



## Sports Injuries Among Players of the Polish National Team in Amputee Football in the Annual Training Cycle

by

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*The aim of the study was to determine the frequency, type and origin of the occurrence of injuries in amputee football. The studied group comprised all members of the Polish national amputee football team (n = 25). During the 9-month observation period, 13 players incurred 22 injuries. The incidence proportion was 48.0 per 100 athletes (95% CI, 28.4-67.6) and the incidence rate was 5.73 per 1000 athlete-days (95% CI, 3.33-8.12). The study showed that 32.8% of the injuries were to the thigh, 13.6% to the ankle, and 9.1% to the knee. The obtained results indicate that amputee football players rather frequently incur play-related injuries, but a single athlete incurs relatively few of them, with the lower limb being most commonly injured.*

**Key words:** trauma, limbs amputations, team sports, adapted sports, physical disability.

### Introduction

Although participation in sport offers distinct physical, mental and social benefits, it is also associated with a significant risk of sustaining injuries which may have long-lasting effects. Accordingly, sport injuries and fear thereof may either preclude one from participation in sports or affect one's life in another manner. The incidence, prevalence and type of sports injuries vary depending on the sports discipline, age, sex, flexibility, and proprioception of its players, local climate, type of surface on which the sport is played and its equipment (Sallis et al., 2001; Bahr & Holme, 2003; Ristolainen et al., 2009). The most common definition of a sport injury determines it as any injury or trauma which prevents, limits or modifies one's participation in sport for at least one day (Ferrara & Peterson, 2000). Sports injuries can be classified into acute and chronic (overuse) injuries. Acute injuries most commonly result from a single traumatic incident involving contact or non-contact forces (Yang et al., 2012), whereas chronic injuries result from repetitive and cumulative micro-traumas (Fuller et al., 2006, 2007).

Sports injuries in able-bodied athletes most often interrupt or cut short an athlete's career (Laux et al., 2015), but can also be a burden for the society, with funds needed for medical treatment, physical therapy, and offsetting reduced work capacity (*Textbook of Sports Medicine*, 2002). For athletes with disabilities, sports injuries have more serious consequences, since this group often experience difficulties in accessing emergency and ongoing healthcare services or obtaining appropriate treatment (Vanlandewijck and Thompson, 2011). Additionally, consequences of serious sport related injuries in athletes with disabilities tend to go well beyond expected changes in sports participation, work capacity and leisure patterns, directly affecting the athletes' activities of daily living (Bauerfeind et al., 2015; Fagher and Lexell, 2014; Ferrara and Peterson, 2000; Urbański et al., 2021). Previous studies have demonstrated the existence of at least two models of the injury occurrence in athletes with disabilities, classified according to either the type of disability or the sports discipline (Willick and Webborn, 2011). Even though some researchers have claimed that the incidence of sports injuries is similar in able-

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bodied athletes and athletes with disabilities, athletes participating in Paralympic sports usually incur only minor injuries and are often cleared to resume their training in less than seven days (Ferrara and Peterson, 2000; Nyland et al., 2000).

The number of athletes with disabilities participating in sports and the popularity of sporting events for such athletes are steadily increasing. Some athletes with disabilities have professionalized their participation, increasing their performance and training times (Fagher and Lexell, 2014). In consequence, sports science researchers and the International Paralympic Committee have jointly recommended to increase efforts to collect epidemiological data to better inform injury prevention programs for athletes with disabilities (Kasińska and Tasiemski, 2017; Wieczorek et al., 2017; Gunaydin 2020, 2021). Indeed, the data indicate that the growing professionalization of that group directly results in an ever-increasing number of sports injuries. During the 2002 Winter Paralympics, every tenth athlete suffered an injury (Webborn et al., 2016); in Beijing during the 2008 Summer Paralympics, over 2,000 medical interventions were recorded (Willick and Webborn, 2011), while during the 2016 Paralympic Games in Rio, a total of 510 injuries were reported over two weeks (Derman et al., 2018).

