weight categories in order to facilitate equitable competition (Cleather, 2006). This sport is open to all athletes with cerebral palsy, wheelchair athletes, lower limb amputees and *les autres* who meet the minimal disability criteria.

Several studies supported the inference that muscular strength is major importance to the physical performance of individual in wheelchairs (Davis et al, 1981). As regard with the nature of powerlifting event, it suggests that some specific physical fitness may confer a competitive advantage to the expression of maximal strength among the powerlifters.

In powerlifting, lifters compete in various division based on body mass, gender and age with the aim of lifting the greatest possible

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loads (Keogh et al, 2007). Powerlifting is the ultimate test of upper body strength which competitors must lower the bar to the chest, hold it motionless on the chest and then press it upwards to arms length with locked elbows. The bench press is the only discipline with 10 different categories based on body weight. The athletes are given three attempts and the winner is the athlete who lifts the highest number of kilograms.

Individual with some form of paraplegia, due to either cerebral palsy or spinal cord injury, should be able to achieve general standards for upper body measures involving the hands or arms but may have difficulty with measure involving the trunk or abdomen. Unilateral test items such as handgrip strength and dumbbell press have the most relevance for individual with some types of cerebral palsy and for single-limb amputees. 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).

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 et al, 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).

Cerebral palsy refers to a group of disorders that have an effect on a person's coordination and ability to move. Cerebral palsy may make daily living tasks for those afflicted with the disorder. Cerebral palsy affects thousands of children each year. There are three types of cerebral palsy that can affect children which are spastic, athetoid and ataxic cerebral palsy (Gilman, 2001).

METHOD

Sample

This study sample consisted of 8 national powerlifters with disabilities (5 males and 3 females) and voluntarily participate in the present study with the advice and guidance from

their coaches. The subject age were between 24 to 53 years old. The subjects are currently in the National Sports Council of Malaysia's (NSC) elite programme. Permission from NSC was obtained prior to data collection. After being informed of the purpose, procedures, and potential risks of the study in question, all subjects signed an informed consent statement.

Instrumentation and procedures

Subjects performed a set of tests such as one repetition maximum bench press test, 20-seconds wheelchair push-up test, 50-meter dash test, handgrip strength test and arm crank ergometer test.

One repetition maximum test (1-RM) is a popular method of measuring isotonic muscle strength (Adams, 2002). It is a measure of the maximal weight a subject can lift with one repetition. This test had been performed using Cybex Olympic bench press equipment. The athletes themselves are familiar with the equipment as they regularly used it during the competition and training session. The athletes were given two minutes before performing the one repetition maximum attempt with proper technique. After 90% of 1-RM, loads had been increased using small plates (1, 2.5, 5, and 10 kg) until the 1-RM was reached. The athlete is allowed to choose the subsequent weights until they could only repeat one full and correct lift of that weight.

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 (1999). The test measures upper body strength and endurance, particularly of the elbow extensors. Besides that, the ability to lift the body from the seat of a wheelchair by placing the hands on the arm rests and extending the elbows was believed to be important for lifting the body and providing relief of skin pressure and as a prerequisite to transferring. The subject will perform a 20-seconds standard lifting procedure.

This 50-meter dash test had been done to measure the speed of each subject. The test might be noticed as weird to the powerlifters. However, the modification had been done for wheelchair user that was mentioned by Winnick & Short (1985) in their project UNIQUE physical fitness test. In this test, the subjects were required to push their wheelchairs as

fast as they can until the finish line. 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 et al, 1996). This test had been performed on the athletics track at NSC.

The purpose of the handgrip strength test was to measure the maximum isometric strength of the hand and forearm muscles. It was because handgrip strength is important for most of sports as the hands are used for lifting, catching or throwing. According to Winnick & Short (1985), 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). This test had been conducted using Takei digital handgrip dynamometer.

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. It equipped with an electronic meter which showing the total pedal revolutions, pedal revolutions per minute and time function. The machine was calibrated before and after each test. The workload and time had been set with 20 watt as workload for 15 minutes test.

