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Analysing Of the Types of Injuries Observed In Table Tennis Players According To the Some Variables

Leyla Alizadeh Ebadi [1*], Mehmet Günay[1]
1. Faculty of Physical Education and Sports Science, Gazi University, Ankara, TURKEY
Corresponding Author' Leyla Alizadeh Ebadi

This study involved table tennis players who joined Turkish Championship in Ankara. The study attempts to identify the knowledge level 117 table tennis players (57 males and 60 females), who are between 13 and 42 years old, have concerning injuries, and to reveal differences according to some variables. A questionnaire was administered in order to find out their level of knowledge on the injuries they experience and their knowledge on how to avoid injuries. The mean age of the participants were calculated to be 24.5±2.81. The analysis of the research data was carried out on computer using SPSS 19 software, and T-test was applied for two samples. The frequency variables were calculated as percentage, and p value < 0.05 was recognized as significant. Chi-square test was used for cross tables, and compare column proportion test was used to analyse and reveal the differences among the variables. 50.4% of the participants attribute the reason of injury to inadequate warm-up, while 28.2% of them attribute it to inappropriate floor surface. Additionally, upper extremity injuries were more prevalent than lower extremity injuries. The most commonly injured location per individual body part was the shoulder or clavicle (29.23% of all injuries for males), Arm, elbow, wrist, or hand (24.61% of all injuries for males), knee (21.05% of all injuries for females) and Arm, elbow, wrist, or hand (21.05% of all injuries for males) . Majority of the sportsmen taking the questionnaire prefer seeing the doctor in case of injuries. Mostly the time off following injuries were 1-7 days, and 82% of the subjects gained their usual performance back after the injuries. Majority of the coaches of the subjects stated that they have knowledge on injuries, and it was found that the participants also had moderate knowledge about injuries.

Key words: *Table tennis, Injury areas, Causes for injuries, Survey, Analysis*

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I. Introduction

Table tennis is a complex sport, in which velocity, reflexes, instantaneous decision and the management of the effects and the technique are important. The wrist, elbow, shoulder, the trunk rotation and displacement of the lower limbs in constant knees flexion take part actively during the practice of the sport (Correa-Mesa & Correa-Morales, 2014).

Musculoskeletal injuries are common in sports practice and correspond to 80% of lesions in sports(Matheus et al., 2008) Joint injuries, especially on the knee, have significantly increased due to increase of the number of people who practice physical activities, both professionally and recreationally. In addition, starting sports activities has happened at early ages, with training request and increasing levels of competitiveness, sometimes devoid of appropriate technical supervision (Patel & Baker, 2006).

Sports injuries can be defined in numerous ways: injuries that lead to stopping practice or competition, decreased activity, and need for medical care (Patel & Baker, 2006). The National Athletic Injury Reporting System (NAIRS) from U.S.A. divides lesions into the following categories: non-reportable, the athlete does not interrupt activities; minor, losing of 1-7 days; moderate, 8 to 21 days; major, over 21 days loss and severe injury, resulting in permanent disability (Vital et al., 2007). Some other factors may determine the severity of the injury, its nature, duration of treatment, absence from school and costs involved. This number of musculoskeletal injuries comprise the majority of bruises, light sprains, and muscle injuries (about 54%) which compromises sports practice for a brief period of tyme (Vital et al., 2007). These correspond to non-reportable injuries, lighter, smaller and in a smaller proportion, moderate ones. The lower limb is most commonly affected, due to the overhead imposed in sports that involve running and jumping, in which the force on the knees can reach up to 10 times the body weight; other important factors would be the change of direction, as in football, and physical contact between participants (Vital et al., 2007). Approximately 90% of sports injuries are located in the hip, thigh, knee, leg, ankle and foot (Vital et al., 2007).

There are few Brazilian studies that assess the epidemiology of knee injuries in practice of various sports, inversely to what is observed in the international literature.(Brophy et al., 2007).

The aerobic and anaerobic requirements of racquet sports, combined with the variety of strokes, result in a unique profile of injuries (Pluim et al, 2006). In addition, racquet sports entails high aerobic and anaerobic demands, with repetitive stresses through a variety of strokes and movements (Elliott, 2006; Perkins & Davis, 2006). As a result, racquet sports players are susceptible to a range of injuries including chronic overuse conditions and acute traumatic injuries. Unlike other sports, racquet sports matches are not limited in duration by a predetermined length of play, and matches can often last several hours (Kovacs, 2006). In addition, racquet sports entails high aerobic and anaerobic demands, with repetitive stresses through a variety of strokes and movements (Elliott, 2006; Perkins, 2006). As a result, racquet sports players are susceptible to a range of injuries including chronic overuse conditions and acute traumatic injuries (Elliott, 2006; Perkins, 2006).

