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Is the Pilates method effective in preventing musculoskeletal injuries in football players? A narrative review

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Abstract

Football is one of the most demanding team sports, as it requires a complex combination of technical skills and excellent physical fitness across various parameters. At the same time, due to the significant strain placed on the musculoskeletal system during both training and matches, football players are prone to musculoskeletal injuries. Therefore, supplementary training is recommended to prevent such issues. The aim of this narrative review was to investigate whether the Pilates method is effective in preventing musculoskeletal injuries in football players. A literature search was conducted to identify relevant studies, and articles focusing on traditional football or futsal were included. According to the findings of the present study, research on this topic is limited and highly heterogeneous, mostly involving amateur football players of both sexes and different ages, with all studies focusing exclusively on mat-based Pilates. Based on the synthesis of findings, Pilates exercises appear promising in preventing mechanical low back pain and indirectly preventing musculoskeletal injuries (e.g. muscle strains) by improving joint range of motion (ROM) and muscle flexibility. Specifically, the long-term effects of Pilates (practice for over a month) include reduced recurrence of low back pain, increased ROM of major lower limb joints (hip, knee, and ankle), and improved spinal ROM (flexion, extension, lateral flexion). However, further research is needed to confirm these findings, and future studies should also be conducted on professional football players.

Keywords: Pilates, Football, Injury Prevention, Flexibility, Range of Motion

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Introduction

Football is one of the most demanding team sports, as it requires a complex combination of technical skills that in turn require excellent fitness in a variety of parameters (Smpokos, Mourikis, Theos, & Linardakis, 2019). The intense demands of the sport require intensive and multifaceted training. At the same time, due to the heavy loads on the musculoskeletal system both during training and during matches, footballers are prone to musculoskeletal injuries. Therefore, it is suggested to carry out additional training, with the aim of preventing similar problems (Biz et al., 2021).

Among the most common injuries in footballers are hamstring (OM) sprains (Ekstrand et al., 2023), many of which are attributed to the muscular demands of intense stretching during high-intensity football movements (Kamandulis et al., 2023). In particular, it has been recorded that these injuries are now the most common, constituting 19% of all injuries in professional footballers (Ekstrand et al., 2023). A key predisposing factor for the induction of fracture in muscles of the lower limbs (OM, quadriceps, adductors) in football athletes is the shortening of the muscles which in turn leads to reduced flexibility (Bertolla, Baroni, Leal Junior, & Oltramari, 2007; Bradley & Portas, 2007; Witvrouw et al., 2003). In addition, a significant number of footballers experience low back pain, with the percentage amounting to at least 27% of the team (Morales-Neira et al., 2023). Notably, in a previous survey, 57% of high-level female footballers reported back pain in the last 12 months (Tunås, Nilstad, & Myklebust, 2015).

In recent years there has been growing interest in investigating the Pilates method in terms of its effectiveness in preventing similar problems in athletes of various sports (Giufrida, da Cruz, de Oliveira Rosa, & de Souza Vespasiano, 2020; Kamatchi et al., 2020). Pilates is an exercise method created by Joseph Pilates. He called it "Contrology" and had been teaching it systematically since 1927 in his studio in New York. The exercises of the method can be done either on the ground (with body weight or with light equipment) or on specially designed machines, such as the Reformer, Cadillac, Barrel, Wunda Chair, etc. (Malliou, 2023). Pilates training aims to improve flexibility while emphasizing core muscle strength, posture, and coordination of movement with breathing (Chinnavan, Gopaladhas, & Kaikondan, 2015). Now, this method, in addition

to promoting general fitness, is widely used for the prevention and management of musculoskeletal problems in a variety of populations.

Taking into account the various benefits associated with this exercise system, the purpose of this narrative review was to investigate whether the Pilates method is effective in preventing musculoskeletal injuries in female football athletes.

Methodology

To find articles, a literature search was carried out on Google Scholar, PubMed, Research Gate, Scopus, Science Direct, and freely on Google, using combinations of the terms "Football", "Soccer", "Pilates", "prevention" and "flexibility" as keywords. Additional relevant studies were found in the bibliographic sources of the articles found. Surveys focused on classic football or indoor football were included, while those related to Australian football or were only available in summary form were excluded.

