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## Epidemiology of musculoskeletal injuries in basketball players: Systematic review

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### Abstract

Basketball is one of the most popular physical activities in the world. It is contact sports causing complex movement which includes jumping, turning, twisting and change in direction which cause frequent musculoskeletal injuries in all parts of body. The objective of the study was to explore what the research suggests on the concept of the prevalence of Musculoskeletal injuries in basketball players. We selected published articles in the last decade in the databases PUBMED, GOOGLE SCHOLAR, COCHRANE JOURNAL with Full text, Articles which are published in last 10 years, systematic reviews, Cross sectional studies, Observational studies, Basketball players of any age, All gender were included. Article which has Mixed sports games, Case reports, Articles which are published prior 2009, Studies which has only abstracts, Studies which did not present specific percentage of injury were excluded. The search used combinations of the terms “Basketball players”, “Basketball injuries” “Musculoskeletal disorders”, and “Musculoskeletal injuries.” A Principal investigators and two reviewers conducted the survey and analyzed all the potentially relevant articles, initially by the abstract and title. A total of 71 articles were reviewed in which 12 articles with 12,905 basketball players were analyzed for Musculoskeletal injuries in basketball players. The study showed there were increased rate of injuries in players involving both upper limb and lower limb based on evidence. Upper limb showed more percentage injury in Wrist and fist(10.9%) followed by head/neck(10.5%) and Trunk/Spine(10%) compared to shoulder and arm(6.8%). In lower limb injury to Knee(22.8%) followed by ankle and foot(20.4%) compared to hip and thigh(18%).

**Keywords:** Basketball players, Musculoskeletal injuries, Musculoskeletal problem, Basketball injuries.

### Introduction

Eleven percent of world population plays recreational basketball, which makes basketball one of the most popular sports worldwide [1]. Basketball was originally conceived as a non-contact sports and rules of the game were based on the idea that, “if the offense did not have the opportunity to run with the ball, there would be no necessity for tackling and would eliminate roughness.” despite its origin as the non-contact sports basketball has evolved into an increasingly physical game in which contact is accepted and expected [2].

Not only is the popularity of the basketball increasing, but also the intensity with which it is played. The physiological demands of sports include elevated aerobic and anaerobic capacities in addition to the integration of physical characteristic such as muscle strength, power, endurance, flexibility, speed, agility and skill. Frequent jumping, landing and changes in direction make up much of physical load of competitive games, which players exposed to high level of eccentric loading [3]. Consequently the intensity and aggressiveness of the game should not be underestimated because the contemporary game of basketball puts full emphasis on speed and power of competitors. Strength and quickness are necessary to control an opponent position, “muscle”, a rebound, or “power” a shot, all of these are pre requisites for successful basketball career [4]. The common type of injuries seen in adolescent athletes are sprains, strains, growth plate fractures, overuse injuries, wounds, epiphyseal injuries, stress fractures and dislocations. Sports injuries are not single causative variable but because of variety of

factors that interact at time of injury they maybe intrinsic (personal, host), extrinsic (environmental) and previous injury which may cause injury in up to 50-70% [5]. Basketball injuries are generally defined as either acute/traumatic or overuse injuries. Acute or traumatic injuries occur due to a sudden force, or impact, like a fall or a stumble. Overuse injuries occur over time due to stress on the muscles, joints and soft tissues without proper time for healing. They begin as a small, nagging ache or pain, and can grow into a nasty debilitating injury if they aren't treated early.

Both sorts of injuries may result from overuse, lack of proper rest, lack of proper warm ups or poor conditioning. However, the regular participation among young players, added to the specific risks of the sport factors can increase the chances of suffering an injury mainly due to the immaturity of the musculoskeletal system during the period of structural and motor development [6]. The important step for good performance is to avoid injuries, illness, and pain. is the symptom that changes our movement patterns and increases the risk of non-contact sports injuries. Screening positive for pain may also help prescribe targeted interventions to avoid further pain and risk of injury [7].

Several studies have already been published describing injuries in basketball. Some focus on professional athletes, others focus on college students or high school students, and others on adult athletes. Some studies focus only on a specific region of the body or a selected diagnosis, like concussion, shoulder or ankle injury, and lots of compare injury rates between sexes. The understanding of basketball injury epidemiology is a crucial first step in the development of targeted, evidence-based interventions to provide recommendations for injury prevention. The objective of this study was to perform an Systematic review of the epidemiology of musculoskeletal injuries in basketball [8].

