

Original Article

Changes in throwing sports rules: Implications about the performance of Paralympic athletes

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ABSTRACT

The objective of this study was to identify statutory changes in throwing sports occurred in 2014 and how they interfere with the Brazilian athletes' performance. The research is characterized as descriptive, documentary and quantitative. Rules were consulted in the archives from the International Paralympic Committee and the Brazilian Paralympic Committee as well as 177 results from competitions between 2013 and 2014. Student's t-test (paired) was used during statistical analysis with a 5% significance level. Results show a significant difference in throwing competitors' performance following the statutory changes. The functional classification F58 and F57 revealed a decrease in performance in 2014. Athletes with higher functional capabilities had worse performance compared to the results of those who are less functionally capable. The results of this investigation show that the changes in rules had direct consequences in results during the years analyzed, thus suggesting athletes have yet to assimilate and adapt to them. **Key words:** PARALYMPICS SPORTS, FRAME OF THROW, FUNCTIONAL CLASSIFICATION.

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INTRODUCTION

Disabilities refer to a deviation from what is generally accepted as normal considering the body's biomedical patterns and its functions, which can suffer from physical, intellectual, or sensorial loss (OMS, 2001).

It is hard to believe that the Paralympics only began 64 years ago in the Stoke Mandeville Hospital with 16 wounded war veterans as participants, especially considering that, in London, there were 4,200 athletes representing 165 countries. Although these facts, paralympic sports are incipient and the performance levels of paralympic athletes are likely to surpass all others in similar events (IPC, 2014).

One particular piece of handicap-friendly equipment that made participating in sports possible was a chair for shot put athletes with complications in the lower members. Shot put using this chair is an example of a widely diffused activity in the field of adapted athletics, in which the athlete uses the equipment as an extension of his/her body during physical activity (Freire,2008).

Throwing competition rules and their changes

The statutory aspects involving the throwing chair establish certain parameters for its conception, prioritizing fair play so that all athletes may compete in equal conditions. The existing rules in 2013 stated that the athlete must begin a throw while seated. If the athlete stood up, he/she would have to keep one foot in contact with the ground and within the circle until the tool¹ was thrown. All of the chair's structural parts and the footrest had to remain within the vertical axis of the circle, while the first movement before throwing was considered the beginning.

Statutory changes regarding the chair came into force on January 1st, 2014, specifically in regard to rule 35.1. These changes influenced an increased demand in manufacturing these chairs, so that they could be adjusted to the new rules. The reason is that the athletes who use it must remain seated from the moment they begin their movement until they throw the object being used in the competition and the object lands near the closest mark. This is then checked for throw distance (the athlete must sit in such a way that both lower members remain in contact with the surface of the chair from the back of the knee up to the nates². Athletes are no longer allowed to raise themselves and support their body with one foot on the ground within the circle. According to the new rules, the use of straps on the lower members, pelvis, and torso is allowed for safety. The intent of this rule is to minimize the use of the legs in athlete's performance. This position has been suggested for all athletes from the F31 to F34 and from the F51 to F58 status class. The athletes must compete with a square or rectangular chair whose sides must be approximately 12 inches in length. The surface of the chair must either be leveled or leaned slightly backwards. The front side of the chair must not be lower than the back side.

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¹ The term "throwing" was used to refer to all three sports (shot put, discus throwing, and javelin throwing) in several instances in this article. The term "tool" was also used to refer to throwing implements.

² Ischial tuberosity

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Functional Classification

The functional classification system aims to structure the competition prevailing equal conditions during the dispute, thus preventing unfair advantages or disadvantages due to disabilities⁴. The system attempts to balance the impact of these sequelae in athletic performance, which must be observed based on skills, aptitude, strength, resistance, tactical ability, and concentration. The IPC uses the international classification system to make sure the conditions for each disability category are fair, and each sport has its own classification levels and factors (IPC, 2014; Heztlar et al., 2014).

