

Research Article / Araştırma Makalesi

## Adolescent tennis players' injury profile and awareness level of sports injury

### *Adolesan tenisçilerin yaralanma profilleri ve spor yaralanmalarına ilişkin farkındalık düzeyleri*

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#### ABSTRACT

**Objective:** The aim of this study is to examine the relationship between injury risk profile and injury awareness, as well as the level of injury knowledge and the incidence of injuries among adolescent tennis players.

**Material and Methods:** One hundred seventy-nine adolescent tennis players (n: 98 females and 81 males, age: 13.9±1.6 years), who had a history of at least one sports injury were included in the study. A questionnaire was designed by sport experts that questioned about the tennis injuries and awareness of tennis injuries.

**Results:** The most injured area was the shoulder (22%). It was followed by elbow (19%), ankle (17%), wrist (16%), and the knee (12%). Experiencing more sport injuries (more than twice) increased 5.7 times ( $p<0.01$ ) if they had medium knowledge level, and increased 22.4 times if they had low knowledge level ( $p<0.001$ ).

**Conclusion:** Upper extremity injuries are more common in adolescent tennis players comparing with lower extremity injuries. In addition, the number of previous tennis injuries was related to training load and the athletes' awareness of tennis injuries. Therefore, optimizing tennis training load and increasing the level of injury awareness in adolescent tennis players may be important in preventing future sports injuries.

**Keywords:** Adolescent, tennis, injury, survey

#### ÖZ

**Amaç:** Çalışmanın amacı, adolesan tenisçilerde yaralanma riski profili ile yaralanma farkındalığı arasındaki ilişkinin yanı sıra yaralanma bilgi düzeylerini ve yaralanma insidanslarını incelemektir.

**Gereç ve Yöntem:** Çalışmaya en az bir spor yaralanması öyküsü olan 179 adolesan tenisçi (n: 98 kadın ve 81 erkek, yaş: 13.9±1.6 yıl) alındı. Spor uzmanları tarafından tenis yaralanmaları ve tenis yaralanmalarına yönelik farkındalığı sorgulayan bir anket hazırlandı.

**Bulgular:** En çok yaralanan bölge omuzdu (%22). Bunu dirsek (%19), ayak bileği (%17), el bileği (%16) ve diz (%12) izledi. Daha fazla spor yaralanması yaşanma oranı (iki kezden fazla) bilgi düzeyi orta olan oyuncularında 5.7 kat ( $p<0.01$ ), bilgi düzeyi düşük olan oyuncularında ise 22.4 kat yüksekti ( $p<0.001$ ).

**Sonuç:** Üst ekstremitte yaralanmaları adolesan tenisçilerde alt ekstremitte yaralanmalarına göre daha sık görülmektedir. Ek olarak, önceki tenis yaralanmalarının sayısı, antrenman yükü ve sporcuların tenis yaralanmaları konusundaki farkındalıkları ile ilişkilidir. Bu nedenle adolesan tenisçilerde tenis antrenman yükünün optimize edilmesi ve yaralanma hakkında farkındalık düzeylerinin artırılması ilerideki spor yaralanmalarının önlenmesi açısından önemli olabilir.

**Anahtar Sözcükler:** Adolesan, tenis, yaralanma, anket

#### INTRODUCTION

Tennis players train extensively on the court to improve their technical capacity while maintaining their technical characteristics (1). High-intensity training is particularly crucial for tennis players to achieve optimum performance during long tennis matches in tournaments, where considerable physical and physiological capabilities are required (2). Tennis players, who need to satisfy certain qualities, may experience serious injuries, especially in the upper

extremity during high-intensity training sessions (2-5). These serious injuries are mostly rotator cuff tendinitis, lateral epicondylitis, muscle injuries, damage to growth plates, and stress fractures (6). Expressively, the most common injury due to acute trauma are ankle sprains (2). Such sports injuries prevent young players from joining essential tennis tournaments, and influence their professional career development (2,7).

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In a surveillance study, injury statistics of young tennis players during a tournament were given (4). However, only a limited number of studies are reported in the literature on sports injuries experienced by players during regular tennis training sessions. These studies on sports injury in young tennis players are inconsistent with each other. In one of the early studies on this subject, it was stated that most injuries seen in tennis players occurred in lower extremities, while in another study it was reported that injuries were mostly experienced in the upper extremity and core regions (8,9). On the other hand, recent studies reveal that most tennis injuries occur in the lower extremity (31-67%), followed by the upper extremity (20-49%), and lastly, the core region (3-21%), (6,10,11). Besides, Kovacs et al. stated that young American tennis players have more injuries in their upper extremities (back and shoulder), and emphasized the need for more research on sports injuries in young tennis players (7).

