

A quantitative analysis of injuries in American football players with a special focus on the most often injured parts of the body

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SUMMARY

American football is a sports discipline involving a high-risk of injuries. The aim of the study is a quantitative analysis of injuries reported by the players. The following aspects have also been assessed: the behavior of the players after suffering from an injury, and the situations most often involving injuries. The research has been conducted on 218 players from teams included in the American Football Association in Poland (PZFA). The findings of the research have confirmed the thesis that American football is a high-risk sports discipline. The most often injured regions of the body have been ankle joint and foot.

Key words: American football, injuries

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INTRODUCTION

American Football (AF) is a contact sport with sources in 19th century sport disciplines in the British Isles. The game involves two teams trying to score the highest amount of points, each team including 11 players. There is also an 8-players in a team version of AF. The players are divided into specific positions, including offence, defence and a special formation to perform kickoffs. Professional AF league matches involve almost exclusively male players [4, 8].

American football is the most popular sport discipline in the US. National Football League (NFL) finals (Superbowl finals) are watched by more than a half of the American TV audience [1, 6]. In Poland, there had been an increasing interest in American football that led to the establishment of the American Football Association in Poland (Polski Związek Futbolu Amerykańskiego – PZFA) in 2004. Consequently, the association led to the creation of the American Football League in Poland (Polska Liga Futbolu Amerykańskiego – PLFA) in 2006. Nowadays, there are Top League, PLFA I, PLFA II and junior league matches organized in Poland. There is also a PLFA and junior league for the 8-player American football version [11].

As a contact sport, AF involves a lot of risk of injuries. Because of numerous injuries that are involved, American football is often called a “team combat sport”. In the beginning of the 20th century, the number of injuries increased so high that game rules restrictions were implemented and pads were introduced. Nowadays, one can find hints instructing players to obey the rules of the game, and to take care of both their own security and security of the other players. These hints are expected to prevent injuries. It is also the members of the training staff that are to properly prepare players, both physically (by means of warm-ups) and techni-

cally [11]. An injury is a damage to tissue, organs or larger parts of the body caused by the influence of a mechanical, thermal, chemical or other factor. In the case of sportsmen, the most common factor leading to injuries is the mechanical factor.

There are numerous physical loads affecting the human body. However, in the case of professional sportsmen, these loads are often much greater than the regenerative potential of the body. Being involved in sports is directly connected with the possibility of macro- and microdamages to the tissues in the locomotor system. Locomotor system problems may be acute (and are visible directly after the damage) or chronic (and asymptomatic in the very beginning).

Microinjuries are caused by intensive exercises leading to an over-exploitation of tissue. Sportsmen are also often affected by overuse syndromes related with regular trainings. In the case of acute injuries, players often neglect the pain accompanying the injury. As a consequence, the injuries become more severe than in the beginning [3, 14]. The source of such behavior may be the players' determination to win and prove themselves and others that they are resistant to pain. The treatment of professional sportsmen causes difficulties to both doctors and physiotherapist because, as already mentioned, sportsmen often neglect their injuries and want to return to training as soon as possible.

The locomotor system is the most vulnerable part of a sportsmen's body. Many players end their sport career because of an injury. Professional top league players spend one fifth of the year on injuries treatment. Therefore, preventing injuries seems to be of great significance here [9]. Currently, there is no unified educational program on the prevention of injuries. The introduction of helmets and additional pads is expected to increase the safety of the players. However, in some sports group the game with such equipment is claimed to be less attractive.

THE AIM OF THE ARTICLE

The aim of the research have been:

1. A quantitative analysis of injuries in American football players with a special focus on the most often injured parts of the body
2. A behavior assessment of injured players
3. A quantitative analysis of situations causing the most frequent injuries in American football.

MATERIAL AND METHOD

The research has been conducted on 218 American football players in Poland. All of them were male players between 16 and 37 years old.

The information has been gathered on the basis of internet surveys distributed to the teams within the American Football Association in Poland (PZFA).

These surveys were voluntarily filled in by anonymous AF players. Later on, additional research material based on personal interviews with players during trainings was added to the results of the surveys.

All of the information provided by the players has been used only for the purpose of this research. The results have been presented in tables and pictures. The statistical analysis has been presented in Microsoft Excel.

FINDINGS

Research group characteristics

In the research group, the largest group included 21 to 25 years old players: 88 (40.37%). There were 57 (26.15%) players within the group between 16 and 20 years old, as well as 45 (20.64%) players in the group between 26 and 30 years. The least numerous group included players in the ages 31 to 37 years old (28 – 12.84%).

