

## Estado actual del rendimiento deportivo en Boccia: revisión sistemática de la literatura

### Current status of sport performance in Boccia: systematic review of the literature

\*,\*\*Cátia C. Ferreira, \*,\*\*\*José M. Gamonales, \*\*,\*\*\*\*, Mário C. Espada, \*Jesús Muñoz-Jiménez

\*Universidad de Extremadura (España), \*\*Instituto Politécnico de Setúbal (Portugal), \*\*\*Universidad Francisco de Vitoria (España), \*\*\*\*Life Quality Research Centre (Portugal)

**Resumen.** La Boccia es un deporte Paralímpico y practicado con una perspectiva recreativa por parte de la población. El rendimiento deportivo en este deporte Paralímpico implica complejidad. Por ello, el objetivo de este estudio fue realizar una revisión sistemática de la literatura relacionada con la Boccia, y específicamente en el área del rendimiento deportivo. Las palabras clave “Boccia” y “Performance” se utilizaron como descriptores en la búsqueda de referencias. Las palabras en inglés fueron introducidas en las bases de datos *Web of Science*, *PubMed*, *Scopus* and *Google Scholar*. Se encontraron 669 documentos usando la palabra “Boccia”, y después de incluir la palabra “Performance” los resultados fueron reducidos a 26 documentos. Para ello, se aplicaron tres criterios de exclusión: i) *Documentos no publicados en revistas científicas*; ii) *Documentos no mencionan en el título o resumen tanto “Boccia” como “Performance”*; y iii) *Los documentos de Tesis Doctorales, Capítulos de libros, Resúmenes de conferencias o Resumen*. Finalmente, se seleccionaron 9 documentos que cumplían con los criterios de inclusión y exclusión hasta Febrero del 2022. Los resultados confirmaron que los documentos relacionados con la Boccia son escasos en comparación con otros deportes para personas con discapacidad. Por tanto, el deporte Paralímpico ha sido analizado desde la perspectiva de una gran diversidad de disciplinas, sin embargo, dentro de la disciplina “*Coaching Science*” existe un gran espacio y necesidad de aumentar las investigaciones, con la finalidad de mejorar las condiciones de entrenamiento y optimizar el rendimiento deportivo.

**Palabras clave:** Deporte paralímpico, discapacidad, parálisis cerebral.

**Abstract.** Boccia is a Paralympic sport, also practiced in a recreational perspective by the population. Performance in this parasport involves complexity. Hence, the aim of this study was to conduct a review of the literature on Boccia, specifically in the field of sports performance. Keywords “Boccia” and “Performance” were used as descriptors in the references search. The words in English were introduced in the *Web of Science*, *PubMed*, *Scopus* and *Google Scholar* databases. 669 documents were found using the word “Boccia” and after including the word “Performance” results reduced to 26 documents. Three exclusion criteria were applied: i) *Documents not published in scientific journals*; ii) *Documents do not mention in title or abstract both “Boccia” and “Performance”*; and iii) *Documents are thesis, chapters of books, conference resumes or abstract*. Finally, 9 documents were selected that met the inclusion and exclusion criteria until February 2022. Results confirmed that research in Boccia is scarce compared to other sports to persons with disabilities. Therefore, the Paralympic sport has been analysed from a great diversity of disciplines perspective, however, regarding the discipline “*Coaching Science*” there is a great space and need for further research, in order to improve training conditions and optimize sports performance.

**Keywords:** Paralympic sport, disability, cerebral palsy.

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Mario André da Cunha Espada

mario.espada@ese.ips.pt

## Introduction

Boccia is a parasport, which involves throwing coloured balls at a target ball (jack) from a seated position, consisting of a series of rounds in which players must try to place game balls (in red or blue colour) as close as possible to target ball, in white colour (Reina et al., 2018). The game was initially designed for players with cerebral palsy (CP) and recently described as a target sport played with soft leather balls, which request precision and strong tactical skills (Roldan et al., 2020). A disability is an impairment that may be cognitive, developmental, intellectual, mental, physical, sensory or some combination of these. Previously, World Health Organization (2001) stressed that between 110 and 190 million adults have significant difficulties in functioning and rates of disability are increasing due to population ageing and increases in chronic health conditions, among other causes.

