Brain Impairment (2023), 1–17
doi:10.1017/BrImp.2022.37

CAMBRIDGE UNIVERSITY PRESS

ORIGINAL ARTICLE

A cross-sectional study examining Nigerian footballers' knowledge and attitudes towards sport-related concussion and associated contextual factors

Oluwaseyi Olanrewaju[1], Haroon Rashid[1,2] and Nick Dobbin[1]*

[1]Department of Health Professions, Manchester Metropolitan University, Manchester, UK and [2]Department of Emergency Medicine, Manchester Royal Infirmary, Manchester, UK
*Corresponding author. Email: N.Dobbin@mmu.ac.uk

(Received 19 May 2022; revised 3 December 2022; accepted 16 December 2022)

Abstract

Objective: To examine Nigerian footballers' knowledge and attitudes towards sport-related concussion (SRC) and associated contextual factors.

Methods: A cross-sectional study design was used with an online questionnaire distributed to Nigerian footballers affiliated with a registered team. The questionnaire included demographic information and the Rosenbaum Concussion Knowledge and Attitudes Survey (RoCKAS-ST). The concussion knowledge index (CKI, 0–25) and attitude index (CAI, 15–75) were calculated. The association between various contextual factors with "high" knowledge and attitude were determined.

Results: A total of 331 participants completed the questionnaire from 10 football clubs. Mean CKI and CAI scores were 14.0 ± 3.0 (56.2 ± 13.2%) and 54.5 ± 9.4 (72.6 ± 12.5%), respectively, and the association between scores was considered large ($r = 0.530$; 28%). A small proportion ($n = 25$; 7.6%) of participants reported a previous diagnosis of an SRC, with a further 40 (12.1%) suspecting they have suffered SRC. Thirty-five participants (10.6%) reported sustaining a SRC but did not seek medical help. Results indicated that men were at 4.8 times greater odds of having a "high[er]" CKI than women, and that those with 5–10 years playing experience had lower odds of a "high" CKI than those with >10 years' experience. Men had 7 times greater odds of having a "high" CAI than women.

Conclusion: The results of this study suggest that Nigerian footballers have a moderate level of SRC knowledge, satisfactory symptom recognition, and high SRC attitudes. Those working with Nigerian football may consider these findings when seeking strategies to improve concussion knowledge, potentially by improving attitudes and considering sex and playing experience.

Keywords: Football; soccer; concussion; traumatic brain injury; education; management

Introduction

Sports-related concussion (SRC) can be described as a temporary neurological dysfunction that results from a direct or indirect impact to the head (Carpenter, Lininger, & Craig, 2020; O'Reilly et al., 2020). SRCs can result from high-impact collisions, falls, and direct blows to the head, face, or neck, by an opponent (e.g., a player's arm) or an object (e.g., a ball) (Labiste, McElroy, Chaniotakis, Duong, & Haffizulla, 2021; Mihalik, Lynall, Teel, & Carneiro, 2014). Physiologically, concussion causes a neurochemical cascade resulting in ionic shifts, altered metabolism, and decreased connections leading to alterations in neurotransmission in the brain (Giza & Hovda, 2001). These neurochemical changes in the brain result in the signs and symptoms we observe in cases of concussion (e.g., headache, amnesia, dizziness, difficulty

concentrating, confusion, sleep disturbances, irritability, and mental fogginess) (Ferry & DeCastro, 2021). Recovery from a concussive episode takes an average of 7 to 10 days in 80%–90% of cases (Labiste et al., 2021), especially when guidelines are known and are appropriately followed by clinicians and athletes (Register-Mihalik et al., 2013a). Failure to follow these guidelines, due to a lack of awareness or dismissing the risk, combined with a return to sport before full resolution of the initial symptoms, can increase the risk of what is termed 'second impact syndrome'. Second impact syndrome describes the diffuse and potentially catastrophic cerebral oedema caused by a second concussion (McLendon, Kralik, Grayson, & Golomb, 2016). As such, to minimise the risk of this, and the potential long-term implications of repeated concussions, it is essential the symptoms, guidelines, and risk is fully understood by all parties involved in the management of SRC.

Due to the potential long-term implications, concussion is referred to as a major health concern (Finch, Clapperton, & McCrory, 2013). Hence, clinicians, researchers in sports medicine, and national governing bodies (e.g., Fédération Internationale de Football Association) have developed a keen interest in the symptoms, management, and long-term consequences of concussion (Fuller, Junge, & Dvorak, 2011). Additionally, the recognition of a concussion has been heavily prioritised by some, with several sports now introducing video technology (e.g., rugby league) and sensors (e.g., instrumented mouthguards) that are thought to support sports medicine clinicians in the detection and diagnosis of SRC (Mooney et al., 2020).

SRC continues to receive considerable attention by national governing bodies, governments, sports clubs, the media, and the medical community. According to the Centre for Disease Control and Prevention, 1.6–3.0 million concussions are sustained during sports and recreational activities in America each year (Langlois, Rutland-Brown, & Wald, 2006). No such insight is available for less developed countries. Currently, SRC research is largely focused on American football, ice hockey and rugby given high-impact collisions are common, there are clearer mechanisms, and resources are available to capture this data. In continents such as Africa, there is limited evidence available on the epidemiology of concussion, and where this does exist, it largely focuses on rugby union in South Africa given the popularity of the sport and the emphasis World Rugby places on SRC (Patricios, Kohler, & Collins, 2010; Viljoen, Schoeman, Brandt, Patricios, & Van Rooyen, 2017). However, recently greater focus has been placed on SRC and sub-concussive forces in football (soccer) (Labiste et al., 2021). Football is the most popular and fastest-growing sport in the world with over 270 million people actively engaged (registered and unregistered) in the sport (FIFA Communications Division, 2007). Recent high-profile cases of [suspected] concussion, and the controversies of the 2014 World Cup (e.g., Germany's Midfielder) and 2021 African Cup of Nations (e.g., Senegal's Striker), have increased the awareness in football (Williams, Langdon, McMillan, & Buckley, 2016). The incidence of concussion in football is estimated to be 0.2–6.9 injuries per 1000 playing hours (Mooney et al., 2020). Additionally, elite male and female football players competing for 10 years have a 50% and 20% chance, respectively, of developing symptoms associated with multiple SRCs (Covassin, Swanik, & Sachs, 2003). In Africa, Wallace et al. (2021) recently stated that, amongst 125 Zambian footballers, 7.2% reported that they had previously sustained a concussion which is likely to be higher when considering reporting behaviours, attitudes and knowledge of players.

Studies have examined footballers' knowledge of concussion, with results revealing mixed findings (Broglio et al., 2010; Cournoyer & Tripp, 2014; Gallagher & Falvey, 2017; Williams et al., 2016). A mixed-methods study by Williams et al. (2016) noted an average concussion knowledge score of 65.6% amongst English professional footballers. A slightly higher mean score (74.8%) was found in a cross-sectional study of Irish amateur and semi-professional players (Gallagher & Falvey, 2017). Similarly, in a study including junior soccer player in Canada, knowledge was on average 78.8% using the Rosenbaum Concussion Knowledge and Attitudes Survey student version (RoCKAS-ST) (Doucette, Du Plessis, Webber, Whalen, & Garcia-Barrera, 2021). Two studies conducted amongst high-school footballers revealed that over 50% were not aware of

https://doi.org/10.1017/BrImp.2022.37 Published online by Cambridge University Press

concussion symptoms and return to play guidelines (Anderson, Gittelman, Mann, Cyriac, & Pomerantz, 2016; Cournoyer & Tripp, 2014), meaning that most of the footballers studied would not have adequate knowledge to be able to report a concussion nor follow appropriate guidance. Clearly, increasing concussion knowledge is an important stage in the concussion-care-process for both coaches and players since it aids symptom recognition (Daneshvar et al., 2021; Register-Mihalik et al., 2018). For example, a prospective cohort study by Kurowski, Pomerantz, Schaiper, Ho, & Gittelman (2015) compared the effect of a pre-season, lecture-based education programme on concussion knowledge at a high school compared to a control school. Statistical improvements were identified in knowledge and self-reported behaviour/attitudes at the end of the season. Doucette et al. (2021) also noted among a group of young rowers, soccer players and contact sport athletes, that the odds of past non-discloser of SRC or the intention of non-disclosure was slightly lower (odds ratio = 0.88–0.95) with greater SRC knowledge. Hence education on the symptoms, implications, and management strategies might be one route for improving concussion recognition, reporting, and management (Van Vuuren, Welman, & Kraak, 2020).

