

Season-long pattern and anatomical distribution of injuries among college soccer players

DANIELLE LACASSE¹, WYCLIFFE W. SIMIYU, NJORORAI²

^{1,2}Health and Kinesiology, Tyler, University of Texas, UNITED STATES OF AMERICA

Published online: March 31, 2021

(Accepted for publication March 15, 2021)

DOI:10.7752/jpes.2021.02115

Abstract

Injuries in sporting activities can alter the trajectory of one's career and life. Therefore, the purpose of this retrospective study was to investigate the season long injury rate and anatomical location of injuries among male and female soccer players at the University of Texas at Tyler (UT Tyler) during the 2019 competition season. Records of injury occurrences were sought from the Head of Athletic Training in the Department of Athletics after obtaining consent from the individual players on the soccer roster for fall 2019 season. The Athletic Trainers collected data throughout the season and results were analyzed to derive any patterns regarding frequency, type and anatomical location of injuries so that preventive strategies can be instituted before and during the following season. Findings showed that 62 injuries occurred during the season with men incurring 19 (30.65%), while the women suffered 43 (69.35%). It was apparent that most injuries occurred during training (64.5%) compared to those in games (35.5%). Anatomically, the lower limbs suffered most injuries (37, 59.70%); followed by the trunk (11, 17.75%), head (08, 12.90%), upper limb (04, 6.5%) and neck (02, 3.23%) respectively. It was established that women suffered more injuries compared to men; most injuries occurred during practice compared to those during competition; and that the lower limbs tended to suffer more injuries compared to other anatomical parts of the player's body. The higher occurrence of injuries to the lower limbs was attributed to the nature of the soccer game as the execution of most skills and movements within the sport are lower limb dependent. Most frequent injuries were soft tissue related especially strains and sprains. It is recommended that a preventative prospective study of lower limb injuries be done to aid in reducing the risk of injury during the season.

Key Words: Soccer, injuries, lower limb, sprain, strain, gender, collegiate athletics

Introduction

Sustaining an injury is one of the inevitable consequences of participating in athletics (Wekesa, Asembo, & Njororai, 1996). According to Lütthje et. al., (2007), an injury in a sporting context is defined as an incident that occurs in a scheduled practice or game that causes the individual to temporarily interrupt the game or training to receive medical attention so as to restore or enable the athlete to perform at maximal potential. Injuries in athletics are extremely complex because not only do they affect the individual athlete's physical and mental functioning, but also a team as a whole.

In the past, determining preventatives for injuries was limited due to lack of education, but with new technology and improved data recording protocols, the injury rate is easier to pinpoint. For instance, Rossi et. al, (2018), established that soccer injuries in Spain caused 16% of the season to become hindered leading to a loss of 188 million euros per season. This type of information can be used to determine how to prevent injuries in the future and help athletes with the mental side of coping with recovery and possible financial costs. While technology is key to seeing the cost and determining injury occurrence in terms of percentages as well as interventions, there is first a need to break down injuries into categories to determine the type, location, and time patterns within them (Rossi et. al, 2018). This type of research is defined as retrospective surveillance of injury and is the first step in finding a preventative strategy (Ekstrand et.al., 2021). Retrospective surveillance research specifically takes records from the past to develop a plan of action. In athletic cases, they take records of seasons or insurance records to determine injury rates (Lütthje et. al., 2007). These can then be used as a mode of developing preventative measures.

College soccer is just one of these sports where injury is prevalent and should be studied. According to the National Collegiate Athletic Association (Karr et. al., 2015) soccer injuries are unique to other collegiate sports in that players are more susceptible to muscle strains and ligament sprains because of quick changes in direction (De Souza et.al., 2017; Manoel, et.al., 2020). Furthermore, the leg muscles are susceptible to injuries over other locations due to minimal protection in the sport (Admin, 2016; Men's Soccer Injuries, 2009). Because of soccer's uniqueness in injuries, the NCAA adopted specific protocols and requirements in order to protect the safety of individuals. These preventative measures include signing medical forms, physical examinations, and

concussion protocols to ensure catastrophic injuries are not unnoticed (Alexander, 2013; Dowdell & Hecht, 2017). Along with these tests, athletic trainers at the University are required to keep a log of injuries for athletes and report injuries to the school's physician (Alexander, 2013). This is no exception for the University of Texas at Tyler (UT Tyler). The athletic trainers at UT Tyler are required to make logs of the injury rate of each athlete, time of injury, and type of injury (Alexander, 2013). This is essential data that can be utilized with retrospective surveillance to determine what issues are prevalent in each team. For instance, if a team has a higher rate of injury during practices, then next season the practices can be modified to prevent or minimize injury occurrence for both men and women sports.

