The Current State of Concussion Knowledge and Attitudes in British American Football

Abstract

Objectives: To examine concussion knowledge and concussion attitudes of players, coaches and support staff in British American Football (BAF).

Methods: Data from players, coaches and support staff (n=236) were collected from across all leagues in BAF. An online survey tool was used which included the Rosenbaum Concussion Knowledge and Attitudes Survey (RoCKAS), and questions examining concussion education and perceived risk of participating in football.

Results: The mean score on the RoCKAS concussion knowledge was 21.0 ± 2.1 of a possible score of 25 reflecting good knowledge. Of a possible score of 65, the mean concussion attitude score was 55.6 ± 6.1 showing safe attitude. Whilst an overall safe attitude was seen, almost half of participants (45.3%) noted they would continue to play with a concussion. No relationship was found between CAI and prior concussion history. Fifty seven percent of participants agreed the benefits of playing football outweighed the risks. Forty eight percent reported that they had received no concussion-related education in the past 12 months.

Conclusion: BAF participants have good concussion knowledge and safe attitudes. However, risky behaviour is demonstrated through unsafe likelihood to report and attitude to long term health risks. Access to the British American Football Association (BAFA) concussion policy and education was poor raising questions over what sources of information stakeholders are drawing their knowledge from. These findings can help form the foundation of educational interventions (e.g., coaching workshops) to challenge current misconceptions and improve likelihood to report concussion in BAF.

Keywords: Concussion Reporting; British American Football; Health Education; Injury Risk; Concussion Attitude; Concussion Knowledge

Introduction

American football (AF) is a growing sport in the United Kingdom with 473 National League teams currently playing under the national governing body, the British American Football Association (BAFA) in both the flag and tackle game [1]. In the 2020-21 season there were 9075 players across BAFA flag and tackle leagues, with possible age ranges from 7 years to adult (no upper age limit). Due to the tackling and blocking element of this sport, a significant number (59.3%) of injuries including concussion-injuries are caused by player contact [2]. In 2020, 32% of athletes in the British university game of AF were at risk of sustaining at least one concussion over the course a season [3]. However, it should be noted that these findings were in university AF players only and at present there is no data on non-self reported diagnosed concussions.

Appropriate and timely recognition of concussion is important to the management of the injury, to provide both immediate and secondary stage care, in order to avoid long-term tertiary effects. Unfortunately, under-reporting of concussion is common within BAF, where almost 45% of players suspected they had a concussion but did not get this formally diagnosed [4]. Furthermore, when asked about concussion injury reporting behaviour 23.5% of players reported hiding symptoms from coaches or medical staff [4]. Findings from this study reported players would downplay, ignore and deny injury [4], This greatly increases the risk of subsequent acute or chronic illness (e.g. secondary impact syndrome [5], chronic traumatic encephalopathy or “traumatic encephalopathy syndromes” (TESs)) [6,7].

Worryingly, a history of concussions puts the athlete at elevated risk of further concussions which are likely more severe and have a longer recovery period [8-11].

As a developing sport BAF has finite resources with many teams having limited access to suitably trained medical personnel and updated concussion protocols [4]. Thus, there is a greater need for players and game day staff (e.g., coaches, players and referees) to recognise signs and symptoms of concussion and for players to self-report suspected concussions. Coaches have gaps in knowledge regarding concussion, particularly around diagnostic methods and recovery of youth athletes [12]. This therefore needs to be addressed to ensure player safety.

The aim of this study was to investigate the knowledge and attitudes of concussion in players, coaches and staff involved in the game of BAF.

Investigation of the knowledge and attitudes of concussion in BAF is a key step to understanding the reasons behind the under-reporting of injury and to help guide the creation of future educational strategies of the national governing body for all parties involved within the game.

Materials and Methods

Participants

Participants (n=236) were drawn from across all (insert number of leagues) leagues in British American Football in the UK during the autumn of 2021. They were contacted via central BAFA email communication (to registered coaches, players and support staff, those who had 'opted-in' to email communication) and social media (Facebook and Instagram). The demographic sample can be found in table 1.

Inclusion criteria: Participants had to be over the age of 18 and actively involved in British American Football as a coach, player, support personnel or combination of roles in the 18 months prior to the release of the survey. Exclusion criteria: Nonparticipating minors were not actively involved in the study.

