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Profile of injuries in wheelchair basketball athletes in Greece

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Προφίλ τραυματισμών αθλητών καλαθοσφαίρισης με αναπηρικό αμαξίδιο στην Ελλάδα

Abstract at the end of the article

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Introduction: Wheelchair basketball is one of the most spectacular and popular sports of Paralympic Games. However, few studies have information about injury patterns and risk factors in athletes with disabilities. **Aim:** The aim of this study was to record injuries in athletes with physical disabilities who participated in the 22nd Panhellenic Wheelchair Basketball Championship during the 2019 season and to investigate the the causative factors of injuries. Material and M**ethod:** The sample of the research consisted of 42 elite wheelchair basketball players with a mean age of (SD=36±1.69 years) and average years of participating in international competitions (SD=7,93±1.63years). As a measuring instrument was used a structured and appropriately adapted questionnaire injuries for wheelchair athletes by Malliou et al. (2007). The anonymous questionnaires were distributed to athletes during the week of competition. **Results:** The results of the research showed that 57.1% of all athletes reported musculoskeletal injuries. The majority of injuries were acute at 62.5%, while overuse injuries were at 37.5%. Most injuries occurred in the anatomical area of the shoulder, followed by the wrist/fingers, elbow and with the smallest percentage the waist.The most common overuse injuries were tendinopathy/tendonitis while the most common acute were muscle injuries (sprains, strains). The main causative factors of injuries were due to bad technique, due to overuse, direct contact or impact from an opposing player and due to insufficient warm-up. The majority of athletes were absent from training for 8-28 days due to the severity of their injuries. **Conclusions:** The results of the present study, identifying the causes and mechanisms of sports injuries will help coaches and physiotherapists to develop appropriate preventative measures and rehabilitation programs with the ultimate goal of reducing the incidence

of injuries and better performance of athletes in wheelchair basketball.

Keywords: *disability, external risk factors, prevention, sports injuries, wheelchair basketball players*

Introduction

Physical activity through sport is an effective means of achieving physical, emotional health and social well-being.[1] In addition to the benefits of physical health and fitness, participating either in a recreational or competitive sport promotes improved self-esteem and provides a sense of belonging, thus empowering people with disabilities.[2] In recent decades, the participation in sports activities for people in wheelchairs has increased exponentially despite the challenges and daily problems they face. More than 10 wheelchair sports have been added to the official Paralympic Games list.[3] These sports can be from martial arts such as wheelchair fencing, non-contact sports such as wheelchair table tennis and contact sports such as rugby and wheelchair basketball.

An increasing number of athletes's training and competitions, the pursuit of high efficiency and performance can increase the risk of injury.[4] The epidemiology of injuries in Olympic sports has been thoroughly studied [5-7] while in Paralympic sports information on injury patterns, causal risk factors and management strategies for wheelchair athletes is limited.[8-9] International sports federations have implemented a standard system for reporting and recording injuries during championships, however, few scientific studies have investigated injuries to athletes with disabilities during official games other than the Paralympic Games.[10]

Wheelchair basketball is one of the most spectacular and popular sports of Paralympic Games.[11] It is a physical contact sport and is distinguished for its unique style, the fast flow of the match and the constant alteration of phases with continuous offensive movements and defensive techniques.[12-13] The International Wheelchair Basketball Federation estimates that approximately 30,000 people participate in wheelchair basketball around the world.[10]

The rules of a game and the basic skills of wheelchair basketball players are similar to those of able bodied players.[14] The differences in a basketball game are the 35 seconds for the attack event as well as the two hands (movement) by the athlete for the propulsion of wheelchair. At the pre-competition season, athletes are classified based on a scoring system used to classify the athlete's functional ability to perform movements in basketball.[15] The classification depends to a large extent on the level of disability. Athletes, depending on their abilities and limitations, are evaluated in the balance and mobility of the torso, as well as in handling the ball and the wheelchair. The classification system classifies athletes using a range of 1 to 4.5 points with the lowest number representing a high degree of disability. In case an athlete's characteristics do not exactly fit into a category then the examiner can grade the athlete by half a point (1.5, 2.5 or 3.5).[16] In a wheelchair basketball game can participate only one able-bodied athlete and the total score of the five players on the court should not exceed 14 points.[15]

