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REVIEW ARTICLE

Injury incidence among soccer referees: A systematic review

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ABSTRACT

Background: The scientific interest in the match performances of soccer referees has grown substantially over the past two decades. Referees need to maintain good physical performance to reduce injuries. So, this study aims to identify the injury rates in soccer referees. Methods: A search was conducted on the main international databases (PubMed, Scopus, Web of Science). Amateur and professional levels are both considered. Reviews, no English language studies, and studies that did not investigate only referees are not considered. Results: The search produced 380 results, 167 after removing duplicate results. In the end, 11 studies are selected. The match injury incidence ranges from 0.7 to 19.6 per 1000 hours; the training injury incidence ranges from 0.3 to 4.6 per 1000 hours. Conclusions: Monitoring injury incidence in referees is crucial, particularly in short-time competitions, which exhibit a notably high incidence.
Keywords: Performance analysis, Sport medicine, Football, Injury.

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INTRODUCTION

Over the years, soccer has become one of the most popular sports today. The fact that this sport involves 4% of the world's population (270 million people) confirms that statement. With a large number of soccer players worldwide, 5 million referees play an important role in the sport (Talović et al, 2018). Scientific interest in the match performances of soccer referees has grown significantly over the past two decades. Observational studies on the physical demands of soccer refereeing report distances exceeding 10 km per match, indicating that the activity is mainly aerobic (Di Salvo et al, 2012; Fernández-Ruiz et al, 2021; Preissler et al, 2022; Samarein et al, Weston, 2015). During official matches, maximum heart rates can reach about 170 bpm, and top speeds can go up to 24 km/h (Preissler et al, 2022). Elite referees may perform up to 1270 activity changes and make more than 130 decisions per game (Krustrup & Bangsbo, 2001). Maintaining good physical condition is crucial to reduce decision errors (Castillo-Rodríguez et al, 2023), and it is also important to minimize injuries among referees. Consequently, referees' physical activity involves high physical demands with shifts between aerobic and anaerobic metabolism, driven by high-intensity movements such as changes of direction, acceleration, turns, and sprints, which contributes to a high incidence of injuries (Weston et al, 2012; Witvrouw et al, 2003). Therefore, this study aims to identify injury rates in soccer referees.

MATERIALS AND METHODS

A search was conducted on the main international databases (PubMed, Scopus, Web of Science). Table 1 shows the search strings and the number of results. An injury that causes a player to require medical attention is called a ‘‘medical attention’’ injury, while an injury that prevents a player from fully participating in future football training or competition is known as a ‘‘time loss’’ injury (Dvorak et al, 2007). The same definition and criteria were applied to referees, focusing only on the “*time loss*” injury.

Table 1. Summary of search strings.

Databases	Search strings (from 2013)	Results
1. PubMed	("*Soccer*"(Mesh) AND injury AND referee) OR (((soccer OR football) AND (injury)) AND (referee))	61
2. Web of Science	Soccer OR football (All Fields) AND referee (All Fields) AND injury (All Fields)	79
3. Scopus	(TITLE-ABS-KEY (soccer OR football) AND TITLE-ABS-KEY (referee AND injury))	83
Total		**223**

Inclusion criteria

Only primary studies that investigate the injury incidence of soccer referees around the world. Amateur and professional levels for referees are both considered. Studies that are cited as references of other studies in this review are considered.

Exclusion criteria

Reviews, non-English languages, studies about only particular injuries, mixed population referees, and players.

Data extraction

The purpose of the study, participants (number of subjects, sex, competitions, season/s of study), and the incidence. Only the Injury Incidence (IR) is considered for the review; match IR (IR only during matches),

training IR (IR only during training), and total IR (match IR plus training IR) are considered where are differentiated.

One study is not considered because there is a poster and only the abstract is available (Wilson et al, 2011).

