Concussions Symptoms Among Icelandic Female Athletes: Can Concussion-Related Instruction Affect the Development of Concussion Symptoms Today

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BSc in Psychology

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Foreword

Submitted in partial fulfillment of the requirements of the BSc Psychology degree, Reykjavik University, this thesis is presented in the style of an article for submission to a peer-reviewed journal.
Abstract

The purpose of the study was to examine if concussion-related instruction can affect the development of concussion symptoms today. This was done by exploring the difference in the total number of concussion symptoms of Icelandic female athletes depending on whether they received instructions following injury. It was also examined whether the quality of information matters regarding concussion symptoms today. The current study tested two hypotheses. The first hypothesis suggested that the athletes that got instructions following the injury had a better outcome regarding concussion symptoms today. The second hypothesis suggests that there is a positive correlation between the perceived quality of the information and concussion symptoms today. Participants were 138 Icelandic female athletes who all had a history of concussion. Data was obtained from a study on the concussion history of Icelandic female athletes, conducted at the beginning of 2018. The questionnaire that was used is an Icelandic version of the Sports Concussion Assessment Tool 5th Edition (SCAT-5).

Results do not support the idea that receiving instructions is more effective than not receiving instructions, in relation to having a better outcome from concussion symptoms today. There was not a correlation between the perceived quality of the information and post-concussion symptoms today.

Keywords: post-concussion, sport-related concussion, instructions
The current state of knowledge on concussion needs to have clear and practical guidelines to determine recovery and safe return to play for athletes with a sport-related concussion (McCrory et al., 2017). Around twenty published studies have indicated that athletic trainer, physician, parent, coach, and athlete knowledge are compliance with sport-related concussion guidelines are limited (Donaldson et al., 2014). Inconsistency in the general understanding of concussion may have the effect that patients with a concussion are given different and not equally good concussion discharge instructions. Patients may be confused about when to return to the emergency department after evaluation for a head injury. This factor may then affect what patients will do afterward, which can significantly affect concussion symptoms (Thomas et al., 2018).

There has not been much consistency in the definition of concussion. The term concussion has no clear definition, and no pathological meaning and the lack of clearly defined definitions of these terms often leads to confusion. This confusion is increasingly problematic as the management of 'concussed' individuals is a pressing concern (Sharp & Jenkins, 2015). The definition of concussion is often used to describe the constellation of clinical signs and symptoms that occur following such an injury (Sussman, Pendharkar, Ho, & Ghajar, 2018).

According to the American Medical Society for Sports Medicine position statement, a sport-related concussion is defined as a traumatically induced transient disturbance of brain function and involves a complex pathophysiological process (Harmon et al., 2013a). Despite the fact that some consensus statement on concussion in sport has been designed for physicians and healthcare providers to treat sport-related concussion (SRC) and return-to-play decisions. Designed to develop further conceptual understanding build on the principles outlined of SRC using an expert consensus-based approach (McCrory et al., 2017).

There seems to be a lack of general knowledge about a concussion. The study by
Fedor and Gunstad (2015) suggests that student-athletes have an incomplete understanding of concussion-related symptoms (Fedor & Gunstad, 2015). A recent survey by Gardner (2017) examined the public's attitudes and knowledge of concussion. A total of 210 individuals answered the survey. Participants expressed that they had little knowledge regarding concussion symptoms. While 59% had no knowledge of concussion instructions, 82% considered it essential for athletes to know what to do after the concussion, 21% had heard of the consensus statement on concussion in sport. The conclusion in that study is that the general public's knowledge about concussion seems to be modest (Gardner, Kay-Lambkin, Shultz, & Iverson, 2017). Bakes (2014), conducted a study to investigate if athletes follow guidelines governing when they can return to play. All 150 patients have been diagnosed with a concussion during a one-year period and all athletes were given instructions developed from the third international Consensus Statement on Concussion in Sport. The findings showed that 39% of athletes reported returning to play on the same day as the injury and athletes who returned in the second week, where 35% still symptomatic. Athletes who returned to play at week 4, were 23% still symptomatic. These results suggest that athletes do not follow guidelines and it is strongly recommended that the emergency department educating parents, athletes at discharge, should stress the importance of compliance with guidelines (Bakes, 2014).