Participation in physical exercise can help offset physical decline and dementia (Perez & Cancela Carral, 2008) and provide the opportunity to rehearse old skills and develop new ones (Bowes et al., 2013). Traditionally, the main goals of intervention sought to promote the auton-

omy and well-being of youth with CP through the appropriate combination of interventions tailored to the specificity of this condition (Rosenbaum, 2003), and these dynamics have been increasing throughout the time (Shirazipour et al., 2018). Nevertheless, a question arises as to what extent these initiatives alter the motor prognosis or make a clinically significant change at the level of disability (Damiano, 2006; Anttila et al., 2008).

This parasport is played by people with different eligible impairments including hypertonia, athetosis, ataxia, impaired passive range of movement, impaired muscle power, or limb deficiency (International Paralympic Committee, 2015a) and is always played in a wheelchair. The eligible impairments in Boccia must have some impact (e.g., activity limitation) on the performance of main game actions (Tweedy & Vanlandewijckm, 2011). The main objective of classification in Paralympic sports is to group athletes in different sports classes to minimize the impact of the eligible impairments and its severity, ensuring that sports performance is only determined by individual sporting excellence (International Paralympic Committee, 2015b). Considering this topic, recently Roldan et al. (2020) indicated that it is essential to develop evidence-

based classification to assess the real impact of players' impairment on sports performance, allowing fair and equitable competition and avoiding unfair advantage caused by their degree of impairment.

Athletes with disabilities affecting motor skills such as spinal muscular atrophy play Boccia, in some cases, also with therapeutic perspective, as a part of a multidisciplinary rehabilitation program (Suárez-Iglesias et al., 2020). Boccia has become a Paralympic sport in 1984, and since 2012 is administered by the Boccia International Sport Federation (BISFed), created by the Cerebral Palsy International Sports and Recreation Association (CPISRA). Nowadays is one the most popular competitive parasports for athletes with a severe disability and one of the most established (Kumar et al., 2012; Barfield & Malone, 2013), being associated to both competition and leisure functions, reason for its popularity particularly in the school environment and in an advanced stage of age, for example in nursing homes.

Unfortunately, there are few scientific studies reported in the literature that explore this parasport (Fong et al., 2012; Huang et al., 2014; Tsai et al., 2014; Reina et al., 2015). Two possible reasons for this were indicated by Howe and Jones (2006), the progressive disappearance of athletes with high support needs (most severe impairments) from big sports events, such as the Paralympic Games and a lack of interest in the scientific community in a minority group with great inter-individual variability and difficult access to the study sample. Factual is the importance of understanding which variables contribute to performance in Boccia with the intention of enhancing competitive performance and contribute to a fair qualification system. Hence, the aim of this study was to conduct a review of the literature on Boccia, specifically in the field of sports performance.

## Materials and Methods

### Design

This study is described as theoretical research, since it constitutes a review on the literature regarding the sports performance in Boccia, using systematic data gathering and study selection processes (Ato et al., 2013). It is, therefore, a literature review to analyse and learn about the existing manuscripts related to the parasport understudy, specifically in the sports performance domain.

Table 1.

Criteria for inclusion or exclusion of manuscripts.	
Inclusion criteria	
It mentions at least one characteristic of Boccia.	
It may be any type of document.	
Available in full-text version or abstract.	
It is written in English, Portuguese or Spanish.	
Exclusion criteria	
Documents not published in scientific journals.	
Documents do not mention in title or abstract both "Boccia" and "Performance".	
Documents are thesis, chapters of books, conference resumes or abstract.	

### Inclusion criteria

Keywords "Boccia" and "Performance" were used in Eng-

lish to collect specific studies related to Boccia. The documents were selected to become part of the sample if they met the inclusion and exclusion criteria shown in table 1.