Many behaviours are influenced by one's attitude, with more positive attitudes often being associated with the preferred behaviour (Raudsepp, Viira, & Hannus, 2010). Some studies have examined the attitude of footballers towards SRC (Gallagher & Falvey, 2017; Williams et al., 2016). Williams et al. (2016) revealed that English players had an average attitude score of 79.4% which was similar in Irish players at 80% (Gallagher & Falvey, 2017) and Canadian junior soccer player at 85.4% (Doucette et al., 2021), suggesting a good attitude towards SRC. However, through a semi-structured interview, many respondents reported unsafe concussion behaviours despite accurately identifying the potential risks (Williams et al., 2016), with 64% indicating they would continue playing after a concussion (Williams et al., 2016). Non-disclosure of concussions has been linked to several factors (Kirkwood, Parekh, Ofori-Asenso, & Pollock, 2015); for example, McCrea, Hammeke, Olsen, Leo, and Guskiewicz (2004) and Register-Mihalik et al. (2013b) found three common causes for not reporting athletic concussions with 66.4%–70.2% of athletes not believing the injury necessitated medical care, 36.5%–41.0% not wanting to be withdrawn from the game or suspended for future games, and 14.9%–36.1% were not aware they might have sustained a concussion.

Most of the literature exploring SRC comes from the Western World, with only a very small number of studies being undertaken in South Africa albeit involving rugby players (Patricios et al., 2010; Viljoen et al., 2017) and collegiate athletes (van Tonder, Kunorozva, Viviers, Derman, & Brown, 2021). With over 6.5 million footballers (men and women), Nigeria has the highest number of soccer players in Africa, and it serves as an instrument for personal development for individuals through increased physical activity (Owoeye, VanderWey, & Pike, 2020). However, involvement in sports such as football exposes players to injury risk (Owoeye, Aiyegbusi, Fapojuwo, Badru, & Babalola, 2017). In an underdeveloped country like Nigeria, where medical treatment is sometimes limited, the 'horror of a player suffering an injury is unthinkable'. Unfortunately, there are only a few studies based in Nigeria which can help us understand the pattern of football injuries, especially concussions (Azubuike & Okojie, 2008; Owoeye et al., 2017). A prospective cohort study by Owoeye et al. (2017) investigated the prevalence of injury amongst semi-professional soccer players during a national tournament in Nigeria. Concussion was found to account for 3.0% and 10.0% of injuries in male and female soccer players, respectively, as well as 13.0% of all time-loss injuries.

Before researchers and clinicians can design appropriate interventions, there is a need to understand the current level of knowledge and attitude towards SRC within an under-studied group of soccer players (Provvidenza et al., 2013) as extrapolation from other populations such as the UK, America or New Zealand may be inappropriate (Broglio et al., 2010; Kaut, DePompei, Kerr, & Congeni, 2013; McCrea et al., 2004) given the differences in various contextual factors (e.g., ethnicity, access to medical services) (Salmon et al., 2020). Furthermore, many of the surveys used in previous research possess poor psychometric qualities. Hence, the Rosenbaum Concussion

https://doi.org/10.1017/BrImp.2022.37 Published online by Cambridge University Press

Knowledge and Attitudes Survey (RoCKAS) was created for student athletes, coaches and medical personnel with the reliability and validity established (Rosenbaum & Arnett, 2010). The student athlete version has also recently undergone a slight modification to the SRC symptom checklist, thus enhancing the validity of this survey further.

The purpose of this study was to assess Nigerian footballers' knowledge and attitudes surrounding concussions using a psychometrically appropriate survey as well as to determine associated contextual factors.

Methods

A cross-sectional study design was used to assess the knowledge and attitude of Nigerian footballers towards SRC. This design allowed for data to be gathered across a wide range of sub-populations engaging in football in Nigeria. Accordingly, several contextual factors such as age group, sex, level of education, playing experience, playing level, ethnicity and whether they had suffered a SRC previously were captured. Ethical approval for the study was granted by the Faculty of Health and Education Research Ethics Committee at Manchester Metropolitan University (number: 35654).

An estimation of the required sample size was completed using the Raosoft Sample Size calculator, and a sample size of ∼300 participants was deemed sufficient to give adequate precision of players' concussion knowledge index (CKI) and concussion attitude index (CAI) using 95% confidence intervals. The response distribution was set at 50:50 as to not bias any perceptions of the responses, an estimated sample of over 20,000 was used, where thereafter, it makes minimal difference in the required sample, and the error was set at 5%.

An introduction letter was sent to Nigerian football clubs via their publicly available email addresses to gauge their interest and willingness to support this research. Those that agreed to support were provided with a link to the questionnaire, and were free to share this via any appropriate channel they chose (i.e., social media, newsletters, website) to potential participants. Consent was implied by participants completing the questionnaire. The use of an online questionnaire allowed for the publication on the World-Wide-Web, thus meaning individuals in Nigeria could complete the questionnaire despite it being a UK-based study. A pilot study was completed by selecting seven Nigerian footballers who were not part of the larger sample, and having them check the language and logic of the questionnaire before distributing it on a larger scale (Thabane et al., 2010). Following the completion of the pilot study, the questionnaire was made available online for eligible participants.

The inclusion criteria for participation included being affiliated to a football club that plays organised 11-aside football and is registered under the Nigeria football association. The players were required to be over the age of 18 years and have played organised football for a minimum of 12 months. Players were excluded if they were unable to read or write, unable to access the internet, or engaged in solely 'non-official' versions of the sport (e.g., 5-aside, 7-aside and walking football). The online survey was made available from August 2021 until December 2021 for any footballer who met the inclusion criteria.

Concussion knowledge and attitudes were measured using an amended version of the Rosenbaum Concussion Knowledge and Attitudes Survey student version (RoCKAS-ST) (Rosenbaum & Arnett, 2010). Permission was granted to use this tool by one of the authors of the RoCKAS-ST questionnaire. The RoCKAS-ST questionnaire was developed in an online format via JISC online survey. The questionnaire is made up of six sections. Section one collected information about the participants and history of SRC. Specifically, section one asked if participants have ever been diagnosed with a SRC, if they think they have had a SRC but were not diagnosed, and if they suspected a SRC but did not seek medical help. The same participant could select "Yes" or "No" to each of these questions. Section two and three examined the participant's

https://doi.org/10.1017/BrImp.2022.37 Published online by Cambridge University Press

knowledge of concussion. This comprised of 21 true/false questions which included 4 distractor questions. Sections four and five consisted of 18 questions to assess attitude towards concussion, each in a Likert Scale format, ranging from "strongly disagree" to "strongly agree". These were then used to classify participant's responses as "safe", "neutral" and "unsafe". Section four had three distractor questions. Section six contains a checklist of eight common concussion symptoms and eight distracting symptoms. The 16 potential symptoms were based on previously published symptom studies and the distractors were seen to be more reasonable (abnormal sense of smell/taste, black eye and neck pain) than the original RoCKAS distractors (hair loss, excessive studying and arthritis) (Saunders, Burdette, Metzler, Joyner, & Buckley, 2013) as well as increasing the reliability and validity of this tool (Viljoen et al., 2017).