Many individuals will seek help from an emergency department due to health conditions and problems. About 200,000 individuals are expected to seek treatment for sports-related concussions (SRC) at the Emergency Department each year in the US. Also, 70.5% of these individuals are between ten and nineteen years old (Centers for Disease Control and Prevention, 2011). According to the Centers for Disease Control and Prevention, report that concussion-related to sports is very common, about 1.6 to 3.8 million people receive sport-related concussions (SRC) every year in the United States (Daneshvar, Nowinski, McKee, &
Cantu, 2011). These numbers can be underestimated because many of these injuries could go unrecognized or unreported (Funk, Duma, Manoogian, & Rowson, 2007). A concussion is likely underdiagnosed because concussion symptoms can be difficult to detect, recognize, and manage. Another probable cause is that symptoms of a concussion can overlap with another pathologic traumatic brain injury. Symptoms can be mixed with other medical conditions that can influence one another, e.g., depression, posttraumatic, headache syndromes (Giza, Greco, & Prins, 2018), medicolegal status, pain and stress disorder (Potter, Leigh, Wade, & Fleminger, 2006). Therefore, patients, families, and doctors can overlook the problem at the beginning because there is no biotechnology or neuroimaging to detect the concussion (Atif & Hicks, 2019).

A concussion can lead to a variety of signs and symptoms, which can be divided into three major domains: physical, cognitive, and emotional (Chan, 2001). Individuals can show changes in their emotions immediately after the injury, e.g., irritability, depression, and sleep disturbances, but they also may seem healthy even if they behave or feel different than before. Physical and cognitive symptoms are, e.g., headache, neck pain, vision changes, cognitive deficits (Junn, Bell, Shenouda, & Hoffman, 2015). Post-concussive symptoms can be diagnosed when symptoms have been constant irritability for at least three months and occurred shortly after the concussion (Quinn, Mayer, Master, & Fann, 2018). The most commonly reported post-concussion symptoms are e.g., headache (Seifert, 2018), dizziness, memory problems, irritability, decreased concentration, visual disturbances, fatigue, judgment problems, sensitivity to noise, depression, and anxiety (Ryan & Warden, 2003). Symptoms following a concussion are highly variable in duration. They can last for a varying amount of time and may occur immediately, while others may not occur until days, weeks or even several months afterward after the concussion and can even linger (Graham et al., 2014).
Several risk factors may affect concussion risk and the likelihood of prolonged recovery (Scopaz & Hatzenbuehler, 2013). According to new American Academy of Neurology (AAN) guideline states that there is no evidence for a speed recovery from a concussion, but the risk of repeated concussions is a risk factor for long-term cognitive dysfunction. It can be avoided by several days rest, given that the likelihood of repeated concussions is greatest within the first ten days following concussion (Gómez & Hergenroeder, 2013a). Concussion symptoms can be different between individuals, depending on how severe the injuries were and if there is a history of concussions (Collie, McCrory, & Makdissi, 2006). Athletes with a history of multiple concussions may be at risk for experiencing concussion symptoms well beyond the acute stage of an injury (Register-Mihalik, Mihalik, & Guskiewicz, 2009). Players that have a history of three or more previous concussions are three times more likely to sustain another concussion than players with no concussion history (Guskiewicz et al., 2003).