Athletes' knowledge of sports injury profiles and mechanisms may reduce the risk of injuries (12). Diverse injuries can be experienced in many sports branches including tennis. Therefore, injury knowledge is essential to reduce possible occurrences. However, the number of studies investigating the level of injury knowledge is quite limited. A study investigating the injury frequency of adolescent players in team sports reported that an increased level of injuries was experienced during the competition, where the injury knowledge level of these players was limited (10). Satyawati et al. stated that athletes with a high level of sports injury knowledge would have a better mental response to prevent and deal with sports injuries (13).

Adolescent players' injury knowledge in varying branches was compared with descriptive analysis in a study. The authors reported that athletes had low or moderate knowledge about injury. However, they did not make a relational study on the injury amount and injury knowledge (14). Andreoli et al. emphasized in their epidemiological study on sports injuries that randomized studies, surveillances, and epidemiological studies should be conducted to improve knowledge about sports injuries and to confirm the effectiveness of preventive interventions (15). A review article reported that existing data on injury profiles and injury mechanisms could be used to educate players because a solid knowledge of risk is likely to have a preventive effect (12).

Based on literature investigation, there is no study on the quantity of injury in tennis players, and the level of injury knowledge. Therefore, our study aims to determine injury figures and anatomical location of injuries adolescent tennis players in Turkey. Moreover, this study will investigate the relationship between injury occurrence and the level of

injury knowledge of tennis players, probably for the first time. As a main hypothesis, we foresee that players with knowledge about sports injuries would experience less sports injuries.

## MATERIAL and METHODS

Survey questions aiming to determine the injury profile of tennis players were collected (4,7,14,16) before the research started, they were assessed and finalized by sports medicine professionals, physiotherapists and tennis coaches, as a team of seven people in total. The first seven questions were designed to collect data on the players' characteristics and knowledge level about tennis injuries. Knowledge level were assessed by using a Likert scale whereby 4-5 points reflect high knowledge level, 3 points reflect moderate level, and 1-2 points reflect low level. The type, area, location, time of injury, and period of discontinuation from sports were among the items in the second part of the questionnaire.

### Participants

Only tennis players between the ages of 10 and 16 were recruited in the study. Players who practiced tennis at least four days a week and participated in national and international tournaments took part. Those who had suffered at least one sports injury during tennis training or match were included in this study. A total of 179 adolescent tennis players thus formed our study group. Participants were instructed to fill the Sports Injury Questionnaire (SIQ), which was constructed online using Google Forms (supplement file). Interviews and observations were not employed to obtain data for the study; only the questionnaire was used.

### Statistical Analysis

Data were computer-analyzed with the help of a pre-made application. Following the input of data, controls were created first, then the frequency (n), rates (%), means (x) and standard deviation (sd) were calculated for characteristics, and lastly tables were generated. In order to assess the normality distribution of data, skewness and kurtosis coefficients in the range of +1.5 to -1.5 were accepted as the criteria. It was interpreted that the scores obtained from the study did not display normal distribution (17). Data were analyzed using Statistical Package SPSS v22 (IBM Corp. Armonk, NY, USA). An alpha level of  $p < 0.05$  was considered significant. Based on this, Spearman's correlation test, one-way ANOVA (Welch's) and multinomial logistic regression tests were used for relationship scans and multiple comparisons.

## RESULTS

Descriptive statistics of the participants are given in Table 1. Knowledge levels of the athletes about tennis injuries and

the frequency of previous injuries are presented in Table 2.