CKI was derived by summing the scores across sections two, three and six. Correctly answered items received one point and incorrectly answered items received no points. Possible scores on the CKI ranged from 0 to 25 (Williams et al., 2016). CAI was derived by totalling the scores from 15 questions across sections four and five. Possible scores on the CAI ranged from 15 to 75 (Williams et al., 2016). The RoCKAS survey demonstrated fair to satisfactory test-retest reliability when assessed 2 days apart amongst students, with CKI and CAI scores having intraclass correlation coefficient (ICC) of 0.67 and 0.79, respectively (Rosenbaum & Arnett, 2010). The 16-item symptom recognition has a reliability of 0.89, an ICC of 0.88, and a Cronbach's alpha of 0.83 (Williams et al., 2016). An internal validity index consisting of three true/false questions in section two (15, 21 and 26) was added, and a score of <2 resulted in the test being considered invalid (Rosenbaum & Arnett, 2010). In such instances, these responses were removed. Levels of concussion knowledge and attitude were categorised as $>80\%$ very high, 60%–80% high, 40%–59% moderate, 20%–39% low, and $<20\%$ very low (O'Reilly et al., 2020).

Participant characteristics, with reference to sub-grouping, are presented as frequencies and percentages. CKI and CAI are presented as mean and standard deviation and as a percentage of the total possible score. The distribution of data for CKI and CAI as scale variables was checked using the Shaprio–Wilk statistic. As the data was not compatible with the assumptions of a normal distribution, the Spearman Rho correlation test was used, with r interpreted as trivial (<0.10), small (0.11–0.30), moderate (0.31–0.50), large (0.51–0.70), very large (0.71–0.90) and perfect (>0.90) (Hopkins, 2002). The association between contextual factors (i.e., age group, sex, level of education, playing experience, playing level, ethnicity and previous SRC) and a high ($\geq 60\%$) CKI and CAI were determined using a univariable and multivariable binary logistic regression. Sixty percent was chosen to represent "high" knowledge and attitude based on the work of O'Reilly et al. (2020). Some individuals chose options such as "prefer not to say" or "other", and these were excluded from the uni- and multivariable analysis, resulting in a sample of 281. Multicollinearity was assessed alongside the binary logistic regression with a value of 0.7 and above considered substantial multicollinearity. Finally, to aid in the readers interpretation of significance in the uni- and multi-variable regression, the proportion of the sample in each category were compared using a chi squared statistic. All analysis was conducted using SPSS (version 27; Statistical Packages for Social Sciences, Armonk, NY).

Results

In total, 331 participants completed the online survey reflecting 10 registered football clubs within Nigeria. All participants completed all sections to derive the CKI and CAI scores and passed the validity index (mean $= 2.5 \pm 0.5$, range $= 2$–3). A summary of the frequencies can be found in Table 1.

A total of 25 (7.6%) participants reported being diagnosed with a SRC, whilst 40 (12.1%) suspected they had experienced a SRC, but it went undiagnosed. Thirty-three (10.6%) participants suspected a SRC but did not seek medical help. As these questions were independent, participants

https://doi.org/10.1017/BrImp.2022.37 Published online by Cambridge University Press

Table 1. Participant characteristics

Characteristics	Number (%)
Age	
18–25 years	160 (48.3)
26–30 years	110 (33.2)
31–35 years	49 (14.8)
36–40 years	7 (2.1)
>40 years	5 (1.5)
Sex	
Men	224 (67.7)
Woman	98 (29.6)
Prefer not to say	9 (2.7)
Highest level of education	
Primary	3 (0.9)
Secondary	100 (30.2)
Tertiary	188 (56.8)
Other	40 (12.1)
Playing position	
Defender	62 (18.7)
Midfielder	126 (38.1)
Striker	110 (33.2)
Goalkeeper	33 (10%)
Playing experience	
<5 years	52 (15.7)
5–10 years	134 (40.5)
>10 years	145 (43.8)
Highest playing level	
Amateur	117 (35.3)
Semi-professional	111 (33.5)
Professional	82 (24.8)
Other	21 (6.3)
Ethnicity	
Yoruba	143 (43.2)
Igbo	67 (20.2)
Hausa	57 (17.2)
Prefer not to say	49 (14.8)
Other	15 (14.5)

Note: Data presented as frequency and percentage.

https://doi.org/10.1017/BrImp.2022.37 Published online by Cambridge University Press

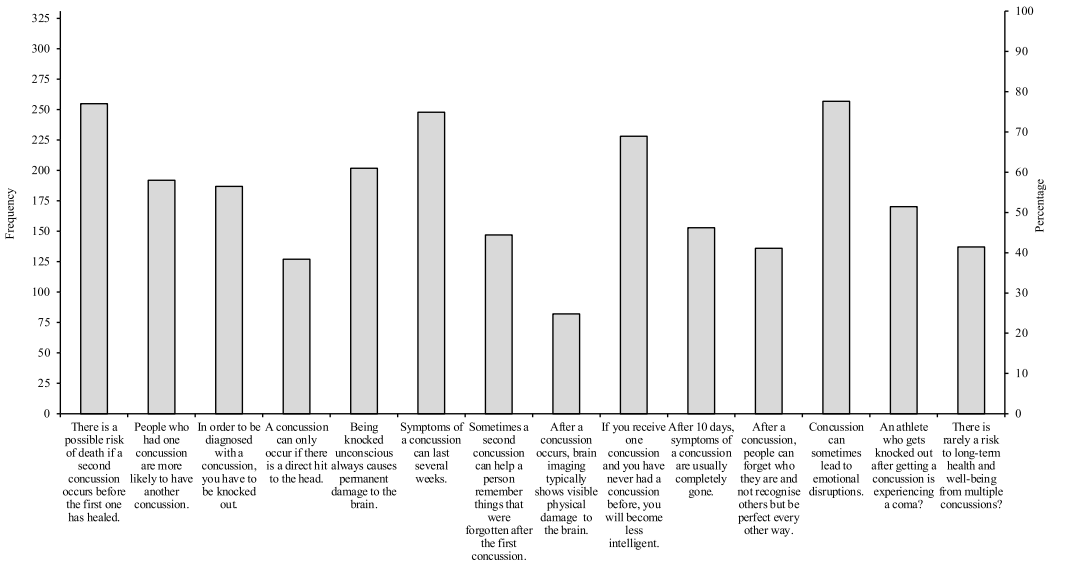

Figure 1. Frequency and percentage of responses answering "true" to CKI statements.

were able to provide an answer of "Yes" or "No" to each question. Ten participants (3.0%) answered "Yes" to being diagnosed previously and suspecting an undiagnosed SRC, whilst seven of these individual also answered "Yes" to being diagnosed previously and not seeking medical help in subsequent case. A total of 24 participants (7.3%) answered "Yes" to suspecting an undiagnosed SRC and not seeking medical help. Three individuals answered "Yes" to all three questions indicating they had been diagnosed with an SRC, suspected an SRC but it went undiagnosed, and did not seek medical help for a suspected SRC.

Mean CKI was 14.0 ± 3.0 (56.2 ± 13.2%) with a range of 6 (24.0%) to 22 (88.0%). The most common misconception about SRC was in reference to diagnostic scans whereas the most common correct answered referred to emotional changes being evident. A full breakdown for all 14 statements can be found in Figure 1.

In examining CKI, the following scenario was given to the participants: "*While playing in a game, player Q and player X collide with each other, and both suffer a concussion. Player Q has never had a concussion in the past. Player X has had 4 concussions in the past*". When asked if player Q's and X's concussion will affect their long-term health and well-being, 197 (59.6%) and 230 (69.5%), respectively, answered "true" correctly. Using a second scenario of "*Player F suffered a concussion in a game. He continued to play in the game despite the fact that he continued to feel the effects of the concussion*", 255 (77.0%) of participants correctly answered "False" when asked if player F's performance will be the same as when he had not suffered a concussion. A summary of the correctly and incorrectly identified symptoms associated with SRC are presented in Figure 2.

