# He Influence of Flat Feet on Athletic Performance: Insights from Elite Basketball Players

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**Abstract.** Flat feet, a state in which the normal foot arch is reduced or collapsed. Flat feet are mainly caused by foot pain due to the collapse or loss of elasticity of the longitudinal arch of the foot caused by some reasons such as abnormal foot bone morphology, muscle atrophy, ligament contracture or chronic strain. It is mostly seen in people who are overweight or standing for a long period of time, and is caused by the ligaments and muscle legs that maintain the arch of the foot being overworked and loosened. Flat feet often lead to swelling and pain in the foot, which is especially serious after standing or walking, and at the same time, those with flat feet will lead to athletes being more prone to injuries. At present, flat feet are mainly treated by orthopedic shoes, medical sports, manipulation and fixation, and surgery.

## 1.Introduction

In the United States, it is estimated that up to sixty million people have flat feet, translating to approximately a quarter of the country's total population (Zanis & Zanis, 2016)0. This prevalent deformity, also known as pes planus, typically manifests in the form of a collapsed arch on the inner side of the foot, leading to abduction (Pita-Fernandez, 2017)0. As such, the soles of the feet of individuals with this condition are constantly in contact with the ground regardless of whether they are walking or static, as opposed to normal people whose soles have a noticeable medial gap . In recent years, this phenomenon has received increasing attention owing to potential impacts on athletes' abilities and performances (Ho et al., 2019)0. This attention is particularly pronounced in the domain of elite basketball, where players have to be at the peak of their physicality, agility, and precision. These players not only exemplify the demands involved in training and playing basketball but also provide a fitting and sufficient sample size for deriving comprehensive insights into the impacts of flat feet on their performance. Additionally, the significance of this investigation is further emphasized by these elite players' athleticism and the evolving landscape of basketball footwear innovations. Ultimately, this research sought to explore the impact of flat feet on the athletic performance of elite basketball players, uncovering the benefits, shortcomings, areas of concern, and potential strategies for enhancing performance and well-being.

## 2.Understanding Flat Feet

In order to effectively explore the topic of flat feet in the context of elite basketball performance, it is crucial to first establish a foundation understanding of foot arch structure. As Frizziero et al. (2019) explain0, in the case of normal foot anatomy, there exists an arch on the foot's inner side, which aids in movement by absorbing shock and distributing weight and energy (As shown in Fig 1). Consequently, it can be inferred that this arch serves the function of a natural spring, thus facilitating more effective propulsion and stability . On the other hand, however, in instances where foot anatomy is affected by the flat feet disorder, this arch is either disrupted or completely absent (As shown in Fig 1). According to Ezema et al. (2014)0, the lack of an arch is typically the culmination of several physical features, including the inward rotation of the subtalar complex when it is carrying weight, the descending movement of the talus, the downward tilt of the calcaneus, the abduction of the navicular bone, the supernation of the forefoot and an inward slope of the heel.

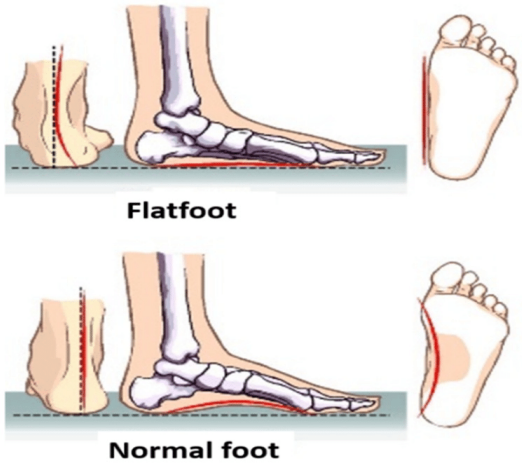


**Fig 1:** The differences between a flat foot and a normally-arched foot (Frizziero et al., 2019).

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Further, it is important to distinguish that flat feet can significantly vary in severity. Many individuals experience a form of it that only appears when their lower limbs are bearing weight, known as a flexible flat foot . Conversely, other individuals experience permanent flat foot, known as rigid flat foot, which is often clinically considered a foot disorder that may require treatment . While the causes of flat feet are numerous, ranging from both hereditary and acquired factors, the severe forms can stem from trauma, structural and musculoskeletal abnormalities, and neuromuscular complications . Studies have reported that this condition is less prevalent as age increases, with females being slightly more susceptible than males (Stolzman et al., 2015)0.

