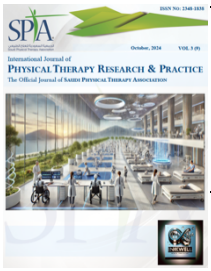


INTERNATIONAL JOURNAL OF
PHYSICAL THERAPY RESEARCH & PRACTICE
AN OFFICIAL JOURNAL OF SAUDI PHYSICAL THERAPY ASSOCIATION

Original Article

Prevalence of Sports Injuries and Illnesses in Saudi Arabia's Inaugural Women's Basketball League: An Injury Surveillance

Wesam Saleh A. AlAttar[1,2,3*]; Eman Fhad H. AlJedaani[1,4]

1. Department of Medical Rehabilitation Sciences, College of Applied Medical Sciences, Umm Al Qura University, Makkah, Saudi Arabia.
2. Discipline of Exercise and Sport Science, The University of Sydney, Sydney, Australia.
3. Department of Sport, Exercise and Health, University of Basel, Basel, Switzerland.
4. Department of Medical Rehabilitation, Physical Therapy Unit, King Abdullah Medical Complex, Jeddah, Saudi Arabia.

*Corresponding Authors: wsattar@uqu.edu.sa

Article info

Received : **Nov. 09, 2024**
Accepted : **Nov. 20, 2024**
Published : **Nov. 30, 2024**

To Cite: Al Attar, W., & Al Jedaani, E. Prevalence of Sports Injuries and Illnesses in Saudi Arabia's Inaugural Women's Basketball League: An Injury Surveillance. International Journal of Physical Therapy Research & Practice, 3(10), 386–395. https://doi.org/10.62464/ijoprp.v3i10.60

Women's participation in sports has been increasing and has led to increased concerns about the risk of sports injuries. However, epidemiological studies on the incidence of sports injuries in women's basketball, particularly in Saudi Arabia, are lacking. This study aimed to determine the prevalence of sports-related injuries and illnesses during the first-ever women's national basketball league (2022) in Saudi Arabia by implementing an International Olympic Committee injury and illness surveillance protocol. The medical staff of the participating teams (n=15) were requested to report all new injuries and illnesses during matches and training daily throughout the competition. Exposure (number of player-hours) during matches was calculated for all the players (n=213). In total, 15.9% of the players were injured. The most frequent injuries were to the lower leg (Calf/Achilles tendon) followed by the ankles and knees. The most common injuries were sprains and muscle spasms. In total, 2.8% of the players (n=6) became ill during the competition. Five of the six cases (83.3%) had respiratory tract infections. Our findings show the importance of monitoring all injuries to prevent at-risk players from injuring themselves further. Whereas lower extremity injuries were the most common in the first-ever women's national basketball league in Saudi Arabia.

Keywords: Risk factors; trauma in athletes; epidemiology; basketball; female.

Introduction

Basketball is one of the most played sports worldwide(Borowski et al., 2008). Basketball players run, change direction, move laterally, jump, and endure constant landing impact, which increases the likelihood of injuries (Dick et al., 2007a). Hence, it is reasonable that lower limb injuries are the most common form of injuries seen in basketball players (Backx et al., 1991). Since the early 1990s, boys' participation rates have risen by more than 10%, whereas those of girls have almost

doubled (Borowski et al., 2008). An increasing number of women are playing sports, including basketball. This increase in participation has led to concerns regarding potential sports injuries in women.

Prevention of injuries, illnesses, and pain is essential for boosting athletic performance. Musculoskeletal symptoms, such as pain, were the second most common reason for patients visiting a physician in the United States in 2006 (Alemany et al., 2017).

Key national regulatory bodies, including the Saudi Basketball Federation and the Ministry of Sports, have played a significant role in organizing and supporting the league (Simon & Lee S., 2012). Sports injuries lead to a negative impact on athlete's performance and their sports participation as well as daily activities, reduction in training time, an increase in health expenses, and the risk of new injuries (Minghelli et al., 2021). Healthcare costs, expenditures, and lost productivity resulting from musculoskeletal injuries in athletes are significant burdens on the nation (Fenton et al., 2015). The identification and classification of sports injury financial costs provide opportunities to determine the extent to which sports injuries are a problem economically, to determine what preventive measures should be implemented for specific injuries and sports, and to measure the return on investment of injury prevention measures implemented (Turnbull et al., 2024). In recent years, the positive impact of preliminary exercise and injury prevention programs on athletic performance and injury reduction has become a topic of significant controversy (H. Neiva et al., 2011; West et al., 2013; Woods et al., 2007).