All of the participants of the survey were injured AF players. A vast majority of them were AF players with more than 3 years of experience 99 (45.41%). 42 (19.27%) participants had between 2 and 3 years of experience. There were 49 (22.48%) players who had trained AF between 1 and 2 years. Finally, there were 28 (12.84%) players with less than one year of experience.

On the basis of the league progress level, the participants were divided into five groups: Top League, PLFA I, PLFA II, PLFA8 and junior league. The most numerous group (88 – 40.37%) were PLFA I players. There were 87 (39.91%) players who represented PLFA II teams, and 36 (16.51%) Top League players. Among the participant of the survey, there were 5 (2.29%) junior league players and 2 (0.92%) players representing the PLFA8.

An analysis of the injuries

The most often injured regions of the body in American football players were ankle joint and foot. These regions of the body were reported

as injured by 148 players (67.89%). A little less participants of the survey (130 – 59.63%) mentioned their hands as the injured part of the body. Knee joint was the third of the most frequently mentioned parts of the body (112 players – 51.38%).

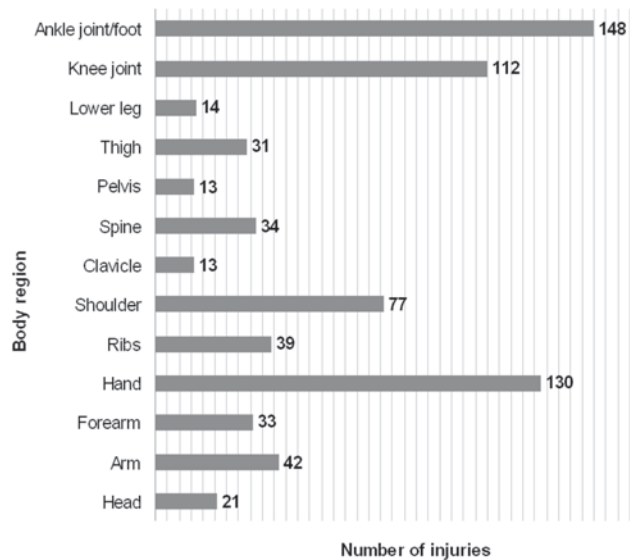
Clavicle and pelvis were the least frequent injuries in players (13 – 5.96%).

In the research, the participants provided information on the mechanisms leading to injuries occurring during AF trainings. Multiple choice was possible. 92 (42.20%) respondents

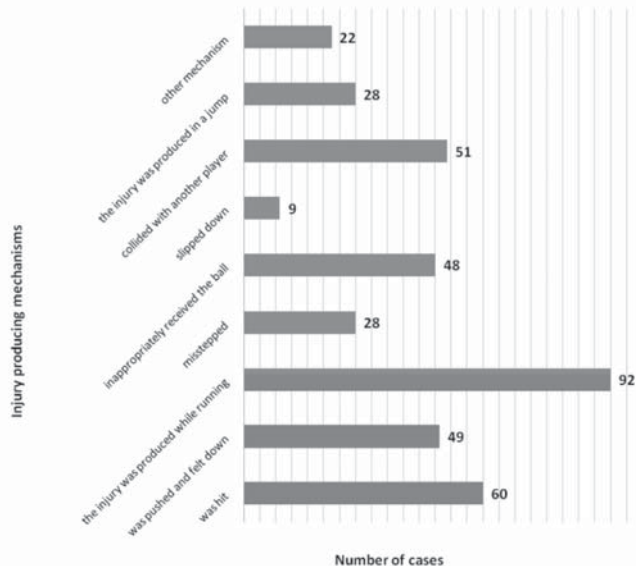
claimed that their injuries were caused by running. To add to this, 60 (27.52%) players indicate that the cause of their injuries was a collision with another player. Finally, 9 (4.12%) players reported that their injuries occurred after they had slipped.

Training is the situation when most of the injuries occur. 127 (58.26%) players noticed that they got injured more often during trainings than in other situations. 91 (41.74%) sportsmen participating in the research had suffered injuries during an AF match.