Mean CAI was 54.5 ± 9.4 (72.6 ± 12.5%) with a range of 35 (47.0%) to 22 (100.0%). In evaluation of their attitudes, five questions were posed with the results presented in Figure 3.

Participants were shown four scenarios to assess their CAI, which were as follow:

Scenario 1: *Player R suffers a concussion during a game. Coach A decides to keep player R out of the game. Player R's team loses the game.*

Scenario 2: *Athlete M suffered a concussion during the first game of the season. Athlete O suffered a concussion of the same severity during the semi-final playoff game. Both athletes had persisting symptoms.*

Scenario 3: *Athlete R suffered a concussion. Athlete R's team has a physiotherapist on staff.*

https://doi.org/10.1017/BrImp.2022.37 Published online by Cambridge University Press

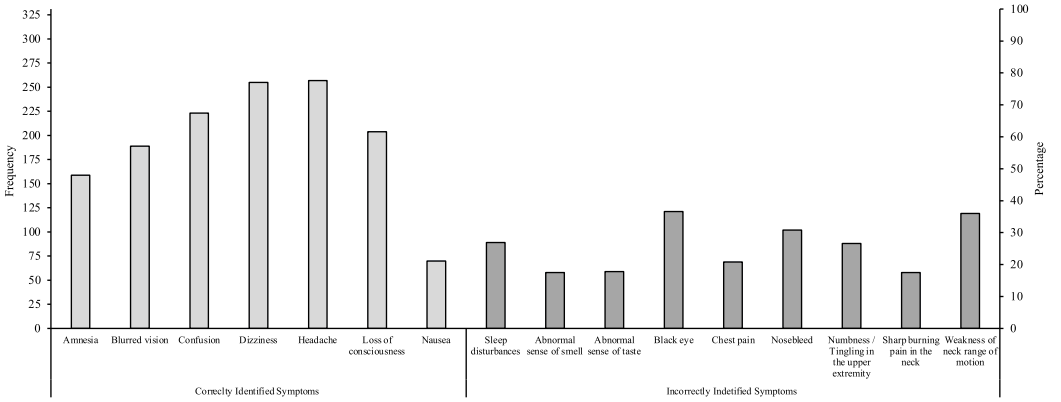

Figure 2. Frequency and percentage of responses identified correct and incorrect SRC symptoms.

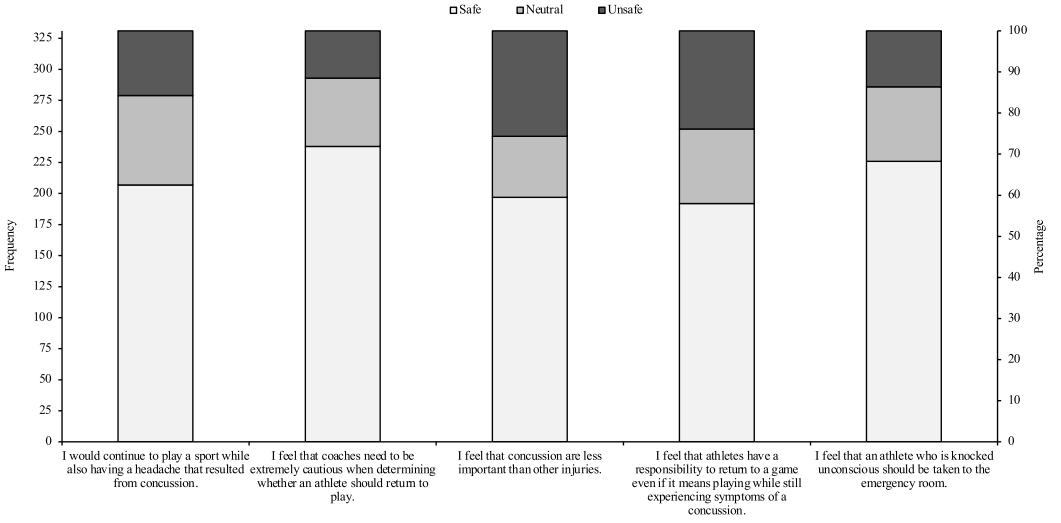

Figure 3. Frequency and percentage of safe, neutral, and unsafe responses to CAI statements.

Scenario 4: *Athlete H suffered a concussion and has a game in two hours. He is still experiencing symptoms of a concussion. However, athlete H knows that if he tells his coach about the symptoms, his coach will keep him out of the game.*

Responses to the four scenarios indicated that most individuals gave a "safe" response with the exception of question 2 in scenario 2 where the highest proportion of "unsafe" responses was given. The greatest proportion (76.7%) of safe responses was observed for question 1, scenario 4. A full breakdown of the responses for each scenario is presented in Table 2.

The relationship between CKI and CAI indicated a large correlation ($r = 0.530$, $P < 0.001$), with 28% of the variance between scores explained. When considering CKI, the chi squared statistic indicated differences in the proportion represented for age ($\chi^2 = 13.770$, $P = 0.008$), sex ($\chi^2 = 27.586$, $P < 0.001$), playing experience ($\chi^2 = 17.316$, $P < 0.001$), ethnicity ($\chi^2 = 23.062$, $P < 0.001$) and those diagnosed with concussion ($\chi^2 = 6.034$, $P < 0.014$). For CAI, differences were observed for age ($\chi^2 = 30.412$, $P < 0.001$), sex ($\chi^2 = 68.286$, $P < 0.001$), playing position ($\chi^2 = 11.701$, $P = 0.008$), playing experience ($\chi^2 = 31.471$, $P < 0.001$), playing level ($\chi^2 = 16.595$, $P < 0.001$), and ethnicity ($\chi^2 = 53.926$, $P < 0.001$). Overall, there was little

https://doi.org/10.1017/BrImp.2022.37 Published online by Cambridge University Press

Table 2. Responses to four scenarios to evaluate concussion attitudes

Scenarios	Safe (%)	Neutral (%)	Unsafe (%)
Scenario 1			
I feel that Coach A made the right decision to keep Player R out of the game.	221 (66.8)	55 (16.6)	55 (16.6)
Most athletes would feel that coach A made the right decision to keep Player R out of the game.	197 (59.5)	64 (19.3)	70 (21.1)
Scenario 2			
I feel that Athlete M should have return to play during the first game of the season.	177 (53.5)	64 (19.3)	90 (27.2)
Most athletes would feel that Athlete M should have returned to play during the first game of the season.	121 (36.5)	87 (26.3)	123 (37.2)
I feel that Athlete O should have returned to play during the semi-final playoff game.	156 (47.2)	72 (21.8)	103 (31.1)
Most athletes feel that Athlete O should have returned to play during the semi-final playoff game.	130 (39.2)	93 (28.1)	108 (32.7)
Scenario 3			
I feel like that athletic trainer rather than Athlete R should make the decision about Athlete R returning to play.	220 (66.4)	61 (18.4)	50 (15.1)
Most athlete would feel that the athletic trainer rather than Athlete R should make the decision about returning Athlete R to play.	201 (60.7)	67 (20.2)	63 (19)
Scenario 4			
I feel that Athlete H should tell coach about the symptoms.	254 (76.7)	51 (15.4)	26 (7.8)
Most athletes would feel that Athlete H should tell coach about the symptoms.	218 (65.8)	76 (23.0)	37 (11.2)

Note: Data presented as frequency and percentage.

presence of multicollinearity with the minimum and maximum correlation values being 0 to −0.37 and 0.001 to −0.55 for CKI and CAI, respectively. Univariate logistic regression, based on 281 participants, revealed that sex, playing position (defender), playing experience and ethnicity were associated with a high CKI, however, only sex and playing experience remained in the full and final models. For these, the OR indicated that the odds of being classified with a "high" knowledge were 4.86 times greater for men, and 46%–63% lower odds for those with less than 10 years of playing experience (Table 3). For CAI, sex, playing position (defender) and playing experience (5–10 years) were associated with a "high" CAI at a univariable level. In addition, when considering the full model, semi-professional status was associated with 79% lower odds of being classified as "high" compared to professional status. In the final model, only sex remained to indicate an association, with men having 7.11 greater odds of being classified as having as a "high" CAI. Age, ethnicity, and previous history regarding SRC were not "significantly" associated with CKI or CAI in the full model (Table 4).

