

Identifying The Level of Flexibility, Agility and Speed Among Track and Field Athletes with Disabilities

Nagoor Meera Abdullah*, Wan Hadhilah Wan Ismail, Rohani Harun, Vincent Parnabas, Mohamad Nizam Nazarudin, Mohd Soffian Omar Fauzee

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Abstract In order to become a successful track and field athlete, an athlete must develop skills in flexibility, agility and speed. However, to date, all the research regarding flexibility, agility and speed have concentrated on normal athletes. The present study extends this line of research to disabled track and field athletes in Malaysia. The aims of the present study were to achieve the set a benchmark for measuring level of flexibility, speed and agility among track and field athletes with disabilities; and to examine the influence of participation in either track or field events on the development of flexibility, agility and speed. Thirty-eight (n=38) track and field athletes with disabilities comprising of 27 males and 11 females participated in the study. Each participant completed six tests made up of sit and reach test, lateral change of direction test, hand grip strength test; back leg dynamometer test and sit-up test. A descriptive analysis was used to assess differences in performance between track and field athletes with disabilities on the six tests. It was observed that track athletes with disabilities were superior on agility, speed and agility than field athletes with disabilities. All the data were analysed using SPSS and presented as mean of (\pm SEM). The mean value height and weight for male 168.35 \pm 1.46m and 66.73 \pm 3.28kg. Meanwhile, the mean value height and weight for female's 153.82 \pm 2.10m and 45.08 \pm 1.94kg. For male Body Mass Index (BMI), the mean was 23.33 \pm 4.5 kg.m² and 19.09 \pm 1.6 kg.m² for females. When divided according to gender category, the mean back grip test for male subjects was 92.06 \pm 44.2 kg and 48.45 \pm 17.2 kg for females. Sit-ups test revealed that the mean performance for male was 35.52 \pm 9.8 and 28.36 \pm 8.14 for the female athletes. Besides that in the sit and reach test, the mean for male athletes was 30.78 \pm 12.2 cm and 23.18 \pm 12.40 cm for females athletes. In the hand grip test, male subjects mean was 70.51 \pm 30.5 kg and 45.47 \pm 15.91 kg for females. The mean value for lateral change of direction test for male athletes was 13.66 \pm 3.7 and 15.78 \pm 2.9 for the female athletes. The field athletes were, however, superior on flexibility, back grip test and hand-grip test than track disabled athletes. The results showed the three measures of flexibility, agility and speed were appropriate for determining the physical fitness level of track and field

athletes with disabilities.

Keywords: track and field, athletes with disabilities, flexibility, agility, speed

INTRODUCTION

The speed of a sprinter, the strength of a thrower, the power of a jumper and the endurance of a distance runner is what draws the crowds to athletics. The track and field events at the Paralympic Games attract the largest number of athletes and spectators. Athletes in general have a long history dating back to the times Greeks. For athletes with a disability, the first organized competition 1952 when wheelchair racing was included at the Stoke Mandeville England within the framework of the games organized for World. They offer a wide range of competitions and the largest number of events. Athletics has been part of the Paralympic Games since 1960 and events are open to male and female athletes in all disability groups. Advances in technology and athletes' dedication to the sport have made once unimaginable feats become realities. Some compete in wheelchairs, others with prostheses, and visually impaired athletes compete with the guidance of a sighted companion. Persons with disabilities (PWD) are a kind of person that has any loss or abnormality of the psychological, physiological or anatomic structure of function. Disability is defined as a long-term reduction in a person's capacity to perform the average kind or amount of activities associated with his or her age group and typically resulting from chronic disease or impairment (Shephard, 1995).

Fitness can be defined as the undertaking of moderate to high intensity activity for the sole purpose of improving abilities in cardiovascular endurance, muscular strength, and endurance, flexibility, morphology, motor abi-

*Faculty of Sports Science and Recreation, Universiti Teknologi Mara, Malaysia,
SMK Syed Mashor, Batang kali, Selangor, Malaysia
Faculty of Health Sciences, Puncak Alam Campus,
Universiti Teknologi Mara, Malaysia,
School of Education & Social Development, Universiti Malaysia Sabah, Malaysia
UUM College of Arts and Sciences, Universiti Utara Malaysia, Malaysia

lity, and metabolic function (Shephard, 1995). This definition include not only activities undertaken for the intentional purpose of improving health and performance, but daily living activities where energy expenditure is equivalent to that of fitness. PWD is very diverse group and their exercise prescription should be specific to their needs, goals, baselines level of fitness, and functional level of mobility (Rimmer, 1993). The exercise prescription for PWD may be focuses more on health-related outcomes and include exercise for improvements in cardiorespiratory fitness, strength and body composition. Maintaining appropriate fitness levels increases one's overall quality of life, both physically and psychologically (Ford et al. 1991). PWD were feeling better about themselves and their abilities when they are more capable of performing even the most basic task without great effort (Carter, McCown & Forest, 2004). Many factors may contribute to the lower fitness levels of PWD. These include lower habitual activity levels due to reduce opportunity for participation and lack of motivation to direct them into habitual or structured physical activity (Blinde & McCallister, 1999).

