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REVIEW ARTICLE

EFFECTIVENESS OF THE FIFA11+ INJURY PREVENTION PROGRAM IN TEAM SPORTS

OCENA SKUTECZNOŚCI FIFA11+ W KONTEKŚCIE ZMNIEJSZENIA RYZYKA URAZÓW SPORTOWYCH W GRACH ZESPOŁOWYCH

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ABSTRACT

Introduction

Since some types of injuries are common for different sports, it is justified to implement the FIFA11+ program also to other team sports despite soccer.

Aim

This systematic review investigates the effectiveness of the FIFA11+ program in preventing injuries in team sports other than soccer.

Material and methods

PubMed and Web of Science databases were searched, applying keywords such as FIFA 11, injury prevention, warm-up program, basketball, volleyball, handball, rugby, cricket, netball, softball, team sport. Quality evaluation of included papers was performed based on the PEDro scale.

Results

From 4.641 potentially eligible publications, only two met the criteria and were enrolled on this systematic review. Both studies were classified with average methodological quality.

Conclusions

Up to now, only a few large-scale randomized control trials are published regarding the effectiveness of FIFA11+ injury prevention programs in other sports then soccer, and their results are contradictory; the impact of this program still needs to be verified in future. The publications should be designed following the best quality criteria (especially including blinding assessors, intervention, allocation), and with well-powered sample size.

Keywords: FIFA11+, injury prevention, warm-up program, team sport

STRESZCZENIE

Wprowadzenie

Niektóre rodzaje kontuzji są wspólne dla różnych dyscyplin sportowych, dlatego zasadne jest wdrożenie programu FIFA11+ także do innych sportów zespołowych niż piłka nożna.

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Cel
Ten przegląd systematyczny analizuje skuteczność programu FIFA11+ w zapobieganiu urazom w sportach zespołowych innych niż piłka nożna.

Materiał i metody
Przeszukano bazy danych PubMed i Web of Science stosując słowa kluczowe takie jak: fifa 11, zapobieganie kontuzjom, program rozgrzewki, koszykówka, siatkówka, piłka ręczna, rugby, krykiet, siatkówka, softball, sport zespołowy. Oceny jakości uwzględnionych artykułów dokonano w oparciu o skalę PEDro.

Wyniki
Spośród 4641 potencjalnie kwalifikujących się publikacji tylko dwie spełniały kryteria i zostały włączone do tego przeglądu systematycznego. Oba badania zostały sklasyfikowane ze średnią jakością metodologiczną.

Wnioski
Do tej pory opublikowano tylko kilka zakrojonych na dużą skalę randomizowanych badań kontrolnych dotyczących skuteczności programu zapobiegania urazom FIFA11+ w innych sportach niż piłka nożna, a ich wyniki są sprzeczne, dlatego wpływ tego programu nadal wymaga weryfikacji w przyszłości. Publikacje powinny być zaprojektowane zgodnie z najlepszymi kryteriami jakości (zwłaszcza z uwzględnieniem zaślepienia osób oceniających, interwencji, alokacji) oraz z odpowiednio dobraną wielkością próby.

Słowa kluczowe: FIFA 11, prewencja urazów, sport zespołowy, program rozgrzewki

Introduction
Soccer is the most popular sport in the world (Dvorak *et al.,* 2004), however, it should be remembered that there are other team sports in which many people play at both amateur and professional levels (Soomro *et al.,* 2016). It was previously confirmed that due to the injury, players are unable to play for their team, which makes the path to success difficult for the clubs, reduces their incomes, or might even be the main cause for quitting the sport (Sadigursky *et al.,* 2017; Maffulli *et al.,* 2010; Grygorowicz *et al.,* 2019). Approximately 5.8 million people are treated for sports-related injuries each year in hospitals in Europe, and team ball sports account for almost half of all hospital sports injury treatments (Kisser *et al.,* 2012). Therefore, to tackle this relevant issue and to reduce the number of injuries, the Fédération Internationale de Football Association (FIFA) prepared a specialized preventive program for soccer players. The FIFA11+ program is a complete warm-up with 15 exercises that are performed at the beginning of the training. It takes 15–20 minutes. The program consists of 3 parts divided into running exercises, core strengthening, neuromuscular control, eccentric exercises, changes of direction, and acceleration, and it comes with 3 difficulty levels. It is important to instruct the trainer and perform the exercises correctly. Implementation of the FIFA11+ program in soccer teams can reduce 30–50% of injuries (Soligard *et al.,* 2008). Lately published meta-analysis regarding the effectiveness of FIFA11+ program confirmed reduction of the overall risk of 34% [RR = 0.66 (0.60– 0.73)] for all injuries and a 29% reduction of injuries localized in lower limbs [RR = 0.71 (0.63– 0.81)] as the effect of the implementation of this soccer-specific injury prevention exercises. Although a few preventive programs designed for other team sports in which athletes are also