Discussion

This study aimed to determine the CKI and CAI amongst Nigerian footballers as well as potential factors associated with being categorised as "high" CKI and CAI. We report a moderate CKI and high CAI, with a degree of shared covariance between these. Furthermore, we have shown that sex,

https://doi.org/10.1017/BrImp.2022.37 Published online by Cambridge University Press

Table 3. Association between contextual information and the likelihood of scoring high on concussion knowledge index

Variable	CKI		Univariable OR (95% CI) Unadjusted	Multivariable OR (95% CI)	Multivariable OR (95% CI) Final Model
	Low (<60%)	High (≥60%)			
Sex					
Men	119	77	5.37 (2.99, 0.64)***	2.59 (1.19, 5.63)*	4.86 (2.67, 8.82)***
Women	66	19	*Referent*	*Referent*	*Referent*
Age group					
15–25 years	61	84	1.38 (0.08, 22.45)	1.55 (0.08, 29.9)	–
26–30 years	51	37	0.73 (0.04, 11.98)	1.38 (0.07, 26.61)	–
31–35 years	26	15	0.58 (0.03, 9.91)	1.42 (0.07, 29.81)	–
36–40 years	4	1	0.25 (0.01, 8.56)	0.03 (0.01, 15.20)	–
>40 years	1	1	*Referent*	*Referent*	–
Education					
Primary	3	0	–	–	–
Secondary	57	41	0.62 (0.37, 1.01)	0.66 (0.36, 1.21)	–
Tertiary	83	97	*Referent*	*Referent*	–
Playing position					
Defender	21	35	2.89 (1.15, 7.22)*	2.22 (0.78, 6.33)	–
Midfielder	56	48	1.48 (0.64, 3.42)	1.33 (0.50, 3.50)	–
Striker	47	44	1.62 (0.69, 3.78)	1.76 (0.67, 4.61)	–
Goalkeeper	19	11	*Referent*	*Referent*	–
Playing experience					
<5 years	24	44	0.50 (0.25, 1.00)*	0.39 (0.17, 0.89)*	0.54 (0.26, 1.13)
5–10 years	71	38	0.32 (0.19, 0.55)***	0.33 (0.18, 0.61)***	0.37 (0.21, 0.66)***
>10 years	48	80	*Referent*	*Referent*	*Referent*
Playing status					
Amateur	44	63	1.96 (1.07, 3.60)*	1.23 (0.56, 2.72)	–
Semi-professional	58	45	1.06 (0.58, 1.95)	0.99 (0.47, 2.10)	–
Professional	41	30	*Referent*	*Referent*	–
Ethnicity					
Yoruba	50	28	1.47 (0.70, 3.08)	1.31 (0.57, 3.01)	–
Igbo	36	28	0.70 (0.31, 1.58)	1.02 (0.40, 2.64)	–
Hausa	40	9	0.20 (0.08, 0.53)**	0.42 (0.13, 1.34)	–
Other minority groups	17	19	*Referent*	*Referent*	–
Diagnosed SRC					
Yes	15	6	0.06 (0.39, 1.03)	0.39 (0.13, 1.23)	–
No	128	132	*Referent*	*Referent*	–

(*Continued*)

https://doi.org/10.1017/BrImp.2022.37 Published online by Cambridge University Press

Table 3. (*Continued*)

Variable	CKI		Univariable OR (95% CI) Unadjusted	Multivariable OR (95% CI)	Multivariable OR (95% CI) Final Model
	Low (<60%)	High (≥60%)			
Suspected SRC					
Yes	18	15	1.18 (0.57, 2.45)	0.69 (0.24, 2.01)	–
No	125	123	*Referent*	*Referent*	–
Sought medical advice					
Yes	16	17	1.12 (0.54, 2.31)	1.39 (0.47, 4.11)	–
No	127	121	*Referent*	*Referent*	–

Note: SRC – sport-related concussion. ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$. OR = odds of falling in the high CKI group. Multivariable model included factors to determine the effect of each factor when fully adjusted. The final model included all factors that met the stopping criteria of $p < 0.05$ in both the univariate and multivariate model.

playing position and playing experience are associated with greater or lesser odds of being considered "high" for CKI and/or CAI. The results of this study also suggest that age group, ethnicity and previous history of concussion (i.e., diagnosed or not; reported or not) was not associated with a higher CKI or CAI at an alpha level of 0.05.

In this study, 7.6% of participants reported being diagnosed with SRC which is lower than 23.4% and 29.9% recorded in high school and university football players, respectively (Delaney, Lacroix, Leclerc, & Johnston, 2002; McCrea et al., 2004). This was, however, similar to the 7.2% reported by Wallace et al. (2021) who studies the incidence of SRC amongst Zambian footballers. In total, 12.1% of respondents felt they might have had a SRC but did not receive a formal diagnosis, whilst 10.6% felt they might have had a SRC but did not seek medical help. Of those who reported being diagnosed with an SRC previously, most (7/10) also said they suspected another SRC, but no formal diagnosis was given. Similarly, most also stated that suspected another SRC but did not seek medical help. These findings support the notion that only a small proportion of SRCs are being diagnosed in Nigeria (McCrea et al., 2004) and that the overall prevalence might be under-represented in this study as many do not receive a formal diagnosis or seek medical help.

The mean CKI in this study was found to be 56.2% which was less than those studies using English professional footballers (65.6%; Williams et al., 2016), Irish semi-professional and professional footballers (74.8%; Gallagher & Falvey, 2017), Canadian youth soccer players (78%; Doucette et al., 2021), amateur South African rugby players (75%; Viljoen et al., 2017) and cyclists from all global regions (75.8%; Hurst, Novak, Cheung, & Atkins, 2019). The findings of inadequate awareness of concussion causes, diagnosis and sequelae in this population specifically may be indicative of the fact that concussion research and public knowledge translation has been primarily focused on developed countries (Eagles et al., 2016). Educational programmes have mostly been targeted towards footballers in the Western World (Daneshvar et al., 2021). There are several factors that might help explain our findings. For example, contextual factors are best understood in a socio-ecological model, which is a systems-based public health model that covers the complex interplay of policy, organisational, interpersonal and intrapersonal levels of influence on a health state and related behaviours (Register-Mihalik et al., 2018). Firstly, considering policy in the United Kingdom as an example, the Football Association introduced rules that meant any player who sustains a suspected concussion should immediately be removed from the pitch and are unable to return until the appropriate assessment or treatment has been administered (Smith, 2016). This kind of policy influences players' knowledge indirectly, and no such policy exists in Nigerian Football (a non-FIFA competition) in which this study was conducted.

https://doi.org/10.1017/BrImp.2022.37 Published online by Cambridge University Press

Table 4. Association between contextual information and the likelihood of scoring high on concussion attitude index

