

Original Article

The Incidence of Osgood-Schlatter Injuries in Young Athletes and Non-Athletes - A Systematic Review

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Abstract

This systematic review explores the incidence of Osgood-Schlatter Disease (OSD) in young athletes and non-athletes, focusing on its epidemiology and characteristics. OSD marked by patellar tendon irritation, local pain, and swelling, primarily arises from repetitive quadriceps strain during adolescence and sports activities. The study conducted a systematic review of twelve eligible studies, encompassing a total of 4814 participants. Football and basketball were identified as the sports most linked to OSD, with the condition more prevalent in young athletes than non-athletes. The heightened occurrence of OSD in athletes can be attributed to the repetitive stress on the tibial tubercle during activities like running and jumping. This research underscores the significance of understanding OSD's epidemiological aspects for effective prevention and management, particularly among adolescents experiencing growth spurts. It also emphasizes the need to educate young athletes on injury prevention and the early recognition of OSD symptoms, including knee pain and swelling.

1. Introduction

Osgood-Schlatter Disease (OSD) can be defined as the irritation of the patellar tendon on the tibial tubercle (Halilbasi et al., 2012). It is accompanied by

local pain, swelling, and tenderness around the tibial tubercle (Ducher et al., 2010) and is caused by repetitive quadriceps strain (Vreju, Ciurea & Rosu, 2010). This knee injury can be associated with sports, growth in adolescents, and often results from acute or chronic overload during physical activities (Lucenti et al., 2022). In boys, it most often occurs between the ages of 10 and 15, while in girls, it occurs between the ages of 8 and 13. It is typically self-limited and disappears during the final stages of skeletal growth (Lucenti et al., 2022). To prevent these injuries, improving flexibility, muscle balance, and refining jumping and skating techniques can be effective (Dubravcic-Simunjak et al., 2003).

The exact cause of this injury is not yet definitively known (Neuhaus, Appenzeller-Herzog & Faude, 2021). However, according to Dubravcic-Simunjak, Pecina, Kuipers, Moran, and Haspl (2003), the injury occurs during landing, take-off, repeated jumps during exercises, and greater load on the landing leg. OSD is most often associated with sports that involve jumping, running, and repeated contractions of the knee extensor apparatus, including football, basketball, volleyball, athletics, and gymnastics (Lucenti et al., 2022). Notably, football and basketball are currently the most popular sports and activities chosen by children, and these sports are characterized by activities that activate the knee extension apparatus, which can contribute to OSD (Halilbasi et al., 2012).

Seyfettinoğlu and associates (2020) have identified injury risk factors that can be either immutable or modifiable. Non-modifiable risk factors include pre-existing anatomical conditions such as sex, age, body height, body size, previous injuries, and growth stage, while modifiable factors include training programs, weekly exercise routines, quadriceps femoris muscle straining during tendon tightening, and triceps surae muscle. Omodaka and associates (2019) conducted a study involving junior baseball teams in Japan. Their research showed that patients with symptomatic OSD had significantly higher height, weight, Body Mass Index, and weekly exercise duration than those without OSD or with asymptomatic OSD. Additionally, the group with symptomatic OSD exhibited significantly limited HBD (heel-buttock distance) and hip range and ankle joint movement compared to the group without OSD. Given these findings, it is evident that the duration of exercise and sports activity, as well as the basic characteristics of the athlete, can significantly impact the occurrence of OSD in gymnasts.

Some authors, such as Itoh and associates (2018), believe that rigorous activities like running, jumping, stopping, sharp changes in direction, and squatting can lead to OSD. Their study aimed to identify the knee extension moment (load on the tibial tubercle) in different movements that can cause OSD and compare the load between these movements. Their findings revealed that running could not be considered a high-impact movement as it did not demonstrate statistical significance. Although it is considered one of the causes of OSD, further research has determined that OSD can develop if a sport or physical activity involves a prolonged period of foot-ground contact, even though it is not considered a high-load movement. As for jumps, it was also determined that single-leg landings result in a higher load compared to landing on both legs, and height was not the sole

reason for the increased load in single-leg landings. Stops have been characterized as sustained stress on the knee extension mechanism and load, with stopping and reversing found to exert even greater stress.