Scientific studies have shown that athletes with physical disabilities are more prone to musculoskeletal injuries than able-bodied athletes.[8,17] It is a fact that wheelchair users rely more on the upper extremities to promote and use the wheelchair during the daily activities and also in sports, resulting in more frequent injuries to the shoulder girdle area.[18,19]

This finding is not surprising given that wheelchair athletes such as (wheelchair basketball, wheelchair table tennis, wheelchair fencing and boccia) constitute a significant percentage of participants in the Paralympic Games.[20] Wheelchair basketball players, due to the constant use of the upper limbs to promote the wheelchair, have an increased risk of pain and injury to their upper limbs, especially in the shoulder area.[11,21] In addition, repetitive activities such as shooting or rebounding, ball handling, and constant movements with the wheelchair, aggravate this condition.[11] Other common injuries to wheelchair basketball players include wrist, neck and lower back due to rapid high-intensity movements.[22]

The fact that injuries are an unfortunate and seemingly inevitable consequence of participating in sports is no less true for athletes with disabilities than for able-bodied athletes. A relatively daily shoulder injury

Table 1. *Anatomical area of injuries in wheelchair basketball players*

Anatomical area of injury	Number	%
Shoulder	13	48.1
Wrist / fingers	5	18.5
Elbow	5	18.5
Waist	4	14.9
Total	**27**	**100**

Table 2. *Type of injury in wheelchair basketball players*

Type of injuries	Number	%
Tendinopathy/ tendonitis	11	45.8
Muscle injury (Sprain,strain)	6	25.0
Fracture	2	8.3
Dislocation	1	4.2
Other (abrasions, bruises, burns)	4	16.7
Total	**24**	**100**

can be a simple inconvenience for an able-bodied athlete, however for a disabled athlete it can have serious implications for his daily life and jeopardize his ability to participate in sports.[23] Injuries related to participation in competitive sports for people with physical disabilities have significant effects on health and improvement of each athlete. An injury can cause great concern to the athlete as it will limit his athletic ability, will force him to be absent from training or competitions but it can also an injury may lead to morbidity and mortality.[7,24,25] Injury can be either acute due to an injury (skin injuries, bruises, ruptures, sprains and strains and less often fractures and dislocations) or chronic injury due to overuse or repetitive strain (tendonitis and bursitis). Location of injury appears to depend on the type of sport and the physical deficits of each athlete with a physical disability.[16]

Several researchers have argued that overuse and muscle imbalance are important causative factors for injuries in wheelchair athletes.[26,27] Also, Patel et al (2018)[28] found that wheelchair athletes are completely dependent on their upper extremities for mobility and for the execution of their sports activities. The combination of muscle imbalance and repetitive mictotrauma occurs more often as subacromial impingement, but may also develop into some other pathology. Repetitive movements and pressures that the shoulder joints receive can lead to rotator cuff tears[29] or even in joint degeneration.[30,31] Finley and Rodgers (2004)[32] also found that shoulder instability can lead to shoulder impact syndrome. Other types of wheelchair injuries mentioned include elbow epicondylitis and as well as De Quervain's Tenosynovitis, a condition caused by irritation of the thumb tendons due to overuse, repetitive grasping or inflammatory conditions.[22] In the research of Wilroy and Hibberd (2017)[33] conducted among wheelchair basketball players it was found that in a six-week program that included strengthening exercises with therapeutic bands and stretching, improved shoulder range of motion and reduced pain in athletes.

