

The Knowledge of Physical Education Teachers on Signs and Symptoms of Sports-Related Concussions

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Abstract

Sports-related concussions (SRCs) can have significant consequences, making it crucial for physical education (PE) teachers to possess knowledge of their signs and symptoms for early management. This study aimed to assess the awareness of Jordanian PE teachers regarding SRC signs and symptoms. A cross-sectional online survey study was conducted using a translated version of a validated survey that included items related to participants' characteristics and 20 items asking PE teachers to identify whether the listed sign or symptom was associated with SRCs. A total of 309 PE teachers participated (54% females). The average score for recognizing signs and symptoms was 64%. The items that were most accurately identified included "blurred vision" (94% correct) and "dizziness" (93% correct), while the most inaccurately identified items included "Bleeding from the ear" (70% incorrect) and "Weakness in neck movements" (53% incorrect). In conclusion, Jordanian PE teachers demonstrated limited knowledge of SRC signs and symptoms.

Keywords: *Sports-related concussions, physical education, knowledge, signs and symptoms, professional development*

1 INTRODUCTION

According to the Concussion in Sport Group, a sport-related concussion (SRC) is a traumatic brain injury that stems from a direct blow to the head, neck, or body resulting in an impulsive force being transmitted to the brain (Patricios et al., 2023). This injury triggers a cascade of neurotransmitter and metabolic reactions, with possible axonal injury, blood flow change, and inflammation affecting the brain. Symptoms and signs may present immediately, or develop over minutes or hours, and usually resolve within days, but may be prolonged (Patricios et al., 2023). SRCs can affect all individuals including male and female children, youth, and adults.

An SRC is common among children and youth. It has been estimated that 33 million children and youth experience SRCs annually worldwide (Davis et al., 2017). That said, the actual prevalence of SRC among this population is difficult to determine due to the inconsistency in injury definitions used across studies and studied populations (Hon et al., 2019). Overall, the prevalence of SRC among this population is likely higher due to the under-detection and under-reporting of many SRCs (Hon et al., 2019).

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Common causes of SRC include sports injuries, motor vehicle collisions, bicycle accidents, falls, and assaults (Hon et al., 2019). A previous study (Yaramothu et al., 2019) involving 1408 children and youth with SRCs suggested that SRCs were most prevalent in organized sports (53.3%), followed by injuries in school (16.5%), recreational settings (6.7%), motor vehicle collisions (6.6%), home (5.5%), and other (11.3%). Among the recorded cases in schools, 64.2% of sports-related concussions (SRCs) occurred during physical education (PE) classes. This places the incidence rate of SRCs during PE classes as the second highest, following organized sports, within this population.

While the risk of SRCs during PE classes among children and youth is high, there is generally a limited number of studies examining the knowledge of physical educators of SRC signs and symptoms (Hildenbrand et al., 2018; O'Connor et al., 2023). These studies have involved PE teachers from the United States of America and Ireland and suggested that PE teachers demonstrated a limited level of knowledge of SRC signs and symptoms. That said, it is impossible to generalize the findings to PE teachers in the Arab region, including Jordan, given the distinct cultural, social, and educational backgrounds that influence the training and professional development of PE teachers in the Arab region. Hence, the main objective of the current study was to examine the knowledge of Jordanian PE teachers of SRC-related signs and symptoms. A secondary objective was to examine discrepancies in the knowledge based on participant demographics.

Examining the knowledge of PE teachers regarding SRC signs and symptoms is vital to identify areas of weakness. This allows healthcare providers involved in school sports, such as physical therapists and athletic therapists, to provide the required education and collaboration with PE teachers to ensure early detection of and response to an SRC, enhance student safety, facilitate compliance with SRC management protocols, and prevent long-term effects. This will, ultimately, create a safer sporting environment in schools. Consistent with previous literature (Hildenbrand et al., 2018), the authors of the current study anticipated that PE teachers will demonstrate limited knowledge of signs and symptoms associated with brain SRCs.

2 METHODS

This was a cross-sectional study. Ethics approval (No: 4/2/2022/2023) was acquired from the Hashemite University Ethics Board. Completing the survey questions implied consent was given by the participant as the risk in the current study was minimal, the authors did not survey vulnerable populations, and the survey was fully anonymous. All data collected was stored using one laptop. Only members of the research team had access to the laptop. The current study was reported based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (Vandenbroucke et al., 2007).