The aim of this systematic research was to investigate and comprehend the epidemiology and characteristics of OSD in young athletes and non-athletes. Specifically, the research seeks to determine the incidence of OSD in these populations and identify any associated factors, such as the most common sports related to OSD. By conducting a systematic review of relevant studies, the goal is to provide insights that are essential for the effective prevention and management of OSD within the field of sports medicine.

2. Material and methods

Literature Identification. Studies were searched and evaluated following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. PubMed was used as the search database.

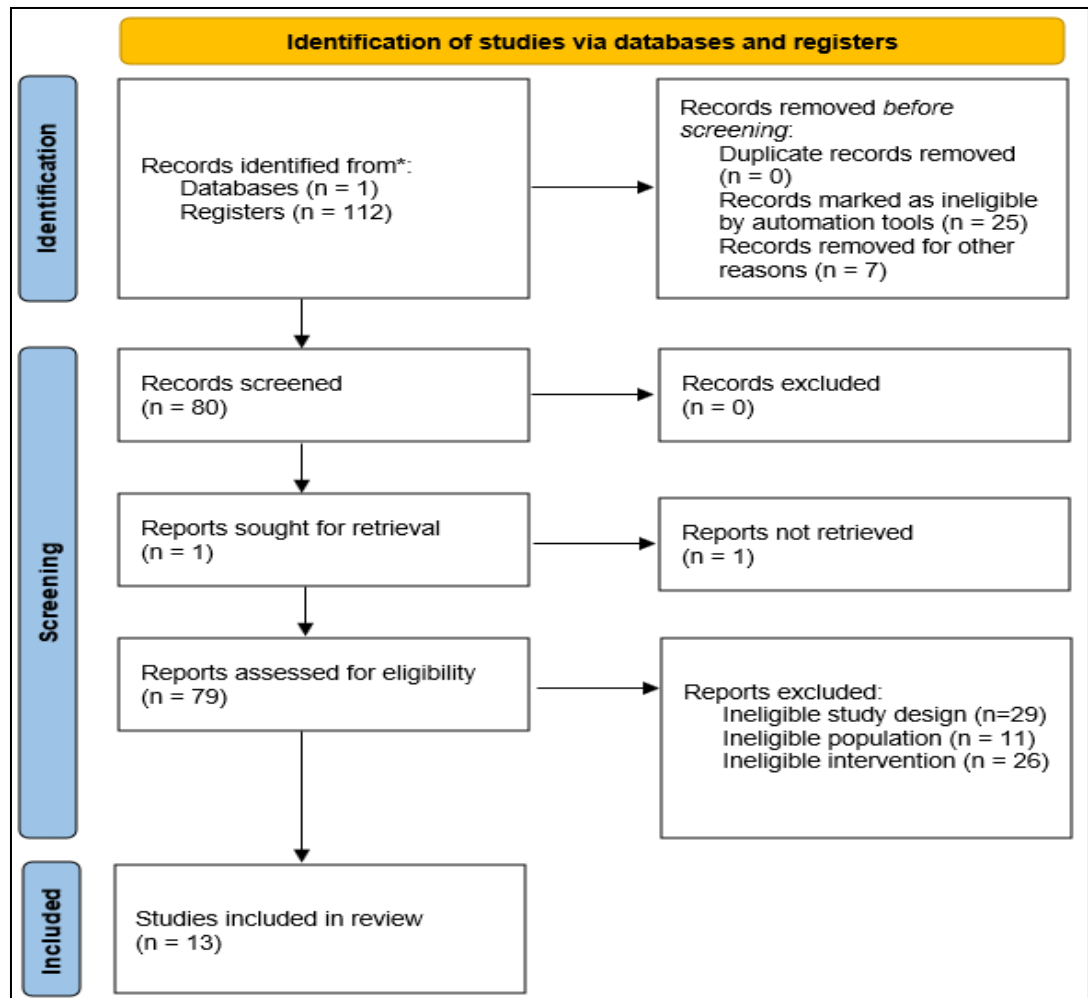


Figure 1. PRISMA flow diagram

The following terms were employed for the web search: Osgood-Schlatter disease, Osgood-Schlatter, OSD, incidence, prevalence, frequency, rate, occurrence, athletes, non-athletes, sport, fitness, team sport, basketball, handball, soccer, football, gymnastics. Authors conducted the web search and study selection. Each author performed the study identification with "blinded" settings using the Rayyan software tool.

