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Original Article

Modification of the wheelchair sports dance classification system for a fair competition

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Abstract
Problem Statement. The functional classification system of wheelchair sports dance has not been considered a satisfactory methodyet, given the recent spread of the phenomenon. The problem is the high degree of variations, especially in the LWD1 category, which would entail unfair competition, as athletes with varying levels of impairment are challenged, affecting their ability to perform dance-relevant movements and skills. In addition, an ideal classification system should expect that the performance on the field reflects the functional class of athletes. **Purpose.** The objective of this study is to verify whether it is possible to reduce the degree of variation within the LWD1 class, dividing it into two equal groups and comparing the most relevant performance of wheelchair dance of the two groups of athletes. **Methods.** The sample is made up of twelve wheelchair-bound athletes, with an average age of 30 years and with different classification scores, class LWD1. They were divided into two equitable groups: group A, with a score of 1 to 7 and group B, of 8 to 14. Three wheelchair propulsion tests were used to evaluate their performance, such as sprint, slalom and resistance test. T test for independent samples was used to check differences between the groups. **Results.**Resultshave been statistically significant in all three trials ($p < 0.05$). Propulsion tests have shown that, within the LWD1 class, the performance of athletes is significantly different. The agility, endurance and speed of group B is given by the fact that athletes have fewer movement restrictions in the pelvis, trunk and upper limbs, unlike group A which has obvious impairments involving the trunk and arms. **Conclusions.** Wheelchair propulsion tests, such as strength, agility and endurance, have shown that in the same functional class, in this case LWD1, there are athletes with significantly different performances**.** The current classification system should not be limited to two classes, but should also introduce an intermediate class to reduce the degree of variation within the LWD1 class, thus ensuring a fairer competition.
Keywords: functional score, tests, propulsion, Para dance sport, inclusion.

Introduction

In para-sport, athletes have an impairment that creates a disadvantage in their performance. Paralympic classification systems aim to promote the participation in sport by people with disabilities by controlling the impact of disability on competition results (Tweedy et al., 2014). To minimize this impact, the classification is used, which determines who is eligible to compete in a sport and then groups them into sports classes according to their limitations, to create a fair and uniform playing field (IPC, 2015). In many sports, adaptation processes are being implemented to improve the participation of disabled and non-disabled athletes in competitions, by modifying sport equipment, spaces or rules (Martino et al., 2019ab). Disabilities today represent one of the main social criticalities that must be addressed to ensure a development without a discrimination (Di Palma et al., 2016; Raiola et al., 2016; D'Isanto& Di Tore, 2016; Raiola et al., 2015).

Every man, woman, child, elderly person has the fundamental right of access to physical education and sport (D'Elia, 2019). The focus on the development of the motor and sports dimension in people with disabilities has changed today: there is an awareness of the benefits that can be found in all areas of the person's functioning (D'Elia, 2020). Regardless of the type of disability, the pathologies of which they suffer limit the autonomy of movements, favoring forced inactivity that negatively affects health. For this reason, competitive sport has a favorable physical and psychological impact on athletes with disabilities.

The benefits are, for instance: an improved respiratory control, balance, flexibility, mobility, endurance and coordination. In fact, sport represents an efficient tool within the famous disability management model, thus entailing the need to organize sporting activity so that it can express its potential with respect to disability (Cassese & Raiola, 2017; Tafuri et al., 2017). Sports dance fully embraces the goal of promoting social integration as an opportunity for personal growth and social inclusion of people with and without disabilities (Raiola, 2015). Finally, wheelchair dancing can have a positive influence on the self-esteem of adolescents with physical disabilities (De Villiers et al., 2013). Speaking of competitions, however, we can find some critical

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issues. The functional classification system of wheelchair sports dance is not yet considered a satisfactory method, given the recent spread of the phenomenon. In this system, the technical gesture is not evaluated, but only the volume of action, given by the range of movements in various directions (IPC, 2015). Athletes can be classified into two classes: LWD 1 and LWD 2. The exercises including the test are:

- Wheel control: ability to accelerate and stop the wheel with both hands
- Push function: pushing the wheelchair accompanied by the partner
- Traction function: traction of the chair accompanied by the partner
- Arm rotation: to check the full extension of the joints and full coordination
- Trunk rotation: to verify the complete rotation of the trunk