In a study conducted during the Summer Paralympic Games in Rio de Janeiro (2016) by (Derman et al 2018),[9] the purpose was to record the frequency of injuries in pre-competition (pre-race) period and during games. The research involved 3657 athletes (2268 men & 1389 women) from 78 countries, representing 83.4% of all athletes and monitored with the electronic injury recording system in 51198 days of athletes. In total, 510 injuries were reported during the 14 days of the race, with an injury rate of 10.0 injuries/1000 sports days (12.1% of all athletes surveyed). The Wheelchair basketball players who participated in this research were 228 athletes (132 men & 96 women) and injuries were recorded were 41 (8.0% of the total injuries) with an incidence rate of 12.8 (9.5 to 17.4).

A similar study was conducted by Willick et al., (2013)[34]

Table 3. *Causative factors of injuries in wheelchair basketball players*

Causative factors of injuries	Number	%
Bad technique	9	25.7
Overuse	7	20.0
Direct impact from an opposing player	6	17.1
Insufficient warm-up	4	11.4
Poor physical condition	3	8.6
Direct impact with a ball	3	8.6
Direct impact from a wheelchair	2	5.7
Other (falls, fatigue)	1	2.9
Total	**35**	**100**

Table 4. *Severity of injuries in wheelchair basketball players*

Severity of injuries	Number	**%**
Light (1-3 days)	0	0,0
Mild (4-7days)	3	12.5
Moderate (8-28 days)	16	66.7
Severe (more than 28 days)	5	20.8
Total	**24**	**100**

during the Summer Paralympics Games in London (2012), the purpose was to study the incidence and nature of injuries. The sample of the research consisted of a total of 3565 athletes (2347 men & 1218 women) who represented 84% of all athletes. Out of the total of 633 injuries recorded in a sample of 539 athletes, 437 injuries occurred in men and 196 in women. The injury rate was 12.7 injuries/1000 sports days. The Wheelchair basketball players who participated in this research were 202 athletes and injuries were recorded were 34 of the total injuries, with an incidence rate of 12.0 (8.3 to 16.8). The majority of injuries were acute injuries with a percentage (65%), followed by overuse injuries with a percentage (23%) and acute injuries that became chronic with a percentage (12%).

The researchers Patatoukas et al., (2011),[35] recorded sports-related injuries to Greek athletes with disabilities. The study was conducted during the 2000 Panhellenic Championship for Athletes with Disabilities that was held in Athens as the final qualification test for the 2000 Paralympic Games in Sydney. The sample of their research was 139 elite athletes who participated in seven Paralympic sports (Wheelchair Basketball, track and field, swimming, gym, powerlifting, wheelchair dancing, shooting). Athletes (n=86, 61.9%) participated in one sport and athletes (n=53, 38.1%) participated in two or more different sports. The results of the research revealed a total of 178 injuries in 69 athletes. Specifically, 27 athletes reported one injury and 42 athletes reported 2 to 10 injuries. In the sport of Wheelchair Basketball participated a total of 34 athletes and were recorded 55 injuries with the percentage of injuries (30.9%) showing the highest injury rate of the other sports.

In a study conducted during the 1992 Barcelona Paralympic Games, researchers[36] reported that 79% of wheelchair basketball players were injured during training or competition.Wheelchair basketball is considered a sport with a high risk of injury compared to low-risk sports such as swimming, archery and shooting. [37] Curtis and Dillon (1985)[38] conducted a study with a sample of the National Team of Wheelchair Athletes. In the research participated 128 athletes (101 men, 27 women). The 93 athletes who reported injuries suffered a total of 291 injuries. The percentage of athletes who participated in the sport of Wheelchair Basketball was 71%. In the sport of Wheelchair Basketball were recorded 84 injuries. Of the total number of injuries (291 injuries which reported in this study the sport of wheelchair basketball had the highest injury rate (24%).