Relevantly to this study, football is classified as a sport with one of the highest injury incidence rates (IRs) among athletes with disabilities. During the London 2012 Paralympic Games, participation in a 5-a-side of football was considered most risky (Willick et al., 2013), whereas during the Rio 2016 Paralympic Games the sports with highest IRs were 5-a-side football, judo, and 7-a-side football (Demers et al., 1999). Amputee football is a relatively new sport for people with unilateral amputations/defects of upper and lower limbs. According to player selection criteria in amputee football, a participant with an amputated or damaged lower limb can play as a field player and a participant with an amputated or damaged upper limb can play as a goalkeeper. In many respects amputee football resembles traditional association football, with some key differences: the outfield players use crutches, the pitch is smaller (40 x 60 m) and the game itself is played by 7 players, with one match consisting of two halves of 25 min each. Rapidly

rising in popularity, amputee football players intend to have their discipline registered in the Paralympic Games program; accordingly, it is of vital importance to assess how injury-prone its players are going to be.

Sport injuries in amputee football have been the subject of two publications so far (Kasińska and Tasiemski, 2017; Wieczorek et al., 2017), with both studies classifying it as a low-risk discipline. However, those authors did not provide any IR in their texts, impeding attempts to accurately compare IRs in this and other types of football. The lack of data on sports injuries among athletes with disabilities contrasts sharply with a wealth of information on injuries of able-bodied players; the disparity arises due to better testing practices, since able-bodied players are routinely tested during every major sports event and at the end of the playing season (Junge and Dvořák, 2015; *UEFA Injury Study Report*, 2016).

Due to many similarities among amputee football, 5-a-side football, 7-a-side football, and football of able-bodied players, we assumed that players with amputations would suffer from injuries of a similar frequency and type (Webborn et al., 2016; Willick et al., 2013; *UEFA Elite Club Injury Study*, 2017), but with more severe consequences for their daily activities. Permanent or prolonged damage to a remaining healthy lower limb can lead to forced locomotion by means of a wheelchair. Therefore, the main goal of this study was to determine the characteristics, IRs, incidence proportion (IP), and time of recovery from sports injuries in the Polish national amputee football team during an annual training cycle.

## Methods

### *Participants*

All members of the Polish national amputee football team (n = 25) took part in the study. Players represented five clubs from diverse locations in Poland. All players were male. The average age of the player was 29 years (SD = 7.9), 48% of all players received university education. The majority of participants acquired their disability during their lives (n = 20), whereas five persons stated that their limb defects were congenital. Among those who acquired their injuries, 14 amputations resulted from traffic accidents, four from cancer and two from other

diseases. Ten players had a leg amputation above the knee (A2) and another 10 below the knee (A4). Among participants, six players declared that they played as strikers, nine as midfielders and ten as defenders (goalkeepers were not included in this study). On average, the study participants trained for 3.42 years (SD = 2.1), 32% of surveyed athletes played football before the incident which led to amputation.

#### Measures

Three research tools were used in this study:

- 1) A personal survey related to demographic data of participants: their age, sex, education, occupation, the date of injury or its diagnosis, the type of disability.
- 2) A register of sports injuries which were not consulted with a physician. Athletes provided information about injuries (their type, anatomical region, time taken off training while the injury healed) and circumstances thereof (the place, situation on the pitch that led to the injury, the phase of a game or training when the injury occurred as well as the type of activity which resulted in the injury). The data about injuries were collected by the club physiotherapist on the day of the injury (Kasińska and Tasiemski, 2017).
- 3) A register of sports injuries which were consulted with a physician. The register included information about circumstances of the injury, the date of consultation with a physician, conducted diagnostic tests, diagnosis, recommended treatment and its duration, time taken off training while the injury healed and duration of lingering trauma aftereffects, if any (Kasińska and Tasiemski, 2017).

#### Design and Procedures

The structure of this study was designed to take into account previous recommendations made by researchers of sports injuries of athletes with disabilities (Fagher and Lexell, 2014; Willick et al., 2013). The study period encompassed one playing season of nine months (from February to October). Participants were asked to complete a personal questionnaire at the beginning of the study; subsequently, they were to complete a record of medically consulted or non-consulted injuries every time they incurred one. The research was carried out by a physiotherapist working with players of the Polish national

amputee football team in cooperation with local club physiotherapists. All players were informed about the aim of the study and could withdraw from the study at any moment.

