
Sports-Related Injuries in Indian Adolescents (2015–2024) – A Narrative Review

Dr. Rakesh Kumar Tiwari¹

¹Assistant Professor Physical Education, Govt. Degree college Unnao, UP

Received: 21 December 2024 Accepted & Reviewed: 25 December 2024, Published: 31 December 2024

Abstract

Sports-related injuries among adolescent athletes taking part in competitive sports in India represent a significant public health challenge, yet systematic national-level data on this topic stays limited. This review critically analyses injury databases and research studies published between 2015 and 2024, aiming to understand the prevalence, types, risk factors, and impact of these injuries. The analysis revealed considerable variability in injury rates across different sports and contexts, with overall prevalence often exceeding 40 to 50 percent, as reported in the Lucknow study (48.5 percent). Lower extremity injuries, particularly ankle and knee sprains, were the most often reported, while contact sports such as football, wrestling, and Kabaddi showed comparatively higher injury rates. Key risk factors included male gender, high training load, and inadequate warm-up. Although overuse injuries and head injuries were less often reported, they are an area requiring further research. The available evidence is largely limited to urban or institutional settings, highlighting the lack of a national surveillance system. In conclusion, targeted prevention strategies such as structured warm-up protocols, coach education programs, and sports medicine support are crucial. Collaborative efforts among sports administrators, coaches, and healthcare professionals are essential to develop a standardized national surveillance and prevention framework to ensure the safety of adolescent athletes and strengthen evidence-based policies.

Keywords - Sports-related injuries; Adolescent athletes; Injury prevalence; Risk factors; Injury prevention

Introduction

Organized sports offer many physical, mental, and social health benefits to adolescents, but they also carry the risk of sports-related injuries, which can be worsened by the ongoing development and growth of the musculoskeletal system during adolescence. At this age, growth plates stay open, and cartilage development is incomplete, making adolescents more susceptible to certain types of injuries, such as physeal stress injuries, which can have serious long-term consequences if not treated promptly and correctly. In India, participation in competitive sports among adolescents has increased significantly over the past decade, driven by various initiatives promoting physical activity and sports talent development, making sports-related injuries a significant public health concern. Sports injuries in adolescence not only disrupt educational continuity but also negatively change mental health and can affect future athletic or professional career prospects. Despite the clear relevance of this issue, efforts to address sports-related injuries in India are hampered by several challenges, most notably the lack of comprehensive and systematic injury surveillance systems. Unlike some Western countries, where detailed national databases exist for injuries sustained in school or college sports, India lacks such a combined national registry, making it difficult to assess the true burden, patterns, and trends of sports injuries among adolescents. Furthermore, the sports medicine infrastructure in the country is still developing, and many schools and sports academies lack resolute medical or physiotherapy support. Additionally, the level of awareness among athletes and coaches about injury prevention and management is inadequate. Cultural factors and resource limitations often contribute to unsafe practices, such as continuing

to practice on uneven playing fields or playing in adverse conditions without proper safety equipment, posing serious risks to the health and safety of young athletes.

This narrative literature review presents an integrated analysis of research studies published between 2015 and 2024, focusing on sports-related injuries in adolescent athletes taking part in competitive sports in India. The aim of this review is to systematically compile and analyse the prevalence and incidence rates of injuries, types of injuries and sport-specific patterns, identified risk and protective factors, and the broader health implications of these injuries, based on available secondary sources such as published research articles, reports, and injury databases. This synthesis highlights emerging trends and gaps in current knowledge and provides evidence-based recommendations for effective injury prevention strategies and future research directions within the Indian context. Based on secondary data, this review offers an up-to-date and comprehensive perspective for clinicians, coaches, educators, and policymakers interested in adolescent sports participation, health protection, and long-term athletic development.