In these calculations, functional data are designed in a scope of finite and numerical characteristics, whether parametric or nonparametric, used as classification tools. Classification determines which athletes are eligible for competing in a paralympic sport and sort out these athletes in a specific group (CPB, 2013; Zhu et al., 2012). For athletes with physical disabilities, sports classification occurs in three phases: medical, functional, and observational examination (Freitas & Santos, 2012). The change from medical to functional classification in athletics occurred in the 1996 Summer Paralympics, in Atlanta. Functional classification is currently divided between two competitive classes: Track – T, describing competitions involving races and Field – F describing competitions involving throwing (Winckler, 2012).

Regarding functional classification in sports, medical examination consists of a physical evaluation to verify pathology and sequelae to reveal which of the body's affected regions may affect the athlete's motor functioning. Functional examination involves strength test, motor skills, and balance to assess the performance level of the muscle functions in specific movements of the sport (functional abilities and inabilities of the athletes). Observational assessments evaluate the movements in a sport's competitive environment using appropriate materials and equipment (Freitas & Santos, 2012).

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⁴ Ischial tuberosity

The status classes in athletics are divided as follows: T/F11, 12, 13 accommodate athletes with vision impairments; T/F20 consists of athletes with intellectual disorders; T/F 32 to 38 group athletes with cerebral palsy; F40 holds athletes with nanism; T/F 41 to 47 brings together amputated athletes and prosthetic users; and T/F 51 to 57 group wheelchair users with sequelae such as poliomyelitis, paraplegics or quadriplegics with limited or non-existent functioning of upper and/or lower members (IPC, 2014).

As stated in the IPC's Classification Rules and Regulations (IPC, 2014), the regulations of January 1, 2014, rules 35 and 36 have determined class F58 is merged with class 57. The functional characteristics of class 57 described in the Regulations include: normal strength levels in the torso and upper members, flexing, extension, adduction, and abduction of the hip, flexing and extension of the ankle, dorsiflexion and plantar flexion of the foot, complete unilateral amputation of lower members or bilateral amputation with parts of the member remaining, equivalent to athletes with unilateral dislocation of the hip or complete L5 lesion of the medulla. Up until December 31, 2013, class F58 had the following characteristics: problems in only one leg, both legs below the knee, one amputation above the knee, and the athletes must perform their throws in a seated position, ending the movement while standing, if possible. However, class F58 no longer exists as it was previously mentioned.

This analysis about these considerations was promoted by new rules, and those influence the results of athletes' performance of Brazilian competitors nationwide. Thus, the objective of this study was to identify changes in the regulations of shot put and how they interfere with participants' performance. Specifically, the objective was to verify if changes in how an athlete should perform on his/her chair interfere with results. The performance of Class F57 after these changes was observed.

METHOD

This is a descriptive, documentary and quantitative study. Data were acquired from the IPC² and the Brazilian Paralympic Committee (CPB) archives describing rules (2013 and 2014) of athletics for physically handicapped individuals. Rule 35, which describes requirements for using shot throwing put chair, has been of particular importance. Documents describing parameters for athletics eligibility (Functional Classification) between 2013 and 2014 have also been used. These documents are available online and can be viewed freely.

The overview of the 2013 and 2014 Brazilian Paralympic Athletics regional competitions on the CPB website analyzed are: 60 shot put athletes, 53 javelin throwing athletes, and 60 discus throwing athletes, both male and female. Students't-test was used in the statistical analysis to compare average throw distances for independent samples with a statistical significance of 5%. IBM® SPSS® Statistics software was used during the analyses.

Sample organizing was done following inclusion criteria which considered that athletes must have participated in the Paralympic Athletics Circuit in 2013 and 2014, with constant assessment marks in the overview of the respective competitive events (IPC, 2014).

The procedures used were: reading the IPC rules set between 2013 and 2014, and selecting convergent and divergent notes. Participants remained anonymous through the numerical codes which allowed the exclusion of athletes who did not participate in the 2014 circuit. Afterward, following the analysis of rules and functional classification, scores used as basis for discussions and conclusions were analyzed.

The study has been approved by the Ethics Committee in Research at São Judas Tadeu University (protocol number 684.204).