[Table 1. Participant demographics]

Procedures

Ethical approval was granted by a British University Ethics Committee (ETHICS2020-61). The survey was available via a link to the website Online Surveys. Informed consent was required prior to proceeding with the questionnaires. The survey was open for two months and follow up reminders were sent via email.

Materials

The survey included sections on demographics (11 questions), previous concussion history (6 questions), policy awareness (2 questions) and football-related risk questions (3 questions).

In addition, the Rosenbaum Concussion Knowledge and Attitudes Survey (RoCKAS) survey was used which is considered a valid and reliable tool for assessing knowledge and attitude of concussion in collegiate athletes [13,14]. The tool consists of 53 items divided into 5 sections with two scores: Concussion Knowledge Index (CKI) and Concussion Attitude Index (CAI). The first subscale (CKI) comprises 14 true/false questions, three applied scenario true/false questions and nine symptom questions, with eight distractors (excluded from total score). Scoring was performed following the instructions from Rosenbaum and Arnett [14]. Possible scores for CKI ranged from 0-25 with a higher score representing greater concussion knowledge.

Responses to the CAI questions were measured on a 5-point Likert scale (1=strongly disagree to 5=strongly agree). Participants received a score between one and five points depending on the safety level of the response (1= very unsafe response, 5= very safe response). The range of the CAI scores ranged from 13-65, with 13 indicating very unsafe attitudes and 65 indicating very safe attitudes.

Perceived risk of football-related neurodegenerative disease was assessed using questions from a previously published study [15]. Using 7-point Likert scale participants indicated their perception and risk of developing dementia, Alzheimer's disease (AD), or chronic traumatic encephalopathy (CTE) later in life because of participating in football. Finally, participants were asked to indicate how strongly they agreed with three statements on the risks and benefits of playing football, in the short and long term as well as health benefits specifically. This was rated on a 7-point Likert scale ranging from 'Strongly disagree (1)' to 'Strongly agree (7)'.

Participants had the opportunity to select if they received concussion education in the last 12 months and how this educational information was presented to them.

Data analysis

Descriptive statistics (means and standard deviations) were calculated using Excel (Version 1808) and SPSS Version 26 (IBM, Chicago, Illinois, USA) was used to calculate Pearson's correlation coefficient. An independent T-test was performed to calculate whether there was a significant difference between CAI scores in offensive and defensive players. The alpha level was set at $p<0.05$ for all statistical tests.

Results

Football risks

Almost 79% (n=186) of participants reported that developing dementia, Alzheimer's disease (AD) or chronic traumatic encephalopathy (CTE) would be very negative. Twenty nine percent of participants (n= 68) reported that they perceived it unlikely they would develop dementia, Alzheimer's disease (AD), or chronic traumatic encephalopathy (CTE) later in life as a result of playing football. Eighty-three percent agreed that the benefits of playing football outweigh/ed the risks in the short term, with sixty two percent stating that the benefits of playing football outweigh/ed the risks in the long term. Fifty seven percent agreed that the benefits of playing football outweigh/ed the risks regarding health benefits specifically and sixteen percent reported they disagreed that the benefits of playing football outweigh/ed the risks regarding health benefits specifically. Twenty three percent (n=62) neither agreed nor disagreed with this statement.

A mean score of 1.5 was reported for how positive or negative developing dementia, Alzheimer's disease (AD) or chronic traumatic encephalopathy (CTE) would be on a scale of 1 (very negative) to 7 (very positive) Of the typical neurodegenerative diseases, a mean score of 3.3 was reported for response to the question 'I will develop dementia, Alzheimer's disease (AD), or chronic traumatic encephalopathy (CTE) later in life because I played football' on a scale of 1 (Definitely won't) to 7 (Definitely will). On a scale of 1 (strongly disagree) to 7 (strongly agree) a mean score of 3.7 was noted for response to 'The benefits of playing football outweigh/ed the risks in the short term', a mean score of 4.8 for response to 'The benefits of playing football outweigh/ed the risks in the long term' and finally a mean score of 4.7 for response to 'The benefits of playing football outweigh/ed the risks regarding health benefits specifically'.

There was a negative correlation between football related risks outweighing risks regarding health benefits and concussion reporting likelihood, r=-0.1, n=236, p = 0.002 indicating that the more the athlete believes the benefits outweigh the risks the less likely they are to report a concussion i.e., athletes are happier to continue to play football with injury.

