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CONOSCENZE SU COMMOZIONE CEREBRALE SPORTIVA TRA GIOVANI ATLETI E GENITORI NELLA SVIZZERA ITALIANA: STUDIO PILOTA

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Riassunto

La conoscenza dei sintomi, della prevenzione e della gestione delle commozioni cerebrali legate allo sport è fondamentale per ridurre le conseguenze gravi nei pazienti pediatrici. Tuttavia, le evidenze sulla conoscenza delle commozioni cerebrali legate allo sport tra i giovani atleti e i loro genitori nel contesto europeo sono limitate.

Questo studio pilota ha valutato la fattibilità e l'accettabilità di uno studio di popolazione sulla conoscenza delle commozioni cerebrali legate allo sport e dei fattori associati nella Svizzera italiana.

Il Concussion Knowledge and Beliefs Questionnaire (CKBBQ) è stato tradotto e adattato al contesto locale. La validità linguistica e di facciata è stata verificata prima della raccolta dei dati pilota. I partecipanti sono stati reclutati all'inizio del 2024 tramite allenatori di sport di squadra ad alto rischio. Sono state condotte analisi statistiche descrittive, t-test e correlazioni bivariate per valutare i livelli di conoscenza delle commozioni cerebrali legate allo sport nei giovani atleti e nei loro genitori e le possibili differenze in base a fattori sociodemografici e relativi all'accesso alle informazioni.

I dati di 61 genitori e 45 giovani atleti hanno mostrato che i fattori sociodemografici non sono associati alla conoscenza delle commozioni cerebrali legate allo sport. Tuttavia, aver ricevuto informazioni sulle commozioni cerebrali legate allo sport nell'ultimo anno è risultato un predittore significativo e positivo. Inoltre, l'analisi diadica ha evidenziato una correlazione positiva significativa tra la conoscenza delle commozioni cerebrali legate allo sport nei genitori e negli adolescenti.

L'accesso a informazioni sulle commozioni cerebrali legate allo sport è essenziale per migliorare la conoscenza sull'argomento. È necessario uno studio di prevalenza su larga scala per confermare questi risultati e sviluppare interventi informativi sulle commozioni cerebrali legate allo sport adattati al contesto socio-culturale specifico. Lo studio sottolinea l'importanza di ridurre le barriere alla compilazione del questionario e di coinvolgere tutti gli stakeholder, particolarmente i medici sportivi, per migliorare la consapevolezza sulle commozioni cerebrali legate allo sport in questa popolazione.

Introduction

Children and adolescents practicing contact sports such as hockey, rugby or soccer are at particular risk of experiencing a sport-related concussion [1]. Sport-related concussion knowledge, i.e., the general perception and understanding of the existence and severity of mTBI in sports contexts [2], is key for its prevention and prompt management. Parents and young athletes need to be able to recognize a concussion and take appropriate action where the help of a healthcare provider or coach is lacking or on its way. Adequate knowledge can lead athletes and their parents to recognize and report symptoms early and seek appropriate medical attention, thus reducing the risk of long-term complications [3]. Research on young athletes' and their parents' sport-related concussion knowledge shows heterogeneous findings pointing towards considerable regional differences and the need to improve education [4]. Most studies to date have been conducted in Canada and in the United States [1,5], raising questions about the applicability of these findings in different cultural contexts. Furthermore, preventive behaviours are influenced not only by individual factors such as gender, age, and socioeconomic background, but also by relational, community, structural, and societal factors [6]. In this regard, evidence from the Italian-speaking part of Switzerland is lacking to date. In the light of these shortcomings, the purpose of the present study is to develop a target- and culture-specific questionnaire for assessing sport-related concussion awareness and knowledge among young athletes and their parents, and to pilot-test the questionnaire in both populations to evaluate its accessibility and feasibility for a future large-scale sport-related concussion knowledge prevalence study. The present paper reports on the different adopted methodologies and pilot results.

Materials and methods

Questionnaire development

We developed two self-administered online questionnaires for young athletes and their parents, adapting items from the Concussion Knowledge, Beliefs, and Behaviour Questionnaire (CKBBQ) [4] to assess concussion-related knowledge, beliefs, and behavior. After translating the

items into Italian and back-translating them to ensure linguistic validity, we implemented the final versions in Qualtrics. To link parent-child dyads, a random code generated at the end of the parent questionnaire was required at the start of the young athlete's questionnaire. We evaluated face and content validity with ten children (10–18 years) and ten parents using the think-aloud technique during completion, assessing clarity, accessibility, and age-appropriate literacy. Terminology was culturally adapted, and complex terms simplified. Three medical experts (JC, AC, BGS) reviewed the final versions to ensure the adapted items accurately captured key concussion-related concepts.