at risk of injury can be found, the evidence of their effectiveness is still limited (Gouttebarge *et al.,* 2017) (McKenzie *et al.,* 2019). Since the epidemiology of injuries is similar in different sports, there are reasonable reasons to implement the FIFA11+ program also to other team sports. For example, in basketball, which is based similarly to soccer on running, changing directions, and jumping (Sahin *et al.,* 2018), and the common localizations of injuries are the ankle (39.7%) and the knee (14.7%) joints, and the most common diagnosis is ligament sprain (44%) (Longo *et al.,* 2012). These types of injuries also typically occurr in soccer. That is why there are some papers describing the usefulness of FIFA11+ warm-up in basketball players.

In this systematic review, we aimed to investigate the effectiveness of the FIFA11+ program in preventing injuries in team sports other than soccer by analyzing randomized controlled trial studies described in the literature.

Methods

Results of individual studies

The following databases were searched for the study: PubMed and Web of Science, applying keywords such as (FIFA 11 OR injury prevention OR warm-up program) AND (basketball OR volleyball OR handball OR rugby OR cricket OR netball OR softball OR team sport). No limitations were applied in terms of the year of publications or language. The search process was performed on January 25, 2021. An application developed for this study was used to assist the process of screening relevant papers and the selection of articles. The application was written in JAVA in a code editor program (IntelliJ IDEA). It was a backend application without a user interface. After entering keywords, it creates a file of specific publications that have been previously downloaded from selected databases and calculates their sum. Inclusion and exclusion criteria were applied to enroll relevant papers by one reviewer and then they were verified by the second reviewer. Only randomized controlled trials were included in this systematic review. Any disagreement between the reviewers was resolved by the discussion between them.

Quality evaluation

The quality of included papers was assessed using the modified 11-points PEDro scale (Maher *et al.,* 2003). This scale was previously applied in the different systematic reviews (Preston *et al.,* 2017), since it was confirmed as a valid tool for the evaluation of the methodological quality of the studies (de Morton, 2009). The PEDro scale is an 11-point scale assessing individual aspects of the methodology of the conducted research. Each affirmative (+) answer is awarded a point and zero points for each negative (–) answer. The first question is not taken into account for the total score of the publication, therefore, the maximum number of points that can be obtained by a given article is 10, and the minimum is 0 points. The score indicates what level of scientific evidence the publication can be assigned to. Level 1 includes randomized clinical trials with high methodological values (8–10 points on the PEDro scale), while level 2 includes randomized clinical trials with low (1–3 points on the PEDro scale) and medium (4–7 points on the PEDro scale) methodological values (Taradaj, 2020).

Results

Study selection

The process of study selection is provided in Figure 1. After searching for articles using keywords from PubMed and Web of Science databases, 4.641 publications were obtained. After rejecting duplicates with the help of the created application, 3.764 publications were left. The app then excluded articles that had the title "soccer" or "football", which resulted in a further 940 publications being rejected. Of the remaining 2.824 articles, 914 publications were left with the title of one of the keywords "fifa 11", "basketball", "volleyball", "handball", "rugby", "cricket", "netball", "softball". A decision was made to analyze articles containing

the keyword "fifa 11". After the analysis of the abstracts, 6 publications were left, as 10 articles related to football were rejected. The next step was to analyze the full texts of the paper. One article was rejected because it was also about soccer and one was simply a conference report. From the remaining 4 studies, another 2 were rejected because they did not describe the number of injuries sustained while running the FIFA11+ program. The two selected articles have been divided into sports disciplines: basketball, lacrosse, and American football. A detailed description of each research is presented in Table 1.

Results of individual studies

Both studies included in the study are randomized controlled trials (RCTs).

In a study by Longo *et al.*, the impact of the FIFA11+ program on basketball trauma was examined (Longo *et al.*, 2012). 11 teams from the same club have been recruited. The intervention group consisted of 80 players (7 teams), and the control group consisted of 41 players (4 teams). The study ranged for a 9-month season (August 2009 to April 2010) in men's teams between 11 and 24 years old. The intervention consisted of the performance of the FIFA11+ program by the intervention group and a standard warm-up by the control group. In the first month, the intervention group performed the program 6 times a week, and in the following months, at least twice a week, while the control group performed the usual warm-up 3–4 times a week throughout the season. The trainers sent information

Table 1. Characteristics of study.