In disability athletics (i.e., track and field) a number of classification systems are internationally recognized, including the systems of Cerebral Palsy-International Sport and Recreation Association (CP-ISRA, 2001), International Stoke Mandeville Wheelchair Sports Federation (ISMWSF, 2000), and the International Sport Organization for the Disabled (ISOD, 1993). ISOD has one system for amputees and one for les autres. The study will investigate and determine the flexibility, agility and speed among track and field disabled athletes. The study is very much needed, since there are no any studies that related to the above topic to determine data in assessing the flexibility, agility and speed among track and field athletes with disabilities in Malaysia.

METHODOLOGY

Research design

The design of the study is under the descriptive research. Descriptive research is oriented toward the present where conducted to describe a present situation and what the subjects are doing, describe systematically, factually and accurately specific characteristics of interest at the moment. It also is conducted by collecting information and based on this information, describing the situation. Consider in this study which n (38 subjects) includes males

and females from track and field athletes with disabilities were selected randomly. A simple random sample is obtained when every individual or element in the population has an equal chance of being selected and the selection of one person does not interfere with the selection chances of any other person. This process is considered to be bias free because no factor is present that can affect selection. The assessment data collection must have weight, height, sit and reach test, lateral change of direction test, handgrip test, back leg dynamometer test and sit-up test. In this study the dependent variables is flexibility, agility and speed and track and field athletes with disabilities as an independent. Data would be analyzed using the SPSS.

Sampling

A total of 38 subjects (n = 26 males, n = 12 females) participated in the study. The numbers subjects are from the Malaysian track and field athletes with disabilities who currently undergo intensive training at the National Sports Council Malaysia.

Instrumentations

This study will use five (5) tests, which are Sit and Reach Test, Lateral Change of Direction Test, Hand Grip Test, Back Leg Dynamometer Test and Sit-ups Test.

Standing height was recorded to the nearest half cm with the subject barefoot and with the back against a vertical wall. Body weight was measured to the nearest 0.5kg with shoes, sweaters (SECA model 841). Body mass index (BMI) was defined as body mass (kg, measured using an electronic weighing scale to the nearest 0.1 kg) divided by height (m, measured to the nearest 0.1 cm) squared (kg/m²).

Sit reach test use to measure the flexibility of the hamstrings, buttocks and lower back. The subjects were instructed to reach as far as possible from a sitting position (Acuflex model 1).

The lateral change of direction test requires the athlete to run and touch a series of cones as fast as possible. The athlete warms up for 10 minutes. The assistant places three cones 5 meters apart on a straight line. The athlete stands by the middle cone (B) facing the assistant. The assistant gives the command "GO" and points in a starting direction, right or left, and starts the stopwatch. The athlete moves to and touches the first cone, returns past the middle cone to the far cone and touches it and then re-

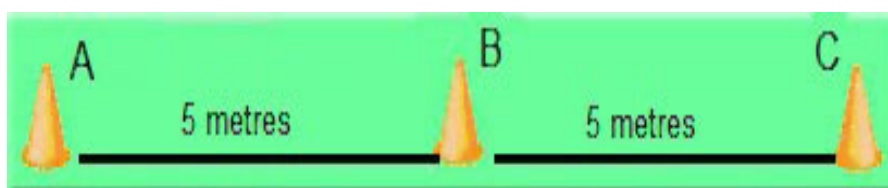


Figure 1. Layout plan of the lateral Change of Direction test

turns to and touches the middle cone. The assistant stops the stopwatch, when the athlete touches the middle cone, and records the time. The test is conducted four times - two in each starting direction (left & right). The fastest time in each direction is used for accessing the athlete's performance (refer figure 1).

Hand grip strength is an important prerequisite for good performance of the upper limb. In the study, handgrip strength was measured using a standard adjustable handgrip strength test (Takei model TKK5401). Maximum handgrip forces for dominant hand were recorded in kilograms as the highest of two trials. Before testing the subjects individually, the researcher gave a brief orientation to the entire group. The dynamometer was adjusted to the size of the hand of participant. The arm, the hand and the body position were standardized according to the suggestion of the American Society of Hand Therapists. Subjects were sitting with shoulder adducted and neutrally rotated, elbow flexed at 90° resting on the table surface and the forearm in neutral and wrist in $0-30^\circ$ extension. The test was performed by squeezing calibrated hand dynamometer as forcefully as possible with the dominant hand. Static strength was assessed.