Measures

The final questionnaires included three main blocks each with both closed- and open-ended questions.

Block 1: Socio-demographics. In the parent questionnaire, we included measures of the responding parent's gender, year of birth, educational background, financial situation, coaching experience, training in medicine and first aid, sports history, number of current children in competitive sports (child's gender, age, and type of sport), and children's concussion history.

Block 2: Concussion knowledge. An open-ended question assessed participants' own definition of concussion. Seven items assessed sport-related concussion knowledge and five items common concussion misconceptions. Three items measured knowledge about management of a presumed past sport-related concussion. Sixteen items measured signs and symptoms of a concussion (eight real symptoms, eight distractor symptoms). Concussion knowledge thus comprised a total of 31 items: 3 for general knowledge, 18 for symptoms, 5 for knowledge about causes and consequences, and 5 measuring correct prevention and management of sport-related concussion. We coded each correct answer as 1 and each incorrect or "I don't know" answer as 0. After calculating the sum of all correct answers, we transformed the score into the percentage of correct answers.

Block 3: Information about concussion. We asked whether young athletes and their parents had received information about sport-related concussion in the past year. If participants selected "yes", we provided them with a list of possible information sources to indicate where or from whom they had received sport-related concussion information (e.g., coach, doctor, media). In the parent version, a question investigated participants' willingness to get informed about sport-related concussion and through which information sources.

Questionnaire administration

We targeted team sports with high sport-related concussion risk (hockey, soccer, basketball, volleyball, rugby). Coaches received project information through an online event and distributed flyers with a QR code linking to the online survey, which included an embedded consent form. Data collection took place from February to May 2024. Participants needed to be competitive athletes, club-affiliated in Italian-speaking Switzerland, and fluent in Italian. Each questionnaire took about 30 minutes. Families who completed both surveys could redeem a 20-Franc voucher by emailing the random code from the young athlete's questionnaire.

Analytical plan

We exported the data to SPSS version 26. The dataset is available online. We calculated descriptive univariate statistics including mean, median, and standard deviation. We analysed skewness, kurtosis, and z-scores for continuous variables to identified potential outliers. Subsequently, we performed independent samples t-tests to compare sport-related concussion knowledge among socio-demographic subgroups for parents and young athletes separately. Finally, we conducted a bivariate correlation of sport-related concussion knowledge in parent-child dyads.

Results

After four months of data collection, a total of 81 parents and 49 young athletes completed the questionnaire. Of these, we excluded 20 parents and 4 young athletes from further analysis due to non-response to at least 90% of the items or ineligibility (e.g., parent questionnaire filled out by a sibling and not parent). The final sample with valid data included 61 parents (41% male; Mage = 49, SD = 5.95) and 45 young athletes (47% male, Mage = 15, SD = 1.89), of which 42 were parent-child dyads. Table 1 summarizes the socio-demographic characteristics for each group.

Concussion knowledge for each category by age group. Figure 1 shows the percentage of correct knowledge answers for the overall sport-related concussion knowledge score and for each category separately: general sport-related concussion knowledge, knowledge of sport-related concussion symptoms, causes and consequences of sport-related concussion, sport-related concussion prevention and management. Concerning overall sport-related concussion knowledge, the average amount of right answer was 68.63% (SD = 13.58) for parents and 63.86% (SD = 16.34) for young athletes. Looking at the different knowledge categories for each age group, we found that while parents had more knowledge about symptoms (parents: M = 78.24%, SD = 16.41; athletes: M = 36.89%, SD = 25.21), the opposite was true for causes and conse-