**Table 1.** Descriptive statistics for the participants

	Gender	n	Mean ± SD
Age (yr)		179	13,9 ± 1,6
Height (cm)		179	167,4 ± 20,6
Body weight (kg)		179	57,3 ± 10,2
Tennis starting age (yr)	Female	98	6,4 ± 1,2
	Male	81	6,3 ± 1,40
Tennis training (days/wk)	Female	98	5,5 ± 0,7
	Male	81	5,6 ± 0,9
Tennis training (hrs/wk)	Female	98	13,4 ± 6,0
	Male	81	12,6 ± 5,3

**Table 2.** Frequency (n) and rate statistics for the participants about sports injuries

Questions	Level/Incidence	n	Rate (%)
Are you knowledgeable in sports injuries?	Low (1-2)	75	41,9
	Moderate (3)	64	35,8
	High (4-5)	40	22,4
Have you had a sports injury before?	Yes Once	116	64,8
	Yes twice	34	19,0
	Yes >twice	29	16,2

It was observed that the most commonly injured areas of the athletes were the shoulder (22%); elbow (19%), ankle (17%), wrist (16%), and knee (12%), followed by the back (7%), hip (3%), and other areas (3%). The most injured area of female athletes was the shoulder, while the most injured area of male athletes was the elbow (Figure 1). It is seen that most of the injuries experienced by the athletes in the 10-12 age (n=50) range were in the shoulder, elbow, and wrist (22.6% each), 15.1% in the ankle, and 11.3% in the knee. Mostly injury affected areas in participants in the 13-14 age (n=55) range were 20.6% the ankle, the shoulder and the elbow (19.6% each), 16.5% the wrist and 12.4% the knee. The most commonly experienced injuries in those between the ages of 15-16 (n=74) were in the shoulder and the elbow (23.7% each), 20.5% in the wrist, 15.3% in the ankle, and 11.9% in the knee (Figure 2).

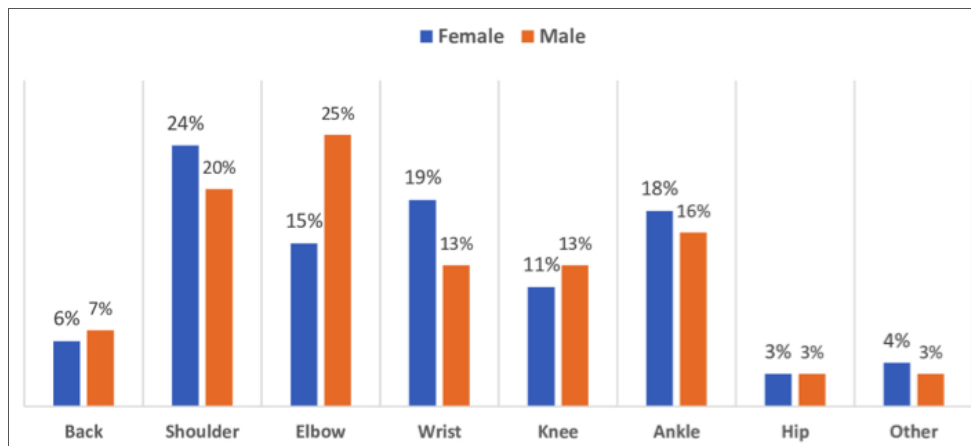


Figure 1. Injury profiles of the participants

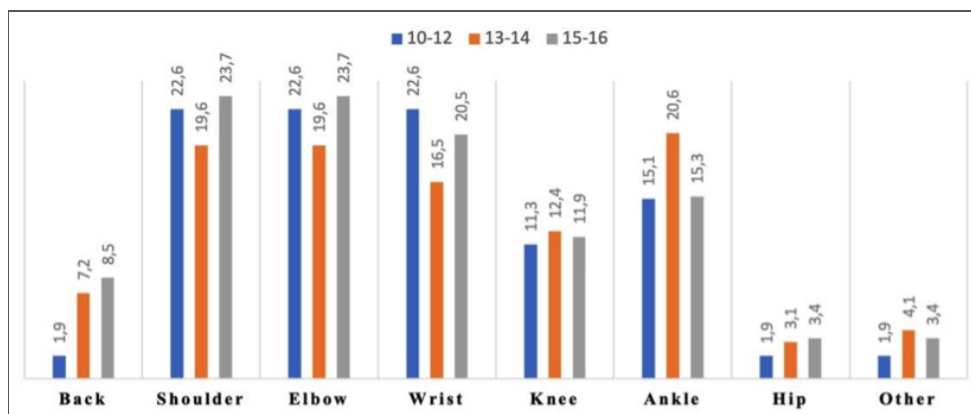


Figure 2. Distribution of the injuries according to age

There was a statistically significant negative moderate correlation between sports injury occurrence and having knowledge about the sports injury ( $r=-0.454$ ,  $p<0.001$ ). A low level of positive correlation was present between the quantity of sports injury suffered by the participants and weekly

tennis training hours ( $r=0.224$ ,  $p<0.01$ ). There was a significant difference between the amount of sports injuries in relation to the level of knowledge on sports injuries ( $F=23.2$ ,  $p<0.001$ ), (Table 3).