## Material and Methods

### Methods

For this review, the term MSD is used to refer to a host of musculoskeletal disorders (e.g., Basketball injuries, sprains, strains, Musculoskeletal Disorders, Back pain, Upper Extremity, Lower Extremity, Prevalence of pain and Musculoskeletal Disorders in upper extremity and lower extremity).

The use of an aggregate term is based on the hypothesis that the individual conditions share several common etiologic factors.

### Inclusion and exclusion criteria

This review includes systematic reviews, Cross sectional studies, Observational studies whose primary outcome was

the prevalence of MSD among Basketball players in India. To minimize bias, I excluded case series, follow-up studies and interventional studies among information professionals. case studies and literature reviews published in peer reviewed English journals were considered for inclusion, with letters to the Editor and conference proceedings excluded. Participants in the studies had to have been listed as Basketball players. No restrictions were placed on age, gender, race or socioeconomic status. Only articles that documented the prevalence of MSD and its risk factors were considered. Articles not written in English were excluded from the Systematic review.

### Searching techniques

The following databases were searched for the period 2010 to 2020. Search engine google scholar, Cochrane and PubMed; all searches are restricted to English-language articles. The search terms include "Injures," "Basketball players" "Musculoskeletal disorders," "pain," "sprains," strains," "musculoskeletal diseases" and "musculoskeletal system." The terms "pain," "musculoskeletal diseases" and "musculoskeletal system" are exploded according to accepted search techniques. I searched the Basketball players Information, using the key words "performing" "survey" and "prevalence and incidence. Empirical research, case studies and literature reviews. An extensive literature search was undertaken in PubMed and google scholar databases during 2010. Keywords used for the search were; musculoskeletal disorders, musculoskeletal discomfort, pain, basketball players, basketball injuries, prevalence of pain.

### Study selection

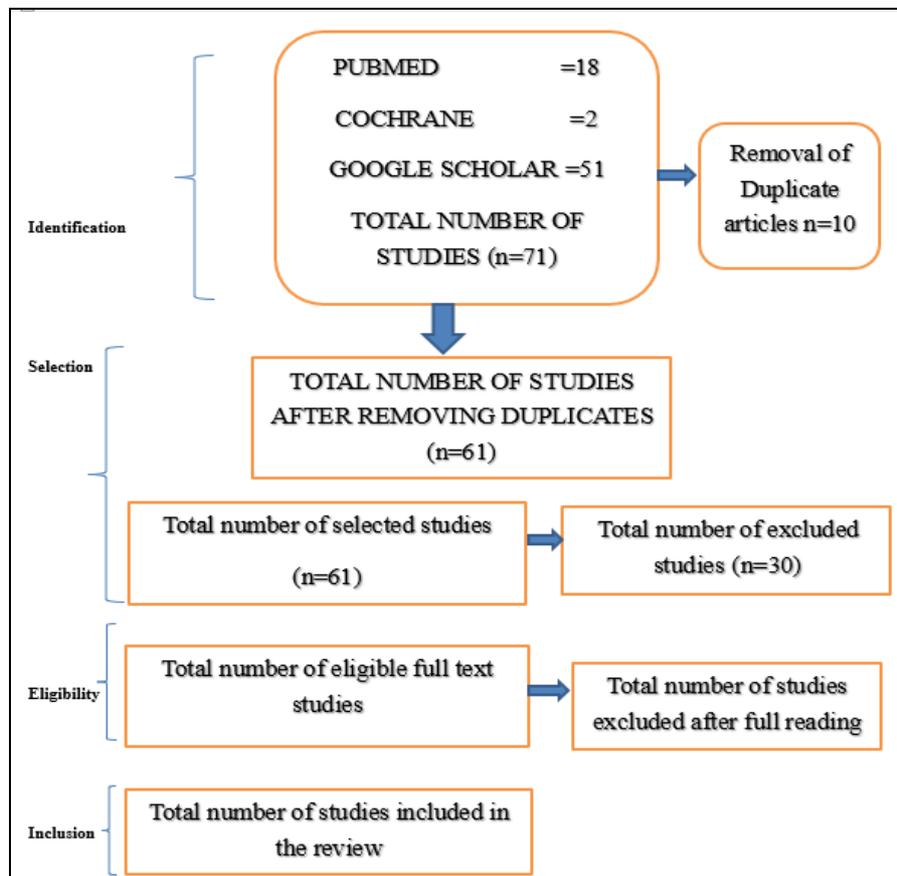
For all research articles identified during the search, the titles, keywords and abstracts, where available, were considered for possible relevance to this Systematic review. Full text copies were obtained for analysis and data extraction for all articles that met the inclusion criteria.

