



Health conditions among retired professional footballers: a scoping review

Sean Carmody ^{1,2}, Karlijn Anemaat,¹ Andrew Massey,³ Gino Kerkhoffs,^{1,4,5,6} Vincent Gouttebarga ^{1,6,7,8}

To cite: Carmody S, Anemaat K, Massey A, *et al.* Health conditions among retired professional footballers: a scoping review. *BMJ Open Sport & Exercise Medicine* 2022;**8**:e001196. doi:10.1136/bmjsem-2021-001196

► Additional supplemental material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/bmjsem-2021-001196>).

Accepted 12 April 2022

ABSTRACT

Objective To conduct a scoping review providing an overview of the health conditions occurring in retired male and female professional footballers, with an emphasis on musculoskeletal, mental, neurocognitive, cardiovascular and reproductive health conditions.

Methods In January 2022, a comprehensive systematic literature search in three databases (MEDLINE via PubMed, SPORTDiscus via EBSCOhost and EMBASE) was conducted for common health conditions among retired male and female professional footballers. Primary research studies (full text available online) which described the incidence or prevalence of a health condition (musculoskeletal, mental, neurocognitive, cardiovascular, reproductive) among retired male and female professional footballers were included for review. Case reports, qualitative research and grey literature were omitted.

Results In total, 917 eligible articles were identified from the databases, with 41 meeting the eligibility criteria. Osteoarthritis of the hip, knee and ankle were found to be common among retired professional footballers. Mental health symptoms (eg, anxiety, depression) are experienced by retired male and female professional footballers. The incidence of neurocognitive disease appears to be higher among retired male professional footballers than among matched controls. There is very limited evidence examining the presence of health conditions in retired female professional footballers.

Conclusion Osteoarthritis of the lower limb, musculoskeletal pain and mental health symptoms are common among retired professional footballers. Knowledge about the occurrence and timing of musculoskeletal, mental health and neurocognitive conditions among retired professional footballers can be used by a wide range of stakeholders to proactively intervene during and after a player's career to mitigate risk.

INTRODUCTION

Elite athletes appear to have better long-term health outcomes than the general population.^{1,2} This is likely to apply to professional footballers, although the literature has highlighted specific health conditions which may be prevalent among retired professional footballers, including musculoskeletal,^{3–7} mental^{8–13} and neurodegenerative health conditions.^{14–16}

Summary box

What is already known

- Elite athletes overall seem to have better health outcomes than the general population.
- Musculoskeletal conditions, such as osteoarthritis, appear to be prevalent among retired professional footballers.
- Professional footballers may be at heightened risk of mental health issues during the transition from playing to retirement.

What are the new findings

- Osteoarthritis of the lower limb, musculoskeletal pain and mental health symptoms are common among retired professional footballers.
- There are very limited data available to understand the health issues encountered by retired female professional footballers.
- Knowledge about the prevalence of musculoskeletal, mental health and neurocognitive conditions among retired professional footballers can be used by a wide range of stakeholders to proactively intervene during and after a player's career to mitigate risk.

Professional football is known for its high injury rate compared with other sports, with an injury rate of about 1.3 injuries per player per season.¹⁷ The management of these injuries may occasionally require surgical intervention, and this, along with the cumulative effect of repetitive microtrauma and considerable joint demands, compounds the risk of complications for professional footballers in retirement, especially early-onset osteoarthritis (OA).³ A diagnosis of OA has implications for quality of life, function and broader health (eg, cardiovascular health) in later life.^{18,19} Injury is also a stressor which may predispose a footballer to mental health symptoms, alongside decreased performance, deselection or negative media attention.²⁰ The onset of mental health symptoms appears to be most apparent during the transition to retirement and this may be linked to a loss of identity and the adoption of negative



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Prof. Dr. Vincent Gouttebarga; v.gouttebarga@amsterdamumc.nl



lifestyle behaviours (eg, alcohol excess).⁹ Retirement is likely to lead to reduced physical activity levels by former professional footballers and this, coupled with the aforementioned issues, may have implications for cardiovascular health.²¹

In recent years, significant attention has been given to the relationship between contact sport, concussion and subsequent neurodegenerative disease.^{22–24} With specific reference to professional football, the repetitive subconcussive effects of ‘heading’ is feared to place players at greater risk of conditions such as dementia in later life, although the evidence for this is limited.²⁵ Initiatives to improve the management of concussion in football are underpinned by a desire to protect player welfare long-term.²⁶

The increasing participation of women in sport, especially professional football, has seen a much needed emphasis placed on understanding the influence of sex hormones and the menstrual cycle in female athlete health and performance.²⁷ Nevertheless, the research appears limited with respect to understanding the long-term reproductive health status of professional female footballers.²⁸

Professional football is a highly rewarding career in many instances, and the long-term health benefits of the associated physical activity is undisputed. There is a growing evidence base examining long-term health issues in retired professional footballers, and this has focused on musculoskeletal and mental health issues—although neurodegenerative, cardiovascular and reproductive health may be avenues worth understanding further. Through better understanding, the potential influence of a career in professional football on players’ long-term health, a wide range of stakeholders may be better informed to intervene proactively during and after a player’s career in order to mitigate the risk of these conditions—without detracting from the spectacle of the sport. No scoping review, to our knowledge, has examined the extent of health conditions commonly afflicting professional footballers on retirement. A scoping review of this nature may guide the work of policymakers and other stakeholders, and inform research policy. Therefore, the aim of this study was to conduct a scoping review providing an overview of the health conditions occurring in retired male and female professional footballers, with an emphasis on musculoskeletal, mental, neurocognitive, cardiovascular and reproductive health conditions.

METHODS

Search strategy

The protocol for this scoping review was established by combining the guidelines of the PRISMA Extension for Scoping Reviews (PRISMA—ScR) with a method outlined by Peters *et al.*^{29 30} The final protocol was not published in advance but can be requested from the corresponding author.

In January 2022, a systematic search was carried out in the databases MEDLINE (via PubMed), SPORTDiscus (via EBSCOhost) and EMBASE. Search strategies were tailored according to the database being examined. The

keywords (and synonyms) common to both databases were ‘football/soccer’, ‘retired’ and ‘health conditions’. For each category of health conditions examined, the keywords searched in both databases consisted of ‘musculoskeletal system’, ‘cardiovascular system’, ‘psychological disorders’, ‘neurocognitive disorders’ and ‘reproductive system’. For MEDLINE, the MeSH terms of the different keywords were used where suitable. For synonyms and key words in both databases, the title and/or abstract rather than text word to ensure that the search terms returned were the primary focus of the article. The Boolean command ‘OR’ was used in between synonyms and in between the different categories of health conditions. The Boolean command ‘AND’ was used to combine the keywords (and synonyms) with each other. A more detailed overview of the search strategies used for MEDLINE, SPORTDiscus and EMBASE is outlined in the online supplemental appendix of the article.

Inclusion criteria

The following inclusion criteria were defined:

1. Primary research studies which included prospective and retrospective studies, cross-sectional studies and case-control studies which aim to describe the prevalence of health conditions in a given population.
2. Studies published in peer-reviewed journals whose full-text was available online.
3. Studies written in English, French or Dutch.
4. Retired professional male and/or professional female football players included in the study population.
5. Studies which described the incidence or prevalence of health conditions related to the health categories of interest, that is, musculoskeletal, cardiovascular, neurocognitive, psychological, reproductive.

The following exclusion criteria were defined:

1. Case reports and qualitative research.
2. Grey literature, including conference proceedings (eg, poster presentations), annual reports, dissertations, unpublished and ongoing trials.

Duplicate articles returned in both searches were removed and the criteria stated above applied to the eligible articles. Articles were initially included based on the information detailed in the title and abstract and subsequent retrieval of the full text to confirm the basis for their inclusion. Two independent reviewers carried out this process. In circumstances where there was discordance, consensus was sought through the input of a third reviewer. Finally, reference lists for each of the studies included were assessed to ensure no relevant articles were omitted. Forward and backward citation tracking provided further reassurance that all of the relevant articles were included in the review.

Data-charting

A data-charting form was created by the research team in order to display the key data to extract from the selected articles. Topics that were included in the form were: article information (author, year of publication, country of origin),



purpose of the study, demographics of the study population, study design, category of health condition under study (cardiovascular, musculoskeletal, neurocognitive, psychological, reproductive), assessment method of the health condition under study and the incidence and/or prevalence of the health condition discussed. The data extraction was performed by two of the aforementioned individual reviewers—in circumstances where there was differing data submitted between reviewers, this was resolved by the contribution of a third reviewer.

RESULTS

Search strategy

We identified a total of 917 eligible articles, a figure which was reduced to 97 once duplicates were removed and the inclusion criteria were applied to titles and abstracts. This number reduced further to 33 once the inclusion criteria were applied to the full texts of each article. Prior to full-text analysis, an estimated 15 articles were excluded as they were written in a language other than those specified in the inclusion criteria. Sixty-one articles were excluded as they did not study the target population, or they did not report on a relevant health condition. Two articles were excluded as they included a duplicate data set with another study already included. A further study was removed as it did not report the results related to the health outcome in question. The reference check and citation tracking of the included articles resulted in eight additional relevant studies. Ultimately, a total of 41 studies were included in our scoping review. Several studies included in the final review reported on health conditions from more than one of the relevant health categories. The flowchart in [figure 1](#) displays the search procedure conducted in our study. Twenty-five of the included studies had incomplete data for data-charting. The authors for 16 of the 25 studies (ie, where a correspondence

email address was provided) were contacted to obtain the additional data. Two authors replied, but neither of them could provide any information on the missing data for their respective studies.

