DOI: https://doi.org/10.30795/jfootankle.2025.v19.1947

Review

Is sports practice a relevant risk factor for hallux valgus? A literature review

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Abstract

Objective: To investigate the relationship between Hallux valgus (HV) and the practice of different sports modalities, considering the etiological and etiopathogenic mechanisms and the functional impacts described in the literature.

Methods: This is an integrative literature review, which followed the systematic steps of search, selection, and analysis of studies. Controlled keywords and Boolean operators were used to search the PubMed database for publications from January 2005 to January 2025. After applying the inclusion and exclusion criteria, eight articles were included in the final sample.

Results: The analysis revealed that sports practice is a relevant risk factor for HV, whose etiopathogenesis may be associated with both repetitive microtraumas—common in sports such as ballet, sports dance, and climbing—and unique traumas—characteristic of modalities such as American football and baseball. In 62.5% of the studies analyzed, there was a relationship with chronic overload in the metatarsophalangeal joint, while 37.5% related HV to acute trauma.

Conclusion: Although multiple factors influence the development of HV, sports practice, when associated with joint overload or direct trauma, is a significant contributor to the pathogenesis of the deformity.

Level of Evidence V; Review.

Keywords: Hallux valgus; Sport; Trauma.

Introduction

Hallux valgus (HV) has a multifactorial origin, resulting, in particular, from the interaction between anatomical predispositions and external mechanical factors[1]. Several conditions are well established in the pathogenesis of HV, including inappropriate footwear, genetic factors, preexisting morphological foot characteristics (e.g., flatfoot), and neuromuscular and rheumatologic disorders[2]. However, the deformity can also be acquired by individuals who engage in intense, repetitive sports practices. In this context, research on the relationship between HV and sport is relevant, particularly given the functional impact of deformity on athletes across different performance levels[3].

In recent years, an increasing number of studies have approached HV from a sports perspective. The development of HV in sports practice may be associated with excessive, chronic use of the metatarsophalangeal joint (MTF), particularly in modalities involving repetitive movements and high forefoot overload. Activities such as dancing, ballet, and climbing often expose this joint to constant microtrauma, thereby favoring, over time, the development and progression of the deformity[4,5].

On the other hand, contact sports practiced on grass, such as football, soccer, and baseball, can also contribute to HV, in this case through direct and acute trauma[6]. Although there are well-established guidelines for the diagnosis and

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How to cite this article: Andrade JPG, Araújo LS, Baumfeld TS, Souza Júnior EA. Is sports practice a relevant risk factor for hallux valgus? A literature review. J Foot Ankle. 2025;19(3):e1947.

treatment of HV in the general population, its management in athletes requires special attention, as symptoms can compromise sports performance and, in more severe cases, interrupt the athlete's career[7].

Understanding the biomechanical and environmental mechanisms underlying the HV in sport is an important step toward improving the prevention and treatment of this condition. It is well known that individual anatomical factors are important for understanding HV, such as foot morphology, joint mobility, and an increased angle of previous valgus[8]. These factors, when combined with the specific requirements of the sport practiced, can significantly shape the way the deformity manifests and evolves[9].

Given the growing relevance of HV in the sports context and the need to systematize the available evidence, this study aimed to conduct an integrative literature review. The objective is to investigate the association between sports practice and the development of HV, to identify the etiological mechanisms involved, the sports modalities most frequently associated with the deformity, and the functional impacts observed in athletes.

Methods

This is an integrative literature review that aims to gather current knowledge on sports practice and HV through the identification, analysis, and synthesis of the results of independent studies[10,11], following the recommended steps for the elaboration of an integrative review, according to the guidelines of the Integrative Systematic Bibliographic Review Manual[12]. Initially, the topic was defined. Subsequently, the keywords were established, and the inclusion and exclusion criteria were determined. Then, the data were extracted by two researchers who independently selected the articles according to the established criteria. To ensure greater accuracy and reduce potential interpretive distortions, the results were compared with one another.

The guiding question of the literature search was: "What is the relationship between hallux valgus and the practice of different sports modalities?". Based on the multilingual thesaurus DeCS/MeSH, the keywords hálux valgo (Hallux valgus), Joanete (Bunion, Juanete), Esportes (Sports, Deportes), and Atletas (Athletes, Atletas). The Boolean operators applied in the search were "AND" and "OR".