2.1 Participants

Participants included a sample of PE teachers in Jordan. Participants were recruited from public and private schools through advertisements, social media, and word of mouth. Participants were included if they were full-time teachers, held a degree in a field that allowed them to work as PE teachers in Jordan (i.e., PE or sports rehabilitation), and could complete the survey. The sample size in the current study was calculated using the SurveyMonkey sample size calculator available on their website [<https://www.surveymonkey.com/mp/margin-of-error-calculator/>]. Based on a population size of 6,000 teachers, a desired confidence level of 95%, and a margin of error of $\pm 5\%$, the SurveyMonkey calculator recommended a sample size of 302 participants.

2.2 Procedures

The research team used Google Forms as the online survey platform. The research team sent out a survey invitation via email and other appropriate social media communication channels to a Google Form that included the survey items. The research team used a Google Form due to its ease of use, accessibility, efficient data collection, and data management abilities. These advantages made the form suitable for use in the current study. The survey allowed for only one attempt per participant to ensure survey response independence and all survey items were mandatory. The survey was active for a total of two weeks, and only completed surveys were recorded and analyzed.

2.3 Outcome measures

The authors used an Arabic version of a survey that included demographic items and items related to the knowledge of signs and symptoms associated with SRCs. The demographics section included items related to their field of study, level of education, age, sex, sector of employment (public or private), geographical region of work (North, Middle, or South), years of professional experience, previous education in SRCs (yes/no), ongoing continuous education concerning sport-related injuries (yes/no), exposure to SRCs during their education (yes/no), the perceived need for additional education on sport-related injuries (yes/no), and their trusted sources of information concerning sports-related injuries.

The section related to the knowledge of SRC signs and symptoms was adopted from a reliable, valid, and previously published survey (Hildenbrand et al., 2018; Lempke et al., 2022; Register-Mihalik et al., 2013). The survey consists of 20 items (8 true, 12 false) asking PE teachers to indicate whether the listed sign or symptom was associated with an SRC (yes/no). The authors translated the true items into Arabic using the valid and reliable symptoms checklist impeded in the Arabic version of the Sport Concussion Assessment Tool, Edition 5 (SCAT5), (Holtzhausen et al., 2021).

The authors translated the false items into Arabic based on previously reported guidelines for forward and backward translation (Ozolins et al., 2020; Sousa & Rojjanasrirat, 2011). Initially, two bilingual translators who have distinct backgrounds and whose mother language is Arabic forward translated the original survey from English to Arabic. This resulted in two Arabic copies of the survey. Next, a third independent translator compared the Arabic versions and the Arabic versions with the English version of the items. A member of the research team resolved ambiguities and discrepancies in the Arabic version of the items. After, a bilingual translator whose mother language is English, and who is knowledgeable about health terminology and SRC, backward translated the Arabic items into English. Finally, an expert and independent translator compared the Arabic version of the items to the original English version in terms of similarity, structure, meaning, and relevance. The authors then tested the final Arabic version on a sample of 11 PE teachers for clarity and readability.

2.4 Statistical analysis

Data analysis started with data screening and cleaning. Descriptive statistics were calculated and reported for all variables. Signs and symptoms recognition responses were transformed into composite scores by summing the correct items (out of 20) and dividing by the total number of items on the measure (20), resulting in a percent correct score (Lempke et al., 2022). Non-parametric statistics were used to examine the total scores given that the scores were not normally distributed. The alpha level for statistical significance was set at $p < 0.05$. The authors used SPSS Statistics 22 (IBM, Chicago, IL, USA) to analyze the data.

3 RESULTS

Three hundred twenty-two participants completed the survey. Of those, 13 were excluded based on their education (i.e., one physician, one nurse, three physical therapists, and eight sports therapists) leaving a sample of 309 participants that consisted of 166 females (54%) and 143 males (46%) for final analysis. Table one shows participant characteristics.

The majority of participants held a bachelor's degree (n=252, 82%) in PE (n=272, 88%), worked in public schools (283, 92%) mainly in the middle side of the country (n=196, 63%), had more than five years of experience (n=257, 83%), received no previous education concerning SRC neither as students (n=233, 75%) nor after graduation (n=284, 92%), reported their need for profession development programs that focus on the management of sport-related injuries (n=298, 96%), and reported the usage of Google as their main source of information regarding sport-related injuries (n=168, 54%).