RESULTS AND DISCUSSION

The results of the study are presented considering the type of competition: shot put, javelin throwing, and discus throwing, all three encompassing both male and female categories. The shot put group in this study had sixty athletes; 70% (42) were male, and 30% (18) were female. The javelin throwing group comprised fifty-three athletes; 71.7% (38) were male, and 28.3% (15) were female. Sixty discus throwers participated on the study; 66.7% (40) of them were male, and 33.3% (20) were female. The table below shows the profile of athletes in each event investigated.

Table 1. Profile of the athletes of the shot put, javelin and discus throwing.

Indicators	Shot Put		Javelin		Discus	
	m	dp	m	dp	m	dp
1.Age group	37,5	9,87	38,7	9,20	39,5	9,59
16 a 27 years	11,7%(7)		7,5%(4)		8,5%(5)	
28 a 39 years	46,6%(28)		43,4%(23)		40,0%(24)	
40 a 52 years	36,7%(22)		43,4%(23)		43,0%(26)	
53 a 65 years	5%(3)		5,7%(3)		8,5%(5)	
2.Region						
Centro/Leste	30%(18)		30,2%(16)		18,3%(11)	
São Paulo	40%(24)		37,7%(20)		38,3%(23)	
Norte/Nordeste	15%(9)		11,3%(6)		20,0%(12)	
Rio/Sul	15%(9)		20,8%(11)		23,3%(14)	
3.Functional Class						
F51	-		-		3,3%(2)	
F52	6,7%(4)		7,5%(4)		1,7%(1)	
F53	3,3%(2)		3,8%(2)		8,3%(5)	
F54	20%(12)		15,1%(8)		16,7%(10)	
F55	28,3%(17)		28,3%(15)		28,3%(17)	
F56	25,0%(15)		20,8%(11)		41,6%(25)	
F57	16,7%(10)		24,5%(13)		16,7%(10)	

In throwing, athletes between 16 and 27 were among the fewest (11.7% for shot put, 7.5% for javelin throwing, and 8.5% for discus throwing) indicating a growing incipient renovation of athletes in these sports in Brazil. Anyway, Winckler (2012) states athletics is among the sports with the highest number of newcomers. It is also worth noting that within the lower functional classifications (that is, classes F51, F52, and F53, whose athletes are more severely handicapped), an incipient percentage of athletes was also identified suggesting more severely affected individuals face more overwhelming difficulties in accessibility, as well as increasing dependence on staff members in competitions. Although paralympic sports is a growing activity in Brazil, the inadequate infrastructure of sports clubs, associations, materials, and equipment, alongside the lack of trained professionals, training methodologies and evaluation are among the greatest complaints in the field of paralympic sports (Costa & Santos,2002). Consequently, data suggest the aforementioned ages and classifications may be neglected in the access to sports. Considering the rules which specify eligibility for Paralympic athletics, this study also shows a higher number of athletes in

classifications F54 and above between 2013 and 2014, indicating these participants are able to overcome accessibility obstacles.

Although athletes' performance in sports is recognized in literature, there is little information on and understanding of the complexities, restrictions, and challenges for the physically handicapped (Curran & Frossard, 2012). This kind of performance is particularly dependent on a series of factors related to the chair, the athlete, and their interface. There should be a higher focus on how sports practice interacts with any disabilities in athletes. Therefore, the statutory changes in using the chair indicate a motor restriction for the investigated activity (Mason et al., 2013). Changes in rules for 2014/2016 establish new requirements for the use of the throwing chair - rule 35.1 (IPC, 2014) athletes using it must start from a "true seated position". This rule aims to make the athlete use their legs minimally, thus limiting their motor actions. The goals to be developed for paralympic sports should consider limitations and explore possibilities for motor activity (Cidade & Freitas, 2009). Wheelchair based sports have three basic objectives with the seated position: (1) offering a comfortable and efficient basis which aids propulsion and control; (2) increasing athlete's efficiency; (3) preventing pressure ulcers or other lesions in soft tissue, so that the athlete can act as one alongside the chair (Cooper & De Luigi, 2014). There are two main components which contribute to performance, referring to wheelchair-based sports – the athlete and the chair itself. The interactions between these two components allow the necessary movements in a sport (Goosey & Prince, 2010).

Data collected during the investigation in 2013 and 2014 indicate the statutory changes interfered with the assessed athletes' performance, as shown in table 2.