Preliminary exercise (warm-up routines prior to exercise aimed at optimizing performance and reducing injury risk) is considered essential before physical activities, and priming practices are meant to optimize performance (H. P. Neiva et al., 2014). Effective pre-season programs must include diverse prevention strategies. These should incorporate various formats, such as warm-ups and training sessions, and utilize multiple locations, like fields and gyms, in appropriate contexts (Mendonça et al., 2022). As a result, players must be physically fit to perform basketball-specific movements and workloads. Maximizing cardiorespiratory capacity, anaerobic capacity, and neuromuscular performance, such as power, balance, and agility, is necessary to limit the risk of injuries (Battaglia et al., 2016; Şahin et al., 2015). To maximize performance, preliminary exercise should allow athletes to maintain their muscle temperature within a limited range while minimizing fatigue (Bishop, 2003; Racinais & Oksa, 2010). Preliminary exercise can improve athletic performance and reduce the risk of pain, fatigue, and injury (L. M. Silva et al., 2018a; van Mechelen et al., 1992).

The International Olympic Committee (IOC) published a consensus statement on processes for recording and reporting general sports injuries and illnesses in February 2020 (Greenspan et al., 2022). The IOC surveillance protocol includes standardized forms and detailed categorization of injuries and illnesses based on internationally accepted criteria. One of the most important questions addressed by sports injury and illness surveillance projects is: How likely is it for an individual athlete to sustain an acute injury, develop an overuse injury, or fall ill during a given sport? When it comes to injuries and illnesses in a certain sport, what is the typical pattern and severity? What is the rate of injury in various sports? What are the effects of participant characteristics

training and competition factors on the risk of injury? The use of the IOC protocol was approved by the International Olympic Committee. The authors are committed to monitoring its impact over time and actively encourage researchers to translate the checklist into other languages, benefiting the international sports medicine community (Bahr et al., 2020).

Using an injury surveillance protocol, the aim of the study is to investigate the incidence, location, type, severity, and burden of injuries in the inaugural Saudi Women's Basketball League.

Methods

This study was conducted in accordance with the principles of the Declaration of Helsinki. Participants were asked to read and sign an informed consent form that explained the purpose of the study, what participation in the study would involve, protection of privacy and confidentiality, and further use of the results in detail. The institutional review board approved this study (HAPO-02-K-012-2020-10-466, Biomedical Ethics Committee of Umm Al Qura University).

This study was conducted among elite female basketball players in Saudi Arabia (Jeddah, Dammam, and Riyadh). Participants were recruited through invitations distributed by the Saudi Basketball Association Federation.

fifteenth teams were invited to participate in the present study, and all the players (n=213) met the inclusion criteria. The average age of participants was 24.3 years (SD: 3.8), with an age range of 18-32 years. The inclusion criteria are as follows: (a) female players participating in the Inaugural Women's Basketball League in Saudi Arabia. (b) not suffering from any injury incompatible with their sport's practice at the beginning of the study. The exclusion criteria were any player with chronic illnesses that required medical attention during the competition.

A brief background on the survey provided the invitation to participate in the study, its purpose, further use of the results in detail, confidentiality measures, and participant rights. All players signed an informed consent form declaring their readiness to be included in the study.

This study was designed and executed according to the protocol established by the International Olympic Committee (IOC) for injury and illness surveillance. During the Saudi Women's National Basketball League (January 20–February 28, 2022), all participating teams (n=15) were invited to report any injuries or illnesses that occurred during the matches and/or training. Regardless of injury or illness, athletes were instructed to complete a standardized one-page report form. In the event of an injury or illness, the report form was filled out according to predetermined categories, definitions, and codes. Furthermore, if there is no injury or illness, the report form is filled in (No). Each day, these reports were submitted either to the researchers present at the hotels (8–10 a.m. each morning) or the physicians of the local organizing committee present at the athlete medical clinics at the three competition venues. Participants were invited to partake in the study through an e-mail that provided a brief background on the study and its purpose 1 month prior to the event. They were also informed of the study at their first official medical team meeting.