#### Statistical Analysis

The IBM Statistical Package for Social Sciences (v. 21.0; IBM SPSS, Chicago, IL, USA) was used for statistical analysis of the collected data. The examined qualitative demographic data were presented in terms of frequency (n) and percentages (%), and quantified using the mean, standard deviation (SD) and 95% confidence intervals (CI). The normality of the distribution of variables was checked with the Shapiro-Wilk test. Due to the lack of normal distribution of particular variables, a non-parametric test (Mann-Whitney U test) was used to assess differences between the groups i.e., athletes with and without sport injuries. The effect sizes were calculated as the difference between means divided by the pooled SD. Using Cohen's (1988) criteria, an effect size  $\geq 0.20$  and  $< 0.50$  was considered small,  $\geq 0.50$  and  $< 0.80$  medium, and  $\geq 0.80$  large (Cohen, 1988). Two injury indicators i.e., the IR (95% CI) and IP (95% CI) were calculated (Knowles et al., 2006). Both indicators and estimated standard error (SE) were calculated in the following way:

$$IR = \text{injuries/athlete-exposures} \times 1000$$

$$\text{Estimated SE} = \frac{\sqrt{\#injuries}}{\sum \text{person-time}}$$

$$95\% \text{ CI: } (IR \pm 1.96 \times SE) \times 1000$$

$$IP = \text{injured athletes/athletes on the team during one season}$$

$$\text{Estimated SE} = \sqrt{\frac{IP \times (1-IP)}{n}}$$

$$95\% \text{ CI: } (IP \pm 1.96 \times SE) \times 100$$

## Results

### *The frequency and types of sports injuries in amputee football*

During nine months, 13 out of 25 players participating in the study sustained 22 sports injuries. The age of players who were injured (mean = 27.6 years; SD = 7.1) did not differ significantly ( $p = 0.568$ ) from the age of players who were not injured (mean = 30.8 years; SD = 8.6).

However, training experience (mean = 4.3 years; SD = 1.3) of the injured players was significantly higher ( $p = 0.024$ ;  $d = 1.15$ ) than that of those who did not incur the injury (mean = 2.3 years; SD = 2.1). The overall IR was 5.73 per 1000 athlete-days (95% CI, 3.33-8.12), while the overall IP was 48.0 per 100 athletes (95% CI, 28.4-67.6). Among incurred injuries, participants reported strains ( $n = 10$ ), contusions ( $n = 5$ ), sprains ( $n = 2$ ), fractures ( $n = 2$ ), dislocations ( $n = 1$ ), tears ( $n = 1$ ) and cuts ( $n = 2$ ), of which 14 required medical consultation. One player suffered four injuries, six players suffered two injuries, while the remaining six players suffered one injury each throughout the season. Players playing as forwards ( $n = 5$ ) and midfielders ( $n = 5$ ) sustained eight injuries, while three defenders suffered six sports injuries in total. Most of the injuries involved the intact side of the lower limb (68.2%). Table 1 presents the location of the injuries by the body part.

Twenty-one of all injuries were acute injuries, while one was a chronic injury (a spinal stretch). One participant experienced four injuries (two repetitive instances). The average time taken off training for a player was 9.8 days (SD = 8.8). Six minor injuries required a short break/modification of the training program lasting between one to three days, eight injuries needed a long break/modification of four to seven days and seven injuries necessitated a long break/modification of the training program lasting between eight and 28 days. One injury forced the player to suspend his training program for more than 28 days.

Participants most often incurred injuries during the game: on artificial grass, not caused by crutches, without contact with an opponent. The same number of injuries occurred during sporting events and training. The incidence of injuries in relation to different variables of the game is presented in Table 2.

