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# Advancing Women's Soccer: Historical Growth and Challenges Concerning Athlete Health and Diversity

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**Abstract:** This exploratory review article synthesizes existing literature on the evolution and increasing significance of women's soccer, particularly in the United States. While acknowledging the sport's progress and the achievements of the U.S. Women's National Team (USWNT), it critically examines two key challenges that impede further advancement: the alarmingly high incidence of knee injuries among female players and the persistent underrepresentation of Black women. The review highlights the biomechanical factors contributing to these issues, emphasizing the need for footwear designed to accommodate the specific anatomical and functional requirements of female athletes. Furthermore, it explores the systemic barriers that contribute to the lack of diversity within the sport, advocating for equitable opportunities and support for Black women. This review concludes by underscoring the necessity for innovative, interdisciplinary approaches to ensure the continued growth and well-being of all participants in women's soccer, and identifies critical areas for future research in kinesiology and related fields.

**Keywords:** Women's Soccer, Knee Injuries, Diversity, Black Women, Athletic Performance, Biomechanics, Sports Equipment

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## 1. Introduction

Women's soccer has experienced exponential growth in participation and professionalization, yet significant challenges remain that threaten the long-term health and equitable development of the sport (Pennington & Castor, 2022) [1]. This review article addresses two critical issues: the high prevalence of knee injuries, particularly anterior cruciate ligament (ACL) tears, among female soccer players, and the persistent lack of diversity, specifically the underrepresentation of Black women at all levels of competition. These challenges are not mutually exclusive; rather, they are interconnected and require a holistic, interdisciplinary approach to address.

### *1.1. Historical Context and Growth of Women's Soccer*

The global history of soccer, with its origins tracing back to ancient variations like "Tsu Chu" in China (5000-300 B.C.) and "Calcio Fiorentino" in Renaissance Italy (Wood, 2008) [2], reveals a gradual evolution towards the standardized game codified in 1863. While women's participation initially lagged behind men's, the formation of FIFA in 1904 marked a pivotal step towards global organization (Wood, 2008) [2]. The National Collegiate Athletic Association's (NCAA) sponsorship of women's sports in 1982 further propelled the development of women's soccer in the United States (Lewis, 2023) [3]. The establishment of the Women's World Cup in 1991 and subsequent successes of the USWNT, particularly their victory in the 1999 World Cup (FIFA, n.d.; Timm-Garcia, 2019) [4,5], catalyzed the growth of professional leagues and increased public interest in the

sport (Wikimedia Foundation, 2023) [6]. Today, women's soccer boasts a global player base of 29 million, with 4.2 million in the United States (FIFA, n.d.) [4].

### *The Problem of Knee Injuries in Women's Soccer*

Despite this progress, the alarmingly high rate of knee injuries, particularly ACL tears, poses a significant threat to the well-being and longevity of female soccer players' careers (Brockway, 2023; Lewis, 2024) [7,8]. While contact injuries are unavoidable in a physically demanding sport, a substantial proportion of these injuries are non-contact, often occurring during pivoting, cutting, and deceleration (Thomson et al., 2022) [9]. These injuries are often attributed to biomechanical differences between men and women, including variations in lower extremity alignment, muscle strength, and ligament laxity (ACSM, 2023) [10]. However, the role of ill-fitting and inadequately designed footwear cannot be overlooked.

### *The Issue of Diversity and Representation*

The underrepresentation of Black women in soccer, particularly at the professional and national team levels, represents another critical challenge. While the USWNT's success has inspired generations of female athletes, the team's historical lack of diversity is a persistent concern (Baxter, 2023) [11]. Systemic barriers, including limited access to resources, biased talent evaluation, and a lack of culturally relevant support systems, contribute to this disparity (Gonzalez, 2023; Nargiso et al., 2020) [12,13].

### *Purpose and Scope of this Review*

This exploratory review article aims to synthesize existing research on the interconnected challenges of knee injuries and lack of diversity in women's soccer. It will examine the biomechanical factors contributing to knee injuries in female soccer players; analyze the limitations of current footwear designs in addressing the needs of female athletes; explore the systemic barriers hindering the participation and success of Black women in soccer; advocate for interdisciplinary research and innovative solutions to address these challenges; and identify critical areas for future research in kinesiology, biomechanics, sports medicine, and social sciences to promote the health, performance, and equitable participation of all female soccer players.

## 2. Methods

This review encompassed a comprehensive search of relevant literature across various databases and reputable news and current events sources. Particularly meaningful to the literature search were publications directly concerning "women's soccer," "biomechanics," "footwear," and "Black women". Reviewed articles were critically appraised for methodological rigor, sample size, and relevance to the research questions. Key findings were synthesized and organized thematically, focusing on biomechanical factors, footwear design, and issues of diversity and representation.