Table 1. Sampled physical education teachers (N=309).

| Variable | Frequency | Percentage |
|---|-----------|------------|
| Education | | |
| Physical education | 272 | 88 |
| Sport rehabilitation | 37 | 12 |
| Level of Education | | |
| Diploma | 7 | 2 |
| Bachelor | 252 | 82 |
| Master | 46 | 15 |
| Doctor of Philosophy | 4 | 1 |
| Age (years) | | |
| 18 – 25 | 10 | 3 |
| 26 – 30 | 27 | 9 |
| 31 – 35 | 61 | 20 |
| 36 – 40 | 109 | 35 |
| More than 40 | 102 | 33 |
| Sex | | |
| Male | 143 | 46 |
| Female | 166 | 54 |
| Sector of working | | |
| Public | 283 | 92 |
| Private | 26 | 8 |
| Area in the country | | |
| North | 77 | 25 |
| Middle | 196 | 63 |
| South | 36 | 12 |
| Years of experience | | |
| <1 | 3 | 1 |
| 1 – 3 | 25 | 8 |
| 4 – 5 | 24 | 8 |
| >5 | 257 | 83 |
| Previous education on concussion | | |
| Yes | 25 | 8 |
| No | 284 | 92 |
| Receive continuous education on sport-related injuries | | |
| Yes | 108 | 35 |
| No | 201 | 65 |
| The educational curriculum covered topics related to concussion | | |
| Yes | 76 | 25 |
| No | 233 | 75 |
| Reported the need for receiving education on sport-related injuries | | |
| Yes | 298 | 96 |
| No | 11 | 4 |
| The source of knowledge on sport-related injuries | | |
| Google | 168 | 54 |

| | | |
|-----------------|----|----|
| Books | 26 | 8 |
| Conferences | 7 | 2 |
| Workshops | 87 | 28 |
| Online training | 21 | 7 |

The authors calculated the internal consistency of the survey used in the current study and it was adequate (Cronbach's $\alpha = .72$). Concerning the knowledge of signs and symptoms associated with SRCs, participants responded to 20 true/false questions related to whether certain signs and symptoms were associated with SRCs (Table 2). Five items were more often answered incorrectly than correctly. These items included "Bleeding from the ear" (70% incorrect) "and "Bleeding from the nose" (66% incorrect) followed by "Numbness or tingling of arms" (53% incorrect), "Weakness in neck movements" (53% incorrect), and "fever" (52% incorrect). The most accurately answered questions included "blurred vision" (94% correct), "dizziness" (93% correct), "amnesia" (93% correct), and "Loss of Consciousness" (91% correct).

The non-parametric Mann-Whitney U test revealed a significant difference ($U=3527, P < 0.01$) in the total scores between participants based on their educational background. That is, scores from PE teachers with an educational background in Sport rehabilitation ranked higher (mean rank=195) than those with an educational background in PE (mean rank=149).

Table 2. Signs and Symptoms Recognition Survey Items and Responses in a Sample of Physical Education Teachers (N=309).

Please indicate which of the following you would consider to be a sign or symptom of concussion.
(Correct response)

| | Correct response frequency | Percentage |
|--|----------------------------|--------------------|
| Abnormal sense of taste (false) | 164 | 53% |
| Abnormal sense of smell (false) | 154 | 50% |
| Amnesia (true) | 288 | 93% |
| Joint stiffness (false) | 176 | 57% |
| Blurred vision (true) | 289 | 94% |
| Black eyes (false) | 175 | 57% |
| Bleeding from the ear (false) | 94 | 30% |
| Bleeding from the mouth (false) | 164 | 53% |
| Bleeding from the nose (false) | 106 | 34% |
| Confusion (true) | 201 | 65% |
| Fever (false) | 149 | 48% |
| Dizziness (true) | 288 | 93% |
| Headache (true) | 263 | 85% |
| Insomnia (true) | 172 | 56% |
| Loss of Consciousness (true) | 281 | 91% |
| Nausea (true) | 271 | 88% |
| Numbness or tingling of arms (false) | 145 | 47% |
| Skin rash (false) | 270 | 87% |
| Sharp burning pain in the neck (false) | 167 | 54% |
| Weakness in neck movements (false) | 146 | 47% |
| | Mean | Standard deviation |
| Signs and symptoms recognition (%) | 64 | 21 |

4 DISCUSSION

The current study examined the knowledge of SRC-associated signs and symptoms among Jordanian PE teachers. Jordanian PE teachers showed 64% signs and symptoms recognition on average (Table 2). This score is lower than the one that has been reported in a comparable sample (71.4%) (Hildenbrand et al., 2018). This can be attributed to the lack of education given that most (92%) of the participants in the current study received no previous education on SRC.

