`Research article`

Clinical Hip Osteoarthritis in Current and Former Professional Footballers and Its Effect on Hip Function and Quality of Life

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Abstract

The objective of the study was to establish the prevalence of clinical hip osteoarthritis in current and former professional footballers and to explore its consequences on hip function and health-related quality of life (HRQoL). A cross-sectional study by means of questionnaire was conducted among current and former professional footballers fulfilling the following inclusion criteria: (1) male (2) active or retired professional footballer (3) member of FIFPRO (Football Players Worldwide) (4) between 18 and 50 years old (5) could read and understand texts in French, Spanish, or English. Controls (matched for: gender, age, body weight and height) were also recruited. The main outcome measures were clinical hip osteoarthritis, hip function and HRQoL. Questionnaires were sent to 2,500 members of which 1,401 participated (1,000 current and 401 former professional footballers). Fifty-two controls were recruited. Prevalence of hip osteoarthritis was 2% among current and 8% among former professional footballers. Hip function was significantly (p ≤ 0.001) lower in both types of footballers with hip osteoarthritis than in footballers without hip osteoarthritis and controls. Current and former professional footballers with hip osteoarthritis reported significantly lower physical health scores (p = 0.032, p = 0.002) than those without. Hip osteoarthritis led to a significantly lower score in the physical (p = 0.004) and mental (p = 0.014) component of HRQoL in former footballers compared to the controls, while in current footballers only the physical component was significantly (p = 0.012) lower compared to the controls. Hip osteoarthritis has a higher prevalence in former than in current professional footballers and impacts hip function and HRQoL negatively.

Key words: Coxarthrosis, osteoarthritis, professional, football, function, quality of life.

Introduction

Participating in sports is associated with many benefits such as a lower likelihood to develop diabetes, osteoporosis and cardiovascular diseases, and having better coping strategies and quality of life (Andersen et al., 2000; Khan et al., 2012; Lemez and Baker, 2015; Malm et al., 2019; Oja et al., 2015). In elite athletes, there is even support of superior longevity, mainly in endurance and mixed sports (Lemez and Baker, 2015). The negative effects of elite sports are less often mentioned, apart from injuries. Recent evidence suggests that elite athletes are likely to report mental health symptoms during their career, with prevalence ranging from 5 to 45% (Reardon et al., 2019). In the past years, more research was done about the long-term effects of elite sports. An increased prevalence of lower limb osteoarthritis (OA) was seen in former elite athletes, being higher than in the general population matched by gender and age (Alentorn-Geli et al., 2017; Gouttebarge et al., 2015; Kuijt MT, 2012; Tran et al., 2016; Vigdorchik et al., 2017). Potential risk factors mentioned in the scientific literature are participating in contact-sports, joint injury and related surgery (Gouttebarge et al., 2015; 2018a; Tveit et al., 2012).

Among former professional footballers (soccer players), the overall prevalence of lower limb OA is estimated to be around 33% (Gouttebarge et al., 2018b). OA in former professional footballers was shown to range from 12 to 17% for the ankle, from 15 to 80% for the knee and from 9 to 21% for the hip (Kuijt MT, 2012; Petrillo et al., 2018). Early development of knee OA in professional footballers is often related to anterior cruciate ligament reconstruction or meniscectomy (Petrillo et al., 2018). When looking at ankle OA in specific 94% of players with ankle OA reported having >1 ankle injury and 62% reported having >1 ankle surgery (Paget et al., 2020). Former professional footballers with a history of ankle surgery were 2.1 as likely to report ankle OA than those players without a history of ankle surgery (Paget et al., 2020). A reduction in function of the knee was noticed in current and former professional footballers with knee OA compared to players without knee OA and to the general population (Gouttebarge et al., 2018a). Around 90% of former professional footballers with OA reported having discomfort and moderate or severe pain of the affected joint (Gouttebarge et al., 2018b). A systematic review in 2014 showed that up to 17% of former professional footballers reported knee pain during daily activities (Gouttebarge et al., 2014). Work related problems or limitations were reported by 28% of former professional footballers suffering from OA (Gouttebarge et al., 2014). Both physical and mental components of HRQoL were reported to be significantly lower in former professional footballers with OA compared to former footballers without OA (Gouttebarge et al., 2018b).