Recovery time after receiving a concussion can depend on many factors. These factors depend on, e.g., what part of the brain was damaged, age, time since the injury happened, how severe the concussion was and symptoms (Dornonville de la Cour, Rasmussen, Foged, Jensen, & Schow, 2019). There is some evidence that activities that require concentration and attention make symptoms worse, and may delay recovery time (Adirim, 2007). Therefore it is crucial to follow-up with all athletes because symptoms may have an impact on their cerebral function in their later years (Hammond, Davies, & Su, 2015). It is estimated as many as 320,000–760,000 athletes in the United States experience prolonged symptoms (Charek, Collins, & Kontos, 2018); therefore, proper follow up could be very important for a large group of people. It is important that an athlete’s take-home information ideally in a written form and it should be discussed with the athlete to follow the instructions. Give athletes instructions and family members, coaches, including signs or symptoms that should prompt
an emergency room evaluation. It is recommended that athletes should avoid any physical or
cognitive exertion that can worsen or mimic signs of a concussion, avoid alcohol use and
come in for a follow-up (Harmon et al., 2013). A recent study demonstrated that children and
adolescents generally take two to three weeks to recover from a sport-related concussion
(Purcell, Harvey, & Seabrook, 2016), normal recovery time within adults is 7–14 days
(Hutchinson, Comper, Csenge, & Richards, 2014).

Studies have shown that many parents and athletes obtain medical recommendations
via the internet, but the quality of available information and resources is highly variable
(Beutel & Cardone, 2014). Online resources are inconsistent in relaying guideline
recommendations for return to play. Information online can be a potential source of confusion
in the management of concussion for athletes and their parents, which may result in an
inappropriate return to play (Swallow et al., 2017). Over the past ten years, there has been an
increasing interest by Internet users and scientists about concussion, and this applies to both
worldwide Google search queries and publications in medical journals (Lawson McLean,
Lawson McLean, Kalff, & Walter, 2016). The Internet allows people to transmit worldwide
information in seconds. Websites are useable to gather information on various issues and, it is
estimated that 61% of American adults regularly lookup online for health information and
recommendations (Ahmed, Sullivan, Schneiders, & McCrory, 2012). Youtube.com is a
hugely popular website worldwide where individuals can upload videos and watch the videos
that people upload. Williams (2014), pointed out that much of these videos include
educational videos on all kinds of issues, problem solve that may consist of various messages,
information, education, including information on health issues such as concussion. Little is
known about whether the information on the site is reliable since anyone can upload videos
without anyone crossing over whether these messages are accurate or not. The aim of the
study by Williams (2014) was to find out what information was available on a concussion on
YouTube. The findings showed there were 434 available videos about concussion, and 100 of these videos had at least 26,191 views. Sport-related concussions were the most popular videos 37%, with very few concussion videos coming from professionals 1%, healthcare institutions 1%, or other academic institutions. This result indicates that the quality of the content is questionable and that individuals cannot rely on instructions or guidelines recommendations on YouTube (Williams et al., 2014).

**Current study**

Most research has explored concussions in general, whether symptoms change within an individual regarding severity (Kerr, Marshall, & Guskiewicz, 2012), frequency (Roberts, Trewartha, England, Goodison, & Stokes, 2017), duration and how symptoms affect the individual (Solomon & Kuhn, 2014). Recent evidence suggests young women athletes in certain sports appear to be more susceptible to concussion than young males (Gómez & Hergenroeder, 2013b); also, females tend to report more concussion symptoms than males (Albicini & McKinlay, 2018; Covassin, Elbin, Harris, Parker, & Kontos, 2012). Female soccer and basketball players displayed more time loss after concussion (Covassin, Moran, & Elbin, 2016). The aim of this study was to examine the importance of receiving instructions following a concussion among Icelandic female athletes on the development of concussion symptoms today. The aim was also to examine whether the perceived quality of the information matters in relation to concussion symptoms today. Hypothesis 1: Athletes that got instructions following a concussion are expected to have a better outcome regarding concussion symptoms today. Hypothesis 2: There is a positive correlation between the perceived quality of the information and concussion symptoms today.
Method

Participants

Participants in this study who constituted a convenience sample, were 138 Icelandic female athletes. Table 1 shows the current age range and age when most serious concussions occurred. The age range was between 17 to 45 years old (Mean = 28.09, SD = 7.37). The age range was between 13 to 40 years old (Mean = 5.61, SD=1.47) when the most serious concussion occurred. Most participants were in high school when the most serious concussion occurred.