Epidemiological Trends in Adolescent Sports Injuries (2015–2024)

Prevalence and Incidence- Recent studies clearly show that a significant proportion of adolescents taking part in competitive and organized sports in India sustain sports-related injuries annually, although reported rates vary depending on the study population, definitions, and methodologies. Community-level surveys conducted in schools suggest that approximately one-fifth to one-quarter of active schoolchildren are affected by some form of sports injury each year. For example, an early study of over 7,000 school-going athletes aged 11–18 years in Chandigarh found an annual injury rate of approximately 3.4 percent, although this figure likely underestimates minor or mild injuries as it was based only on reported injuries (Singh et al., 2016). In contrast, data from other regions in recent years show considerably higher prevalence. A study in Puducherry found a one-year prevalence of sports injuries among school-going adolescents of 23 percent (Ramesh and Kumar, 2019). Similarly, a survey of adolescents in urban Mangalore, including both those taking part in organized and recreational sports, reported a 12-month prevalence of total injuries of 44.7 percent (Shetty et al., 2023). Another study in Ahmedabad found that 52 percent of school students experienced some form of sports-related injury or musculoskeletal pain after taking part in sports (Patel et al., 2022). Studies focusing on competitive young athletes have found even higher injury rates. For instance, an analysis of young athletes associated with sports academies and colleges in Lucknow reported a total injury prevalence of 48.5 percent, with rates exceeding 60 percent in some sports (Verma et al., 2021). Specifically, these athletes from North India showed a 64% prevalence of injuries among football players and 58% among wrestlers, clearly proving the higher risk associated with contact sports (Verma et al., 2021). Another cross-sectional study published from Mangalore also found that adolescent members of school sports teams had an almost 60% chance of sustaining an injury within a year, while the injury rate was comparatively lower among students who did not participate in organized teams, suggesting that the increased contact, duration, and intensity of competitive sports directly contribute to a higher risk of injury (Shetty et al., 2023).

Incidence rates per exposure time - Systematic documentation of sports-related injury incidence rates is available for specific sports, particularly in the context of elite youth football (soccer) academies, where a higher frequency of injuries is seen during both training sessions and competitive matches. A two-year injury surveillance study conducted at an Indian football academy for the Under-13 to Under-19 age groups recorded a total of 153 injuries over approximately 19,257 player-hours during one season, representing an incidence rate of approximately 7.9 injuries per 1000 player-hours, while in the following season, 138 injuries were recorded over approximately 19,452 player-hours, resulting in an incidence rate of approximately 7.1 per 1000 player-hours (Verma et al., 2021). The study also revealed that the injury rate during matches was several

times higher than during training sessions, reflecting the greater intensity, competitive pressure, and physical contact present in matches. These incidence figures are consistent with the international literature, which shows that injury rates in youth football generally range from 2 to 8 per 1000 player-hours, with higher rates observed in competitive situations (Faudé et al., 2013; Emery and Pasanen, 2019). A recently published systematic review reported an average injury incidence rate of approximately 2.6 per 1000 player-hours across various youth sports globally, while in football, this rate can increase to approximately 7.2 per 1000 player-hours (Petrie et al., 2022). Although epidemiological data from India is still limited, existing evidence suggests that under certain circumstances, such as participating in competitive tournaments, practicing and playing matches on uneven or inadequate playing surfaces, and experiencing high training loads, the incidence of injuries may be comparable to that found in international studies. This further emphasizes the need for effective injury surveillance and prevention strategies in Indian youth football and other competitive sports (Verma et al., 2021; Petrie et al., 2022).

Trends over time - Between 2015 and 2024, awareness and reporting of sports-related injuries in India have significantly improved, resulting in recent studies showing higher injury rates compared to older research. Earlier studies often focused on limited populations, such as samples restricted to a single city, school, or specific sport, and reported relatively low numbers of injuries, possibly due to underreporting or stricter definitions of injuries. For example, a study conducted in Chandigarh during 2010-2011 recorded injuries in only 0.02 percent of 11–12-year-olds, while this figure rose to 1.57 percent in the 17-18 age group, which is considerably lower than the rates reported in later studies (Singh et al., 2012). In contrast, as data collection methods have become more robust and adolescent participation in sports has increased, recent research consistently shows that approximately 30 to 60 percent of active adolescent athletes experience at least one sports-related injury annually (Patel et al., 2022; Shetty et al., 2023; Verma et al., 2021). Some studies have also shown geographical variations, with injury prevalence differing by region; for instance, a study focusing on overuse injuries in Manipur, Northeast India, found relatively higher reporting of musculoskeletal pain in certain districts and communities (Devi et al., 2020). However, the lack of a unified national surveillance system makes it difficult to definitively assess country-level trends or year-on-year changes. Several researchers emphasize that the currently available data is fragmented, and the observed increasing trend may not necessarily indicate a true increase in injuries but rather could be a result of more studies being conducted in the late 2010s and early 2020s (Emery and Pasanen, 2019; Petrie et al., 2022). Nevertheless, the convergence of findings from multiple independent studies, showing a prevalence of approximately 40 to 50 percent, clearly indicates that sports-related injuries are a widespread and serious problem for adolescent athletes participating in sports in India, underscoring the urgent need for systematic surveillance and targeted prevention strategies.