Musculoskeletal health conditions

Twenty-eight articles retrieved from the search focused on outcomes pertaining to musculoskeletal health in retired professional footballers (all studies presenting prevalence rates). Twenty-six of these studies featured retired male professional footballers, and two of these examined health conditions in retired female professional footballers. The musculoskeletal conditions and presentations assessed included OA of various joints of the lower limb, joint pain, back pain and deformities of the lumbar and cervical spine. The key data from the 29 studies are outlined in [table 1](#).

The prevalence rate of knee OA in retired male professional football players was found in 15 articles to range from 9% to 80%.^{3–5 31–42} Hip OA was reported on in 12 articles and the prevalence was found to range from 2% to 14% in the majority of studies, with one study showing a prevalence of hip OA as high as 50%.^{4 33 36 43} Five studies investigated the prevalence of ankle OA and found it ranged from 4% to 12%.^{4 33 44 45} Only one study found a higher prevalence of OA in the control group compared with the group of retired professional footballers.⁴¹ The method used to diagnose OA in various limb joints differed across studies, with some relying on clinical assessment, or imaging findings, or in some cases through self-reporting by study participants—or in some instances, a combination of methods.

Knee pain was reported by 37%–52% of retired male professional football players,^{4 5} and hip pain was found in 13% of this cohort.³⁴ Radiological abnormalities in the lumbar spine, specifically osteophytosis, ranged from 24% to 51% with the highest prevalence of osteophytosis at level L4 and the lowest at level L2.⁴⁶ Spinal issues were identified in one study, with 58% of retired players having reduced motion of the cervical spine, 21% of players having a history of cervical pain or stiffness and 33% of players having slight to moderate scoliosis.⁴⁷

Two studies included retired female professional footballers and assessed the prevalence of knee OA and ankle OA, knee and back pain in this population. Knee OA ranged from 14% to 60%.^{7 48} Based on a questionnaire distributed to retired female professional footballers, 7% reported a diagnosis of ankle OA.⁴⁸ The same study identified that 47% of the retired female professional players had knee problems, with 9% suffering with severe knee pain. Additionally, 47% of the same cohort had back issues of some description, with 9% experiencing severe back pain.

Mental health conditions

Mental health symptoms were assessed in 9 out of the 41 articles included in this scoping review (all but one study presenting prevalence rates). Only one of the nine articles examined issues exclusively in retired female

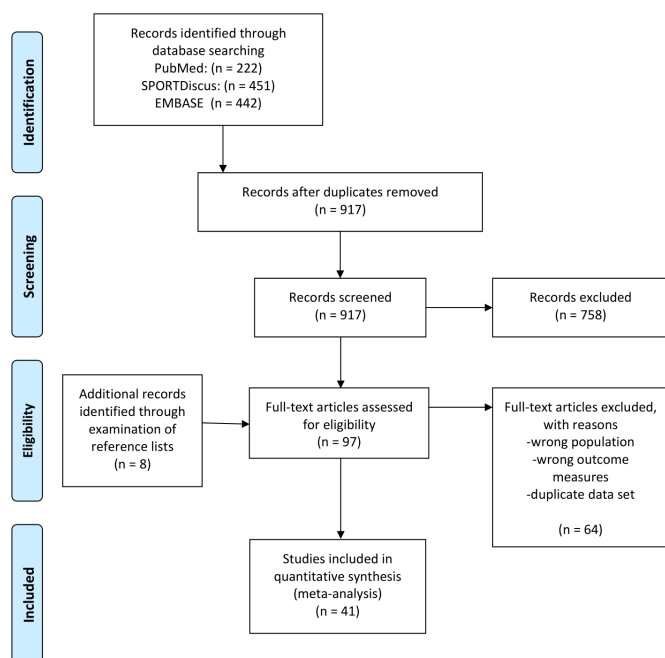


Figure 1 PRISMA flow diagram for the scoping review.

Table 1 Musculoskeletal health conditions in former professional football players: data extraction from included studies

Article details (Author(s), year of publication, reference number, country of origin)	Study demographics	Study design and purpose	Health condition(s)	Assessment method(s)	Outcome
Artlani <i>et al</i> , 2014 ⁵ (Brazil)	N=27 G=male A=45.67 (SD 5.91) C=14.89 years R=not provided	Cross-sectional study To compare the prevalence of osteoarthritis among a group of soccer players and non-professional athletes.	Knee OA	Quantification of pain through VAS, knee radiographs KOOS subjective questionnaire, SF-36, knee MRI	66.6% knee OA in dominant knee (controls: 46.7%) 66.6% knee OA in non-dominant knee (controls: 43.3%)
Armenis <i>et al</i> , 2011 ⁴⁴ (Greece)	N=150 G=male A=49.8 (SD 7.4) C=8–10 years R=not provided	Cross-sectional study To compare OA ankle findings in retired Greek professional footballers with those in the general population.	Foot and ankle OA	Questionnaire, clinical examinations, radiographs	4.1% clinical OA (controls: 3.56%) 8.8% radiographic OA (controls: 3.7%)
Chantraine, 1985 ³¹ (Switzerland)	N=81 G=male A=40–74 C=6–15 years R=not provided	Cross-sectional study To examine the presence of knee OA in a group of retired former footballers and to investigate a relationship between limb axis, previous meniscectomy and the presence of OA.	Knee OA	Clinical examination, radiographs	20% clinical signs of knee OA 56% radiographic signs of knee OA 2% clinical signs, but no radiographic evidence of knee OA 17% clinical and radiographic evidence of knee OA
Drawer and Fuller, 2001 ⁴ (UK)	N=185 G=male A=47.6 (SD 13.2) C=not provided R=not provided	Cross-sectional study To quantify the prevalence of osteoarthritis and the severity of pain in the lower limb joints of players retired from English professional soccer.	OA, hip OA, knee OA, ankle OA	Questionnaire	32% medically diagnosed with OA in at least one of the lower limb joints. 1.7% diagnosed with hip OA of the right hip 4.0% diagnosed with hip OA of the left hip 19.0% diagnosed with knee OA of the right knee 21.3% diagnosed with knee OA of the left knee 5.7% diagnosed with ankle OA of the right ankle 6.3% diagnosed with ankle OA of the left ankle 80% at least minor joint pain in at least one lower extremity joint during one or more daily activities 37% knee pain
Elleuch <i>et al</i> , 2008 ³² (France)	N=50 G=male A=49.2 (SD 3.8) C=10.7 (SD 4.6) R= \geq 20	Case-control study To study the prevalence of knee osteoarthritis in a group of former professional footballers with comparison to a control group.	Knee OA, knee pain, knee disability	Questionnaire, knee examination, functional assessment using Arabic Lequesne index, knee radiographs, KL radiological classification	80% radiographic OA (controls: 68%) 12% knee pain (controls 34%) 12% knee disability (controls: 46%)
Fernandes <i>et al</i> , 2018 ³ (UK)	N=1207 G=male A=59 (SD 11.7) C=not provided R=not provided	Case-control study To determine the prevalence of knee pain, RKOA, TKR and associated risk factors in male ex-professional footballers compared with men in the general population (comparison group).	Knee pain, knee OA, total knee replacement	Questionnaire, knee radiographs	52.2% knee pain (controls: 26.9%) 28.3% diagnosed with knee OA by a physician (controls: 12.2%) 64% signs of knee OA in radiographs (controls: 35.2%) 11.1% total knee replacement (controls: 3.8%)
Goutteborge <i>et al</i> , 2018 ¹⁸ (The Netherlands – Global)	N=396 G=male A=36 (SD 6) C=11 (SD 5) R=5 (SD 4)	Case-control study To investigate whether retired professional footballers with lower extremity OA have a lower health-related quality of life than those without OA or current professional footballers.	OA	Questionnaire	33% OA (mostly knee OA)

