European Journal of Public Health Studies
ISSN: 2668 - 1056
ISSN-L: 2668 - 1056
Available on-line at: www.oapub.org/hlt

doi: 10.5281/zenodo.2652952 Volume 1 | Issue 2 | 2019

CONCUSSION KNOWLEDGE AND ATTITUDES AMONG SUB ELITE RUGBY UNION PLAYERS IN WESTERN KENYA

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Abstract:
Objective: The objective of the study was to determine the level of concussion knowledge and attitudes among sub-elite rugby union players in Western Kenya. **Design:** The study was a descriptive cross-sectional study and Quantitative methods were adopted. **Setting:** The study was carried out in Western Kenya **Sample:** The respondents were Sub elite rugby players who were randomly sampled from various rugby clubs in the region (*n = 209*) **Analysis:** Data was analyzed through descriptive statistics, confirmatory factor analysis and one-way analysis of variance (ANOVA). **Main outcome measures:** Concussion knowledge and attitude **Results:** Results from the Confirmatory factor analysis yielded a 22-item two-factor structure. The results showed a non-significant chi-square result, therefore, indicating good fit, the goodness of fit index (GFI), comparative fit index (CFI), and incremental fit index (IFI) had valued above .90 hence indicating a good fit. Root mean square error of approximation (RMSEA) that normally exceeds .1 warrants rejecting the model, however, our value was .05 indicating close fit. Cronbach's alpha for the 14-items Knowledge scale and 8-items attitude scale were α = .702 and α = .728. Deleting construct items did not increase the alpha. The mean concussion knowledge score was 20.94 out of 27 (95% CI 20.7 to 21.2, ± 2.02), 90% (n=188) correctly said that there was a possible risk of death if a second concussion occurred before the first one had healed. 49.3% (n=103) correctly answered that people who have had one concussion were more likely to have another concussion. In addition, 71.3% (n=149) correctly answered that, in order to be diagnosed with a concussion, a person didn't have to be knocked out. However, only 30% (n=63) answered correctly that after a concussion occurs, brain imaging (e.g., CAT Scan, MRI,

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X-Ray, etc.) does not show visible physical damage (e.g., bruise, blood clot) to the brain. With regards to attitude, most players had a negative attitude (n=122, 58%), many rugby players (48.8%, n=102) strongly disagreed that they would continue playing the sport while also having a headache that resulted from a minor concussion. Many strongly agreed (58.9%, n=123) that coaches need to be extremely cautious when determining whether a rugby player should return to play. The majority strongly disagreed (75.1%, n=157) that concussions are less important than other injuries. The independent between-group ANOVA yielded a statistically significantly effect, F (3, 202) = 3.158, p = .026, η_p^2= .045. Thus, the null hypothesis of no significant differences in concussion knowledge among sub-elite rugby players of different National team caps was rejected, however, only 5% of the variance (small effect size) in knowledge was accounted for by group membership. **Conclusion:** Action should be taken to better educate athletes and to ensure a change in attitude, proper recognition and management of concussions.

Keywords: head injuries, education, symptoms, traumatic brain injury, rugby, concussion, sports injuries, Western Kenya, knowledge, attitude, confirmatory factor analysis, sub-elite

1. Background

A concussion is defined as "*a complex pathophysiological process affecting the brain induced by traumatic biomechanical forces*" resulting from a blow to the head, face, neck, or torso (McCrory et al., 2005). Cognitive signs of a concussion include diminished attention and concentration, slowed information processing, and memory deficits (Erlanger et al., 2003). Postconcussive symptoms include headache, dizziness, difficulty remembering, and irritability (Echemendia et al., 2001). Players of contact sports are at a higher risk of concussion (Pfister et al., 1997; Kelly et al., 2001). In South Africa (SA), the seasonal incidence of concussion has been estimated to range from 4% to 14% at school level and between 3% and 23% at senior level (Shuttleworth-Edwards et al., 2008).