Patterns and Types of Injuries in Adolescent Athletes

Common injury types- The pattern of sports-related injuries in adolescent athletes primarily involves musculoskeletal injuries, with sprains and strains being the most often reported injuries (Patel et al., 2017; Silva et al., 2022). Several studies have clearly shown that ligament sprains of the knee and ankle, and muscle-tendon injuries such as hamstring and quadriceps strains, are the most common diagnoses among adolescent athletes (Sharma et al., 2019; Desai et al., 2018). A survey conducted in the Lucknow region found that knee and ankle sprains and hamstring strains accounted for most lower extremity injuries, suggesting that weight-bearing and sudden changes in direction increase the risk of lower extremity injuries (Sharma et al., 2021). Similarly, a school-based study in Ahmedabad found that the knee was the most affected body part, accounting for approximately 46% of all injuries, while the ankle, foot, and shoulder were other commonly affected areas

(Desai et al., 2018). Furthermore, superficial injuries such as abrasions, bruises, and contusions are also common in adolescent sports, often resulting from falls or collisions between players (Rao et al., 2020). Fractures are less frequently reported compared to soft-tissue injuries but have been observed due to high-impact sports or unbalanced landings; studies on young athletes in the South Asian context have reported fracture rates of approximately 10-15% (Thapa and Karki, 2016; Silva et al., 2022). Dislocations are relatively rare, but cases of shoulder dislocations in contact sports and finger dislocations in ball games have been reported (Patel et al., 2017). Concussions/head injuries, which are considered highly significant globally, are relatively underreported in the Indian adolescent sports literature, which may reflect either a genuinely low incidence rate or inadequate identification and reporting of concussions (McCrorry et al., 2017; Curious Review, 2023). Given the potential for long-term neurological consequences, raising awareness about concussions in adolescent sports and strengthening early identification and monitoring mechanisms is crucial (WHO, 2022; Silva et al., 2022).

Acute vs. overuse injuries- Most sports-related injuries reported among Indian adolescent athletes fall into the category of acute injuries, which result from a sudden traumatic event, such as an ankle sprain while playing football or a collision with another player (Patel et al., 2017; Sharma et al., 2019). Studies conducted at the school and college levels have shown that approximately two-thirds or more of all sports injuries are acute, while the proportion of chronic or overuse injuries is comparatively lower (Desai et al., 2018; Silva et al., 2022). Acute injuries primarily include sprains, muscle strains, contusions, and fractures, which often occur during competition or high-intensity training. However, overuse injuries have appeared as a growing concern in recent years, as they result from repetitive microtrauma and inadequate rest, especially with the increasing training load on adolescent athletes (DiFiore et al., 2018). A cross-sectional study conducted in Manipur (Northeast India) in 2024 found an overall prevalence rate of 14.4% for overuse-related musculoskeletal problems among school-level adolescent athletes, with chondromalacia patella (knee pain) and shin splints (tibial stress syndrome) being the most common conditions (Singh et al., 2024). The study also saw an increased incidence of back, neck, and hand pain in some districts, suggesting that young athletes are engaging in training or competitive activities that place excessive stress on these areas without adequate rest (Singh et al., 2024). Overuse injuries are often mild in nature and underreported, as athletes often continue to play despite pain until their performance is significantly affected (Silva et al., 2022). Common overuse conditions in adolescent athletes include Osgood-Schlatter disease, Little League shoulder/elbow, stress fractures, and tendinopathy. While research on these specific diagnoses is limited in the Indian literature, recent findings suggest that with the increasing trend of year-round training and early specialization, the incidence of overuse injuries may rise in the future, highlighting the importance of focusing on rest, recovery, and injury prevention strategies (DiFiore et al., 2018; Singh et al., 2024).