Continued

Table 1 Continued

Article details (Author(s), year of publication, reference number, country of origin)	Study demographics	Study design and purpose	Health condition(s)	Assessment method(s)	Outcome
Iosifidis <i>et al</i> , 2015 ³³ (Greece)	N=121 G=male A=not provided C=not provided R=not provided	Case-control study To investigate the prevalence of lower extremities clinical and radiographic OA in former elite male athletes and referents from the general population and to examine its association with the participants' demographic characteristics.	OA	Questionnaire, clinical and radiological examination	15.7% clinical OA 2.4% clinical hip OA 9.1% clinical knee OA 4.1% clinical ankle OA 40.6% radiographic OA 7.4% radiographic hip OA 16.5% radiographic knee OA 6.6% radiographic ankle OA
Kettunen <i>et al</i> , 1999 ³⁴ (Finland)	N=31 G=male A=56.5 (SD 5.7) C=not provided R=not provided	Case-control study To evaluate lower-limb explosive strength with respect to lifetime athletic activity.	Monthly knee and hip pain, reported knee and hip disability, knee OA, hip OA	Interviews, clinical examinations, quantitative functional measurements, knee x-ray examination, hip MRI	45% knee pain 13% hip pain 35% knee disability 3% hip disability 29% knee OA 12% hip OA
Kettunen <i>et al</i> , 2001 ³⁵ (Finland)	N=90–107 G=male A=48–95 C=not provided R=not provided	Case-control study To determine the relationship between previous lower-limb loading and current self-reported hip and knee disability.	Hip disability, knee disability	Questionnaire	6.5% hip disability 16.7% knee disability
Klinder <i>et al</i> , 1980 ³⁶ (Denmark)	N=57 G=male A=56.4 (40–79) C=22.8 (11–41) R=not provided	Case-control study The purpose of this study was to examine the relationship between top-level football playing over many years and the prevalence of osteoarthritis in the hip and knee joints.	OA, hip OA, knee OA	Radiographs, clinical examination	52.7% OA (controls: 33.3%) 49.1% hip OA (controls: 26.3%) 14.0% knee OA (controls: 12.3%)
Koch <i>et al</i> , 2021 ³⁷ (Germany)	N=126 G=male A=32.2 (SD 4.2) C=25.6 (SD 4.5) R=not provided	Cross-sectional study To investigate the impact of injuries that male professional football players endure during their career, reasons for the end of their career and the postcareer phase of retirement.	Hip OA, knee OA, ankle OA, shoulder OA	Questionnaire	11% hip OA 44% knee OA 35% ankle OA 4% shoulder OA
Krajnc <i>et al</i> , 2010 ³⁸ (Slovenia)	N=40 G=male A=49.2 (SD 9.7) C=18.9 (SD 3.8) R=not provided	Cross-sectional study The aim of the study was to evaluate differences in knee injuries and osteoarthritis between the dominant and non-dominant legs of former professional football players.	Symptomatic knee problems (dominant vs non-dominant leg), radiographic knee OA (dominant leg vs non-dominant leg)	History of previous knee injury, knee operations during career, knee radiographs	52.5% subjectively more symptomatic knee non-dominant leg. 25% subjectively more symptomatic knee dominant leg 57.5% radiographic knee OA non-dominant leg 42.5% radiographic knee OA dominant leg >60% radiographic knee OA in one or both knees
Kujala <i>et al</i> , 1994 ³⁹ (Finland)	N=313–178 G=male A=23–76 years C=not provided R=not provided	Case-control study To compare the cumulative 21-year incidence of admission to hospital for osteoarthritis of the hip, knee and ankle in former elite athletes and control subjects.	Admissions to hospital for OA of the weight bearing joints of the lower limb (1970–1990)	Public archives and hospital discharge summaries (1970–1990)	6% admission to hospital for OA in lower limb (controls: 2.6%) 3.2% admission to hospital for hip OA (controls: 1.4%) 2.0% admission to hospital for knee OA (controls: 1.3%) 0.8% admission to hospital for ankle OA (controls: 0%)

Continued

Table 1 Continued

Article details (Author(s), year of publication, reference number, country of origin)	Study demographics	Study design and purpose	Health condition(s)	Assessment method(s)	Outcome
Kujala <i>et al</i> , 1995 ⁴⁰ (Finland)	N=31 G=male A=56.5 (SD 5.7) C=not provided R=not provided	Cross-sectional study To determine the relationship between different physical loading conditions and findings of knee OA.	Knee OA	Questionnaire, interview, clinical examination, knee radiographs	29% knee OA 26% tibiofemoral OA 16% patellofemoral OA 29% knee osteophytes 19% tibiofemoral osteophytes 26% patellofemoral osteophytes 23% subchondral cysts 45% monthly knee pain 35% knee disability 39% extension deficiency
Lindberg <i>et al</i> , 1993 ⁶⁶ (Sweden)	N=71 G=male A=63 C=not provided R=not provided	Case-control study The aim of the study was to compare the prevalence of hip OA in former soccer players with a randomly selected control group.	Hip OA	Hip radiographs	14.1% hip OA (controls: 4.2%)
Lv <i>et al</i> , 2018 ⁴¹ (China)	N=86 G=male A=53 (51–58) C=19.8 (SD 6.3) R=not provided	Case-control study This study aimed to investigate the prevalence of radiographic KOA among retired professional football players by comparing with a control group.	Knee OA	Questionnaire, clinical examination, knee radiographs.	15.1% radiographic knee OA (controls: 45.3%)
Öztürk <i>et al</i> , 2008 ⁴⁶ (Turkey)	N=70 G=male A=45.64 (SD 8.39) C=11.04 (SD 3.66) R=13.87 (SD 8.39)	Case-control study To examine the occurrence of radiographic changes and abnormalities of the lumbar spine in former professional football compared with a control group.	Osteophytosis of the lumbar spine	Lumbar spine radiographs, Hannover Functional Ability Questionnaire to measure back pain-related disability	27.1% osteophytosis at level T12 (controls: 5.4%) 27.1% osteophytosis at level L1 (controls: 5.49%) 24.3% osteophytosis at level L2 (controls: 7.1%) 29.0% osteophytosis at level L3 (controls: 19.6%) 51.4% osteophytosis at level L4 (controls: 28.6%) 34.3% osteophytosis at level L5 (controls: 19.6%)
Paget <i>et al</i> , 2020 ⁴⁵ (The Netherlands – Global)	N=401 G=male A=36 (25–50) C=13 (2–19) R=4 (1–17)	Cross-sectional study To determine the prevalence of ankle osteoarthritis among former professional football and rugby players.	Ankle OA	Questionnaire, Health-related QoL using PROMIS-GH	9.2% ankle OA 8.5% ankle OA ≤40 years of age 12.0% ankle OA ≥40 years of age
Paxinos <i>et al</i> , 2016 ⁴² (Greece)	N=100 G=male A=46.9 (SD 5.9) C=20.52 (SD 7.4) R=not provided	Case-control study To investigate the prevalence of knee OA in retired professional soccer players in comparison with a group of athletically active military personnel.	Knee OA	Questionnaire using medical and sport history, Greek language version of KOOS, clinical examination of both knees, ultrasound examination of both knees	25% clinically evident varus (<178.5°) knee deformity (controls: 22%) 55% knee OA (controls: 33%) 32% knee OA after controlling for knee surgeries (controls: 17%) 44.1% knee OA after excluding participants with history of knee surgery (controls: 25.3%)
Shepard <i>et al</i> , 2003 ⁸⁷ (UK)	N=68 G=male A=44 (32–59) C=16 (5–25) R=not provided	Case-control study To compare the prevalence of self-reported, physician diagnosed OA of the hip in ex-professional footballers with that in age matched controls in the general public.	Hip OA	Questionnaire	13% OA hip (controls: <1%)
Sortland <i>et al</i> , 1982 ⁴⁷ (Norway)	N=43 G=male A=49.8 C=not provided R=not provided	Case-control study To investigate the prevalence of degenerative cervical spine changes in a group of retired professional footballers compared with the general population.	Degenerative changes of the cervical spine	Cervical radiographs, clinical examination	32.6% slight or moderate scoliosis (controls: 37.2%) 11.6% healed fractures (controls: 2.3%) 4.7% moderate anterolisthesis at one level (controls: 4.7%) 20.9% history of longstanding cervical complaints: pain and stiffness. 58.1% reduced motion of the cervical spine. 41.1% markedly reduced range of cervical motion

Continued

Table 1 Continued

Article details (Author(s), year of publication, reference number, country of origin)	Study demographics	Study design and purpose	Health condition(s)	Assessment method(s)	Outcome
Turner <i>et al.</i> , 2000 ⁴³ (UK)	N=284 G=male A=56.1 (SD 11.8) C=13.5 (SD 5.3) R=not provided	Cross-sectional study To describe the long term impact of football on the HRQL of former professional footballers in the UK.	Surgery, joint replacement, OA	Questionnaire about demographics and career details, treatment experience since retirement, OA diagnosis, HRQL using EuroQoL (EQ-5D)	26.4% had surgery since retirement 16.9% had knee surgery since retirement (10 joint replacements) 5.3% had hip surgery since retirement, (12 joint replacements, 6 players had two joint replacements) 8.5% currently awaiting surgery (13 for joint replacement operations; 7 hip, 6 knee) 48.6% diagnosed with OA in at least one anatomical site. 29.2% OA in two or more joints 16.5% bilateral knee OA 14.8% OA in three or more joints 15.1% were registered disabled (33 of which had OA)
Tveit <i>et al.</i> , 2012 ⁴⁹ (Sweden)	N=363–371 G=male A=50–93 years C=20–21 years R=1–63 years	Case-control study To investigate the relationship between intense exercise and subsequent risk of hip and knee OA in athletes.	Knee OA, hip OA, hip arthroplasty, knee arthroplasty	Questionnaire	14.2% hip OA 8.7% hip arthroplasty 18.2% knee OA 3.3% knee arthroplasty
van den Noort <i>et al.</i> , 2021 ⁸⁸ (The Netherlands – Global)	N=401 G=male A=36.5 (SD 5.5) C=52 R=5.3 (4.1)	Case-control study To establish the prevalence of clinical hip osteoarthritis in current and former professional footballers and to explore its consequences on hip function and HRQL.	Hip OA	Questionnaire assessing clinical hip OA, hip function and hip-related quality of life	8% hip OA
Volpi <i>et al.</i> , 2019 ⁸⁹ (Italy)	N=104 G=male A=69.70 (SD 3.20) C=15.31 (SD 3.52) R=not provided	Case-control study To estimate the incidence of hip and knee arthroplasty in Italian male professional football players who have played for a minimum 10 years in the Italian major football leagues.	Hip and/or knee arthroplasty	Questionnaire-based (modified WOMAC questionnaire)	13.5% underwent hip arthroplasty (controls: 0%) 5.8% underwent knee arthroplasty (controls: 1%) 5.8% underwent both hip and knee arthroplasty (controls: 0%) 2.9% underwent arthroplasty in dominant leg 8.6% underwent arthroplasty in non-dominant leg 13.5% underwent arthroplasty in both dominant and non-dominant leg. 7.7% underwent ACL reconstruction and/or meniscectomy (controls: 9%)
Prien <i>et al.</i> , 2020 ⁷ (Germany)	N=49 G=female A=37.2 (SD 4.9) C=9.9 (SD 5.3) R=9.6 (SD 4.0)	Cross-sectional study To assess knee health in retired female football players, using MRI and self-report.	Knee OA	Questionnaire, KOOS, knee MRI	24.5% of knees LFC chondral loss of grade 3 or higher 25.5% of knees MFC chondral loss of grade 3 or higher 31.6% of knees LTP chondral loss of grade 3 or higher 18.4% of knees MTP chondral loss of grade 3 or higher 30.6% of knees substantial tibiofemoral chondral loss 12.2% of knees medial side affected 21.4% of knees lateral side affected 32.7% of knees substantial meniscal loss of grade 3 or higher in lateral meniscus. 32.7% of knees substantial meniscal loss of grade 3 or higher in medial meniscus. 24.5% of knees medial meniscus extrusion >2mm 25.5% of knees lateral meniscus extrusion >2mm 51.0% of players substantial tibiofemoral chondral loss 69% of players fulfilled criterion for substantial meniscal loss 59.6% of players fulfilled criteria for substantial knee OA symptoms. 23.4% of players substantial knee OA symptoms only 17% of players substantial chondral loss on MRI only 36.2% of players substantial knee OA symptoms and substantial chondral loss on MRI