Table 1

<table>
<thead>
<tr>
<th>Current age range and when the most serious concussion occurred</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n)</td>
<td>(%)</td>
</tr>
<tr>
<td>Current age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 - 20</td>
<td>23</td>
<td>16.8</td>
</tr>
<tr>
<td>21 - 24</td>
<td>31</td>
<td>22.6</td>
</tr>
<tr>
<td>25 - 28</td>
<td>29</td>
<td>21.2</td>
</tr>
<tr>
<td>29 - 32</td>
<td>16</td>
<td>11.7</td>
</tr>
<tr>
<td>33 - 36</td>
<td>14</td>
<td>10.2</td>
</tr>
<tr>
<td>37 - 40</td>
<td>12</td>
<td>8.8</td>
</tr>
<tr>
<td>41 &gt;</td>
<td>12</td>
<td>8.8</td>
</tr>
<tr>
<td>Age when the most serious concussion occurred</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 - 13</td>
<td>1</td>
<td>1.4</td>
</tr>
<tr>
<td>14 - 17</td>
<td>16</td>
<td>22.2</td>
</tr>
<tr>
<td>18 - 21</td>
<td>23</td>
<td>31.9</td>
</tr>
<tr>
<td>22 - 25</td>
<td>15</td>
<td>20.8</td>
</tr>
<tr>
<td>26 - 29</td>
<td>9</td>
<td>12.5</td>
</tr>
<tr>
<td>30 - 33</td>
<td>5</td>
<td>6.9</td>
</tr>
<tr>
<td>34 - 37</td>
<td>1</td>
<td>1.4</td>
</tr>
<tr>
<td>38 - 41</td>
<td>2</td>
<td>2.8</td>
</tr>
</tbody>
</table>
Measures

*Sport Concussion Assessment Tool 5th Edition (SCAT5)* is used to assess concussion symptoms. The PCS is a scale designed to measure the severity of symptoms in the acute phase of recovery from concussion. It can be used for evaluating athletes aged 13 years and older, who suspected of having sustained an SRC (Echemendia et al., 2017). SCAT-5 is usable for tracking symptoms recovery over time to help inform clinical management decisions, also usable for managed with a return to play guidelines (Mistry, Link to external site, & Rainer, 2018). SCAT’s symptom list included twenty-two statements about presence concussion characteristics and with severity ratings for each endorsed symptom ranged of maximum 132 (“Sport concussion assessment tool—5th edition,” 2017). SCAT-5 was translated from English to Icelandic and adjusted to the researchers’ criteria, only using step two (post-injury evaluations) from the list. The list was on a seven-point Likert scale rating (Meehan, Mannix, O’Brien, & Collins, 2013), but that scale was changed for this study, and participants answered on a two-point scale (Yes/no). The interviewer listed the symptoms and asked participants if they experienced any post-concussion symptoms which are still present today.

Participants were asked, "Did you get instructions following the injury” and answered either yes, no or can't remember. When asked "How satisfactory did you find this information” participants were asked to answer on a scale from 0 to 10 (0 unsatisfactory and 10 very satisfactory).

Procedure

All data was obtained from an existing study on the concussion history of Icelandic female athletes, which took place at the beginning of 2018. The data used here is from the second stage. In the first stage of the study, about 500 female athletes answered an online questionnaire. Athletes answered questions about their history of concussion and other
INSTRUCTION AND DEVELOPMENT OF CONCUSSION SYMPTOMS TODAY

background questions. The second stage was all athletes that reported that they had a concussion in the survey were united for a more detailed interview. Those athletes answered questions in more detail about their experience of concussion and whether they still experience concussion symptoms today.

The questions used in this analysis were if participants experienced any post-concussion symptoms today, whether they had received instructions or not following the injury. If the participant received instructions, then the following question was how satisfactory were these instructions.