### Sample

The sample consisted of different types of documents: books, book chapters, thesis, conference papers, abstracts, scientific journal manuscripts and patent documents. The 669 documents obtained in the first search, based on the word "Boccia" were reduced to 26 when the word "Performance" was included associated with "Boccia", this procedure associated to data collection, was previously and recently implemented in a systematic review performed by Gamonales et al. (2022) regarding sport injuries in football for individuals with visual impairment. A total of 4 documents were repeated between the different search platforms. From the 16 remained documents, 7 were excluded because of exclusion criteria, and finally, 9 scientific journal manuscripts could be selected, in line with previous methodology adopted by our research group (Gamonales et al., 2021, 2022; Gámez-Calvo et al., 2022).

### Variable codification

The selected documents were classified according to the following criteria: author/s, year, title of manuscript, keywords, sport science discipline, and description.

- Author/s: first surname or scientific name of each author of the selected bibliographic reference.
- Year: official year of publication.
- Title of the manuscript.
- Keywords: terms included in the document.
- Sport Science discipline: Documents were grouped according to the Directory of Sport Science of the International Council of Sport Science and Physical Education (ICSSPE; Borms, 2008).
- Description: A brief summary of document was included.

ICSSPE includes seventeen disciplines which constitute the body of knowledge of Sport Science (Table 2) and allows the classification of study bibliographic references.

Table 2.  
Sport Science disciplines approved by ICSSPE.

N.º	Disciplines	Key
1	Adapted Physical Activity Science	APA
2	Sport Biomechanics	SB
3	Coaching Science	CS
4	Motor Behavior	MB
5	Sports Law	SL
6	Motor Development, Motor Control and Motor Learning	MD
7	Sport Philosophy	SPh
8	Sport and Exercise Physiology	SEPh
9	Sport Management	SMa
10	Sport History	SH
11	Sport Information	SI
12	Kinanthropometry	K
13	Sport Medicine	SMe
14	Sport and Leisure Facilities	SLF
15	Sport Pedagogy	SPe
16	Sport and Exercise Psychology	SEPs
17	Sport Sociology	SS

### Study selection process and data analysis

Thomas et al. (2015) indicated that the success of a good literature review resides in an appropriate planning. Assuming this premise and Gamonales et al. (2018), Hernández-Beltrán et al. (2023) and González-Coto et al.

(2023) research method, the steps and strategies followed during the review process allow relevant conclusions to be drawn. All the selected documents for the study met the established inclusion criteria. The used literature search process is represented in figure 1.

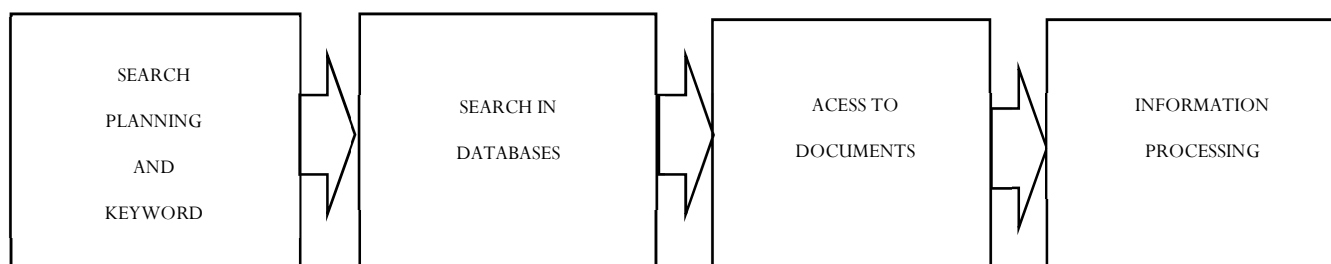


Figure 1. Diagram of the literature search process.

### Search planning and keyword selection

The keywords were selected with the intention to find as many documents as possible related to performance in Boccia. Three researchers individually and independently developed documents search between 21 and 29 of February 2022, using the same criteria. Subsequently, inclusion and exclusion criteria were established following Gamonales et al. (2018) methodology, to have an optimal sample of documents related to performance in Boccia.

### Search in databases

The search processes were conducted in four relevant electronic databases: *Web of Science* (onwards, *WOS*), *PubMed*, *Scopus*, and *Google Scholar*. Similar search patterns were used in every process. Moreover, quotation marks (“...”) were used in *Google Scholar* to narrow the search. Figure 2 depicts the research process as well as the number of documents found.