### Data extraction

Description of 71 studies located during this review had either measured the prevalence of MSD or reported on possible risk factors for MSD among Basketball players. All studies had been published in English. Figure 1 provides a flowchart of the systematic search methodology. INDIAN studies on MSD among information technology professionals have reported a high prevalence of MSD as indicated in Table 1. A number of articles reported a high prevalence of MSD, generally various studies have been done on basketball players and on various risk factors also have been done in different states of India. 12 article had been selected for the study purpose.

**Table 1:** Injury percentage by anatomical segments in relation to total number

Body parts	Male injuries (n)	Male injuries %	Female injuries (n)	Female injuries %	Total	Total %
Head and Neck	386	42.2	591	60.4	977	10.6
Trunk and Spine	519	56.2	403	43.7	922	10
Shoulder/Arm	292	46	342	53.9	634	6.8
Wrist/Fist	405	43.1	534	56.8	939	10.1
Thigh/Hip	894	48.6	945	51.2	1839	19.4
Knee	878	41.6	1232	58.3	2110	22.8
Ankle and Foot	741	41.3	1052	58.6	1793	19.9



**Fig 1:** Flow chart of the literature search. The figure illustrates the details of the strategy

**Table 2:** Epidemiology of injuries in percentage of basketball player of reviewed articles.

Journal	Year	Title	Authors	Method	Objective	Local	Category	Period	Sample
Scientific research	2019	Association of pre-season musculoskeletal screening and functional testing with sports injuries in elite female basketball players	Laimonas Šiupšinskas <sup>1</sup> , Toma Garbenytė-Apolinskienė <sup>1</sup> , Saulė Salatkaitė	retrospective	determine if functional tests can predict sports injuries in elite female basketball player	Lithuania	female players	2013-2016	169
international journal of yoga and physiotherapy	2018	Sports Injuries among Young Basketball Players: A Retrospective Study	Fabio do Nascimento Bastos*, Leonardo Carvalho, Jayme Netto Júnior	retrospective	to analyze the characteristics of injuries and associated personal and training characteristics in young basketball players of both sexes	brazil	male and females	2017-2018	109
sports health	2017	Epidemiology and Impact on Performance of Lower Extremity Stress Injuries in Professional Basketball Players	Moan Khan, MD, MSc, FRCSC,* Kim Madden, MSc, M. Tyrrell Burrus, MD	Cross sectional	incidence of lower extremity bony stress injuries and their impact on return to play and performance in these athletes	US	male and females	2005-2015	75
BMJ Open Sport & exercise medicine	2018	Epidemiology of sports injuries in basketball: integrative systematic review	Carlos Vicente Andreoli, Bárbara Camargo Chiamonti	retrospective	Epidemiology of sports injuries in basketball	brazil	male and females	2008-2018	8893
R Journal of Sports and Physical Education	2014	Common Sports Injuries amongst the Elite Women Basketball Players of India	Raspreet Sidhu <sup>1</sup> , Anjali Chhikara <sup>2</sup> , Dr. D.P. Sharma <sup>3</sup>	retrospective	Injuries amongst the Elite Women Basketball	India	women	2012-2013	120
medicina	2019	Prevalence of Musculoskeletal Injuries, Pain, and Illnesses in Elite Female Basketball Players	Toma Garbenytė-Apolinskienė <sup>1,*</sup> , Saulė Salatkaitė <sup>1</sup> , Laimonas Šiup	retrospective	Prevalence of Musculoskeletal Injuries	Lithuania	female players	2013-2016	358
journal of athletic	2014	prevalance of sports injuries in adolescents	leleni sreekaarini, charu eapen,	cross sectional	prevalance of sports injuries	India	male and females	2013-2014	461

enhancement		athletes	zulfequer cp						
sports medicine arthroscopy and rehabilitation therapy	2012	Incidence and pattern of injuries among adolescent basketball players in Nigeria	Oluwatoyosi Babatunde Alex Owoeye*, Ashiyat Kehinde Akodu,	prospectively	incidence on injuries among basketball	Nigeria	male and females	2009-2010	141
athlete training	2010	Injury in the National Basketball Association: A 17-Year Overview	Mark C. Drakes, MD, Benjamin Dombs, MD,†, Chad	descriptive epidemiology	injuries in basketball players	New York	male and females	2007-2010	1094
journal of athlete training	2018	The First Decade of Web-Based Sports Injury Surveillance: Descriptive Epidemiology of Injuries in US High School Girls' Basketball	Daniel R. Clifton, PhD, ATC*, Jay Hertel, PhD	descriptive epidemiology	sports injury	Ohio	Women	2013-1014	157
the physician and sports medicine	2018	The 'Sequence of Prevention' for musculoskeletal injuries among recreational basketballers: a systematic review of the scientific literature	Özgür Kilic, Vivian Van Os, Ellen Kemler, Maarten Barendrech	systematic review	sequence and prevention for musculoskeletal problem	Lithuania	male and females	2017-2018	109
Journal of sports medicine	2014	Sex-specific differences in injury types among basketball players	Eri Ito, Jun Iwamoto, Koichiro Azuma, and Hideo Matsumoto	Observational study	investigate sex-specific differences in injury types among basketball players.	japan	Male and female	1991-2011	1219