Continued



Table 1 Continued

Article details (Author(s), year of publication, reference number, country of origin)	Study demographics	Study design and purpose	Health condition(s)	Assessment method(s)	Outcome
Prien <i>et al.</i> , 2017 ⁴⁸ (Germany)	N=152 G=female A=33 (SD 6.19) C=8.6 (SD 5.03) R=not provided	Cross-sectional study The aim of this study was to assess the prevalence of health problems and associated risk factors in former elite female football players.	Physical complaints, knee problems	Questionnaire	81.6% minor to very severe physical complaints in the last 4 weeks 57.9% knee problems while exercising 15.8% (very) severe physical complaints in the last 4 weeks 33.6%–45.4% knee problems during normal daily activities 47.4% spine problems (8.6% severe pain) 46.7% knee problems (9.2% severe pain) 0% of players had an artificial joint replacement. 23.7% diagnosed with OA 13.8% diagnosed with KOA 7.2% diagnosed with AOA

A, age; ACL, anterior cruciate ligament; ACF, American College of Radiology; BMI, body mass index; C, duration of career; EQ-5D, EuroQol, -5 dimension; G, gender; HRQL, health-related quality of life; KL, Kellgren and Lawrence radiological classification; KOOS, knee injury and osteoarthritis outcome score; LFC, lateral femur condyles; LTP, lateral tibial plateau; MFC, medial femur condyles; MIP, medial tibial plateau; MTP, medial tibial plateau; N/n, number of participants; OA, osteoarthritis; PROMIS-GH, Patient-Reported Outcome Measurement Information System Global Health; OoL, quality of life; R, duration of retirement; RKOA, radiographic knee osteoarthritis; SF-36, 36-item short form; TKA, total knee replacement; VAS, visual analogue scale; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

footballers, although another study investigated the presence of psychological health conditions in retired male and female footballers but did not differentiate between gender when reporting the study results.¹³ The remainder of articles assessed related to retired male professional footballers. A summary of the key information from each article is outlined in table 2.

Depression, anxiety, sleep disturbance and adverse lifestyle behaviours (eg, alcohol excess, poor nutrition) are among the mental health symptoms and conditions which were identified in retired male professional footballers. A likelihood of depression and anxiety was reported in 6% and 12%, respectively, in a paper by Fernandes *et al* which was similar to the levels of anxiety and depression seen in the general population.¹⁰ However, this cohort of retired male professional footballers reported lower health-related quality of life and higher analgesic usage. In another cohort of retired male professional footballers, depressive symptoms were experienced by a slightly higher percentage of study participants at 16%.⁴⁹ Mixed depression and anxiety was assessed in three of the articles. The incidence of symptoms related to mixed depression/anxiety in these studies ranged from 26% to 39%.^{10 12 50} In one large-scale study in retired professional footballers, hospital admissions for common mental health disorders were lower than population controls, with no difference in suicide.¹²

Sleep disturbance was reported by 28% of former male professional footballers in two studies,^{12 51} although in another study performed in retired male professional footballers, they were found to have better sleep quality than control subjects.¹³ Adverse alcohol use was reported to be as prevalent as 32%, while poor nutrition choices seemed to be more commonly adopted by players on retirement.⁹

One study examined the presence of mental health issues exclusively in retired professional female footballers. In this demographic, it was found that 9% met the criteria for a diagnosis of clinical depression in the first 2 years of retirement, with 20% seeking help from a psychologist and 21% describing their mood as 'low'.⁵² The study by Kilic *et al* also provided data on the population of retired female professional footballers but the results are combined with male data making it difficult to interpret these findings based on gender. Nevertheless, in this cohort, anxiety/depression was seen in 19% of retired professional footballers and alcohol misuse in 8%.¹³

Neurocognitive health conditions

Three studies retrieved from the search presented information exclusively about the occurrence of neurocognitive health conditions in retired male professional football players (all studies presenting prevalence rates). An additional study, referred to in the musculoskeletal health section above, found that 4% of retired professional footballers suffered with neuropsychological issues (eg, memory complaints) in later life.³⁹ There

Table 2 Mental health conditions in former professional football players: data extraction from included studies

Article details (Author(s), year of publication, reference number, country of origin)	Study population	Study design and purpose	Health condition(s)	Assessment method(s)	Outcome (prevalence, incidence)
Fernandes <i>et al.</i> , 2019 ¹⁰ (UK)	N=572 G=male A=60.11 (SD 10.77) C=not provided R=not provided	Case-control study To determine the prevalence of depressive symptoms and general health of male ex-professional footballers compared with general population controls.	Depression, anxiety, sleep issues	Questionnaire using HADS, SF-36, sleep scale from MOS, PANAS, comorbidities, body pain mannequin, self-reported analgesic medication	5.7% probable depression (controls: 5.8%) 12.0% probable anxiety (controls: 10.3%)
Gouttebarge <i>et al.</i> , 2017 ⁵¹ (The Netherlands—Global)	N=220 G=male A=35 (SD 6) C=12 (SD 5) R=4 (SD 3)	Cross-sectional study To explore the relationship between sports career-related concussions and the subsequent occurrence of symptoms of common mental disorders among former male professional athletes.	Distress, anxiety/depression, sleep disturbance, adverse alcohol use, ≥2 CMD symptoms.	Questionnaire using distress screener (based on 4DSQ), GHQ-12, PROMIS, AUDIT-C and total number of confirmed concussions during professional career	18% distress 26% anxiety/depression 28% sleep disturbance 25% adverse alcohol use 25% ≥2 CMD symptoms
Gouttebarge <i>et al.</i> , 2016 ⁵⁰ (The Netherlands—Global)	N=219 G=male A=35 (SD 6.4) C=16.6 (SD 5.0) R=4.4 (SD 3.6)	Case-control study To explore the relationship of level of education, employment status and working hours with symptoms of common mental disorders (distress, anxiety/depression, sleep disturbance, adverse alcohol behaviour, smoking, adverse nutritional behaviour) among current and retired professional footballers.	Smoking, adverse alcohol use, adverse nutrition behaviour, distress, anxiety/depression	Questionnaire using distress screening tool (based on 4DSQ), PROMIS, the 3-item AUDIT-C and additional questions for smoking and eating habits	11.4% adverse smoking behaviour (current players: 3.8%) 24.6% adverse alcohol behaviour (current players: 9.4%) 18.4% distress (current players: 14.8%) 35.3% anxiety/depression (current players: 37.9%) 64.5% adverse nutritional behaviours (current players: 58.1%)
Gouttebarge <i>et al.</i> , 2015 ⁹ (The Netherlands—Global)	N=104 G=male A=36 (SD 5) C=12 (SD 5) R=5 (SD 3)	Case-control study To determine the prevalence of mental health problems and psychosocial difficulties in current and former professional footballers.	Distress, burnout, anxiety/depression, low self-esteem, adverse alcohol use, smoking, adverse nutrition behaviour	Questionnaire using The Distress Screener, The Utrecht Burn-Out Scale, the 12-item General Health Questionnaire, Rosenberg's Self-Esteem Scale, the 3-item AUDIT-C and additional questions for smoking and eating habits	15% distress (current players: 10%) 36% burnout (current players: 5%) 19% anxiety/depression (current players: 26%) 5% Low self-esteem (current players: 3%) 32% adverse alcohol behaviour (current players: 19%) 12% smoking (current players: 7%) 42% adverse nutrition behaviour (current players: 26%)
Kilic <i>et al.</i> , 2017 ¹³ (Denmark)	N=345 G=male (79%), female (21%) A=34.0 (SD 4.9) C=9.8 (SD 4.9) R=6.0 (SD 4.4)	Case-control study To determine the prevalence of symptoms of common mental disorders among current and retired professional football and handball players.	Distress, anxiety/depression, sleep disturbance, adverse alcohol use	Questionnaire using a distress screening tool, GHQ-12, PROMIS, the 3-item AUDIT-C	8.7% distress (current players: 14.7%) 18.7% anxiety/depression (current players: 18.1%) 11.0% sleeping disturbance (current players: 15.8%) 8.4% adverse alcohol use (current players: 2.9%)
Prinz <i>et al.</i> , 2016 ⁵² (Germany)	N=157 G=female A=33.0 (SD 6.25) C=8.695 (SD 5.13) R=6.48 (SD 3.56)	Cross-sectional study To evaluate depression symptoms during and after the career in former female football players of the German First League.	Depression, symptoms related to depression	Questionnaire using CES-D, PHQ-2 and questions on mood, reason for ending career, future life plans, problems in first retirement 2 years after end of football career, need and use for psychotherapeutic support during/after career.	27.3% were bothered by injuries or physical symptoms in the first 2 years after retirement 20.7% were feeling low in the first 2 years after retirement 8.5% classified as depressed in the first 2 years after retirement 20.0% had counselling or treatment by a psychologist

