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Injuries Rates Are Lower in Females Comparing to Males. A Review of Injuries in 18 World Cup Tournaments

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Abstract

Football, being one of the most popular sports globally, gains immense attention during FIFA world cup tournaments. However, among the spectacle and passion, player's injuries remain a significant concern. This has an impact on footballers of both genders. In addition, has been reported that the rate of injury in senior elite athletes women´s football is lower than found in elite male football. This study aims to estimate the incidence of injury in elite senior football during world cup matches as well as to identify the nature of the injury in world cup tournaments. We used FIFA medical reports and previous scientific studies for data extraction. Using t-test for statistical analysis, we found higher total injury incidence (P-value=0.014), higher injury per match of males than females (P-value<0.01), and higher rates of non-contact injuries on males than females (P-value<0.01), in world cup tournaments. Understanding the landscape of football injuries in world cup tournaments is crucial for strategy prevention, enhancing player safety and optimizing performance. The study also highlights the significant gender differences in injury epidemiology, underscoring the need for tailored injury prevention strategies and training protocols for each gender.

Keywords: Football, Injuries, FIFA world cup, Epidemiology, Prevention.
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Introduction

Football is the most popular sport practice with over 260 million participant globally [1], and it is also one of the sport activities where physical activity, dexterity, and multiple movements are performed with high intensities up to the maximum [2]. This has an impact on footballers of both genders [3]. The physical demands of the game vary as a function of the level of play (ie, youth, amateur, elite, international) [1]. As the sport continues to grow, particularly in women's football, understanding injury epidemiology has become a critical focus for sports medicine professionals, coaches, and policymakers. Injuries not only jeopardize athletes' careers but also impose significant economic burdens on teams and healthcare systems [3]. While injury prevention strategies have advanced considerably, gender-specific differences in injury rates, mechanisms, and outcomes remain underexplored, despite the rising prominence of women's football. In addition, it has been reported that the rate of injury in adult elite athletes' women´s football is lower than found in elite male football. Existing literature suggests that injury rates and types differ between sexes due to anatomical, hormonal, and biomechanical factors [4]. For instance, female footballers are at higher risk of anterior cruciate ligament (ACL) injuries, often attributed to differences in neuromuscular control and knee valgus mechanics [5]. Conversely, male athletes report higher rates of muscle strains and contact-related injuries, potentially linked to greater playing intensity and physicality [6]. Despite these insights, comparative studies across large-scale, standardized competitions like the world cup remain sparse, limiting the generalizability of findings. Preliminary analyses indicate that while overall injury rates in female players may be lower, specific injury types—particularly non-contact ACL ruptures—occur at rates 2–3 times higher than in males [3]. This paradox underscores the necessity of moving beyond aggregate injury comparisons to dissect the anatomical, hormonal, and biomechanical mechanisms driving sex-based disparities.

Starting with the 1998 FIFA world cup, FIFA has surveyed males match injuries in the world cup tournaments [8] in order to design and implement preventive strategies. However, despite the growing popularity of women's football and the increasing number of female players, there has been little research on female football players. Several authors have reported the incidence and characteristics of injuries experienced by male players [8-13], and although more recently it has been reported epidemiological data on female football players [14, 15], these studies focused on injuries in elite players during the season, with injuries occurring in tournaments mentioned occasionally. Moreover, Union European Football Association (UEFA) reported that the number of seniors professional players has increased from 2013 [1], and it is expected that the participation rates double by 2026 [16].

Since China hosted the first Women world cup event in 1991, women´s football has continue to grow from strength to strength [17]. Injuries can have a substantial negative impact on team performance and can have a detrimental effect on the future career of football players [18-20]. Recently, the Fédération Internationale de Football Association (FIFA) has documented the Women´s Football strategy to create football-specific medical and health programmes focused on injuries prevention, playing conditions and female biology [21], whereas FIFA outlines the male players health and well-being strategy at 2022 world cup [7 22]. In a systematic review and meta-analysis [1], the injury incident rates across women´s football is reported lower in training than during matches [23]. In addition, the injury incidence rate during national team tournaments matches is

higher than that found in domestic club matches [16]. Biological and sociocultural factors may further explain gender-based injury disparities. Anatomically, females exhibit narrower intercondylar notches and greater ligamentous laxity, predisposing them to ACL injuries [4]. Conversely, males with higher muscle mass and testosterone levels may increase susceptibility to explosive, high-force injuries [14]. Socioculturally, disparities in access to strength and conditioning resources historically limited female athletes' capacity to mitigate injury risks, though this gap is narrowing with professionalization [24]. Additionally, refereeing standards and rules enforcement—such as tolerance for physical challenges—may differ between men's and women's matches, indirectly influencing injury rates [25]. This study synthesizes evidence from 18 FIFA world cup tournaments to evaluate the hypothesis that female football players experience lower overall injury rates than their male counterparts, while confronting higher risks for specific severe injuries.