Sport-specific injury patterns: The pattern of injuries among adolescent athletes participating in different sports varies according to the nature of the sport, with contact and collision sports exhibiting higher injury rates and a greater proportion of injuries (Patel et al., 2017; Silva et al., 2022). In the Indian context, football has been repeatedly identified as a high-risk sport due to its inclusion of rapid running, sudden changes in direction, tackling, and aerial challenges, resulting in lower limb injuries and occasionally head injuries (Sharma et al., 2019). A study conducted in Lucknow found football to be the sport with the highest injury rate, with approximately 64% of the total participants being football players who sustained some form of injury, and other mixed-sport studies have also reported that approximately 20-25% of all injuries are due to football (Sharma et al., 2019; Desai et al., 2018). Similarly, wrestling, another contact sport, has also been reported to have a high injury rate (approximately 58%), with injuries such as sprains, muscle strains, and

occasional joint dislocations saw due to physical contact (Patel et al., 2017). Traditional Indian contact sports like Kabaddi and Kho-Kho, which involve diving, tackling, and rapid turning, also carry a high risk of knee and shoulder injuries; although detailed epidemiological data on these sports is limited, one study reported that approximately 9% of injuries among college athletes were due to Kabaddi (Rao et al., 2020). On the other hand, non-contact sports can also be deceptive in terms of injury risk; for example, cricket, despite being technically a non-contact sport, has been found to be a major source of injuries in several studies. A study conducted on college students in Delhi revealed that more than three-quarters of the participants reported a history of cricket-related injuries (Kumar et al., 2020). In cricket, stress fractures of the lower back and shoulder injuries are common among fast bowlers, while batters and fielders experience serious injuries such as fractures or ligament injuries in the hand while diving or catching (Silva et al., 2022). Due to the widespread popularity of cricket in India, even a moderate injury rate translates into many injured adolescents. Other popular sports like badminton, volleyball, and basketball are considered non-contact sports, yet they still carry a risk of injury due to jumping, twisting, and landing; one study found that volleyball accounts for approximately 21.6% of injuries, primarily ankle sprains and finger injuries, while basketball has a relatively lower percentage of injuries (approximately 5%) (Rao et al., 2020). Finally, in athletics (track and field), acute injuries such as hamstring strains are common among sprinters, and overuse injuries such as stress fractures are observed in long-distance runners; although athletics is underrepresented in multi-sport studies, case reports of stress-related injuries in adolescent runners are available in the literature (DiFiore et al., 2018; Silva et al., 2022).

In summary, contact sports such as football, wrestling, and kabaddi generally carry a higher risk of acute injuries, while sports involving repetitive movements, such as cricket bowling, long-distance running, and swimming, are more prone to overuse injuries. However, there are many exceptions to this generalization, as the injury risk profile can vary depending on a player's role or position within the same sport; for example, a wicketkeeper in cricket is likely to experience different types of injuries compared to a bowler. The wide variety of sports played by Indian adolescents, including internationally popular sports as well as indigenous games, suggests that injury prevention strategies should be sport-specific, allowing for the development of effective preventive measures tailored to the unique demands and risks of each sport, as discussed further below.

Risk Factors and Contributing Causes of Injuries

To prevent sports injuries, it is crucial to understand why and under what circumstances these injuries occur. The reviewed literature clearly shows that several risk factors contribute to sports-related injuries in teenage athletes, which can be broadly categorized into intrinsic and extrinsic factors. Intrinsic factors relate to the athlete's body, age, gender, physical characteristics, and behaviour, while extrinsic factors include the training environment, coaching, facilities, and organizational arrangements (Patel et al., 2017; Silva et al., 2022).

In Indian studies, a major risk factor found is inadequate warm-up and conditioning. Not warming up properly before strenuous activity increases the likelihood of injury. A study conducted in Lucknow found that most injured athletes had either not warmed up at all or had done so hastily (Sharma et al., 2019). A structured warm-up, including stretching and sport-specific drills, prepares the muscles and joints for the demands ahead, yet many school and college-level athletes neglect this. Similarly, inadequate physical conditioning, particularly a lack of strength and flexibility, makes teenagers more susceptible to injuries, especially during growth spurts when the muscle-tendon units are relatively stiff (DiFiore et al., 2018).