A newly incurred injury was defined as an injury that received medical attention during a competition or training session regardless of the consequences of absence from competition or training. Preexisting injuries and those that were not fully rehabilitated

were not reported. Injury recurrence at the same location or of the same type was only recorded if the athlete had returned to full activity following the previous injury.

The injury report included information, such as the location, type, cause, and severity of the injury, whether the athlete returned to play, and the expected timetable for a return to play (days/weeks).

In addition, we defined newly acquired illness as any physical complaint (unrelated to injury) that occurred during a competition or training session throughout the tournament and received medical attention, regardless of whether the illness prevented the athlete from training or competing. The study did not include athletes with chronic illnesses unless they required medical attention during the competition.

The illness form required a note on the affected organ system/region, primary symptom(s), cause, diagnosis, and estimated severity. The IOC injury and illness surveillance protocol was followed for all the definitions, categories, and codes. English and Arabic versions of the report form were used.

The demographic variables of the team, team Doctor/Physio, and contact information. Sports variables included league, date of the match, and the occurrence of injuries or illnesses. The injury variables were injury details (time of the injury, place of injury, player position, injury location, type of injury, cause of injury, severity, and return to play). and information regarding illness (mode of onset, time of illness, affected system, main symptoms, cause of illness, diagnosis, date of occurrence, severity, return to play).

Fifteen teams (213 accredited players) were included in this study. An Excel file (V.2010) (Microsoft Corporation, Redmond, Washington, USA) was created with exposure data on injury incidences. The medical staff of all teams provided the injuries and illnesses of each match, and we transferred them to the Excel file. The league had a total of 45 matches (1,065 player-hours).

Statistical Analyses

The data were organized in Microsoft Excel 2010 (Microsoft Corporation, Redmond, Washington, USA) and analyzed using statistical package for the social sciences (SPSS) version 24.0 (SPSS Inc., Chicago, Illinois, USA). The number of injuries per 1,000 player-hours was measured as injury incidence. Sample size calculation was based on expected injury incidence rates using G*Power software, ensuring adequate power (0.80) for statistical analysis. Descriptive data were provided for subgroups, such as injury types, location, causes, circumstances, severity, and affected illness systems with symptoms, causes, and severity estimates.

Data Availability

All data generated or analyzed during this study are included in this published article.

Results

Injury Incidence

In total, 34 injuries were reported. Of the 213 accredited players, 15.9% had at least one injury during the competition. The number of match injuries per 1,000 player-hours was 32. The highest risk of injury was observed in the line players (Table 1).

Injury Pattern

35% of all the time-loss injuries (n=12) were reported as less severe, leading to an estimated absence of 1 to 2-d from full participation in training and matches. However, 50% (n=17) were moderate injuries with an estimated absence between 3-d and 4 weeks. Four severe injuries (11.7%) were reported, resulting in an estimated absence of >4 weeks (Table 1).

Table 1. Injury rates by location, type, cause, and severity for all players.

Location Of Injury	Injuries (N)	Injuries/ 1000 H
Head & Trunk		
Face (Incl. Eye, Ear, Nose)	3	2.81
Upper Extrimity		
Shoulder/ Clavicle	2	1.87
Elbow	1	0.93
Hand	1	0.93
Finger	3	2.81
Thumb	1	0.93
Lower Extrimity		
Hip	2	1.87
Groin	1	0.93
Knee (Medial/Lateral)	6	5.63
Lower Leg (Anterior/Posterior)	8	7.51
Ankle (Medial/Lateral)	6	5.63
Type Of Injury		
Fracture (Traumatic)	5	4.69
Stress Fracture (Overuse)	1	0.93
Dislocation, Subluxation	2	1.87
Ligamentous Rupture	1	0.93
Sprain (Injury of Joint And/Or Ligaments)	7	6.57
Lesion Of Meniscus or Cartilage	1	0.93
Strain/ Muscle Rupture/ Tear	4	3.75
Contusion/ Hematoma/ Bruise	6	5.63
Muscle Cramps Or Spasm	7	6.57
Cause Of Injury		
Overuse (Gradual Onset)	1	0.93
Overuse (Sudden Onset)	8	7.51
Non-Contact Trauma	3	2.81
Recurrence Of Previous Injury	2	1.87
Contact With Another Player	12	11.26
Contact: Moving Object (E.G. Ball)	2	1.87
Contact : Stagnant Object (E.G.Net)	6	5.63
Severity		
0 Days	2	1.87
1 Day	4	3.75
2 Days	6	5.63
1 Week	11	10.32
2 Weeks	2	1.87
3 Weeks	3	2.81
4 Weeks	1	0.93
More Than 4 Weeks	2	1.87
6 Months Or More	2	1.87
Total	34	