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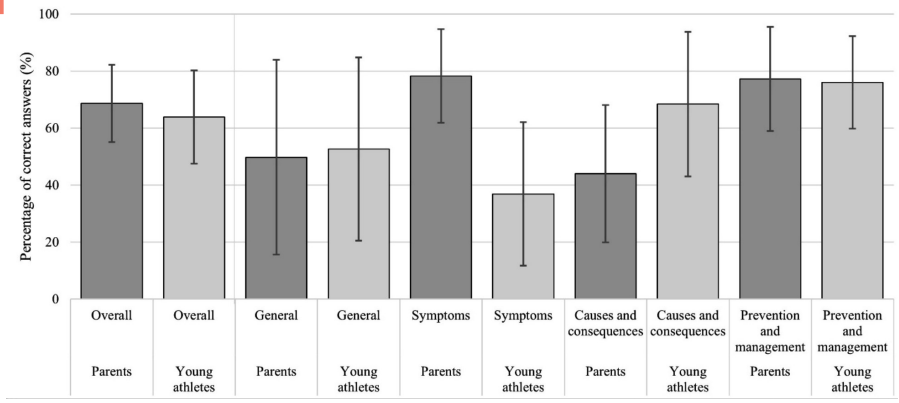

Fig 1: SRC Knowledge by age group (parents n = 61, young athletes n = 45) (percentage of correct answers and standard deviation)

quences, where young athletes were more knowledgeable (parents: M = 44.00%, SD = 24.09; athletes: M = 68.41%, SD = 25.39). In addition, for both groups, we observed similar knowledge patterns for the category 'prevention and management', where the percentage of correct answers reached almost 80% in both groups (parents: M = 77.21, SD = 18.27; athletes: M = 75.95, SD = 16.26).

T-test results for group differences in sport-related concussion knowledge. T-test results (**Table 1**) revealed that, among parents, fathers, those who have been a sports coach in the past, and those who have received sport-related concussion information, on average, had higher knowledge scores than the respective comparison group. No significant group differences emerged for young athletes except for past sport-related concussion information where those how received such information had a significantly higher mean knowledge score compared to those who did not.

Correlation between parents' and children's sport-related concussion knowledge. Focusing on the 42 parent-child dyads, we found a significant and positive correlation between parents' (M = 0.708, SD = 0.120) and their children's sport-related concussion knowledge (M = 0.635, SD = 0.168) (r = .458, p = .002) (**Figure 2**).

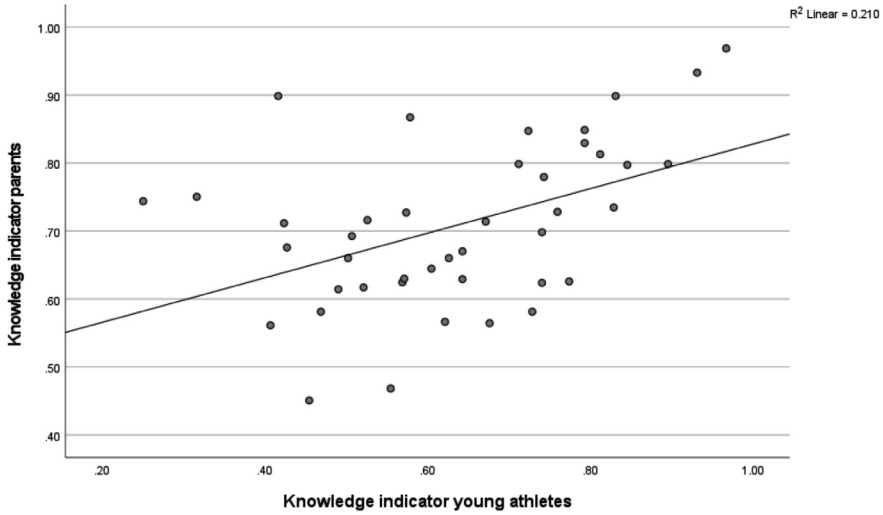

Fig 2: Scatter plot of correlation between SRC knowledge anobg parents and their children

Discussion

Sports-related concussion is a severe injury for young athletes which remains largely understudied and insufficiently addressed in the European context. In the present study, we developed and pilot-tested a questionnaire to assess sport-related concussion knowledge and associated factors among young athletes and their parents and provide useful information for future administration of such a questionnaire in a wider sport-related concussion knowledge prevalence study. To say it upfront, despite some critical challenges, the process holds promise for replication on a larger scale and can potentially be extended to assess laypeople's knowledge of other preventable medical issues.