Most of above-mentioned findings, however, are based on overall OA of the lower limb. Similar information regarding the prevalence and consequences of hip OA in professional footballers is scarce. Such epidemiological information is needed in order to define strategies for the prevention of the condition, as well as for the development of support measures for players. Consequently, the objectives of this study were to establish the prevalence of clinical hip OA in current and former professional footballers and to explore its consequences on hip function and HRQoL. Three research questions were formulated, namely: (1) What is the prevalence of clinical hip OA in current and former professional footballers? (2) What is the hip function in current and former professional footballers with and without clinical hip OA and how does this compare to a control group of non-elite athletes? (3) What is the level of HRQoL in current and former professional footballers with and without clinical hip OA and how does this compare to a control group of non-elite athletes?

Methods

Design

We conducted a cross-sectional study by means of questionnaire, using of the statement from "Strengthening the Reporting of Observational Studies in Epidemiology" to ensure the quality of our report (Vandenbroucke et al., 2014). The study was given ethical approval by the Medical Ethics Review Committee of the Academic Medical Center (W16_366#16.431). The study was conducted in accordance with the Declaration of Helsinki (2013).

Study participants

Study participants were current and former professional footballers. Our definition for a current or former professional footballer was that: (1) he trains or has trained to improve football performances (2) he competes or has competed in one of the two highest national leagues in his country (3) competition and training are or were a main occupational activity. A player was eligible if: (1) male (2) active or retired professional footballer (3) member of FIFPRO (Football Players Worldwide) (4) between 18 and 50 years old (5) able to read and understand texts in French, Spanish, or English. Assuming an anticipated population proportion of 20% for hip OA (objective 1), a sample size was calculated indicating the need of 196 participants in each study group (power of 80%, confidence interval of 95%; absolute precision of 5%). (Woodward, 2014) As we expected a response rate of around 30% (indicated by previous studies in professional athletes), we aimed to reach at least 1300 participants (650 per group) (Gouttebarge et al., 2016; Schuring et al., 2016).

Matched controls

Participants were asked to find one control from their non-elite sport network who were comparable in the following variables: gender, age, body weight and height. The matching was done to reduce risk of pattern and selection bias. Suitable matched controls received information and were asked to fill in the same questionnaires.

Outcome measures

We used the NICE criteria (adapted for age) to define OA, which was described as the joint's cartilage damage that leads to activity-related pain of the joint with either morning stiffness that is less than 30 minutes long or no morning joint-related stiffness (National Clinical Guideline, 2014). Information about the presence of clinically diagnosed hip OA was retrieved by asking a single question ('Have you been diagnosed with osteoarthritis in the hips by a medical professional?'). To answer this question, participants were asked to consult either their physician or their medical record.

Hip related impaired activities and pain were assessed by using the Hip dysfunction and Osteoarthritis Outcome Score Shortform (HOOS-PS) (Lyman et al., 2016; Nilsdotter et al., 2003). Six items were measured on a 5-point scale and subsequently converted to a total score from 0 to 100, where 0 represents total disability of the hip and a score of 100 represents perfect health of the hip (Nilsdotter et al., 2003). To inquire about HRQoL, the Patient-Reported Outcomes Measurement Information System Global Health short form (PROMIS-GH) was used (Hays et al., 2009). Using 10 items scored on a 5-point scale, the Global Mental health and Global Physical Health scores were calculated (Hays et al., 2009). Both scores ranged from 0 to 100, with a lower score indicating a worse quality of life and the mean score of 50 indicating the standard in the general population (Hays et al., 2009). We chose the HOOS-PS and the PROMIS-GH because they have been validated in multiple study populations and different languages among those French, English and Spanish (Hays et al., 2009; Lyman et al., 2016; Nilsdotter et al., 2003).