Of all the injuries reported (n=34), 67.6% were in the lower extremities, mainly the lower leg (Calf/Achilles tendon), ankle, or knee, while 23.5% affected the upper extremities, mainly the shoulder and fingers/thumb. The remaining injuries (8.8%) were located on the head/face (Figure 1). The most common injuries were sprains (injury of joint and/or ligaments) and muscle cramps or spasms (20.5%, n=7), followed by contusions (17.6%, n=6) and fractures (14.7%, n=5). Muscle strains mainly occurred in the lower extremities (11.7%, n=4,), while most contusions were in the face (n=2), knee (n=3), and elbow (n=1). Ankle sprains

(medial/lateral) (n=7) were the most frequently diagnosed specific condition.

Injury Cause

In total, 35.2% (n=12) of the injuries were contact injuries between players, 5.8% were Contact with a moving object (e.g., ball), 17.6% were Contact: stagnant object (e.g., net), and 8.8% were noncontact. The overuse injuries were reported to be 23.5% (sudden onset), and 2.9% were (gradual onset). At the same time, the recurrence of the previous injury was reported to be 5.8% (Table 1).

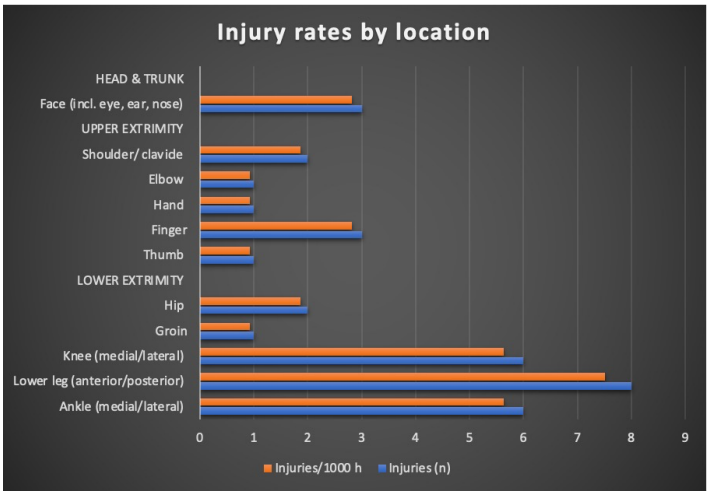
Illnesses

The medical staff team reported six cases of illness during the event, five with a sudden onset and one with a gradual onset. Only 2.8% of the players contracted an illness during the tournament; 16.6% of the ill players were absent for 1 to 2-d. Most cases were diagnosed as coronavirus disease 2019 (COVID-19), and the estimated absence was 1 week. The respiratory tract (mainly the upper respiratory tract) was the most affected (n=5, 83.3%). The predominant symptoms were fever, excessive sweating, and chills (n=6, 100%); pain, aches, or soreness (n=4, 66.6%); and cough, wheezing, and dyspnea (n=2, 33.3%). The most frequent diagnoses were COVID-19 (n=4, 66.6%). The other causes were due to environmental conditions (n=2, 33.3%) (Table 2).