Variable	CAI		Univariable OR (95% CI) Unadjusted	Multivariable OR (95% CI)	Multivariable OR (95% CI) Final Model
	Low (<60%)	High (≥60%)			
Sex					
Men	10	186	7.32 (3.31, 16.16)***	3.93 (1.08, 14.27)*	7.11 (3.14, 16.10)***
Women	25	61	*Referent*	*Referent*	*Referent*
Age group					
15–25 years	8	137	–	–	–
26–30 years	16	72	–	–	–
31–35 years	10	31	–	–	–
36–40 years	9	5	–	–	–
>40 years	0	2	*Referent*	*Referent*	–
Education					
Primary	12	2	0.21 (0.02, 2.42)	0.42 (0.02, 10.36)	–
Secondary	16	82	0.53 (0.26, 1.11)	0.85 (0.22, 2.20)	–
Tertiary	17	163	*Referent*	*Referent*	–
Playing position					
Defender	5	51	3.10 (0.89, 10.82)	1.41 (0.29, 6.73)	1.73 (0.45 (6.66)
Midfielder	9	95	3.21 (1.08, 9.53)*	4.65 (1.81, 18.3)*	2.69 (0.84, 8.60)
Striker	13	78	1.83 (0.65, 5.11)	2.45 (0.69, 8.67)	1.75 (0.58, 5.30)
Goalkeeper	7	23	*Referent*	*Referent*	*Referent*
Playing experience					
<5 years	3	41	1.16 (0.30, 4.42)	1.15 (0.21, 6.26)	–
5–10 years	21	88	0.36 (0.16, 0.79)*	0.48 (0.19, 1.27)	–
>10 years	10	118	*Referent*	*Referent*	–
Playing status					
Amateur	6	101	2.14 (0.71, 6.45)	0.55 (0.13, 2.29)	–
Semi-professional	20	83	0.53 (0.22, 1.27)	0.31 (0.10, 0.97)*	–
Professional	8	63	*Referent*	*Referent*	–
Ethnicity					
Yoruba	7	125	–	–	–
Igbo	10	54	–	–	–
Hausa	17	32	–	–	–
Other minority groups	0	36	*Referent*	*Referent*	–
Diagnosed SRC					
Yes	2	19	0.75 (0.17, 3.37)	1.57 (0.21, 11.99)	–
No	32	228	*Referent*	*Referent*	–

(*Continued*)

https://doi.org/10.1017/BrImp.2022.37 Published online by Cambridge University Press

Table 4. (*Continued*)

Variable	CAI		Univariable OR (95% CI) Unadjusted	Multivariable OR (95% CI)	Multivariable OR (95% CI) Final Model
	Low (<60%)	High (≥60%)			
Suspected SRC					
Yes	4	29	0.99 (0.33, 3.04)	0.36 (0.06, 2.18)	–
No	30	218	*Referent*	*Referent*	–
Sought medical advice					
Yes	3	30	1.43 (0.41, 4.96)	1.50 (0.21, 10.9)	–
No	31	247	*Referent*	*Referent*	–

Note: SRC – sport-related concussion. ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$. OR = odds of falling in the high CAI group. Multivariable model included factors to determine the effect of each factor when fully adjusted. The final model included all factors that met the stopping criteria of $p < 0.05$ in both the univariate and multivariate model.

Furthermore, unfavourable economic conditions in developing countries like Nigeria, as well as policy that prioritises other high-priority health issues e.g., malaria and HIV (Muhammad, Abdulkareem, & Chowdhury, 2017), could affect public awareness of concussion. Factors such as sex, playing experience, and playing position can influence the knowledge and attitude of an athlete, which our findings reinforce at a univariable level. Furthermore, ethnicity appeared to be associated with knowledge at a univariate level for the Hausa tribe, with this tribe having a lower knowledge index compared to other tribes. This could be because the Hausa tribe ranks lowest in literacy levels amongst the major tribes in Nigeria (Smith, 2021) and traditionally live in small villages, so may reflect less exposure to outputs (e.g., written media about SRC) than others. Also, knowledge and safe attitudes have been found to be influenced by coaches, teammates, and parents' education (Chrisman, Quitiquit, & Rivara, 2013; Kraak et al., 2018), though in this study, their own education appeared to have minimal influence on CKI and CAI.

The most common misconception around knowledge amongst participants was that 'after a concussion occurs, brain imaging typically shows visible physical damage to the brain' which was incorrectly answered as "true" by 75.2% of participants. This misconception was similarly high among South African rugby players (Viljoen et al., 2017). Further, in a mixed-methods study by Williams et al. (2016), this accounted for the second most common misconception on a quantitative survey. However, despite thinking that concussion can be associated with bleeding in the brain, they still expressed during the interview that they felt it was not as serious as a leg break suggesting some degree of 'downplaying the severity' of concussion because concussion symptoms are often mild and non-visible. Another misconception was that 'concussion can only occur if there is a direct hit to the head', with 61.6% incorrectly answering "true". A similar finding was found among junior (37%) and amateur rugby players (43%) (Viljoen et al., 2017). This misconception highlights the need for the proper education for football (soccer) players on the causes, possible mechanism of SRC, and sequelae as the respondent's understanding of these was inadequate.

The most recognised symptoms were headache, dizziness, and confusion. Similar patterns of responses were seen amongst high school and English footballers (Cournoyer & Tripp, 2014; Williams et al., 2016), though they were identified by over 90% of participants in these studies compared to 67%–78% in this study. This small differences might be due to the growing publicity around SRC in the Western World (O'Reilly et al., 2020). It should also be noted that the previous studies had a smaller sample compared to this study. Nausea (21.1%), sleeping problems (26.9%), and amnesia (48%) were the least identified symptoms which were consistent with previous findings in football and rugby (Broglio et al., 2010; Kraak et al., 2018). In addition, there was a

https://doi.org/10.1017/BrImp.2022.37 Published online by Cambridge University Press

misunderstanding between the symptoms of a concussion and those of a more severe brain or neurological injury, with 30.8% and 36.6% of respondents identifying bleeding nose and black eye, respectively, as symptoms of concussion. It is critical that footballers understand the differences between concussion and symptoms of severe brain injury to be able to seek the most appropriate medical care and allow for a degree of identification of SRC symptoms in themselves and others. Overall, these findings imply that, despite continued misunderstandings, most Nigerian footballers have a moderate understanding of SRC and can recognise some of the concussion symptoms. These misconceptions can be addressed via a targeted concussion education programme.

Participants in this study reported a mean CAI score of 72.6%, which was similar to studies in English football (79.5%; Williams et al., 2016), Irish footballers (80.4%; Gallagher & Falvey, 2017), Canadian junior soccer players (85.5%; Doucette et al., 2021), and high school athletes (79.9%; Register-Mihalik et al., 2013b). Respondents indicated conservative attitudes on the survey by providing safer responses on 14 out of 15 questions. For example, most respondents stated that footballers should inform their manager of suspected concussion even if it means removal from play (76.7%). Respondents also felt coaches need to be cautious when determining whether an athlete should return to play (71.9%), and that an athlete who is unconscious should be taken promptly to an accident and emergency department (68.3%). Two-thirds of participants (66.4%) felt that physiotherapist should be responsible for a return-to-play following a concussive episode. These findings show that most players know the role coaches and medical personnel play in identifying and managing concussion. Similar findings were found when a questionnaire was administered to English footballers (Williams et al., 2016). However, also in agreement with Williams et al. (2016), 25.7% of respondents in this study felt concussions are not as important as other injuries and 33 participants suspected an SRC but did not seek help. This not only highlights the potential knowledge gap, but also a somewhat dismissive attitude, meaning footballers might not be aware of how severe concussion can be both in the short- and long-term. Furthermore, 15.7% and 21.8% of respondents reported an unsafe or neutral response when asked if they would return-to-play when experiencing a headache because of an SRC. This decision may be influenced by the fact that respondents may want to return to a game because of their competitiveness or the perceived importance of the game as evidenced by the 23.9% who reported an unsafe response regarding responsivity to return. This finding is not unique. Indeed, FIFA reported that 96% of players who were interviewed indicated that match importance influenced their decision to play or not when experiencing symptoms associated with concussion (Football IFOA, 2013). Doucette et al. (2021) also demonstrated that competitiveness was positively associated with past non-disclosure or the intention of non-disclosure (OR 1.02–1.05) of an SRC in Canadian youth soccer players.