Consistent with the current scientific literature (Hildenbrand et al., 2018), the most accurately identified SRC-associated signs and symptoms in the current study included blurred vision and dizziness. Further, the most inaccurately identified signs and symptoms included bleeding from the ear and weakness in neck movements (Table 2).

Interestingly, a significant portion of the teachers inaccurately categorized severe signs and symptoms (e.g., bleeding from nose and ears) as being associated with an SRC, which may indicate a misinterpretation of the severity of this injury. This can be attributed to many possible reasons. The first possible reason is the lack of education on this specific injury. Findings from the current study support this possibility given that 75% of the participants received no formal education on SRC (Table 1). The second possible reason is the lack of ongoing professional development opportunities for PE teachers. Results from the current study also support this possible reason as 92% of the teachers reported not receiving continuous education on SRC (Table 1). The final possible reason is the absence of standardized protocols for managing SRCs in Jordanian schools. Future studies may examine this possibility.

The findings from the current study revealed that teachers with an education in Sport rehabilitation scored higher than those with an education in PE. This can be explained by the lack of education on SRC among teachers with PE educational background. For instance, further analysis of the data in the current study revealed that more teachers ($n=5$, 14%) with Sport rehabilitation education received previous training on SRC compared to those with an education in PE ($n=20$, 7%).

The current study has practical implications. Initially, there is an urgent need to provide targeted professional development programs and resources to PE teachers to improve their knowledge of SRCs. These resources need to be available in both Arabic and English languages as Arabic is the language of education in PE colleges in Jordan. The resources can be in various forms including, but not limited to workshops, online training modules, and educational materials. There is also a need to enhance the collaboration between PE teachers and healthcare professionals to ensure accurate diagnosis, appropriate referrals, and comprehensive support for students with SRCs. By equipping PE teachers with the necessary knowledge and professional support, Jordan can enhance the safety of students engaged in physical activities and, ultimately, their well-being.

4.1 Strengths and limitations

To the best of the authors' knowledge, this is the first study examining the knowledge of SRC signs and symptoms among Jordanian PE teachers. Findings from the current study, however, should be interpreted while considering a few limitations. For instance, most PE teachers in the current study possessed a bachelor's degree ($n=252$, 82%) in PE ($n=272$, 88%) and were employed in public schools ($n=283$, 92%). Hence, the generalizability of the findings to PE teachers with a degree in sport rehabilitation, who possess higher educational qualifications (i.e., master's and Doctorate), and/or work in private schools is limited. Future studies should aim at the recruitment of participants representing PE teachers with educational backgrounds in sport rehabilitation and physical education, involving both public and private school settings. Further, due to the cross-sectional nature of the study, test-retest reliability of the survey items was not examined in a sample of PE teachers. It is imperative for subsequent studies to investigate the test-retest reliability of the questionnaire utilized in the current study using representative samples of PE teachers. Furthermore, the current cross-sectional study provides insight into the level of PE teachers' knowledge only at the time of survey instrument completion, but not the change of knowledge over time. Future studies may investigate the changes in the knowledge of PE teachers regarding SRC signs and symptoms. These studies may employ methods to assess the knowledge of PE teachers before and after training interventions.

5 CONCLUSION

Jordanian PE teachers showed limited knowledge of the signs and symptoms associated with SRC. This can be attributed to the lack of education and training in this specific area. Healthcare providers who are involved in school sports, including physical and athletic therapists, should offer education and collaborate with PE teachers to improve their knowledge of SRCs. This is crucial to enhance the safety of students engaged in physical activities and, ultimately, their well-being.

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Data availability statement.

The data that support the findings of this study are available from the corresponding author, [TM], upon reasonable request.

Disclosure statement.

The authors report there are no competing interests to declare.

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