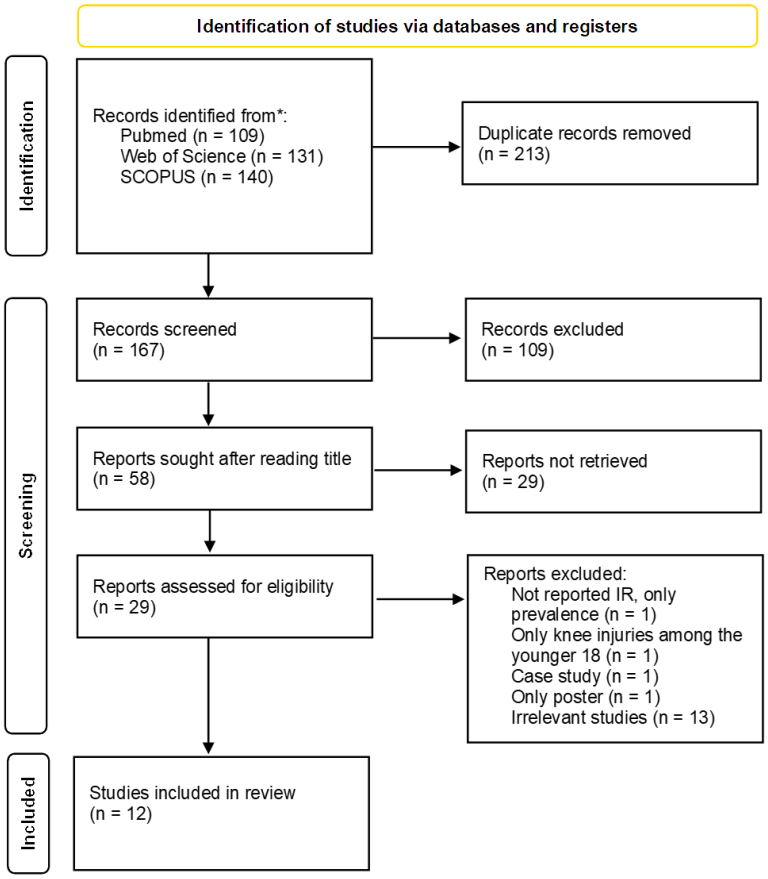

Figure 1. Diagram showing the stages of review and item selection (Page et al, 2021).

Figure 1 shows the stages of review; the PICO framework (Population, Intervention, Comparator, Outcomes, Study design) is shown in Table 2.

Table 2. PICO question.

Description	Scope
Population	Soccer referees
Intervention	Observation during one or more seasons or training interventions
Comparator	Control group or referees, where the study needs comparison
Outcomes	Injury incidence
Study design	Only primary studies were considered

Quality Evaluation: Subsequently, the selected articles were critically analysed by two researchers using the "*CASP Checklist*" (Critical Appraisal Skills Programme) tool, giving one point for each indication evaluated positively (with "*yes*") (Critical Appraisal Skills Programme (2018). CASP (2018). CASP Checklists. Available at: https://casp-uk.net/casp-tools-checklists/); the evaluation "*Can't tell*" in the CASP is considered in the CASP evaluation in Table 3.

Table 3. Summary of the reviewed studies.