Data collection

All tests were administrated in an individual setting. After the warm-up sessions, each of the participants will follow the researcher to one of the station to begin their test. Each station was administrated by the tester and supervised by the researcher that follows the participants. The testers were responsible to explain and demonstrate the tests to participants. The skill demonstrated and its verbal description was standardized according to the listed. After the demonstration, a practice trial was given for each participant. Then participants were asked to perform only one-test trials in turn, then the other one to complete each of the test. The participants will undergo the tests by following the test sequence: a) one repetition maximum bench test, b) 20-seconds wheelchair pushup test, c) 50-meter dash test, d) handgrip strength test and e) arm crank ergometer test.

The test will be done in one day to ensure the good data collected.

Analysis of data

The study was analyzed using the Statistical Package for the Social Sciences (SPSS) version 19. The descriptive statistics such as percentage, frequencies, mean, and standard deviation were used to describe above mentioned variables. The data were presented as mean \pm SD (standard deviation).

RESULTS AND DISCUSSIONS

Table 1. Anthropometric data of the subjects

Variable	Mean \pm SD
Height (m)	1.56 \pm 0.10
Weight (kg)	70.75 \pm 13.40

Table 1 show the mean score of the subject's height and weight. The mean score of the subject's height was 1.56 \pm 0.10 m while the mean of subject's weight was 70.75 \pm 13.40 kg. The BMI (body mass index) was not valid for these subjects due to physical abnormalities.

Table 2. Descriptive result of physical fitness profiles among national powerlifters with disabilities

Fitness tests	Mean \pm SD
Wheelchair push-up (rep.)	26.00 \pm 8.50
1-RM bench press (1-RM / BW)	1.78 \pm 0.58
50 m dash (s)	17.35 \pm 4.72
Arm crank ergometer (RPM)	100.50 \pm 25.57
Handgrip strength (kg)	Left 38.86 \pm 12.95 Right 37.12 \pm 12.77

Table 2 demonstrate the physical fitness profile among the national powerlifters with disabilities. The mean value of the subjects for the wheelchair push up test was 26.00 \pm 8.50 repetitions. Despite no data available for normative value of this test, the ratios described that 75% of the subjects completed 1.20 to 1.75 repetitions of push up per second which was classified as above average if the ratio for 30-seconds push-up for normal people being adapted Heyward (2010). The mean score among the subjects' in 1-RM bench press was 1.78 \pm 0.58. Based on the normative values provided by Heyward (2010), all of the subjects

were rated as above average. As all of the subjects were national powerlifters that trained consistently, the results were considered as normal. In addition, the bench press type of test was considered more than familiar for them. The current IPC powerlifting world records revealed that the record holder was lifted 3.67 times heavier than his body weight (IPC Powerlifting, 2010).

The results of the 50 yard dash test shows that the mean score among the subjects were 17.35 ± 4.72 seconds. As the test was the different type of dash and the different type of muscles involved, the results cannot be compared nor classified using the normative value of sprint test for normal people.

In the present study, all of the subjects completed the required 15 minutes in arm crank ergometer test. The total pedal revolutions was obtained and converted into pedal revolutions per minute (RPM) to present the results. The mean score among the subjects for this test was 100.50 ± 25.57 RPM.

The mean score for left handgrip strength was 38.86 ± 12.95 kg while the mean score for right handgrip strength was 37.12 ± 12.77 kg. Based on the normative values provided by Davis & Roscoe (2005), 25% of the subjects were above average, 50% were in average rank, while another 25% were below average for their left handgrip strength. For the right handgrip strength, only 12.5% ranked as above average, 50% were average, and another 37.5% were rated as below average.

In one repetition maximum bench press test, the mean value of the subject's performance was 1.78 ± 0.58 . Based on the normative values provided by Heyward (2010), all of the subjects were rated as above average. As all of the subjects were national powerlifters that trained consistently, the results were considered as normal. In addition, the bench press type of test was considered more than familiar for them. The current IPC powerlifting world records revealed that the record holder was lifted 3.67 times heavier than his body weight (IPC Powerlifting, 2010).

The mean value of the subjects for the 20-seconds wheelchair push-up test was 26.00 ± 8.50 repetitions. Despite no data available for normative value of this test, the ratios described that 75% of the subjects completed 1.20 to 1.75 repetitions of push up per second which was classified as above average if the ratio for 30-seconds push-up for normal people being adapted McArdle et al (2006). Only one of the

subjects was classified as average while another one was below average and this might be influenced by the functional health concern.