In summary, wheelchair basketball is a physical contact sport or conflict between players, where the frequency of serious injuries such as fractures or dislocations is low.[37,39] However, several scientific studies have identified musculoskeletal pain and other injuries mainly in the anatomical

area of the shoulder.[11,40] Other anatomical areas of injury include the wrist, neck, and lumbar spine due to high-intensity wheelchair movements.[22]

The existing literature on the injuries of disabled athletes indicates the high risk of injury and pain due to the constant use of the upper extremities. Despite the growing interest there are few studies who have investigated the external causative factors of injury in elite wheelchair basketball players.[41] The aim of this study was to investigate the causative factors of injury in Greek wheelchair basketball players and also to record the anatomical area of the injury, the type and severity of injuries.

Methods

Participants

The sample of the study consisted of 42 wheelchair basketball players with a mean age 36 ± 1.69 years, a mean height 1.78± 0.08 cm, a mean weight 80.09 ± 15.99 kg and average years of participation in international competitions 7.93 ±1.63 years who participated in the 22nd Panhellenic Wheelchair Basketball Championship (National Category A2) during the 2019 season.

Measures

The injury recording and investigation questionnaire of Malliou et al (2007)[42] was used to record and investigate injuries after being adapted accordingly for the needs of the present study. It includes a total of 37 questions about injuries (types of injuries, anatomical area, severity of injuries, external risk factors and questions with demographic characteristics and details related to the training of athletes (competition experience, frequency and training hours per week, etc.). The anonymous questionnaires were distributed during the week of the competition and training. Completion of the questionnaire was voluntary, as the necessary instructions from the researchers were given and the participants reported the most important injuries during the last 12 months that they cost them at least a week away from training or competition.

Procedure

Athletes after communication of the researchers with the National Federation of Greek Wheelchair basketball players and the granting of relevant license, were informed about the purposes of the reasearch and the confidentiality of their answers. The anonymous questionnaires were completed voluntarily by athletes during the start week of the games 2019 season.

Statistical Analysis

For the statistical processing of the research data, frequencies analyzes were performed to extract percentages related to the injuries, type, severity and anatomical area of the injury and the non-parametric X^2 distribution (Chi square distribution) to investigate the relationship between injuries and causative factors. The significance level was set at $p < .05$.

Results

The statistical analysis of the results showed that 57.1% (n=24) of athletes with disabilities reported that they had injuries during the last 12 months that cost them at least a week away from competitions or training. Most injuries were recorded during games/competitions (58.3%, n = 14) and the percentage of injuries during training was lower (41.7%, n = 10). The majority of injuries were acute at 62.5% (n = 15) followed by overuse injuries at 37.5% (n = 9). The most commonly injured anatomical area was shoulder, followed by wrist / fingers, elbow and with a smaller percentage was the waist (Table 1)

The most common injuries of overuse injuries were tendinopathy/tendonitis while the acute injuries were muscle injuries (sprains/strains). The majority of injury types were tendinopathy/tendonitis, followed by muscle injuries (sprains /strains) and other injuries (e.g abrasions, bruises, burns) and more rarely were fractures and dislocations (Table 2).

According to the personal opinion of the athletes, the causative factors of their injuries were due to bad technique, due to overuse, direct impact from an opposing player and insufficient warm-up. Also, with the same percentage were due to poor physical condition and direct impact with a ball, while a smaller percentage was due to direct impact from a wheelchair and other reasons (falls, fatigue)(Table 3).

Regarding the severity of the injury, the injury of the athletes was characterized as moderate and the athletes had to abstain from training for 8-28 days (66.7%), followed by the injury that was characterized as severe and the athletes had to abstain from training for more than 28 days (20.8%). While with a percentage (12.5%) their injury was characterized as mild and the athletes abstained from training for 4-7 days (Table3).

