

Injury prevalence, types and anatomical localizations in elite football players

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Abstract. *Study Objectives:* In this study, it was aimed to evaluate the prevalence, types, and anatomical localization of elite football players' injuries in one season. *Methods:* The participants of the study are 50 professional male footballers playing in Professional Leagues of Turkish Football Federation with a mean age of 20-29 (25.4±3.1) with 12.67±3.72 years of experience in football. The data collection followed the international consensus statement on procedures for epidemiologic studies of football injuries recommended by FIFA and UEFA. In this study, the contact person collected the date of injury, mechanisms of injury, body area injured, injured structure, diagnosis, severity, minute of match or training results, and time-off (days) for each player together with the sports medical history of the players. Data were collected and analyzed. *Results:* When the injury profile of the players was considered, it was determined that 34 (68%) players were injured once, nine players (18%) were injured for the second time, and a total of 50 players had 43 injuries in a season. The highest prevalence of injured players was observed in midfielders with 16 (37.2%) and the lowest in goalkeepers with four players (9.3%). In terms of anatomical location, more injuries were observed in the lower extremity and joint and muscle injuries. The most frequently observed types of injuries are sprain, muscle laceration, partial muscle tear, local degeneration, and crush respectively. *Conclusion:* This study is thought to be a potentially valuable tool for understanding the events that lead to injuries in football by examining some of the factors that affect the injury process of professional soccer players and identifying the types of injuries and their anatomical localization.

Keywords: Football, Injury, Injury types, Injury prevalence

Introduction

Football is the most popular sporting event worldwide, with over 270 million participants (1) and although it is an intermittent demand sport style in terms of intensity, its practice is characterized by high-intensity efforts and repetition of specific gestures and techniques, resulting in a high incidence of injuries (2).

Football is a vigorous sporting activity with a relatively high injury incidence (17–24 injuries per 1000

playing hours) compared with many other sports (3). Elite football players are known to have a high incidence of injury. The risk of injury in professional football is about 1000 times higher than that observed in other industrial occupations generally regarded as high risk (4).

Injury has a detrimental effect on player welfare, health, and lifestyle including an increased risk of distress, anxiety, sleep disturbance, depression (5), cognitive impairment (6), and financial cost

due to loss of employment (7). Furthermore, injuries in sport also affect that economic losses such as an increase in health expenditures, decrease in club revenues as a result of players not being able to play, decrease in testimonial fees of injured players and decrease in club success (8). Injury is multifactorial with inherent risk factors that are both non-modifiable (e.g.: age, sex) and modifiable (e.g.: strength, flexibility) (9). The manipulation of modifiable risk factors provides coaches and sports scientists with opportunities that may reduce the risk of injury. These associated detrimental effects, therefore, justify the recent increase in research examining associations with injury (10).

However, despite its importance and the high number of injuries sustained, many of which mean that people have to give up the sport, there is little homogeneous data collection of sports injuries, and no internationally accepted prevention protocol (11). Research and discussions about injury rates and their prevention in elite football are one of the hottest topics in the medical and sport science literature (12). Overall injury rates remain high in elite football despite the significant research on injury prevention (13). This array of information is likely useful to improve our understanding of what the best practices may be, and in turn, increase our ability to better prepare, manage, and treat players (14). Thus, football injuries and their consequences are followed closely by football players, their clubs, and the large crowds of fans (15).

In this regard, surveillance programs are vital to analyze the cause and nature of injuries and ultimately to establish protocols of action to decrease the risk and rate of injuries (16). Finding out what happens in competition offers the best way of predicting and preventing injuries (17). Investigating football injuries according to their type, the reasons for the higher incidence rates, the injury mechanisms, and the most affected anatomic sites will facilitate the development of management strategies in health care, especially in preventive medicine (18).

For this purpose, in this study, it was aimed to evaluate the prevalence, types, and anatomical localization of elite football players' injuries in one season.