Continued



Table 2 Continued

Article details (Author(s), year of publication, reference number, country of origin)	Study population	Study design and purpose	Health condition(s)	Assessment method(s)	Outcome (prevalence, incidence)
Russell <i>et al.</i> , 2020 ¹² (UK)	N=7676 G=male A=not provided C=not provided R=not provided	Case-control study To investigate whether former professional soccer players with known high neurodegenerative mortality are at higher risk of common mental health disorders and have higher rates of suicide than the general population.	Admission to hospital for mental disorders, suicide.	Records from prewar Scottish league players and records of postwar Scottish league players.	5.1% admitted to hospital for management of mental health disorder (controls: 6.1%) 93 (0.40%) suicides as cause of death (controls: 19 (0.25%)) 27 (0.35%) admission to hospital due to anxiety and stress related disorder (controls: 222 (0.96%)) 0.50% admission to hospital due to depression (controls: 0.73%) 0.31% admission to hospital due to drug use disorders (controls: 0.82%) 1.52% admission to hospital due to alcohol use disorder (controls: 2.43%) 0.27% admission to hospital due to bipolar and affective mood disorders (controls: 0.49%)
Sanders and Stevinson, 2017 ⁶ (UK)	N=307 G=male A=46.8 (SD 15.7) C=6.7 (SD 3.7) R=21.2 (SD 14.6)	Cross-sectional study To examine associations between career-ending injury, chronic pain, athletic identity and depressive symptomatology in retired professional footballers.	Depressive symptoms	Questionnaire using the SDHS, PI-NRS, AIMS, question for reason of retirement	15.6% depressive symptoms
Van Ramele <i>et al.</i> , 2017 ¹¹ (The Netherlands)	N=212 G=male A=35 (SD 6) C=1.2 (SD 5) R=4 (SD 3)	Cross-sectional study To prospectively explore the incidence of symptoms of CMD (distress, sleep disturbance, anxiety/depression, adverse alcohol use) in retired professional football players.	Distress, sleep disturbance, anxiety/depression, adverse alcohol use (12-month incidence)	Questionnaire using the Distress Screener, PROMIS, CHQ-12, AUDIT-C, SARRS, 5 questions on needs for medical support related to symptoms of CMD	11% distress 28% sleep disturbance 29% anxiety/depression 15% adverse alcohol use

A, age; AIMS, Athletic Identity Measurement Scale; AUDIT-C, Alcohol Use Disorders Identification Test; C, duration of career; CES-D, Centre for Epidemiologic Studies Depression Scale; CHQ-12, 12-item General Health Questionnaire; CMD, common mental disorder; 4DSq, Four-Dimensional Symptom Questionnaire; G, gender; HADS, Hospital Anxiety and Depression Scale; MOS, Medical Outcome Survey; N/n, number of participants; PANAS, Positive and Negative Affect Scale; PHQ-2, Patient Health Questionnaire-2; PI-NRS, pain intensity numerical rating scale; PROMIS, Patient-Reported Outcome Measurement Information System; R, duration of retirement; RSES, Rosenberg Self-Esteem Scale; SARRS, Social Athletic Readjustment Rating Scale; SDHS, Short Depression-Happiness Scale; SF-36, 36-item short form; SIP, Sleep Problem Index.

were no studies found which detailed neurocognitive issues among retired female football players, while only one study explored the neurocognitive performance of retired elite female footballers.⁵³ A summary of the key information from the included studies can be found in table 3.

Neurocognitive health conditions that were found included neurodegenerative disease, dementia, mild cognitive impairment (MCI) and brain atrophy. In a study by Mackay *et al*, mortality from neurodegenerative disease was higher and mortality from other common diseases lower among retired professional soccer players than among matched controls. Dementia-related medications were prescribed more frequently to former players than to controls.¹⁴ More than 10% of the former players screened by Vann Jones *et al* were found to have possible MCI.¹⁵ One third of retired professional footballers in a Norwegian study found evidence of brain atrophy on neuroimaging, although it was not highlighted whether these findings were accompanied by clinical symptoms related to neurocognitive disease.¹⁶

Cardiovascular health conditions

None of the retrieved articles directly or exclusively explored the occurrence of cardiovascular health conditions in retired male or female professional football players. However, some studies indirectly examined issues related to cardiovascular health in retired professional footballers. Two studies highlighted that retired footballers were more likely than current footballers to adopt behaviours which may increase their risk of cardiovascular disease; for example, smoking, alcohol misuse and poor nutritional behaviours.^{9,50} Another study found no difference between risk of death from ischaemic heart disease between retired professional footballers and matched-controls.³ A lower reporting of diabetes and heart attacks among a cohort of retired professional footballers in the UK confirmed the potential long-term physical health benefits of professional football.¹⁰

Reproductive health conditions

No articles were retrieved covering the occurrence of reproductive health conditions in former professional male or female football players.

DISCUSSION

The aim of this scoping review was to provide an overview of the health conditions occurring in retired male and female professional footballers, with an emphasis on musculoskeletal, mental, neurocognitive, cardiovascular and reproductive health conditions. There was a high prevalence of OA of various lower limb joints among retired male professional footballers, with evidence of knee OA in up to 80% of this cohort, and one study suggesting the presence of hip OA in 50% of retired players. Knee and back pain were also commonly reported by retired male professional footballers. Knee OA was reported in up to 60% of retired female professional footballers. Mixed

anxiety and depression was found to be as high as 39% in retired male professional footballers. The only study carried out exclusively in retired female professional footballers found that 9% met the criteria for a diagnosis of clinical depression within 2 years of retirement. Dementia was among the neurocognitive conditions found to be present in retired male professional footballers. Only one study investigated neurocognitive health conditions among retired female professional footballers. There were limited specific data on the presence of cardiovascular conditions among retired professional footballers, and no studies retrieved examined reproductive health conditions among retired professional footballers.

Perspective of the findings

This is the first scoping review of health conditions in retired professional footballers and as such comparisons are limited. The aim of this scoping review was not to compare health conditions among retired professional footballers with other populations and, as such, any comparisons are made with caution considering the unsuitability of the research question to address this. There is established evidence demonstrating that OA is associated with occupations that demand challenging and repetitive use of the knee joints.⁵⁴ The findings of this scoping review support the notion that OA is more prevalent among retired professional footballers than the general population. Knee OA was present in up to 80% of retired professional footballers, while in comparison, 13% of women and 10% of men aged 60 years and older have symptomatic knee OA.⁵⁵ It is reported that 18% of the general UK population have sought treatment for knee OA, and 8% have sought treatment for hip OA.⁵⁶ The prevalence of knee OA (13%) among current professional footballers is significantly less than retired professional footballers.⁵⁷

The incidence of depressive symptoms among retired male professional footballers was as high as 39%, while 9% of retired female professional footballers met the criteria for a diagnosis of clinical depression within 2 years of retirement. The estimated worldwide prevalence of depression is 4.5%, with up to 25% of adults estimated to experience an anxiety disorder at some point in their life.⁵⁸ Mental health complaints appear slightly less prevalent among current professional footballers compared with retired players; 26% of active players demonstrate evidence of anxiety/depression.⁹

These findings indicate that musculoskeletal and mental health conditions are potentially more prevalent among retired professional footballers than age-matched controls and active footballers. The limited data on neurocognitive, reproductive and cardiovascular conditions make it challenging to draw detailed comparisons with other populations.