Table 2. Illness rates by affected system, main symptom(s), cause of illness, and severity for all players

Affected System	Illness (N)	Illness/ 1000 H
Upper Respiratory Tract (E.G. Nose, Sinuses)	5	4.69
Lower Respiratory Tract (Trachea, Bronchi, Lungs)	1	0.93
Main Symptom(S)		
Pain, Ache Or Soreness	4	3.75
Fever, Excess Sweating or Chills	6	5.63
Fatigue, Lack of Energy, Lethargy or Arterial Hypotension	1	0.93
Cough, Wheezing, Dyspnea or Shortness in Breath	2	1.87
Cause Of Illness		
Infectious (Viral, Bacterial, Fungal, Etc.)	4	3.75
Environmental (E.G. Heat, Cold, Altitude)	2	1.87
Severity		
2 Days	1	0.93
1 Week	5	4.69

Figure 1. Injury rates by location for all players



Discussion

To the best of our knowledge, this study is the first to describe injuries and illnesses among players in the first Women's National Basketball League in Saudi Arabia. In this study, we investigated the injury rate, type, location, severity, and burden.

This study is the first step toward prevention and epidemiological and illness surveillance studies of elite female basketball players in Saudi Arabia.

Basketball requires basic movements of high-risk sports, such as jumps, landings, acceleration, deceleration, shifts, and pivoting, making it potentially harmful. According to a recent systematic review of injuries in the NBA (National Basketball Association), lower limb stress fractures, meniscal tears, ACL tears, hand fractures, and concussions were the most common injuries (Lian et al., 2022). In a previous 4-year study, 43% of 358 athletes sustained at least one injury, indicating a high injury rate (Smith et al., 2012). Other studies have reported similar results (Henry et al., 1982; A. S. da Silva et al., 2007).

In basketball literature (Adirim & Barouh, 2006; Dick et al., 2007), lower extremities had the highest incidence of injuries, especially knee and ankle sprains, regardless of grouped body parts (e.g., head and neck, upper limbs, or lower limbs). Based on a retrospective review of data from six seasons of the Women's National Basketball Association and National Basketball Association, Deitch et al. (Deitch et al., 2006) found that injuries were most frequently reported in the lower extremities (65%) with lateral ankle sprains being the most common diagnoses. According to our study, more than 60% of the athletes injured their lower extremities, and 29% had experienced pain. These regions are susceptible to injuries that are common in high-intensity intermittent team sports because of the sprinting, jumping, acceleration, and deceleration involved in basketball (Conte et al., 2015, 2016; Scanlan et al., 2012).

Other reported injuries in our study were head and neck trauma (22%) and upper extremity injuries (12%). The head and neck were involved in approximately 15% of all the injuries, and the upper extremities were involved in 14% (Agel et al., 2007). We defined an athlete's health adversity as any condition that affects an athlete's normal state of health, irrespective of its effects on the athlete's participation or performance in sports or whether the athlete expected medical attention as communicated by the authors of the IOC consensus statement (Clarsen et al., 2020). Researchers found that athletes with a health adversity prior to the championship were approximately six times more likely to experience a new health adversity during the competition than those without (Edouard et al., 2015). Therefore, attention should be paid to athletes who have suffered previous injuries.

Upper respiratory tract infections were the most common diagnoses (27.6% of the illnesses), as reported by Edouard et al. (Edouard et al., 2015). Our study also reflected this (19% of the illnesses). Therefore, considerable attention should be paid to prevent infectious diseases. The risk of sustaining a new injury increases when training is longer than 12-h per week (Edouard et al., 2015). In our study, all players trained for at least 12.4-h per week. Changes in climatic conditions and season (fall) may explain these results. Additionally, long workouts can lead to fatigue. Preliminary exercise may prevent injuries and improve performance (Ekstrand et al., 1983) because it may delay fatigue (H. Neiva et al., 2011). Preliminary exercise strategies were assessed by a study which reviewed 19 articles: 69% of them showed improvements in sprinting, 87.5% in jumping, and 83% in agility (L. M. Silva et al., 2018b). Over 33% of the players reported fatigue during all preseasons. Fatigue can diminish athletes' capacity to perform over a long season and can lead to a decrease in performance (Edwards et al., 2018)

This study had some limitations. First, we could not precisely report that some players were at risk of injury. Second, this was an instantaneous study, and seasonal injuries were not analyzed. Third, our data collection on athletes' health adversities was self-reported; the accuracy of the player data was based on the reporting of athletes and team staff.

There is no information on the incidence and characteristics of sports injuries in female basketball players during season. This is our recommended second prevention step, in which the collection of preparticipation data on risk factors is required. Scientific injury and illness surveillance systems should be further developed through preventive measures.