## 3. Results

### *3.1. Biomechanical Factors and Knee Injuries*

Existing research consistently demonstrates that female soccer players exhibit biomechanical differences compared to their male counterparts, including altered lower extremity kinematics, increased knee valgus angles, and reduced hamstring strength (Thomson et al., 2022; ACSM, 2023) [9,10]. These factors contribute to a higher risk of ACL injuries, particularly during cutting, pivoting, and landing maneuvers (Warren & Pennington, 2025) [14]. Furthermore, studies have shown that inadequate footwear, particularly cleats that do not accommodate the specific anatomical and functional needs of the female foot, can exacerbate these biomechanical risks (Lewis, 2024) [8].

Female soccer players exhibit a higher incidence of knee injuries, particularly non-contact anterior cruciate ligament (ACL) injuries, compared to their male counterparts (Grassi et al., 2023; Weingart et al., 2022) [15,16]. Several biomechanical factors are believed to contribute to this disparity. One prominent factor is knee valgus, an inward collapse of the knee, which is often more pronounced in female athletes during dynamic tasks like landing, cutting, and pivoting (Fortune Journals, n.d.) [17]. This increased valgus angle places greater stress on the ACL (Fortune Journals, n.d.) [17]. Studies have shown that females often land jumps with greater knee valgus compared to males (PMC, n.d.) [18]. Differences in hip and knee kinematics also play a role. Females tend to exhibit greater hip internal rotation and adduction, which can contribute to increased knee valgus and ACL loading (Fortune Journals, n.d.) [17]. Furthermore, landing mechanics differ, with females often landing with less knee flexion and greater quadriceps activation, increasing anterior shear forces on the tibia and thus ACL strain (Fortune Journals, n.d.; PMC, n.d.) [18]. Reduced knee flexion upon landing may limit the knee's ability to absorb forces dynamically (PMC, n.d.) [18]. Altered muscle activation patterns, including a potentially less dominant hamstring activation relative to the quadriceps (imbalanced hamstring-quadriceps ratio), may also contribute to increased ACL risk in females (Weingart et al., 2022) [16].

### *3.2. Footwear Design and Performance*

A significant portion of the literature highlights the limitations of current soccer cleats, which are often designed primarily for male athletes and simply scaled down in size for women (Wrack, 2023) [19]. This approach fails to address the distinct anatomical features of the female foot, such as a narrower heel, wider forefoot, and higher arch (Footalk, 2019) [20]. Studies have shown that ill-fitting cleats can lead to discomfort, pain, blisters, and increased risk of injury, as well as negatively impacting performance by hindering agility and stability (Lewis, 2024) [8].

While advancements in footwear technology aim to enhance performance and reduce injury risk, limitations exist, particularly concerning female soccer players. Much of the research and design in sports footwear has historically been based on male biomechanics, potentially leading to suboptimal performance and increased injury susceptibility in females (Stefanyshyn et al., 2000) [21].

One key limitation lies in sizing and fit. Female feet generally differ from male feet in shape, often being narrower in the heel and wider in the forefoot (Luximon & Goonetilleke, 2001) [22]. Footwear designed primarily on male lasts may not adequately accommodate these differences, potentially leading to discomfort, blisters, and altered biomechanics (Stefanyshyn et al., 2000) [21]. Ill-fitting boots can negatively impact agility, stability, and potentially contribute to lower extremity injuries. Another potential limitation relates to stud design and traction. While traction is crucial for performance, excessive or improperly placed studs can increase rotational forces at the knee, a known risk factor for ACL injuries (Andriacchi et al., 2009) [23]. Research specifically examining the interaction between stud design and ground reaction forces in female soccer players during cutting and pivoting maneuvers is less prevalent compared to male studies, suggesting a gap in understanding optimal outsole configurations for this population. Furthermore, the material properties and flexibility of the footwear upper and sole might not be optimally tuned for the specific biomechanical demands of female soccer players. Differences in gait patterns and muscle activation between sexes could mean that the stiffness and responsiveness of current boot designs may not cater effectively to female athletes (Dufek & Bates, 1991) [24].

### *3.3. Diversity and Representation*

Research consistently reveals a lack of diversity in women's soccer, particularly at the professional and leadership levels (Gonzalez, 2023) [12]. Systemic barriers, including

socioeconomic disparities, limited access to quality training facilities, and biased talent identification, contribute to the underrepresentation of Black women (Nargiso et al., 2020) [13]. The absence of role models and culturally relevant support systems can further discourage participation and limit opportunities for advancement (Baxter, 2023) [11].

Research indicates a disparity in participation rates, with Black women often being less represented in elite youth leagues, collegiate programs, and professional teams compared to their White counterparts (e.g., Harrison & Hardin, 2018; Lapchick et al., 2023) [25,26]. This lack of representation can stem from various interconnected factors. Socioeconomic barriers can play a significant role. Access to quality coaching, training facilities, and travel teams, often prerequisites for elite development in soccer, can be financially prohibitive, disproportionately affecting marginalized communities (Harrison & Hardin, 2018) [25]. This limits opportunities for talented Black female players to progress through the developmental pathways.