This log of injuries is important because it also outlines another huge aspect in soccer at the collegiate level: the differences in injuries between both men and women's soccer players (Gulbrandsen, et.al., 2019; Larruskain et. al., 2017). At a national level, many people witness men and women sustain injuries on and off the field. While these injury rates may look similar, women are actually more prone to injuries at all levels according to the Harvard Health Association (Ralston, et.al, 2020; Schmerling, 2015). This is because women have higher estrogen levels, greater flexibility leading to weak ligaments, a wider pelvis to alter knee and ankle alignment, a smaller space for Anterior Cruciate Ligaments (ACL) to move, and a higher chance of having an inadequate calcium and vitamin D levels (Blasco et.al., 2018; Geier, 2016; Schmerling, 2015). All these issues can lead to a higher chance of attaining an injury compared to their male counterparts. At University of Texas at Tyler, there are two separate soccer teams for men and women. However, no study has been done to establish whether there is a different injury rate occurring between the male and female players. This is important to know so that the different coaches and the attending Athletic Trainers can put into place data-driven preventive training regimens to minimize or prevent injury occurrence among the players.

This study, therefore, utilized retrospective surveillance to analyze the injury rate between the men and women's soccer team at UT Tyler. Injury time, location of injury, and type of injury were recorded by the athletic trainers at UT Tyler and were used to investigate the season-long occurrences and anatomical distribution of injuries between both men and women's soccer. It was hypothesized that overall, men and women soccer players would not have more injuries to the lower extremities compared to the upper extremities; that women would not have more injuries than men in total and that there would be no significant relationship in the injuries sustained and the phase of soccer involvement i.e. practice vs competition as well as type of injuries.

Material & methods

During the fall competition season of 2019, the UT Tyler men and women's soccer teams were evaluated based on their injury rates. The University of Texas at Tyler has had soccer programs for men and women since 2002. Both teams first took part in the NCAA Division Three and affiliated to the South Western Conference from inception to 2018. However, after the 2018 season, the University applied and was accepted to NCAA Division Two and affiliated to the Lonestar Conference. Fall 2019 was the first time the teams played a Division Two schedule although the rules did not allow them to qualify for the post season portion of the competition schedule as the transition phase takes three years. Evaluation took place after a signed consent form from each competing athlete (27 men and 34 women) were taken. The assessment took place on all grass fields at UT Tyler and affiliated Lonestar conference soccer fields from August 16th, 2019 till November 9th, 2019 with the athletic trainers at University of Texas at Tyler keeping a record of all the injuries. For this study, an injury was defined as an incident that occurred in a scheduled practice or game that led an individual to temporarily interrupt the game or training to receive first aid or medical attention. Every time a stoppage happened for an athlete to be attended to, a record was made. The attending athletic trainers kept a log of each person's injury type, date, location, and demographic information of the player. The athletes were also required to sign into treatment for follow up assessment. These logs are kept in a secure place in line with Health Insurance Portability and Accountability Act requirements for the US Government. In order to access the information, each athlete signed a part of the consent indicating their injuries could be shared for research purposes.

For this specific study, the trainers assessed athletes as indicated above, and blocked the timing, to make the data easier to collect, into three indicated times of the season namely, preseason (August 16th-September 20th), midseason (September 21st- October 11th), and end of the season (October 12th to November 9th). These time periods were further broken down into two sections: games and practice. These time periods and sections were essential to understanding what time of the season injuries occur and what type of play is happening when they occur. The next part of the study that was organized measured the anatomical distribution of each injury. Anatomical body parts vary from head to toe and were measured out as a percentage of the total injury in that body part for men and for women. These evaluations were then broken down to types of injury. Types of injury included: concussion, contusion, laceration, nosebleed, sprain, strain, tendinopathy, spasm, and other. These values were also measured as a percentage and organized into a table. Season phase injury, anatomical location of injury from head to legs, and injury type were averaged out overall and placed into pie charts comparing men and women soccer players. There was also a total combined pie chart comparing overall injuries amongst soccer players at the collegiate level. The descriptive data was further subjected to a Chi square to test the Hypotheses of the study with the confidence level set at .05.