Therefore, the primary aim of our review was to estimate the incidence of injury in elite adult football during 14 world cup matches. A secondary aim was to characterise the nature, and type of injury in the world cup tournaments. As the sport continues to evolve, particularly in women's football, understanding and mitigating injury risks will remain a critical priority for researchers, medical professionals, and governing bodies alike.

Materials and Methods

We designed our review in accordance with previous reporting items using protocols based on a combined methodology where previous scientific articles from the databases SCOPUS, PUB MED, and MEDLIINE as well as the FIFA medical reports were included for data extraction. The FIFA injury report its been implemented routinely in world cup tournaments and we have included the FIFA world cup tournaments since Italy 1990 and China 1991 world cups when we found the first medical report [26]. The injury definition and data collection procedures are in accordance with a previous consensus statement [27]. The injury report is collected from the physicians of all the participating teams and an injury was defined as any physical complaint during a match that received medical attention regardless of the absence from match or training [28]. Since the 1990 Italy and 1991 world cup in China, we have included all the FIFA world cup Tournaments in this study (See Table 1). FIFA Futsal world cup, FIFA Clubs world cup, and the beach Soccer world cups were excluded because of the settings of these tournaments. Following a previous guideline for expressing the incidence of injury [28], the incidence of injury was expressed as the number of injuries per match / all matches ×100. Data was processed using excel 2021 and SPSS 29. Statistical methods were two tails t-test and statistical significance was accepted at the 5% level.

Table 1. Number of injuries, number of matches, and type of injury in. FIFA world cups

World cup	Injuries	Matches	Sex	Reference	Injuries/match	Type of injury
1990	109	52	Males	29	2,28	33% contact injury 67% non-contact injury
1991	31	26	Females	20	1,19	29% contact injury 71% non-contact injury
1994	110	52	Males	30	2,11	22.7% contact injury 77,3% non-contact injury
1998	106	64	Males	8	1,65	> 20% contact injury.
1999	104	52	Females	30-33	1,3	No reported
2002	171	64	Males	34	2,7	73% contact injury 27% non-contact injury
2003	55	32	Females	32, 33, 35	1,7	64% contact injury 36% non-contact injury
2006	145	64	males	36	2,3	74% contact injury 26% non-contact injury
2007	74	32	Females	33, 37	2,3	86% contact injury 14% non-contact injury
2010	125	64	males	38	2,0	64,5% contact injury 35,5% non-contact injury
2011	74	32	Females	33	2,3	75% contact injury 25% non-contact injury
2014	104	64	males	38	1,68	63,4% contact injury 36,6% non-contact injury
2015	109	52	Females	33	2,1	75% contact injury 25% non-contact injury
2018	123	64	Males	40, 41	1,92	75% Contact injury 25% non-contact injury
2019	142	52	Females	42, 43	2,88	79% Contact injury 21% non-contact injury
2022	81	64	Males	27, 43	1,01	69% contact injury 31% non-contact injury
2023	161	64	Females	44	1,95	76% contact injury 24% non-contact injury

Results

A total of 920 matches were included in this study, where 368 (40%) matches were played in females world cup tournaments, whereas 552 matches (60%) of the total matches were played in FIFA world cup tournaments by males (See Table 1).

All world cup tournaments reported the mean of incident injury of 124.2±25.1 with significant difference between males and females (P-value=0.014) (Figure 1). We also reported significant differences on non-contact injuries 58.5±21.5 for males and 21±10.41 for females (P-value≤0.01) (Figure 2). We no observed differences on contact injuries between males 78.10±31.01 and females 68.51±40.4 in world cup tournaments (P-value=0.12) (Figure 2). The males world cup tournaments reported a significant injury incident per match 2.19±0.32 compared with females injury incident 1.61±0.35 in world cup tournaments (P-value<0.01) (Figure 3).