Researchers contend that it is extremely difficult to accurately determine the incidence of sport-related concussion and that the current research literature might significantly underestimate the extent of the problem (Haseler & Carmont, 2009; Bailes, 2009). A study found that the prescribed guidelines on concussion prevention and management did not appear to be filtering down to the coaches and paramedical staff involved in sports in Australia (White et al., 2014). Effective concussion prevention and management has been highlighted as a priority in contact sports in general, and particularly in rugby union (Walker, 2015). A series of consensus statements have called for the implementation of uniform measures aimed not only at the effective identification and management of concussion but also at a reduction in the incidence of concussion in contact sports (Harmon et al., 2013; McCrory et al., 2013).

As McCrory et al, (2008) said, the cornerstone of concussion management is physical and cognitive rest until symptoms resolve and then a graded program of exertion before medical clearance and return to play. Uniform processes for screening for and diagnosing concussion, as well as specific return-to-play (RTP) guidelines have been implemented by various unions at both the professional and amateur levels (Viljoen, Patricios & Boksmart, 2012). However, while a number of broad-based concussion education initiatives have been introduced worldwide, these appear to have had a less than the optimal impact on the concussion-related knowledge and behavior of rugby union players in a number of countries (Walker, 2015).

A study by Walker (2015) found that in excess of a third of the participants did not view educational initiatives as the most effective means of reducing the incidence of concussion in rugby union. Similar studies in other countries found that not only are educational initiatives seemingly not having the desired impact, but a substantial proportion of sub-elite players do not view information dissemination initiatives as an effective means of reducing concussion rates (Jansen van Rensburg, 2013; Kroshus et al., 2014).

Empirical data suggest that 50–75% of concussions among athletes especially high school athletes go unreported due to difficulty detecting the injury or not feeling that it was severe enough to report (McCrory, 2005). Research by O'Connell & Molloy (2016) and Delahunty et al., (2015) respectively found 75% and 73% of the players indicated that they would play with a concussion in important matches. Perceptions of concussion across the high school athletic population and many athletes(elite and sub-elite) were that reporting a concussion may be embarrassing (Register-Mihalik et al., 2013). The findings corroborate previous findings (McCrea et al., 2004, Cusimano, 2009) that athletes and coaches across various sports hold misconceptions surrounding concussion. In another study, almost 25% of football players still participated in their sport while experiencing symptoms of a concussion (Kaut, DePompei, Kerr & Congeni, 2003). One of the main factors responsible for athletes not reporting their injury to an appropriate health care professional was a lack of knowledge about the signs, symptoms, and consequences of concussions (Kaut, DePompei, Kerr & Congeni, 2003). Therefore, premature return to play was and still is due to attitudes that encompass a desire to succeed, not wanting to let the team down, and other similar pressures. (Cusimano, 2009).

There seems to be a dearth of information regarding the level of concussion knowledge and attitudes among sub-elite rugby union players, especially in Africa. Limited data analysis was reported by the developers of other surveys measuring knowledge and attitudes: The College Football Head Injury Survey (Sefton, 2003) and the Knowledge and Attitudes about Sports Concussion Questionnaire (KASCQ-24). (Simonds, 2004).

The small sample sizes and lack of psychometric analyses do not reflect quality statistics to suggest that these surveys can adequately quantify athletes' knowledge and attitudes. Therefore, this study opted for RoCKAS survey to get the concussion

knowledge and attitudes. Extensive psychometric examination of the RoCKAS determined it is a fairly valid and reliable survey in the measurement of athletes' knowledge and attitudes toward concussions (Rosenbaum & Arnett, 2010). Consequently, the current study aimed to determine the level of concussion knowledge and attitudes among sub-elite rugby union players in Western Kenya. We hypothesized that there would be significant differences in knowledge among players with different National team caps (number of times played in the national team)

2. Methods

This study focused on gathering quantitative information through the implementation of a cross-sectional study design. Participants were excluded because of an incomplete questionnaire and others due to lack of a consent form. The purpose of the study and the procedures of the questionnaire were explained to the participants. Those who agreed to participate completed an informed consent form and the questionnaire. The participants completed the questionnaires in person enabling them to ask questions or withdraw from the study at any time during the data collection.

2.1 Participants

The sample consisted of 209 Sub elite rugby players in western Kenya (male, n = 209; mean age 20 ± 2.8 years). Players were invited to participate in the anonymous survey following permission from rugby clubs across the area. No incentive was provided to participants. All study protocols and the survey instrument were approved by the University Human Research Ethics committee and conducted in accordance with the ethical principles of the Declaration of Helsinki.

