



## Football injuries on synthetic turf fields

Halı sahada oluşan futbol yaralanmaları

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**Objectives:** Football injuries that occur during football matches played on synthetic fields and the features of these injuries were investigated and the data was pursued for the prevention and reduction of these injuries.

**Patients and methods:** All adolescent and adult trauma cases who admitted to the Emergency Department with football injuries on synthetic fields were retrospectively investigated. Nine hundred and eighty-five male cases were detected with a mean age of 30.1±4.2 years (range 15-57 years). Age, gender, times of admittance to the Emergency Department, site of injury, type of injury, and clinical result data of the cases were examined.

**Results:** 19:00 to 24:00 hours (n=852, 86.5%) and weekdays were the most frequent admittance times. It was detected that lower-extremities (n=583, 59.2%) were the most commonly affected body parts and the upper-extremity injuries (n=281, 28.6%) and the head and neck injuries (n=75, 7.6%) were the second and third most commonly seen injuries, respectively. The most frequently observed injury types were contusions, abrasions and hematomas in all cases (n=364, 37.0%). Sprains/strains were the second most common types of injuries (n=343, 34.8%). When the final diagnoses of all cases were examined, it was determined that the anterior talofibular ligament injuries were the second most frequent after soft-tissue injuries (n=217, 22%).

**Conclusion:** Football matches on synthetic fields can lead to serious orthopedic injuries. Investigation of the mechanisms of these injuries, which cause workday and economic losses, will be a guide for the future studies on the prevention of these injuries.

**Key words:** Emergency medicine; football; injuries; traumatology.

**Amaç:** Halı sahalarda oynanan futbol karşılaşmaları sırasında meydana gelen yaralanmalar ve özellikleri incelendi, azaltılması ve önlenmesine yönelik veriler araştırıldı.

**Hastalar ve yöntemler:** Halı sahada futbol yaralanması nedeniyle acil servise başvuran ergen ve yetişkin tüm travma olguları retrospektif olarak incelendi. Yaş ortalaması 30.1±4.2 yıl (dağılım 15-57 yıl) olan 985 erkek olgu saptandı. Olguların yaş, cinsiyet, Acil Servise başvuru zamanı, yaralanma bölgesi, yaralanma tipi ve klinik sonuç verileri araştırıldı.

**Bulgular:** 19:00-24:00 saatleri arası (n=852, 86.5%) ve hafta içi günler en sık başvuru zamanlarıydı. Alt ekstremitenin (n=583, %59.2) vücudun en sık etkilenen bölgesi olduğu, üst ekstremitte yaralanmalarının ikinci sırada (n=281, %28.6), baş ve boyun bölgesi yaralanmalarının (n=75, %7.6) ise üçüncü sırada görüldüğü saptandı. Tüm olgularda en sık gözlenen yaralanma tipi, kontüzyon, abrazyon ve hematomdu (n=364, %37). Zorlanma/burkulma tarzı yaralanmalar ikinci sıklıkta gözlemlendi (n=343, %34.8). Tüm olguların son tanıları incelendiğinde, yumuşak doku yaralanmalarından sonra (n=431, %43.9), ayak bileği anterior talofibuler bağ yaralanmalarının sıklık açısından ikinci sırada geldiği belirlendi (n=217, %22.0).

**Sonuç:** Halı sahada futbol karşılaşmaları, ciddi ortopedik yaralanmalara neden olabilmektedir. İş gücü kaybına ve ekonomik kayıplara neden olan bu yaralanmaların oluşum mekanizmalarının araştırılması, bu yaralanmaların önlenmesiyle ilgili yapılacak çalışmalar için yol gösterici olacaktır.