**Statistical analysis**

Data were analyzed using the *Statistical Package for the Social Sciences (IBM SPSS statistics 25)*. Cronbach’s alpha was calculated to investigate how well the PCSS items measured underlying constructs. All of the 22 post-concussion symptoms were calculated for each symptom by dividing the sum by the total number of symptoms reported. Participants were divided into two groups, yes and no group. The yes-group was the group of participants who received guidelines/instructions about what to do the following the concussion. The no-group was the one who did not receive guidance/instructions. Participants within the yes group were also divided into two subgroups those who got “satisfactory instructions” and those who got “unsatisfactory instructions.” Unsatisfactory instructions ranged from 0 – 5, and satisfactory instructions ranged from 6 – 10.

Independent samples t-tests were used to explore the differences in the total number of concussion symptoms today between yes group and no group. Pearson's correlations were used to investigate the relationship between concussion symptoms today and instructions satisfactory levels within the yes group.

Assumptions were checked for the independent sample T-test, to explore if any usability problems are present or not. There were no outliers in the data, as assessed by
inspection of a boxplot showed that symptoms today were approximately normally distributed for both yes and no-group. The assumption of homogeneity of variance states that the standard deviation of the dependent variable must be equal within both groups. Levene’s test was used to identify if the homogeneity was equal in groups, the Levene’s test was not significant, $F(129) = 472, p=.493$, and assumption of homogeneity was met. The Alpha level was set at 0.05 for all comparisons.

**Results**

Two statements from the questionnaire were used as independent and dependent variables was composed of twenty-two questions that formed symptoms today. The frequency and percentages of the 22 responses on the post-injury evaluation scale of the SCAT-5 reported are presented in Table 2. The least frequently non-concussion symptoms ranged from 42.3% to 96.4%, was confusion ($n=132, 96.4$%), feeling like “in a fog” ($n=123, 89.8$%), nausea or vomiting ($n=116, 85.3$%) and balance problems ($n=112, 81.8$%). The frequencies of individual reported symptoms today ranged from 3.6% to 62.0%. The most frequently reported symptoms today, were: fatigue or low energy ($n=85, 62.0$%), difficulty concentrating ($n=79, 57.7$%), headache and nervousness/anxious ($n=72, 52.9$%) and difficulty remembering ($n=59, 43.4$%).

Table 2

*Percentage of the post-concussion symptoms today for the dependent variable*

<table>
<thead>
<tr>
<th>Post-Injury Concussion Symptoms Today</th>
<th>Concussion symptoms</th>
<th>Non-concussion symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n$ (%)</td>
<td>$n$ (%)</td>
</tr>
<tr>
<td>Headache</td>
<td>72 (52.2)</td>
<td>65 (47.4)</td>
</tr>
<tr>
<td>Pressure in head</td>
<td>52 (38.5)</td>
<td>83 (61.5)</td>
</tr>
<tr>
<td>Neck Pain</td>
<td>56 (40.9)</td>
<td>81 (59.1)</td>
</tr>
<tr>
<td>Nausea or vomiting</td>
<td>20 (14.7)</td>
<td>116 (85.3)</td>
</tr>
</tbody>
</table>
Dizziness 54 (39.7) 82 (60.3)
Blurred vision 32 (23.4) 105 (79.6)
Balance problems 25 (18.2) 112 (81.8)
Sensitivity to light 56 (40.9) 81 (59.1)
Sensitivity to noise 55 (40.1) 82 (59.9)
Feeling slowed down 26 (19.0) 111 (81.0)
Feeling like “in a fog“ 14 (10.2) 123 (89.8)
Don’t feel right 39 (28.7) 97 (71.3)
Difficulty concentrating 79 (57.7) 58 (42.3)
Difficulty remembering 59 (43.4) 77 (56.6)
Fatigue or low energy 85 (62.0) 52 (38.0)
Confusion 5 (3.6) 132 (96.4)
Irritability 50 (36.5) 87 (63.5)
Sadness 40 (29.2) 97 (70.8)
Nervousness or Anxious 72 (52.9) 64 (47.1)
More emotional 44 (32.1) 93 (67.9)
Drowsiness 58 (42.3) 79 (57.7)
Trouble falling asleep 50 (36.5) 87 (63.5)