The 50-meter dash had been conducted in this study to determine the speed of the subjects. However, Winnick & Short (1985) mentioned that the main fitness component and subcomponent that were involved were muscular strength, endurance, and power. Power was also related to a combination of muscular strength and speed that required muscles to contract rapidly to overcome significant resistance (Horvat et al, 1996). The results of the test shows that the mean values for the subjects were 17.35 ± 4.72 seconds. As the test was the different type of dash and the different type of muscles involved, the results cannot be compared nor classified using the normative value of sprint test for normal people.

The handgrip strength test is used to measure the upper body strength specifically to predict the maximum isometric strength of the hand and forearm muscles. The mean value had been calculated based on the three trials given for both left and right hands. The mean for left handgrip strength was 38.86 ± 12.95 kg while the mean for right handgrip strength was 37.12 ± 12.77 kg. Based on the normative values provided by Davis & Roscoe (2005), 25% of the subjects were above average, 50% were in average rank, while another 25% were below average for their left handgrip strength. For the right handgrip strength, only 12.5% ranked as above average, 50% were average, and another 37.5% were rated as below average.

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. Subjects need to complete the required 15 minutes. The total pedal revolutions was obtained and converted into pedal revolutions per minute (RPM) to present the results. The mean among the subjects for this test was 100.50 ± 25.57 RPM.

CONCLUSIONS

Powerlifting is the ultimate test of upper body strength which lifters compete with the aim of lifting the greatest possible load (IPC, 2010). As regard with the nature of powerlifting sport, fitness components, especially health related fitness are crucial in giving the competitive advantage to the lifters. Therefore, health related fitness was the major focus of the present study. However, power had also

been included as it was mentioned by Malina & Bouchard (1991) as a combination of strength and speed that were the determinant component in powerlifting.

Performance of 1-RM bench press test showed that all of the subjects were rated as above average. As the nature of the test was similar to their sport's discipline, the results were not a big surprise. The 20-seconds wheelchair push-up revealed that most of the subjects completed more than 1.20 repetitions per second. Despite no data available for normative value of the population, majority of the subjects classified as above average if the ratio being adapted from able bodied push-up (Malina & Bouchard, 1991). Performance of 50-meter dash showed that most of the subject completed the test not more than 20 seconds with some of them performed less than 15 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 that half of the subjects were in 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 80 and even beyond 110 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, the subjects train about 18 hours every week, focusing more to the strength and power training.

Mayhew and researchers have reported that body mass and limb circumferences had the highest relationships with lifting performance (Mayhew et al, 1993). Despite of the supposition, little research has been conducted to verify the existence of anthropometric predispositions to success in powerlifting. Therefore, prospect of future research could be undertaken to compare the anthropometric profiles of powerlifters to other athletic groups as well as that of successful and less successful powerlifters. The comparison could also

be perform based on the physical fitness tests. The study could utilize a between group comparison design as well as involve correlation. Wider body composition and anthropometric profiles could be obtained including skinfolds, girths, lengths and breadths measurements. Besides that, further research should on the other hand include the investigation of training regimens, as to verify whether their trainings are optimal or can be optimized. Investigation of changes in anthropometry with training and competition performance would also provide additional information on the role that anthropometric characteristics play in powerlifting performance.

The results of the study could play roles in talent identification programmes for powerlifting. It might be the platform to construct the physical fitness tests for talent identification of powerlifting if the tests than been performed can be carried out and studied from time to time. Those accumulated outcome will certainly lead to the description or creation of normative values of these selected tests for national disabled powerlifters. Further investigation should be conducted to justify the study done by Keogh, et al (2007) which stated that powerlifting performance is strongly affected by anthropometric measures of body size, composition, and proportion. If the results remain unchanged, talent identification programmes could focus on selecting muscular individuals who are not overly tall and who possess relatively short limbs, whereas changes in body type, muscular girths, and skinfolds could be used for the monitoring of training. In addition, the data of dietary supplement intakes might be beneficial as part of nutritional assessment in order to stabilize it with the training intensity to optimize performance of the athletes.

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