The inclusion criteria were publications that addressed the HV acquired through sports practice, published between January 2005 and January 2025, and indexed in PubMed in Portuguese, English, and Spanish.

The exclusion criteria were publications that did not address HV; publications that did not include athletes from any sport as the study population; and publications that did not specify the sport practiced.

The search was conducted in the first half of 2025 and yielded 254 results. Then, the inclusion and exclusion criteria were applied in this sample. The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) protocol was used to systematize the search[13].

Figure 1 shows the flowchart illustrating the selection of articles according to the PRISMA protocol.

Results and discussion

Eight articles were selected for full analysis. Regarding study design, there were two cohort studies, two experimental studies, two case reports, one descriptive cross-sectional study, and one observational cross-sectional study. The information on the included articles was systematized in Table 1, which presents the main classification and relevant data for each study analyzed in this review. The data extracted from the studies included the authors, year of publication, article title, study design, sample, study objective, and main results.

Cobos-Moreno et al.[4] report that the most common injuries among climbers are claw fingers, bursitis, hallux limitus, and HV, the latter being prevalent in 40% of their sample. The HV can be aggravated by tight shoes and high forefoot pressure, which are common in sports climbing, where these factors overload the first MTF joint. The study also indicates that 45% of climbers reported pain in the first toe, potentially related to HV, which denotes significant impairment of this segment in this sport. In addition to pain and functional limitations, HV can elicit time-dependent biomechanical compensations that compromise sports performance and increase the risk of other foot and ankle injuries, supporting a significant association between years of climbing and chronic foot injuries ($p = 0.035$).

Liu et al.[5] examined the impact of plantar pressure on the progression of the deformity and found a significant 2.1° ± 3.5° increase in the HV angle after one year of sports dance practice. The results indicate that the repetitive load imposed by technical dance movements, such as jumps and spins, favors structural adaptations that lead to misalignment of the

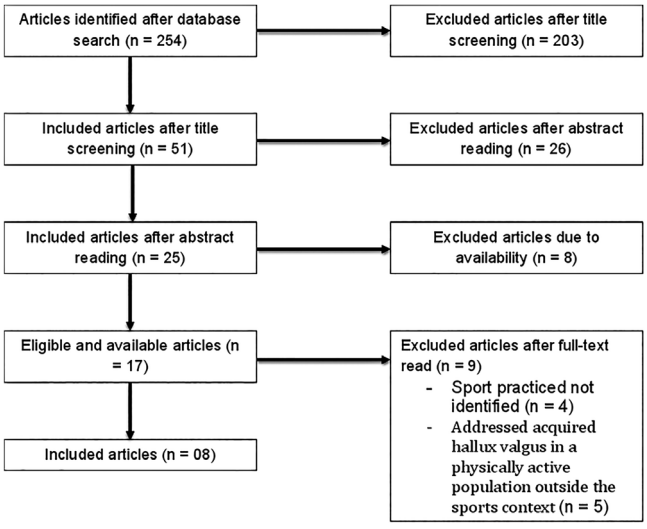

Figure 1. Flowchart illustrating the selection of articles according to PRISMA.