2.2 Protocol

The knowledge and attitudes of the participants were measured using a modified Rosenbaum Concussion Knowledge and Attitudes Survey –Student Version (RoCKAS-ST) (Rosenbaum & Arnett, 2010). This survey consisted of three main parts, namely; Demographics section, the Concussion Knowledge Index (CKI), Concussion Attitude Index (CAI). Section one examined some demographics, Sections two examined the participants' knowledge of concussion, causes, and sequelae. In summary, the scores of Section two were accumulated and the totals ranged from 0-27 to establish the CKI. The participant with a higher score in the CKI revealed a higher level of the knowledge of concussion. In section three, the CAI was used to examine the separate views of all participants. The section consisted of 8 questions, each in a 'Likert Scale' format, ranging from "strongly disagree" to "strongly agree". The points received in this section for each question ranged from one-five points depending on the participant's response to safety.

2.3 Statistical Analysis

The primary playing positions by the individual were categorized into eight main groupings: props, hookers, second-rows, back rows, halfbacks, centers, wingers and fullback. The number of national team caps reported by players was categorized into one of four main groupings: Not played, played once, played twice and played thrice or more. Data from returned surveys were entered into, and analyzed, using SPSS V25 (SPSS Inc, USA). Confirmatory Factor Analysis (CFA) was conducted using the estimation method of the Maximum Likelihood over the variance-covariance matrix to establish goodness of fit of the factor model to explain the relationship between observed variables and underlying latent constructs. In order to achieve model identification, regression coefficients of the error terms over the endogenous variables were fixed to 1. The CFA was performed to determine if the hypothesized statistical model fits the actual data set by using a number of 'goodness-of-fit' statistics. Normality assessment is usually rejected if the skewness ratio is more than ±1, and/or kurtosis is more than ±2. A two-factor model was examined to confirm the measurement theory for both CKI and CAI. Following AMOS analysis guideline (Arbuckle 2012), Factors (latent variables) were presented in ovals; Items (observed indicators) were presented in rectangles, and Measurement Errors appeared in ellipses.

The measurement model was identified by two constructs (Concussion Knowledge index and concussion attitude index) inter-correlated to each other with double-headed arrows (Fig. 1). The single-headed arrows from ovals to the rectangles represented regression paths that show the links between the factors and their corresponding set of items. Factor loadings were represented by the coefficients on the paths. Further, the single-headed arrows from ellipses to rectangles showed the measurement error associated with each item. The typically used fit statistics include the goodness of fit index (GFI), comparative fit index (CFI), and incremental fit index (IFI). All these indices have a range from 0 to 1, with values above .90 indicating a good fit (Wang et al. 1996). The root mean square error of approximation (RMSEA) that exceeds .1 warrants rejecting the model, while values equal .05 or less indicates a close fit (Browne and Cudeck 1989). To conclude the analysis of the CKI and CAI, internal consistency analysis, Cronbach's Alpha, of both constructs were evaluated. Comparison of self-reported concussion knowledge by the number of national team caps was conducted using one-way ANOVA with Bonferroni post-hoc test. Shapiro-Wilk tests were conducted to screen for normal distribution of the dependent variables. The data was not normally distributed (SW = 0.638 to 0.846; $p < 0.001$). Transformation of the data showed a normal distribution (SW = 0.418 to 0.532; $p < 0.25$).

3. Results

The study asked the respondents to indicate their background characteristics based on age groups playing positions and national team caps. The summary of their responses is given in Table 1.

The results in Table 1 below showed that, of the 209 respondents, the majority (n=135, 64.6%) were 20 years and below. The mean age was 20 years ±2.8, the majority (n=62,29.7%) were halfbacks and props were few (n=4, 1.9%). The results also showed that the majority (n=166, 79.4%) had not played in the national team.