RoCKAS survey

The total mean CKI score was 21.0 ± 2.1 (range 12-25). Within the CKI, the most common knowledge question correctly identified was: Symptoms of a concussion can last for several weeks (98.3%, 232/236). The most common misconception identified was: An athlete who gets knocked out after a concussion is experiencing a coma (14.4%, 34/236). See table 2.

[Table 2. Percentage of correct responses to Knowledge ROKAS questions]

The CAI component mean score was 55.6 ± 6.1 (range 23-65). The most commonly accepted safe attitude was: coaches/managers need to be extremely cautious when determining whether an athlete should return to play (95.7%, 226/236). The most commonly accepted riskiest behaviour was the athlete would continue playing sport whilst suffering with a headache as a result of concussion (45.3%, 107/236). See table 3.

[Table 3. Percentage of safer responses to risk attitude RoCKAS questions.]

Figure 1 shows the mean CAI scores for positional groups. This includes players who have indicated other responsibilities in football.

[Figure 1. Mean CAI scores according to position]

The most common correct recognition of concussion symptoms were headache, difficulty concentrating and dizziness. The most concerning and least correctly identified symptoms was ‘feeling slowed down’. See table (4) for the percentage of respondents who correctly identified the concussion symptoms.

[Table 4. Percentage of correct responses to RoCKAS 16-item symptom recognition checklist]

Correlations were performed to explore relationships between variables. See table 4 for results.

There was significant positive correlation between CAI and the likelihood to report concussion and age. Negative correlations were noted between CAI and risk attitude to heath specifically and prior history of concussion. In addition, there were significant positive correlations between CKI and likelihood to report concussion. See table 5 for the relationship of CAI and CKI with variables. Negative correlations were found between CAI and perceived benefits of playing AF versus the long- and short-term risk to health. No clear correlation was noted between CKI and perceived benefits of playing AF versus the long- and short-term risk to health.

[Table 5. Relationships of participants' response to Concussion Attitude Index and Concussion Knowledge Index to age, prior concussion diagnosis, reporting likelihood and attitude to risk.]

Concussion, concussion education and policy

The mean number of diagnosed concussions by a medical practitioner of all participants was 0.9 (± 1.4). The mean number of suspected concussions of all participants was 2.3 (± 3.7).

Almost 47.9% (n=113) of participants reported receiving education about sport-related concussion in the past 12 months. However, 48.3% (n = 114) reported that they had received no education in the past 12 months. A small percentage (3.8%, n = 9) reported that they did not know or were unsure if they had received education in the last 12 months. See table 6 for methods of receiving concussion education information. Of those who selected the 'other'

option, participants noted academic papers, coaching qualifications, formal training as a medical practitioner and online concussion awareness courses as forms of education.

[Table 6. Participant's recognition of methods of receiving concussion education.]

When participants were asked about their awareness of the BAFA concussion policy, 63.1% (n=149) reported they were aware. However, when asked whether they had previously accessed and read the BAFA Concussion policy, 63.6% (n=150) reported that they had not accessed or read the policy.

Discussion

This is the first study to provide an insight into the current state of concussion knowledge and attitudes within BAF. The results suggest that concussion knowledge among BAF participants was generally good. Worryingly, regarding attitudes, the more an individual believes the benefits of playing outweigh the risks, the more likely they are to under-report symptoms and play through injury.

Over half of all participants had previously sustained a self-diagnosed concussion, however less than half had been medically diagnosed. This supports previous findings in BAF [4] and could explain the increased confidence in knowledge of concussion. However, prior findings suggest knowledge may not be sufficient for injury self-diagnosis and give athletes a 'false sense of security' [16]. It is positive that participants felt able to self-diagnose concussion, but this does not explain why there was no formal diagnosis by a medical practitioner.

The primary finding of this study was that attitudes towards and knowledge of concussion may influence player behaviour. Athletes with a safer attitude to concussion are overall more cautious in their approach to concussion and thus are more likely to report the injury to a

medical practitioner or coach. However, it is concerning that almost half of participants stated that they would continue to play with a concussion. In addition, increased knowledge of concussion results in players being more likely to report concussive symptoms. However, intention to report is not always reflective of true reporting behaviour [17] but this may improve with the introduction of concussion education. Furthermore, future research could explore the impact of educational delivery methods in BAF.