Study	Study design	Type of sport	Population	Intervention	Follow-up (months)	Definition of injury	Outcome	Main conclusion
Longo *et al.* (2012)	RCT	Basketball	Male, youth and senior (11–24 years) IG: 80 CG: 41	IG: The FIFA11+: a 20 min exercise programme for lower extremity and trunk with progression levels CG: usual pre-participation warm-up program	9	Any physical complaint sustained by a player that results from a scheduled basketball match or basketball training session, leading to activity day loss (matches or training sessions)	31 injuries IG: 14 (IR: 0.95) CG: 17 (IR: 2.16)	The FIFA11+ is effective in reducing the rates of injuries in elite male basketball players
Slauterbeck *et al.* (2019)*	RCT	Basketball	Male and female, youth (14–18 years) Men: 452 IG: 230 CG: 222 Women: 350 IG: 185 CG: 165	IG: The FIFA11+: a 20 min exercise programme for lower extremity and trunk with progression levels CG: usual pre-participation warm-up program	24 (12 with FIFA11+ program)	An injury was defined as any event where a player was not able to fully participate in the subsequent practice or game. Exposure to the risk of an injury during participation in sport was calculated by determining the number of athletes on each team and multiplying by the number of days available for practices and games across the course of a sport season.	Men: 44 injuries IG: 17 CG: 27 Women: 43 injuries IG: 29 CG:14 IR: IG: 1.35 CG: 1.27	The FIFA11+ did not reduce lower extremity injuries in basketball

Table 1. (cont.) Characteristics of study.

Study	Study design	Type of sport	Population	Intervention	Follow-up (months)	Definition of injury	Outcome	Main conclusion
Slauterbeck *et al.* (2019)*	RCT	Lacrosse	Male and female, youth (14–18 years) Men: 524 IG: 236 CG: 288 Women: 450 IG: 229 CG: 221	IG: The FIFA11+: a 20 min exercise programme for lower extremity and trunk with progression levels CG: usual pre-participation warm-up program	24 (12 with FIFA11+ program)	An injury was defined as any event where a player was not able to fully participate in the subsequent practice or game. Exposure to the risk of an injury during participation in sport was calculated by determining the number of athletes on each team and multiplying by the number of days available for practices and games across the course of a sport season.	Men: 37 injuries IG: 13 CG: 24 Women: 19 injuries IG: 6 CG: 13 IR: IG: 0.67 CG: 1.29	The FIFA11+ reduce lower extremity injuries in lacrosse