Inclusion Criteria. The primary inclusion criterion was that studies encompassed OSD. The secondary criterion was that authors reported the percentage or absolute number of participants diagnosed with OSD. The studies could have been published at any date since this research area was not frequently explored. Furthermore, the studies had to be published in English. Detailed selection is illustrated in the PRISMA flow diagram (Figure 1). The incidence rate was calculated from participants that have reported any kind of knee pain, and not from total number of participants.

3. Results and discussions

Table 1. An overview of the Osgood-Schlatter disease studies

First Author and Year of Publication	Sample of Participants		Sport	Incidence Total	Incidence percentage of OSD %
	Number	Age			
Orava and Virtanen (1982)	N – 178	9-26 (14.4)	Track and field sports (53.5%) Football (20%)	T - 56	T – 31.5
	M – 135			M – 39	M – 21.9
	F – 43			F - 19	F – 10.7
Kujala et al. (1986)	N – 886	(20.8)	Football (20.8%) Long distance running (13.1%) Volleyball (11.6)	T - 89	T – 10.1
	M – 697				
	F – 189				
Dubravcic-Simunjak et al. (2003)	T – 469 (*)	13 - 20	Figure skaters	T - 67	T – 14.2
	M – 233				
	F – 236				
Frey et al. (2008)	N – 19	(13.7)	Basketball Running Football	T - 3	T – 15.8
	M – 18				
	F – 1				
de Lucena et al. (2011)	T – 956 (*)	12 – 15	Non-athletes	T - 94	T – 9.8
	M – 474				
	F – 482				
Foss et al. (2012)	T – 183	Middle and High school	Basketball	T - 31	T – 16.9
Suzue et al. (2014)	T – 198	/	Football	T - 13	T – 6.6
Foss et al. (2014)	T – 205	11-19	Basketball	T - 5	T – 2.5
Kaneuchi et al. (2018)	T – 731 (*)	6 – 14	Basketball	T – 50	T – 6.8
Bezuglov et al. (2020)	T – 280	11-15	Football	T – 28	T - 10
Rathleff et al. (2020)	T – 252	10 - 14	Non-athletes	T – 51	T – 20.2
Andreucci et al. (2021)	T – 323	10-19 (14.4)	Non-athletes	T - 52	T – 16
Schultz et al. (2022)	T – 127	12-17	Football	T -21	T - 17

A total of twelve studies met the eligibility criteria. The earliest published study was by Orava and Virtanen (1982), and the most recent was by Schultz, Tol, Veltman and Reurink (2022). The sample included in this review consisted of N=4814 participants. The study with the highest number of participants was conducted by de Lucena, dos Santos Gomes, and Guerra in 2011 (N=956), including both healthy participants and those with diagnosed knee injuries. The study with the highest number of participants, including only individuals with diagnosed knee injuries, was conducted in 1986 by Kujala, Kvist, and Österman (N=886). The analyzed studies included both male and female populations. Five studies focused on football, and four studies focused on basketball as the most common sports associated with OSD. The participants' ages ranged from 6 to 26 years, with a mean age corresponding to the adolescent maturity stage (Table 1).

Discussions

The aim of this study was to analyze the incidence of OSD injuries and comprehend the epidemiology and characteristics of OSD in young athletes and non-athletes. This systematic review found that the incidence of OSD is higher in young athletes than in non-athletes, with the highest incidence occurring in track and field sports, football, and basketball.