**Table 3.** ANOVA (Welch's) results for sports injuries and sports injury knowledge level of participants

IK level	n	SV	SS	df	MS	F	p	η <sup>2</sup>
Low	75	Between groups	21.4	2	10.722			
Moderate	64	In groups	21.4	2	10.722	23.2	0.001***	0.21
High	40	Total	81.3	176	0.462			

IK: injury knowledge; SV: source of variation, SS: sum of squares, df: degrees of freedom, MS: mean of squares; η<sup>2</sup>: Cohen eta squared effect size; \*\*\*: p<0.001.

It was found that being a female athlete increased the probability of injury by 3.5 times (p<0.01). In low level knowledge, the probability of experiencing more two times sports injuries than once increased by 3.7 times (p<0.05) compared with the medium level of knowledge, and by 8.3 times compared with the high level (p<0.001). The probability of experiencing more >2 times injuries than once increased by 5.7 (p<0.01) times compared with the medium level of knowledge, and by 22.4 times compared with the very knowledgeable level (p<0.001), (Table 4).

**Table 4.** Multinomial regression test results of the participants

Predictor	Estimate	SE	CI	Odds Ratio	P
Intercept	-3.2203	0.73	-4.65 / -1.79	0.04	0.001***
Female-male	1.2525	0.47	0.34 / 2.17	3.5	0.007**
<b>Twice/Once</b>	<b>Are you knowledgeable in sports injury?</b>				
Little-middle	1.3148	0.55	0.24 / 2.39	3.7	0.017*
Very-little	2.1161	0.62	0.91 / 3.32	8.3	0.001***
Intercept	-3.0940	0.84	-4.75 / -1.44	0.05	0.001***
<b>Yes &gt;Twice/Once</b>	<b>Are you knowledgeable in sports injury?</b>				
Little-middle	1.7388	0.72	0.32 / 3.16	5.7	0.002**
Very-little	3.1066	0.76	1.62 / 4.59	22.4	0.001***

N=179, R<sup>2</sup>=0.25 (Nagelkerkes), Model= χ<sup>2</sup> (2) =64.3, p<0.001; SE: standard error; CI: confidence interval.

## DISCUSSION

In present study, it was aimed to document adolescent tennis players' injury profile and to investigate whether adolescent tennis players' knowledge levels about tennis injuries were related to tennis injury rates. It appeared that adolescent tennis players experienced more injuries in the upper extremity. In the age groups, the players in the 10-12 and 15-16 age groups mostly had shoulder injuries, while the players in the 13-14 age group had ankle injuries. A positive relationship was found between the training time and the number of injuries. The level of knowledge about sports injuries was found to be related to the number of experienced injuries.

The results of the present study can be important in terms of providing information to sport professionals about injuries of adolescent tennis players. In the literature, there are limited studies on injuries suffered by adolescent tennis

players. In this study, when all age groups were combined, the prevalence of injuries in different areas was as such: 22.0% shoulder, 19.4% elbow, 17.2% ankle, 16.4% wrist, and 11.9% knee. When the injuries experienced are examined in terms of gender, the most common injuries in females were in the shoulder, wrist, ankle and elbow; while in males elbow, shoulder, ankle and wrist injuries were observed.

Consistent with our findings, Kovacs et al. reported that American adolescent tennis players had the highest number of shoulder, ankle, knee and wrist injuries (7). Pluim et al. documented that the most common injuries experienced by adolescent tennis players during a season were placed as such: knee (18.2%), waist/spine (17.0%), shoulder (15.9%), ankle (12.5%) and wrist (9.1%), (18). In their epidemiological study, Kibler and Safran examined the injuries suffered by adolescent tennis players (2). According to their results, the most common injuries among adolescent tennis players were in the lower extremities (39-59%), followed by the upper extremities (20-45%). These authors revealed that shoulder and elbow injuries were most prevalent in the upper extremity, whereas ankle injuries were most common in the lower extremities. These findings are consistent with those of our research.