**Table 1**

*Types and locations of injuries in examined amputee football players*

contusion	strain	sprain	Dislocation	cut	fracture	tear
quadriceps muscle (3)	hamstring (2)	ankle (2)	patella (1)	superciliary arch (1)	fifth metatarsal bone (1)	biceps femoris muscle (1)
shoulder (1)	quadriceps muscle (3)				nose (1)	
ribs (1)	back muscles (3)					
	fibular collateral ligament (1)					
	triceps surae muscle (1)					
(5; 22.7%)	(10; 45.5%)	(2; 9.1%)	(1; 4.5%)	(1; 4.5%)	(2; 9.1%)	(1; 4.5%)

*Note. Contusion – an injury to tissues with skin discoloration and without breakage of skin; strain – an injury to a tendon or muscle (stretch) resulting from overuse or trauma; tear – a term useful for classifying the relative severity of strain, it can be related for ligaments, tendons, muscles; sprain – a common musculoskeletal injury in which the ligaments partially or completely tear due to sudden stretching; dislocation – an injury to a joint in which the ends of bones are forcefully moved from their normal positions; cut – an area of severed skin; fracture – a partial or complete break in the continuity of the bone.*

Table 2

<i>Injury by the game component in amputee football</i>	
Variables of the game	Sport injuries (n = 22)
<i>Surface [n (%)]</i>	
natural grass	8 (36.4%)
synthetic grass	14 (63.6%)
<i>Circumstances [n (%)]</i>	
training	11 (50%)
sporting event	11 (50%)
<i>Crutches [n (%)]</i>	
caused by crutches	3 (13.6%)
not caused by crutches	19 (86.4%)
<i>Contact with an opponent [n (%)]</i>	
yes	9 (40.9%)
no	13 (59.1%)

## Discussion

During the 9-month duration of the study, players of the Polish national amputee football team incurred 22 injuries. The IR was 5.73 per 1000 athlete-days (95% CI, 3.33-8.12). Thus, it has been shown that the IR in the amputee football is lower than in 5-a-side football (IR 22.4 per 1000 athlete-days, 95% CI, 14.1-33.8), and 7-a-side football (IR = 10.4 per 1000 athlete-days, 95% CI, 5.4-15.5), played at the London Paralympics (Webborn et al., 2016; Willick et al., 2013). In turn, the IP level in amputee football was higher (IP 48.0 per 100 athletes, 95% CI, 28.4-67.6) than in 5-a-side football (IP 31.4 per 100 athletes, 95% CI, 20.9-43.6), and 7-a-side football (IP 14.6 per 100 athletes, 95% CI, 7.5-21.6) (Webborn et al., 2016). These data indicate that participation in amputee football induces a higher risk of injury than participation in 5- and 7-a-side football. It is difficult to compare injury rates reported in studies on three types of football for players with disabilities with those reported by able-bodied players of traditional football. For example, the report of the Union of European Football Associations after the 2016 European Championship provided the IR of 22.6 (UEFA Injury Study Report, 2016); nevertheless, that IR was calculated on the basis of the number of injuries suffered per 1000 hours of training/matches, while for persons with disabilities, the IR is calculated on the basis of training/match days (Blauwet et al., 2016; Fagher

and Lexell, 2014). The difference in reporting stems from the fact that regular football as a professional sport usually requires players to train twice a day, while amputee football and many other sports for persons with disabilities are played by amateurs, dividing their time between irregular training (several hours a week), work and other responsibilities.

The results of this study confirmed what previous studies indicated for persons with disabilities playing three kinds of football, i.e., that their lower limbs were most vulnerable to injury. In our study, lower limb injuries amounted to 68.2%, a proportion broadly in line with previous research. In 5-a-side football, 54.5% of injuries concerned the lower limb and in 7-a-side football, this value was of 78.6% (Webborn et al., 2016). Comparable results were also obtained when juxtaposing locations of injury in amputee football and football for able-bodied athletes. In our study, 32.8% of the injuries were to the thigh, 13.6% to the ankle, and 9.1% to the knee. Similarly, during the 2014 Football World Cup in Brazil, 25% of injuries were to the thigh, 12% to the knee and 10% to the ankle (Junge and Dvořák, 2015). During the 2016/2017 football season, 28.9% of injuries were to the thigh, 17.2% to the knee and 15.4% to the ankle (UEFA Elite Club Injury Study, 2017). Thus, this research confirms that athletes with disabilities and able-bodied athletes playing the same sport are exposed to similar injuries resulting from its specificity (Ferrara and Peterson, 2000; Laskowski and Murtaugh, 1992).