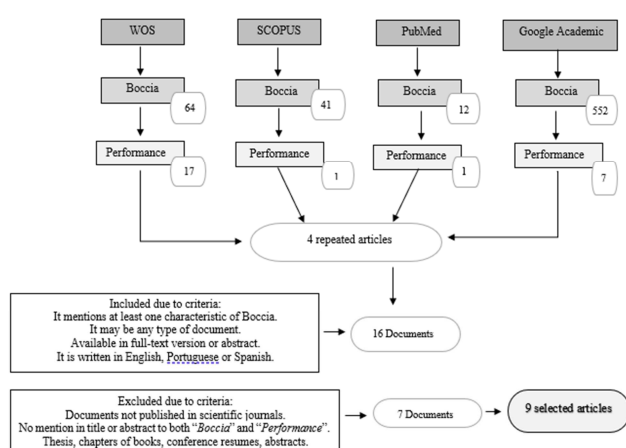


Figure 2. Number of documents found from the databases.

### Access to documents

Full texts were not available in some of the databases used to conduct the literature search. Therefore, to gain access to as many original studies as possible, the electronic library of the University of Extremadura was used.

### Information processing

The first search through the word “Boccia” revealed a relevant number of documents, although with one more word specifically related to the objective of this systematic review (“Performance”) the results went down significantly, a fact that we highlight as evidence of the low number of studies regarding specifically the performance in this parasport. The search was performed considering the presence of the selected words in the title or abstract of manuscripts published in scientific journals.

With respect to selected documents quality, the manuscripts were evaluated by three experts in Boccia (PhD’s in Sports Sciences with wide experience in Boccia), in order to analyze the methodology and avoid the bias of these (Law et al., 1998), as well as classify the selected documents in: A) *Excellent methodological quality* (Score > 75%), B) *Good methodological quality* (Score between 51% and 75%), and C) *Low methodological quality* (Score < 50%) (Sarmiento et al., 2018). Table 3 highlights the documents quality.

Table 3. Selected documents quality.

ID	Expert 1	Expert 2	Expert 3	M	DQ
1	81,25	81,25	93,75	85,41	A
2	87,50	81,25	75,00	81,25	A
3	100,00	93,75	100,00	97,91	A
4	75,00	68,75	75,00	72,91	B
5	81,25	81,25	93,75	85,41	A
6	100,00	87,50	93,75	93,75	A
7	93,75	81,25	87,50	87,50	A
8	81,25	81,25	87,50	83,33	A
9	93,75	81,25	87,50	87,50	A

ID: Identification; M: Mean; DQ: Documents quality; A: Excellent methodological quality B: Good methodological quality; C: Low methodological quality.

### Results

The selected documents were classified according to the ICSSPE (Borms, 2008). Some of the documents included in the sample belonged to more than one discipline. The documents were divided into 9 research disciplines (Figure 3): *Adapted Physical Activity Science (APA)*,

*Motor Development, Motor Control and Motor Learning (MD)*, *Sport Biomechanics (SB)*, *Motor Behavior (MB)*, *Sport and Exercise Physiology (SEPh)*, *Sport and Exercise Psychology (SEPs)*, *Sport Information (SI)*, *Sport Sociology (SS)* and *Sport Medicine (SME)*.

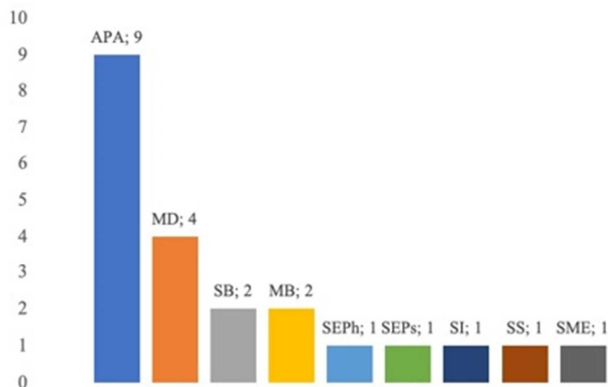


Figure 3. Number of selected documents according to the topics included in the Directory of Sports Science.