High-intensity hits (such as serving) in tennis are one of the most common causes of shoulder injuries (18,19). High-speed arm motions are required to perform these strokes. During matches or extensive training, injuries can arise due to these repetitive differential motions, and the excessive use of upper extremity parts (shoulder, elbow), (7,16,18). The service stroke in tennis is more difficult than other strokes because shoulder and forearm muscle activation is higher, comparing to other strokes (2). As this situation may be similar for kids and teenage players, serving incorrectly or with a short angle of motion puts extra strain on the shoulder and forearm (2,19). It is necessary for players to learn appropriate technical strokes, and include branch-specific strength training in order to reduce risk of injury during these strokes (2).

Acute injuries such as ankle sprains occur due to movements such as acceleration-deceleration and sudden change of direction in the lower extremity during tennis (2). The majority of lateral ankle sprains are caused by twisting while the ankle is in plantarflexion (2,20). The talofibular ligament is the most commonly damaged ligament, but in more severe sprains, the calcaneofibular ligament can also be damaged (4,19).

In this study, a low level correlation was found between the number of injuries and weekly training hours. However, Kovacs et al. reported that adolescent tennis players who train

or compete six days a week suffer more than 50% of all reported injuries, whereas individuals who rest two days a week (i.e., train/compete five days a week) have only one injury per week. There were 50% fewer injuries in individuals who rested every other day (7). Thus, in order to reduce the risk of injury to the players, coaches should adjust the number of annual tournaments and weekly training days and times according to the current situation of the players, following the load-rest principle (21,22).

Knowing injury profiles and mechanisms in the players can be effective in reducing the risk of injury in sports (12). The frequency of sports injuries and the level of knowledge about sports injuries were shown to be negatively correlated in the current study. There was also group differences, when sports injury knowledge levels of the athletes in our study were examined. In terms of the number of injuries, it was found that those with low and moderate injury knowledge had more than those with high injury knowledge. According to these findings, adolescent tennis players' understanding on how to avoid injury may assist them in reducing the risk of future injuries in their careers. In another study, where descriptive analysis was used to examine injury knowledge levels of adolescent players in various sports branches, Ozdemir et al. reported that athletes (football players, n=89; volleyball players, n=37; basketball players, n=46) had low to moderate knowledge of injury (14).

Likewise, it has been observed that players who had injuries twice and those who had more than two injuries were 22.4 times at more risk of injury compared with players with low or high injury knowledge. There are limited studies in the literature investigating the level of injury knowledge in sports. Andreoli et al. emphasized that more randomized studies, more surveillance and epidemiological studies need to be conducted to improve knowledge about sports injuries, and to confirm the effectiveness of preventive interventions (15).

Most studies investigating the level of injury knowledge included contact-based sports branches (such as American football, ice hockey, football), (13,22-24). Satyawan et al. investigated the relationship between knowledge on sports injuries and mental responses in football players (13). The level of knowledge on sports injuries plays an important role not only in reducing the risk of injury, but also in helping sports physicians or other physicians who are experts in diagnosing the injury, and in the complications that follow the injury (13,23). Especially in contact sports, this issue is vital in some situations (such as blows to the head). A study including players from a college team revealed that football players with higher levels of sports injury were more likely to suffer concussion (23). Every injury has a ne-

gative impact on overall health of the body; hence it is important to inform the athletes how to prevent injuries and rehabilitate them appropriately once they occur.

### Limitations

In our study, a questionnaire was created by reviewing studies in the field of tennis, with a group of experts in the field. Therefore, a subjective measurement tool was used in the study. Data were gathered from self-reports of the players, remembering past injuries. We tried to ask simple questions that the adolescent population could easily answer. As such, the scope of the questions about injuries may have been limited. Besides, the results of the study reflects adolescent tennis players' situation, and cannot be generalized to adult tennis players.

### CONCLUSION

Upper extremity injuries are more common in adolescent tennis players. Moreover, the number of previous tennis injuries are associated with training load and the awareness of athletes about tennis injuries. Appropriate training load for adolescent athletes and increasing knowledge on tennis injuries among those athletes can be effective in decreasing the rate of tennis injuries.

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### Ethics Committee Approval / Etik Komite Onayı

The approval for this study was obtained from Sinop University Ethics Committee (Decision no: no: 2021/115, Date: 27.09.2021).

### Conflict of Interest / Çıkar Çatışması

The authors declared no conflicts of interest with respect to authorship and/or publication of the article.

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### Author Contributions / Yazar Katkıları

Concept - All authors; Design - All authors; Materials - GH, MA, AM; Data Collection/or Processing - MG, AM, MA; Analysis and Interpreting - GH, MG; Literature Review - All authors; Writing Manuscript - GH, MA; Critical Reviews - GH.

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