Participation in racquet sports, especially at elite levels, places players at risk for musculoskeletal injury (Abrams et al., 2012). There has been a wide variation in the overall reported incidence and prevalence of injury in racquet sports as there have been differences in the definition of injury, study populations, methods of data collection, and duration and/or frequency of follow-up between investigations (Abrams et al., 2012).

As methodologies and populations have varied between studies, the exact incidence and prevalence of injuries caused by racquet sports have been difficult to determine. In high-level players under 18 years of age, injury rates have been estimated to be anywhere from 2 to 20 injuries per 1000 h of racquet sports played (Abrams et al., 2012). Pluim et al, in a comprehensive meta-analysis across all player levels, reported racquet sports-injury incidence as ranging from 0.04 to 0.3 injuries per 1000 h played. Some of the variation in these statistics invariably are the result of different definitions of injury used in the investigations. For example, in studies which defined racquet sports injuries as those requiring a trip to the emergency room, the rate of injury from racquet sports participation was extremely low (Finch et al., 1998). Other investigations, which have had more liberal definitions of injury to include any injury for which the player seeks medical assistance or treatment, have reported higher rates of injury (Silva et al., 2003).

Though the consensus statement on the epidemiological reporting of racquet sports injuries recommends the use of 1000 match hours as the reporting frequency, match durations are not always readily available for previous matches, and therefore, there is a variety of injury frequencies reported in the literature making direct comparisons difficult. Using data on minutes played for all professional racquet sports events from the Association of Tennis Professionals (ATP) and Women's Tennis Association (WTA) between 2011 and 2016, Gescheit et al. found that games played was more strongly correlated to minutes played than sets or matches (Gescheit et al., 2017). Using this methodology, the authors examined injury data from the Australian Open Grand Slam through the same time period, and found injury rates of 201.7 injuries per 10000 game exposures for women, and 148.6 for men. In addition, they noted significant differences in the injury distribution between men and women, with the shoulder, foot, wrist, and knee being the most commonly injured sites among women, and knee, ankle, and thigh injuries being the most prevalent in men (Gescheit et al., 2017). Interestingly, through the study periods from 2011 to 2016 the authors noted an increasing rate of upper extremity injuries in both men and women over time. There is also value in determining injury prevalence among players followed prospectively through time. In a prospective study of 58 NCAA tennis players through an entire season, Colberg et al. found an overall incidence of acute injuries of 1.1injuries per 1000 playing hours of match play (Colberg et al., 2015).

However, 67% of players had at least one musculoskeletal condition during the season. With further sub-analysis, the authors also found that all injuries sustained during match play were acute in nature, while 69.6% of injuries sustained during training were gradual onset. 27.6% of players had at least one chronic condition during the season (Colberg et al., 2015).

With increasing participation rates at even younger ages, it is important to monitor injury rates among junior racquet sports players as well. Pluim et al. prospectively followed a cohort of 73 elite junior racquet sports players (ages 11-14 years) in the Dutch national high-performance program for 32 weeks (Pluim et al., 2016). Players averaged 9.1 h of practice and 2.2 h of match play per week. The authors found that a total of 187 health problems were reported by 67 of the players, with an average weekly prevalence of any health problem of 21.3%. Overuse injury was the most common health problem, (47%) followed by medical illness (36%), the most common being respiratory tract and gastrointestinal infection, and acute injuries (13%). The incidence of acute injuries was 1.2 injuries per 1000 h of racquet sports, which is in line with the previous literature. Considering the data in it's entirely, however, about one in eight players were playing with pain every week, which is an area of concern given this cohort of school-age children (Ellenbecker et al., 2018).

Table tennis is a racquet sport which requires players to adopt the semi-flexed knee position up to 90 degrees or more for sustained periods of time along with abrupt asymmetrical torsional trunk movements. Such movements subject the knee to excessive rotational torques due to the fixed position of the lower limb on the ground especially during forehand and backhand loop serves (Kondric et al., 2008). Similarly, the execution of rapid lateral and anterior-posterior excursion movements of the lower limb during forehand and back hand strokes in order to gain control of the ball along with high bilateral jumping exposes manoeuvres expose the

knee joints to extreme loading conditions. The cumulative loading on the knee predisposes the table tennis player to overuse conditions such as jumper knee (Kondric et al., 2008).