Studies in the scope of the following disciplines were not observed: *Coaching Science (CS)*, *Sports Law (SL)*, *Sport Philosophy (SPh)*, *Sport Management (SMa)*, *Sport History (SH)*, *Kinanthropometry (K)*, *Sport and Leisure Facilities (SLF)* and *Sport Pedagogy (SPe)*. The description of the selected manuscripts can be found in chronological order in Appendix A.

## Discussion

This study aimed to conduct a systematic review of the literature in Boccia, specifically related to the topic sports performance, following the methodological framework described in the literature (Ato, et al., 2013; Gamonales et al., 2018). The main findings were: 1) Research in Boccia is scarce compared to other sports; and 2) Studies specifically directed to performance in Boccia are residual.

The search procedure is developed by phases that are necessary to proceed safely and carry out an optimal review, to identify and classify the most relevant information regarding performance in Boccia. To develop a systematic review, the analysis and selection of keywords are important, because they allow obtaining an optimum number of documents related to the study subject. Our research was based in two words, “*Boccia*” and “*Performance*” and it becomes evident that the number of studies related to this parasport is very small namely when compared for example to sports such as soccer, athletics, basketball, and swimming, all played in Olympic and Paralympic context, contrary to what is reality in Boccia. In parallel to this evidence, we do not found studies related to the “*Coaching Science*” discipline in Boccia, area related to knowledge about sports performance, training, and competition processes. The interaction of this scientific knowledge and its application in training and competition constitute the

specific body of knowledge of coaching science (Schaefer & Wertheim, 2008). This fact reiterates the previous indications by Barak et al. (2016), that research in Boccia has focused mainly on biomechanical, learning and motivational aspects.

All the published manuscripts were associated with the discipline “*Adapted Physical Activity*” and it is noteworthy that some studies integrated more than one discipline. The second discipline which involved more studies was “*Motor Development, Motor Control and Motor Learning*”, with four published articles. Roldan et al. (2017) studied the manual dexterity and intralimb coordination assessment to distinguish different levels of impairment in Boccia players with CP while Tsai et al. (2014) focused on the study about the seat surface inclination influence in the postural stability during Boccia ball throwing executed by children with CP. Yet, Huang et al. (2014) studied the motion analysis of throwing Boccia balls in CP and Morriss and Wittmannová (2010) analysed the effect of blocked versus random training schedules on Boccia skills performance of experienced athletes with CP.

More recently, Roldan et al. (2017) concluded that using sport-specific equipment facilitated grasp function during the manual dexterity assessment and regarding the intralimb coordination, the type of movement (continuous vs. discrete) seems to be more relevant for classification than the movement direction (vertical vs. horizontal) or the presence of a ball. Also, Tsai et al. (2014) indicated that the anterior-inclined seat yielded superior postural stability for throwing Boccia balls among children with bilateral spastic CP, whereas the posterior-inclined seat caused difficulty and Huang et al. (2014) showed that research participants with CP seemed to mainly use head and shoulder movements to bring the Boccia balls forward with limited torso movement. Therefore, it is important to study the movement patterns that disable or hinder the action, as well as the coordination of the muscles involved in the launch in Boccia. In Morriss and Wittmannová (2010) research, it was evident that the blocked training schedule group, on average, showed greater gains across all three Boccia skills measured when compared to the random training schedule group. This suggested that athletes following the random training schedule found difficulties to adjust to the changing conditions (length) of each shot, as opposed to the repetition of the blocked training schedule group.

These findings challenge the beliefs (Schmidt, 1991; Hanlon, 1996) that random training is more beneficial to improvement and learning than blocked training but are in line with a previous study which suggested that blocked training provide better learning results, especially during the skill acquisition phase (Magill & Hall, 1990). In our perspective it is important to design a training plan consistent with the needs of the competition to face any type of tournament in the best conditions. Therefore, it would be interesting to analyse the influence of fatigue and spasticity levels of Boccia players during the play, indicators

and information that could also be very relevant to deepen and improve the classification system in order to be as fair as possible for athletes according to their real functional abilities.