On average, players reporting injuries during the study were significantly more likely to have played amputee football for longer time than those players who did not. One possible explanation for this correlation takes into account the fact that experienced players might have accumulated microtraumas which hampered natural recovery mechanisms and made injuries more likely; future studies will likely demonstrate whether this hypothesis is true or not. The average recovery time between injury and return to unimpeded sport activity among our study participants was 9.8 days. Six injuries necessitated only a short recovery time (Fuller et al., 2006). The longest recovery time, i.e., 35 days, was brought about by a tear of the femoral biceps. One player in the study suffered two reinjuries of same body parts. In the first case, the player stretched his ischio-shin muscles (in general) and subsequently tore the femoral biceps; in the second case, the same player pulled his back musculature, an injury which healed and then reoccurred after two months of training.

The data obtained in this study did not match conclusions drawn by authors of previous reports, who claimed that athletes with disabilities mostly incurred only minor injuries. In our study, medically consulted injuries 63.6% ( $n = 14$ ) almost doubled the non-consulted ones 36.4% ( $n = 8$ ). Perhaps the divergence in data sets came from methodological differences as authors of previous reports collected data on abrasions (possibly inflating the number of minor injuries), whereas our study did not include abrasions as a category of injuries (Ferrara and Peterson, 2000; Kasińska and Tasiemski, 2017; Molik and Marszałek, 2013).

Some authors link the location of injury to the type of disability and the discipline practiced (Fuller et al., 2006). Nyland et al. (2000) indicated that visually impaired players and other players with disabilities who practiced in a standing position incurred more lower limb injuries (e.g. in 5-a-side football). Similar results were obtained in our study, with 68% of injuries incurred to the lower limb. In contrast, a study by Klenck and Gebke (2007), having compared players with various types of disabilities, surmised that amputees were more exposed to injuries to the stump than other players (Klenck and Gebke, 2007). However, Klenck and Gebke (2007) did not specify stumps of which limb were most injury-

prone; on the other hand, our data recorded only a single injury of the lower limb stump. The low incidence of stump injuries among players of the Polish national team was perhaps due to the team's consistent use of elastic bandages and specialized stump compression bands under the gaiters to minimize the risk of injury, a practice not mentioned in the article by Klenck and Gebke (2007).

After an injury, a decision whether to return to intensive training or to fully recover is often influenced by multiple factors. Based on previous findings, it is known that many players want to resume their training as soon as possible, either encouraged by coaches or driven by attention they receive due to their sport participation (Podlog and Eklund, 2005), but premature resumption of an intensive training program may result in another injury or negative psychological consequences (Janse van Rensburg and Nolte, 2011; Podlog and Eklund, 2005). To protect athletes' health and reduce incidents of injury and illness are key responsibilities of every coach, who should insist on athletes' receiving medical clearance before their return to active participation, optimally in consultation with a physiotherapist. Ideally, an athlete would receive clearance only in the event of complete recovery, i.e., full range of movement in the affected body part, unimpaired strength, complete neuromuscular control, cardiorespiratory tests, and demonstration of other sport-specific functional skills (Janse van Rensburg and Nolte, 2011).

Some limitations were encountered during this study. First of all, we did not collect information of injury history of players which could be related with injuries during the studied period. Another limitation was the small sample size, however, it consisted of all members of the Polish National Amputee Football team ( $n = 25$ ). Previous research studies, either on 5-a-side ( $n = 70$ ), 7-a-side ( $n = 96$ ) or able-bodied ( $n = 529$ ) football, benefitted from much larger sample sizes; studies on 5-a-side and 7-a-side players included members of all national teams during the London Paralympics, whereas the study on able-bodied players took place during Euro 2016 in France. Future research should ideally include the entire population of amputee football players in Poland (Polish Amputee Football League

members), with a necessary step of appraising their sport performance levels beforehand.

### Conclusions

The obtained results indicate that amputee football players rather frequently incur play-related injuries, but a single athlete incurs

relatively few of them, with the lower limb being most commonly injured. The injury risk in amputee football is comparable with risks in football for abled-bodied, with 5-a-side and 7-a-side football considered high-risk disciplines.

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