There has been a wealth of studies that have explored the impacts of flat feet on physical and athletic performance. A study by Şahin et al. (2022)0 found that having flat feet was associated with reduced foot stability. This builds on an earlier finding by Otman et al. (1988) 0that individuals with flat feet need to expend more physical energy since it causes instability. Indeed, this condition often leads to reduced arch support, which undermines the normal alignment of the foot and sensory information coming from it with the rest of the body, leading to poor stability, balance, and posture. Consequently, it is not surprising that individuals with flat feet have been found to have poorer posture control, balance on their dominant foot, and general physical fitness. Additionally, Kaufman et al. (1999)0 assert that flat feet are an increased risk factor for developing injuries in the lower extremities since they cause overpronation, where the foot significantly slides inwards during physical activity. Some of these injuries could include ankle sprains and stress fractures . Further, flat feet are associated with an increased risk of chronic pain in the lower extremities, including ankle pain, knee pain, and hip pain .

There has also been some empirical research specifically exploring the relationship between flat feet and elite basketball players. A study by Kakade (2020)0 found that basketball players with flat feet were up to two times more susceptible to inferior heel pain than those with normally-arched feet. Additionally, it is worth noting that while it has long been believed that being flat-footed undermines jumping, Ho et al.study involving male basketball players found that jump performance is relatively similar regardless of the foot structure. That said, the study also found that flat feet influence take-off biomechanics when jumping since they are associated with reduced engagement of the hip joint . That said, hip power is not as important when jumping, thus explaining why flat-footed basketball players have similar levels of jump performance despite reduced engagement of the hip joint . On the other hand, a study conducted among 45 active National Basketball Association (NBA) players found that those with alignment issues, such as those associated with flat feet, had a greater risk of developing foot and ankle injuries (de Cesar Netto et al., 2019)0.

Ultimately, the existing literature suggests that elite basketball players may experience higher incidences of injuries and reduced physical performance, both of which could undermine their playing time and overall effectiveness on the court. That said, while this information is insightful, there remain significant gaps in the existing literature. Indeed, the number of flat feet studies specifically focused on elite basketball players is relatively few, making it difficult to draw definitive conclusions about the relationship between flat feet and basketball performance. Additionally, many of the studies have a narrow definition of elite basketball players, focusing solely on male basketball players. These gaps highlight the need for a more comprehensive exploration of how flat feet impact basketball performance.

## 3. Effects of flat feet on basketball players

In this study, a case study approach was chosen to investigate the influence of flat feet on the athletic performance of elite basketball players. As Priya (2020)0 explains, case studies are a fitting research design where one is looking to gain in-depth and contextual insights based on occurrences in the real world. Similarly, the case study design was chosen to enable the research to derive insights based on the real-world experiences of elite basketball players. To this end, the elite basketball players to be included in the case study were selected based on defined criteria, including being a present or past participant in the NBA, having recognition for athletic abilities, and having a confirmed diagnosis of flat feet. While there exist technologies that can be used for imaging foot anatomy, the lack of direct access to NBA players meant that the assessment of foot arch structure was based on publicly available relevant data on each player. Additionally, the research design incorporated a variety of basketball-related performance metrics, including vertical jumping, shooting accuracy, and injury incidence tracking.

### 3.1.The Case of the Elite Basketball Player

As intimated above, the case study design allowed the research to delve into the real-world experiences of elite basketball players with flat feet. The elite basketball players selected for the case study, based on the inclusion criteria in the methodology, were Kobe Bryant, Tracy McGrady, and Kevin Durant, all of whom have flat feet throughout their exemplary careers.

Kobe Bryant had a 20-year career in the NBA as a shooting guard (Olympics, 2023)0. During an interview conducted in 2009, Kobe confirmed that he differed from many of his teammates as he had flat feet (Elliott, 2014)0. That said, the condition did not stop him from becoming one of the most prolific scorers in the league's history, ranking third in all-time scoring leaders . He also had numerous individual and team achievements, including being a five-time NBA champion and two-time Olympic champion . It was also reported that he had a vertical leap of 38 inches (Fernandes, 2017)0. Further, while Kobe had a relatively low injury record, it is worth noting that he occasionally had ankle and knee issues (Chaudhary, 2021)0.

Tracy McGrady had a 15-year NBA career in which he primarily played as a shooting guard or a small forward (Reisinger, 2020)0. He confirmed in an interview conducted in 2006 that he had flat feet (Feigen, 2006)0. He enjoyed an eventful career in which he led scoring in multiple seasons and was a seven-time all-star. Additionally, he had one of the highest-recorded vertical leaps at 42 inches. That said, it is worth noting that McGrady's performances on the court were regularly undermined by recurrent ankle and back injuries, forcing him to retire early (Koteska, 2023)0.