Many BAF players in the UK follow the NFL and, despite a current lack of research in BAF concussion, players might be aware of discussions from the US. In recent years, the NFL has addressed the 'concussion crisis' by actioning a response strategy of media and marketing [18], encouraging player educational programmes across many sports, under the Lystedt Law. Through this increased media coverage, we might expect that UK players might be more aware of the implications of playing with head injury and associated long-term risks. Moreover, as BAF is currently an amateur sport, players might be more cautious of the long-term effects of injury on their wider life (i.e., careers, family or studies), meaning they are safer in their approach to injury and reporting behaviour. Indeed, prior research suggests athletes' risk-taking attitude is linked to career decisions [19].

Our results confirm that an increased knowledge of concussion does not affect the number of concussions a player has, however this prior knowledge might help players to self-diagnose a concussion. With an increased ability to self-diagnose, players may be able to prevent secondary or tertiary harm [20]. Furthermore, knowledge of concussion was not related to the number of concussions, suggesting that athletes with no prior history of concussion have a similar understanding of as those who have had one, agreeing with research conducted with Japanese collegiate athletes [21]. Our findings are positive, suggesting that concussion education is reaching the whole community. However, there is a paradox given that 37% of participants reported to have not accessed and read the BAFA concussion policy. At present

there is no mandate in BAF for those involved in the game to be educated on concussion and some participants have had no concussion training at all [4]. It therefore cannot be presumed that all participants are accessing this information from the NGB and are getting information elsewhere. Concussion educational material was reported to come from a range of sources (e.g., web-based), however the specific details about educational platforms warrants further investigation. Table 7 outlines a series of educational recommendations for the NGB.

In general, improved knowledge positively influenced likelihood to report concussion to a coach or medic. Greater knowledge of concussion was demonstrated through increased recognition of signs and symptoms. In line with other studies [21], most participants correctly identified the highly recognisable symptoms such as headache, difficultly concentrating and dizziness while fewer identified symptoms such as feeling like in a 'fog'. However just as there are common symptoms of concussion (e.g., headache), there are broader acute signs of concussion which might require medical examination. It is of concern that a number of symptom distractors were incorrectly selected such as 'feeling slowed down'. This is a concern because this is a common symptom of fatigue and so a player could be misdiagnosed.

Furthermore, our findings suggest that as age increases, risk attitudes become more cautious, agreeing with Kerr [22] and Hutchinson et al. [23]. This may not be unique to athletes as humans naturally become more cautious about health with age in general life [24]. We found no significant relationship between age and concussion knowledge however, despite previous findings which suggest that concussion knowledge increases with age [22]. No matter the age of an individual, knowledge may be perceived in different ways despite the amount or type of knowledge, and this requires further investigation.

It is concerning that the more athletes believe the benefits of playing outweigh the risk to health, the less likely they are to report injury. Although this study did not explore what the individuals perceived benefits might be, prior research suggests that individuals report the benefits of sport participation to be: improvements in daily life, improved physical and mental wellbeing and social outlets [25]. Thus, if BAF players perceive these benefits of being part of team as more important that personal wellbeing, they may choose to play through injury.

Amateur BAF participants may believe the long-term health implications seen at the professional level will not impact them. Indeed, amateur rugby players have been noted to downplay and ignore concussion suggesting they do not fully understand concussion but have trivialised it as part of the sport [26]. In addition, athletes may only remove themselves from play if they perceived the injury posed a long-term threat to their own health [27]. Despite these findings it should be noted that Liston et al. [27] reported data from a small pool of university rugby athletes and so may not be representative of all athletes. Comparable findings have also been seen at 'sub-elite' level with clinicians reporting that athletes do not fully understand their bodies and think they are invincible [28]. As such, the education of amateur athletes may be insufficient, and they do not believe that serious health implications can occur at that level of the game. Indeed, this study found that over half of participants perceived it unlikely they will develop a neurodegenerative disease as a result of playing football. At present there is limited research to confirm the likelihood of developing neurodegenerative disease in amateur contact athletes, however links have been noted in the professional game [29].

It has been suggested that athletes reporting decisions are dependent on the athlete's level of competitiveness and game circumstances, for example the availability of substitutions or the importance of the game [30]. To overcome the underreporting of injury in sports such as

soccer, governing bodies such as the English Premier League have brought in the concussion substitute law which allows each team to have two permanent concussion substitutes whilst players are assessed by medics. However, unlike other sports with smaller squad sizes, substitutions are not an issue in BAF where teams have no maximum roster size nor are there restrictions on substitutions. Yet, at an amateur level, not all teams will have roster depth and so some players may be required to play in multiple positions, thus placing the athletes under pressure to stay on the field. Further investigation might be taken to investigate BAF players reasons for concussion reporting barriers.