Discussion

The results of the present study showed that the majority of athletes with disabilities who participated in 22nd Panhellenic Wheelchair Basketball Championship during the season 2019, had injuries and only 18 athletes did not

report any injuries. Most injuries occurred during games (58.3%) and fewer during training (41.7%). The results of the present study are consistent with a study by Rocco and Saito (2006) conducted on a sample of 26 wheelchair basketball players and found that 77% of athletes were injured, either by acute or overuse during games or training.

Also, the statistical analysis of the results showed that most of the injuries were in the upper extremities and specifically in the area of the shoulder girdle. The results of the present study were similar to other researches that have been carried out.[11,19,40] Similarly, a study by Hoeberigs and Verstappen (1984) [43] reported that 42% of wheelchair basketball players experienced upper extremity pain, with 34% of the pain located in the deltoid region.

In addition, the recording of sports injury data showed that the majority of injuries were acute with a rate of 62.5% while with a smaller percentage were overuse 37.5%. Among the acute injuries, the most common were muscle injuries (sprains//strains) while the overuse injuries were tendon tendinopathy/ tendonitis.

Researchers, Willick et al., (2013)[34] studied the incidence and nature of injuries during the Summer Paralympics Games in London (2012), and recorded 633 injuries in 539 athletes. The Wheelchair basketball players who participated in this research were 202 athletes and injuries were recorded were 34 of the total injuries. The majority of injuries were acute injuries with a percentage (65%), followed by overuse injuries with a percentage (23%) and acute injuries that became chronic with a percentage (12%). Generally, wheelchair basketball is a sport of physical contact or conflict between players and the incidence of serious injuries such as fractures or dislocations is low.[37,39]

As for the causal factors of injuries, according to the personal opinion of the athletes, the results showed that it was mainly due to poor technique, followed by overuse, direct impact from an opposing player and lack of adequate warm-up. The results were also similar to other researches[44] which recorded that overuse, lack of proper warm-up and poor flexibility in shoulder, repetitive movements above the level of the head as well as fatigue, can contribute significantly to the shoulder impact syndrome, in wheelchair basketball players. The majority of athletes in the present study with a percentage (66.7%), had to be absent from training for 8-28 days, due to the severity of their injury.

Several injury prevention techniques are already applied to able-bodied basketball players during training or competition and usually involve the use of tape.[45] In addition, stretching is known to be an important factor in preventing injury during the warm-up and during recovery as they reduce the stiffness of the connective tissue and increase the range of the joint.[33] Stretching is effective for the treatment of orthopedic conditions or injury, however, few athletes with disabilities use them.

It's important to make changes to both the technique and the training standards with mechanisms such as "learning a new wheelchair promotion technique" as well as with injury prevention measures, which not only lead to maximizing active participation and performance [44] but they are also important preventative factors, which should be taken seriously by coaches and as well as by athletes to reduce the incidence of wheelchair injuries.

Coaches and rehabilitation specialists should take into account the results of the present research on type, frequency and anatomical area of injuries, as well as the causative injuries risk factors to be able to properly manage training units (intensity, quantity, duration) and training methods. Furthermore, they will be able to design effective injury prevention and rehabilitation programs with the aim of reducing injuries. Such a result will lead to a massive participation of athletes with mobility disabilities in the sport of wheelchair basketball and will continue, long-term participation and better performance for athletes.

Conclusion

Due to the increasing growth of wheelchair basketball, further research is necessary to strengthen these findings. Understanding and identifying sports injuries and causative factors of the study will provide useful information to coaches and rehabilitation specialists to improve rehabilitation and treatment protocols in disabled atheltes. These findings however need to be substantiated with larger studies to provide generalizable results.