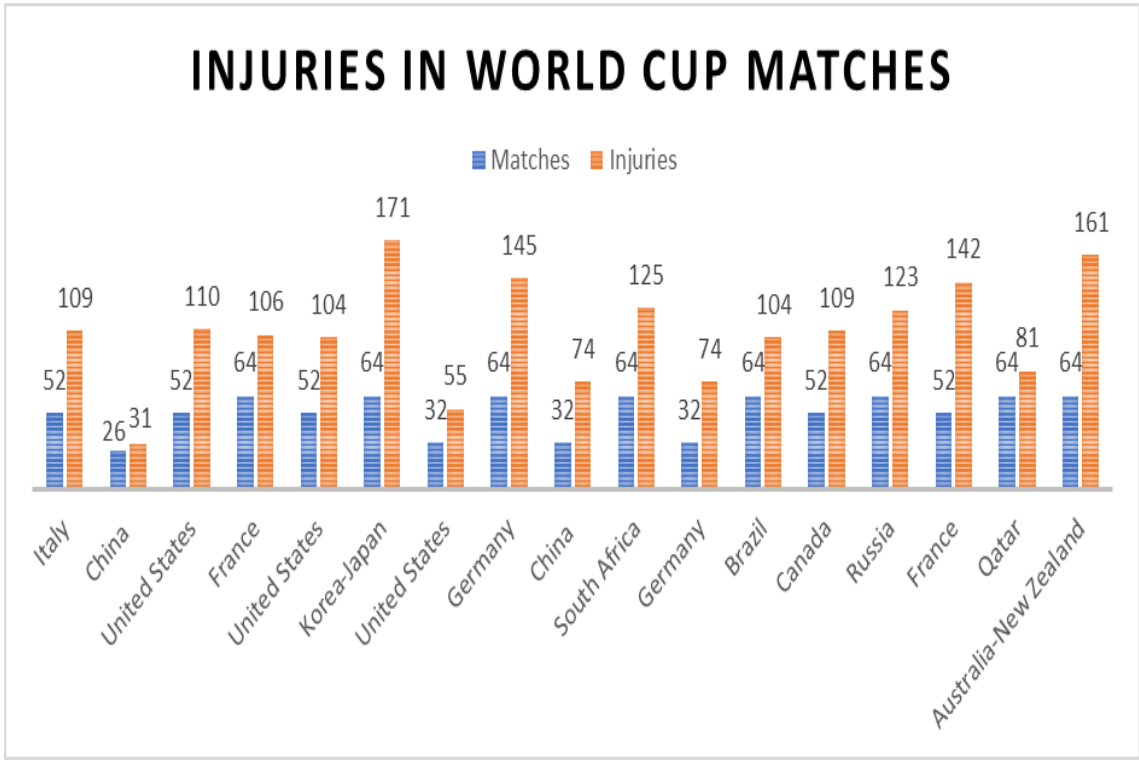

Figure 1. Injuries in world cup matches

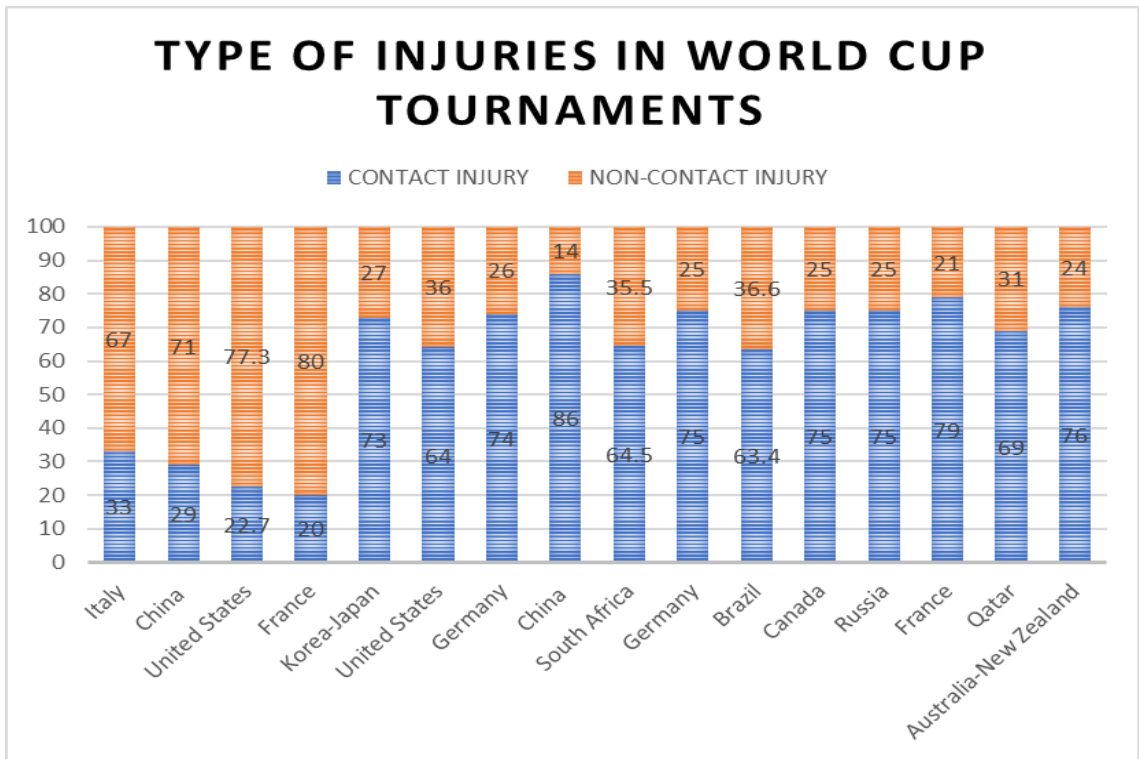

Figure 2. Type of injury in world cup tournaments

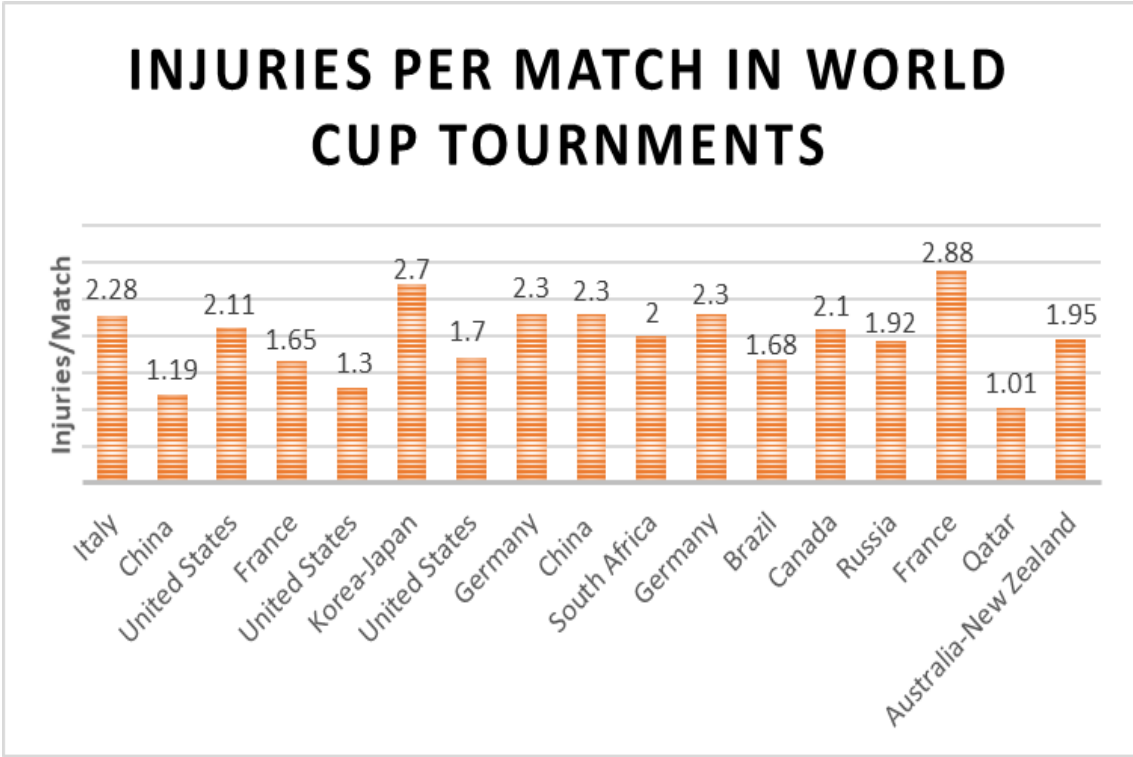

Figure 3. Injuries per match in world cup tournaments

Discussion

The primary goals of our systematic review were to quantify the total number of injuries, the number of injuries per match in males and females football world cups since the FIFA 1990 Italy and 1991 China world cup. The methodology applied has been previously proven and been implemented in world cup tournaments [7] as well as in elite senior football in local competitions [45]. This study revealed that female injuries rates are lower at the world cup tournaments. This is supported for a previous study where females suffered fewer injuries than males in international tournaments [28].

Additionally, we also reported higher incidence injury rates in males than females. This may be explained by supported by a previous study where males are reported 20% higher in both, training and match exposure compared to females [46]. These results may be explained by the injury incidence in international tournaments is higher that national leagues [23]. However, these results should be taken carefully as the sex-specific- injury literature is not conclusive. For example, some studies showed similar injury rates between sexes [47, 48], other studies reported a higher injury in males than females [49, 50] and others reported a higher injury incidence among females than female football players [52, 51]. In addition, the observed gender differences in injury rates can be attributed to a combination of anatomical, hormonal, and biomechanical factors. Anatomically, male athletes typically have greater muscle mass and bone density, which may contribute to higher forces