Material and Method

Participants

The participants of the study are 50 professional male footballers playing in Professional Leagues of Turkish Football Federation with a mean age of 20-29 (25.4±3.1) with 12.67±3.72 years of experience in football. Initially, the footballers' medical history was taken to verify the existence of possible metabolic syndromes and health problems that would prevent the participation of these subjects in the study. It was declared that the subjects had the option to leave the study at any time, without having any responsibility. The study protocol and purpose were explained to all subjects, and written informed consent was obtained from each participant.

Data Collection

Within each club, one person was responsible for entering the data. This contact person was a member of the club's medical staff (physical therapist or team physician). At the start of the study, baseline characteristics of all players were recorded by the contact person, including information regarding age, height, body weight, playing position, years of experience as a professional football player, and player injuries lasting more than one week that were sustained during the previous year (number and body part affected). Individual training-session exposures were recorded by the contact person on a daily.

The data collection followed the international consensus statement on procedures for epidemiologic studies of football injuries recommended by FIFA and UEFA (19-20). In this form, the contact person collected the date of injury, mechanisms of injury, body area injured, injured structure, diagnosis, severity, minute of match or training results, and time-off (days) for each player together with the sports medical history of the players. An injury was defined as "any musculoskeletal complaint (including concussion) that occurred during a match and received medical attention from the team physician regardless of the consequences concerning absence from the match

or training.” (21). The recurrent injury was defined as the injury of the same type and on the same body location as a previous injury. The remaining injuries were classified as first-time injuries (1), this included both the pre-season and season periods. And also collected the medical reports on all the matches and training in the one football season.

Statistical Analysis

Data were analyzed with the SPSS for Windows 21.0 packet program. Descriptive statistics were given as “mean \pm standard deviation” and “frequency (percentage)”.

Results

The characteristics of the study participants are shown in Table 1. Professional male footballers mean

ages, heights, and weights were identified as 25.7 ± 3.99 , 178.32 ± 5.42 cm, and 75.16 ± 5.60 kg respectively. The subjects were determined to play sports for 11.40 ± 4.44 years in their lifetime.

Table 2 shows the injury profile of the players was considered and it was determined that 34 players were injured once, 9 players were injured for the second time, and a total of 50 players had 43 injuries in a season. The highest prevalence of injured players was observed in midfielders with 16 (37.2%) and the lowest in goalkeepers with 4 (9.3%).

The most common injuries in the players were joint injury with 13 (30.4%). Muscle injuries (10-23.2%), ligament injuries (8-18.6%), tendon injuries (6-13.9%), and bone injuries (6-13.9%) followed, respectively. In joint injuries, the most common injury was sprain with 16.4% ($n=7$). Only one partial rupture and bone fracture injury were detected in defenders, and one 2nd degree (medium) ligament and strain in midfielders (Table 3).

Table 1. Characteristics of professional football players

<i>Variables</i>	<i>Goalkeeper</i> (<i>n= 6</i>)	<i>Defender</i> (<i>n= 14</i>)	<i>Midfielder</i> (<i>n= 17</i>)	<i>Forward</i> (<i>n= 13</i>)	<i>Total</i> (<i>n= 50</i>)
<i>Age (year)</i>	27.17 \pm 2.40	26.36 \pm 5.10	25.24 \pm 4.02	24.92 \pm 3.25	25.7 \pm 3.99
<i>Body height (cm)</i>	181.33 \pm 3.72	178.3 \pm 5.38	175.81 \pm 4.68	180.38 \pm 6.14	178.32 \pm 5.42
<i>Body weight (kg)</i>	79.33 \pm 6.44	75.29 \pm 6.11	72.94 \pm 4.89	75.46 \pm 6.14	75.16 \pm 5.60
<i>Active sport duration (year)</i>	12.67 \pm 3.61	12.79 \pm 4.00	10.53 \pm 4.80	10.46 \pm 4.67	11.40 \pm 4.44