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Conflict of interest: The authors declare that they have no conflict of interest

ΠΕΡΙΛΗΨΗ

Προφίλ τραυματισμών αθλητών καλαθοσφαίρισης με αναπηρικό αμαξίδιο στην Ελλάδα

Αναστασία Καγιάογλου, Παρασκευή Μάλλιου, Αναστασία Μπενέκα, Ασημένια Γιοφτσίδου
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Εισαγωγή: Η καλαθοσφαίριση με αμαξίδιο είναι ένα από τα πιο θεαματικά και δημοφιλή αθλήματα των Παραολυμπιακών Αγώνων. Ωστόσο, λίγες μελέτες έχουν πληροφορίες σχετικά με τα πρότυπα τραυματισμών και τους παράγοντες κινδύνου σε αθλητές με αναπηρία. **Σκοπός:** Σκοπός της παρούσας μελέτης ήταν η καταγραφή των τραυματισμών σε αθλητές με κινητικές αναπηρίες που συμμετείχαν στο 22ο Πανελλήνιο Πρωτάθλημα Καλαθοσφαίρισης με Αμαξίδιο κατά την αγωνιστική περίοδο 2019 και η διερεύνηση των αιτιολογικών παραγόντων των τραυματισμών. **Υλικό και Μέθοδος:** Το δείγμα της έρευνας αποτέλεσαν 42 επίλεκτοι αθλητές καλαθοσφαίρισης με αναπηρικό αμαξίδιο με μέση ηλικία (SD=36±1,69 έτη) και μέσο όρο ετών συμμετοχής σε διεθνείς αγώνες (SD=7,93±1,63έτη). Ως όργανο μέτρησης χρησιμοποιήθηκε ένα δομημένο και κατάλληλα προσαρμοσμένο ερωτηματολόγιο τραυματισμών για αθλητές με αναπηρικό αμαξίδιο των Malliou et al. (2007). Τα ανώνυμα ερωτηματολόγια διανεμήθηκαν στους αθλητές κατά τη διάρκεια της εβδομάδας των αγώνων. **Αποτελέσματα:** Τα αποτελέσματα της έρευνας έδειξαν ότι το 57,1% του συνόλου των αθλητών ανέφερε μυοσκελετικούς τραυματισμούς. Η πλειονότητα των τραυματισμών ήταν οξείς σε ποσοστό 62,5%, ενώ οι τραυματισμοί υπερχρήσης ήταν σε ποσοστό 37,5%. Οι περισσότεροι τραυματισμοί συνέβησαν στην ανατομική περιοχή του ώμου, ακολουθούμενοι από τον καρπό/δάχτυλα, τον αγκώνα και με το μικρότερο ποσοστό στη μέση. Οι πιο συνηθισμένοι τραυματισμοί υπερχρήσης ήταν τενοντοπάθειες/τενοντίτιδες, ενώ οι πιο συνηθισμένοι οξείς ήταν μυϊκοί τραυματισμοί (διαστρέμματα, διαστρέμματα). Οι κυριότεροι αιτιολογικοί παράγοντες των τραυματισμών οφείλονταν σε κακή τεχνική, σε υπερβολική χρήση, σε άμεση επαφή ή κρούση από αντίπαλο παίκτη και σε ανεπαρκή προθέρμανση. Η πλειονότητα των αθλητών απουσίαζε από την προπόνηση για 8-28 ημέρες λόγω της σοβαρότητας των τραυματισμών τους. **Συμπεράσματα:** Τα αποτελέσματα της παρούσας μελέτης, προσδιορίζοντας τα αίτια και τους μηχανισμούς των αθλητικών τραυματισμών, θα βοηθήσουν τους προπονητές και τους φυσιοθεραπευτές να αναπτύξουν κατάλληλα προληπτικά μέτρα και προγράμματα αποκατάστασης με απώτερο στόχο τη μείωση της συχνότητας των τραυματισμών και την καλύτερη απόδοση των αθλητών στην καλαθοσφαίριση με αμαξίδιο.

Λέξεις-κλειδιά: *Αναπηρία, εξωτερικοί παράγοντες κινδύνου, πρόληψη, αθλητικοί τραυματισμοί, καλαθοσφαιριστές σε αναπηρικό αμαξίδιο*

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