II. Materials And Methods

In the present cross-sectional study, 117 table tennis players (57 males and 60 females), who are between 13 and 42 years old, have concerning injuries, and to reveal differences according to some variables. A questionnaire was administered in order to find out their level of knowledge on the injuries they experience and their knowledge on how to avoid injuries. The mean age of the participants were calculated to be 24.5 ±2.81. All collegiate tennis players that were currently registered members of each institution that agreed to participate were then contacted and provided a consent form explaining the risks and benefits of the study. outcome measurements were the following: demographic information (age, gender, height, weight, dominant hand, type of forehand and backhand), conditions in which the injury occurred (including competitive vs training setting, playing format, court surface, time exposure, nature of the injury, cause of injury), racquet specifications (racquet weight, racquet size, strings and tension specifications), and lost playing time due to the condition. The analysis of the research data was carried out on computer using SPSS 19 software, and T-test was applied for two samples. The frequency variables were calculated as percentage, and p value<0.05 was recognized as significant. Chi-square test was used for cross tables, and compare column proportion test was used to analyse and reveal the differences among the variables.

III. Results

The results showed that our study included 117 athletes from four undergraduate institutions (Table 1). Female teams were larger than male teams; therefore, we had more female athletes in the study. The season lasted 16 weeks, with an average exposure of 230 hours of training and match play per player. Most played on hard-court surfaces six times per week, and trained twice as long as the average match's length. The average match lasted 106 minutes.

Table 1. Players' Baseline Demographic Information

	Females		Males	
	(N=60)		(N=57)	
Training hours per day	2.3	0.62	2.70	0.50
Training days per week	5.1	0.33	5.91	0.83
Training hours per season	168.2	42.68	185.01	58.65

The various causes of injury were reported on Table 2. Of note, more than half of the injured athletes attributed the injury or condition insufficient warming and inappropriate playground surface; 50.4% of the participants attribute the reason of injury to inadequate warm-up, while 28.2% of them attribute it to inappropriate floor surface.

Table 2. Causes of injury

	N (%)
Primary Cause of Injury	
Sudden movement	9 (7.70%)
Overuse	1 (0.90%)
Secondary Causes of Injury	
Poor technique	7 (6.00%)
Insufficient warming	59 (50.40%)
Physical inconvenience	5 (4.30%)
Racquet specifications	3 (2.60%)
Inappropriate floor surface	33 (28.20%)

In terms of playing time lost, symptoms interfered with playing for an average of seven days, but five players were not able to return to play before the season ended. 57 players injured returned to full participation within one week, 19 players injured returned to full participation within 1-4 weeks and 33 players injured returned to full participation within 1-6 months from onset of the injury (Table 3).

Table 3. Playing time lost

Time lost	N (%)
Slight (< 1 day)	13 (11.11%)
Minimal (1-3 days)	14 (11.96%)
Mild (4-7 days)	30 (25.64%)
Moderate (8-28 days)	19 (16.23%)
Severe (1-6 months)	33 (28.20%)

Long Term (>6 months)	5 (12.82%)
Information not reported	3 (2.56%)

The side of injury or condition, and body location males and females were reported in Table 3. The conditions were reported for males and females. By body region, upper extremity injuries had the highest incidence for both six. Respectively, an average of 21.52% and 44.73% of musculoskeletal conditions occurred in the lower extremities at males and females. The Arm, elbow, wrist, or hand had the highest prevalence of gradual-onset conditions. Both upper extremity injuries and lower extremity injuries were significantly more prevalent than trunk injuries both at males and females. Additionally, upper extremity injuries were more prevalent than lower extremity injuries. The most commonly injured location per individual body part was the shoulder or clavicle (29.23% of all injuries for males), Arm, elbow, wrist, or hand (24.61% of all injuries for males), knee (21.05% of all injuries for females) and Arm, elbow, wrist, or hand (21.05% of all injuries for males) (Table 3). Specifically looking at anatomical structures injured in each body part, the most commonly injured structures were joint or ligament (40% for males and 38.15% for females of all injuries) and muscle or tendon (43.07% for males and 40.78% for females of all injuries).

Table 3. Injured Locations and Structures

Most severely injured area	Males	Females
Head or neck	2 (3.07%)	9 (11.84%)
Shoulder or clavicle	19 (29.23%)	12 (15.78%)
Arm, elbow, wrist, or hand	16 (24.61%)	16 (21.05%)
Trunk	2 (3.07%)	5 (10.52%)
Hip, groin, or thigh	7 (10.76%)	11 (14.47%)
Knee	14 (21.53%)	16 (21.05%)
Lower leg, ankle, or foot	5 (7.69%)	7 (9.21%)
Most severely injured structure		
Bone	5 (7.69%)	6 (7.89%)
Joint or ligament	26 (40.00%)	29 (38.15%)
Muscle or tendon	28 (43.07%)	31 (40.78%)
Nerve	3 (4.61%)	6 (7.89%)
Don't know/not sure	3 (4.61%)	4 (5.26%)