Gender bias

The comparative lack of female participants in the studies included in this scoping review reflects wider trends

Table 3 Neurocognitive health conditions in former professional football players: data extraction from included studies

Article details (Author(s), year of publication, reference number, country of origin)	Study population	Study design and study purpose	Health condition(s)	Assessment method(s)	Outcome (prevalence, incidence)
Mackay <i>et al.</i> , 2019 ¹⁴ (UK)	n=7676 G=male A=67.9 (SD 13.0) (age of death) C=not provided R=not provided	Case-control study To compare mortality from neurodegenerative disease among Scottish former professional soccer players with that among matched controls from the general population.	Mortality with neurodegenerative disease.	Electronic health records for death certification and medication prescribed for treatment of dementia (databases of all Scottish professional soccer players)	15.4% any cause of death (controls: 16.5%) 1.7% neurodegenerative disease listed as primary cause of death (controls: 0.5%) 2.9% any neurodegenerative disease listed as primary or contributory cause of death (controls: 1.0) 2.3% dementia not otherwise specified listed as primary or contributory cause of death (controls: 0.8%) 0.8% AD listed as primary or contributory cause of death (controls: 0.2%) 1.6% non-Alzheimer's dementias listed as primary or contributory cause of death (controls: 0.6) 0.3% motor neuron disease listed as primary or contributory cause of death (controls: 0.1%) 0.4% PD listed as primary or contributory cause of death (controls: 0.2%)
Prien <i>et al.</i> , 2020 ³³ (Germany)	n=66 G=female A=37.4 (SD 4.8) C=11.0 (SD 4.8) R=8.6 (SD 4.4)	Case-control study To compare neurocognitive performance, cognitive symptoms and mental health of retired elite female football players compared with an age and sex matched control group of retired elite non-contact sport athletes.	Neurocognitive performance	Computerised test battery CNSVS and four written tests	63.6% minor to severe memory problems (controls: 40.0%)
Sortland and Tysvaer, 1989 ¹⁶ (Norway)	n=33 G=male A=52 C=not provided R=18 (8-39)	Cross-sectional study To investigate neuroimaging findings in a group of retired male professional footballers.	Brain atrophy, macroscopic brain injury	CT brain	27% widened ventricles 18% cortical atrophy by visual grading 33% atrophy (11 players; five purely central, 4 central and cortical, 2 purely cortical) 18.2% showing an EI higher than 0.32 33.3% showing an EI equal to or higher than 0.30 63.6% MFH exceeding the upper range of normal 78.8% exceeding normal values of median HI 0% exceeding normal 3V values. three players aged 54–66 Moderate cerebellar atrophy two players (59 and 66 years of age) septum pellucidum cyst
Vann Jones <i>et al.</i> , 2014 ¹⁵ (UK)	n=92 G=male A=67.45 (SD 6.96) C=13.84 (SD 4.67) R=not provided	Cross-sectional study To investigate the hypothesis that chronic low-level head trauma is associated with persistent cognitive decline.	MCI	TYM questionnaire	10.87% screened positive for possible MCI

A, age; AD, Alzheimer's disease; BFI, bifrontal cerebroventricular index; BW, transverse width of the brain; C, duration of career; CD, distance between caudate nuclei; CNSVS, CNS vital signs; CS, maximum width of cortical hemispheric sulci; EI, Evans Index; G, gender; HI, Huckmann Index; LSC, left septum caudate distance; MCI, Mild cognitive impairment; MFH, maximum bilateral width of frontal horns; N/n, number of participants; PD, Parkinson's disease; R, duration of retirement; RSC, right septum caudate distance; TYM, Test Your Memory; 3V, width of third ventricle.

in sports medicine research where females are under-represented.^{59 60} There is increasing professionalism and interest in women's football, and efforts should be made to better understand sex-specific issues experienced by retired female professional footballers.

Additional studies which focus on assessing the presence of OA in retired female professional footballers are required, and the impact this has on quality of life and other important health outcomes may be needed. No studies were identified which assessed the prevalence of hip OA in female athletes, and this may provide useful insight. It is likely that the type of frequency and timing of mental health symptoms faced by retired female professional footballers differs from that of males, and subsequently this may influence the approach to provision of mental health support for females during and after their careers. Only one study included in this scoping review explored mental health symptoms in retired professional female footballers, and the findings from this study warrant further investigation.

There is emerging evidence to suggest women are more at risk of concussion than men, and that current gender-neutral return to play guidelines may not sufficiently consider gender differences.⁶¹ Additionally, women are believed to be more at risk of neurocognitive disease than men.⁶² With this in mind, urgent studies are required to assess the risk of neurocognitive disease in retired female footballers and to improve the management of concussion in the Women's game.

Last, there is a better understanding of the relationship between menstrual cycle and performance in female footballers.²⁷ Our search could not identify any studies which examined the effects of a career in football on long-term reproductive health, and future studies of this nature may provide useful information which can improve the health of female footballers during and after their career.

Duty of care and after career consultation

Our scoping review does provide insights into health conditions encountered by retired professional footballers which may pave the way for interventions during and after a player's career in order to mitigate risk. Through understanding the common health conditions encountered by professional footballers in retirement, we may be better placed to intervene proactively during and after their career. The specific interventions which may benefit retired footballers has yet to be established, although they may include initiatives such as improvements in the management of concussion, injury prevention programmes, workload monitoring and a better understanding of surgical options for injuries during a player's career.⁶³ A wide range of stakeholders have a duty to protect the long-term health of footballers, and this can likely be achieved without detracting from the spectacle of football.⁶⁴

Plausible interventions for retired players after their careers may include lifestyle education (eg, for improved mental and cardiovascular health) or the GLA:D

programme for OA.^{21 65} There are growing calls for footballers to undergo a formal process on retirement in order to identify current health issues, signpost them to available resources and mitigate risk against future disease.^{21 64} Recently, an after career consultation (ACC) was developed in order to empower the sustainable physical, mental and social health and the quality of life of retired professional footballers.²¹ The ACC focusses on (among other aspects) musculoskeletal health, mental health, cardiovascular health and neurocognitive health. This review has identified that mental health problems such as anxiety and depression are as common among retired footballers as in the general population. However, retired footballers may be more at risk of issues during the transition to retirement which suggest that the timing of the ACC may be important.^{50 52} Through proactive support and intervention, the effects of a high prevalence of OA and pain medication usage among retired professional footballers may be reduced. It would also provide an opportunity for retired footballers to discuss any concerns they may have with respect to their long-term neurocognitive health. The ACC has primarily been developed for retired male professional footballers, and this review has highlighted that despite the limited research into retired female professional footballers, a female-specific protocol is warranted.

Strengths and limitations

This is the first scoping review to investigate the common health conditions encountered by retired professional footballers. Studies were included from 16 different countries, which indicates the limited breadth of the available data. Socioeconomic and cultural factors are likely to influence health outcomes for retired professional footballers, and in this context, studies performed in retired professional footballers from a broader range of countries would deliver a more accurate impression of the health conditions experienced by retired professional footballers. This, in turn, may improve the specificity of the health guidance that retired professional footballers receive.

The health categories emphasised during this review were chosen in order to ensure the most frequent conditions associated with retired football players were captured, although it is not unreasonable to consider that other categories or subcategories may have been worth exploring (eg, problem gambling). Given the composition of the research team, it was decided that only studies written in English, Dutch or French would be included for analysis. The impact of such language exclusion, and the omission of grey literature, is that the number of potentially excluded but relevant publications is estimated, but not known.

Scoping reviews do not formally assess the methodological quality of individual studies, and the risk of bias was not appraised systematically in this review. The interpretation of studies and their significance was assessed according to the expertise of the authors for discussion. The impact of

this approach is that caution should be exercised when interpreting the significance of the incidence and prevalence of the included studies, as their reported rates may not be truly reflective of health conditions among retired professional footballers. A high number of studies included in this review were cross-sectional in nature, which makes interpreting the temporal relationship between exposure and health outcomes difficult. The definition of ‘professional footballer’ may have differed between studies, and not all studies included key data such as duration of career and time since retirement. Additionally, there were little data provided on playing positions, nationalities, career earnings or ethnicity—all of which may have provided improved insight into the findings. Small sample sizes and poorly matched control groups in some studies may have introduced potential errors in interpretation.

Future research examining health conditions among retired male and female professional footballers should include relevant injury history, career duration, time since retirement, playing position as well as any socio-economic factors which may confound the findings (eg, current occupational status). A consistent definition of ‘professional footballer’ in studies is also required, for example, a retired professional footballer is defined as an individual who is remunerated for devoting several hours in all/most days (exceeding the time allocated to other types of professional or leisure activities) to playing football, and in which they competed in the highest or second highest national league.

CONCLUSION

A career in professional football is likely to confer long-term health benefits associated with physical activity. This scoping review, the first of its kind, has highlighted that musculoskeletal and neurocognitive conditions are relatively prevalent among retired professional footballers. Additionally, mental health symptoms exist among retired professional footballers, and they may be more vulnerable during the transition to retirement. Very few studies exist exploring health outcomes in retired female professional footballers, and considering the rapid growth in participation and interest in women’s football, efforts should be made to understand long-term health outcomes for female footballers. A wide range of stakeholders have a duty to protect the long-term health of professional footballers during and after their career. Potential interventions during a player’s career may include injury prevention measures, improved concussion care, better surgical decision-making and workload monitoring.

Author affiliations

¹Amsterdam UMC location University of Amsterdam, Orthopedic Surgery, Meibergdreef 9, Amsterdam, The Netherlands

²Medical Department, Chelsea Football Club, London, UK

³Medical Department, Fédération Internationale de Football Association (FIFA), Zurich, Switzerland

⁴Amsterdam Movement Sciences, Sports, Ageing & Vitality, Amsterdam, The Netherlands

⁵Academic Center for Evidence based Sports medicine (ACES), Amsterdam, The Netherlands

⁶Amsterdam Collaboration on Health & Safety in Sports (ACHSS), AMC/VUmc IOC Research Center, Amsterdam, The Netherlands

⁷Section Sports Medicine, University of Pretoria, Pretoria, South Africa

⁸Football Players Worldwide (FIFPRO), Hoofddorp, The Netherlands

Twitter Vincent Goutteborge @VGoutteborge

Contributors All coauthors contributed to this manuscript. KA developed the search strategy in conjunction with VG and SC. SC wrote the initial draft of the manuscript, with AM, KA, GK and VG all contributing to subsequent iterations. The final manuscript was agreed and approved by all authors prior to submission.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Sean Carmody <http://orcid.org/0000-0001-8683-5532>