These five criteria can score 2 points for full functionality, 1 point for reduced function and 0 points for no function. The sum of the scores for each side can reach a maximum of 20. If the sum of the scores exceeds 14, the athlete is placed in the strongest class; instead, if less than 14 it falls into the category of the most compromised athletes. Furthermore, with regard to scores approaching 14, there is always the possibility that the athlete will be assigned to a functionally stronger upper class. The relevance of this expectation is signaled by sandbagging, i.e. the phenomenon whereby athletes exaggerate their impairment by deliberately underperforming during the classification process (Bosma& Van Yperen, 2020). The problem with the functional classification system is the higher degree of variation, especially in the LWD1 category, which would result in an unfair competition, as athletes with various levels of impairment are challenged affecting their ability to perform movements and skills relevant to the dance. A range between athletes with a minimum residual volume to athletes with a greater volume of action is taken in consideration. All of these athletes compete in the same functional class. In fact, an ideal classification system should expect that the performance on the field reflects the functional class of the athlete.

This would imply that athletes with higher ratings should demonstrate a stronger field performance because they have greater functional potential. Therefore, there should be some links between classification and performance of specific wheelchair dance skills. Like any coach, those in wheelchair sports are looking for efficient ways to train or analyze their athletes' technique and fitness to improve their performance (Tolfrey and Leicht, 2013). Tests evaluating performances are necessary to verify the improvements resulting from training activities (Aquino et al., 2019; D'Isanto et al., 2019). Exercise and learning are central factors for disabled people and should be investigated through the evaluation of quantitative and qualitative performance (Raiola, 2020; Raiola et al, 2018). To test the performance of athletes, field tests are widely used, given the limited availability of laboratory tests. The advantage of field tests is that athletes are evaluated in their natural environment, they are also easy to apply and can be tested simultaneously. Wheelchair propulsion tests are taken from a study (Gagnon, Dany H., et al., 2016) evaluating upper limb strength and trunk stability.

These tests appear to be suitable for assessing basic motor skills for Paralympic dance, such as agility, speed and endurance. Speed and agility are components that significantly influence a sporting gesture, making it effective and precise in respect to the situation (Di Domenico et al., 2019); sport and agility also allow the dancer to give expressiveness to the technical gesture. On the other hand, a good resistance increases the physical performing capacity (Altavilla et al., 2017; D'Isanto, 2020; Federici et al., 2019), eliminating the residues produced by a faster fatigue and by reducing the probability of incurring injuries (Izzo et al., 2019). The goal of this study is to verify whether it is possible to reduce the degree of variation within the LWD1 class, dividing it into two equal groups and comparing the most relevant performance of wheelchair dance of the two groups of athletes, such as agility, speed and endurance. Surely, sports dance is not a competition of physical tests, but if present, these skills would greatly improve the quality of the technical movements and the management of the wheelchair both in competition and in everyday life.

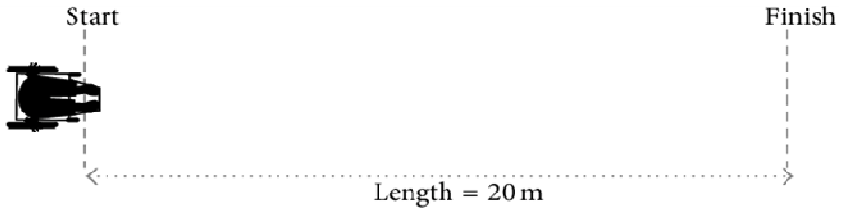
Materials and method

The sample is made up of twelve wheelchair athletes with different LWD1 classification scores with an average age of 30 years. Participants were asked to indicate their latest functional classification score, so they must have entered a competition at least once. The athletes were divided into two groups of six: 1 to 7 and 8 to 14. Three wheelchair propulsion tests were used to assess the athletes' speed, agility and endurance. The data were analyzed by statistical analysis with Microsoft Excel software. T test for independent samples was used to verify the difference between groups after verifying the normality of the data with the Shapiro Wilk test.