As seen in Figure 1, the sum of the total number for individual symptoms, as well as the total number of symptoms reported by each participant. The sum of the number of symptoms reported ranged from 0 to 19. A total of 137 participants reported having at least one or more

Figure 1. Total number of symptom endorsements for the post-concussion scale in concussed Icelandic female athletes
signs and symptoms listed on the PCS and were very common \((n=11, 8.0\%)\) of participants who did not report any of the listed symptoms. As seen in the following Figure, 16 participants reported \((n=5, 11.6\%)\) concussion symptoms and none of the participants had all 22 symptoms, but 2 participants reported had 19 symptoms \((1.5\%)\).

Participants’ answers to the statement, "Did you get instructions following the injury."

Of the 137 participants, 6 did not remember, 62 receive instructions and, 70 did not receive instructions following the injury. Participants were divided into two groups, depending on whether they received instructions or not “yes-group” receive instructions and “no-group” did not receive instructions. The frequencies of athletes reported symptom by two groups for the concussed athletes are presented in Figure 2. The most frequently reported symptoms, within yes-group \((n=57, 47.1\%)\) were as follows: sensitivity to light \((57.4\%)\), headache \((56.6\%)\), sensitivity to noise \((55.6\%)\), nervousness or anxious \((50.0\%)\), fatigue or low energy \((48.1\%)\) and, difficulty remembering \((48.1\%)\). The most frequently reported symptoms within no-group \(n=64 (52.9\%)\) were drowsiness \((61.8\%)\), fatigue or low energy \((51.9\%)\), difficulty

![Figure 2. Frequency of reported symptoms today across participants who receive instructions and how did not](image-url)
concentrating (51.9%), difficulty remembering (51.7%) and, nervousness or anxious (50.0%).

On average, the yes group \((n=62)\), \(M=7.80, 95\% \text{ CI} [6.55, 9.05], SD=4.935\), was not significantly different than the no-group \((n=69)\), \(M=7.63, 95\% \text{ CI} [6.35, 8.88], SD=5.696\). The groups did not differ significantly, \(t(129) = -0.205, p = .838, 95\% \text{ CI} [-1.95, 1.58]\). Within the yes group, two subgroups “satisfactory instructions” and “unsatisfactory instructions.” On average, satisfied instructions \((n=28)\), \(M=6.96, 95\% \text{ CI} [5.34, 8.58], SD=4.167\), was not significantly different than receiving unsatisfied instructions \((n=24)\), \(M=8.25, 95\% \text{ CI} [5.63, 10.86], SD=6.201\). The groups did not differ significantly, \(t(39.24) = 0.862, p = .394, 95\% \text{ CI} [-1.72, 4.300]\). There was a weak downhill (negative) linear relationship, correlation indicated that there was not a significant between the symptoms today and perceived quality of the information \(r(52) = -0.107, p (.450) > .05\).

The most frequently reported symptoms today across the perceived quality of the information are presented in Table 3. The most frequently reported symptoms, at satisfactory instructions, were as follows: headache \((n=19, 55.9\%)\), fatigue or low energy \((n=18, 58.1\%)\), difficulty concentrating \((n=16, 55.2\%)\), sensitivity to noise \((n=14, 53.8\%)\), nervousness or anxious \((n=14, 51.9\%)\) and sensitivity to light \((n=13, 52\%)\). These reported symptoms were 34-65.9\% of the sample. The least frequently symptoms within satisfactory instructions were confusion, feeling like “in a fog“ and nausea or vomiting. Most frequently reported symptoms for unsatisfactory instructions were: headache \((n=15, 44.1\%)\), difficulty remembering \((n=14, 73.7\%)\), nervousness or anxious \((n=13, 48.1\%)\) and fatigue or low energy \((n=13, 41.9\%)\).
Table 3

*Percentage of reported symptoms today across the perceived quality of the information*