during physical contact and explosive movements, increasing the risk of injuries such as muscle strains and fractures [53]. In contrast, female athletes are more prone to non-contact injuries, particularly ACL injuries, due to differences in neuromuscular control and knee valgus mechanics [54, 55]. These biomechanical differences are often exacerbated by hormonal fluctuations, particularly the influence of estrogen on ligamentous laxity, which can increase the risk of ACL injuries in female athletes [56].

In addition, we reported no significant differences on contact injuries between sexes. However, although we did not report contact injury differences between sexes, it is been reported that females have higher time-loss due to injury compare with males, particularly on knee and ankle injuries [46]. Interestingly, we reported higher incident rates on non-contact injuries on males compared with females in world cup tournaments. These results are supported by a previous study were males were found to have higher rates of injury than females in world cup tournaments and Olympic Games [32]. Interestingly, we reported that the trend of males injuries is decreasing in both contact and non-contact injuries. These may be due to the increased awareness of the importance of fair play and the improvements in the refereeing standards. However, females injuries do not show a specific trend.

A critical limitation of our study, inherent in its aggregated data sources, is that it captures overall injury rates but cannot speak to the specific nature and severity of those injuries. This masks a well-documented phenomenon in sports medicine: the ACL injury paradox. While our data show a lower overall injury rate in females, extensive literature confirms that female footballers are at a 2-6 times greater risk of sustaining non-