Table 2. Analysis of the comparison between the averages results of shot putters, javelin throwers, and discus throwers.

Category	2013 m ± dp	2014 m ± dp	Δ%	P
Shot put	5.57 ± 2.21	5.28 ± 1.85	5.2 ± 16.3	0.046
Javelin throwing	13.2 ± 8.58	12.42 ± 6,59	5.9 ± 23.2	0.175
Discus throwing	14.4 ± 6.97	14.51 ± 6,77	0.8 ± 2.9	0.774

Returning to the statutory change which limits the lowers members levers of the athletes (thighs and gluteus remain in contact with the chair during the entire duration of the movement), the movement capabilities of athletes is reduced. The athletes were once allowed to keep their feet placed on the ground, raise their gluteus from the chair and extend the knee and hip, which could increase throw performance (Winckler, 2012). During the movement of the athlete there are three throwing parameters (angle, velocity, and height); velocity of the movement is the most relevant in determining the amplitude of the throw since amplitude is proportionate to throwing velocity as double level of power. When velocity is doubled, the amplitude is increased by four times. As such, considering shot put is biomechanically linear and throwers moved in an adapted manner⁵ and were allowed to keep their feet on the ground, the body's posture (back facing where the throw will be performed) adjusted the tool so it could move further distances, allowing increased propulsion, acceleration, and velocity (Fernandes, 2003; Bartlett, 2004).

Consequently, the use of a lower member remained on the ground indicates continuous acceleration of tools in throwing sports. With the statutory changes, shot put athletes with higher functional potential were prevented from performing their techniques to their best, which interfered in their performance as shown in

⁵ Movement style developed by Parry O'Brien (FERNANDES, 2003).

table 1. The results demonstrate the changes in rules had significant impact on shot putters' results ($p=0.046$), suggesting that these new rules are related to a lack of adapting in performing movements. Similar manifestations were not detected in javelin and discus throwing. It is possible to infer that the posture of the athletes before the rule changes made it easier to help the tool maintain continuous acceleration in all three competitions: shot put (linear), javelin throwing (linear), and discus throwing (circular). It is important to note the tool used in shot put is heavier than in the other two categories, making it difficult to accelerate and, consequently, decreasing performance.

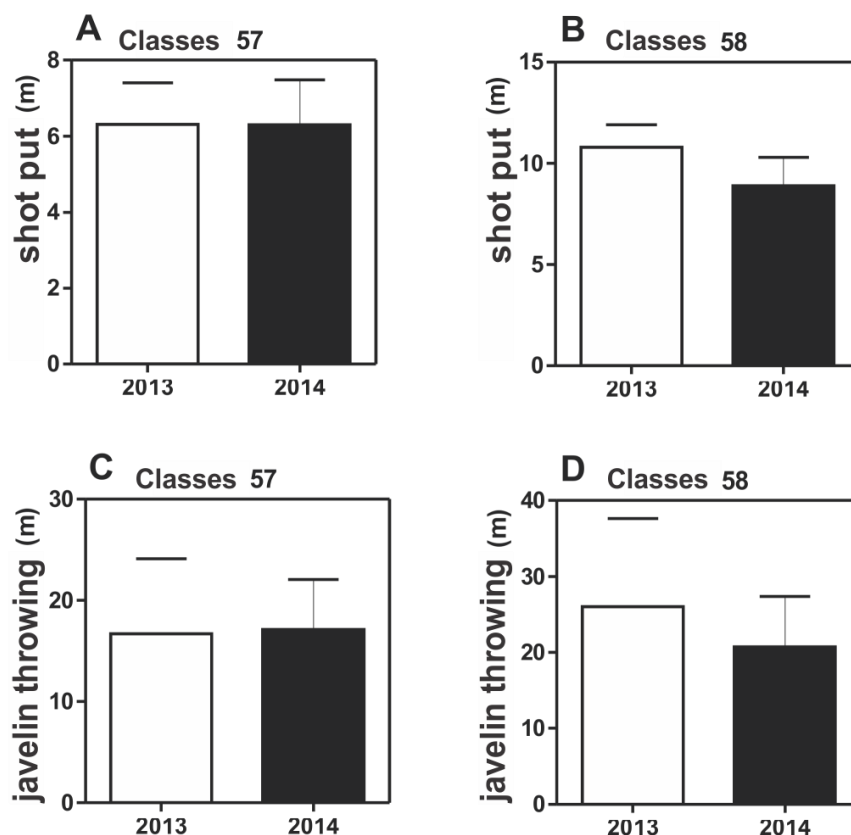


Figure 1. Shows the results for shot put and javelin throwing in 2013/2014 with data taken from analyses of classes F57 (2013/2014) and F58 (2013).