Table 2. Injury prevalence of professional football players

<i>Variables</i>		<i>Goalkeeper</i> (<i>n= 6</i>)	<i>Defender</i> (<i>n= 14</i>)	<i>Midfielder</i> (<i>n= 17</i>)	<i>Forward</i> (<i>n= 13</i>)	<i>Total</i> (<i>n= 50</i>)
<i>First-Time Injuries</i>	<i>Yes</i>	3 (50%)	8 (57.1%)	13 (76.5%)	10 (76.9%)	34 (68%)
	<i>No</i>	3 (50%)	6 (42.9%)	4 (23.5%)	3 (23.1%)	16 (32%)
<i>Recurrent Injuries</i>	<i>Yes</i>	1 (16.7%)	2 (14.3%)	3 (17.6%)	3 (23.1%)	9 (18%)
	<i>No</i>	5 (83.3%)	12 (85.7%)	14 (82.4%)	10 (76.1%)	41 (82%)
<i>Total Injuries</i>		4 (9.3%)	10 (23.3%)	16 (37.2%)	13 (30.2%)	43 (100%)

Table 3. Distributions of injury types and players' positions

Main Grouping - Category		Goalkeeper	Defender	Midfielder	Forward	Total
Muscle Injuries	<i>Muscle Laceration</i>	-	-	4 (25%)	1 (7.7%)	5 (11.6%)
	<i>Partial muscle tear</i>	1 (25%)	3 (30%)	-	1 (7.7%)	5 (11.6%)
	Total					10 (23.2%)
Tendon Injuries	<i>Local degeneration</i>	-	1 (10%)	2 (12.5%)	2 (15.4%)	5 (11.6%)
	<i>Partial rupture</i>	-	1 (10%)	-	-	1 (2.3%)
	Total					6 (13.9%)
Ligament Injuries	<i>1st degree - light</i>	-	-	2 (12.5%)	2 (15.4%)	4 (9.3%)
	<i>2nd degree - medium</i>	-	-	1 (6.3%)	-	1 (2.3%)
	<i>3rd degree - heavy</i>	-	2 (20%)	-	1 (7.7%)	3 (7%)
	Total					8 (18.6%)
Joint Injuries	<i>Dislocation</i>	-	-	1 (6.3%)	-	1 (2.3%)
	<i>Sprain</i>	1 (25%)	2 (20%)	3 (18.8%)	1 (7.7%)	7 (16.4%)
	<i>Strain</i>	-	-	1 (6.3%)	2 (15.4%)	3 (7%)
	<i>Bleeding</i>	-	-	-	2 (15.4%)	2 (4.7%)
	Total					13 (30.4%)
Bone-Tissue Injuries	<i>Fractures and bone Stress</i>	-	1 (10%)	-	-	1 (2.3%)
	<i>Crush</i>	2 (50%)	-	2 (12.5%)	1 (7.7%)	5 (11.6%)
	Total					6 (13.9%)
Total Injuries (n=43)		4 (100%)	10 (100%)	16 (100%)	13 (100%)	43 (100%)

Regarding the anatomical location of the injury, lower limbs accounted for 62.8% of all injuries and were mostly seen in forward players. About players with symptoms, 58.2% returned to the play and 30.2% returned after treatment but 11% player could not return to the play. While 76.7% of the athletes were injured during the season, 23.3% were injured before the season, 31% in the official match, 9% in training, and 3% during the warm-up. When we look at the reason for injuries of the athletes, 46.5% were injured by a foul by the body contact, 58.2% were intervened by the club doctor and 69.8% stayed away from sports for 1-3 days (Table 4).