Table 1: Background characteristics of respondents

Demographics		Frequency	Percent
Age group	20 years and below	135	64.6%
	Above 21 years	74	35.4%
	Total	**209**	**100%**
Playing positions	Props	4	1.9%
	Hookers	20	9.6%
	Second rows	53	25.4%
	Back rows	32	15.3%
	Half-backs	62	29.7%
	Centers	18	8.6%
	Wingers	13	6.2%
	Full back	7	3.3%
	Total	**209**	**100%**
National team caps	Not played	166	79.4%
	Played once	23	11%
	Played twice	17	8.1%
	Played thrice or more	3	1.4%
	Total	**209**	**100%**

3.1 Confirmatory factor analysis

Confirmatory factor analysis involves the specification and estimation of one or more hypothesized models of factors structure, each of which proposes a set of factors (latent variables) to account for covariance among a set of observed variables. The measurement model included two latent constructs measured by 22 indicator variables. All of the completely standardized parameter estimates obtained were significantly different from zero ($t > 1.96$) and loaded satisfactorily onto their corresponding latent variable. Correlations among indicators across constructs (N = 209) ranged from .13 to .92. The overall fit of the measurement model was acceptable based on fit indices as shown in Table 2. Cronbach's alpha for the 14-items Knowledge scale and 8-items attitude scale was α = .702 and α = .728. Deleting construct items did not increase the alpha.

Table 2: Goodness-of-Fit Indices for the modified model

Parameters	Score
Number of parameters	45
Chi-square	623.945*
Degree of freedom	208
Relative Chi-square	3
Goodness of fit index(GFI)	.911
Adjusted goodness of fit index	.87

Comparative fit index(CFI)	.869
Increment fit index(IFI)	.87
Root mean square error of approximation(RMSEA)	.05

* p<001

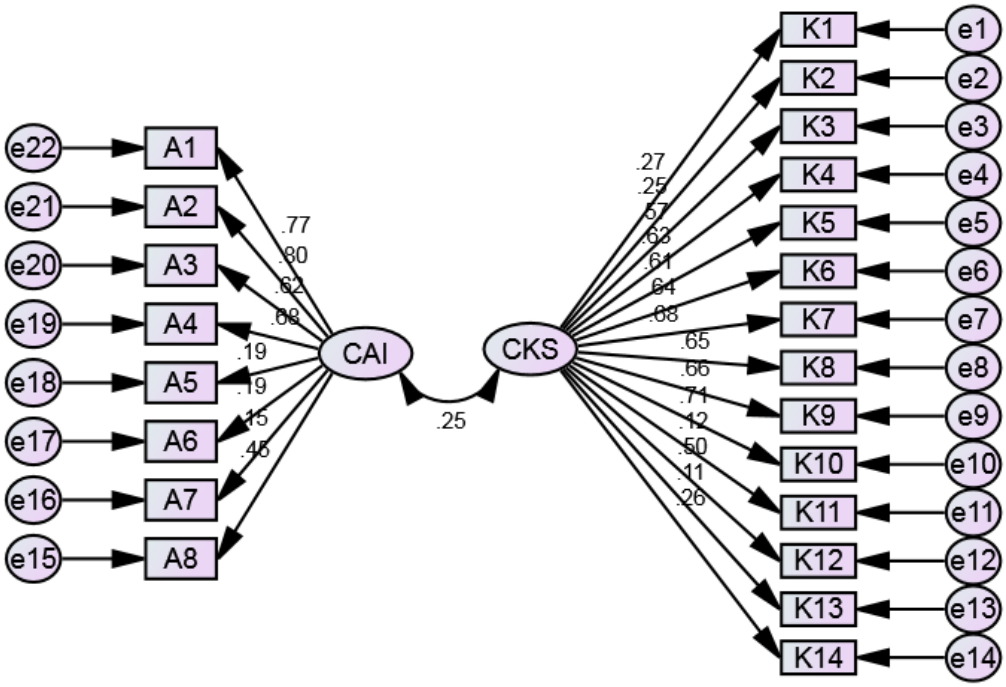

Figure 1: Standardized estimates for the 22-item two-factor structure

3.2 Knowledge

The mean concussion knowledge score was 20.94 out of 27 (95% CI 20.7 to 21.2, ± 2.02). From the results, 90% (n=188) correctly said that there was a possible risk of death if a second concussion occurred before the first one had healed. 49.3% (n=103) correctly answered that people who have had one concussion are more likely to have another concussion. In addition, 71.3% (n=149) correctly answered that, in order to be diagnosed with a concussion, a person didn't have to be knocked out. However, only 30% (n=63) answered correctly that after a concussion occurs, brain imaging (e.g., CAT Scan, MRI, X-Ray, etc.) typically does not visible physical damage (e.g., bruise, blood clot) to the brain. Very few (36%, n=75) answered correctly that after a concussion, people cannot forget who they are nor fail to recognize others. Table 3 below gives a summary of the responses.