Upon suspecting symptoms of concussion, athletes should be removed or remove themselves from physical activity. However, despite good knowledge or prior concussion history, underreporting is still present. Indeed, Liston et al. [26] found contact athletes preferred receiving a concussion over musculoskeletal injury which in their eyes would mean less time out of the game. Secondly, the participants somewhat rationalised the benefits of concussion, allowing them to play in a 'primal state' and so not capable of conscious cognition thus not needing to adhere to the social norms of reporting behaviour [31]. However, studies have reported that contact athletes with prior injury history demonstrate greatest worry and concern of re-injury [32]. There is currently a lack of research looking at the role fear of re-injury has on symptom reporting and future research could seek to investigate this. This might be further explained by the manifestation of anxiety in the injured athlete. Fear of losing their position on the team, letting the team, family, friends or community down, believing they could manage the injury alone or losing their athletic ability which has been previously reported to pressure the athlete to continue to play [29]. Athletes will continue to play under the pressure of coaches and parents, changing reporting behaviour which might intensify the athlete's reason to underreport [33].

Underreporting is present in BAF. Players may hold misconceptions about concussions which lead to underreporting of injury exposing the athlete to considerable health implications. As a developing sport, BAF has an opportunity to challenge these misconceptions through player education.

Limitations

This is the first known study of concussion knowledge and attitudes in BAF however there are some limitations. The authors recognise the limitation in analysing the mix of groups however this is an exploratory study looking to capture current concussion knowledge. Therefore, future research may look to investigate individual groups or differences between these groups. This study was cross-sectional in design; therefore, the data should be regarded as a snapshot of behaviour in a single moment of time and thus could be unrepresentative of group behaviour as a whole. Participants in this study were contacted and invited to participate through varied avenues resulting in participants choosing to participate which might have resulted in selection bias. It was difficult to contact all registered BAFA members due to opt-out marketing communication options. Additionally, some areas of the survey required athletes to rely upon their ability to remember past events which may have led to recall bias and potential inaccuracies. Furthermore, it was assumed that respondents were honest in their responses and did not answer based on what they thought to be socially acceptable. However, these findings should not be discredited and provide primary data on knowledge and attitudes of concussion in BAF.

Future Directions

With the support of key stakeholders, future research should aim to further investigate perceived risk and reporting behaviour in BAF to inform future educational strategies and reduce risky concussion-related behaviour. Our recommendations for the NGB are outlined in

table 7. We recommend that key stakeholders in the game emphasise the importance of a safe approach to concussion reporting and encourage regular concussion education. By creating a culture of reporting concussive symptoms, we may see safer reporting trends. [16]. Furthermore, research might seek to understand the true sources of education in BAF participants to inform future educational strategies of the NGB and examine the effectiveness (both in cost and player knowledge) when introducing educational programmes in BAF.

[Table 7. Recommendations.]

Conclusion

This is the first study to examine attitudes and knowledge of concussion in BAF and could be used to inform BAF concussion education, implemented within BAF coaching workshops. The findings are generally positive, with knowledge of concussion and symptom recognition generally good. However, these findings show there is evidence of risky behaviour seen in BAF through unsafe unlikeliness to report and poor attitudes to long term health. Many respondents had not received concussion education in the last 12 months nor accessed the NGB concussion policy. Future interventions should look to challenge these misconceptions, improving attitude towards concussion, reporting behaviour and educational strategy. Future research is needed to examine the relationship between concussion-related knowledge and attitudes and reporting behaviours in BAF athletes.

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Table 1. Participant demographics

Role		Frequency (n)	Age Mean ± SD	Gender Frequency (n)			Playing years Mean ± SD
				Male	Female	Prefer not to say	

All participants		100.0 (236)	30.5 ± 11.2	75.4 (178)	23.7 (56)	0.8 (2)	5.2 ± 5.0
Player	Offence	40.7 (96)	29.4±10.0	29.7 (70)	10.6 (25)	0.4 (1)	4.2±3.8
	Defence	40.3 (95)	25.9±6.3	29.2 (69)	10.6 (25)	0.4 (1)	5.5±5.1
	Special Teams	0.8 (2)	24.0±8.5	0.8 (2)	0.0 (0)	0.0 (0)	4.9±4.8
	Total	64.0 (151)	25.6±6.5	45.8 (108)	17.8 (42)	0.4 (1)	4.2±3.8
Coach		13.6 (32)	43.1±12.8	13.1 (31)	0.4 (1)	0.0 (0)	-
Support Personnel		2.5 (6)	45.7±9.0	0.8 (2)	1.7 (4)	0.0 (0)	-
Combined role of player, coach or support personnel*		19.9 (47)	35.7±11.6	15.7 (37)	3.8 (9)	0.4 (1)	-
Code							
	Tackle	81.8 (193)	29.3±10.8	63.1 (149)	18.2 (43)	0.4(1)	-