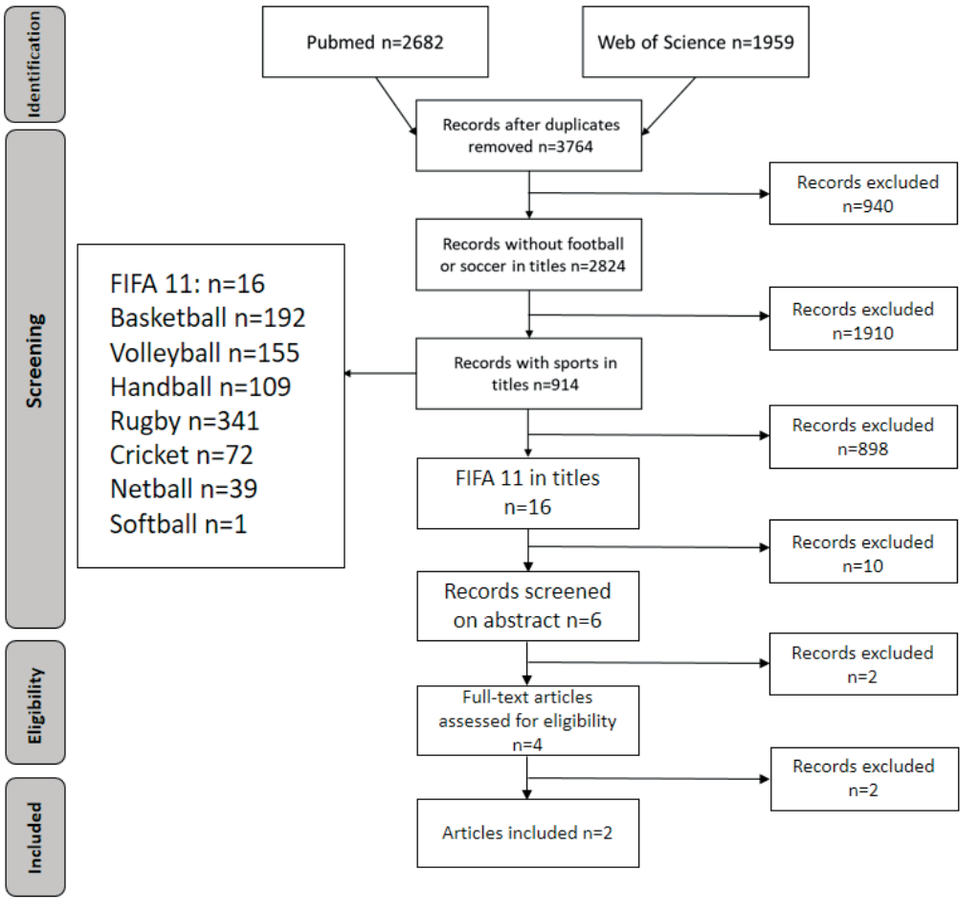

Figure 1. Flow chart of study selection.

about the injury, its location, and the type of injury. After examining the player, physiotherapists decided about the type of injury (acute or overuse). The injury was defined as "any physical complaint sustained by a player that results from a scheduled basketball match or basketball training session, leading to activity day loss (matches or training sessions)". During the 9-month season, the intervention group played 23.640 hours of basketball (2040 hours during matches and 21.600 hours during training) and the control group played 12.648 hours (984 hours during matches and 11.664 hours during training). 23 out of 121 players were injured (19%). The number of injuries was 31 (14 in the intervention group and 17 in the control group). 24 acute injuries and 7 overuse injuries were diagnosed. A lower coefficient of overall injuries, training injuries, lower limb injuries, acute and severe injuries as well as torso, leg, hip, and groin injuries were found in the intervention group. There was no statistically significant difference between the groups in match injuries, knee injuries, ankle injuries, and overuse injuries. The most common acute injury was ligament sprains, and tendinopathy was most often diagnosed in overuse injuries. In the intervention group, injury rates were lower than in the control group (IG: 0.95; CG: 2.16). There was significant effect (P = .0004). The estimated injury rate was calculated as follows: [(number of events during a specified period)/(total athlete-exposures at risk during a specified period)] x1000. The exposure time was calculated as participation hours and athlete-exposure. The athlete-exposure was calculated for each group as the number of athletes participating in each game or training session (1 athlete participating in 1 game/1 training session). Hours of participation were calculated for each group as the sum of the number of exposure hours of each player (training exposure time, match exposure time, total exposure time – match 1 training hours) (Longo *et al.,* 2012).

A study by Slauterbeck *et al.* concerned the impact of the FIFA11+ program on the prevention of lower limb injuries in high school athletes (Slauterbeck *et al.,* 2019). Soccer-related data has been discarded for the purposes of this article. The performance of athletes in basketball, lacrosse, and American football was taken into account. After meeting the criteria, 14 high schools were admitted to the study. The study lasted for two years (2015–2017). In the first year, a routine warm-up was observed in schools, and in the second year, the FIFA11+ program was introduced for the intervention group, while the control group used the usual warm-up programs. Seven randomly selected high schools (coaches and players) were trained in FIFA11+ before applying it. Trainers reported on the type (fracture, dislocation/subluxation, sprain, meniscus/cartilage lesion, muscle strain, tendon injury, bruise/contusion/hematoma, abrasion, laceration, and nerve injury) and location (foot, ankle, leg, knee, thigh, groin, and hip) lower limb injuries and the time lost by the player due to the injury. The injury was defined as "any event where a player was not able to fully participate in the subsequent practice or game", and lost time "as the interval between the injury and when the athlete fully returned to participate in a practice or game." 802 basketball players took part in the study: 452 boys (230 in the intervention group and 222 in the control group) and 350 girls (IG: 185; CG:165). The men's basketball teams had 44 injuries (IG: 17 vs CG: 27), and in the women's basketball teams, 43 injuries (IG: 29 vs CG: 14). Additionally, 974 lacrosse players participated in the study: 524 boys (236 in the intervention group and 288 in the control group) and 450 girls (IG: 229 vs CG: 221). Men's lacrosse teams had 37 injuries (IG: 13 vs CG: 24), and in women's lacrosse teams 19 injuries (IG: 6 vs. CG: 13). Moreover, this study also involved 629 American football players, divided into the intervention group (n = 341) and the control group (n = 288). There were 78 injuries in American football