Table 3: Concussion knowledge score

CKS	**Answered Correctly**	**Correct Response**
There is a possible risk of death if a second concussion occurs before the first one has healed.	188 (90%)	TRUE
People who have had one concussion are more likely to have another concussion.	103 (49.3%)	TRUE
In order to be diagnosed with a concussion, you have to be knocked out	149	FALSE

	(71.3%)	
A concussion can only occur if there is a direct hit to the head	113 (54.1%)	FALSE
Being knocked unconscious always causes permanent damage to the brain.	166 (79.4%)	FALSE
Symptoms of a concussion can last for several weeks.	172 (82.3%)	TRUE
Sometimes a second concussion can help a person remember things that were forgotten after the first concussion.	169 (80.9%)	FALSE
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.	63 (30.1%)	FALSE
If you receive one concussion and you have never had a concussion before, you will become less intelligent.	167 (79.9%)	FALSE
After 10 days, symptoms of a concussion are usually completely gone.	77 (36.8%)	TRUE
After a concussion, people can forget who they are and not recognize others but be perfect in every other way.	75 (35.9%)	FALSE
Concussions can sometimes lead to emotional disruptions.	139 (66.5%)	TRUE
A rugby player who gets knocked out after getting a concussion is experiencing a coma.	97 (46.4%)	TRUE
There is rarely a risk to long-term health and well-being from multiple concussions.	62 (29.7%)	FALSE

3.3 Attitude

The mean concussion attitude score was 26.02 out of a possible 40 (95% CI 25.6 to 26.5, ± 3.2). From the results, many rugby players (48.8%, n=102) strongly disagreed that they would continue playing the sport while also having a headache that resulted from a minor concussion. Many strongly agreed (58.9%, n=123) that coaches need to be extremely cautious when determining whether a rugby player should return to play. The majority strongly disagreed (75.1%, n=157) that concussions are less important than other injuries. Table 4 below gives a summary of the responses.

Table 4: Concussion attitude score

CAS	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I would continue playing a sport while also having a headache that resulted from a minor concussion.	102 (48.8%)	83 (39.7%)	13 (6.2%)	11 (5.3%)	0 (0.0%)
I feel that coaches need to be extremely cautious when determining whether a rugby player should return to play.	14 (6.7%)	0 (0.0%)	19 (9.1%)	53 (25.4%)	123 (58.9%)
I feel that mouthguards protect teeth from being damaged or knocked out	0 (0.0%)	3 1.4%)	27 (12.9%)	39 (18.7%)	140 (67.0%)
I feel that professional rugby players are more skilled in their sport than high school rugby players.	0 (0.0%)	4 (1.9%)	39 (18.7%)	42 (20.1%)	124 (59.3%)
I feel that concussions are less important than	157	44	3	5	0

other injuries	(75.1%)	(21.1%)	(1.4%)	(2.4%)	(0.0%)
I feel that a rugby player has a responsibility to return to a game even if it means playing while still experiencing symptoms of a concussion.	166 (79.4%)	37 (17.7%)	6 (2.9%)	0 (0.0%)	0 (0.0%)
I feel that a rugby player who is knocked unconscious should be taken to the emergency room.	20 (9.6%)	9 (4.3%)	9 (4.3%)	46 (22.0%)	125 (59.8%)
I feel that most of my teammates will play professional rugby in the future	9 (4.3%)	0 (0.0%)	15 (7.2%)	52 (24.9%)	133 (63.6%)

Respondents answered a total of eight closed-ended questions. Each response was given a mark based on the level on the 5-point Likert scale with the anchors being strongly disagree=1 to strongly agree=5 and vice versa for questions that were reverse coded. Scale scores were computed by adding responses to the eight questions resulting in a minimum possible score of 8 and a maximum of 40. The score varied from 10 - 40 points and was classified into 2 levels using the mean as cut off point: Positive attitude (above 26.02) and Negative attitude (below 26.02). From the results, most players had a negative attitude (n=122, 58%) (Figure 2).