Table 1. Relevant data from each study

Author/year	Title	Study design	Sample	Study objective	Main results
Cobos-Moreno et al.[4]	Epidemiological Study of Foot Injuries in the Practice of Sport Climbing	Descriptive Cross-sectional Study	53 climbers	Identify and characterize the most frequent foot injuries among climbers and examine their relationship with practice time	HV was found in 21 athletes (40%). Years of climbing practice are significantly associated with foot injury (p = 0.035)
Covell, et al.[7]	Operative Treatment of Traumatic Hallux Valgus in Elite Athletes	Cohort study	1 baseball player and 18 football players (12 NFL, 6 college, and 1 high school)	Evaluate the surgical treatment of traumatic HV, using the modified McBride technique added to other procedures, and analyze the return to sport of these athletes	Of the 19 patients, 14 (74%) returned to the sport, whereas 5 did not return to the same level or retired. However, 5 of the 14 that returned retired in subsequent seasons
Fernandez et al.[18]	Post traumatic medial instability of the MTP1 joint and ensuing surgical reconstruction: A case report	Case report	1 runner who was injured while playing football	Case report of a runner who, after suffering a sprain in the first MTF joint playing soccer, developed subclinical medial laxity HV, undergoing surgical treatment later	Surgical correction of the bone cyst and the microinstability of the first ray, an early stage of VH, enabled the patient's recovery and return to high-performance sports after 1 year
Gorica et al.[17]	Surgical Repair of Posttraumatic Hallux Valgus Deformity in a Collegiate Football Player: A Case Report	Case report	1 college football player	Report a rare case of post-traumatic HV and evaluate the results of the modified McBride procedure, with repair of the medial ligament complex assisted by a suture anchor	The treatment was effective, correcting the deformity, restoring pain-free movement, and enabling a return to sport within 5 months. The athlete scored 95% on the FAOS at 10 months
Ishihara et al.[16]	The vertical mobility of the first tarsometatarsal joint during demi-plié with forced turnout in ballet dancers	Experimental study	Ballerinas	Determine how the forced turnout movement of the ballet affects the mobility of the first tarsometatarsal joint, one of the pathogenic factors of HV	The greater the plantar displacement of the medial cuneiform and the mobility of the TMT joint in the forced turnout movement, the greater the risk of developing HV
Liu et al.[14]	The Effect of Foot Deformity and First Metatarsophalangeal Joint Plantar Pain on Performance in DanceSport Athletes	Cross-sectional observational study	63 adolescent sports dance athletes	To evaluate the effect of HV and pain in the first MTF joint on load distribution and plantar pressure percentage among adolescent sports dance athletes	Increased HV angle and pain are associated with lower hallux load and higher metatarsal head pressure, affecting hallux function and performance in sports dance
Liu et al.[15]	Effects of 4 weeks of foot exercise on subjective outcome and foot plantar pressure in elite adolescent dancers with hallux valgus: a pilot study	Experimental study	13 elite adolescent dancers	Determine the effects of 4 weeks of foot exercises on 3 perspectives: HV angle, subjective clinical outcomes, and plantar pressure change during specific dance techniques	The HV angle was reduced from 20.1° to 15.4°. There was improvement in pain in the MTF joint and toe function. Plantar pressure increased in the hallux and reduced in the MTP joints from the 2nd to the 5th
Liu et al.[5]	Progression and risk factors of hallux valgus angle in elite adolescent dancers: a cohort study	Cohort study	40 elite teen dancers	Determine the progression of the HV angle over 1 year and evaluate the risk factors associated with the distribution of plantar pressure of the foot during the half-point movement practiced in dance	There was higher pressure in the midfoot and lower pressure in the hallux, resulting in a 2.1° ± 3.5° increase in VH angle over 1 year

first radius. In addition, statistical analysis revealed significant correlations between changes in the HV angle and plantar pressure distribution at the hallux ($r = -0.480$, $p = 0.002$), toes ($r = -0.313$, $p = 0.049$), MTP joint ($r = 0.446$, $p = 0.004$), medial foot region ($r = -0.331$, $p = 0.037$), and midfoot region ($r = 0.386$, $p = 0.014$). Thus, the increase in plantar pressure under the hallux and the decrease in plantar pressure over the central area of the foot are directly associated with an increase in the HV angle, reinforcing the biomechanical influence on the evolution of deformity.

These findings corroborated with Liu et al.[14], who analyzed adolescent sports dance athletes and identified that those with HV and pain in the first MTF joint presented a redistribution of plantar load, with a reduction in pressure in the hallux ($p < 0.001$, $R = -0.601$) and an increase in the load on the head of the metatarsals ($p < 0.001$, $R = 0.603$). In addition, the increase in HV is associated with a reduction of pressure impulse in the hallux ($p = 0.013$, $R = -0.356$). Consequently, these biomechanical changes can affect athletic performance, as load redistribution compromises

hallux function and reduces propulsion efficiency during sport-specific movements.

In this regard, Liu et al.[15] suggested that improved plantar pressure control, enabled by a specific exercise program, may play an essential role in the treatment of HV in elite dancers. The exercise program tested included abduction of the first MTF joint through manual stretching, toe opening, plantar shortening, and "rock-paper-scissors" exercises for the feet. After four weeks, there was a reduction in pressure on the hallux and from the second to the fifth MTF joints, which contributed to the mean reduction of the HV angle from 20.1° to 15.4°, as well as a reduction in pain in the first MTF joint and an improvement in the function of the hallux.