Wheelchair propulsion test:

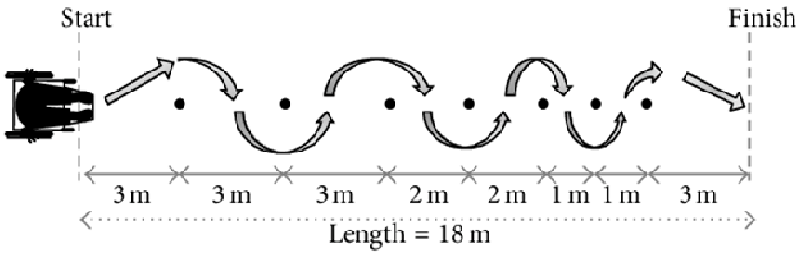
Before each test session, all participants were given 10 minutes to warm up at their own pace and warm up on their own. Participants were instructed to perform all tests at maximum intensity and were allowed to rest adequately between tests.

1) Sprint 20m – speed



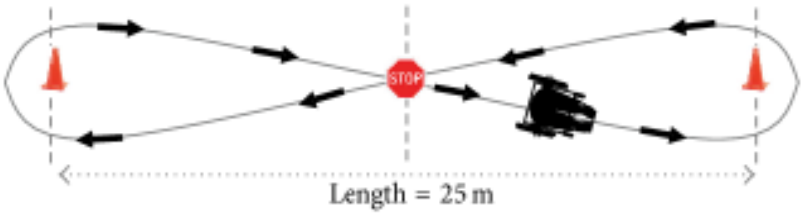
The participant started from a firm position behind the starting line and, following a signal, made a straight sprint of 20 m, as fast as possible. The sprint was performed twice in 2 minutes and the best result was recorded. The reference parameter taken into consideration is the time expressed in seconds.

2) Slalom test - coordination skills, agility, trunk stability



Participants were instructed to push the wheelchair at a self-selected maximum speed along a slalom trajectory defined by cones aligned in a straight line at a distance of 3m, 2m and 1m. The reference parameter taken into consideration is the estimated time needed to complete the test, expressed in seconds.

3) Resistance



The test involves the positioning of two cones placed at a distance of 25m and a central line. The athlete must run the figure 8 for six minutes. It is possible to stop to recover on the centerline. The parameter considered are the meters traveled at the end of the time.

Results

The difference between the means of the two groups was statistically significant in all three trials ($p < 0.05$).

Table 1. Test t - Significant difference between two groups in sprint test.

T-test: two samples assuming different variances

	Variable 1	*Variable 2*
Average	15,61667	11,16667
Variance	6,625667	0,718667
Remarks	6	6
Difference assumed for the means	0	
gdl	6	
Stat t	4,022161	
P(T<=t) one tail	0,003471	
t critical one tail	1,94318	
P(T<=t) two tails	0,006942	
t criticaltwo-tailed	2,446912	

Table 2. Test t – Significant difference between two groups in slalom test.

T-test: two samples assuming different variances

	Variable 1	*Variable 2*
Average	42,73333	35,95
Variance	14,76267	9,607
Remarks	6	6
Difference assumed for the means	0	
gdl	10	
Stat t	3,365844	
P(T<=t) one tail	0,003586	
t critical one tail	1,812461	
P(T<=t) two tails	0,007171	
t criticaltwo-tailed	2,228139	

Table 3. Test t - Significant difference between two groups in resistance test.

T-test: two samples assuming different variances

	Variable 1	*Variable 2*
Average	929,0833	1130,6
Variance	3787,794	9112,424
Remarks	6	6
Difference assumed for the means	0	
gdl	9	
Stat t	-4,34598	
P(T<=t) one tail	0,000931	
t critical one tail	1,833113	
P(T<=t) two tails	0,001861	
t criticaltwo-tailed	2,262157	

Discussion

Groups A and B, which characterize the LWD1 class, showed statistically significant differences ($p < 0.05$). The agility, endurance and speed of group B is given by the fact that athletes have less movement in the pelvis, trunk and upper limbs, a difference in group A which has evident impairments involving the trunk and arms. For the quantitative performance evaluation, which concerns the functional organic requirements necessary for the competition, coordination, agility, strength and endurance are to be considered. In the Paralympic dance what is necessary is to be able to control the wheelchair and to maneuver it gracefully as the subject will be evaluated based on the quality of the movements. To do this it is important to train basic motor skills such as speed, agility and endurance. The speed management allows you to follow the rhythm, the agility allows you to make fast diagonal changes of direction (slow waltz), and finally, the resistance to lead the competition without getting tired between one dance and another. In the sprint and agility tests, a significant difference was observed between the groups (Table 1 and 2) which could depend on the influence of the stability of the trunk and its control. To obtain a faster turn, athletes must in fact keep the trunk stable, but in subjects with severe impairment this is very difficult.