Procedures

Using LimeSurvey professional (LimeSurvey GmbH, Hamburg, Germany), we compiled a digital anonymous questionnaire available in French, English and Spanish. This questionnaire included the following descriptive variables: age, height, body-weight, duration of professional football career, level of play, nature and duration of retirement, level of education, and current employment status. FIFPRO's administration sent information about the study to potential participants. All participants gave their electronic informed consent and filled in the questionnaire (within 2 weeks, reminders being sent after 2 and 4 weeks). Contribution to the study was done voluntarily and no reward was given for participating.

Statistical analyses

Data analyses were conducted with IBM SPSS statistics 26. By using height and weight, Body mass index (BMI) was calculated in $kg \cdot m^{-2}$. For all variables included in the study a descriptive data analysis (e.g., standard deviation (SD), mean, frequency, median) was performed. The proportion of the number of participants with hip OA compared to the total number of participants was used to

calculate the prevalence of hip OA (percentages), using the Wald method for the calculation of 95% confidence interval (CI) (Woodward, 2014). The Chi-square test was used to calculate the difference in prevalence between current and former professional football players (Woodward, 2014). The level of hip function and HRQoL were both descriptively analyzed in the group of participants (both with and without hip OA) and in the group of matched controls. The Kolmogorov-Smirnov test and Mann-Whitney test (independent samples) was used to determine normal distribution and make comparisons between groups, respectively (Woodward, 2014). A cut off value of $p < 0,05$ for significance was chosen.

Privacy and confidentiality
Potential participants were recruited with blinding of the principal investigator. The anonymous questionnaires ensured privacy and confidentiality. Questionnaires were stored on a secured electronic server to which only the principal investigator had access.

Results

Participants
From the 2500 current and former professional footballers that were contacted, there were 1,401 players who gave informed consent and filled in the questionnaires (1,000 current and 401 former professional footballers). A total of 52 controls were recruited. In current professional footballers the mean age was 26.1 (SD 4.5) years with an average career duration of 7.3 (SD 4.4) years. The mean age of retired players was 36.5 (SD 5.5) years with an average career duration of 11.3 (SD 4.7) years. All characteristics of the participants are presented in Table 1.

Hip osteoarthritis
Prevalence of hip OA was 2% (95% CI 1.6-3.6) among current professional footballers. The prevalence among former professional footballers was 8% (95% CI 5.7-11.1). Comparison showed a significantly higher prevalence of

hip OA in former professional footballers than in current professional footballers ($X^2 = 23.23$; df = 1; $p \leq 0.001$).

Hip function
Both current and former professional footballers with hip OA reported a lower HOOS-PS score than players without hip OA. A mean score of 74.4 was reported by current professional footballers with hip OA while current players without hip OA reported a mean of 92.7 (Mann-Whitney test: U = 3614; Z = 5.64; $p \leq 0.001$). Former professional footballers with hip OA reported a mean HOOS-PS 56.6 while those without hip OA reported a mean of 92.9 (Mann-Whitney test U = 722.7; Z = 9.03; $p \leq 0.01$). The control group reported a mean HOOS-PS score of 91.2 (SD 14.5). The footballers with hip OA reported significant lower scores of the HOOS-PS than the control group: 74.4 (Mann-Whitney test U = 243.5; Z = 3.68; $p \leq 0.001$) for the current and 56.6 (Mann-Whitney test U = 139; Z = 6.25; $p \leq 0.001$) for the former professional footballers. The HOOS-PS scores of both current and former footballers without hip OA were similar to the scores reported in the control group. All data about hip function are presented in Table 2.

Health-related quality of life
Current professional footballers with hip OA reported mean scores of 47.7 and 50.0 for the physical and mental health components, respectively. Those without hip OA reported higher scores: 50.8 (Mann-Whitney test U = 6739; Z = 2.14; p = 0.032) and 51.2 (Mann-Whitney test U = 9500.5; Z = 0.19; p = 0.853) for the physical and mental health scores components, respectively. Former professional footballers with hip OA reported mean scores of 47.7 and 48.9 for the physical and mental health components, respectively. Those without hip OA reported higher scores: 51.3 (Mann-Whitney test U = 3539; Z = 3.04; p = 0.002) and 51.7 (Mann-Whitney test U = 4391; Z = 1.54; p = 0.124) for the physical and mental components, respectively. See Figure 1 for a visual representation of the physical and mental scores in current and former professional footballers with and without hip OA.