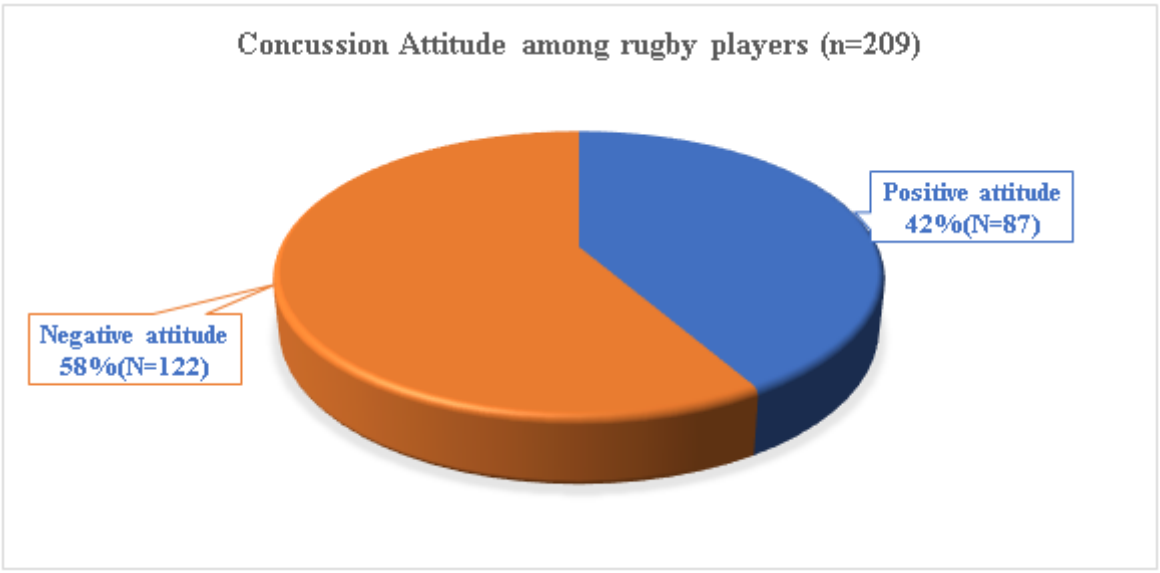

Figure 2: Concussion attitude among rugby players

The descriptive statistics associated with concussion knowledge across the four National team caps groups are reported in Table 5. It was seen that those who had played once were associated with the numerically smallest mean of concussion knowledge (M=20.0, CI=19.2-20.8) and those who played twice were associated with the numerically highest mean of concussion knowledge (M=21.9 SD=1.03 CI=20.9-22.9). In order to test the hypothesis that the National team caps (not played, played once, played twice, played thrice or more) had an effect on concussion knowledge, a between-groups ANOVA was performed.

Prior to conducting the ANOVA, the assumption of normality was evaluated and determined to be satisfied as the three groups distributions were associated with

skew and kurtosis less than |-1.0| and |1.0| respectively. Furthermore, the assumption of homogeneity of variances was tested and satisfied based on Levene's F test, F test (3, 202) = .17.23, p= .122.

Table 5: Descriptive statistics for Concussion knowledge scores across players with different national team caps

National Team Caps	n	M	SD	CI 95%	Skewness	Kurtosis
Not played	163	20.9	2.198	20.7-21.3	.735	.191
Played once	23	20.0	0.0	19.2-20.8	-.546	-.880
Played twice	17	21.9	1.03	20.9-22.9	.130	.550
Played thrice or more	3	21.0	0.0	18.7-23.3	.458	.730

Note: M= mean; SD = standard deviation; CI = confidence interval

The independent between-group ANOVA yielded a statistically significant effect, F (3, 202) = 3.158, p = .026, η_p^2= .045 (Table 6) Thus, the null hypothesis of no significant differences in concussion knowledge among sub-elite rugby players of different national team caps was rejected, however, only 5% of variance in knowledge was accounted for by group membership. According to Cohen d this is a small effect size. Bonferroni post-hoc analyses demonstrated a significantly higher concussion knowledge mean from players who played twice in comparison to those who played once (p = 0.016).