teams (IG: 47 vs CG: 31). For basketball teams, injury rates were similar in the FIFA11+ and control groups (IG: 1.35 vs CG: 1.27), but the FIFA11+ group had a lower injury rate than the control group for lacrosse teams (IG: 0.67 vs CG: 1.29) and somewhat higher injury rates for football teams (IG: 2.18 vs CG: 1.69). Level of play had a significant effect on the injury rate. The raw injury rate was lower for freshman and junior varsity than for varsity teams, but there was no significant interaction between the intervention group and level of play. The exposure to the risk of injury from playing sports was calculated by taking the number of athletes on each team and multiplying by the number of days available for training and matches during the sports season (Slauterbeck *et al.,* 2019).

and the analysis of the homogeneity of the studied groups showed their similarity. None of the selected publications met criteria five to seven, which was a blank sample. Neither the study investigators nor the study participants were blinded. On the other hand, both articles met the criterion from eight to 11 because the respondents participated in the study according to their group assignment; the publications contained the results in the form of analyzes of both groups and had both point measures and measures of variability the key factor. A study by Longo *et al.* (2012) (Longo *et al.,* 2012) scored 5 points on the PEDro scale, and the study by Slauterbeck *et al.* (2019) (Slauterbeck *et al.,* 2019) obtained 7 points on the PEDro scale, so both publications are included in the randomized control study with average methodological values.

Table 2. PEDro scale.

PEDro scale	Criteria of the PEDro scale	Longo *et al.* (2012)	Slauterbeck *et al.* (2019)
1	eligibility criteria were specified	+	+
2	subjects were randomly allocated to groups	+	+
3	allocation was concealed	–	+
4	the groups were similar at baseline regarding the most important prognostic indicators	–	+
5	there was blinding of all subjects	–	–
6	there was blinding of all therapists who administered the therapy	–	–
7	there was blinding of all assessors who measured at least one key outcome	–	–
8	measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	+	+
9	all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat"	+	+
10	the results of between-group statistical comparisons are reported for at least one key outcome	+	+
11	the study provides both point measures and measures of variability for at least one key outcome	+	+

Study quality

Table 2. In an article by Longo *et al.* (2012) (Longo *et al.,* 2012) and Slauterbeck *et al.* (2019) (Slauterbeck *et al.,* 2019), the second criterion of the PEDro scale, meaning the random selection of participants to groups, was met. Only the study by Slauterbeck *et al.* (2019) (Slauterbeck *et al.,* 2019) met criteria three and four, indicating that the allocation of participants to groups was classified,

Discussion

In this systematic review, we aimed at investigating whether the effectiveness of the FIFA11+ program in other team sports than football was examined. Several studies have been conducted on athletes from various sports. However, it is difficult to clearly answer the question of whether the use of FIFA11+ reduces the risk of injury. In a study by Longo *et al.* (2012) (Longo *et al.,* 2012) authors showed

that the FIFA11+ program was effective in reducing the risk of injury in professional basketball players. In contrast, the study by Slauterbeck *et al.* (2019) (Slauterbeck *et al.,* 2019) shows that the FIFA11+ program did not reduce lower limb injuries in basketball players. However, gender has to be considered as the important factor influencing the results. In women, the number of injuries was higher in the intervention group than in the control group, which influenced the injury risk, which was calculated only for the discipline, not for gender. In men, the results were the opposite.

It must be underlined that the studies have significant limitations in terms of their scientific quality despite some strengths. Longo *et al.* did not provide any information on concealed allocation of participants to intervention and control groups. This technique ensures that implementation of the random allocation sequence occurs without knowing which participant will receive interventional or standard therapy. Thus, it is crucial to avoid any influence on whether a participant is included or excluded based on perceived prognosis (Dettroi, 2010). The study by Longo *et al.* also did not report the information on whether the groups were similar at baseline regarding the most important prognostic indicators. It is crucial for RCT studies that the characteristics of participants that may influence the outcome are distributed between treatment groups so that any difference in outcome can be assumed to be due to the intervention (Roberts *et al.,* 1999). Both analysed papers did not provide enough information if the blinding of all participants were performed, if there was blinding of all therapists who administrated the therapy, and if there was blinding of all assessors who measured at least one key outcome. Although, in physiotherapeutic research, it might be very difficult to blind the intervention, if possible, it is recommended that researchers should blind five groups of individuals involved in trials: participants, clinicians (therapists), data collectors, outcome adjudicators and data analysts (Karanicolas *et al.,* 2010). If participants are not blinded, knowledge about group assignments can influence their behavior in the study and their responses to subjective performance measures. Similarly, blinded clinicians are much less likely to shift their attitudes towards participants or provide differential treatment to active and placebo groups than unblinded clinicians (Shultz *et al.,* 2002). Blinding data collectors and result evaluators (sometimes the same people) is critical to ensure an unbiased evaluation of the results (Shultz *et al.,* 2002). Statistical analysis of a study also could be biased through the selective use and reporting of statistical tests. The best way to avoid this type of bias is when the data scientist is blinded until the entire analysis is complete (Probost *et al.,* 2016).