	Flag	8.9 (21)	33.8±10.2	5.1 (12)	3.8 (9)	0.0 (0)	-
	Tackle and Flag	9.3 (22)	37.6±12	7.2 (17)	1.7 (4)	0.4 (1)	-

* Support personnel was defined as a team manager, medical staff, conditioning staff or other (excluding coach or player).

Percentages based upon total participant number. Total participants n=236

All playing positions apart from 'Punter' were covered.

Table 2. Percentage of correct responses to Knowledge ROKAS questions

Question	%	n
Symptoms of a concussion can last for several weeks. (True)	98.3	232
Concussions can sometimes lead to emotional disruptions. (True)	97.5	230
There is a possible risk of death if a second concussion occurs before the first one has healed. (True)	90.7	214
People who have one concussion are more likely	69.5	164

to have another concussion. (True)		
In order to be diagnosed with a concussion, you have to be knocked out. (False)	99.6	235
A concussion can only occur if there is a direct hit to the head. (False)	91.1	215
Being knocked unconscious always causes permanent damage to the brain. (False)	84.3	199
Sometimes a second concussion can help a person remember things that were forgotten after the first concussion. (False)	95.3	225
After a concussion occurs, brain imaging (e.g., CAT scan, MRI, X-Ray, etc) typically shows visible physical damage (e.g., bruise, blood clot) to the brain. (False)	38.6	91
If you receive one concussion and you have	98.3	232

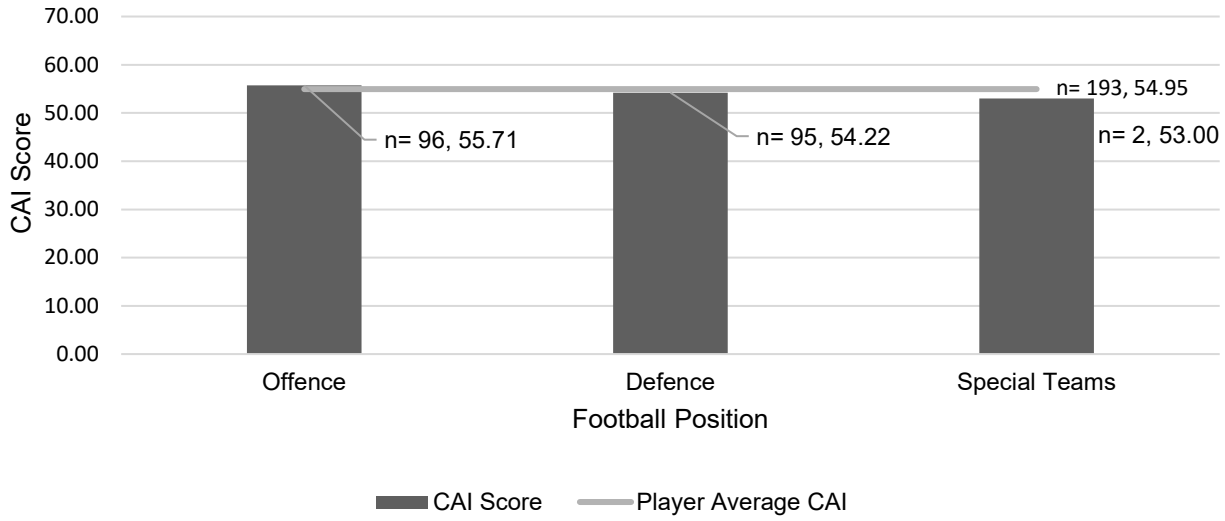
never had a concussion before, you will become less intelligent. (False)		
After 10 days, symptoms of a concussion are usually completely gone. (True)	48.3	114
After a concussion, people can forget who they are and not recognise others but be perfect in every other way. (False)	26.3	62
An athlete who gets knocked out after getting a concussion is experiencing a coma. (True)	14.4	34
There is rarely a risk to long-term health and wellbeing from multiple concussions. (False)	89.8	212

Table 3. Percentage of safer responses to risk attitude RoCKAS questions.