Table 6: Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta squared
Corrected Model	37.513	3	12.504	3.158	.026	.045
Intercept	15938.092	1	15938.092	4025.436	.000	.952
National Team Caps	37.513	3	12.504	3.158	.026	.045
Error	799.788	202	3.959			
Total	91180.000	206				
Corrected Total	837.301	205				

The null hypothesis was rejected (p < 0.05) leading to the conclusion that there exist significant differences in concussion knowledge amongst players of different national team caps. Figure 3 below shows the estimated marginal means of concussion knowledge index.

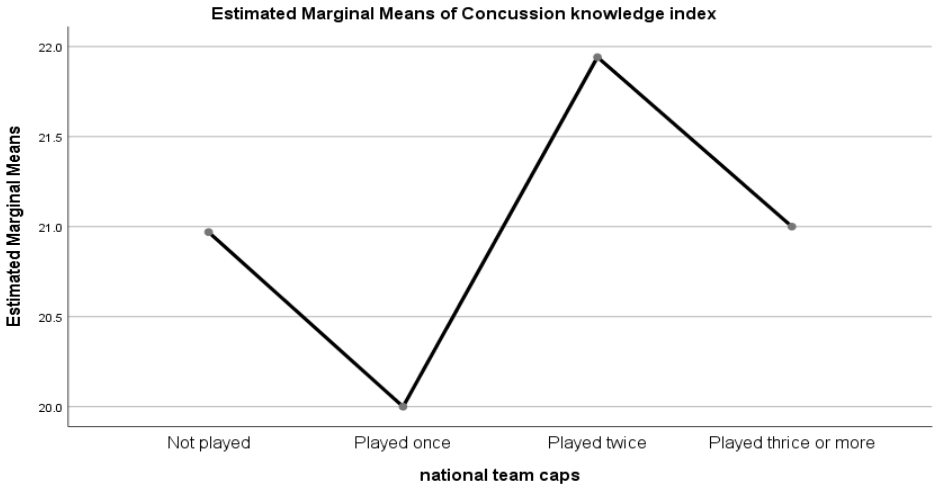

Figure 3: Estimated marginal mean of concussion knowledge index

4. Discussion

The objective of the study was to find out concussion knowledge and attitudes among sub-elite rugby union players in western Kenya. The current study noted that 36.8% of the players (n=77) answered the question "After 10 days, symptoms of a concussion are usually completely gone" correctly. In addition, only 30.1%(n=63) knew that after a concussion occurs, brain imaging (e.g., CAT Scan, MRI, X-Ray, etc.) typically don't show visible physical damage (e.g., bruise, blood clot) to the brain. This limited knowledge corroborates with previous studies. A previous study by Hollis et al, (2012) found that 78% of concussed Australian amateur rugby union players did not receive any return to play advice. In New Zealand, a study indicated that a significant proportion of schoolboy rugby players had limited concussion knowledge (Sye, Sullivan & McCrory, 2005). In college athlete samples, misconceptions about return to play guidelines, post-concussive symptoms, vulnerability to a concussion, and mechanisms of injury were found (Livingston & Ingersoll, 2004; Sefton, 2003). A study by Jessica et al., (2017) found that across the sample, athletes' knowledge scores were moderate, with a mean of approximately 27 of 35 questions answered correctly. Consistent with the current study are findings by Kirk et al, (2018) where knowledge of concussion in a sample of university-level sportsmen was insufficient in various areas, however, there was a significant main effect for group ($F = 8.22$, $p < 0.01$); post-hoc analyses demonstrated a significantly higher proportion of correct responses from coaches in comparison to players ($p < 0.01$).