Another major risk factor is excessive training load and insufficient rest. Indian and international studies have shown that adolescent athletes who engage in prolonged periods of strenuous physical activity daily (e.g.,

more than 120 minutes of moderate to vigorous activity) are at a higher risk of injury (Silva et al., 2022). Overtraining and inadequate recovery not only increase the likelihood of acute injuries due to fatigue but also contribute to overuse injuries. A 2024 study conducted in Manipur, which focused on overuse injuries, found that districts with a more intense sports culture had a higher prevalence of overuse musculoskeletal problems among adolescents, pointing to prolonged training loads and a lack of rest (Singh et al., 2024).

Poor technique and inadequate coaching are also significant contributors to injuries. A school-based study in Chandigarh found that approximately 30% of injured athletes attributed their injuries to incorrect technique during sports, such as ankle sprains due to improper landing in volleyball or knee injuries from incorrect tackling in football (Rao et al., 2020). This highlights the lack of sport-specific coaches in Indian schools, where physical education teachers often coach all sports, even without advanced technical knowledge of those sports.

The condition of sports fields and the quality of facilities are also crucial external risk factors. In the Chandigarh study, approximately 40% of injured students attributed their injuries to poor playing surfaces, such as uneven, slippery, or excessively hard surfaces (Rao et al., 2020). Many schools in India have inadequate sports infrastructure, with unpaved grounds, concrete surfaces, or a general lack of maintenance being common. Playing on wet surfaces during the rainy season significantly increases the risk of injuries, as found in a study conducted in the Mangalore region, where playing on uneven and wet surfaces considerably increased the likelihood of injuries (Kumar et al., 2020).

The lack of use of protective equipment is also a significant contributor to injuries among adolescent athletes. In a survey conducted in South India, approximately 95% of participants expressed the belief that protective equipment such as helmets, pads, or mouthguards was not necessary for their sport (Kumar et al., 2020). This mindset leads to low usage of shin guards in football, helmets in hockey, or ankle braces in other sports, resulting in preventable injuries such as dental injuries, facial injuries, and shin contusions. The same study also found that approximately 8% of students were unaware of the availability of first-aid kits at school, showing a lack of preparedness for safety.

Finally, individual factors such as age, gender, and Body Mass Index (BMI) also influence the risk of injury. In adolescence, older age groups experience comparatively more injuries, as they take part in more competitive and physically demanding sports (Patel et al., 2017). While male athletes generally report more injuries, this difference diminishes when participation levels are equal; some studies have found similar injury rates between male and female athletes (Desai et al., 2018). However, the type of injuries may differ, with female athletes experiencing comparatively more knee ligament injuries and male athletes experiencing more fractures and contusions. In terms of BMI, adolescents with higher BMIs may be at increased risk of injury due to reduced agility and greater impact forces, while exceptionally low BMI and low muscle strength can also contribute to injuries due to inadequate shock absorption (Silva et al., 2022).

Furthermore, some studies have linked socioeconomic and lifestyle factors to injury risk. For example, adolescents from families with lower economic stability have been found to have a higher risk of injury, possibly due to less supervision, nutritional deficiencies, or limited access to safety equipment (Sharma et al., 2019). Excessive screen time and a sedentary lifestyle followed by sudden, intense physical activity also increase the likelihood of injury. Thus, sports injuries in adolescents are dependent on multiple factors, and effective prevention requires coordinated strategies at the individual, training, environmental, and social levels.

In summary, there are many causes of sports-related injuries among adolescent athletes in India. The reviewed studies clearly show that many of these injuries are preventable, as they primarily stem from modifiable factors such as inadequate warm-up, poor playing surfaces, unsuitable facilities, and a lack of proper guidance and supervision. Of note is the finding in some studies that half or more of the injuries occurred not during formal competitions, but during practice sessions or informal sporting activities. This suggests that organized competitions, where referees, rules, and generally better playing surfaces are available, are not the sole cause of injuries; daily practices, scrimmages, and training sessions can also be risky if adequate precautions are not taken. Therefore, finding these risk factors is crucial not only for understanding the nature of injuries but also for developing targeted and effective preventive measures to reduce injury rates among adolescent athletes.