Table 1. Participant characteristics.

Variables	Current (n = 1000)			Former (n = 401)			Control
	Total	No hip OA	With hip OA	Total	No hip OA	With hip OA	(n = 52)
Age (yrs; mean ± SD)	26.1 ± 4.5	26 ± 4.4	29.0 ± 4.6	36.46 ± 5.5	36.5 ± 5.6	36.2 ± 5.3	39.4 ± 6.6
BMI (kg/m²; mean ± SD)	23.3 ± 1.8	23.2 ± 1.8	23.5 ± 1.8	24.9 ± 2.2	24.9 ± 2.2	25.3 ± 1.8	29.4 ± 5.4
Duration of football career (yrs; mean±SD)	7.3 ± 4.4	7.3 ± 4.4	9.7 ± 5.4	11.3 ± 4.7	11.2 ± 4.7	12.0 ± 4.3	-
Duration of retirement (yrs; mean ± SD)	-	-	-	5.3 ± 4.1	5,2 ± 4.0	5.8 ± 4.8	-
Played in highest league (%)	67.1	66.8	79.2	80.9	79.8	93.5	-
Employed (%)	-			88.8	88.4	93.8	88.5
Voluntary retirement (%)	-			70.6	71.1	65.6	-
Level of education (%)							
No school	2.1	2.1	0	0.5	0	6.3	-
Nursery/elementary	3	3.1	0	2.6	2.8	0	-
High School	45.2	45.5	33.3	28.1	29.2	15.6	-
Vocational/Technical school	15.8	15.9	12.5	7.9	7.2	15.6	-
College, university or equivalent	33.9	33.4	54.2	60.9	60.7	62.5	-

OA = osteoarthritis, SD = standard deviation, BMI = body mass index.

Table 2. Outcome measures. *hip dysfunction and osteoarthritis outcome score shortform.

Outcomes	Current (n = 1000)			Former (n = 401)			Control
	Total	No hip OA	With hip OA	Total	No hip OA	With hip OA	(n = 52)
HOOS-PS total score (mean ± SD)	92.3 ± 13.7	92.7 ± 13.4	74.4 ± 16.2	90.3 ± 17.2	92.9 ± 13.5	56.6 ± 20.5	91.2 ± 14.5
Physical health (mean ± SD)	50.7 ± 7.3	50.8 ± 7.3	47.7 ± 5.9	51.0 ± 7.6	51.3 ± 7.6	47.7 ± 6.7	53.1 ± 9.1
Mental health (mean ± SD)	51.2 ± 7.4	51.2 ± 7.4	50.0 ± 9.2	51.5 ± 8.1	51.7 ± 8.0	48.9 ± 9.1	53.8 ± 7.3