Discussion

Injury definition as any physical complaint sustained by a player that resulted from a football match or football training, irrespective of the need for medical attention or time loss from football activities (19). The injury profile of the players, it was determined that 34 (68%) players were injured once, nine players (18%) were injured for the second time, and a total of 50 players had 43 injuries in a season. The highest prevalence of injured players was observed in midfielders with 16 (37.2%) and the lowest in goalkeepers with 4 (9.3%). These injuries, 69.8% resulted in an absence of max

Table 4. Injury incidence and characteristics

Main Grouping - Category		Goalkeeper (n=4)	Defender (n= 10)	Midfielder (n=16)	Forward (n= 13)	Total (n= 43)
Anatomical Location	<i>Head-Neck</i>	-	1 (10%)	1 (6.2%)	1 (7.7%)	3 (7%)
	<i>Upper extremities</i>	1 (25%)	4 (40%)	5 (31.3%)	3 (23.1%)	13 (30.2%)
	<i>Trunk</i>	-	-	-	-	-
	<i>Lower extremities</i>	3 (75%)	5 (50%)	10 (62.5%)	9 (69.2%)	27 (62.8%)
Injury Period	<i>Pre-season</i>	1 (25%)	2 (20%)	3 (18.8%)	4 (30.8%)	10 (23.3%)
	<i>All-season</i>	3 (75%)	8 (80%)	13 (81.3%)	9 (69.2%)	33 (76.7%)
Place of Injury	<i>Matches</i>	2 (50%)	7 (70%)	12 (75%)	10 (76.9%)	31 (72.1%)
	<i>Training</i>	2 (50%)	2 (20%)	3 (18.8%)	2 (15.4%)	9 (20.9%)
	<i>Warming</i>	-	1 (10%)	1 (6.2%)	1 (7.7%)	3 (7%)
Reason of Injury (Match)	<i>Body contact - fouls</i>	2 (50%)	5 (50%)	6 (37.4%)	7 (53.8%)	20 (46.5%)
	<i>Insufficient training</i>	-	2 (20%)	3 (18.8%)	2 (15.4%)	7 (16.3%)
	<i>Pre-season overload</i>	-	1 (10%)	3 (18.8%)	1 (7.7%)	5 (11.6%)
Reason of Injury (Training)	<i>My friend's careless move</i>	1 (25%)	1 (10%)	-	2 (15.4%)	4 (9.3%)
	<i>Insufficient warming</i>	1 (25%)	1 (10%)	2 (12.5%)	1 (7.7%)	5 (11.6%)
	<i>Overuse</i>	-	-	2 (12.5%)	-	2 (4.7%)
After Injury	<i>Medical attention</i>	-	1 (10%)	2 (12.5%)	2 (15.4%)	5 (11.6%)
	<i>Return to play</i>	2 (50%)	5 (50%)	3 (18.8%)	3 (23.1%)	13 (30.2%)
	<i>I continued after recovery</i>	2 (50%)	4 (40%)	11 (68.7%)	8 (61.5%)	25 (58.2%)
Treatment	<i>Doctor</i>	4 (100%)	6 (60%)	9 (56.3%)	6 (46.2%)	25 (58.2%)
	<i>Masseur</i>	-	2 (20%)	2 (28.6%)	-	4 (9.3%)
	<i>By myself</i>	-	2 (20%)	5 (31.3%)	7 (53.8%)	14 (32.5%)
Injury Severity (Days Lost) (day)	<i>1-3 minimal</i>	4 (100%)	6 (60%)	10 (62.5%)	10 (76.9%)	30 (69.8%)
	<i>4-7 mild</i>	-	2 (20%)	4 (25%)	2 (15.4%)	8 (18.6%)
	<i>8-28 moderate</i>	-	1 (10%)	2 (12.5%)	1 (7.7%)	4 (9.3%)
	<i>>28 severe</i>	-	1 (10%)	-	-	1 (2.3%)

one day. The incidence of injury for the 2006 World Cup was 68.7 injuries/1,000 hrs of match play (22). This study defined an injury as a physical complaint developed during a match or training regardless of the need for medical attention or any subsequent absence from football activities.

The findings obtained are supporting the data in the literature. The great majority of footballers underwent injuries due to many reasons. Players in midfield and forward positions were faced more injuries. In terms of anatomical location, more injuries were observed in the lower extremity and joint and muscle

injuries. The most frequently observed types of injuries are sprain, muscle laceration, partial muscle tear, local degeneration, and crush respectively.