Question	%	n
I feel that coaches/managers need to be extremely	95.76	226

cautious when determining whether an athlete should return to play		
I would continue playing a sport while also having a headache that resulted from a minor concussion.	45.34	107
I feel concussions are less important than other injuries.	91.10	215
I feel that an athlete has a responsibility to return to a game even if it means playing while experiencing symptoms of a concussion.	90.25	213
I feel that an athlete who is knocked unconscious should be taken to the emergency room.	87.29	206

Figure 1. Mean CAI scores according to position



*No significant difference between CAI score and offensive and defensive playing position only $p<0.097$ level

Table 4. Percentage of correct responses to RoCKAS 16-item symptom recognition checklist

	Player	Coach	Support Personnel	Player, Coach, Support Personnel	Player, Coach	Coach, Support Personnel	Player, Support Personnel	Total
Headache	99.3	100	100	100	100	100	83.3	99.1
Difficulty speaking	100	100	100	100	100	100	100	76.1
Sensitivity to light	96.0	96.9	83.3	75	100	40	100	94.9

Difficulty rememberin g	91.3	96.9	83.3	100	93.8	80	83.3	92.0
Panic attacks	100	100	100	100	100	100	100	26.7
Drowsiness	84.1	96.9	83.3	100	84.3	60	83.3	85.6
Feeling like in a "fog"	85.4	100	83.3	100	100	80	100	89.8
Feeling slowed down	77.5	71.9	66.7	75	71.9	60	83.3	75.4
Reduced breathing rate	100	100	100	100	100	100	100	30.1
Difficulty concentratin g	95.4	100	100	100	100	100	83.3	96.6
Dizziness	96.7	100	100	100	100	80	100	97.5
Hives	100	100	100	100	100	100	100	0.4
Arthritis	100	100	100	100	100	100	100	0.4
Weight Gain	98.0	90.6	50	25	90.6	40	50	1.3
Excessive Studying	98.0	90.6	50	25	90.6	40	50	1.7
Hair loss	100	100	100	100	100	100	100	0

*The percentage (%) of respondents who correctly included each symptom and correct concussion symptoms are in bold.

Table 5. Relationships of participants' response to Concussion Attitude Index and Concussion Knowledge Index to age, prior concussion diagnosis, reporting likelihood and attitude to risk.

		Age	Prior Concussion Diagnosis	Likelihood to report concussion to coach or medic	Attitude to health risks specifically vs the benefits of playing AF	Attitudes towards the benefits of playing AF vs risks in the long term	Attitudes towards the benefits of playing AF vs risks in the short term
CAI	r	.228	-.231	.440	-.163	-.192	-.218
	Sig. (2-tailed)	.000**	.000**	.000**	.012*	.003**	.001**
CKI	r	.124	-.059	.172	.002	.047	.038
	Sig. (2-tailed)	.058	.365	.008**	.978	.468	.563

*Correlation is significant at 0.05 level

**Correlation is significant at 0.01 level

Total participants n=236

Table 6. Participant's recognition of methods of receiving concussion education.

Q. If you received education about concussion, how was this information presented?	
Consent form required for participation	28 (24.8)
Education from my coach	34 (30.1)
Education from my parents	5 (4.4)
Education from a medical provider (i.e., sports therapist, physiotherapist, doctor etc)	39 (34.5)
Web based resource (e.g., educational blog)	66 (58.4)
Social Media	20 (17.7)
Magazines or other print material	8 (7.1)
Concussion fact sheet	35 (31.0)
Other	26 (23.0)

*Brackets denote percentage of responses in each category,

Table 7. Recommendations

	Recommendations for future directions
1.	The development of BAF-specific concussion educational programmes to include the dangers of under-reporting injury and risk taking, This should be delivered to coaches, athletes, parents/guardians, game-day staff, referees and medical staff.
2.	Regular concussion educational training to be mandated within the concussion policy. This educational training should be provided by a healthcare practitioner or academic at minimum of once per year/season?

3.	The development of BAF-specific concussion posters and leaflets which can be shared with all NGB associated teams upon review of the concussion policy each year.
4.	The NGB should regularly share concussion education on social media platforms.
5.	Future studies should focus on one pool of participants e.g., players only, to allow for a targeted approach to informed education.