**Result**

A total of 12 Literature search were reviewed for Musculoskeletal injuries in basketball players. The study showed there were increased rate of injuries in players involving both upper limb and lower limb based on evidence.

Upper limb showed more percentage injury in Wrist and fist (10.9%) followed by head/neck (10.5%) and Trunk/Spine (10%) compared to shoulder and arm (6.8%). In lower limb injury to Knee (22.8%) followed by ankle and foot (20.4%) compared to hip and thigh (18%).

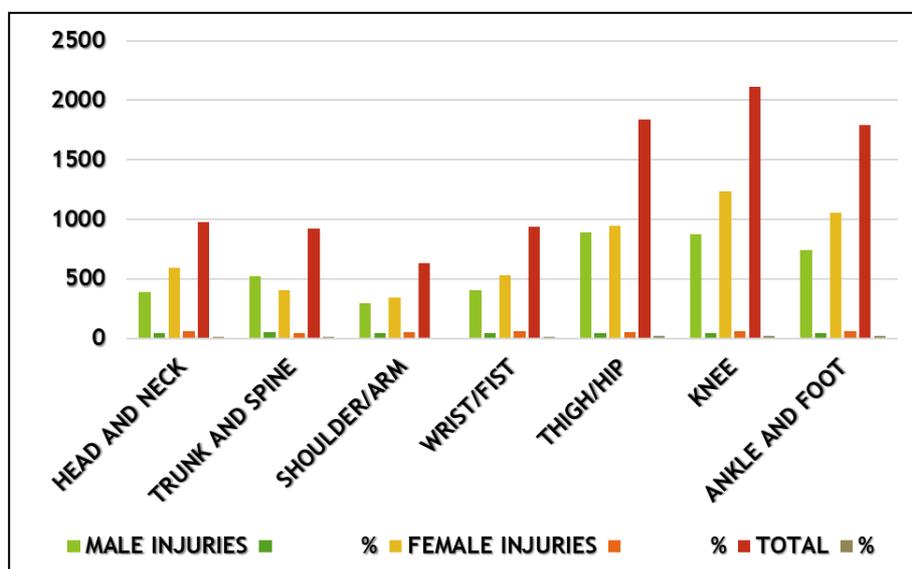


Fig 2: Anatomical Region Affected Mostly in basketball players

ANKLE (19.4%) The occurrence of this type of injury is by impact with floor of basketball court, especially during jumping and landing on side of foot or on someone else's foot.

KNEE (22.8%) is by maximal ground reaction force, structures of knee are fully tensed by the impact load, which favors the occurrence of injury.

WRIST/FIST (10.9%) caused by falling on outstretched hand followed by head and neck (10.5%) caused by bumping of heads with another player or accidental hit by elbow or ball

Also to SHOULDER/ARM (6.8%) due to use of frequent movements overhead while shooting ball or while passing it

to player.

**Discussion**

Certain similarities and differences between different players are easy to establish due to analysis of result. Synthesizing the result was possible studies included were Full text, Articles which are published in last 10 years, systematic reviews, Cross sectional studies, Observational studies. The aim of this systematic review the epidemiology of musculoskeletal injuries in basketball players.

In this study, 12, 905 basketball players were analysed from 12 included studies, and results showed that there were more

injuries in lower limbs 60.2% in which Ankle was (19.4%) the occurrence of this type of injury is by impact with floor of basketball court, especially during jumping and landing on side of foot or on someone else's foot other joint was Knee with (22.8%) by maximal ground reaction force, structures of knee are fully tensed by the impact load, which factors the occurrence of injury then Wrist/Fist which showed (10.9%) injury caused by falling on outstretched hand followed by head and neck (10.5%) caused by bumping of heads with another player or accidental hit by elbow or ball. Also with least injury of Shoulder/Arm (6.8%) caused due to use of frequent movements overhead while shooting ball or while passing it to player. This study have also shown that the sudden change in direct and multidirectional run, side shifts, jumps, landing, accuracy and training errors etc. has been proved to be extrinsic risk factors for injury to players. Also, lack of appropriate strength, endurance, flexibility, and other skill related components are other intrinsic risk factors. Drakos *et al.*, in an epidemiological study of injuries affecting professional basketball players in NBA over a 17-year period, found lower extremity was most frequently injured body area, accounting for 62.4% of all injuries and 57.8% of all game-related injuries. The impact of lower extremity injury and return to play was studied and has been reported in literature for other related injuries [6].