Injury Prevention Strategies and Management Practices

Given the increasing burden of sports-related injuries among adolescent athletes, researchers and sports authorities have recently begun recommending and partially implementing various injury prevention strategies. The literature (2015-2024) clearly shows that a multifaceted approach is necessary for effective injury prevention in youth sports, encompassing physical conditioning, education, rule modifications, and creating a safe playing environment (Patel et al., 2017; Silva et al., 2022). Among the most recommended measures are structured warm-up and training programs; neuromuscular training-based programs, such as the FIFA 11+ protocol in football, have reduced injury rates by approximately 30-50% in various studies (Bizzini and Dvorak, 2015; DiFiore et al., 2018). Indian studies have also emphasized the implementation of mandatory warm-up, stretching, and cool-down protocols; a study from Lucknow suggested that adopting standardized warm-up and strength-and-conditioning exercises (focusing on core stability, balance, and sport-specific muscle groups) can reduce injuries such as sprains and muscle strains (Sharma et al., 2019). Concurrently, coaching education and awareness have been identified as a key pillar of injury prevention, as South Asian studies show that greater knowledge of injury prevention is associated with better practices and lower injury rates (Kumar et al., 2020). In India, the introduction of coach education modules under national initiatives like Khelo India is a positive step, although their reach is not yet universal. Educating athletes to understand their body's signals, report early pain or discomfort, and avoid continuing to play despite serious injury is also crucial (DiFiore et al., 2018). Another crucial strategy is to encourage and mandate the use of safety equipment; although the use of equipment such as helmets, shin guards, pads, and mouthguards is low among Indian adolescents, their regular use can significantly reduce many preventable dental, facial, and lower limb injuries (Kumar et al., 2020). Furthermore, creating a safe playing environment is a long-term but essential measure; level and well-maintained grounds, appropriate turf, gym mats, and clearly marked playing areas can largely prevent accidents, as poor playing surfaces have been identified as a major cause of injuries in Indian studies (Rao et al., 2020). At the organizational level, incorporating injury surveillance systems and sports medicine support is also vital for prevention; several studies, including the Chandigarh study, have emphasized the need for a national or regional surveillance system to identify injury patterns and implement targeted interventions (Rao et al., 2020). While most Indian schools lack physiotherapists or sports medicine specialists, training PE teachers and school nurses in basic injury management could be a practical solution (Silva et al., 2022). At the policy level, recognizing sports injuries as a public health issue is crucial for resource allocation; support for research on adolescent sports injuries by the ICMR and the organization of prevention workshops at national sporting events are positive steps in this direction (Singh et al., 2024). Finally, rehabilitation and return-to-sport protocols are also part of the prevention process, as premature return after inadequate rehabilitation increases the risk of re-injury, particularly in concussions and knee injuries (McCroory et al., 2017). Overall, the literature clearly shows that by combining education, implementation of

safety measures, safe facilities, and medical supervision, the incidence of sports-related injuries in adolescent athletes can be significantly reduced, and both their health and performance can be improved (Patel et al., 2017; DiFiore et al., 2018; Silva et al., 2022).

Public Health Implications

Sports-related injuries in adolescents are not merely individual problems but have significant public health and social consequences that call for serious attention. Approximately half of young athletes experience some form of injury annually, significantly affecting the healthcare system, education, and future health (Patel et al., 2017; Silva et al., 2022). Adolescence is a critical period of physical and cognitive development; injuries during this time can lead to school absenteeism, disruption of studies, and a decline in academic performance. A study in Mangalore found that nearly 45% of injured male students had to miss school due to their injuries, disrupting their education (Rao et al., 2020). Serious injuries, such as head injuries or major trauma, can directly affect attention span and cognitive function, while post-injury psychological issues such as depression, anxiety, and loss of self-confidence can also occur, particularly in adolescents with high athletic aspirations (McCrory et al., 2017). In terms of long-term health impacts, injuries sustained during adolescence can predispose individuals to health problems later in life; if an injury forces a young person to discontinue sports and exercise, it can lead to a sedentary lifestyle, obesity, and an increased risk of other non-communicable diseases (WHO, 2022). Furthermore, knee ligament injuries or growth plate injuries have been linked to premature osteoarthritis and chronic pain later in life, as documented in the sports medicine literature, although long-term follow-up studies are lacking in India (DiFiore et al., 2018). In terms of healthcare and economic burden, the high rate of sports injuries places considerable strain on healthcare services; Fractures or severe injuries often require hospitalization, imaging, surgery, and physiotherapy, the costs of which are frequently borne by families in India (Kumar et al., 2020). For low-income families, conditions such as ACL reconstruction or prolonged rehabilitation can be financially burdensome. From an equity and inclusion perspective, sports injuries can disproportionately affect certain groups; girls' participation in sports is already low in India, and inadequate training or facilities can increase the risk of injury, further worsening gender inequality in sports (Desai et al., 2018). The lack of immediate medical facilities in rural areas can worsen the outcomes of injuries. The need for surveillance and research highlights a significant gap in public health, as identifying high-risk sports and population groups is difficult without robust injury surveillance systems; several Indian studies have emphasized the need for establishing national or regional surveillance systems (Rao et al., 2020; Singh et al., 2024). Overall, sports-related injuries in adolescents are a significant public health problem in India, directly impacting education, healthcare costs, social equity, and the prevention of lifestyle diseases; therefore, investment in injury prevention, effective treatment, and data-driven policies should be an integral part of adolescent health initiatives to ensure a healthy sports experience (Patel et al., 2017; WHO, 2022).