Studies also indicate that CP Boccia players were aware of their neuromotor and biomechanical constraints and adjust appropriate motor solutions for achieving task successfully (Burtner et al., 1998; Brogren et al., 2001; Ju & Valvano, 2001). Also, Hadders-Algra et al. (2007) observed that children with bilateral spastic CP demonstrated less head displacement during reaching when sitting on horizontal surfaces than when sitting on anterior and posterior-inclined surfaces. Authors also determined that children with bilateral spastic CP had greater trunk displacement during reaching when sitting on horizontal surfaces than when sitting on anterior-inclined surfaces, suggesting that horizontal seat surfaces facilitate optimal postural control among these children. Consequently, these children exhibited weaker reach-out movements, but stronger retraction movements (Ju et al., 2010).

Previously, Ronnqvist and Rosblad (2007) indicated that the movement path of the throwing hand in children with CP required increased time and the movement trajectory was inefficient, therefore, the maximal forward reach velocity was reduced. Also, Chang et al. (2005) indicated that irregular movement trajectories in children with CP accompanied numerous movement error corrections, thereby resulting in long movement durations and increased movement difficulties. Given that wrist flexion and ulnar deviation are related to spasticity (De Bruin et al., 2014), it could be hypothesized that playing Boccia could be a useful strategy to ameliorate this symptom. On the one hand, the allocation of a sports class in Boccia is not based solely on players' trunk function, as there are other factors to consider, such as arm function or manual dexterity (Roldan et al., 2017), that usually have greater importance for the classifiers for decision-making due to the high impact on performance (e.g., ball throwing).

With respect to "*Sports Biomechanics*" two studies were found. Reina et al. (2018) studied the throwing distance constraints regarding kinematics and accuracy in high-level Boccia players, concluding that spasticity degree and trunk control might affect performance. Previously, Huang et al. (2014) develop a motion analysis for PC players during throwing balls in Boccia. This study is also associated with "*Motor Development, Motor Control, and Motor Learning*" discipline. Two manuscripts were associated to "*Motor Behavior*", Tsai et al. (2014) studied the seat surface inclination influence in the postural stability during ball throwing of children with CP (study also integrated in "*Motor Development, Motor Control and Motor Learning*" discipline) and Fong et al. (2012), aimed to analyse the upper limb muscle fatigue during prolonged Boccia games with underarm throwing technique, concluding that fatigue on the upper trapezius muscle was demonstrated in elite Boccia athletes following a prolonged Boccia game and may have affected the performance. Therefore we consider that the study of

biomechanical patterns associated to fatigue before, during, and after the practice of Boccia has a determining role in sports performance, and it would be advisable to analyse fatigue in various contexts to understand how it affects performance and define recovery strategies for fatigue recovery, factor that can be determinant, namely in the Paralympic Games, where athletes sometimes compete on the same day at the beginning of the morning and later near the end of the day.

Other studies have also reported that children with CP have impairments in the sensory system. Therefore, they cannot accurately react to situational changes based on their feedforward control ability (Stiers et al., 2002; Steenbergen & Van der Kamp, 2004), which is relevant since for example physical expression is one of the first forms of communication in children (Rojo-Ramos et al., 2023). Little research has explored whether a lack of feedforward control ability affects throwing movements in children with CP. A few studies have addressed the upper extremity but focused mainly on hand function (Arnould et al., 2007; Van Meeteren et al., 2007). However, the activity of the upper extremities also includes the use of the elbow and forearm, and the CP population often experiences neuromuscular impairments in these areas (Chin et al., 2005). Therefore, coordination can limit the ability of people to carry out certain activities, such as grasping, dropping, or manipulating objects, which are essential tasks for daily life or to practice sports such as Boccia, and consequently influence performance.