**Anahtar sözcükler:** Acil servis; futbol; yaralanmalar; travmatoloji.

Football matches which are conventionally played on natural grass may also be played on soil, sand, gravel and asphalt surfaces.<sup>[1]</sup> Synthetic fields have recently become alternative playing fields to natural grass fields due to seasonal and economical considerations.<sup>[2]</sup>

Football, a high intensity sport with unidirectional overloading and constant change of movement direction, requires good neuromuscular control, speed and plyometric power. Due to intrinsic factors associated with player characteristics and extrinsic factors such as characteristics of the game, equipment used and playing field, football was reported to have a relatively higher incidence of injury than other sports.<sup>[3]</sup>

Football injuries account for 50-60% of overall sports injuries and 3.5-10% of injuries treated at hospitals in Europe. Similarly in our country, it was reported that 17.4% of the applications to hospitals for the adult and active age range of 19-49 were due to sports injuries, and that a great majority of these applications were football injuries.<sup>[1,4]</sup>

Injuries occurring during football matches played on synthetic fields, and their characteristics, were investigated and data was obtained to help reduce and prevent such injuries.

## PATIENTS AND METHODS

All consults at the Emergency Department of a university hospital due to injury while playing football on a synthetic field were retrospectively reviewed using the hospital record system. Nine hundred and eighty-five male adolescent and adult cases (mean age 30.1±4.2 years; range 15 to 57 years) seen during the four-year period from January 2007 to January 2011 met the study criteria and were included in the study.

The following exclusion criteria were used for the study: age 14 years and below; injuries occurring while playing football on areas other than synthetic fields; injuries occurring on synthetic fields, but not while playing football; cases with no complaint and trauma evidence after accident, but brought to the emergency department for drawing up a judicial report; and patients whose study data could not be accessed on the hospital record system.

Age, sex, when and how the accident occurred, injury site, injury type and clinic course data were investigated for all the cases included in the study.

All data obtained from the study were recorded in a standard program named "Statistical Package for the Social Sciences (SPSS Inc., Chicago, Illinois, USA) for Windows 11.0". Descriptive statistics and frequency analyses were used for evaluation. Numerical variables

were presented as average ± standard deviation and categorical variables were presented as number and percentage.

## RESULTS

Most of the cases (n=813, 82.5%) were treated at the emergency department and discharged. One hundred seventy two (17.5%) cases were hospitalized and treated in various services of our hospital (orthopedics, plastic surgery, neurosurgery). No life-threatening major trauma was encountered. Only one case was confined in an intensive care unit (with loss of consciousness due to head-to-head collision) and was discharged the following day. One hundred fifty nine (92.4) of 172 cases hospitalized in a service were found to have undergone surgical operation. Mean hospitalization period was 8.1±3.7 days (range 2 to 23).

Temporal characteristics of the cases by month, day and hour were investigated. Cases were found to decrease in the summer months (June, July and August) compared to other months. They peaked in March, April and May (Figure 1). Fewer cases were encountered on Saturdays (n=42, 4.3%) and Sundays (n=21, 2.1%), and were often on weekdays (n=922, 93.6%). Trauma cases mostly took place between 19:00 and 23:59 hours (n=852, 86.5%).

When reviewing injury sites, it was found that the lower extremity (n=583, 52.9%) was the most frequently affected site, followed by the upper extremity (n=281, 28.6%) and head/neck (n=75, 7.6%), respectively. The injury site of 29 cases (2.9%) was the thoracodorsal region, and there were injuries in more than one region in 17 cases (1.7%). The most frequently encountered injuries were contusions, abrasions and hematomas (n=364, 37%). Strain and sprain injuries were in second place (n=343, 34.8%) and fractures in third place (n=161, 16.4%). Rupture, perforation, and graze injuries were seen in 98 cases (9.9%), and dislocations were seen in 19 cases (1.9%).

The final diagnoses for all cases obtained from the patient record system were grouped and reviewed,

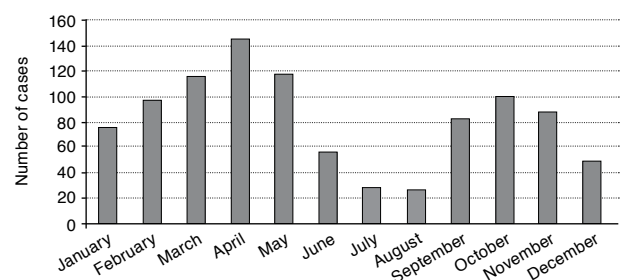


Figure 1. Distribution of cases according to months.