Results and discussion

This section presents the results followed by a discussion of each assessment including injury rate based on phases of season, anatomical distribution, and type of injuries for both Men’s and Women’s soccer teams at the University of Texas at Tyler.

Injury Rate

Table 1 and figure 1 show the injury rates among the players on both the men’s and women’s teams during games and practices throughout early, middle, and end of the season:

Table 1: Injury rate among the men and women’s teams during practice and games

Men’s Soccer	Women’s Soccer	Combined	Percentages
Games Total	9	13	22 35.5%
Early season	1	0	1
Midseason	2	5	7
End of Season	6	8	14
Practice Total	10	30	40 64.5%
Early Season	4	21	25
Midseason	3	6	9
End Season	3	3	6
Total	19	43	62

Note. $X^2(1, N=62) = 1.69 p > .05$, $X^2(1, N=19, 43) = .031 p > .05$

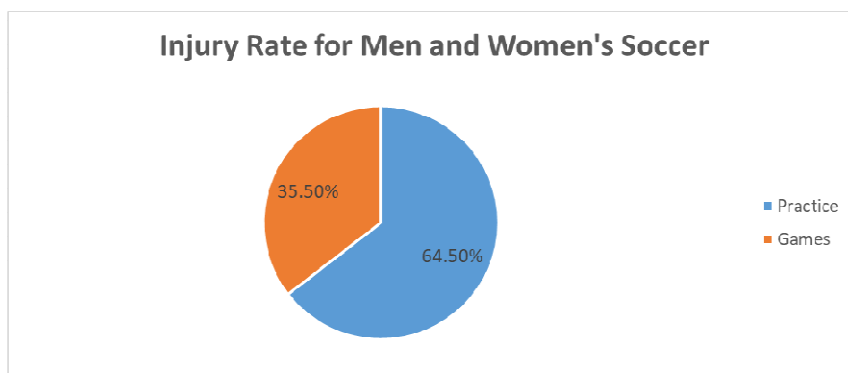


Figure 1: Injury rate based on practices and games for both men and women’s soccer

Table 1 and figure 1, show that most injuries occurred during scheduled practices for the men (10, 52.6%) and women (30, 69.8%) with a total combined percentage of 64.5% injury rate compared to a 30.2% injury rate for games. These results do not concur with earlier studies (Giza, E., & Michel, 2005) and the 2018 NCAA statistics. The NCAA (Karr et. al., 2015) states that men and women’s soccer statistically have three times more injuries during games than practices. This is because the competitiveness of the game elicits more fatigue and expression (Men’s Soccer Injuries, 2009). However, the results in this study prove otherwise. According to the chi-squared test, the p value was greater than .05 meaning that the results of injuries between games and practices are not significant. This signifies that the results concluded accept the null hypothesis that there is no significant association between the phase (Games vs Practice) of the season and injury occurrence. This can be seen by looking at the breakdown of injuries between the beginnings to the end of season. The numbers are varying with no common pattern as men and women had more injuries in games as the season went on and less injuries in practices as the season went on, resulting in a higher p value. There could be many factors as to why there was more injuries in practices than games. For one, there are statistically more practice days than game days during a season. High injury rates during preseason reflect the poor physical state and the vigorous practices sessions athletes are subjected too. It is also a period when most players are jostling for positions on the first team. Players want to impress the coach and therefore may engage in heavy tackles that leave other player’s injured (Gebert et. al., 2019). There could also be outside factors either contributing from the physical training facilities or training styles of the coaches. Another possible reason could have come from the institution changing from Division Three to Division Two. The difference in injury could be a result of fear during games versus practice (Gebert et. al., 2019). To determine the reason for this, more research should be conducted on the precise reason for this peculiar occurrence.