Within the physical capabilities, trunk control is considered an essential aspect in this parasport (BISFed, 2018), as its deficit may hinder upper-extremities function related to the throwing success as grasping or carrying balls (Miyake et al., 2013). Improvements in the pinch strength level adults with severe CP have been found after the performance of exercise programs specifically designed for this purpose (Hutzler et al., 2013). Because children with CP have more difficulty in anticipating control and controlling coordination between body segments than typically developing children (Eliasson et al., 1992; Westcott & Burtner, 2004; Olney & Wright, 2006) they might choose different strategies to cope with this specific task. This observation agrees with the hypothesis that different motor solutions may be used because of different individual constraints (Newell, 1986; Majsak, 1996).

All the other five disciplines only integrated one study each. In "*Sport and Exercise Psychology*" De la Vega et al. (2013) focused the precompetitive mood and perceived performance in Paralympic Boccia, emphasizing the importance of continuing to deepen the relationship between states of mind and perceived performance in contexts of high competition for people with disabilities. Related to "*Sport Sociology*" and "*Sports Information*", the study of Marques et al. (2015) shows the media approach over Paralympic Sport. This study observed the discontent of athletes with low media coverage, with supercrip stigma and the supremacy of football (soccer), becoming evident

the manifestation of a desire to occupy a space of more prominent sports field, which confer them greater legitimacy and possibility of athletic-competitive development, besides financial and social gains.

It would be interesting to know the emotions of athletes in Boccia since it is one of the most important points in sports success. This factor becomes more important in Boccia, where precision in shooting and decision-making, regarding changing situations, is of vital importance. The motor disorder that players present increases the possibilities of developing psychological and emotional disorders, anxiety, hypermobility, and affective immaturity. Furthermore, increased anxiety can cause an increase in the degree of spasticity and athetosis, causing a decrease in the competitive performance of the subjects. Therefore, it is essential to consider the pre-competitive mood of athletes with CP.

Lastly, in the disciplines “*Sports and Exercise Physiology*” and “*Sports Medicine*” Ichiba et al. (2020) studied the relationship between pulmonary function, throw distance and psychological competitive ability of elite highly trained Japanese Boccia players. It is noteworthy that although studies on this specific subject are scarce, their quality is high (all A, except for one case B). The results in this study raised the question as to whether focusing on the development of Boccia players' competitive ability and physical function will improve their overall performance, indicating the need for this issue to be addressed in future investigation.

## Conclusions

This systematic review revealed that studies in Boccia are scarce compared to other sports, and specifically in the domain of performance are residual. This Paralympic sport has been analysed based in a great diversity of sport disciplines, but specifically considering “*Coaching Science*” there is a great space and need for further research, to improve training conditions and optimize sports performance. The search for better training strategies with the desire of competitive enhancement also seems something that should be the object of further study. It is important to continue improving functional classification with the goal to promote equal opportunity in competition classes in sports involving people with disabilities. This summary will be useful for researchers and coaches aiming for information to improve daily training basis and performance in Boccia.

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## Appendix A.