<table>
<thead>
<tr>
<th>Post-Injury Concussion Symptoms Today</th>
<th>Unsatisfactory instructions</th>
<th>Satisfactory instructions</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>44.1% (15)</td>
<td>55.9% (19)</td>
<td>34</td>
</tr>
<tr>
<td>Pressure in head</td>
<td>55.0% (11)</td>
<td>45.0% (9)</td>
<td>20</td>
</tr>
<tr>
<td>Neck Pain</td>
<td>58.8% (10)</td>
<td>41.2% (7)</td>
<td>17</td>
</tr>
<tr>
<td>Nausea or vomiting</td>
<td>16.7% (1)</td>
<td>83.3% (5)</td>
<td>6</td>
</tr>
<tr>
<td>Dizziness</td>
<td>57.1% (12)</td>
<td>42.9% (9)</td>
<td>21</td>
</tr>
<tr>
<td>Blurred vision</td>
<td>57.1% (8)</td>
<td>42.9% (6)</td>
<td>14</td>
</tr>
<tr>
<td>Balance problems</td>
<td>62.5% (5)</td>
<td>37.5% (3)</td>
<td>8</td>
</tr>
<tr>
<td>Sensitivity to light</td>
<td>48.0% (12)</td>
<td>52.0% (13)</td>
<td>25</td>
</tr>
<tr>
<td>Sensitivity to noise</td>
<td>46.2% (12)</td>
<td>53.8% (14)</td>
<td>26</td>
</tr>
<tr>
<td>Feeling slowed down</td>
<td>55.6% (5)</td>
<td>44.4% (4)</td>
<td>9</td>
</tr>
<tr>
<td>Feeling like “in a fog“</td>
<td>100.0% (4)</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Don’t feel right</td>
<td>66.7% (10)</td>
<td>33.3% (5)</td>
<td>15</td>
</tr>
<tr>
<td>Difficulty concentrating</td>
<td>44.8% (13)</td>
<td>55.2% (16)</td>
<td>29</td>
</tr>
<tr>
<td>Difficulty remembering</td>
<td>73.7% (14)</td>
<td>26.3% (5)</td>
<td>19</td>
</tr>
<tr>
<td>Fatigue or low energy</td>
<td>41.9% (13)</td>
<td>58.1% (18)</td>
<td>31</td>
</tr>
<tr>
<td>Confusion</td>
<td>100.0% (2)</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>38.9% (7)</td>
<td>61.1% (11)</td>
<td>18</td>
</tr>
<tr>
<td>More emotional</td>
<td>33.3% (6)</td>
<td>66.7% (12)</td>
<td>18</td>
</tr>
<tr>
<td>Irritability</td>
<td>50.0% (9)</td>
<td>50.0% (9)</td>
<td>18</td>
</tr>
<tr>
<td>Sadness</td>
<td>50.0% (9)</td>
<td>50.0% (9)</td>
<td>18</td>
</tr>
<tr>
<td>Nervousness or Anxious</td>
<td>48.1% (13)</td>
<td>51.9% (14)</td>
<td>27</td>
</tr>
<tr>
<td>Trouble falling asleep</td>
<td>50.0% (7)</td>
<td>50.0% (7)</td>
<td>14</td>
</tr>
</tbody>
</table>

*Note.* Total participants were n=47, % = percentage of respondents; some columns do not add up to the total due to missing data.
Discussion

The present study aimed to find out whether there would be a difference in self-reported post-concussion symptoms among Icelandic female athletes in relation to if they received instructions or not following a concussion. It was also examined whether the quality of information matters regarding concussion symptoms today.

The research had two main hypotheses, and the first hypothesis was that athletes that got instructions following a concussion are expected to have fewer concussion symptoms today. The first hypothesis was not supported. There is no significant difference in total symptom today, between athletes that received instructions and athletes that did not receive instructions. Findings do not support the idea that getting instructions is more effective than not getting instructions in relation to concussion symptoms today. The second hypothesis examined whether there was a positive correlation between the perceived quality of the information and post-concussion symptoms today. The results indicated that preserving the instructions as good was not related to having better outcomes regarding concussion symptoms today. Therefore, the second hypothesis is also not supported.