and are presented in table I. Besides the soft tissue trauma including superficial injuries and contusions, ankle anterior talofibular ligament (ATFL) injuries (n=217, 22%) were determined to occur most frequently in football matches on synthetic fields. Knee ligament and meniscus injuries (n=67 6.8%), foot fractures (tibia and/or fibula lower end) (n=51 5.2%) were among the other most frequently encountered injuries (Table I). All ligament injuries and fractures in the ankle comprised up to 30.5% of all cases (n=300). The total (n=67) of ligament (n=48) and meniscus (n=19) injuries in the knee came up to 6.8% of all cases. The most frequent ligament injury seen in the knee involved the anterior cruciate ligament (n=37, 77.1%; Table I). One case diagnosed to have a calcaneus fracture was interestingly determined to have a stress fracture.

While the most frequent injury site was the lower extremity in our study group, 281 cases (28.6%) had upper extremity injury. Of these, wrist sprain/strain injuries were the second most frequent following soft tissue injuries (n=24, 2.4%; Table I). However, when upper extremity fractures were reviewed as one group,

it was detected that the most frequent upper extremity injuries following soft tissue injuries were fractures.

## DISCUSSION

Football is the most popular sport today despite its high rate of injury. Requiring power, speed and strength, football is a sport which has a great number of amateur players besides professional players.<sup>[5]</sup> After development of synthetic field surfaces produced an economical alternative to natural grass fields, the tendency among amateur playing matches for fun and sports purposes to be held on these synthetic surfaces has increased. It has been reported that injury risks may increase since the ground of these synthetic fields made by covering hard ground with polyethylene fiber surface material is hard, a high friction force occurs between the player's shoe and the ground and the forces transmitted to the player's tissues are different from those on other surfaces.<sup>[2,6]</sup>

In our study, it was found that soft tissue injuries (superficial tears, abrasions, contusions, etc.) were most frequently seen in adult cases seen in the emergency department as a result of football injuries on synthetic fields, and that the most frequently injured sites were the lower extremities. It was shown that among the lower extremity injuries, soft tissue injuries often occurred, the ankle was the most frequently affected site, and the most frequent injury occurring in this site was ATFL injury. Similarly, Cromwell et al.<sup>[7]</sup> reported in a retrospective review of 107 cases that most of the football injuries were soft tissue injury, and they mostly occurred in the ankle.

Yamaner et al.<sup>[4]</sup> compared injuries of 96 amateur and 98 professional footballers, and reported that sprains were in first place (17.1%) and fractures were in second place (15.5%) among amateurs, while tendon-ligament injuries were in first place (19%) among professionals.

In a prospective study, the mean injury incidence and injury causes of 252 amateur male football players with mean age of 27 years (range 18-43) playing football on a soil field, and of 216 amateur male football players with mean age of 28 years playing football on a synthetic field, were compared. This study reported that injury incidence on a soil field was higher than on a synthetic field, but that while most of the injuries on a soil field were superficial injuries (skin injuries such as abrasion, laceration), most of the injuries on a synthetic field were moderate injuries (sprain and ligament injuries).<sup>[1]</sup> Similarly, ligament injuries were more frequent among lower extremity injuries on synthetic fields in our study.<sup>[1,8]</sup> Kordi et al.<sup>[1]</sup> reported that injury incidence on a soil field was big since

**TABLE I**

Distribution of final diagnosis

Final diagnosis	n	%
Soft tissue traumas	431	43.9
Injuries of anterior talofibular ligament	217	22.0
Injuries of knee ligaments and meniscii	67	6.8
Fractures of ankle (distal end of tibia and/or fibula)	51	5.2
Fractures of phalanx	39	3.9
Injuries of deltoid ligament of ankle	32	3.3
Sprains/strains of wrist	24	2.4
Colles fracture	19	1.9
Fractures of elbow	17	1.7
Dislocations of phalanx	15	1.5
Fractures of tarsal bones	12	1.2
Rupture of achilles tendon	10	1.0
Scaphoid fractures	9	0.9
Patella fractures	5	0.5
Dislocations of shoulder	3	0.3
Fractures of talus	3	0.3
Seperation of acromioclavicular joint	2	0.2
Fractures of tibial plateau	2	0.2
Fractures of clavícula	2	0.2
Dislocation of elbow	1	0.1
Calcaneus fractures	1	0.1
Fractures of fore arm (galeazzi)	1	0.1
Other	22	2.3
<i>Total</i>	985	100.0