In a study of Women's National Basketball Association and NBA six-season retrospective study, Deitch *et al.* 24 concluded that lower limbs (65%) were most common site of injury in basketball. Of the 5272 injuries of professional category included in their study, 3411 occurred in lower limbs, representing 64.7% of total injuries reported. According to specific anatomical region, largest proportion of injuries occurred in ankle (2832 injuries, 21.9%), followed with knee (2305 injuries, 17.8%). Most authors point to ankle as frequent site of injury. however, some authors reported knee as most affected region [7].

Prevalence rate of injuries in India was found to be (27.9%). In other countries prevalence rate varies, 51% in Western Australia, 56.1% in Israel, 32.1% in Switzerland 42.1% in Scottish adolescents. It has also been reported adolescents may be particularly at risk for sports-related injuries as a result of improper technique, muscle weakness, poor proprioception and playing with adult-sized balls. The muscle-tendon units elongate secondarily in response to bone growth leads to tightness of muscles. Training in improper environments or with inappropriate footwear, equipment can be reason for injury. Less frequency of matches and increased training sessions can also lead to more number of injuries during the training sessions. But there are few studies which report more number of injuries at competitive level. As reported in one study higher rates of injury during competition may be due to increased play intensity, increased legal, illegal physical contact also due to increased exposure to high-risk activities [9].

Henry *et al.* noted that 94% of games missed were due to injuries of knee, ankle, and foot, compared to 53% of games also other studies found ankle injuries were most common but that knee injuries accounted for the greatest number of games missed [10].

Also some other injuries which can be called above average includes wrist sprain, nose injury, rotator cuff tear, quadriceps strain, black-eye, sprain of collateral ligament of finger, concussion, hamstring strain and sprain of meniscus. Researcher feels these injuries are common in contact of limited contact sports in which basketball is also included.

Other than the nature, intensity of game and vigorous training given to prepare basketball players are causes making them prone to above mentioned common injuries. Though, rate of occurring of these injuries was not as high as in respect to mentioned injuries, still these injuries need to be given attention for consideration of adopting protective measures [8]. However, some (25%) of injuries were time loss injuries. This implies that 1 out of every 4 injuries resulted in a disposition of discontinuity of play during competition. These time loss injuries were moderate and severe injuries that prevented players from returning to play immediately after a sideline treatment. It is imperative that injury countermeasures that would help prevent such injuries in future competitions are introduced. The level and intensity of play in high risk sports such as basketball, is one area which may be addressed by sports medicine experts, parents, coaches, sports administrators and injury prevention policy makers. focus of sports activity by young people should be directed at technique development in order to train their neuromuscular system to control the biomechanical strain imposed by the game of basketball [11].

Thus, the information gathered can contribute to the establishment of preventive measure aimed in reducing the occurrence of injuries during participation of basketball.

### Other Professional Games

Systematic reviews and few other studies states that musculoskeletal injuries are topic of concern for players at all skill level. Many evidences said that most bothering factor for duration and frequency of injuries are intrinsic and extrinsic factors. Also in all the other games most common site for prevalence of injury is lower limb followed by ankle and knee. It is due to various reasons such as turning, twisting and other external forces from other players. Any player irrespective of any games must be trained under proper guidance, any kind of carelessness or improper body movements can lead a player to injury.

### Conclusion

After analysing studies included in this systematic review, it was evident that most affected segment was in lower limbs, especially, foot, ankle and the knee. however, there was difficulty in identify the etiologic of these injuries, as well an appropriated instrument to detect the injuries in the basketball players. The impact of injury was caused by the training routine or inappropriate movement while playing which influenced not only their professional life but also affecting their health even after their professional career. Epidemiology is first step for effective preventive measures to be implemented to reduce this incidence of injuries. The best available evidence suggests that musculoskeletal disorders are an important health issues in basketball players. In these terms is suggested that more studies be developed with this target population, investigating with gender distinction, focus on incidences, severity and injuries etiologic in this players. Boosting preventive actions that favour a healthy and safe career to basketball players involved in the practice.

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