Pict. 1. The regions of the body that were injured in American football players



Pict. 2. The mechanisms leading to injuries in the AF players participating in the research



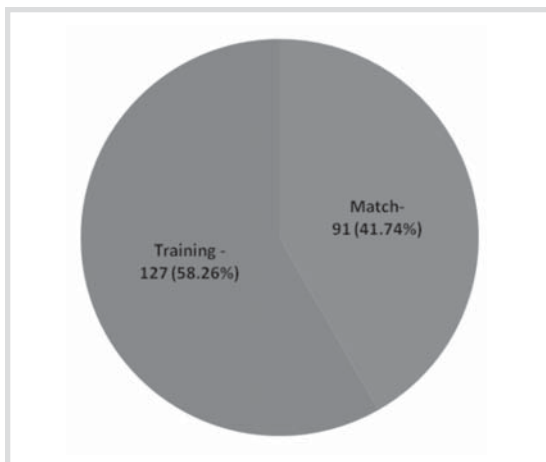
The respondents were asked to describe their behaviors just after the injury had been produced. 102 (46.79%) players had immediately left the pitch, however, 116 (53.21%) had continued with the match or training. First aid had been applied in 141 (64.68%) cases. Nevertheless, in 77 (35.32%) players, there had been no first aid activities undertaken.

During league matches, there is a Medical Rescue Team (MRT) available. No medical support is required for trainings, however, the MRT is called when needed. There are two MRT team types: a specialist team (including a doctor) and a basic team (including medical rescuers only). The basic Medical Rescue Team had provided first aid assistance in 45 (31.92%) of cases, whereas in 12 (8.51%) cases the specialist MRT had been involved, as reported by the respondents. Other participants claimed that they were supported by the trainer (29 – 20.57%),

a team colleague (34 – 24.11%) or themselves (21 – 14.89%).

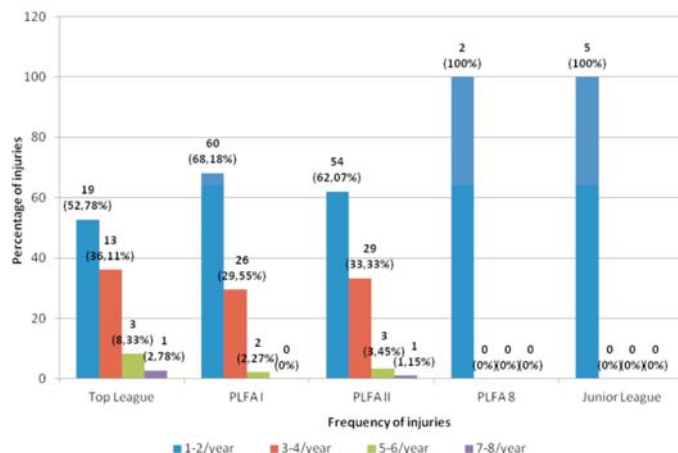
A vast majority (140 – 64.22%) of respondents indicated that they are usually injured once or twice a year. There were 68 (31.19%) participants of the survey who claimed to be injured 3-4 times a year. Finally, 8 (3.67%) players become injured 5-6 times a year, and 2 sportsmen suffer injuries 7 or 8 times a year. The correlation of the league placement and the amount of injuries in AF indicates that, most frequently, it is the Top League that suffers from injuries most. More than a half of the Top League players suffer 1-2 injuries a year. 13 (36.11%) Top League players suffer injuries 3-4 times a year. Further, there are 3 (8.33%) players of this league who become injured 5-6 times a year, and one (2.78%) Top League player suffering injuries 7 or 8 times a year. All of the PLFA8 league and the junior league mentioned that they suffered 1-2 injuries a year.

Head, forearm and arm injuries were most often reported by defence players (13 – 17.81%: head injuries; 13 17.81%: forearm injuries; 16 – 21.92%: arm injuries). Hand and ribs were the most affected body regions in offence players (61 – 65.59%: hand injuries; 19 – 20.43%: ribs injuries). Shoulder, clavicle and spine injuries were most frequently reported by defence players (31 – 42.47%: shoulder; 6 – 8.22%: clavicle; 14 – 19.18%: spine). Moreover, in contrast to offence and defence, special formation players most often suffered pelvis (6 – 11.54%), thigh (13 – 25.00%), lower leg (7 – 13.46%), knee joint (41 – 78.84%), ankle joint and foot injuries (50 – 96.15%). Almost all special formation players suffered ankle joint and foot injuries.