contact ACL injuries compared to their male counterparts [50, 55, 56]. This paradox underscores that aggregate rates are insufficient; a deeper dive into injury-specific epidemiology is crucial.

We documented data from either FIFA official documents of previous scientific research only from matches data, and we did not include training data. The study's methodology and data sources did not capture injury-specific data (e.g., ACL, hamstring, concussion) and thus cannot speak to the ACL injury paradox. Future data should include data from training sessions contributing to the total amount of injuries. We had to exclude four FIFA world cup tournaments as the total amount of injuries and the number of injuries per match was not reported in either FIFA reports or previous scientific research studies.

The incidence of injuries in FIFA world cup is higher in males than females as well as the number of injuries per match. The high proportion of non-contact injuries suggests that the incidence is a multifactorial event including the intense physical demand of the world cup matches, as well as anatomical, physiological and molecular differences between sexes, including intensity, muscle mass, collagen fibers and genetics. Strategies to prevent soft tissue injuries should a be focus in the world cup tournaments. In addition, the increase of refereeing standards will also help to mitigate the total amount of contact injuries. We suggest that future research should address the overload demands in the world cup tournaments.

Ethical Considerations

This review paper utilized publicly data and did not involve participants. Therefore, no ethical approval was needed for this study.

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Conflict of Interest

No conflict of interest was reported by the authors.

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