Sit up test use to measure muscular endurance of the abdomen. The subjects need to lie down on the exercise mat, with both their leg bend at 90° . Upon receive the signal Go, the subjects need to perform sit up with their chest touching their leg as many as they can within 1 minute. The score will be recorded.

Back leg dynamometer test is to measure back and leg strength. Make sure the dial is reset to zero before you start. Stand upright on the base of the dynamometer with your feet shoulder width apart. Let your arms hang straight down to hold the center of the bar with both hands, and with the palms facing toward the body. Adjust the chain so that the knees are bent at approximately 110 degrees. In this position your back should be bent slightly forward at the hips, your head should be held upright, and you should look straight ahead. Then wit-

hout bending your back, pull as hard as possible on the chain and try to straighten your legs, keeping your arms straight. Pull against the weight steadily (no jerky movements), keeping the feet flat on the base of the dynamometer. Maximum performance will result when your legs are almost straight at the end of the lift. If not, adjust the chain length and starting position

The entire test been conducted to the subjects. Before start the test, the permission been granted by the team manager and the coaches. The subject fill in the personal detail form, the consent form and also been briefed about the tests. A demonstration session also been conducted by the test administrators. The entire test conducted for a day. Each of the subjects will be given two (2) trials to complete the tests.

Test administration and data collection

In this study sit and reach, lateral change of direction, sit-ups, hand grip, back leg dynamometer and body mass index test been used to measure flexibility, agility and speed among track and field disabled athletes. The entire test been conducted at 10.00 a.m. to 4.00 p.m. at Stadium Bukit Jalil. Before conducting the test, the test administrators give the briefing for the subjects how the test was conducted. Besides that the weight and height the subjects been taken and the test administrators conduct the warm up and stretching about 15-20 minutes to prepare the body from injury. Then the subjects perform the test and follow the procedure and the best's score been recorded in the scores sheet.

Analysis of data

The data from this study will be analyzed using the Statistical Package for Social Science (SPSS) besides that, this study only used descriptive statistic in frequency, percentage, mode and median.

RESULT

This study consists of 27 males and 11 females that are voluntarily selected. The mean age of the male track and field disabled athletes were 25.93 ± 1.48 years and 19.64 ± 1.40 years old for females track and field disabled athletes. The mean age of the subjects was 22.79 ± 1.44 years old. The mean of height and weight for the male track and field disabled athletes were 168.35 ± 1.46 m and 66.73 ± 3.28 kg. For the female's subjects, the mean of height was 153.82 ± 2.10 m and 45.08 ± 1.94 kg for their weight. The BMI for males was 23.33 ± 4.45 and the BMI for females are 19.09 ± 1.04 . The demographic data of the subjects was shows on Table 1.

The Table 2 shows the descriptive data of the fitness test among the male disabled track and field athletes. The mean score for the back leg dynamometer test were 92.06 ± 44.24 kg.m². The mean score for the sit up test were 35.51 ± 9.76 , while the mean score for the sit and reach test were 30.78 ± 12.19 . The mean score for the dominant hand grip strength test for the male disabled athletes were 70.51 ± 30.51 kg, and the mean overall score for the lateral change of the direction test were 13.66 ± 3.67 seconds.

The Table 3 shows the descriptive data of the fitness test among the female disabled track and field athletes. The mean score for the back leg dynamometer test were 48.45 ± 17.18 kg.m². The mean score for the sit up test were 28.36 ± 8.13 , while the mean score for the sit and reach test were 23.18 ± 12.39 . The mean score for the dominant hand grip strength test for the female disabled athletes were 45.47 ± 15.91 kg, and the mean overall score for the lateral change of the direction test were 15.77 ± 2.85 seconds.

DISCUSSION

Sit-ups test have become the dominant field test of muscular endurance in many field test batteries. Approximately the male disabled athletes have good score where the mean 35.5 while the female athletes mean 27.8. The effect of the health component in the muscular endurance might have influenced the test result too. The hand grip test was conducted to determine the respondent's strength and power in the static strength. It shows that this test suitable for the field games especially the throwers uses the hand to grip the javelin, shot put and so on. So they must have the strength and power for their hand while throwing. Besides that, in this study shows that the field athletes have good

Table 1. Demographic data of the male and the female disabled track and field athletes

	Male	M±SD	Female	M±SD
Age (yrs)	27	25.93 ± 1.48	11	19.64 ± 1.40
Height (m)	27	168.35 ± 1.46	11	153.82 ± 2.10
Weight (kg)	27	66.73 ± 3.28	11	45.08 ± 1.94
BMI	27	23.33 ± 4.45	11	19.09 ± 1.04

Table 2. Descriptive data of the fitness tests for the male disabled track and field athletes

Fitness tests	Mean	SD
Back leg dynamometer (kg)	92.06	44.24
Sit up test	35.51	9.76
Sit and reach test	30.78	12.19
Hand grip strength test (kg)	70.51	30.51
Lateral change of direction test (sec)	13.66	3.67