The difference in resistance (Table 3) between the groups shows that group B has more chances to lead the competition without feeling too much fatigue, given the prolonged effort. An improvement in endurance determines the body's ability to manage the necessary energy and reduce breathlessness and oxygen debt (Pastore et al., 2017; Raiola et al., 2013). It is fundamental as the dances are carried out without pauses and therefore it is necessary to train it to try to lead the competition without feeling the sense of fatigue. The performance of paraplegic dancers is given by the stability of the trunk, the range of movement of the shoulders, the strength of the upper limbs, as well as physiological factors such as weight, trunk height and arm length. All these features lead to a different way of driving the wheelchair. The basic movements are push and recovery, thanks to the use of the upper limbs. The most compromises do not have full functionality of the arms, so they

have more difficulty in performing both the tests and the various technical gestures of sports dance. For example, the strength of the shoulders would allow for kicks to be performed in a jive choreography, which would inevitably attract attention. Each choreography must be designed taking into account the possibilities of each one: who has a very low score, for example 7, will not have the same chance as an athlete with a score of 12 to perform certain movements to embellish the choreography. Postural control of the trunk is another important factor in stabilizing the whole body (Aliberti et al., 2020; Altavilla et al., 2014; Sgrò et al., 2015) and generating muscle strength during sports. When the trunk is stable, it is easier and safer to transfer the forces applied along the body to perform any motor task because it improves muscle action and reduces joint loads. Maintaining balance while sitting is impaired in individuals with spinal cord injury due to impaired function of the muscles primarily responsible for postural control.

Therefore, we must also take into account the level of the injury, which involves greater or lesser range of motion. If the subject is in a "middle" phase, in which he cannot be fully functional, but not even not very functional, it means that a new category is needed for the subject to feel motivated. If they find themselves competing with LWD2, they may become demotivated over time, as it would be nearly impossible to win a competition. If they were to compete with LWD1, most likely they would always win causing disadvantage to the more limited. Coaches should also consider field tests when evaluating an athlete's performance (Raiola &Altavilla, 2020; Sannicandro, 2015). Each athlete must plan his training by acting on the proximal development area, which is a sort of bridge between the athlete's current development skills and potential ones, obtainable through interaction with his or her teacher. To evaluate the basic motor skills of an athlete, tests are necessary and those previously proposed can be adapted and used for a comparison in two different moments of the sporting path (Altavilla et al., 2019; Raiola & Tafuri, 2015). The results indicate that the speed, agility and endurance capabilities are different based on the volume of action and therefore should not be included in a single functional classification. If everyone competed with groups of athletes who have similar abilities to each other, they would be more motivated and the competition would be fairer. This leads to the need to create an additional intermediate competition class, to give equal opportunities for everyone to compete equally.

Conclusion

Wheelchair propulsion tests, such as strength, agility and endurance, have shown that in the same functional class, in this case LWD1, there are athletes with significantly different performances. Athletes in group A could not compete with group B for the simple fact that it would not be a fair competition, as group A has more movement restrictions and therefore it is disadvantaged. The trunk and arms play a fundamental role in managing movements with the use of the wheelchair and should be trained correctly. Propulsion tests would be an ideal tool to use during a long-term training to check the improvements of athletes. The classification in disabled sports is aimed to providing a fair and equitable competition, although the functional potential of the competitors is significantly different. The disability limits one's ability to participate in sport and this limitation should be recognized by the classification system. In order to reduce the degree of variation present within the LWD1 class, the performance of individual athletes should also be taken into account. The world of Paralympic dance is relatively new in Italy and the number of competitors is increasing year by year. If in the past years two classes were sufficient to classify athletes, otherwise there could be the risk of individual competitions, today it is possible to increase the number of classes, when possible, to ensure a greater equity. The grading system should not be limited to two classes, but should also introduce an intermediate scoring class to favor those who achieve an average score on functional grading.

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