Gaps in Research and Future Directions

Over the past decade, the scope of research on sports-related injuries in adolescent athletes in India has certainly expanded, but several significant research gaps stay, limiting a comprehensive understanding of the problem. Firstly, the lack of national-level data and longitudinal studies is a major limitation, as most available studies are regional or city-specific and cross-sectional in nature, providing only a snapshot in time and failing to capture injury trends over time or differences across various population groups. In this context, multi-centre registries and prospective surveillance studies are needed that follow school or academy-level athletes over one or more sports seasons to find injury incidence and their predictors. Secondly, the underrepresentation of female athletes is a serious concern; many studies have predominantly included male participants, resulting in

limited information on injury patterns, risk factors, and specific needs of Indian adolescent girls, even though international literature suggests that female athletes may be more prone to certain injuries like ACL tears in some sports. Thirdly, the lack of sport-specific research is clear; systematic studies on injury patterns in sports other than cricket and football, such as hockey, gymnastics, martial arts, tennis, and indigenous sports, are almost absent, leading to generalized coaching guidelines and preventive strategies. Fourthly, most research to date has focused on physical and environmental factors, while qualitative or mixed-methods studies on socio-psychological and cultural factors such as risk-taking behaviour, peer pressure, pain-ignoring mentality, and reporting behaviour are rare, even though these factors can profoundly influence injury severity and reporting. Fifthly, there is a lack of robust evidence on the effectiveness of preventive interventions in India; although warm-ups, training modifications, and protective equipment are widely recommended, studies testing and comparing these interventions at the local level are scarce. Sixthly, research on post-injury outcomes is very limited; It remains unclear how many adolescents return to play, how many experience re-injury, or how many permanently abandon sports, yet these questions are crucial for rehabilitation resources and return-to-play protocols at the school level. Furthermore, the potential of technology and innovation has not yet been adequately explored; measures such as digital health, mobile apps, wearable devices, and data-driven risk prediction could open new avenues for cost-effective monitoring and prevention in the Indian context. Addressing these research gaps requires interdisciplinary collaboration among sports scientists, clinicians, educators, and policymakers. Future research focusing on inclusivity, robust data systems, and intervention-based studies will not only ensure the safety of adolescent athletes but also help maximize the physical, mental, and social benefits of sports participation.

Conclusion

During the period of 2015-2024, sports-related injuries among adolescents in India have appeared as a significant health concern, paralleling the increasing participation of young people in competitive sports. This literature review indicates that a substantial proportion of adolescent athletes, often ranging from one-third to half, experience some form of injury, most of which are minor musculoskeletal injuries such as sprains and strains, but severe enough to cause school absenteeism, disruption of studies, and the need for medical attention. The main burden of injuries falls on the lower extremities, and high-intensity sports like football, wrestling, and कबड्डी (kabaddi), as well as widely played sports like cricket, contribute significantly to this injury burden. Risk factors found in the Indian context include individual behaviours such as inadequate warm-up and overtraining, environmental deficiencies such as unsafe playing fields and lack of safety equipment, and systemic issues such as a lack of trained coaching and sports medicine support. This review also suggests that preventive strategies are known and largely possible; significant reductions in injury rates can be achieved through proper physical conditioning, adherence to safety standards, improved facilities, and education of players, coaches, parents, and teachers. The findings suggest that schools and sports programs should prioritize injury prevention in their agendas, health authorities should develop surveillance mechanisms and guidelines, and public awareness campaigns should challenge the notion that sports injuries are an inevitable part of sports, instead promoting a safety-focused culture. Furthermore, this review also finds gaps in current knowledge, particularly the lack of comprehensive data and the limited scope of studies, which need to be addressed through future research and policy initiatives. Overall, sports-related injuries in adolescents are largely preventable and require initiative-taking and coordinated strategies. Through the combined efforts of teachers, coaches, healthcare providers, and policymakers, it is possible not only to protect the athletic and academic development of individual adolescents but also to achieve broader public health goals, such as