First author	Year of publication	Methods	Participants	Results	CASP evaluation
Al Attar et al	2021	Randomized controlled trial	**200 Arabian amateur referees** (100 study group, 100 control group), from August 2018 to January 2019	**IR total control group** 1.44 per 1000 hours **IR total study group** 0.50 per 1000 hours	9/11
Bizzini et al	2009	Retrospective study with survey	71 **referees** (27 MRs and 44 ARs, 66 men and 5 women) of the 2 top divisions of the SFL, in the 2005/06 season	**Match IR MRs** 6.84 per 1,000 hours **Match IR ARs** 3.7 per 1,000 hours **Training IR MRs** 1.74 per 1,000 hours **Training IR ARs** 0.48 per 1,000 hours	8/12
Bizzini et al	2009	Retrospective survey and prospective study	63 **referees** (21 MRs and 42 ARs men) during the preparation camp and during the FIFA World Cup 2006 tournament	**During the World Cup:** **Match IR MRs** 31.3 per 1,000 hours **Match IR ARs** 15.6 per 1,000 hours **Match IR Total** 20.8 per 1,000 hours	12/12
Bizzini et al	2009	Retrospective and prospective descriptive epidemiological study	81 **referees** (30 MRs and 51 ARs women) preselected for the FIFA Women's World Cup 2007 36 **referees** (14 MRs and 22 ARs) during the tournament	**Match IR Total (before the tournament)** **During the entire career** 0.6 per 1,000 hours **During the last 12 months** 2.8 per 1,000 hours **Related last match** 8.2 per 1,000 hours During the tournament: **Match IR Total** 34.7 per 1,000 hours	12/12
Bizzini et al	2011	Randomized retrospective survey	**489 Swiss referees** (481 men, 8 women) at all levels (13 semi-professional leagues; 123 upper amateurs, 215 lower amateurs, 138 junior leagues), during the 2005/2006 season	**Training IR** **Junior leagues** 0.02 per 1000 hours **Lower amateurs** 0.11 per 1000 hours **Upper amateurs** 0.11 per 1000 hours **Semi-professional** 0 per 1000 hours **Total** 0.09 per 1000 hours **Match IR** **Junior leagues** 0.59 per 1000 hours **Lower amateurs** 2.57 per 1000 hours **Upper amateurs** 1.97 per 1000 hours **Semi-professional** 5.54 per 1000 hours **Total** 2.06 per 1000 hours	10/12

De Oliveira et al	2016	Retrospective study	36 **Brazilian referees** of FPF and FGF	**Referring IR FPF** 0.47 per 1000 hours **Referring IR FGF** 1.41 per 1000 hours **Test training IR FPF** 88.3 per 1000 hours **Test training IR FGF** 166.7 per 1000 hours	9/12
Gabrilo et al	2013	Retrospective study with self-administered questionnaire	**342 Croatian referees** (157 MRs and 185 ARs; divided for competition: UEFA competition 18, 1st League 78, 2nd League 91, 3rd League 155) from April to July 2011	**Match IR** **MRs UEFA** 3.85 per 1000 hours **ARs UEFA** 2.01 per 1000 hours **UEFA total** 3.33 per 1000 hours **MRs 1st League** 12.21 per 1000 hours **ARs 1st League** 8.37 per 1000 hours **1st League total** 9.90 per 1000 hours **MRs 2nd League** 6.24 per 1000 hours **ARs 2nd League** 5.42 per 1000 hours **2nd League total** 5.89 per 1000 hours **MRs 3rd League** 1.90 per 1000 hours **ARs 3rd League** 2.11 per 1000 hours **3rd League total** 2.00 per 1000 hours **Match IR total MRs** 5.29 per 1000 hours **Match IR total ARs** 4.58 per 1000 hours **Match IR total** 4.92 per 1000 hours	7/12
Kordi et al	2013	Prospective cohort study reporting all injuries occurred during trainings and matches	**75 referees** (30 MRs, and 45 ARs) in the 2009/2010 season of the IPFL	**Training IR** 4.6 per 1000 hours **Match IR** 19.6 per 1000 hours **IR total 5.75** (**MRs** 5.74, **ARs** 5.76) per 1000 hours	8/12
Matute-Llorente et al	2020	Retrospective study with survey during a training camp (July 2019)	**232 referees**: 18 elitè MRs 1st League, 34 elitè ARs 1st League, 22 elitè MRs 2nd League, 42 elitè ARs 2nd League and 116 non-elitè MRs 2ndB League, during the 2018/2019 season.	**Training IR** **MRs 1st League** 0.4 per 1000 hours **ARs 1st League** 0.3 per 1000 hours **MRs 2nd League** 0.6 per 1000 hours **ARs 2nd League** 0.3 per 1000 hours **MRs 2ndB League** 0.6 per 1000 hours **Match IR** **MRs 1st League** 1.3 per 1000 hours **ARs 1st League** 0.7 per 1000 hours **MRs 2nd League** 4.2 per 1000 hours **ARs 2nd League** 1.5 per 1000 hours **MRs 2ndB League** 3.8 per 1000 hours	10/12
Moen et al	2023	Prospective cohort study with weekly reporting	**55 Norwegian referees** (38 men, 17 women; 22MRs, 33 ARs), during the 2020 season	**IR** 11 per 1000 hours / 3 injuries per athlete/year	11/12