On the other hand, one thing to note is the women’s soccer team generated over double the number of injuries (43, 69.35%) compared to those of the men’s team (19, 30.65%). The Chi square test as shown in table 1 revealed that the women had significantly more injuries than men with a p value of .031 for the comparison. Therefore, these results reject the null hypothesis as there is a significant association between injuries in soccer and the gender of the players. These results corroborate earlier findings which attribute the higher injuries to

women on their anatomical structure and hormonal differences (Schmerling, 2015). According to Schmerling (2015) women have more limitations because they have higher estrogen levels along with less muscle mass than men. They carry more fat than men. They also have looser ligaments and less powerful muscles than men. There is also a wider pelvis and a narrower space within the knee creating more knee and ankle injuries for females. Finally, women have a higher chance of inadequate calcium intake than men (Grygorowicz et. al., 2013). These possible explanations for more women’s injuries compared to men in soccer are yet to be tested and verified (Grygorowicz et. al., 2013). However, the current study confirms that women are likely to have more injuries than men. There is therefore need for more research to establish the differences in injury occurrence between women and men in soccer at the collegiate level.

Anatomical distribution of injuries

For anatomical distribution of injuries, the head, neck, upper limb, lower limb, and trunk were evaluated. The results are shown in table 2 and figure 2.

Table 2: Anatomical Distribution of Injuries for the Men and Women’s Soccer team

Body Part	Men’s Soccer	Women’s Soccer	Combined Totals	Percentages
Head	3	5	8	12.90%
Neck	0	2	2	3.20%
Upper Limb	3	1	4	6.45%
Trunk	1	10	11	17.75%
Lower Limb	12	25	37	59.7%
Total	19	43	62	

Note. $\chi^2(4, N=62) = 211.4 *P<.00001$

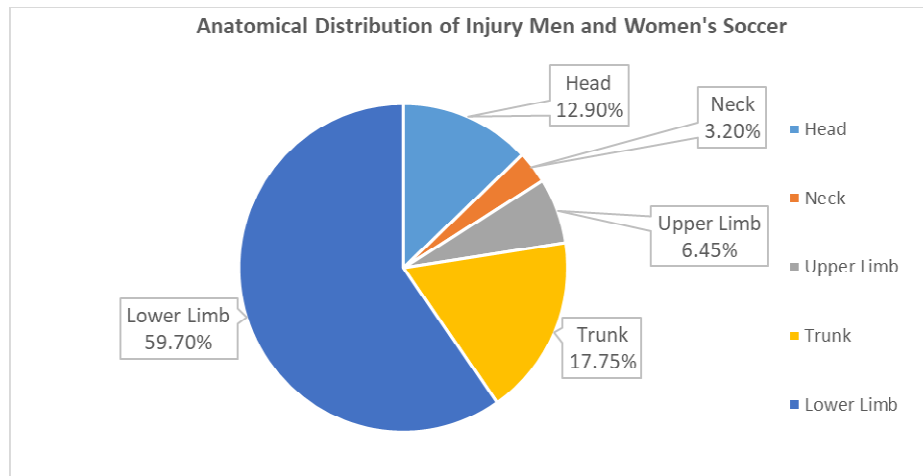


Figure 2: Anatomical distribution of injury during the season of both men and women’s soccer

The lower limb had the most injuries for both the men (12, 63.16%) and women (25, 58.14%) with a combined percentage of 59.70%. The next anatomically injured spot was the head for the men’s team (03, 15.79 %) and the trunk for the women’s team (10, 23.26%). The overall order of anatomical injuries were the lower limb (37, 59.70%), the trunk (11, 17.75%), the head (08, 12.90%), the upper limb (04, 6.45 %), and the lowest was the neck at 3.20% (02). The chi-squared test results as shown in table 2 revealed that there was a significant association of injury occurrence with the lower limbs. The p value was less than .00001 meaning that the result of injuries to the lower limb was significant for both men and women’s soccer and was caused by chance (table 2). The null hypothesis stated that there would be no significant association in the injury occurrence with anatomical location and was therefore rejected. Lower limbs suffer more injuries compared to the upper part of the body for soccer players. This makes sense as it reflects the reality of soccer as it is primarily a lower extremity sport. These results corroborate those reported by Geier (n.d.) and Giza and Micheli (2005). According to Giza and Micheli (2005), about 60% of injuries are on the lower limb which is very close to 59.70% in the current study. Soccer is a game that involves kicking, passing, shooting, tackling, and controlling by use of the lower limbs. While there are many injury preventions like shin guards and referee’s penalty calls, the injury rate among soccer players continues to be high in the lower extremities, specifically ankle sprain, anterior cruciate ligament injuries and hamstring strains (Grooms et. al, 2013). Research also suggests that the lower limbs for soccer players are most susceptible to injuries because of quick changes in direction, lateral movements, acceleration, deceleration, and the fact that soccer is a lower limb involved sport (Souza et. al., 2017).