Vincent Goutteborge <http://orcid.org/0000-0002-0126-4177>

REFERENCES

- Garatachea N, Santos-Lozano A, Sanchis-Gomar F, *et al*. Elite athletes live longer than the general population: a meta-analysis. *Mayo Clin Proc* 2014;89:1195–200.
- Antero-Jacquemin J, Pohar-Perme M, Rey G, *et al*. The heart of the matter: years-saved from cardiovascular and cancer deaths in an elite athlete cohort with over a century of follow-up. *Eur J Epidemiol* 2018;33:531–43.
- Fernandes GS, Parekh SM, Moses J, *et al*. Prevalence of knee pain, radiographic osteoarthritis and arthroplasty in retired professional footballers compared with men in the general population: a cross-sectional study. *Br J Sports Med* 2018;52:678–83.
- Drawer S, Fuller CW. Propensity for osteoarthritis and lower limb joint pain in retired professional soccer players. *Br J Sports Med* 2001;35:402–8.
- Arliani GG, Astur DC, Yamada RKF, *et al*. Early osteoarthritis and reduced quality of life after retirement in former professional soccer players. *Clinics* 2014;69:589–94.
- Kuijt M-TK, Inklaar H, Goutteborge V, *et al*. Knee and ankle osteoarthritis in former elite soccer players: a systematic review of the recent literature. *J Sci Med Sport* 2012;15:480–7.
- Prien A, Boudabous S, Junge A, *et al*. Every second retired elite female football player has MRI evidence of knee osteoarthritis before age 50 years: a cross-sectional study of clinical and MRI outcomes. *Knee Surg Sports Traumatol Arthrosc* 2020;28:353–62.
- Goutteborge V, Aoki H, Kerkhoffs G. Symptoms of common mental disorders and adverse health behaviours in male professional soccer players. *J Hum Kinet* 2015;49:277–86.
- Goutteborge V, Frings-Dresen MHW, Sluiter JK. Mental and psychosocial health among current and former professional footballers. *Occup Med* 2015;65:190–6.

- 10 Fernandes GS, Parekh SM, Moses J, *et al.* Depressive symptoms and the general health of retired professional footballers compared with the general population in the UK: a case-control study. *BMJ Open* 2019;9:e030056.
- 11 van Ramele S, Aoki H, Kerkhoffs GMMJ, *et al.* Mental health in retired professional football players: 12-month incidence, adverse life events and support. *Psychol Sport Exerc* 2017;28:85–90.
- 12 Russell ER, McCabe T, Mackay DF, *et al.* Mental health and suicide in former professional soccer players. *J Neurol Neurosurg Psychiatry* 2020;91:1256–60.
- 13 Kilic Özgür, Aoki H, Haagensen R, *et al.* Symptoms of common mental disorders and related stressors in Danish professional football and handball. *Eur J Sport Sci* 2017;17:1328–34.
- 14 Mackay DF, Russell ER, Stewart K, *et al.* Neurodegenerative disease mortality among former professional soccer players. *N Engl J Med* 2019;381:1801–8.
- 15 Vann Jones SA, Breakey RW, Evans PJ. Heading in football, long-term cognitive decline and dementia: evidence from screening retired professional footballers. *Br J Sports Med* 2014;48:159–61.
- 16 Sortland O, Tysvaer AT. Brain damage in former association football players. An evaluation by cerebral computed tomography. *Neuroradiology* 1989;31:44–8.
- 17 Hawkins RD, Hulse MA, Wilkinson C, *et al.* The association football medical research programme: an audit of injuries in professional football. *Br J Sports Med* 2001;35:43–7.
- 18 Gouttebauge V, Aoki H, Kerkhoffs GMMJ. Lower extremity osteoarthritis is associated with lower health-related quality of life among retired professional footballers. *Phys Sportsmed* 2018;46:471–6.
- 19 Mobasheri A, Rayman MP, Gualillo O, *et al.* The role of metabolism in the pathogenesis of osteoarthritis. *Nat Rev Rheumatol* 2017;13:302–11.
- 20 Gervis M, Pickford H, Hau T. Professional Footballers' Association Counselors' Perceptions of the Role Long-Term Injury Plays in Mental Health Issues Presented by Current and Former Players. *J Clin Sport Psychol* 2019;13:451–68.
- 21 Gouttebauge V, Goedhart E, Kerkhoffs G. Empowering the health of retired professional footballers: the systematic development of an after career consultation and its feasibility. *BMJ Open Sport Exerc Med* 2018;4:e000466.
- 22 Cunningham J, Broglio SP, O'Grady M, *et al.* History of sport-related concussion and long-term clinical cognitive health outcomes in retired athletes: a systematic review. *J Athl Train* 2020;55:132–58.
- 23 Manley G, Gardner AJ, Schneider KJ, *et al.* A systematic review of potential long-term effects of sport-related concussion. *Br J Sports Med* 2017;51:969–77.
- 24 Lehman EJ, Hein MJ, Baron SL, *et al.* Neurodegenerative causes of death among retired National football League players. *Neurology* 2012;79:1970–4.
- 25 Gouttebauge V. Is the call to reduce heading exposure in professional football to prevent dementia evidence-based? *BMJ Open Sport Exerc Med* 2021;7:e001076.
- 26 Gouttebauge V, Ahmad I, Iqbal Z, *et al.* Concussion in European professional football: a view of team physicians. *BMJ Open Sport Exerc Med* 2021;7:e001086.
- 27 McNulty KL, Elliott-Sale KJ, Dolan E, *et al.* The effects of menstrual cycle phase on exercise performance in eumenorrhic women: a systematic review and meta-analysis. *Sports Med* 2020;50:1813–27.
- 28 Bruinvels G, Burden RJ, McGregor AJ, *et al.* Sport, exercise and the menstrual cycle: where is the research? *Br J Sports Med* 2017;51:487–8.
- 29 PRISMA. Extension: Prisma for scoping reviews, 2018. Available: <http://www.prisma-statement.org/Extensions/ScopingReviews>
- 30 Peters MDJ GC, McInerney P, Munn Z. Chapter 11: Scoping reviews (2020 version). In: Aromataris EMZ, ed. *JBI manual for evidence synthesis*, 2020: 406–51.
- 31 Chantraine A. Knee joint in soccer players: osteoarthritis and axis deviation. *Med Sci Sports Exerc* 1985;17:434–9.
- 32 Elleuch MH, Guerhazi M, Mezghanni M, *et al.* Knee osteoarthritis in 50 former top-level soccer players: a comparative study. *Ann Readapt Med Phys* 2008;51:174–8.
- 33 Iosifidis MI, Tsarouhas A, Fylaktou A. Lower limb clinical and radiographic osteoarthritis in former elite male athletes. *Knee Surg Sports Traumatol Arthrosc* 2015;23:2528–35.
- 34 Kettunen JA, Kujala UM, Rätty H, *et al.* Jumping height in former elite athletes. *Eur J Appl Physiol Occup Physiol* 1999;79:197–201.
- 35 Kettunen JA, Kujala UM, Kaprio J, *et al.* Lower-limb function among former elite male athletes. *Am J Sports Med* 2001;29:2–8.
- 36 Klünder KB, Rud B, Hansen J. Osteoarthritis of the hip and knee joint in retired football players. *Acta Orthop Scand* 1980;51:925–7.
- 37 Koch M, Klügl M, Frankewycz B, *et al.* Football-related injuries are the major reason for the career end of professional male football players. *Knee Surg Sports Traumatol Arthrosc* 2021;29:3560–8.
- 38 Krajnc Z, Vogrin M, Recnik G, *et al.* Increased risk of knee injuries and osteoarthritis in the non-dominant leg of former professional football players. *Wien Klin Wochenschr* 2010;122(Suppl 2):40–3.
- 39 Kujala UM, Kaprio J, Sarna S. Osteoarthritis of weight bearing joints of lower limbs in former elite male athletes. *BMJ* 1994;308:231–4.
- 40 Kujala UM, Kettunen J, Paananen H, *et al.* Knee osteoarthritis in former runners, soccer players, weight lifters, and shooters. *Arthritis Rheum* 1995;38:539–46.
- 41 Lv H, Chen W, Yuwen P, *et al.* Multivariate analysis of factors related to radiographic knee osteoarthritis based on the comparison between football players and matched nonsportsmen. *Int Orthop* 2018;42:519–27.
- 42 Paxinos O, Karavasili A, Delimpasis G, *et al.* Prevalence of knee osteoarthritis in 100 Athletically active veteran soccer players compared with a matched group of 100 military personnel. *Am J Sports Med* 2016;44:1447–54.
- 43 Turner AP, Barlow JH, Heathcote-Elliott C. Long term health impact of playing professional football in the United Kingdom. *Br J Sports Med* 2000;34:332–6.
- 44 Armenis E, Pefanis N, Tsiganos G, *et al.* Osteoarthritis of the ankle and foot complex in former Greek soccer players. *Foot Ankle Spec* 2011;4:338–43.
- 45 Paget LDA, Aoki H, Kemp S, *et al.* Ankle osteoarthritis and its association with severe ankle injuries, ankle surgeries and health-related quality of life in recently retired professional male football and rugby players: a cross-sectional observational study. *BMJ Open* 2020;10:e036775.
- 46 Öztürk A, Ozkan Y, Ozdemir RM, *et al.* Radiographic changes in the lumbar spine in former professional football players: a comparative and matched controlled study. *Eur Spine J* 2008;17:136–41.
- 47 Sortland O, Tysvaer AT, Storli OV. Changes in the cervical spine in association football players. *Br J Sports Med* 1982;16:80–4.
- 48 Prien A, Prinz B, Dvořák J, *et al.* Health problems in former elite female football players: prevalence and risk factors. *Scand J Med Sci Sports* 2017;27:1404–10.
- 49 Tveit M, Rosengren BE, Nilsson Jan-Åke, *et al.* Former male elite athletes have a higher prevalence of osteoarthritis and arthroplasty in the hip and knee than expected. *Am J Sports Med* 2012;40:527–33.
- 50 Gouttebauge V, Aoki H, Verhagen E, *et al.* Are level of education and employment related to symptoms of common mental disorders in current and retired professional footballers? *Asian J Sports Med* 2016;7:1–6.
- 51 Gouttebauge V, Aoki H, Lambert M, *et al.* A history of concussions is associated with symptoms of common mental disorders in former male professional athletes across a range of sports. *Phys Sportsmed* 2017;45:443–9.
- 52 Prinz B, Dvořák J, Junge A. Symptoms and risk factors of depression during and after the football career of elite female players. *BMJ Open Sport Exerc Med* 2016;2:e000124.
- 53 Prien A, Feddermann-Demont N, Verhagen E, *et al.* Neurocognitive performance and mental health of retired female football players compared to non-contact sport athletes. *BMJ Open Sport Exerc Med* 2020;6:e000952.
- 54 Industrial Injuries Advisory Council. Osteoarthritis of the knee in professional football players: position paper 44, 2020. Available: <https://www.gov.uk/government/publications/osteoarthritis-of-the-knee-in-professional-football-players-iiac-position-paper-44/osteoarthritis-of-the-knee-in-professional-football-players-position-paper-44>
- 55 Zhang Y, Jordan JM. Epidemiology of osteoarthritis. *Clin Geriatr Med* 2010;26:355–69.
- 56 National Clinical Guideline Centre (UK). *Osteoarthritis: care and management in adults*. London: National Institute for Health and Care Excellence (UK), 2014. <https://cks.nice.org.uk/topics/osteoarthritis/diagnosis/diagnosis/>
- 57 Gouttebauge V, Aoki H, Kerkhoffs GMMJ. Knee osteoarthritis in professional football is related to severe knee injury and knee surgery. *Inj Epidemiol* 2018;5:26.
- 58 National Clinical Guideline Centre (UK). *Mental health*. London: National Institute for Health and Care Excellence (UK), 2021. <https://cks.nice.org.uk/specialities/mental-health/>
- 59 Costello JT, Bieuzen F, Bleakley CM. Where are all the female participants in sports and exercise medicine research? *Eur J Sport Sci* 2014;14:847–51.
- 60 Kryger KO, Wang A M, *et al.* Research on women's football: a scoping review, Science and Medicine in Football 2021.