Szymski et al	2022	Retrospective cohort study with questionnaire	**923 German referees** (91 at the professional level, 151 at the semi-professional, and 681 at the amateur level; 796 men and 127 women)	**Training IR** **Professional level** 0.66 per 1000 hours **Semi-professional level** 0.54 per 1000 hours **Amateur level** 0.51 per 1000 hours **Match IR** **Professional level** 1.01 per 1000 hours **Semi-professional level** 1.92 per 1000 hours **Amateur level** 3.14 per 1000 hours **IR total (Prevalence)** **Professional level** 0.72 per 1000 hours (26.4%) **Semi-professional level** 0.86 per 1000 hours (25.8%) **Amateur level** 0.96 per 1000 hours (25.7%)	10/12
Vieira et al	2019	Prospective cross-sectional study with a sample	**257 Brazilian FPF referees**, between 2012 to 2014	**Training IR** 3.5 per 1,000 hours **Match IR** 3.7 per 1,000 hours	10/12

Note. ARs assistant referees; CGT Constructivist grounded theory; FPF Federação Paulista de Futebol; IP injury prevention; IPFL Iranian Premier Football League; IR Incidence rate of injuries; MRs main referees. All injuries refer to time-loss injuries and not time-loss injuries.

RESULTS

On December 9, 2023, the search yielded 380 results, with 167 remaining after removing duplicates. Eventually, 12 studies were selected. Table 3 displays the results.

Al Attar et al. (Al Attar et al., 2021) conducted a randomized controlled trial with 200 Arabian referees (100 in the study group, 100 in the control group), analysing the development of the 'FIFA 11+' injury prevention program for soccer players among the study group. Four studies by Bizzini et al. are selected. In the first study, they (Bizzini et al., 2009a) investigated injuries and musculoskeletal complaints among Swiss referees officiating in the Swiss Super and Challenge League. In the second study of the same group (Bizzini et al., 2009b), they reported injuries during the preparation camp and the FIFA World Cup 2006 tournament. The third study by Bizzini (Bizzini et al., 2009c) analysed injuries during the preparation camp and the FIFA Women's World Cup 2007. In 2011, in the last study considered (Bizzini et al., 2011), they investigated injuries among 489 Swiss referees, randomized across all Swiss-registered referees. De Oliveira et al. (De Oliveira et al., 2016) conducted a retrospective study among 36 Brazilian referees from the Paulista Football Federation (FPF) and the Gaucha Football Federation (FGF), examining injuries during games, training, and physical tests. Gabrilo et al. (Gabrilo et al., 2013) studied injuries in 342 Croatian referees. Kordi et al. (Kordi et al., 2013) performed a prospective cohort study documenting all training and match injuries among 75 Iranian Premier Football League referees during the 2009/10 season. Matute-Llorente et al. (Matute-Llorente et al., 2020) examined injuries in 232 Spanish referees, divided into 116 elite referees (main referees who officiate as the principal in matches, and assistant referees of the 1st and 2nd Leagues) and 116 non-elite referees (main referees of the 2nd B League). Moen et al. (Moen et al., 2023) conducted a prospective cohort study with 55 Norwegian referees. Szymski et al. (Szymski et al., 2022) retrospectively studied injury

occurrence and prevention strategies among German football referees. Vieira et al. (Vieira et al., 2019) carried out a prospective cross-sectional study, dividing injuries into time-loss injuries and all injuries (including those that do not require time loss from matches).