It is also important to note that the second highest injured area for women was the trunk area. The trunk injuries were mostly associated with the back. The reasons women have more back injuries than the men are not fully understood, but some researchers like Jacobson (2006) suggest that this back pain is related to the menstrual cycle. It has been suggested that when women are having their menstrual cycle, the spike in hormones predisposes the body to more injuries (Jacobson, 2006). Since the back is the antagonist to most female anatomy, it is susceptible for injury (Jacobson, 2006). Other studies suggest however that back pain can be caused by the female anatomy having lower muscle mass and bone density to prepare the body for pregnancy (Fett et. al, 2017). Overall, however, there is no real understanding of the gender differences in males and females and therefore the best way to prevent injury is to strengthen the back and abdominal muscles as well as track menstrual cycle symptoms for females and refer to a physician on details of what to do (Jacobson,2006). However, more research needs to be conducted on factors predisposing women soccer players to trunk injuries compared to men players.

Another seemingly high injury was to the head. According to the NCAA concussions are the number one cause for injuries to the head and has been a serious issue in the sport (Men’s Soccer Injuries, 2009). Rules have been implemented to prevent concussions, but overall based on results they are still occurring.

Type of injuries

The type of injuries occurring range from concussion, contusion, laceration, nosebleed, sprain, strain, tendinopathy, spasm, to other as shown in table 3 and figure 3.

Table 3: Type of Injuries Presented during the Season for the Men and Women’s Soccer Team

Type of Injury	Men’s Soccer	Women’s Soccer	Combined	Percentages
Concussion	1	3	4	6.00%
Contusion	2	3	5	8.00%
Laceration	2	0	2	3.00%
Nosebleed	0	1	1	2.00%
Sprain	10	9	19	31.00%
Strain	4	14	18	29.00%
Tendinopathy	0	3	3	5.00%
Spasm	0	7	7	11.00%
Other	0	3	3	5.00%
Total	19	43	62	