its surface friction force was high, but the probable injuries were slight since the ground was not hard, and that injuries were more severe on synthetic fields although the injury incidence was lower.

In a prospective epidemiologic study among professional football players, injuries were reported to be muscle damage, muscle contusion and fractures.<sup>[9]</sup> While soft tissue injuries were in the first place in both lower and upper extremity injuries in our study, it was found that ligament or connective tissue injuries were more frequent than fractures in lower extremity injuries, and that the rate of fractures in upper extremity injuries was more frequent than in those in the lower extremity. Upper extremity injuries came up to 28.6% of the patients in our study. While fractures were most frequently found in this site, dislocations were observed to be in the second place. Although upper extremity injuries are seen with less frequency in football, the injuries in this site were reported to be more severe since they were mainly fractures and dislocations.<sup>[10]</sup>

Orhan et al.<sup>[11]</sup> reported a case of calcaneus stress fracture following a football match on a synthetic field. It was noted that even a short-lasting sport activity may cause calcaneus stress fracture in a healthy individual since synthetic fields use hard ground such as concrete or asphalt covered with synthetic materials. Similarly, one case diagnosed with calcaneus stress fracture was encountered in our study group.

Hawkins et al.<sup>[9]</sup> reviewed injuries of 91 professional football clubs prospectively, and reported that strains and sprains were the most frequent injuries and that 87% of injuries occurred in the lower extremities. In this study, it was found that injury incidence could change in different seasons, that training injuries peaked in June, and match injuries peaked in August, the month in which the first matches of the new season are played. Our study found that injuries were most frequently seen in the months of March, April and May and least frequently in the months of February, September, October and November. Our study also found that injuries most frequently occurred after business hours. Since the players in our study were not professional and played on synthetic fields for recreation, and since a period in which the competitions for synthetic field matches began or a training period for the players before beginning of the competitions was not available, it would not be appropriate to compare the injury periods found with the study of Hawkins et al.<sup>[9]</sup> In our study, it was thought that the patterns of injury by month and hours were associated with the times preferred by the amateur players for recreation and sports activities.

Our study has some limitations due its retrospective design. Since all cases reviewed occurred in the same city but on different synthetic fields in different localities, standardization of the synthetic fields where the injuries occurred was not possible. Also, standardization of factors that may affect injury, such as condition level of the cases and state of sports equipment was not possible. Therefore, the results of our study may not be used as basis to suggest that the injuries resulted entirely from the synthetic field ground. Another restriction of our study was the lack of a control group playing football on different fields such as soil, asphalt or natural grass. These restrictions reveal the need for prospective studies covering different control groups, and investigating football injuries on synthetic fields which are common sites for amateur football matches in our country. Despite these restrictions, our study covers a high number of cases, reveals the regional distribution characteristics of the football injuries on synthetic fields, injury types and diagnoses, underlines taking the necessary measures for prevention of such injuries, and the need for studies investigating preventive methods for amateur footballers in our country.

Football injuries in such sites as the knee and ankle lead to increased surgical procedures, and the increased rate of surgical procedures and subsequent rehabilitation constitute an economic burden.<sup>[3,12-14]</sup> The application of exercise programs to prevent injuries, performing warming exercises before the matches, protection of the sites with high possibility of injury by injury preventive equipment and complying with the rules of the game could reduce football injuries, and such measures are cost-effective.<sup>[1,3,5]</sup> Hence, investigating the sites, frequencies and possible mechanisms of injuries occurring in synthetic field football matches which are commonly played in our country by amateur players for recreation and sports purposes may guide in identification of measures that could be taken.

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