The training injury rate (including all injuries, even those that do not cause time loss) is estimated at 39.9 per 1000 hours, and the match injury rate (all injuries) is estimated at 37.8 per 1000 hours. The training injury rate for time-loss injuries is estimated at 3.5 per 1000 hours, while the match injury rate for time-loss injuries is estimated at 3.7 per 1000 hours. The match injury rate varies from 0.6 to 34.7 per 1000 hours, and the training injury rate ranges from 0.02 to 4.6 per 1000 hours.

DISCUSSION AND IMPLICATIONS

The studies show varying results: six studies differentiate between match IR and training IR. The study by de Oliveira (De Oliveira et al, 2016) distinguishes physical tests and referrals, with no distinction between training and match IR. Four studies report IR for different categories: two studies (Matute-Llorente et al, 2020; Szymski et al, 2022) show higher IR in lower leagues for match IR, while two (Bizzini et al, 2011; Gabrilo et al, 2013) report higher IR in higher competitions. Only five studies distinguish between MRs and ARs (one reports only total IR). For MRs, the match IR ranges from 0.6 to 31.3 per 1000 hours; training IR ranges from 0.4 to 1.74 per 1000 hours. For ARs, the match IR ranges from 0.7 to 15.6 per 1000 hours; training IR ranges from 0.3 to 0.48 per 1000 hours. MRs have higher incidence in four studies (Bizzini et al, 2009a and 2009c; Gabrilo et al, 2013; Matute-Llorente et al, 2020), while no difference is observed for Kordi (IR MRs 5.74, ARs 5.76) (Kordi et al, 2013).

Three studies report only match IR. The training IR is lower than the match IR; only Vieira et al (Vieira et al, 2019) report higher IR in training but for all injuries. For time-loss injuries, match IR is higher, similar to other studies. Injuries to hamstrings (Al Attar et al, 2021; Matute-Llorente et al, 2020), knees, lower legs (ankles), and feet are most common (Al Attar et al, 2021; Bizzini et al, 2009a, 2009b, 2009c; De Oliveira et al, 2016; Kordi et al, 2013; Moen et al, 2023; Szymski et al, 2022; Vieira et al, 2019). One randomized controlled trial indicates that the training program in the study (FIFA 11+) may improve IR, reducing injuries in the experimental group by 65% compared to the control group (Al Attar et al, 2021). Thus, training appears to be an important factor influencing IR for referees: an effective training program can improve IR. IR tends to be higher in matches than in training, similar to elite players (Hägglund et al, 2013), though still lower overall. Studies of short-term competitions (such as various international tournament matches) show a significant increase in IR among referees (Bizzini et al, 2009b and 2009c). Referee IR seems lower compared to professional soccer players (López-Valenciano et al, 2020): a 2020 meta-analysis of 44 studies on professional players reported an IR of 8.1 injuries per 1000 hours, with match IR at 36 injuries per 1000 and training IR at 3.7 injuries per 1000 hours. Similar data for referees are only available in short-term competition studies. Therefore, injury prevention in referees, particularly during short-term competitions, offers a promising avenue for sports science to improve performance. Implementing specific injury prevention programs based on evidence about injury types and locations, alongside a thorough understanding of match activity profiles, could help reduce injury rates (Weston, 2015). During short competitions, increasing the number of referees and promoting higher turnover might be effective solutions.

CONCLUSIONS

It is important to monitor injury incidence in referees, especially in short-term competitions that show a high occurrence. Contrasting differences are found between lower and higher levels of competition.

Limits

This study has certain limitations. Some studies analyse injuries using questionnaires, which can introduce notable biases. The lack of grey literature may reduce the number of results. The diversity of geographical areas and levels of professionalism should also be considered as challenges in trying to standardize the study's objectives.

AUTHOR CONTRIBUTIONS

AB and ST did the literature search, ST and BP evaluated the selected studies, AB summarized the results and discussion, ST and BP wrote the introduction, methods and grammatically corrected the text.

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DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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