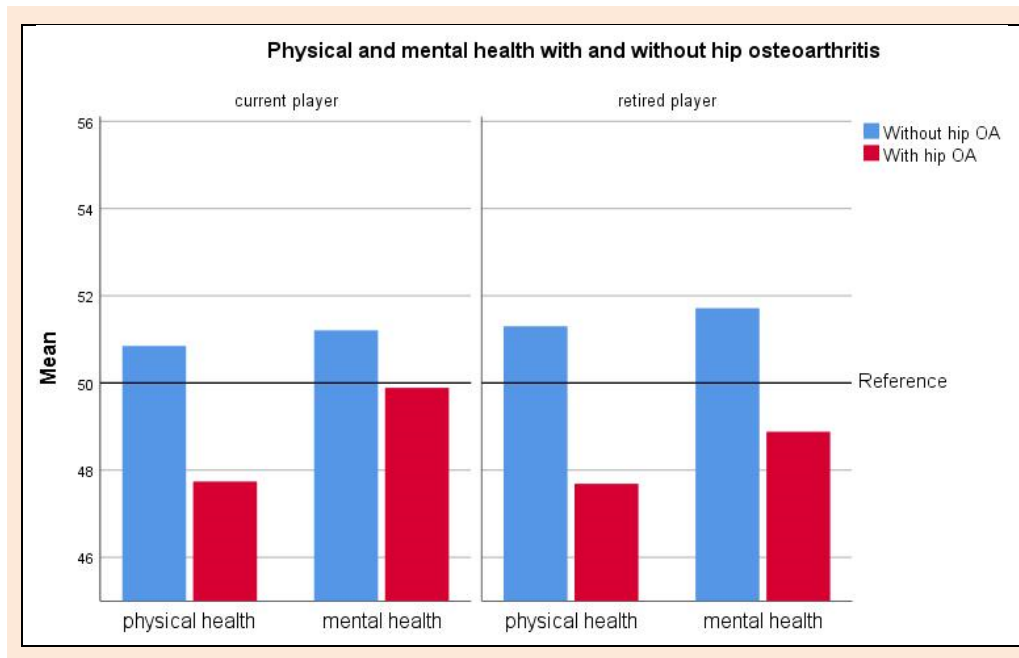HOOS-PS = hip dysfunction and osteoarthritis outcome score shortform.

Figure 1. Physical and mental health with and without hip osteoarthritis. With the general US population as reference.

The control group reported mean scores of 53.1 and 53.8 for the physical and mental health components, respectively. The current professional players with hip OA reported a significantly lower physical health score 47.7 (Mann-Whitney test U = 322; Z = 2.51; p = 0.012) compared to the control group but not a significant lower mental health score 50.0 (Mann-Whitney test U = 436; Z = 1.07; p = 0.286). The current professional footballers without hip OA reported a significantly lower mental health score 51.2 (Mann-Whitney test U = 1804.5; Z = 1.97; p = 0.049) when compared to the control group. The current professional footballers without hip OA did not report a lower physical health score (Mann-Whitney test U = 1815.5; Z = 1.92; p = 0.055) when compared to the control group. Former professional footballers with hip OA reported significantly lower scores both in the physical 47.7 (Mann-Whitney test U = 462.5; Z = 2.9; p = 0.004) and mental 48.9 (Mann-Whitney test U = 506.5; Z = 2.46; p = 0.014) components. The former professional footballers without hip OA showed no significant difference compared to the controls. The total mean of both the physical and mental components and the standard deviations are presented in Table 2.

Discussion

The main findings of our study were: (1) prevalence of hip OA was 2% among current and 8% among former professional footballers; (2) hip function was significantly lower in both current and former professional footballers with hip OA than in those without hip OA or in the control group; (3) former and current professional footballers with hip OA reported significantly lower physical health scores than those without hip OA; (4) hip OA led to a significantly lower score in both components of HRQoL in former professional footballers when compared to the controls, while in current professional footballers only the physical component was significantly lower compared to the controls.

Perspective of the findings

Hip OA is a common problem in the general male population with prevalence ranging from 0.3% to 8.3% (age >19) (Guillemin et al., 2011). A lot of variance is seen in prevalence of hip OA because of the definition used and whether radiological imaging is used or not for diagnosis (Parsons et al., 2015). In our study, the prevalence of clinical hip OA was around 2% among current players and around 8% among former professional footballers. We know, however, that prevalence of OA rises with age (Lespasio et al., 2018; Quintana et al., 2008). Therefore, we decided to run a post hoc analysis by splitting arbitrarily both current and former professional footballer into three different age groups. Among current professional footballers, prevalence of hip OA was 1%, 3% and 5% for the age groups 18-24 years, 24-30 years and >30 years, respectively. Former professional footballers showed a prevalence of hip OA of 8%, 8% and 10% for the age

groups <35 years, 35-40 years and >40 years, respectively. Our results confirm that prevalence of hip OA increases with age, and that the condition is already present among current professional footballers.