Kevin Durant is a current NBA player who plays as a forward and is known for his versatility. Durant has previously shared that he has flat feet, which is also widely believed to be the main reason his shoes fall off so often while he is playing (Herring, 2018)0. Despite having the condition, he has gone on to win two NBA titles and multiple scoring titles. Additionally, he has a reported vertical leap of 34 inches (ABC News, 2007)0. That said, his injury record is concerning as he has suffered several ankle-related injuries, including sprains and an Achilles rapture, that have kept him off the court for extended periods of time (Irving, 2023)0.

### 3.2.Impact of Flat Feet on Basketball Performance

This exploration of the impact of flat feet on basketball performance was informed by the fact that anatomical variations can lead to both advantages and disadvantages. Indeed, the remarkable shooting volume and accuracy of all three players included in the case study imply that flat feet do not undermine shooting. Additionally, the fact that flat feet make more contact with the ground might be advantageous when these players propel their bodies upwards to shoot. On the other hand, when it comes to agility and injury risk, while all three players were described as powerful athletes, the recurrent ankle and knee injuries they experienced highlight that flat feet increase vulnerability to certain types of injuries. The case of Kevin Durant is particularly compelling as Achilles ruptures are a common complication of flat feet Herchenröder et al., 2021)0. Ultimately, these case studies highlight how flat feet can shape various aspects of basketball performance, emphasizing that while significant injury risks exist, tailored strategies can be used to enhance other aspects of performance.

## 4.Coping Strategies and Interventions

Elite basketball players have access to various coping strategies and interventions for effectively managing their conditions to ensure strong performances on the court. Arguably, the most pronounced approach has involved their footwear choices . Indeed, footwear, which is specially designed to provide arch cushioning and support can help overcome the biomechanical shortcomings that come with having flat feet . More recently, orthotic devices that are tailored to the structural and functional needs of individuals' feet have also emerged as effective options. Players also have access to specialized conditioning and training programs that focus on joint stability and strengthening muscles to mitigate the biomechanical issues stemming from flat feet, improving balance and stability (Brijwasi & Borkar, 2023)0. The effectiveness of such strategies in maintaining high athletic performance among basketball players is emphasized by the success of players such as Kobe Bryant, Tracy McGrady, and Kevin Durant.

## 5.Basketball-Specific Movements

The few studies exploring the movements of players with flat feet have offered crucial insights into how this condition shapes athletic performance. For example, given that players with flat feet typically engage lower levels of hip power when jumping, they do not push off the ground as effectively. As such, they are often forced to deploy compensatory movement strategies to make their jumping performance more effective. For example, they might prefer running vertical jumps to standing vertical jumps. The shooting accuracy of players such as Kobe Bryant and Tracy McGrady was further enhanced by the fact that they had excellent shooting form in addition to their jumping performance. Additionally, given that players with flat feet often develop enhanced ankle strength to compensate for their reduced spring capabilities, they can still possess similar movement capabilities to their normal-arched peers. This could explain why the players included in the case study were effective dribblers despite dribbling being associated with rapid changes in movement and pace. That said, the absence of the spring mechanism coupled with the reduced balance associated with flat feet explains why these players' agility often came at the cost of ankle-related pain and injuries.

## 6.Practical Implications for Coaches and Players

Understanding the impacts of flat feet on athletic performers is of key significance to both coaches and players. Indeed, the findings of the case study above show that while fat feet can have detrimental impacts, players can still maintain high-performance levels by adopting effective coping strategies. To this end, coaches and players should consider tailoring training and conditioning to each player's unique ankle structure to enhance balance and stability while reducing the risk of injury. Similarly, players should embrace footwear choices that provide them with adequate arch support. Ultimately, these findings show that for coaches and players to fully unlock the potential of those with flat feet, they must take a proactive approach towards reducing the risks associated with the condition.

## 7.Conclusion

This research sought to contextualize the impacts of flat feet on the athletic performance of elite basketball players. Indeed, flat feet are associated with several challenges

that increase players' vulnerability to injuries and compromise their agility. That said, it is apparent that these challenges can be mitigated through tailored coping strategies and interventions. The most effective of these interventions include footwear choices, orthotic devices, and specialized training and conditioning. Ultimately, despite the practical benefits offered by the insights generated through this research, it was undermined by several limitations. The case study design chosen only allowed for the inclusion of a few elite players, making it harder to generalize. Additionally, the case study did not include any female elite players owing to the lack of publicly available data. As such, future research should look to involve larger sample sizes and a more direct study design.

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