To be effective, the FIFA11+ program requires long-term use (at least 10–12 weeks) and regularity (at least twice a week) (Bizzini *et al.,* 2015). Conducting research on professional sports teams can therefore be a problem because some coaches are unwilling to introduce new exercises into their training sessions and are not patient.

The prepared running exercises are adapted to a football field, which, for example, is over three times larger than a basketball field. However, American football and lacrosse fields have similar dimensions. The type of surface is also different for basketball. It is a dance floor, and the rest of the sports are played on the grass. We know that the type of surface may have an impact on trauma. The studies of Calloway *et al.* (2019) showed that playing on artificial turf increases the risk of ankle injury than playing on natural grass; however, the overall injury rate did not show statistically significant differences between surfaces (Calloway *et al.,* 2019).

In studies dedicated to implementing FIFA11+, it was difficult to apply blind intervention as the program is popular and available online. It is important to educate the coaches and players who perform the exercises. A lot of material has been produced

in the form of films, posters, and manuals (Bizzini and Dvorak, 2015). Unfortunately, this reduced results in the PEDro scale.

After analyzing the publications, we were able to find less-known preventive programs that were created for other sports. They were NetballSmart Dynamic Warm-Up for netball (McKenzie *et al.,* 2019), i.e. a game similar to basketball, and the Activate Injury Prevention Exercise Program for rugby (Barden *et al.,* 2021), i.e. the equivalent of American football. By analyzing them, it can be concluded that they are based on the FIFA11+ program. They consist of running exercises, strengthening the core, direction changes, landing technique, and plyometry. Studies have shown that the Activate program can reduce the number of soft tissue and ligament injuries by 26–40% and the number of concussions by 29–60% in young and adult rugby players (Hislop *et al.,* 2017), (Attwood *et al.,* 2017). This proves the rightness of the use of preventive programs in sports teams. It doesn't have to be FIFA11+. It is worth adjusting the warm-up program to the specificity of the sports discipline. They can reduce the risk of injury, saving you money on treatment. Healthy players can also contribute to success in matches and tournaments.

Although only two studies met the criteria to be included in the current systematic review, and the scientific quality of these studies was assessed as average, we think there is still scientific potential in the implementation of FIFA11+ across team sports than soccer. Since common types of injuries occur in different kinds of sport, implementation of standard low-cost injury prevention warm-up might be beneficial both for players and clubs. Although Longo *et al.* confirmed that FIFA11+ is effective in reducing rates of injuries in male basketball players (Longo *et al.,* 2012), Nuhmani showed no enhancement in sports performance parameters such as sprint speed, agility, and vertical jump performance in amateur female basketball players. Unfortunately, Nuhmani did not report any data regarding the injuries; thus, the study was not introduced in this systematic review. Following the scientific discussion dedicated to health-related, sport-related and economical-related benefits of implementing the FIFA11+ in football/soccer, it is probable that similar scientific discussion might have a place in other types of sport. However, we still need more data.

Study limitation

The creation of the application that was used to select publications shortened the time needed to prepare the flow chart. This made it easier to write the article, and it is worth considering this solution in writing future systematic reviews. However, automatically rejecting articles after selected words in the title could have missed a useful publication. For example, excluding a publication after the word "football" may have rejected an article describing American football players. Although we put a relevant effort during the development process, and close contact with the developer was maintained through this process, it might be possible that some relevant papers might have been missed and not included in this systematic review. Additionally, expanding the number of searched databases also might result in a larger number of relevant papers.

Conclusions

Up to date, only a few large-scale randomized control trials have been published regarding the effectiveness of FIFA11+ injury prevention program in other sports than soccer, and their results are contradictory; the impact of this program still needs to be verified in the future. The publications should be designed following the best quality criteria (mainly including blinding assessors, intervention, allocation) and with well-powered sample size.

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