There was a relationship between CKI and CAI that reflected 28% shared covariance. This was found to be higher than a study amongst South African rugby players (Kraak et al., 2018), and suggests that educational interventions targeted at concussion knowledge could invariably help improve attitudes towards SRC amongst Nigerian footballers. The purpose of educational interventions is likely to be twofold: to increase people's concussion knowledge and, more crucially, to modify people's behaviour by encouraging them to report self-suspected concussions, seek medical help, and follow the guidance given (Kroshus, Daneshvar, Baugh, Nowinski & Cantu, 2014). However, such approaches should also consider the results from our regression analysis which highlighted that further education and attitude modification may be required for women, specific playing positions, and those with fewer years of playing experience.

Whilst this study provides valuable insight in the CKI and CAI in a population previously not reported upon, there are some limitations worthy of mention. Firstly, this study was cross-sectional in design and relied upon self-reported details and accounts of SRC. As such, we are unable to verify the true accuracy of the details provided despite the approach used (anonymous, online questionnaire) or if socially desirable results were given. Further, whilst a relatively large

https://doi.org/10.1017/BrImp.2022.37 Published online by Cambridge University Press

sample was used, for some sub-groups, the relatively small numbers did impact our statistical power and analysis (e.g., influence of age and ethnicity of CAI) meaning some associations might have gone undetected or the confidence intervals are wider than desired.

Overall, the results of this study highlight that those involved in Nigerian football have moderate knowledge, but generally good attitudes towards SRC, agreeing with previous literature in non-African countries. Furthermore, our results suggest that changes in knowledge might increase the attitudes towards concussion, and that an initiative to promote knowledge should consider the association with sex, playing position and playing experience. Our results indicate that, in Nigeria, further work is needed to educate footballers on all aspects of SRC especially in females and those with fewer years of football experience.

Acknowledgements. The authors would like to thank all the participants who completed the online questionnaire and gate-keepers who provided access.

Author contributions. OO and ND were involved in the conceptualisation, data collection, ethics submission, data analysis and implementation of the methodology. OO and ND wrote the draft manuscript which was read and edited by HR and ND. ND revised the article. All authors approved the final manuscript and any revisions.

Financial support. This research received no specific grant from any funding agency, commercial or not-for-profit sectors.

Conflicts of interest. The authors have no conflicts of interest to disclose.

Ethical standards. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. This project was approved by the Faculty of Health and Education Research Ethics Committee, Manchester Metropolitan University, UK. The approval number for the project is 35654.

References

Anderson, B. L., Gittelman, M. A., Mann, J. K., Cyriac, R. L., & Pomerantz, W. J. (2016). High school football players' knowledge and attitudes about concussions. *Clinical Journal of Sport Medicine*, *26*(3), 206–209.

Azubuike, S. O., & Okojie, O. H. (2008). An epidemiological study of football (soccer) injuries in Benin City. *British Journal of Sports Medicine*, *43*(5), 382–386.

Broglio, S. P., Vagnozzi, R., Sabin, M., Signoretti, S., Tavazzi, B., & Lazzarino, G. (2010). Concussion occurrence and knowledge in Italian football (soccer). *Journal of Sports Science and Medicine*, *9*(3), 418–430.

Carpenter, S., Lininger, M., & Craig, D. (2020). Intrapersonal factors affecting concussion reporting behaviors according to the theory of planned behavior in high school football players. *The International Journal of Sports Physical Therapy*, *15*(3), 374–379.

Chrisman, S. P., Quitiquit, C., & Rivara, F. P. (2013). Qualitative study of barriers to concussive symptom reporting in high school athletics. *The Journal of Adolescent Health*, *52*(3), 330–335.

Cournoyer, J., & Tripp, B. L. (2014). Concussion knowledge in high school football players. *Journal of Athletic Training*, *49*(5), 654–658.

Covassin, T., Swanik, C. B., & Sachs, M. L. (2003). Epidemiological considerations of concussions among intercollegiate athletes. *Applied Neuropsychology*, *10*(1), 12–22.

Daneshvar, D. H., Yutsis, M., Baugh, C. M., Pea, R. D., Goldman, S., Grant, G. A., . . . Sorcar, P. (2021). Evaluating the effect of concussion education programs on intent to report concussion in high school football. *Journal of Athletic Training*, *56*(11), 1197–1208.

Delaney, J. S., Lacroix, V. J., Leclerc, S., & Johnston, K. M. (2002). Concussions among university football and soccer players. *Clinical Journal of Sport Medicine*, *2*(6), 331–338.

Doucette, M. M., Du Plessis, S., Webber, A. M., Whalen, C., & Garcia-Barrera, M. A. (2021). In it to win it: Competitivness, concussion knowledge and nondisclosure in athletes. *The Physician and Sportsmedicine*, *49*(2), 194–202.

Eagles, M., Bradbury-Squires, D., Powell, M., Murphy, J., Campbell, G., & Maroun, F. (2016). The impact of a concussion-U educational program on knowledge of and attitudes about concussion. *Canadian Journal of Neurological Sciences/Journal Canadien Des Sciences Neurologiques*, *43*(5), 659–664.

Ferry, B., & DeCastro, A. (2021). *Concussion*. StatPearls [Online]. Retrieved February 9, 2022, from https://www.ncbi.nlm.nih.gov/books/NBK537017

FIFA Communications Division (2007). *FIFA big count 2006: 270 million people active in football* [Online]. Retrieved September 1, 2022, from https://digitalhub.fifa.com/m/55621f9fdc8ea7b4/original/mzid0qmguixkcmruvema-pdf.pdf

https://doi.org/10.1017/BrImp.2022.37 Published online by Cambridge University Press

Finch, F. F., Clapperton, A. J., & McCrory, P. (2013). Increasing incidence of hospitalisation for sport-related concussion in Victoria, Australia. *The Medical Journal of Australia*, *198*(8), 427–430.

Football IFOA (2013). *Laws of the game 2013/14*. Zurich:: Fédération Internationale de Football Association [Online]. Retrieved February 12, 2022, from https://cdn.ghanasoccernet.com/resources/log2013en_neutral.pdf

Fuller, C. W., Junge, A., & Dvorak, J. (2011). Risk management: FIFA's approach for protecting the health of football players. *British Journal of Sports Medicine*, *46*(1), 11–17.

Gallagher, C., & Falvey, E. (2017). Assessing knowledge and attitudes towards concussion in Irish footballers. *British Journal of Sports Medicine*, *51*(11), 60–61.

Giza, C. C., & Hovda, D. A. (2001). The neurometabolic cascade of concussion. *Journal of Athletic Training*, *36*(3), 228–235.

Hopkins, W. G. (2002). *A scale of magnitudes for effect statistics* [Online]. Retrieved August 18, 2021, from https://www.sportsci.org/resource/stats/effectmag.html

Hurst, H. T., Novak, A. R., Cheung, S. S., & Atkins, S. (2019). Knowledge and attitudes towards concussion in cycling: A preliminary study. *Journal of Science and Cycling*, *8*(1), 11–17.

Kaut, K. P., DePompei, R., Kerr, J., & Congeni, J. (2013). Reports of head injury and symptom knowledge among college athletes: Implications for assessment and educational intervention. *Clinical Journal of Sport Medicine*, *13*(4), 213–221.

Kirkwood, G., Parekh, N., Ofori-Asenso, R., & Pollock, A. M. (2015). Concussion in youth rugby union and rugby league: A systematic review. *British Journal of Sports Medicine*, *49*(8), 506–510.