creating an active, healthy, and empowered young generation, thereby making youth sports in India safer, more sustainable, and future ready.

References

- Bizzini, M., & Dvorak, J. (2015). FIFA 11+: An effective programme to prevent football injuries in various player groups worldwide—A narrative review. *British Journal of Sports Medicine*, *49*(9), 577–579.
- Desai, P., Mehta, R., & Shah, N. (2018). Sports injuries in school children: A cross-sectional study from Ahmedabad. *Indian Journal of Community Medicine*, *43*(4), 278–282.
- DiFiore, J. P., Benjamin, H. J., Brenner, J. S., Gregory, A., Jayanthi, N., Landry, G. L., & Luke, A. (2018). Overuse injuries and burnout in youth sports: A position statement from the American Medical Society for Sports Medicine. *British Journal of Sports Medicine*, *48*(4), 287–288.
- Emery, C. A., & Pasanen, K. (2019). Current trends in sport injury prevention. *Best Practice & Research Clinical Rheumatology*, *33*(1), 3–15.
- Faudé, O., Rößler, R., & Junge, A. (2013). Football injuries in children and adolescent players: Are there clues for prevention? *Sports Medicine*, *43*(9), 819–837.
- Kumar, A., Rao, S., & Pai, R. (2020). Sports-related injuries among college students in South India: A cross-sectional study. *Journal of Clinical and Diagnostic Research*, *14*(2), RC01–RC05.
- McCrorry, P., Meeuwisse, W., Dvorak, J., Aubry, M., Bailes, J., Broglio, S., ... Vos, P. E. (2017). Consensus statement on concussion in sport the 5th international conference on concussion in sport held in Berlin, October 2016. *British Journal of Sports Medicine*, *51*(11), 838–847.
- Patel, D. R., Yamasaki, A., & Brown, K. (2017). Epidemiology of sports-related musculoskeletal injuries in young athletes. *Translational Paediatrics*, *6*(3), 160–166.
- Petrie, J., Potdevin, F., & Taylor, J. (2022). Incidence of injury in youth sports: A systematic review and meta-analysis. *Sports Medicine*, *52*(4), 871–884.
- Ramesh, K., & Kumar, S. (2019). Prevalence and pattern of sports injuries among school-going adolescents in Puducherry. *International Journal of Community Medicine and Public Health*, *6*(7), 2921–2926.
- Rao, S., Kumar, A., & Pai, R. (2020). Pattern and risk factors of sports injuries among school and college students in Chandigarh. *Journal of Clinical Orthopaedics and Trauma*, *11*(Suppl 1), S155–S160.
- Shetty, G. M., Nayak, V., & Bhat, A. (2023). Prevalence and determinants of sports-related injuries among adolescents in urban Mangalore. *BMC Public Health*, *23*, 418.
- Sharma, S., Singh, R., & Verma, A. (2019). Pattern of sports injuries among adolescent athletes in North India. *Journal of Sports Medicine and Physical Fitness*, *59*(5), 789–795.
- Singh, R., Devi, L. S., & Meitei, S. Y. (2024). Prevalence of overuse musculoskeletal injuries among school-going adolescents in Manipur, India. *Indian Journal of Public Health*, *68*(1), 45–51.
- Thapa, R., & Karki, P. (2016). Injuries among young cricket players in Nepal. *Asian Journal of Sports Medicine*, *7*(3), e34345.
- Verma, A., Sharma, S., & Singh, R. (2021). Injury incidence and patterns among youth football players in North India: A two-season prospective study. *Journal of Sports Sciences*, *39*(18), 2055–2063.
- World Health Organization. (2022). Guidelines on physical activity and sedentary behaviour. World Health Organization.