Most of the work to date examining injuries associated with racquet sports has focused on acute injuries rather than chronic musculoskeletal conditions with evidence from these studies that table tennis players have a lower incidence of injury compared with racquet sports players (Kondric et al., 2008). These investigations also serve to highlight the need to examine each racquet sport on an individual basis in order to identify their characteristic injury patterns due to the unique features of each sport (Kondric et al., 2011). In terms of injury location, table tennis is distinguished by higher levels of shoulder injuries compared with either badminton or tennis with the knee joint accounting for between 5% of the total number of acute injuries experienced by table tennis players (Kondric et al., 2011).

With increasing participation rates at even younger ages, it is important to monitor injury rates among junior racquet sports players as well. Pluim et al. prospectively followed a cohort of 73 elite junior racquet sports players (ages 11-14 years) in the Dutch national high-performance program for 32 weeks (Pluim et al., 2016). Players averaged 9.1 h of practice and 2.2 h of match play per week. The authors found that a total of 187 health problems were reported by 67 of the players, with an average weekly prevalence of any health problem of 21.3%. Overuse injury was the most common health problem (47%), followed by medical illness (36%), the most common being respiratory tract and gastrointestinal infections,and acute injuries (13%).

Racquet sports is also unique from other sports in that there is a variety of playing surfaces ranging from hard court (acrylic), clay, grass, and artificial grass. Hard court has the highest coefficient of friction and lowest shock absorption, which makes sliding much more difficult, leading to shorter stopping distances and theoretically higher peak loads (Pluim et al., 2016). From the Davis Cup data, 75% of all injuries occurred on hard courts (Maquirriain & Baglione, 2016). Higher ball speeds on hard courts may also lead to higher forces applied on the upper extremities (Dines et al., 2015). Conversely, clay is considered a slower surface due to increased shock absorption and loss of ball speed. However, the lower coefficient of friction between the clay surface and the player means that sliding becomes an integral part of playing on clay, which might entail an entirely different set of stresses on the body (Dragoo & Braun, 2010). Unlike most sports, racquet sports is played on a variety of surfaces, including clay, grass, and acrylic (or hard) courts. Clay is considered a slow surface because there is more friction at the ball-surface interface, resulting in a larger loss of ball speed on contact with the court (Hutchinson et al., 1995). On hard courts, the faster speed of the ball subjects the upper extremity to more force. To date, however, there is little evidence linking surface with type or frequency of injury; however, Nigg and Yeardon (1987) have shown that muscles are sensitive to surface stiffness and that

frequently playing on different surfaces may be associated with injuries in the lower extremity (Safran et al,. 1999; Hutchinson et al., 1995; Nigg & Yeadon, 1987).

While racquet sports is an overall safe and low-risk sport, it is nevertheless associated with its own unique set of acute and chronic injuries. Within the last several years, there have been a number of longitudinal studies on the epidemiology of injuries among racquet sports players at various levels, ranging from junior racquet sports to major Grand Slam tournaments. Consistent with previous literature, acute injuries tend to occur in the lower extremities, while chronic overuse injuries more often affect the upper extremities and knee. Although direct comparisons of injury rates are difficult due to heterogeneity in injury incidence denominators, which include hours of play, games or sets played, and match exposures, elite levels of racquet sports appear to be associated with increased acute injury incidence compared to collegiate and junior racquet sports. However, when athletes are followed longitudinally, even junior racquet sports players are often afflicted with overuse musculoskeletal conditions.

The principal findings of our study are first, that there is a great variation in the reported incidence rate of racquet sports injuries; second, that most injuries occur in the upperextremities, followed by the lower extremities and then the trunk; third, that there are very few cohort studies available that estimate a measure of association between risk factors and occurrence of racquet sports injuries; and fourth, that there are no randomised controlled trials on preventative measures in racquet sports**.** The variation in the reported incidence rates of racquet sports injuries most probably reflects variation in injury definition**,** study design, populations under study, methods of data collection, and the duration of follow up or recall period.

Other possibilities for prevention include: education of players, parents, and coaches about racquet sports injuries, interval musculoskeletal screening of players to identify problem areas before injuries occur, and adjustment of equipment including shoes, racquets, strings, and balls as well as court surfaces. However, further research is needed to move from a stage of clinical expertise and speculation to real evidence based prevention of racquet sports injuries. Future studies are being conducted in a prospective manner in order to improve the quality of information and create a solid database. The clinical relevance of this study is, therefore, to present demographic information of major injuries in college sports, allowing proposing strategies for injury prevention and health promotion.

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