Ishihara et al.[16] warned of the effects of the forced "turnout" movement in ballet, which generates a plantar displacement of the medial cuneiform and increases the mobility of the tarsometatarsal joint (TMT), favoring the progressive misalignment of the first ray. These factors, combined with excessive pronation and collapse of the medial longitudinal arch, intensify overload on the MTF joint, thereby promoting HV progression. Multiple regression analysis revealed that the extent of the forcing angle in the turnout was significantly associated with the vertical displacement of the medial cuneiform ($\beta = 0.779$, $p = 0.008$, $R^2 = 0.557$) and changes in the gap between the first metatarsal and the medial cuneiform ($\beta = 0.775$, $p = 0.008$, $R^2 = 0.551$), suggesting that biomechanical compensation in certain movements is a determining factor for the development of deformity.

Another three studies (37.5%) addressed HV from an acute traumatic perspective, a phenomenon observed among practitioners of American football, baseball, soccer, and running. Hallux valgus from a single trauma usually occurs due to direct impacts, excessive twists, or hyperextension in the MTF joint, resulting in ligament injuries, joint instability, and misalignment of the first metatarsal. Practitioners of these sports frequently perform explosive movements, lateral cuts, and rapid changes of direction; therefore, they are particularly susceptible to injuries to the MTF joint of the hallux, which can significantly compromise sports performance and career longevity.

Covell et al. [7] analyzed the HV in 19 athletes—one baseball player and 18 football players, of whom four were active in the National Football League (NFL). The sample was submitted to the modified McBride surgical procedure, associated with other complementary interventions: three medial sesamoidectomies, one medial sesamoid bone graft, eight transfers of the abductor hallucis tendon for reconstruction of the flexor hallucis brevis or additional repair of the plantar plate, six cheilectomies, one chondroplasty of the metatarsal head, and one removal of free bodies. As a result, 14 athletes returned to their pre-injury activity level, with a mean time to return of 3.4 months. However, 26% of athletes did not return to their previous competitive level, and among the 14 who did, five retired after a few seasons. These data highlight the complexity of the injury and the athlete's surgical recovery, showing that although most returned to the sport, a significant portion did not maintain the same level of competitive performance in the long term.

Gorica et al.[17] reported the case of an American football player with traumatic HV. The patient also underwent the modified McBride technique, using a suture anchor to repair the medial ligament complex. After five months, the athlete demonstrated restoration of pain-free movement and returned to sports practice, underscoring the procedure's effectiveness in restoring joint function and resuming high-impact activities. After ten months, the player achieved a score of 95% on the Foot and Ankle Outcome Score (FAOS)—a widely used measure of foot and ankle function after injury—which indicated an excellent postoperative functional outcome.

Fernandez et al.[18] reported the case of a runner who was injured playing soccer, developing post-traumatic HV and a bone cyst of the first metatarsal. After failure of conservative treatment, the patient underwent curettage and filling of the bone cyst, followed by proximal reinsertion of the medial collateral ligament. The surgery, performed for microinstability of the first ray and a bone cyst that developed after the sprain, enabled the runner to return to the sport after one year. The study also highlighted the importance of assessing the stability of the first MTF joint early after trauma to prevent future complications.

Considerations

Sports practice is a risk factor for HV, whether through acute trauma, such as sprains and direct impacts, or through repetitive microtrauma associated with chronic overload. Different sports modalities exhibit distinct etiopathogenic mechanisms: ballet, climbing, and sports dancing are characterized by a high incidence of HV related to joint overload, whereas contact sports, such as football, baseball, soccer, and running, are more commonly associated with acute traumatic injuries.

Authors' contributions: Each author contributed individually and significantly to the development of this article: JPGA *(https://orcid.org/0000-0003-4995-3163) Conceived and planned the activities that led to the study; LSA *(https://orcid.org/0009-0001-4124-6053) Wrote the article; and TSB *(https://orcid.org/0000-0001-9244-5194) and EASJ *(https://orcid.org/0000-0002-5054-874X) Participated in the review process. All authors read and approved the final manuscript. *ORCID (Open Researcher and Contributor ID).

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