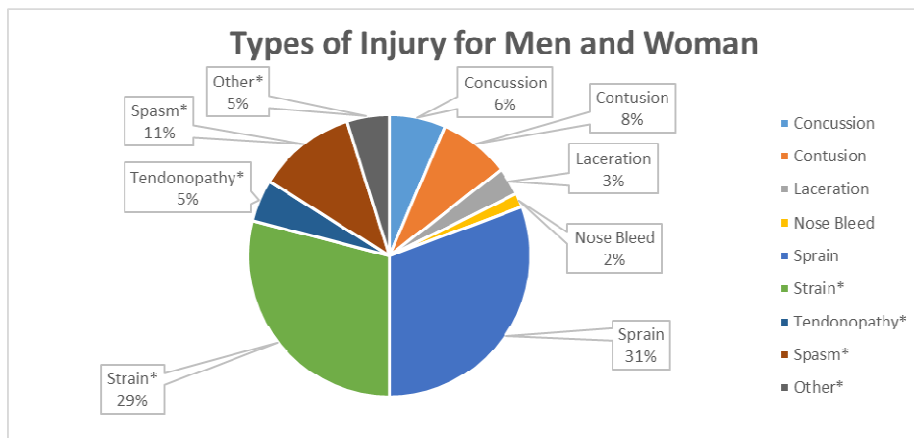


Figure 3: The types of injuries for the both the men and women’s soccer team

For the men’s team, the sprain is the highest injury occurrence accounting for 52.6% (10) of the injuries followed by the strain (04, 21%), the contusion and laceration each (02, 10.5%), and ending with a concussion at 5.2% (01). On the women’s side there was a wider range of injuries. The strain was the most at 32.5% (14) followed by a sprain (09, 20.9%) and the spasm (16.3%). Then, the lowest for the women was the nosebleed at 2.32%. (01) For the combined total types of injuries sprain was the highest occurrence at 31.0% (19) and the strain was close with 29.0% (18). The nosebleed was the lowest at 2.0%. The strain and sprain remaining at the highest overall injury between men and women’s soccer correlates with the data the 2018 NCAA and other researchers have collected. A sprain is a stretching or tearing of ligaments that connects two bones together. A strain on the other hand involves injury to the muscle or tendon that attaches a muscle to the bone. In this study, men had more sprains than women did and women had more strains than men did. However, overall women had 23 strains and sprains compared to men’s 14. According to Schmerling (2018), this finding is a result of women having ligaments and tendons that are not as strong as for the men. The hormones in the female body allow these

looser ligaments and tendons to tear and stretch easier than in men's bodies, and therefore women are more susceptible to these injuries (Schmerling, 2015). In fact, injuries to things like the anterior cruciate ligament (ACL) are far more likely in women than men because of loose ligaments and female hormones (Wilkerson and Mason, 2000). On the other hand, men are naturally less flexible than women. Additionally, men tend to engage in faster movements involving change of direction, lateral movements, pivoting, and rapid acceleration as well as deceleration that characterize specific soccer movement behaviors. These cause strains and sprains to muscles like the hamstring or other leg muscle/bones that connect to tendons or ligaments resulting in men having a high number as well (Marshall and Siegler, 2014). According to other studies, women most likely have a higher number of overall strains and sprains to the ankle specifically because women's ankles are normally laxer than men's (Wilkerson and Mason, 2000). This causes more injury upon impact with a sport like soccer and is a reason why women have nine more sprains/strain injuries.

Another thing to note about the injury types is the women had far more injury types than men did. There could be many possible reasons for this originating from hormonal differences and anatomical differences in men and women, but a couple of researchers suggest that the woman's body goes through more wear and tear than men (Grygorowicz et. al., 2013). The game of soccer was originally invented for men, so women have to adapt their bodies to a men's game. This causes women to tire quicker than men and lead their body to experience more types of injuries than men (Pedersen et. al., 2019). However, as women soccer becomes more entrenched in the cultural fabric of various societies around the world, including collegiate levels, more studies are needed to fully understand the anatomical, physiological, biomechanical as well as training effects that soccer has on the woman player. Most research on the science of soccer participation has heavily focused on men as they have been involved in the game for a longer time than women.

Conclusions

Overall, after a retrospective study of the men and women's soccer at UT Tyler, it was found that women experience far greater injuries than men, but both experience the most injuries to the lower leg, more specifically strains and sprains (De Souza et.al., 2017; Manoel, et.al., 2020). The results showed that women experience more injuries than men (Grygorowicz et. al., 2013; Schmerling 2018) and that most injuries associated with the lower limbs among soccer players are in conformity with previous research findings (Geier, n.d.; Giza and Micheli, 2005). However, the study also revealed that more injuries were sustained in training compared to competitive games during the 2019 University at Tyler soccer teams' season. This finding conflicts with previous findings which show that more injuries occur during competitions compared to practice. However, one must bear in mind that many athletes hide injuries or play through injuries to keep their spot on the first team as well as maintaining their coveted athletic scholarship. There is a need for more research on injuries sustained during practice versus competitive games at the collegiate level to shed more light on this contradictory finding.

Recommendation

The University of Texas men's and women's soccer teams had 62 injuries in total during the fall 2019 season. Most injuries occurred to lower limbs, women had more injuries compared to men, more injuries occurred during training than competition and most injuries were on soft tissues. As a follow up to these findings, a recommendation is made to carry out a prospective study which shall entail instituting preventive measures and recording the pre and post event warm up and cool down routines with a view of minimizing injury occurrence to both programs.

Conflicts of interest -The authors have no conflict of interest to declare.

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