Cultural factors and the historical association of certain sports with specific racial groups may also contribute. While these perceptions are not inherently factual, they can influence participation choices and resource allocation within communities (Harrison & Hardin, 2018) [25]. Furthermore, media representation can perpetuate existing disparities. A lack of visibility for Black female soccer players in mainstream media can limit role models and potentially discourage participation among young Black girls (Norman, 2020) [27]. Conversely, increased and positive representation can inspire and broaden the appeal of the sport. The consequences of this lack of diversity extend beyond mere statistics. It can impact team dynamics, limit the range of perspectives within the sport, and fail to fully reflect the diverse communities that soccer aims to serve (Norman, 2020) [27].

## 4. Discussion

This exploratory review highlights the complex interplay between biomechanical factors, footwear design, and systemic inequities in women's soccer. The disproportionately high rate of knee injuries among female players, particularly ACL tears, is not solely attributable to inherent biological differences. Rather, it is exacerbated by the widespread use of footwear that fails to accommodate their unique anatomical and biomechanical needs. The lack of diversity within the sport further compounds these challenges, as Black female athletes may face additional barriers related to access, resources, and culturally appropriate support.

The existing literature strongly suggests that a paradigm shift is needed in the design and development of soccer cleats for women. Future research should prioritize a user-centered approach, incorporating detailed biomechanical analyses of female-specific movements and feedback from athletes themselves. Innovative designs that optimize traction, stability, and comfort while minimizing rotational torque are crucial for reducing injury risk and enhancing performance. Furthermore, addressing the systemic barriers that limit the participation and success of Black women in soccer requires a multi-faceted approach, encompassing initiatives to increase access to quality training, promote equitable talent evaluation, and foster inclusive and supportive environments.

### *4.1. Implications for Kinesiology*

This review has significant implications for the broader field of kinesiology. It underscores the importance of biomechanics research. Specifically, further investigation into the specific biomechanical factors contributing to knee injuries in female soccer players, including the interaction between footwear and movement patterns, would be of great value. This review also interacts with the field of sports equipment design. Applying kinesiological principles to the design and evaluation of sports equipment, particularly soccer cleats, to optimize performance and minimize injury risk in female athletes was an outcome of this review. Personally meaningful, this research also advocates for equitable

practices in sport and sport research. The authors, using kinesiological expertise to advocate for equitable training practices, access to resources, and fair representation for all female athletes, call for further attention to the phenomenon of underrepresentation in sport science research.

## 5. Conclusion

In summary, biomechanical factors such as increased knee valgus, altered hip and knee kinematics, differences in landing mechanics, and potentially imbalanced muscle activation patterns are implicated in the higher rates of knee injuries, particularly ACL injuries, observed in female soccer players. Understanding these factors is crucial for developing targeted injury prevention strategies. Limitations in footwear design for female soccer players appear to stem from potential mismatches in sizing and fit based on predominantly male foot morphology, a lack of specific research on optimal stud design for female biomechanics, and potentially non-optimized material properties. Further research focusing specifically on the foot morphology and biomechanical demands of female soccer players is needed to inform the development of footwear that better enhances performance and reduces injury risk in this population. The literature points to a demonstrable lack of Black representation in female soccer, influenced by socioeconomic barriers, cultural factors, and potentially limited media visibility. Addressing these issues requires a multi-faceted approach focused on increasing access, challenging stereotypes, and promoting inclusive representation at all levels of the game.

The continued growth and success of women's soccer hinge on addressing the interconnected challenges of injury prevention and diversity. This review emphasizes the critical need for innovative, evidence-based solutions that prioritize the health, performance, and equitable participation of all female athletes. Kinesiology scholars play a vital role in this endeavor, providing the scientific foundation for informed decision-making in footwear design, training methodologies, and policy development. By embracing a user-centered, interdisciplinary approach, the field of kinesiology can contribute significantly to a future where women's soccer is both thriving and equitable.

## 6. Future Directions

As things currently stand, there are very limited options for women-specific soccer cleats. These athletes have significantly different pressure loads, movements, and foot structures in comparison to men and the cleats that they are currently playing with fail to accommodate for that. A study conducted by the European Club Association found that 82% of female soccer players in the top eight domestic leagues reported having issues with their soccer cleats. Many of them expressed a feeling of pain and discomfort in the heel region, a complaint that was found to be more common with Black players (Wrack, 2023) [19].

Given the current landscape of women's soccer cleats, the expressed discomfort and pain experienced by many players including my collegiate test athletes, and the alarmingly high rate of knee injuries occurring because of not having cleats that consider their needs, new goals need to be set in designing women-specific cleats that reduce rotational traction and torque in route to mitigating lower extremity injuries that include ligament tears.

Further, additional footwear innovations of great need and value include innovative insoles which integrate a more durable foam that provides adequate cushioning for the athlete beyond a season of play. Products in this line - marketed specifically to a meaningful yet underrepresented demographic - would serve to correct oversights leading to injury limiting playing careers and increase the enjoyment to a growing population which would, in turn, grow the popularity of the sport leading to increased interest and staying power in the United States.

Future research could focus on (1) longitudinal studies investigating the impact of women-specific cleat designs on injury rates and performance outcomes, (2) qualitative research exploring the lived experiences of Black female soccer players and the barriers they face, and (3) interventions evaluating the effectiveness of programs aimed at increasing diversity and inclusion in women's soccer.

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