Former professional football players report a prevalence of hip arthroplasty ranging from 8.9% to 13.5% compared to controls ranging from 0% to 3.8% (Lohkamp et al., 2017; Volpi et al., 2019). This could be expected due to higher prevalence of hip OA and hip arthroplasty being the main treatment for symptomatic hip OA if non-surgical options were without success (Lespasio et al., 2018).

Literature shows that other sports are associated with hip OA. Elite handball has shown a prevalence of hip OA up to 60% (Vigdorchik et al., 2017). A higher prevalence of hip OA is also seen among other impact sports and skiing at the highest level with prevalence ranging from 3% up to 58% (Iosifidis et al., 2015; Vigdorchik et al., 2017).

Development of knee and ankle OA is associated with previous injury of the joint (Gouttebarge et al., 2018a; Paget et al., 2020). In the hip, no such association has been found (Vigdorchik et al., 2017). A link between hip/groin symptoms and a decrease in hip function has, however, been found (Tak et al., 2016).

In current players, we observed that players without hip OA reported a lower mental component score than our control group (having a higher BMI), while players with OA did not report a significantly lower score. This might be explained by two factors: 1) our control group reported a mean mental component score of 53.8, while the general population average is at 50, so our controls scored above average; 2) due to a large number of current players without hip OA, small differences can be significant (Hays et al., 2009). Professional footballers with hip OA reported a significant lower score for the physical component of HRQoL compared to professional footballers without, this is in accordance with earlier studies (Gouttebarge et al., 2018b). The PROMIS method for measuring HRQoL used the US general population as a reference, leading to a score with a mean of 50. So when compared to the general population, our study shows that current footballers with hip OA score lower than average on only the physical component and former footballers with hip OA score lower in both components.

Methodological considerations

There are a few limitations to our study. First, it was a cross-sectional study, so we can show that current and former professional players with hip OA, have a lower hip function and lower physical health scores, but our research cannot prove a direct causal relation. Second, because recruitment procedure was blinded, performing a non-response analysis was not possible. Since a response rate of 56% was achieved with 1,401 current and former professional footballers, we deem that potential bias was avoided and that these results are representative for this population. Third, as in every scientific research, participation was voluntary. This could lead to participation bias because participants with interest in hip OA might be more likely to participate. Fourth, clinical hip OA was diagnosed by a medical professional. The ideal method would be to have all participants clinically

examined at the time of the questionnaire combined with radiological imaging; however, due to a large and spread out sample size, this was not possible.

Recommendations

Based on our findings, we advise that there should be more attention for hip OA and the associated negative effects. Current professional footballers should be guided by the medical teams of their respective clubs. This guidance should focus on the prevention of recurrent injuries, while players should also be informed about the consequences that may arise after playing professional football for multiple years, with the focus on effects after retirement. Former professional footballers should prevent deterioration of the condition with focus on pain relief, minimizing disability and keeping the joint as mobile as possible. Also, the After Career Consultation developed by FIFPRO might help players during retirement with the focus on sustainable HRQoL (Gouttebarge et al., 2018c). The After Career Consultation manages this by focusing on five main domains; (1) helping players detrain from professional play; (2) encouraging a healthy lifestyle; (3) focusing on education and employment; (4) remission of OA; (5) and preventing cognitive and mental health problems (Gouttebarge et al., 2018c).

Furthermore, to prove causation and explore the course of OA, a longitudinal study was launched on October 2019 in order to track players between the ages of 28 to 38 during and also after their careers (Gouttebarge et al., 2019). Data collection on various health domains among which OA could help us gain more insight into both the physical and mental health of players and how certain influences (retirement, injuries, etc.) might affect this. This information could be used to develop measures both preventive and curative to attain a high level of both physical and mental health.

Conclusion

Hip osteoarthritis has a higher prevalence in former than in current professional footballers and impacts hip function and HRQoL negatively.

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Key points

- Prevalence of hip OA is 2% among current and 8% among former professional footballers.
- Hip function is significantly lower in both current and former professional footballers with hip OA than in those without hip OA.
- Former and current professional footballers with hip OA report significantly lower physical health scores than those without hip OA.

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