- 61 Bretzin AC, Covassin T, Wiebe DJ, *et al.* Association of sex with adolescent soccer concussion incidence and characteristics. *JAMA Netw Open* 2021;4:e218191.
- 62 Scheyer O, Rahman A, Hristov H, *et al.* Female sex and Alzheimer's risk: the menopause connection. *J Prev Alzheimers Dis* 2018;5:225–30.
- 63 Parekh SM, Fernandes GS, Moses JP, *et al.* Risk factors for knee osteoarthritis in retired professional footballers: a cross-sectional study. *Clin J Sport Med* 2021;31:281–8.
- 64 Carmody S, Jones C, Malhotra A, *et al.* Put out to pasture: what is our duty of care to the retiring professional footballer? Promoting the concept of the 'exit health examination' (EHE). *Br J Sports Med* 2019;53:788–9.
- 65 Skou ST, Roos EM. Good Life with osteoArthritis in Denmark (GLA:D™): evidence-based education and supervised neuromuscular exercise delivered by certified physiotherapists nationwide. *BMC Musculoskelet Disord* 2017;18:72.
- 66 Lindberg H, Roos H, Gärdsell P. Prevalence of coxarthrosis in former soccer players. 286 players compared with matched controls. *Acta Orthop Scand* 1993;64:165–7.
- 67 Shepard GJ, Banks AJ, Ryan WG. Ex-professional association footballers have an increased prevalence of osteoarthritis of the hip compared with age matched controls despite not having sustained notable hip injuries. *Br J Sports Med* 2003;37:80–1.
- 68 van den Noort D, Oltmans E, Aoki H, *et al.* Clinical hip osteoarthritis in current and former professional footballers and its effect on hip function and quality of life. *J Sports Sci Med* 2021;20:284–90.
- 69 Volpi P, Quaglia A, Carimati G, *et al.* High incidence of hip and knee arthroplasty in former professional, male football players. *J Sports Med Phys Fitness* 2019;59:1558–63.
- 70 Sanders G, Stevinson C. Associations between retirement reasons, chronic pain, athletic identity, and depressive symptoms among former professional footballers. *Eur J Sport Sci* 2017;17:1311–8.

APPENDIX

Search Strategy Pubmed:

- #1: "Soccer"[Mesh] OR Football*[tiab] OR Soccer[tiab]
 #2: "Retirement"[Mesh] OR Retire*[tiab] OR Former[tiab]
 #3: "Musculoskeletal system"[Mesh] OR "Musculoskeletal Diseases"[Mesh] OR Tendon*[tiab] OR Bone*[tiab] OR Muscle[tiab] OR Ligament[tiab] OR Cartilage [tiab] OR Joint[tiab] OR Osteoarthritis[tiab] OR OA[tiab] OR Musculoskeletal[tiab]
 #4: "Cardiovascular System"[Mesh] OR "Cardiovascular Diseases"[Mesh] OR Cardiovascular[tiab] OR Heart[tiab] OR Blood[tiab] OR Artery[tiab] OR Vein[tiab] OR Capillary[tiab] OR Cardiac[tiab] OR Arrhythmia[tiab] OR Vessel[tiab] OR Coronary[tiab] OR Cardio*[tiab]
 #5: "Mental Disorders"[Mesh] OR "Mental Processes"[Mesh] OR Cogniti*[tiab] OR Psychological[tiab] OR Neurocogniti*[tiab] OR Mental[tiab] OR Brain[tiab] Neuropsychological[tiab] OR Neurological[tiab] OR "Mental health"[tiab]
 #6: "Reproductive Physiological Phenomena"[Mesh] OR Reproduct*[tiab] OR Menstrua*[tiab] OR Fertil*[tiab] OR Ovulation[tiab] OR Menarche[tiab] OR Pregnant*[tiab] OR Amenorrhea[tiab] OR Oligomenorrhea[tiab] OR Estrogen[tiab] OR Oestrogen[tiab] OR Menses[tiab] OR Menorrh*[tiab] OR Folic*[tiab] OR Luteal[tiab]
 #7: #1 AND #2 AND (#3 OR #4 OR #5 OR #6)

Search Strategy SPORTDiscus

- S1: TI(Soccer OR Football*) OR AB(Soccer OR Football*)
 S2: TI(Retire* OR Former) OR AB(Retire* OR Former)
 S3: TI(Musculoskeletal OR Muscle OR Bone OR Tendon OR Ligament OR Cartilage OR Joint OR Osteoarthritis OR OA) OR AB(Musculoskeletal OR Muscle OR Bone OR Tendon OR Ligament OR Cartilage OR Joint OR Osteoarthritis OR OA)
 S4: TI(Cardiovascular OR Heart OR Blood OR Vein OR Vessel OR Artery OR Capillary OR Cardio OR Coronary OR Arrhythmia OR Cardiac) OR AB(Cardiovascular OR Heart OR Blood OR Vein OR Vessel OR Artery OR Capillary OR Cardio OR Coronary OR Arrhythmia OR Cardiac)
 S5: TI(Mental OR Cogniti* OR Psychological OR Neurocogniti* OR Neuropsychological OR Neurological OR Brain) OR AB(Mental OR Cogniti* OR Psychological OR Neurocogniti* OR Neuropsychological OR Neurological OR Brain)
 S6: TI(Reproduct* OR Menstrua* OR Fertil* OR Ovulation OR Menarch OR Pregnant* OR Amenorrhea OR Oligomenorrhea OR Estrogen OR Oestrogen OR Menses OR Menorrh OR Folic* OR Luteal) OR AB(Reproduct* OR Menstrua* OR Fertil* OR Ovulation OR Menarch OR Pregnant* OR Amenorrhea OR Oligomenorrhea OR Estrogen OR Oestrogen OR Menses OR Menorrh OR Folic* OR Luteal)
 S7: S1 AND S2 AND (S3 OR S4 OR S5 OR S6)

Search Strategy EMBASE

- #1: soccer OR football*
 #2: soccer OR football* (Title or Abstract)
 #3: retirement OR retire* OR former
 #4: musculoskeletal system OR musculoskeletal disease OR tendon OR bone* OR muscle OR ligament OR cartilage OR joint OR osteoarthritis OR OA
 #5 cardiovascular system OR cardiovascular diseases OR cardiovascular OR heart OR blood OR vein OR capillary OR cardiac OR arrhythmia OR vessel OR coronary OR cardio*

#6 Mental Disorders OR Mental Processes OR Cogniti* OR Psychological OR Neurocogniti*
OR Mental OR Brain OR Neuropsychological OR Neurological OR Mental health
#7 Reproductive Physiological Phenomena OR Reproduct OR Menstrua* OR Fertil* OR
Ovulation OR Menarche OR Pregnan* OR Amenorrhea OR Oligomenorrhea OR Estrogen
OR Oestrogen OR Menses OR Menorrh* OR Folic* OR Luteal
#8: #1 AND #2 AND #3 AND (#4 OR #5 OR #6 OR #7)