Table 3. Descriptive data of the fitness tests for the female track and field disabled athletes

Fitness tests	Mean	SD
Back leg dynamometer (kg)	48.45	17.18
Sit up test	28.36	8.13
Sit and reach test	23.18	12.39
Hand grip strength test (kg)	45.47	15.91
Lateral change of direction test (sec)	15.77	2.85

score compare to track athletes. The Back Grip test also show that the field athletes more good compare to track athletes because the throwers have more flexible while throwing and they must lock at the back to make sure they throw as far as they can. So the strength and power from the back is important for the field athletes. Meanwhile, the tracks games, the athletes must have more agility and speed while maintain the balance of the body.

The lateral change of direction test (LCDT) was need to measure the physical fitness specifically agility of the subjects. The objective of this test is to monitor the development of the athlete's speed with directional change. The test is also known as 20 meter shuttle run. This test will give the outcome, how far it is affected. It shows that the track athletes have more agility compare to field athletes. It is because the track games more use agility and speed while running. The track athletes also must have these characteristics ability to make them able to score positive result. Without agility training, this result could not be attained. Agility drills such as agility ladder, step hurdles and side-strike box also can be applied in this training. In achieving this result, consideration that the coach have to look is combining strength and power training with speed and agility is important. According to Mookerjee et al. (1995), flexibility measurements included ankle plantar flexion and dorsiflexion as well as hamstring and lower back flexibility (sit and reach test). Sit and reach test are often used in physical fitness measures. Perhaps in part because of its ease of administration, the sit and reach is often used in screening programs for athletes, moreover, some physicians to make a qualitative judgement of patient flexibility use it. (Liemohn et al. 1997). In general, girls are more flexible than boys (Hall 1956; Milne et al. 1976; Phillips et al. 1955). But in this study show that the male athletes more flexible than female athletes. It is because anatomical and regular activity and movement pattern differences between the sexes may account for the flexibility differences (Corbin & Noble 1980).

An examination of the reported research and empirical evidence support the benefits of stretching can increase in functional range of motion (Taylor et al. 1990), reduction of low back pain and injury (Bach et al. 1985; Farfan, 1973), reduction in the incidence and severity of injury (Safran et al. 1988), improvement in posture and muscle symmetry (Corbin & Noble 1980), delay in the onset of muscular fati-

gue (DeVries & Adams 1972), prevention and alleviation of muscle soreness after exercise (DeVries 1961), increase in the level of certain skills and muscular efficiency (Beaulieu 1980), promotion of mental relaxation (DeVries et al. 1981) and an opportunity for spiritual growth, meditation and self-evaluation (Alter 1988). The study shows that the track and field athletes have different level of performance in the certain test. It is because the types of activity, games and exercises can influence the score of the test. To be a successful athlete at the elite level, it is important to maintain a consistent level of performance through the whole competition. This can only be achieved if the athletes develop and maintain a high level of fitness, together with other attributes.

CONCLUSION

The result of this study shows that there is sufficient evidence to conclude that physiological parameters of track and field disabled athletes in determining their fitness level is slightly different in the mean scores. The track and field athletes required to variety of movement patterns, skills and demands high energy. To conclude that the track disabled athletes were in great fitness level whereby in agility and speed, their score are better than the field disabled athletes. The track athletes also show good performance in flexibility but not so good like field athletes. But, track athletes was not so good in results of back grip test and hand grip test, in which the mean score is below than the field athletes.

Concerning body types, there is general agreement among investigators that endomorphs (fatty types) have the least potential of the somatotypes concerning performance in agility (Bookwalter et al. 1952; Cureton 1941). However, some disagreement exists concerning whether mesomorphs (muscular types) are superior to ectomorphs (thin types). Bookwalter and associates noted that thin boys of average size perform better than medium physique boys of average size. Different scores in physical fitness factors indicate that each athlete has the advantage and disadvantage on certain components that may contribute to the success of track and field disabled athletes. Hence, the three fitness components selected may be suitable to determine variable physical fitness for track and field disabled athletes where the tools of measure were a valid and reliable indicator and most and effective for athletic games. As the conclusion the PNF stretching is

suitable in preventing injuries and to build the flexibility. The flexibility, agility and speed can be built with the training activities and lack of it can influence in track and field performance.

RECOMMENDATIONS

Recommendations to be considered by coaches for future related studies based on the findings of this study are:

all the six tests are the suitable field test that can be used to examine the physical fitness in various standards of track and field athletes with disabilities.

all coaches are encourage to conduct the tests to gauge their athlete's progress and current fitness status.

educate parents about the abilities of persons with disabilities. Knowledge of the importance of appropriate physical fitness and commitment to provide them are essential for improving the fitness and quality of life among persons with disabilities.

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