Results-Discussion

As it has been found, the research that has investigated the effectiveness of the Pilates method in the prevention of musculoskeletal injuries in football athletes is almost non-existent, as only one relevant research was found (Morales Neira et al., 2023). In the other studies included in this review, the improvement of the parameters under consideration (flexibility of the spine and lower limbs and abdominal strength) indirectly contributes to the reduction of musculoskeletal injuries. For example, it is reported that lack of flexibility and muscle strength not only limit athletic performance, but also contribute to postural imbalance and increased risk of musculoskeletal injuries (Pertile et al., 2011). On the contrary, maintaining satisfactory flexibility and muscle strength contributes to proper posture and body control, promoting safety, stability and effective performance of sports activities (Claros Vidarte, & Villada Grajales, 2020). Therefore, similar surveys were considered relevant to the topic under investigation and were included in the study.

All the research found focused on Pilates on the ground with body weight (in no research did the machines of the method be used). Otherwise, the surveys were quite heterogeneous: in one of them, the participants were indoor footballers, while in the rest the participants were classical football players. The samples differed in gender (only men or only women or both sexes), age (minors, adults or a mixture of both age groups) and

the context of the group (club, university group). It is noteworthy that no research was found that focused on professional footballers.

In addition, several of the included surveys lacked sufficient methodological competence: for example, some of them do not describe the content of Pilates workouts (Claros Vidarte, & Villada Grajales, 2020; Morales Neira et al., 2023), so it cannot be understood which elements of the training are responsible for the differences or improvements achieved. On the other hand, in the research of Chinnavan et al. (2015) does not adequately explain the stretching protocol applied by their experimental team, which makes it impossible to draw conclusions about where this training was lagging behind Pilates. Also, the research of Bertolla et al. (2007) had a limited number of participants (n=11), therefore it does not have sufficient statistical strength. Therefore, due to the heterogeneous research and the aforementioned methodological weaknesses, any comparative results should be interpreted with reservation and are not generalizable, while they do not in any way concern professional footballers but only amateurs.

The surveys included in this study are summarised in terms of their key elements (purpose and measurements, groups, protocols, results) in Table 1.

Table 1. Characteristics of surveys.

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Authors/Country	**Purpose**	**Groups**	**Intervention**	**Results**
Bertolla et al. (2007) Brazil, South America	Comparison of hip EC and SL (Sit and Reach and anterior SL flexion with inclinometer) within groups (before, at the end and 15 days after retention) and between groups (PO and OE)	N = 11 male indoor footballers (17-20 years old) PO: Pilates on the ground (n=6) OE: No interference (n=5)	3 tm/w,4w. Exercises: Leg Circles, Up and Down, Scissors, Side Kick, The Saw, Spine Stretch, Shoulder Bridge, Neck Pull, Push Up, Rest Position.	*Better performance of PO (within the team in all measurements and between teams).
Chinnavan and co. (2015) India, Asia	Comparison of hip EC and HS (Sit and Reach and Straight Leg Raise Test with goniometer) in PO and OE	N = 30 male and female University football players (17-20 years old) PO: Pilates on the ground (n = 15)	5 times/week X 4 weeks (X 30 minutes of training). Exercises: Same as Bertolla and co. (2007).	*Better performance of PO (within the team in all measurements and between teams).

