ORIGINAL ARTICLE

Functional performance of wheelchair basketball players with spinal cord injury

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ABSTRACT

Spinal cord injuries affect people's daily activities and limit their mobility and participation in the community. Adapted sports improve functioning because they supplement the rehabilitation of people who need a wheelchair for mobility. **Objective:** The aim of this study was to evaluate the functional performance of wheelchair basketball players with spinal cord injury. **Method:** This cross-sectional study was conducted with 12 athletes. To evaluate their functional performance the Modified Barthel Index, the adapted version of Texas Fitness test, and the medicine ball test were applied. The correlation of functional dependence with other functional performance tests was performed by the nonparametric Spearman test. **Results:** Six athletes were classified as moderately dependent and six as mildly dependent. The average time for the adapted version of Texas Fitness test was 27.3 ± 3.8 seconds. The average distance for the medicine ball test was 5.2 ± 0.9 meters. We observed a strong negative correlation between the Modified Barthel Index and the adapted version of Texas Fitness test ($r = -0.9193$, $p < 0.0001$). **Conclusion:** The sample group presented as mildly to moderately dependent in carrying out the activities of daily living, with upper limb strength similar to what is described in the literature, but with less agility.

Keywords: Spinal Cord Injuries, Health Evaluation, Motor Activity, Wheelchairs

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INTRODUCTION

The debilitating consequences of spinal cord injuries (SCI) frequently bring impairments in the ability to perform daily activities and limit mobility and community participation.[1] However, practicing adapted sports provides improvements in the functioning of SCI sufferers, for it supplements the rehabilitation process of those who need wheelchairs to get around.[2]

Wheelchair basketball is one of the most popular group sports among paraplegics, among which are individuals with SCI.[3,4] Among adapted sports, basketball is a modality that demands great speed on the part of wheelchair athletes and, in addition to quick direction changes, that requires agility and great upper body strength, especially in the specific musculature involved in propelling wheelchairs.[5]

One of the parameters used to quantify the benefits to individuals from this sport is functionality. Since basketball is a conventional sport, functional evaluation plays a fundamental role in this Paralympic sport, and its importance is determined by its ability to give support to a coherent intervention. In addition, it is possible to set goals regarding the physical ability of the athletes, which allows them to be diagnosed according to their level of performance.[6]

OBJECTIVE

The objective of this work was to evaluate the functional performance of athletes disabled by SCI who participate in wheelchair basketball, by means of evaluating their independence, agility, and upper body strength.

METHODS

This was a descriptive, cross-sectional study of athletes from a wheelchair basketball team in the city of Guarapuava, in Paraná. Male paraplegic athletes with SCI disabilities were included who were over 18 years old and who had been playing wheelchair basketball for at least three months. There were 12 athletes in the sample.

The study was approved by the Ethics Committee of the *Universidade Estadual do Centro-Oeste*, ruling No. 84090/2012. The participating athletes were told about the study and signed consent forms in accordance with Resolution No. 196/96 from the *Conselho Nacional de Saúde* (National Health Council). The evaluations were done during September of 2012.

To evaluate functional performance, the Modified Barthel Index,[7] the adapted Zig-Zag test,[8] and the Medicine Ball Throw test described by Johnson & Nelson in 1979[5] were applied. The athletes' degree of dependence was defined by the Modified Barthel Index in which ten functional categories were evaluated: grooming, bathing, feeding, toilet use, stairs, dressing, bladder, bowels, mobility/wheelchair, and transfers. Final scores between 0 and 25 represent total dependence; between 26 and 50, severe dependence; 51 to 75, moderate dependence; 76 to 99, mild dependence; and 100, totally independent. However, for subjects who use a wheelchair, the highest possible score is 90.[7]

The adapted zigzag test (Texas Fitness Test) was used to evaluate wheelchair agility. The goal is to run the course, which requires changes in direction, with the maximum speed and efficiency. The adapted version maintains the route, but with greater distances to run with the wheelchair. Each athlete used his own wheelchair to run the course, which was marked off with 5 cones. At the signal from the evaluator, the athlete would run the chair through the course as fast as possible. They were given five attempts and rested for five minutes in between. The first run was to get to know the course and was done at low speed. The second was done at high speed, and the next three runs were considered valid for the test. A stopwatch was used that was accurate to the hundredths of a second, and the final result was the fastest of the three trials.[8]

The upper body strength was evaluated via the medicine ball throw. The athlete remained in the chair, strapped in to avoid instability during the throw. Holding the three-kilo medicine ball with both hands against the chest and with elbows at his side, the athlete made four throws: one to familiarize himself with the movement, and the others for performance evaluation. The longest of the throws was considered for the test.[5]

Initially, the variables were analyzed descriptively. The quantitative variables were considered as averages and standard deviations and the qualitative, as absolute and relative frequencies. Correlating the degree of functional dependency with the functional performance tests was done using the non-parametric Spearman correlation test, with the significance level established at 5%. As a parameter for interpreting correlation the following scoring was used: perfect correlation ($r = 1$), strong correlation (r-value between 0.75 and 0.99), average correlation (r-value between 0.5 and 0.74), weak correlation ($0.0 < r < 0.5$), and non-existent correlation ($r = 0$). The analyses were done using Graphpad Instat software version 3.0.