Although the pilot study included a small number of participants, some results are worth being discussed. First, similar to findings from previous studies [7], overall sport-related concussion knowledge was relatively high with approximately two third of correct answers both among parents and young athletes. In addition, both age groups had higher knowledge about prevention and management of sport-related concussion, i.e., the 'know how' (procedural knowledge) to protect oneself, compared to medical knowledge about symptoms, causes and consequences, i.e., the 'know what' (factual knowledge). Such differences have also been observed in other health-related studies, e.g., chronic disease management [8,9]. Within both age groups, we found no significant differences in sport-related concussion knowledge due to socio-demographic characteristics, such as gender, age, education level, and financial situation, echoing findings from previous studies [10,11]. Instead, our results suggest that sport-related concussion knowledge is rather associated with the quality and quantity of sport-related con-

		n (%)	M_{know}	SD_{know}	*t*	df	*p*
PARENTS (n=61)							
Gender[a]	Female	36 (59.02)	0.650	0.132	2.615	59	0.011
	Male	25 (40.98)	0.738	0.126			
Age group[c]	< 49 years	28 (45.90)	0.683	0.148	0.180	59	0.858
	49+ years	33 (54.09)					
Education	Obligatory school	5 (8.20)	0.692	0.165	-0.103	59	0.918
	Post-obligatory school	56 (91.80)	0.686	0.135			
SES	Enough to live	40 (65.57)	0.668	0.142	-1.484	59	0.143
	More than enough to live	21 (34.42)	0.722	0.118			
Coach[a]	Ever been a sports coach	16 (26.23)	0.749	0.136	2.200	59	0.032
	Never been a sports coach	45 (73.77)	0.664	0.130			
Concussion experience	Yes, at least once in their child	19 (31.14)	0.697	0.107	0.400	59	0.691
	No, never in their child	42 (68.86)	0.682	0.148			
Concussion information during the last year[b]	Yes, received	18 (29.51)	0.731	0.150	1.668	59	0.050
	No, not received	43 (70.49)	0.668	0.127			
YOUNG ATHLETES (n=45)							
Gender	Female	24 (53.33)	0.662	0.158	-1.030	43	0.309
	Male	21 (46.67)	0.612	0.169			
Age group[c]	< 15 years	21 (46.67)	0.627	0.193	0.449	43	0.656
	15+ years	24 (53.33)	0.649	0.136			
Direct concussion experience	Yes, at least once	14 (43.75)	0.620	0.169	-0.259	30	0.798
	No, never	18 (56.25)	0.636	1.761			
Indirect concussion experience	Yes, at least once	25 (73.53)	0.677	0.163	1.143	32	0.262
	No, never	9 (26.47)	0.604	0.172			
Concussion information during the last year[b]	Yes, received	17 (37.78)	0.697	0.156	1.927	43	0.030
	No, not received	28 (62.22)	0.603	0.160			

[a] significant group differences using two-sided test
[b] (marginally) significant group difference using one-sided test
[c] age group defined by median split

Tab. 1: *Summary of participant characteristics and t-test results for group differences in SRC knowledge*

cussion information received, as both young athletes and parents who received this information demonstrated greater knowledge of the topic, a result confirmed by previous studies [12,13]. To note, Italian-speaking part of Switzerland does not dispose of a coordinated, large scale prevention initiative such as CDC's Heads Up! Campaign [13] in the United States. Moreover, we do not know what type of sport-related concussion information young athletes and their parents have received and how it was perceived. Yet, previous research has shown that communication campaigns or education interventions proved to be effective in increasing sport-related concussion knowledge in these populations [14].

Second, although the cross-sectional nature of our study does not allow conclusions on causality mechanisms, the positive correlation between parents' and children's sport-related concussion knowledge suggests that improving parental sport-related concussion knowledge can have a cascading effect on their children [3,15], and vice-versa. This underscores the need for targeted educational programs involving both young athletes and their parents [16] and stimulating follow-up communication and reciprocal education among these groups. Information and training initiatives should be strengthened and expanded, perhaps by including mandatory information sessions for parents at sports team meetings or through accessible online platforms. This practice is widespread in the United States [13] but almost absent in the European context.