Kraak, W. J., Bernardo, B. A., Gouws, H. A., Loubser, A., Vuuren, J. O., & Coetzee, M. C. (2018). Concussion knowledge and attitudes amongst Stellenbosch University hostel rugby players. *South African Journal of Sports Medicine*, *30*(1), 1–5.

Kroshus, E., Daneshvar, D. H., Baugh, C. M., Nowinski, C. J., & Cantu, R. C. (2014). NCAA concussion education in ice hockey: An ineffective mandate. *British Journal of Sports Medicine*, *48*(2), 135–140.

Kurowski, B., Pomerantz, W., Schaiper, C., Ho, M., & Gittelman, M. (2015). Impact of preseason concussion education on knowledge, attitudes, and behaviors of high school athletes. *The Journal of Trauma and Acute Care Surgery*, *79*(3), 21–28.

Labiste, C. C., McElroy, E., Chaniotakis, S., Duong, N., & Haffizulla, F. (2021). Effectiveness of pitchSafe on knowledge and attitude of baseball-related concussion. *Cureus*, *13*(4), 14732.

Langlois, J. A., Rutland-Brown, W., & Wald, M. M. (2006). The epidemiology and impact of traumatic brain injury: A brief overview. *Journal of Head Trauma Rehabilitation*, *21*(5), 375–378.

McCrea, M., Hammeke, T., Olsen, G., Leo, P., & Guskiewicz, K. (2004). Unreported concussion in high shool football players: Implications for prevention. *Clinical Journal of Sport Medicine*, *14*(1), 13–17.

McLendon, L. A., Kralik, S. F., Grayson, P. A., & Golomb, M. R. (2016). The controversial second impact syndrome: A review of the literature. *Pediatric Neurology*, *62*(1), 9–17.

Mihalik, J. P., Lynall, R. C., Teel, E. F., & Carneiro, K. A. (2014). Concussion management in soccer. *Journal of Sport and Health Science*, *3*(4), 307–313.

Mooney, J., Self, M., ReFaey, K., Elsayed, G., Chagoya, G., Bernstock, J. D., & Johnston, J. M. (2020). Concussion in soccer: A comprehensive review of the literature. *Concussion*, *5*(3), 1–15.

Muhammad, F., Abdulkareem, J. H., & Chowdhury, A. A. (2017). Major public health problems in Nigeria: A review. *South East Asia Journal of Public Health*, *7*(1), 6–11.

O'Reilly, M., Mahon, S., Reid, D., Hume, P., Hardaker, N., & Theadom, A. (2020). Knowledge, attitudes, and behavior toward concussion in adult cyclists. *Brain Injury*, *34*(9), 1175–1182.

Owoeye, O. B. A., Aiyegbusi, A. I., Fapojuwo, O. A., Badru, O. A., & Babalola, A. R. (2017). Injuries in male and female semi-professional football (soccer) players in Nigeria: Prospective study of a National Tournament. *BioMed Central Research Notes*, *10*(1), 133–139.

Owoeye, O. B. A., VanderWey, M. J., & Pike, I. (2020). Reducing injuries in soccer (football): An umbrella review of best evidence across the epidemiological framework for prevention. *Sports Medicine Open*, *6*(1), 46.

Patricios, J. S., Kohler, R. M. N., & Collins, R. M. (2010). Sports-related concussion relevant to the South African rugby environment – A review. *South African Journal of Sports Medicine*, *22*(4), 88–94.

Provvidenza, C., Engebretsen, L., Tator, C., Kissick, J., McCrory, P., Sills, A., & Johnston, K. M. (2013). From consensus to action: Knowledge transfer, education and influencing policy on sports concussion. *British Journal of Sports Medicine*, *47*(5), 332–338.

Raudsepp, L., Viira, R., & Hannus, A. (2010). Prediction of physical activity intention and behavior in a longitudinal sample of adolescent girls. *Perceptual and Motor Skills*, *110*(1), 3–18.

Register-Mihalik, J. K., Guskiewicz, K. M., McLeod, T. C., Linnan, L. A., Mueller, F. O., & Marshall, S. W. (2013a). Knowledge, attitude, and concussion-reporting behaviors among high school athletes: A preliminary study. *Journal of Athletic Training*, *48*(5), 645–653.

Register-Mihalik, J. K., Linnan, L. A., Marshall, S. W., Valovich-McLeod, T. C., Mueller, F. O., & Guskiewicz, K. M. (2013b). Using theory to understand high school aged athletes' intentions to report sport-related concussion: Implications for concussion education initiatives. *Brain Injury*, *27*(7-8), 878–886.

https://doi.org/10.1017/BrImp.2022.37 Published online by Cambridge University Press

Register-Mihalik, J. K., Williams, R. M., Marshall, S. W., Linnan, L. A., Mihalik, J. P., Guskiewicz, K. M., & McLeod, T. C. V. (2018). Demographic, parental, and personal factors and youth athletes' concussion-related knowledge and beliefs. *Journal of Athletic Training*, *53*(8), 768–775.

Rosenbaum, A. M., & Arnett, P. A. (2010). The development of a survey to examine knowledge about and attitudes toward concussion in high-school students. *Journal of Clinical and Experimental Neuropsychology*, *32*(1), 44–55.

Salmon, D. M., Mcgowan, J., Sullivan, S. J., Muphy, I., Walters, S., Whatman, C., . . . **Romanchuk, J.** (2020). What they know and why they are telling: Concussion knowledge and disclosure behaviour in New Zealand adolescent rugby union players. *Journal of Sports Sciences*, *38*(14), 1585–1594.

Saunders, E. A., Burdette, G. T., Metzler, J. N., Joyner, A. B., & Buckley, T. A. (2013). Knowledge of coaching education students regarding sport-related concussions. *Athletic Training and Sports Healthcare*, *5*(1), 11–13.

Smith, J. G. (2021). A case for literacy: New hope for Northern Nigeria through western teaching strategies. *Honors Theses*, *843*(1), 1–2.

Smith, P. (2016). *Premier League head injury and concussion rules explained*. SKY SPORTS [Online]. Retrieved February 11, 2022, from https://www.skysports.com/football/news/11662/10584878/premier-league-head-injury-and-concussion-rules-explained

Thabane, L., Ma, J., Chu, R., Cheng, J., Ismaila, A., Rios, L. P., . . . **Goldsmith, C. H.** (2010). A tutorial on pilot studies: The what, why and how. *BMC Medical Research Methodology*, *10*(1), 1–10.

Van Tonder, R., Kunorozva, L. K., Viviers, P., Derman, W. E., & Brown, J. C. (2021). Presenting features of female collegiate sports-related concussion in South Africa: A descriptive analysis. *South African Sports Medicine Association*, *33*(1), 1–7.

Van Vuuren, H., Welman, K., & Kraak, W. (2020). Concussion knowledge and attitudes amongst community club rugby stakeholders. *International Journal of Sports Science and Coaching*, *15*(3), 297–305.

Viljoen, C. T., Schoeman, M., Brandt, C., Patricios, J., & Van Rooyen, C. (2017). Concussion knowledge and attitudes among amateur South African rugby players. *South African Journal of Sports Medicine*, *29*(1), 1–6.

Wallace, J., Mulenga, D., Bretzin, A., Delfin, D., Muyinda, G., Sichizya, K. A., & Mulenga, J. (2021). Diversifying sport-related concussion measures with baseline balance and ocular-motor scores in professional Zambian football athletes. *The Physician and Sportsmedicine*, *49*(3), 289–296.

Williams, J. M., Langdon, J. L., McMillan, J. L., & Buckley, T. A. (2016). English professional football players concussion knowledge and attitude. *Journal of Sport and Health Science*, *5*(2), 197–204.

Cite this article: Olanrewaju O, Rashid H, and Dobbin N. A cross-sectional study examining Nigerian footballers' knowledge and attitudes towards sport-related concussion and associated contextual factors. *Brain Impairment*. https://doi.org/10.1017/BrImp.2022.37