The segment of classes F57/58 (2013 and 2014) in shot put (figures 1A and 1B) and javelin throwing (1C and 1D) show athletes in class F58 decreased performance. Athletes in this classification would go on to be part of class F57, indicating the use of the chair following these changes interfered in their performance.

Due to the lack of discus throwers in class F57 in 2014, comparative analysis was not possible, although it is likely that throwers were not yet adapted to the new situation imposed by the rule changes.

Changes in functional classification allowed athletes with higher functional potential (F58) in the same class as those with lower potential (F57). The objectives of functional classification include promoting fair events for all athletes, and the functional classification procedures are intended to cooperate with the principle of equality, as long as a group of athletes has the same functional capacities (Strohkendl, 1996; Freire, 2008). Athlete's training and skill level are decisive factors for this system to succeed (Winnick, 2004), however, the

changes in functional classification were not supported scientifically (Freitas & Santos, 2012). Studies about functional classifications are not entirely recent, showing that researchers are concerned with improving the analysis and the classification itself (Santos & Freitas, 2011; Moreira, 2011).

Consequently, the recent change in functional classification brings to light different issues about the fragility of the sports classification system. This system must be constantly evaluated to become more sensitive to repercussions stemming from the changes themselves and that this system makes sure athletes perform to the best of their abilities. The use of a chair in sports demands adequate technologies, rules, techniques, and adaptations to the athlete's characteristics such as biological, physical, and mental limitations. The study suggests time to adapt to the new conditions of the athletes has been insufficient to keep and improve performance (Freire, 2008).

CONCLUSION

The study demonstrates the lower number of competitors between the ages of 16 to 27 is a matter of concern, because it indicates an incipient renovation of athletes in this sport's scene. Athletes in classes with poorer functional capacities (F51/F52/F53) have a lower percentage of competitors as well, suggesting these individuals face more severe obstacles surrounding, as well as contextual difficulties caused by their disabilities, a fact which can make it harder for these athletes to participate in events and to improve their presence in paralympic games. Statistical analysis showed the statutory changes of the chair in throwing sports significantly interfered in the performance of shot putters. Studies suggest there must be interaction between the sport, its equipment, its rules, and the athletes' commitment. The segments of shot put and javelin throwing between classes F57 and F58 (which would later be moved to class F57, shown in figure 1) suggest a decrease in performance in 2014. Athletes with the highest functional capacities also suffered from decreased performance following the rule changes compared to the results of athletes with worse functional capacities. Still, athletes from class 57 started to compete alongside a group of individuals with better capacities, which could, in a way, compromise fair play in the scene. The study has gone some way towards enhancing our understanding of athletes who make use of the chair, the relationship between the athlete and the chair itself, and competition rules.

REFERENCES

1. Bartlett, R. (2004). Princípios do lançamento. In: Vladimir, M, Z. (Eds.) Biomecânica no esporte. Performance do desempenho e prevenção de Lesão (pp. 340-357). Rio de Janeiro: Guanabara Koogan.
2. Cidade, R, E, A. & Freitas, P, S. (2009). Introdução à educação física adaptada para pessoas com deficiência. Curitiba. UFPR, Curitiba.
3. Cooper, R, A. & De Luigi, A, J. (2014). Adaptive Sports Technology and Biomechanics: Wheelchairs. PM&R, 6(8 Suppl), S31 – S39. <https://doi.org/10.1016/j.pmj.2014.05.020>
4. Costa, A, M. & Santos, S, S.(2002). Participação do Brasil nos Jogos Paraolímpicos de Sydney: apresentação e análise. Rev Bras Med Esporte, 8(3), 70-76. <https://doi.org/10.1590/S1517-86922002000300002>
5. CPB - Comitê Paralímpico Brasileiro. Ranking do atletismo 2013. Acessado em 10 de dezembro de 2013. Disponível em: <http://www.cpb.org.br>
6. CPB - Comitê Paralímpico Brasileiro. Ranking do atletismo 2014. Acessado em 15 de dezembro de 2014. Disponível em: <http://www.cpb.org.br>