Conclusions

Our results show that elite female basketball players should be monitored to determine the prevalence of sports-related injuries and illnesses. Our findings highlight the importance of monitoring lower extremity injuries and pain in at-risk players. We found that the lower extremities had the highest frequency of injuries and pain. The most common cause of the illness was infections of the upper respiratory tract, including (COVID-19).

Acknowledgements

The authors would like to thank all the medical staff, teams and players who participated in this study.

Reference

Adirim, T. A., & Barouh, A. (2006). Common orthopaedic injuries in young athletes. Current Paediatrics, 16(3), 205–210. https://doi.org/10.1016/j.cupe.2006.03.001

Agel, J., Olson, D. E., Dick, R., Arendt, E. A., Marshall, S. W., & Sikka, R. S. (2007). Descriptive epidemiology of collegiate women's basketball injuries: National Collegiate Athletic Association Injury Surveillance System, 1988-1989 through 2003-2004. Journal of Athletic Training, 42(2), 202–210.

Alemany, J. A., Bushman, T. T., Grier, T., Anderson, M. K., Canham-Chervak, M., North, W. J., & Jones, B. H. (2017). Functional Movement Screen: Pain versus composite score and injury risk. Journal of Science and Medicine in Sport, 20, S40–S44. https://doi.org/10.1016/j.jsams.2017.08.001

Backx, F. J. G., Beijer, H. J. M., Bol, E., & Erich, W. B. M. (1991). Injuries in high-risk persons and high-risk sports. The American Journal of Sports Medicine, 19(2), 124–130. https://doi.org/10.1177/036354659101900206

Bahr, R., Clarsen, B., Derman, W., Dvorak, J., Emery, C. A., Finch, C. F., Hägglund, M., Junge, A., Kemp, S., Khan, K. M., Marshall, S. W., Meeuwisse, W., Mountjoy, M., Orchard, J. W., Pluim, B., Quarrie, K. L., Reider, B., Schwellnus, M., Soligard, T., … Chamari, K. (2020). International Olympic Committee Consensus Statement: Methods for Recording and Reporting of Epidemiological Data on Injury and Illness in Sports 2020 (Including the STROBE Extension for Sports Injury and Illness Surveillance (STROBE-SIIS)). Orthopaedic Journal of Sports Medicine, 8(2). https://doi.org/10.1177/2325967120902908

Battaglia, G. , Giustino, V. , Iovane, A. , Bellafiore, M. , Martines, F. , Patti, A. , & Palma, A. (2016). Influence of occlusal vertical dimension on cervical spine mobility in sports. Acta Medica, 32(1589).

Bishop, D. (2003). Warm Up I: potential mechanisms and the effects of passive warm up on exercise performance. Sports Medicine, 33(6), 439–454. https://doi.org/10.2165/00007256-200333060-00005

Borowski, L. A., Yard, E. E., Fields, S. K., & Comstock, R. D. (2008). The Epidemiology of US High School Basketball Injuries, 2005–2007. The American Journal of Sports Medicine, 36(12), 2328–2335. https://doi.org/10.1177/0363546508322893

Clarsen, B., Bahr, R., Myklebust, G., Andersson, S. H., Docking, S. I., Drew, M., Finch, C. F., Fortington, L. V., Harøy, J., Khan, K. M., Moreau, B., Moore, I. S., Møller, M., Nabhan, D., Nielsen, R. O., Pasanen,

K., Schwellnus, M., Soligard, T., & Verhagen, E. (2020). Improved reporting of overuse injuries and health problems in sport: an update of the Oslo Sport Trauma Research Center questionnaires. British Journal of Sports Medicine, 54(7), 390–396. https://doi.org/10.1136/bjsports-2019-101337

Conte, D., Favero, T. G., Lupo, C., Francioni, F. M., Capranica, L., & Tessitore, A. (2015). Time-Motion Analysis of Italian Elite Women's Basketball Games. Journal of Strength and Conditioning Research, 29(1), 144–150. https://doi.org/10.1519/JSC.0000000000000633