Pict. 3. The situation when the injury was produced

Pict. 4. A correlation of amount and percentage with the players' team placement in the AF league



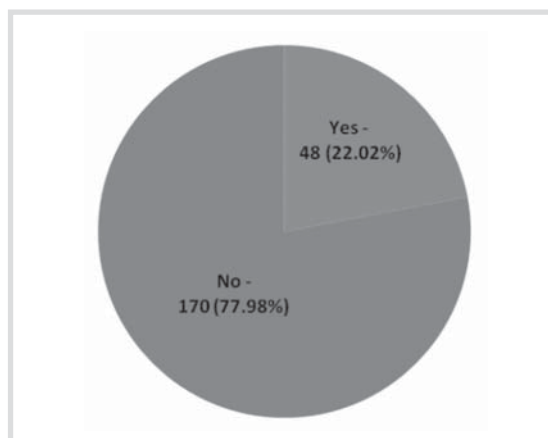
Limb immobilization was applied in 116 (53.21%) injured players. Orthotics immobilized 51 (23.39%) participants of the research, and in the case of 97 (44.49%) players, injuries treatment involved orthopedic cast (19 – 8.72%: plaster cast; 46 – 21.10%: splint).

There were 61 (27.98%) players whose AF-related injuries were treated in a hospital. Surgeries were performed on 48 (22.02%) sportsmen.

During the research, the awareness of game rules preventing injuries was verified. 203 (93.12%) players claimed that they knew how to prevent injuries, and 201(92.20%) respondents reported that they used additional pads to improve their own security.

DISCUSSION

Regular physical activity involves numerous health benefits. It improves blood circulation and leads to an overall fitness and well-being. However, sports involve the risk of injuries [9],



Pict. 5. Required surgery as a consequence of AF related injuries

where American football is connected with a much higher risk of injuries than many other sport disciplines. Only in the US, over a million injuries a year is related with American football [10].

The role of defence players in the game is to prevent the opposite team player carrying the ball from reaching the required distance. This activity involves a lot of physical strength. Although kicking, hitting and tripping up other players is forbidden, the cruelty of this action often leads to injuries.

Lattermann et al. estimate that around 25% of all injuries in sports affect ankle-tibia joint and foot [9].

Muczyński et al. have also analysed the exposure to injuries in AF players. Their point of focus was a group of 35 AF players of a team in Białystok. In their research, feet injuries included 4.5% respondents and ankle joint injuries – 14.9% [2]. The outcomes of both research studies, the study by Muczyński et al. and this particular article, have been very close to each other. In this research, ankle joint injuries involved 20.93% of the players. This region of the body was most exposed to injuries.

Dziak claims that the most vulnerable region of the body is knee joint, and is especially exposed to injuries in sports. Due to the mobility and biomechanical characteristics of the knee joint, it is impossible to guarantee full stability and prevention from injuries. Physical activity and regular trainings increase the vulnerability of the knee joint. Knee injuries preventive measures are impossible, and preventing the premature knee joint exploitation syndrome is based exclusively on early diagnosis and defects treatment [3]. However, as it has been indicated in this research, minor injuries are

Tab. 1. A correlation of injuries in the particular body regions with the players' positions in a team

Body region	Offence	Defence	Special formation
Ankle joint/foot	47 (50.54%)	51 (69.86%)	50 (96.15%)
Knee joint	37 (39.78%)	34 (46.58%)	41 (78.84%)
Lower leg	3 (3.23%)	4 (5.48%)	7 (13.46%)
Thigh	10 (10.75%)	8 (10.96%)	13 (25.00%)
Pelvis	3 (3.23%)	4 (5.48%)	6 (11.54%)
Spine	14 (15.05%)	14 (19.18%)	6 (11.54%)
Clavicle	5 (5.38%)	6 (8.22%)	2 (3.85%)
Shoulder	30 (32.26%)	31 (42.47%)	16 (30.77%)
Ribs	19 (20.43%)	12 (16.44%)	8 (15.38%)
Hand	61 (65.59%)	46 (63.01%)	23 (44.23%)
Przedramię	14 (15.05%)	13 (17.81%)	6 (11.54%)
Forearm	15 (16.13%)	16 (21.92%)	11 (21.15%)
Head	5 (5.38%)	13 (17.81%)	3 (5.77%)

often neglected by the sportsmen. In this study, 53.21% of the respondents continued the match or training despite of some complaints resulting from the injury. In the study Muszyński et al., there were 71.4% of the players confirmed to have continued the game after an injury.