Third, some additional insights concerning the development and administration of our questionnaires and stakeholder engagement are worth being discussed. Widely used questionnaires on sport-related concussion knowledge such as the CKBBQ [4] or the RoCKAS [17] have been originally developed and validated in English-speaking context. To be used in our study, this required translation and cultural adjustments for a non-English context, involving forward-backward translation and think aloud interviews to ensure validity. We made sure that the wording was clear and reduced complexity whenever possible while adhering as much as possible to the original version of the CKBBQ [4]. For this reason, we refrained from eliminating concepts from the original scale altogether. However, while the English version has been applied in studies using paper-and-pencil format during in-person meetings (e.g., during a training session), we opted for an online questionnaire to be filled out at a convenient time for participants. Since the questionnaire took approximately 30 minutes to be completed, this led to low response rates and high dropout rates. Thus, we advise to use shorter and simpler questionnaires and consider more dynamic and interactive data collection methods to enhance participation and understanding [18]. In addition, past studies indicate that a lack of topic knowledge often leads to low response rates and participation bias [19], likely affecting our study as well given the comparably low response rate and high sport-related concussion knowledge score of those who responded to the questionnaires. To overcome recruitment difficulties, it might be useful to involve schools in the awareness-raising process, given their central role in educating and training young people [16,20]. To conclude, future research should aim to administer sport-related concussion knowledge questionnaires in a larger sample to obtain population-based prevalence rates and a representative needs assessment for targeted sport-related concussion information interventions contributing to the adequate prevention and management of sport-related concussion incidents in paediatric populations.

Educational highlights

Definition of concussion

A concussion, or mild traumatic brain injury (mTBI), is a transient disruption of brain function caused by a sudden jolt to the head or body. Despite being termed "mild," concussions can have serious short- and long-term consequences, particularly in young individuals whose brains are still developing.

Potential consequences

Concussions can lead to a range of cognitive, emotional, and physical symptoms, including headaches, dizziness, confusion, memory impairment, and mood changes. Repeated concussions, especially without adequate recovery time, increase the risk of persistent post-concussive symptoms and long-term neurological conditions, such as chronic traumatic encephalopathy (CTE).

Consequences of a missed diagnosis

Failure to diagnose and properly manage a concussion can lead to prolonged symptoms, academic difficulties, and mental health challenges. A critical risk is second impact syndrome, a rare but potentially fatal condition where a second head injury occurs before the first has fully healed, leading to rapid and severe brain swelling.

Key considerations for physicians

- **Recognizing symptoms:** Symptoms may be subtle and evolve over hours or days. Physicians should be aware of red flags such as worsening headaches, repeated vomiting, or loss of consciousness.
- **Use of standardized tools:** Clinical assessments like SCAT6 (Sport Concussion Assessment

Tool) can aid diagnosis. Imaging is typically unnecessary unless red flags suggest intracranial injury.

- **Individualized recovery plans:** Rest, symptom monitoring, and gradual return to physical and cognitive activities are crucial. Over-restriction can be counterproductive.
- **Patient and family education:** Clear guidance on symptom monitoring, risk factors, and return-toplay protocols is essential to prevent complications.
- **Interdisciplinary management:** Collaboration with pediatric neurologists, physiotherapists, and mental health professionals may be necessary for prolonged or complex cases.

Timely diagnosis and appropriate management are essential to ensuring optimal recovery and reducing long-term risks.

Young athletes' and parents' knowledge of sports-related concussion in Italian-speaking Switzerland: a pilot study

Abstract

Knowledge about sport-related concussion symptoms, prevention and management is critical to minimise severe consequences in paediatric patients, yet evidence on sport-related concussion knowledge among young athletes and their parents in the European context is scarce. This pilot study aims to test the feasibility and acceptability of population-based study on sport-related concussion knowledge and associated factors in the Italian-speaking part of Switzerland. The CKBBQ was translated and adapted to fit the cultural context. linguistic and face validity were assured before collecting pilot data. participants were recruited in early 2024 through sports coaches of high-risk team sports. descriptive statistics, t-tests, and bivariate correlations were performed to evaluate sport-related concussion knowledge levels in young athletes and parents and how it might differ based on socio-demographic and information-related factors. Data from 61 parents and 45 young athletes revealed that sociodemographic factors are not associated with sport-related concussion knowledge, but having received sport-related concussion information in the past year is a significant and positive predictor. Also, using dyadic data, a significant positive correlation was found between parents' and adolescents' sport-related concussion knowledge. Sport-related concussion information is crucial in improving knowledge about it. A large-scale population-based prevalence study is needed to corroborate these findings and inform future sport-related concussion information interventions adapted to the specific cultural context. The study highlights the importance of reducing barriers to questionnaire access and involving key stakeholders including the sports doctor catering for this population.

Keywords: concussion, sport, knowledge, young athletes, parents

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Declarations
- Authors' role in the preparation of the manuscript: conceptualization: BGS, MF, DB, A-LC, GP; manuscript preparation: GP, MF, A-LC; tables and figures: A-LC; final version: BGS, GP, MF, A-LC, AC, JC, DB.
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