7. Curran, S, A. & Frossard, L. (2012). Biomechanical analyses of the performance of paralympians: from foundation to elite level. *Prosthet Orthot*, 36(3), 380-395. <https://doi.org/10.1177/0309364612453257>
8. Fernandes, J, L. (2003). *Atletismo: Lançamentos e Arremessos*. São Paulo: EPU.
9. Freire, G, M. (2008). *Recomendações para o desenvolvimento de cadeiras, a partir de uma análise ergonômica: Arremesso do peso nos Jogos Parapan-americanos 2007*. (Master's thesis). Retrieved from: UTFPR.(Accession) <http://www.pg.utfpr.edu.br/dirppg/ppgep/dissertacoes/arquivos/80/Dissertacao.pdf>
10. Freitas, P, S. & Santos, S, S. (2012). Fundamentos da Classificação Esportiva. In: Mello, M, T. & Winckler, C. (Eds.), *Esporte Paralímpico* (pp. 45-49). São Paulo, SP: Atheneu.
11. Goosey, Tolfrey, V, L. & Price, M. (2010). Physiology of wheelchair athletes. In: VG-T (Eds.), *Wheelchair Sport* (pp. 47-62). Ottawa, CAN: Human Kinetics.
12. Heztlar, T. Smith, A, E. Rempe, D. (2014). Amputee Athletes, Part 1: Foundational Knowledge. *Int J Athl Ther Train*, 19(2), 33-38. <https://doi.org/10.1123/ijatt.2013-0104>
13. IPC - International Paralympic Committee [Internet]. Official Rules for Athletics 2013 [update 2014, Aug 16; cited Aug 20]. Available from: <http://www.paralympic.org>
14. IPC - International Paralympic Committee [Internet]. Official Rules for Athletics 2014 [update 2014, May 10; cited May 11]. Available from: <http://www.paralympic.org>
15. Mason, B, S. Woude, L, H, V. Goosey, V, L, T. (2013). The Ergonomics of wheelchair configuration for optimal performance in the wheelchair court sports. *Sports Med*, (4)43, 23- 38. <https://doi.org/10.1007/s40279-012-0005-x>
16. Moreira, L, M., Lima. M. C., & Santos, S. S. (2011, Out). Desempenho e classificação funcional do comitê paralímpico internacional de atletas com déficit motor em competições de atletismo. In Costa, A. M.(Chair), *Anais do IIº Congresso Paraolímpico Brasileiro e Iº Congresso Paradesportivo Internacional*. UNIFESP, Uberlândia-MG.
17. Santos, S, S. & Freitas, P, S. (2011, Out). Análise de desempenho do arremesso de peso paralímpico. In Costa, A. M.(Chair), *Anais do IIº Congresso Paraolímpico Brasileiro e Iº Congresso Paradesportivo Internacional*. UNIFESP, Uberlândia-MG.
18. Strohkendl, H. (1996). *The 50th anniversary of wheelchair basketball: a history*. New York: Wasmann.
19. Winckler, C. (2012). *Atletismo*. In: Mello, M, T. & Winckler, C. (Eds.) *Esporte Paralímpico* (pp. 65-74) São Paulo, SP: Atheneu.
20. Winnick, J, P. (2004). *Educação Física e Esportes Adaptados*. Trad. Fernando Augusto Lopes. São Paulo: Manole.
21. World Health Organization: *International Classification of Functioning, Disability and Health (ICF)*. Geneva, Switzerland, World Health Organization, 2001.
22. Zhu, H. Philip, J, B. Morris, J, S. (2012). Robust Classification of Functional and Quantitative Image Data Using Functional Mixed Models. *Biom J*. 68, 1260–1268. <https://doi.org/10.1111/j.1541-0420.2012.01765.x>