The increased incidence of OSD in athletes is likely due to the repetitive stress placed on the tibial tubercle during activities such as running, jumping, and kicking, leading to inflammation and irritation of the tibial tubercle, which can cause pain and swelling (Ladenhauf et al., 2020). The mean age of participants in the studies included in this review correspond to the adolescent maturity stage. OSD is most common during adolescents' growth spurts when their bones are growing rapidly, making the tibial tubercle particularly vulnerable (Zumwalt, 2023). Although the cut-off value for quadriceps femoris flexibility during OSD onset has not been studied enough, it is a commonly reported risk factor in OSD development (Takei et al., 2023). To the best of the authors' knowledge, the first study on this topic by Orava and Virtanen (1982) revealed that OSD occurs most frequently in track and field sports and football. Furthermore, Orava and Virtanen (1982) found that of the total cases of OSD, six required operative treatment (at the last stage). The number of female athletes with OSD was lower due to lower impacts from jumping and running, but they were still present in the mentioned study, accounting for 9.2% of the total.

A study by Kujala and associates (1986) reported a prevalence of OSD at 21% in young athletes compared to 4.5% in non-athletes, with OSD having the highest incidence compared to other knee disorders such as patellar chondropathy, ligamentous sprains, and meniscus tears. Typically, OSD occurs among athletes in track and field, football, and basketball. Dubravic-Simunjak and associates (2003) studied OSD incidence in elite junior figure skaters and found that 14.2% of participants had OSD during the adolescent period (13-20 years). Frey and associates (2008) examined tibial tuberosity fractures among 20 patients, and three of them had OSD in addition to fractures. Before diagnosing tuberosity fractures and OSD, patients were involved in running (5), football (3), and basketball (8).

Heel pain is a significant predictor for OSD presence and it is strongly related to OSD in football players (Schultz, Tol, Veltman, & Reurink, 2022). Moreover, the heel pain is associated with OSD, future studies should focus on this cause and conduct research in different population.

Kaneuchi and associates (2018) noted that the risk of OSD increases with age in male basketball athletes. Foss and associates (2012) studied knee disorders in adolescent female athletes, all of whom were basketball players in high school and middle school. Out of 183 athletes with knee pain, 31 were diagnosed with OSD. Another study by Foss and associates (2014) found an OSD incidence of 2.5% in basketball players. It is evident that OSD is a common problem in early adolescents. In contrast to basketball players, Suzue and associates (2014) reported an OSD incidence of 6.6% in football players. Bezuglov and associates (2020) found that OSD commonly occurred during the winter season in football players.

The elevated incidence of OSD in athletes is likely attributable to the repetitive stress placed on the tibial tubercle during high load sport activities. In Brazilian children aged 12 to 15 years old, the incidence rate of OSD was 9.8% (N=94) out of a total of 956 boys and girls (de Lucena et al., 2011). This study confirmed that OSD is a common problem with a high incidence in the young population. Andreucci and associates (2021) reported that OSD incidence in children is 16% of total knee related disorders. Children with OSD also reported pain medication use for knee pain (12%). Sport practitioners and parents should raise awareness and monitor children's development, especially if they are involved in sports. Rathleff and associates (2020) examined OSD incidence in non-athletes aged 10-14 years, with an incidence rate of 20.2%.

Based on the available evidence, it is recommended that an intervention aimed at reducing injuries in adolescent athletes during the growth spurt should encompass the adjusting training load, incorporating exercises to enhance balance, coordination, and landing techniques, and implementing a personalized strength training regimen (Johnson, Williams, Bradley, & Cumming, 2023).

The increased incidence of OSD in athletes has important implications for sports medicine practitioners. It is crucial to be aware of the risk factors for OSD and to educate athletes on how to prevent this injury. Athletes should also be aware of the signs and symptoms of OSD and should seek medical attention if they experience any knee pain or swelling. OSD is more commonly found in boys, as they are more likely to exert greater force during running, jumping, and landing.

This knowledge can contribute to the prevention of this knee disease by identifying which sports it most commonly affects. Accordingly, training approaches can be adjusted to reduce the risk of OSD in athletes.

4. Conclusions

This systematic review reveals that the incidence of OSD injuries is higher in athletes than in non-athletes. The highest incidence of OSD was observed in track and field, football and basketball players. This finding highlights the importance of recognizing knee pain as a potential precursor or indicator of OSD in this specific

population. In addition, we discovered that it occurs largely in adolescents - young athletes, which contributes to paying special attention to this age group during training, so that OSD injuries do not occur.

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