	within groups (before and after) and between groups.	OE: Stretching (ballistic, PNF, and static for OM) (n = 15).		
Claros Vidarte και Villada Grajales, (2020) Colombia, South America	Comparison of EC joints of the lower limbs (flexion, extent, hip adduction and abduction, knee flexion, dorsal flexion of the PDC), and the SL (flexion, extent, right and left lateral flexion) (Comparisons within the groups.	N = 40 young youth players (the majority 17-18 years old) from two football clubs. PO: Pilates on the ground (n=20) OE: No interference (n=20).	3 months. Exercises: No description of the protocol.	*In all variables, PO. OE only in the hip extension of the right lower limb, in the left flexion of the SL and in the strength of the abdominals.
Morales Neira et al. (2023) Ecuador, South America	Comparison of Pilates and Williams Muscle Strengthening System in Delay of Recurrence of Mechanical Leg Pain in Football Players.	N = 65 male footballers (18-28 years old) from various clubs. PO1: Pilates on the ground (n=20). PO2: Williams exercises (n=21). OE: No interference (n=24).	2 years, at least 3 times a week (5 minutes in the warm-up and 20 minutes at the end of training). Exercises: No description of the protocols.	*Between the teams: PO1 and PO2 much better results than OE. PO1 and PO2 similar results.
Pertile and co. (2011) Brazil, South America	Comparison of hip EC and SS (Sit and Reach and torso flexion from an upright position with an inclinometer) and isometric muscle strength of the SS extensors (dynamometer), within groups (before, after and 15 days of maintenance).	N=26 minors, young footballers (16.5±0.7 years old) of the SERC Brasil/UCS team. PO1: Pilates on the ground (n=9) PO2: Therapeutic exercise (n=9). OE: No interference (n=8).	4 weeks x 3 times/week (x 25 minutes). 1-2 week: 3 sets x 10 repetitions for each exercise 3-4 week: 3 sets x 15 reps ΠΟ1: Double Leg Stretch, Leg Pull Front, Double Leg Kick, Swimming, Swan Dive. PO2: 5 conventional kinesiotherapy exercises (	* In all variables (except force) only PO2.
Famisis and co.	Comparison of	N = 16 female	Exercises:	PS1 and PS2 are

(2017) Greece, Europe	the direct effects of a single Pilates workout with fewer repetitions versus a single Pilates workout with more repetitions in the EK of the basal joints of the lower limbs	amateur footballers (26.2 ± 3.8) who performed the two protocols with a difference of one week between the two. PS1: 5 repetitions per exercise. PS2: 10 repetitions per exercise.	Front-Back, Single Straight Leg Stretch, Up-Down, Leg Pull Front, Single-Leg Kick.	equally effective in increasing the EP of all movements.
Famisis et al. (2016).	Comparison of the direct effects of a single Pilates workout with full EC versus a single Pilates workout versus a single Pilates workout with a single Pilates workout with limited EK. Measurements same as Famisis and co. (2017).	N = 18 female amateur footballers (25.6 ± 3.5) who performed the two protocols with a difference of one week between the two. PS1: 10 repetitions of the exercises in full EC. PS2: 10 repetitions of the exercises in limited EC.	Exercises: The same as those of Famisis and co. (2017).	*Only MS1 in all variables.

EC: Range of Motion. OE: Control Group. OM: Posterior femurs. PDK: Ankle joint. PO: Experimental Group. MS: Experimental Condition. SS: Spine. *: Statistically significant differences.

Based on the results of this review, Pilates appears to be effective in preventing back pain and indirectly preventing musculoskeletal injuries through improving range of motion (EC) and flexibility. Specifically, the implementation of Pilates exercises led to a significant reduction in the time of occurrence of back pain recurrence (20.95 months) in adult male footballers, in contrast to a control group (OE) whose relapse time was just 12.71 months (Morales Neira et al., 2023). As far as EP is concerned, significant improvements were found after the application of Pilates exercises in both indoor footballers (Bertolla et al., 2007) and classical football athletes (Claros Vidarte & Villada Grajales, 2020; Chinnavan et al., 2015), who noted an increase in the flexibility of the OM and low dorsal joints during the anterior flexion of the spine, while Pilates proved to

be more effective than stretching in improving these parameters (Chinnavan et al., 2015).