Conte, D., Tessitore, A., Smiley, K., Thomas, C., & Favero, T. (2016). Performance profile of NCAA Division I men's basketball games and training sessions. Biology of Sport, 33(2), 189–194. https://doi.org/10.5604/20831862.1200512

Deitch, J. R., Starkey, C., Walters, S. L., & Moseley, J. B. (2006). Injury Risk in Professional Basketball Players. The American Journal of Sports Medicine, 34(7), 1077–1083. https://doi.org/10.1177/0363546505285383

Dick, R., Hertel, J., Agel, J., Grossman, J., & Marshall, S. W. (2007a). Descriptive epidemiology of collegiate men's basketball injuries: National Collegiate Athletic Association Injury Surveillance System, 1988-1989 through 2003-2004. Journal of Athletic Training, 42(2), 194–201.

Dick, R., Hertel, J., Agel, J., Grossman, J., & Marshall, S. W. (2007b). Descriptive epidemiology of collegiate men's basketball injuries: National Collegiate Athletic Association Injury Surveillance System, 1988-1989 through 2003-2004. Journal of Athletic Training, 42(2), 194–201.

Edouard, P., Jacobsson, J., Timpka, T., Alonso, J.-M., Kowalski, J., Nilsson, S., Karlsson, D., Depiesse, F., & Branco, P. (2015). Extending in-competition Athletics injury and illness surveillance with pre-participation risk factor screening: A pilot study. Physical Therapy in Sport, 16(2), 98–106. https://doi.org/10.1016/j.ptsp.2014.05.003

Edwards, T., Spiteri, T., Piggott, B., Bonhotal, J., Haff, G. G., & Joyce, C. (2018). Monitoring and Managing Fatigue in Basketball. Sports, 6(1), 19. https://doi.org/10.3390/sports6010019

Ekstrand, J., Gillquist, J., & Liljedahl, S.-O. (1983). Prevention of soccer injuries: Supervision by doctor and physiotherapist. The American Journal of Sports Medicine, 11(3), 116–120. https://doi.org/10.1177/036354658301100302

Fenton, B. W., Shih, E., & Zolton, J. (2015). The Neurobiology of Pain Perception in Normal and Persistent Pain. Pain Management, 5(4), 297–317. https://doi.org/10.2217/pmt.15.27

Greenspan, S., Munro, D., Nicholas, J., Stubbe, J., Stuckey, M. I., & Van Rijn, R. M. (2022). Circus-specific extension of the International Olympic Committee 2020 consensus statement: methods for recording and reporting of epidemiological data on injury and illness in sport. BMJ Open Sport & Exercise Medicine, 8(3), e001394. https://doi.org/10.1136/bmjsem-2022-001394

Henry, J. H., Lareau, B., & Neigut, D. (1982). The injury rate in professional basketball. The American Journal of Sports Medicine, 10(1), 16–18. https://doi.org/10.1177/036354658201000104

Lian, J., Sewani, F., Dayan, I., Voleti, P. B., Gonzalez, D., Levy, I. M., Musahl, V., & Allen, A. (2022). Systematic Review of Injuries in the Men's and Women's National Basketball Association. The American Journal of Sports Medicine, 50(5), 1416–1429. https://doi.org/10.1177/03635465211014506

Mendonça, L. D. M., Schuermans, J., Denolf, S., Napier, C., Bittencourt, N. F. N., Romanuk, A., Tak, I., Thorborg, K., Bizzini, M., Ramponi, C., Paterson, C., Hägglund, M., Malisoux, L., Al Attar, W. S. A., Samukawa, M., Esteve, E., Bakare, U., Constantinou, M., Schneiders, A., … Witvrouw, E. (2022). Sports injury prevention programmes from the sports physical therapist's perspective: An international expert Delphi approach. Physical Therapy in Sport, 55, 146–154. https://doi.org/10.1016/j.ptsp.2022.04.002

Minghelli, B. , Queiroz, S. , Sousa, I. , Trajano, J. , Graça, S. , & Silva, V. (2021). Musculoskeletal injuries in basketball players southern Portugal: epidemiology and risk factors. Northern Clinics of Istanbul. https://doi.org/10.14744/nci.2021.21549

