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Literature Review

The "sequence of prevention" for musculoskeletal injuries among adult recreational footballers: A systematic review of the scientific literature

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ABSTRACT

Objective: To gather epidemiological information related to all steps of Van Mechelen's "sequence of prevention" for musculoskeletal injuries among adult recreational football players.
Methods: A systematic review of the scientific literature was conducted in Medline via Pubmed. Therefore, two highly sensitive search strategies based on three groups of keywords (and related search terms) were used.
Results: In total, 33 relevant original studies were included in our systematic review. The results of our systematic review showed that the incidence of musculoskeletal injuries among recreational adult football players ranged from 9.6 to 15.8 injuries per 1000 exposure hours. These injuries are especially located in the ankle, knee, groin and hamstring, being associated with previous injury and match exposure. The FIFA11 + injury prevention programme and the Nordic Hamstring Exercise (NHE) were found to be effective for the reduction or prevention of musculoskeletal injuries among adult recreational football players.
Conclusions: Our systematic review showed that musculoskeletal injuries are common among recreational adult football players, while effective preventive programmes are available. Further studies should focus on the identification and understanding of the key factors responsible for the optimal adoption, implementation and maintenance of these measures.

1. Introduction

Football (also referred to as 'soccer') is the most popular sport in the world, being played in more than 200 countries by nearly 400 million people. While its physical and psychosocial health benefits have been recently established, recreational football is also known for its risk for musculoskeletal injuries (Bangsbo, Hansen, Dvorak, & Krustrup, 2015; Dvorak & Junge, 2015). The incidence of football injuries among recreational players is estimated at up to 10 injuries per 1000 football hours, being more likely to be located in the lower limbs and to occur during competition (van Beijsterveldt, Stubbe, Schmikli, van de Port, & Backx, 2015; Inklaar, 1994). Because these injuries can lead to high (direct and indirect) costs for society, increased attention is being paid to injury prevention in football (Bizzini & Dvorak, 2015).

When it comes to sport injury prevention, van Mechelen's "sequence of prevention" has been recognized as the most influential model in the past 25 years (van Mechelen, 2017; van Mechelen, Hlobil, & Kemper, 1992). Van Mechelen's "sequence of prevention" relies on four sequential steps, from establishing the incidence, severity and aetiology of musculoskeletal injuries (steps 1 and 2) to the development and evaluation of preventive interventions (steps 3 and 4) (van Mechelen et al., 1992). These four steps of van Mechelen's "sequence of prevention" are essential for a successful implementation of interventions aiming to reduce or prevent the occurrence of musculoskeletal injuries in sports. Currently, no systematic overview exists that presents the scientific evidence related to all the steps of van Mechelen's "sequence of

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prevention" for musculoskeletal injuries among recreational football players. Such an overview would provide the football community with the available epidemiological knowledge and the available interventions related to injury prevention in recreational football, as well as point out the empirical information that still needs to be gathered.

Consequently, the objective of this study was to gather epidemiological information in order to answer the following four research questions: 1) What are the most common musculoskeletal injuries occurring among adult recreational football players?; 2) What are the risk factors and mechanisms of these most common musculoskeletal injuries among adult recreational football players?; 3) What are the available primary preventive interventions to prevent these most common musculoskeletal injuries among adult recreational football players?; 4) What is the effectiveness of the available primary preventive interventions on the reduction or prevention of musculoskeletal injuries among adult recreational football players?

2. Methods

A systematic review of the scientific literature was conducted in accordance with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Moher et al., 2009).

2.1. Search strategies and database

Two highly sensitive search strategies (Appendix 1 as supplementary material) were built (one for our first and second research question, and one for our third and fourth research question) based on three groups of keywords (and related search terms), namely 'injury', 'football/soccer' and 'cohort study'. One electronic database was searched up to February 2017, namely Medline (biomedical literature) via Pubmed. For both search strategies, the following filters were applied: Humans; English. For the second search strategy (third and fourth research question), an additional filter was applied: Randomized Controlled Trial. Within each keyword, all search terms were combined by the Boolean command OR, and the keywords (and respective search terms) were linked by the Boolean command AND. Existing medical subject headings [MeSH] were used if possible, while search terms were truncated with *.

2.2. Eligibility criteria

To retrieve articles relevant to all research questions, criteria for inclusion were:

1. The population of interest consists exclusively of adult recreational football players.
2 The article presents an original study.
3 The article is written in English.
4a If related to descriptive epidemiology: prospective cohort design is used.
5a If related to descriptive epidemiology: incidence (relative to exposure) or prevalence rate (overuse injuries) are reported.
4b If related to aetiology: prospective cohort design is used.
5b If related to aetiology: a risk estimate is reported.
4c If related to primary prevention: randomized controlled trial is conducted.
5c If related to primary prevention: incidence rates and/or effect are reported.

2.3. Study selection

All studies identified through both search strategies were separately imported in a citation database (EndNote). To identify potentially relevant articles, titles and abstracts were screened independently by two researchers (EK, VG) by using the relevant eligibility criteria. If the title and abstract did not provide sufficient information to determine whether the eligibility criteria were met, it was included for the full text selection. Then, full text articles were assessed independently for eligibility by two researchers (EK, VG). Any disagreements regarding the inclusion or exclusion of articles were resolved by consulting a third researcher (OK). To avoid missing any relevant publications, the references of included studies were screened.

2.4. Data extraction

Data from the included articles were extracted and cross-checked by two authors (OK, VG). Therefore, two standardised extraction forms were used (one for our first and second research question, and one for our third and fourth research question) in order to report: study information (author, year), study population (sample size, age, gender, level of sport), injury definition and registration, injury incidence (inclusive pathology), risk factors and mechanism (if applicable), preventive measure (if applicable), effect (if applicable).

2.5. Risk of bias appraisal

The risk of bias of all included articles was assessed and cross-checked by two authors (KO, VG). If there was a difference in scoring an item, a consensus was reached by authors. Any disagreements regarding the methodological appraisal of articles were resolved by consulting a third researcher (EK). For the articles related to descriptive epidemiology and aetiology (first and second research question), the Quality in Prognosis Studies (QUIPS) tool was used (in Appendix 3 as supplementary material), exploring the following six bias domains: study population, study attribution, prognostic factor information, measurement of and controlling of confounding variables, measurement of outcomes, analysis approaches (Hayden, van der Windt, Cartwright, Côté, & Bombardier, 2013). Each of the six potential bias domains was rated as having high, moderate or low risk of bias. We considered a study to have an overall low risk of bias when the methodological risk of bias was rated as low or moderate in all six domains, with at least four domains being rated as low. A study was rated as having an overall high risk of bias if two or more of the domains were scored as high. In-between quality was scored as moderate. For the articles related to prevention (third and fourth research question), the Cochrane Collaboration's tool was used (in Appendix 3 as supplementary material), exploring the following six bias domains: sequence generation, allocation concealment, blinding of participant and personnel, blinding of outcome, incomplete data and selective reporting (Higgins et al., 2011). Studies were classified as having a low risk of bias when all items were rated as low. A high risk of bias was assigned when at least one item was rated as high. A moderate risk of bias was assigned when at least one item was classified as moderate.

2.6. Synthesis of evidence

Because it remains essential when it comes to injury and injury prevention in sports, the four steps of Van Mechelen's "sequence of prevention" model was applied to visually synthetize and present the gathered scientific information. Therefore, only studies with a low risk of bias were used.

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