More specifically, in the research of Bertolla et al. (2007), gym footballers who practiced Pilates increased the combined flexibility of the lower back and OM in both the tests they performed (Sit and Reach Test and Front Spine Bending from an Upright Position) both in relation to OE and at different times of measurements (before, after, and 15 days of maintenance). These results can be explained based on the exercises applied, most of which – at some stage of the exercise – include either isolation stretching of the OM (Leg Circles, Scissors, Shoulder Bridge, Side Kick) or low back (Rest Position) or simultaneous stretching of the OM and low back (The Saw, Spine Stretch, Neck Pull, Push Up). Although the number of participants in this intervention was small, in the absence of a sufficient number of studies on footballers, the results are exploitable, as they confirm what could be assumed by an exercise professional anyway, namely, that these exercises would improve the EC of the joints and therefore of the flexibility of the muscles. In that regard, Chinnavan and Others. (2015), who compared the effectiveness of a Pilates protocol similar to that of Bertolla et al. (2007) versus a stretching program (ballistic, PNF and static for OM) recorded that Pilates led to a statistically significant increase in flexibility in both measurements performed (Sit and Reach and Straight Leg Raise Test with a goniometer) both in relation to OE (stretching) and at different times of measurements (before and after). These results reinforce the view on the effectiveness of these exercises in improving EP and flexibility. However, as mentioned above, researchers have not accurately described the stretching program, so it is not possible to attempt a hypothesis about why stretching was not as effective as Pilates. Respectively, in the research of Claros Vidarte and Villada Grajales (2020), the Pilates protocol they applied led to a statistically significant improvement in the EC of the basal joints of the lower limbs and spine in flexion, extension and lateral flexion. However, even in this case, the absence of a reference and description of the exercises of the program makes it difficult to draw safe conclusions.

Surprisingly, in the research of Pertile et al. (2011), where the effectiveness of Pilates exercises versus conventional kinesiotherapy exercises in young footballers was compared, only the second group saw an improvement in the combined flexibility of the OM and low backs, while neither group saw an improvement in the strength of the SS extensors. According to the authors, this is because, based on the literature, the Pilates method yields results in the medium and long term. Therefore, they judge that the

conventional exercises they applied are more effective than the more complex exercises of the Pilates method in the short term in increasing flexibility. Looking at the exercises applied by the researchers, indeed the exercises of the Pilates method were more complex, requiring greater coordination and better control of the body (Table 1). However, since the exercises of both groups focused mainly on strengthening the SA extensors, in our view, the lack of improvements in flexibility would have been to be expected. For the same reason, it is not clear through which mechanism the conventional exercises they applied, which were mainly based on torso extension, led to an increase in flexibility during torso flexion but not to an improvement in the strength of the SS extensors. Also, as will be shown immediately below, Pilates can also bring about immediate improvements in EP, so the argument that long-term sessions are needed to achieve results cannot be generalized.

In the investigations of Famisis and co. (2016, 2017) who studied only the acute effects of a Pilates workout on lower limb flexibility found that performing five exercises was equally effective whether five repetitions or ten repetitions were performed (2017), while a key prerequisite for achieving this improvement was that the movements were performed in full and not in limited EC (2016). The conclusion of the researchers' second study is probably expected, as it would not be expected to achieve an increase in EP when the exercises are deliberately performed conservatively and in a way inferior to the athlete's capabilities. In both protocols, the acute effects on EC are attributed, according to the authors, to a selection of exercises that dynamically and purposefully stretch specific muscles (the Front-Back the iliac psoitis, the Single Straight Leg Stretch the OM, the Up-Down, the adductors, the Leg Pull Front, the plantar flexors and the Single-Leg Kick the hip flexors), which act on the joints evaluated with the measurements. This last observation, in combination with the above-mentioned, confirms that when planning Pilates workouts for soccer players (and not only), specific exercises should be chosen according to the goals pursued.

Conclusion

The application of Pilates exercises seems promising in preventing frequent recurrences of low back pain in adult male amateur footballers and in increasing the flexibility of OM and core muscles in non-professional footballers of different ages of both sexes. The increase in flexibility implies the treatment of muscle shortening and is indirectly linked to the prevention of sprains in the muscles of the lower limbs. However,

more research is needed to confirm these findings, and it is also suggested that professional footballers should be tested in the future.

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