Among high school students, studies have found the trend to be same, in a study of high-school athletes, about only 25% of the 296-athlete sample reported that concussion was best characterized by loss of consciousness (Sye et al., 2006). The current study noted that the majority of the players knew that symptoms of concussion can last for several weeks however previous studies showed inconsistency especially in noting of symptoms and their progression. In a study by Paolo et al, (2011), twenty-five athletes (38.5%) reported that they had not been informed by anyone about symptoms

of concussion and its consequences. In a study by Kraak et al, (2018) participants had to identify the correct symptoms, 59% identified loss of consciousness and 52% indicated sleep disturbances as a symptom, and well over 50% of the participants lacked the knowledge of concussion in four questions. In studies by Hecimovich and Viljoen sleep disturbances were shown as the lowest correctly identified symptom. (Hecimovich, King & Marais, 2016). Other studies among high school student were inconclusive and had different results. Register-Mihalik et al, (2013) found that high school athletes were relatively knowledgeable about the general signs and symptoms of concussion (e.g., headache, confusion, dizziness). Hence need for further research to find more conclusive finding. Although many studies cite limited knowledge on concussion matters, other studies noted that players who had a previous history of concussion showed a greater knowledge of this type of injury, thus indicating that knowledge potentially comes from experience rather than from educational programmes (Walker, 2015).

With regards to attitudes, the current study found that many players had a negative attitude (n=122, 58%). This was slightly different from finding of Kraak et al, (2018) where players on average answered 81% of the CAI questions correctly. Our study also found that 48.8% (n=102) of the players strongly disagreed that they would continue playing a sport while also having a headache that resulted from a minor concussion. 79.4% (n=166) also strongly disagreed that a rugby player had a responsibility to return to a game even if it means playing while still experiencing symptoms of a concussion. Previous studies were inconsistent, a study by Sye et al., (2006) indicated that players had returned to play (RTP) after concussion without medical clearance or against physician's orders (22%), and/or they indicated that the importance of the game should influence RTP decisions (27%). Participants in another study also indicated that they would continue playing with a concussion because they did not want to let their teammates down (O'Connell & Molloy, 2016). Possible explanations of inconsistency could be that the level of competition was different between the samples in two studies. A study by Sefton, (2003) indicated that approximately one third stated that it would be acceptable to wait until the end of a game/practice to report a concussion. Viljoen stated that the players themselves can play an essential role in reducing the incidences of concussion and improving the management thereof (Viljoen et al., 2017). To some extent, the players take concussion seriously; however, the mindset of the players is largely influenced by coaches, fellow teammates and the importance of matches. (Walker, 2015)

In the current study, 59.3% (n=124) of the players strongly agreed that professional rugby players were more skilled at their sport than high school rugby players. Consistent with these results, a study by Walker (2015) found that there appeared to be a perception that players competing at higher levels are somehow less affected by concussion. This also supports our findings that players who had played in the national team twice had a better attitude towards concussion compared to those that had played once. According to Walker, (2015), a discrepancy between the participants

'knowledge and their attitudes suggests that knowledge alone is not sufficient to bring about attitudinal and behavioral change. Viljoen et al, (2017) noted that players had insufficient knowledge of concussion and their attitudes/behaviors were deemed unsafe, this is supported by the current study findings.

5. Conclusion & Recommendation

In conclusion, sub-elite rugby players need education about concussion as one of the main components of prevention and management. The recommendations that flow from the explanation is for improved educational tools that take into account existing attitudes to benefits and risks in playing contact sports. Action should be taken to better educate athletes and to ensure the proper recognition and management of concussions. This study is not without limitations. Our interpretation of the findings is bound by the fact that it was only focused on males. The current sample was drawn from only one region of the country. Consequently, the findings cannot be reliably generalized beyond this specific geographical context. In addition, participants were not provided with a definition of concussion in order to help them determine whether or not they may have been previously concussed. For future studies related to concussion, researchers should take note that testing the knowledge and attitudes of concussion on rugby players may be challenging because there might be a difference between answering a questionnaire and the actual behavior of players during a match or practice session when referring to a concussion.

Declarations

Ethics Approval
Ethical clearance was obtained from Masinde Muliro University of Science and Technology Ethics Committee. Consent.

Competing interest
The authors declare that they have no competing interests.

Authors & contributions
Micky Olutende Oloo and Anthony Muchiri conceived the paper, designed and performed the study. Dr. Maximilla Wanzala contributed the analysis software and analyzed the data. Prof Edwin Wamukoya was the paper's peer reviewer. All authors read and approved the final manuscript.

Disclaimer
The findings and conclusions presented in this manuscript are those of the authors and do not necessarily reflect the official position of Masinde Muliro University.

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