## Most relevant studies related with performance in Boccia.

Author/s, year, and title	Discipline	Keywords	Description	DQ
Ichiba T, Okuda K, Miyagawa T, Kataoka M, & Yahagi K. (2020) Relationship between pulmonary function, throw distance, and psychological competitive ability of elite highly trained Japanese boccia players via correlation analysis	APA SEPh SMe	Boccia athletes, Competitiveness, Disability, Health disparity, Health promotion, Physical activity, Rehabilitation, Respiratory function, Respiratory system.	This study aimed to determine the relationship between pulmonary function, pitching distance, and psychological competitive ability of Japanese boccia players. The results raise the question as to whether focusing on the development of boccia players' competitive ability and physical function will improve their overall performance. The study warrants future investigation.	A
Reina, R., Domínguez-Díez, M., Urbán, T., & Róldan, A. (2018) Throwing distance constraints regarding kinematics and accuracy in high-level boccia players	APA SB	Biomechanics, Sport technique, Sport performance, Paralympic sport.	The aim of the study was to investigate whether different throwing distances might have an impact on kinematics and accuracy across repeated throws. Positive correlations were found between throwing speed and accuracy for medium distances, and negative correlations regarding long distances.	A
Roldan, A., Sabido, R., Barbado, D., Caballero, C., & Reina, R. (2017) Manual Dexterity and Intralimb Coordination Assessment to Distinguish Different Levels of Impairment in Boccia Players with Cerebral Palsy	APA MD	Box and block, Cerebral palsy, Neurological impairment, Para-sport, Paralympic, Tapping test.	The study aimed to design new sport-specific coordination tests to assess impaired manual dexterity and intralimb coordination in boccia players. Afterward, quantify to what extent their coordination is impaired compared to a control group (CG) without neurological impairments. Participants with cerebral palsy scored significantly worse in all the coordination tests compared to the CG.	A
Marques, R.F.R., Marivoet, S., de Almeida, M.A.B, Gutierrez, G.L., Menezes, R.P., & Nunomura, M. (2015) Media approach over Paralympic Sport: Perspectives of Portuguese athletes	APA SI SS	Paralympic, Media, Sport for Person with Disability, Sociology of Sport.	The aim of this study was to identify the characteristics and trends of the media approach over Paralympic movement, based on personal perceptions of nine Portuguese Paralympic athletes. The main conclusions were the discontent of athletes with low media coverage, with supercrip stigma and the supremacy of football (soccer), becoming evident the manifestation of a desire to occupy a space of more prominent sports field, which confer them greater legitimacy and possibility of athletic-competitive development, besides financial and social gains.	B
Tsai, Y.S., Yu, Y.C., Huang, P.C., & Cheng, H.Y.K. (2014) Seat surface inclination may affect postural stability during Boccia ball throwing in children with cerebral palsy	APA MB MD	Control, Motor activity, Rehabilitation.	The aim of the study was to examine how seat surface inclination affects Boccia ball throwing movement and postural stability among children with cerebral palsy (CP). The anterior-inclined seat yielded superior postural stability for throwing Boccia balls among children with bilateral spastic CP, whereas the posterior-inclined seat caused difficulty.	A
Huang, P.C., Pa, P.J., Ou, Y.C., Yu, Y.C., & Tsai, Y.S. (2014) Motion analysis of throwing Boccia balls in children with cerebral palsy	APA MD SB	Biomechanics, Movement, Control.	This study investigated the differences between children with cerebral palsy (CP) and normally developed children regarding throwing patterns of Boccia balls. Participants with CP seemed to mainly use head and shoulder movements to bring the Boccia balls forward with limited torso movement. Normally developed participants brought the Boccia ball forward with faster torso and greater elbow movement while stabilizing head and shoulder movements.	A
De la Vega, R., Galán, Á., Ruiz, R., & Tejero, C.M. (2013) Precompetitive mood and perceived performance in Paralympic Boccia	APA SEPs	Sport psychology, Mood, Perceived performance, Boccia, Paralympic Games, Disability.	This study examines the mood profile of the Spanish National Boccia team at the Paralympics in Beijing '08. The results reveal a stable pattern of emotional non-alteration, although the degree of depression is statistically higher in collective competition compared to individual competition, while it is obtained that fatigue is associated with perceived sports performance in individual competition. The importance of continuing to deepen the relationship between moods and perceived performance in contexts of high competition for people with disabilities was emphasized.	A
Fong, D.T., Yam, K.Y., Chu, V.W., Cheung, R.T., & Chan, K.M. (2012) Upper limb muscle fatigue during prolonged Boccia games with underarm throwing technique	APA MB	Paralympics, Muscle mechanics, Performance, Electromyography.	This study investigated the acute fatigue pattern in neuromuscular activity after a simulated Boccia game and the effect of fatigue pattern on sport performance. Fatigue on the upper trapezius muscle was demonstrated in elite Boccia athletes following a prolonged Boccia game and may have affected Boccia performance.	A
Morriss, L. & Wittmannová, J. (2010) The effect of blocked versus random training schedules on Boccia skills performance in experienced athletes with cerebral palsy	APA MD	Cerebral palsy, Boccia, Motor skills, Performance, Blocked and random training schedules.	The aim of study was to measure the effect of blocked versus random training schedules on boccia skills performance. findings and individual cases of improvements plus athletes and coaches' remarks indicated a practical significance towards blocked training schedules over random training schedules in terms of improving Boccia skills performance.	A

DQ - Document's quality