RESULTS

Table 1 shows the characteristics of the 12 athletes.

According to the evaluation of the degree of dependence, six athletes were considered moderately dependent and six mildly dependent. The average time to run the zigzag test was 27.3 ± 3.8 seconds. The average distance to throw the medicine ball was 5.2 ± 0.9 meters (Table 2).

Upon analyzing the functional categories defined by the Modified Barthel Index, severe dependence was observed in climbing stairs, and moderate dependence for bladder and bowel control. In the other categories, dependence was considered mild.

When functional dependence was correlated with the other functional performance tests, a strong negative correlation was found only between the Barthel Index and the agility test (Table 3).

DISCUSSION

In spite of the knowledge on adapted motor evaluation being in its infancy,[9] studies on the functioning of disabled athletes are relevant because they provide a consistent means of evaluation for health professionals who work with athletes.[6] In addition, there is a direct relationship between functional classification and on-court performance[10] that can support the interventions of those who work with these athletes.

The Modified Barthel Index is a gauge of physical dependence that has been proven valid and reliable. It is easy to apply and interpret, aside from being recommended for routine use to evaluate functional disability in activities of daily living.[11] Gauging by this index, half of the present sample showed moderate dependence, and the rest mild. This result demonstrates that most of the participants were able to carry out their basic activities of daily living. Analyzed separately, the questions revealed variations in dependence, since most of the impairments involved climbing stairs and bladder and bowel control. However, for a more in-depth functional evaluation, it is necessary to combine the Modified Barthel Index with other instruments.[11] Hence the logical

Table 1. Characterization of sample

Variable	Average ± SD
Age, in years	35.5 ± 7.2
Time with injuries, in years	10.3 ± 6.4
Variable	n(%)
Etiology	
Firearm	4(33.3%)
Fall from a height	4(33.3%)
Traffic accident	4(33.3%)
Level of injury	
Paraplegic	12(100%)
Type of injury	
Complete	6(50%)
Incomplete	6(50%)

Table 2. Functional performance of the athletes

Athlete	ÍModified Barthel Index Score	Classification	Agility test (s)	Throw test (m)
1	74	Moderate dependence	25.26	6.00
2	60	Moderate dependence	30.94	4.10
3	69	Moderate dependence	28.88	6.04
4	69	Moderate dependence	31.62	4.30
5	90	Mild dependence	22.20	6.20
6	85	Mild dependence	23.18	5.40
7	80	Mild dependence	23.86	6.50
8	88	Mild dependence	23.80	5.10
9	60	Moderate dependence	31.86	4.90
10	82	Mild dependence	25.30	4.05
11	52	Moderate dependence	32.70	4.80
12	81	Mild dependence	27.64	4.45

Table 3. Correlation between the Modified Barthel Index and the agility and throw tests

	Agility Test		Throw Test	
	r	*p*-valor	r	*p*-valor
Barthel Index	-0.9193	< 0.0001*	0.3123	0.3194
Agility test	-	-	-0.5455	0.0708

option was to associate it with two specific motor ability tests for the practice of wheelchair basketball: an agility test on a circuit and a test of throwing strength.

Regarding the zig-zag agility test, one study compared athletic paraplegics with sedentary ones and came out with an average time for the athletes of 14.8 ± 1.1 seconds, while the sedentary individuals averaged 25.4 ± 3.3 seconds.[8] Another study applied the test to children between 5 and 12 years old, wheelchair basketball players, and the average time was 26.2 ± 8.1 seconds.[12] In the present study, the athletes needed 27.3 ± 3.8 seconds to run the course, showing a poorer performance than the children as well as the sedentary individuals in the above-cited studies. This can be justified by the time practicing the adapted sport, because in the study by Gorgatti & Böhme,[8] the athletes had been practicing the sport for at least one year, whereas in the present study they practiced for a minimum of only three months. Thus, the shorter training time appears to influence the execution of the test, for the athletes did not present a good functional performance.

One possible bias of the adapted zigzag agility test is that the athletes used their own wheelchairs, but in the process of validating the test the authors suggested that all the subjects do the test in the same wheelchair to prevent the type of wheelchair from influencing the results.[8] However it is known that each participant using his own wheelchair makes for a better performance in the tests.[13]

As for the medicine ball throwing test, one study[5] demonstrated that athletes who had practiced basketball for more than a year managed to throw the medicine ball an average of 5.2 ± 0.7 meters, whereas the sedentary individuals managed only 3.8 ± 0.2 meters. In the present study, the athletes reached 5.2 ± 0.9 meters. In contrast to the agility test, the athletes in the present evaluation showed upper body strength similar to other athletes who had practiced wheelchair basketball for a longer time.

A correlation was expected between the degree of dependence and the agility and strength tests, however, there was only a correlation in the agility test. Thus, the greater the functional independence, the faster the zigzag test was performed. In spite of both tests evaluating the functioning of the upper limbs-for agility and for strength-there was no correlation between them.

This study was limited to a sample of wheelchair basketball players disabled by SCI from the city of Guarapuava, Paraná, which does not allow the results to be generalized.

CONCLUSIONS

The sample studied presented with moderate and mild impairment in the performance of daily life activities, with upper body strength similar to what is described in the literature, but with less agility than the literature cites.

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