The issue of severe injuries in AF has been proportionally increasing along with the public interest in this sport discipline. There were 32 death cases reported in the US in 1968. In 1969, a special committee NOCSAE (National Operating Committee on Standards for Athletic Equipment) was established to be devoted to AF injuries. Starting in 1970, the committee worked on the standardization of helmets to make sure that high-quality equipment is used in AF. The implementation of certified helmets has significantly reduced the number of fatal injuries. In 1990, for the first time since the beginning of the yearly mortality report, there was no reported death [5]. The National Football League is also concerned with the issue of injuries prevention. In 2011, there was a change in the AF rules to improve the security and health of AF players [12]. Among the players within this study, 93.12% of them claimed that they were aware of the risk in AF, and that they know how to prevent injuries. 92.20% of the respondents use additional pads for own security reasons. In the case of the research by Muszyński et al., there were 91.4% players using additional pads. On the one hand, additional pads secure players, on the other hand, the awareness of additional security sometimes leads to a more intensive attack on the opponent, and thus leads to a higher number of injuries.

Kochański et al. prepared a functional analysis of AF players using a test called the Func-

tional Movement Screen. This test is a system applied to prepare a complex functional analysis of basic motor patterns. The research by Kochański et al. indicates that there are stability, mobility and nerve-muscle coordination disorders observed in AF players. As a consequence, these disorders may lead to a relatively high risk of injuries [7]. This has also been confirmed by the respondents involved in this research. All respondents suffered injuries and there were 707 injuries in 218 players. This means that there were around 3.24 injuries per player.

American football is a discipline involving a high risk of injuries. What is more, injuries prevention in this discipline is a very difficult and complex process. The usage of technologically improved pads, proper warm-ups and game technique improvement lead to a decreased number of injuries. An important element of injuries prevention is players' awareness of the risks related with AF. Although the findings of this article indicate that 93.12% players know how to prevent injuries, we still claim that further education on injuries prevention is needed.

CONCLUSION

1. American football is a very risky sports discipline. Most of the players involved in the research suffer injuries 1-2 a year.
2. Ankle joint and foot are body regions involving most of the injuries.
3. A majority of respondents continued match or training despite of the injury related complaints.
4. Most of the injuries occurred when the players were running.

1. Anderson, L. (2001). *The Proving Ground: A Season on the Fringe in NFL Europe*.
2. Muczyński, D., Krajewska-Kułak, E., Guzowski, A. (2013). Ocena narażenia na kontuzje oraz referowanych zachowań zdrowotnych w grupie zawodników futbolu amerykańskiego. *Pielęgniarstwo Chirurgiczne i Angiologiczne*, 125–133.
3. Dziak, A., Samer, T. (2000). *Urazy i uszkodzenia w sporcie*. Kraków: Wydawnictwo Kasper.
4. Sullivan, G. (1985). *Football Rules Illustrated*. Simon and Schuster.
5. The history of NOCSAE <http://nocsae.org/aboutnocsae/history-and-purpose/>
6. M. Football, K. (2004). Scholastic Library Pub, USA.
7. Kochański, B., Falkowska, E., Kałużna, A., Kałużny, K., Wołowicz, Ł., Hagner-Deręgowska, M., Zukow, W. Oce-

- na funkcjonalna zawodników uprawiających futbol amerykański z wykorzystaniem testu Functional Movement Screen. *Formerly Journal of Health Sciences*. ISSN 1429-9623 / 2300-665X.
8. J. Pellowski, M. (2005). *The Little Giant Book of Football Facts*. Sterling.
9. Patrick J. McMahon: *Medycyna sportowa. Współczesne metody diagnostyki i leczenia*. Wydawnictwo Lekarskie PZWL, Warszawa, 2009
10. W. McCarthy, P., J. Hume, P. [...], and D. Lark, S. Wearing American Football helmets increases cervicocranial kinesthetic awareness in "elite" American Football players but not controls. *Chiropr Man Therap*. 2015 Nov 16;23:32. doi: 10.1186/s12998-015-0077-4. eCollection 2015.
11. Regulations of the the American Football Association in Poland (PZFA) <http://plfa.pl/rules>

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| 12. Ruestow PS, Duke TJ, Finley BL, Pierce JS. Effects of the NFL's Amendments to the Free Kick Rule on Injuries during the 2010 and 2011 Seasons. <i>J Occup Environ Hyg.</i> 2015 Dec;12(12):875-82. | 13. Słownik języka polskiego, wydawnictwo naukowe PWN, Warszawa, 2012
14. Widuchowski, J., Widuchowski, W., (2008). Urazy i obrażenia narządu ruchu w sporcie, [in:] <i>Medicina Sportiva. Supplement</i> , 13: 5-15 |
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