Neiva, H., Morouço, P., Silva, A., Marques, M., & Marinho, D. (2011). The Effect 0f Warm-up on Tethered Front Crawl Swimming Forces. Journal of Human Kinetics, 29A(Special-Issue), 113–119. https://doi.org/10.2478/v10078-011-0066-1

Neiva, H. P., Marques, M. C., Barbosa, T. M., Izquierdo, M., & Marinho, D. A. (2014). Warm-Up and Performance in Competitive Swimming. Sports Medicine, 44(3), 319–330. https://doi.org/10.1007/s40279-013-0117-y

Racinais, S., & Oksa, J. (2010). Temperature and neuromuscular function. Scandinavian Journal of Medicine & Science in Sports, 20(s3), 1–18. https://doi.org/10.1111/j.1600-0838.2010.01204.x

Şahin, N., Bianco, A., Patti, A., Paoli, A., Palma, A., & Ersöz, G. (2015). Evaluation of knee joint proprioception

and balance of young female volleyball players: a pilot study. Journal of Physical Therapy Science, 27(2), 437–440. https://doi.org/10.1589/jpts.27.437

Scanlan, A. T., Dascombe, B. J., Reaburn, P., & Dalbo, V. J. (2012). The physiological and activity demands experienced by Australian female basketball players during competition. Journal of Science and Medicine in Sport, 15(4), 341–347. https://doi.org/10.1016/j.jsams.2011.12.008

Silva, A. S. da, Abdalla, R. J., & Fisberg, M. (2007). Incidência de lesões musculoesqueléticas em atletas de elite do basquetebol feminino. Acta Ortopédica Brasileira, 15(1), 43–46. https://doi.org/10.1590/S1413-78522007000100009

Silva, L. M., Neiva, H. P., Marques, M. C., Izquierdo, M., & Marinho, D. A. (2018a). Effects of Warm-Up, Post-Warm-Up, and Re-Warm-Up Strategies on Explosive Efforts in Team Sports: A Systematic Review. Sports Medicine, 48(10), 2285–2299. https://doi.org/10.1007/s40279-018-0958-5

Silva, L. M., Neiva, H. P., Marques, M. C., Izquierdo, M., & Marinho, D. A. (2018b). Effects of Warm-Up, Post-Warm-Up, and Re-Warm-Up Strategies on Explosive Efforts in Team Sports: A Systematic Review. Sports Medicine, 48(10), 2285–2299. https://doi.org/10.1007/s40279-018-0958-5

Simon, & Lee S. (2012). RELIEVING PAIN IN AMERICA: A BLUEPRINT FOR TRANSFORMING PREVENTION, CARE, EDUCATION, AND RESEARCH. Journal of Pain & Palliative Care Pharmacotherapy, 26(2), 197–198. https://doi.org/10.3109/15360288.2012.678473

Smith, H. C., Vacek, P., Johnson, R. J., Slauterbeck, J. R., Hashemi, J., Shultz, S., & Beynnon, B. D. (2012). Risk Factors for Anterior Cruciate Ligament Injury. Sports Health: A Multidisciplinary Approach, 4(1), 69–78. https://doi.org/10.1177/1941738111428281

Turnbull, M. R., Gallo, T. F., Carter, H. E., Drew, M., Toohey, L. A., & Waddington, G. (2024). Estimating the cost of sports injuries: A scoping review. Journal of Science and Medicine in Sport, 27(5), 307–313. https://doi.org/10.1016/j.jsams.2024.03.001

van Mechelen, W., Hlobil, H., & Kemper, H. C. G. (1992). Incidence, Severity, Aetiology and Prevention of Sports Injuries. Sports Medicine, 14(2), 82–99. https://doi.org/10.2165/00007256-199214020-00002

West, D. J., Dietzig, B. M., Bracken, R. M., Cunningham, D. J., Crewther, B. T., Cook, C. J., & Kilduff, L. P. (2013). Influence of post-warm-up recovery time on swim performance in international swimmers. Journal of Science and Medicine in Sport, 16(2), 172–176. https://doi.org/10.1016/j.jsams.2012.06.002

Woods, K., Bishop, P., & Jones, E. (2007). Warm-Up and Stretching in the Prevention of Muscular Injury. Sports Medicine, 37(12), 1089–1099. https://doi.org/10.2165/00007256-200737120-00006