In this study, regarding the anatomical location of the injury, lower limbs accounted for 62.8% of all injuries and were mostly seen in forward players (Table 4). When the types of injuries which athletes were exposed to were examined, it was reported in a study by Yamaner F et al. (2009) findings that many lower extremity injuries were 16.6% sprains (23). Similarly, in the study of Adamczyk G et al. (2002), it was stated that the most effected part of the body was lower extremities regarding sports injuries (4). Woods et al. (2002) found that 77% of the injuries were related to lower extremities (8). The men's FIFA World Cup and Olympic games from 1998 to 2012 have demonstrated similar injury distributions, with the lower extremity accounting for 67% to 73% of injuries (24)

Chahla J et al. (2018) collected electronic medical reports submitted at each match of the 2017 Gold Cup and reviewed the reports of 276 players and 12 teams. When analyzed according to player positions, it could not detect a significant difference in injury frequency. The overall injury rate was 1.04 per match, and the most common injuries were crushing (42.3%), sprains (7.7%), sprains (7.7%), and fractures (7.7%). These injuries were mostly caused by contact (75.0%) and non-contact (25.0%) mechanisms (25).

Ekstrand et al. (2020) used the Union of European Football Associations (UEFA) injury dataset to analyze 44 teams for up to 15 seasons (total, 244 team-seasons). Study teams averaged 30 preseason training sessions (range, 10–51) and at the end of the research, greater number of preseason training sessions was associated with less injury load during the competitive season in 4 out of 5 injury-related measures. Teams that performed a greater number of preseason training sessions had “healthier” in-season periods. Many other factors also contribute to in-season injury rates. Understanding the benefit of preseason training on in-season injury patterns may inform sports teams' planning and preparation. The beneficial impact of a qualified preparatory interval before competitive games should be further highlighted since the number of preseason training sessions appear to reduce injuries during the season (26).

Soccer injuries are associated with the player's age, exercise load, level of play, and standard of training. Pfirrmann et al. (2016) reported in their study that “Youth players had a higher incidence of training injuries than professionals”. Injury rates were higher for matches than for training for both youth and adult players. Therefore, preventive interventions such as adequate enforcement of the rules and a focus on fair play should be analyzed and developed to reduce match-related injuries (27).

The truth is, elite club practitioners are more on the front lines with new treatment options and training programs. Therefore, they can have less injury incidence. The inclusion of future studies in these clubs will clarify the issue. Planning future studies to include amateur athletes will support the literature on sports injuries and their prevention. Injuries may be better prevented and managed in clubs than it may appear from some of the research papers. Since elite environments are more complex than meets the eye, before making any recommendations, we, both as researchers and practitioners, should never over-see the importance of context. Pragmatism, use of common sense, and the consideration of best practices (28) are often to be prioritized over oversimplified research findings.

On the other hand, recurrent injuries 9 (18%) show that the diagnosis, treatment, and rehabilitation programs in the clubs are insufficient and the athletes are overloaded.

Different factors, such as age, playing position, season, concealment of injury, double burden, the mismatch between external pressure and internal effort, training (training intensity and reinjuries higher during training), playing schedule (recovery time), re-injuries, and maturity status can lead to higher injury incidences and have varied effects on elite youth and professional adult soccer players (27)

A clear disparity in Griffin et al (2020) research and this study is the absence of studies on female participants. Of the twenty-two studies in his review, ten sports were examined, at various levels, but all included male teams (29). Gender (sex) has been identified as a risk factor associated with injury (30) so injury epidemiologic should also be investigated in female athletes.

Conclusion

The most common types of injuries, prevalence, and anatomical localization in professional adult soccer players in this study were consistent with previously published results. This study is thought to be a potentially valuable tool for understanding the events that lead to injuries in football by examining some of the factors that affect the injury process of professional soccer players and identifying the types of injuries and their anatomical localization. Preventive measures should focus on the most common diagnoses, namely, muscle/tendon injuries of the lower extremities.

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Conflicts of Interest

The authors declare that there is no conflict of interest about this manuscript.

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