When looking at athletes’ answers on self-reported post-concussion symptoms, concussion symptoms were very common within athletes. Athletes in this study seem to have at least one or more concussion symptoms today. Only 8.0% of the athletes reporting having none symptoms concussion today. The most frequently reported symptoms today in this study are fatigue or low energy, difficulty concentrating, headache, nervousness or anxious and, difficulty remembering. These symptoms are also commonly reported in other studies (Seifert, 2018; Ryan & Warden, 2003). Athletes who did not receive instructions had higher frequency for almost every post-concussion symptom today than those athletes how received instructions, although the difference was not significant.
It is not known if athletes did a follow-up on the instructions that they received. According to prior research, athletes do not follow guidelines and it is strongly recommended that the emergency department educating parents, athletes, at discharge, should stress the importance of compliance with guidelines (Bakes, 2014). These results could be one factor that might explain the results of the current study, that athletes did not follow-up the instructions that they received. It has been claimed that most athletes in the current study were at high school age when the most serious concussion occurred. The previous study recommended that athletes should avoid any physical or cognitive exertion that could worsen or mimic signs of a concussion (Harmon et al., 2013b). Also have previous studies found some evidence that activities that require concentration, attention may worsen the symptoms, and that may delay recovery time (Adirim, 2007). It cannot be known with certainty if athletes in the current study did any physical or cognitive exertion in school and still symptomatic. These factors might be another factor that explains why concussion symptoms very common within athletes since this factor might have delayed the recovery time. Therefore it is important to follow-up with all athletes because this may have an impact on their cerebral function in their later years (Hammond et al., 2015).

The quality of the instructions which athletes received in this study may be important in this case, may have been poor or good. It is unknown what kind of instructions athletes received or who gave them the instructions. Might have come from via the internet or from professionals, healthcare institutions or other academic institutions. Studies have shown that many parents and athletes obtain medical recommendations via the internet (Swallow et al., 2017). Williams (2014), pointed out that very few concussion videos come from professionals, healthcare institutions, or other academic institutions (Williams et al., 2014). These findings are striking since the quality of the content is questionable and that the general public cannot be relying on instructions or guidelines recommendations on YouTube.
The research has some limitations; concussion symptoms were assessed through a self-reported questionnaire on the post-concussion symptom scale (PCSS). It was not possible to confirm participants’ symptoms and therefore, we cannot draw any definite conclusions. PCS can reflect an unusually good or unusually bad day for the athlete, which might mislead the answers inaccurate. It can occur during the preseason evaluation or during post-injury evaluations and therefore, essential to take the results with caution. It cannot be known with certainty if other factors motivate symptom reports among individuals. Prior study indicates symptoms of a concussion can overlap with another pathologic traumatic brain injury such as depression, posttraumatic stress disorder, headache syndromes (Potter et al., 2006). This point can be by one possible factor that confuses symptoms today reports. Another limitation was that the initial small sample size with 137 athletes and only 52 athletes received instructions following the injury. Therefore, it could have made it difficult to detect any significant effects between receiving instructions or and satisfactory levels on post-concussion symptoms today. Despite these limitations, this study possesses several strengths. The Icelandic version of the post-concussion symptom scale of SCAT-5 which was used in this study, had excellent internal consistency (Cronbach’s $\alpha = .86$) (Kim et al., 2019). In-depth interviews were conducted, focusing only on females athletes with a history of concussion.

Regarding future research, it seems to be a lack of research studying the importance of receiving good quality information and guidelines. It would be interesting to explore whether athletes feel pressure to return to play from coaches, players, family members, fans or other parties. Whether this pressure is the reason for athletes does not follow the instructions. Future studies in this field should study the relationship between receiving information after concussion injury and if it can affect an athlete’s recovery time or development of symptoms today. It might be sensible to carry out a similar study, only with a greater number of participants, both gender, and have more groups. One group will receive good quality
information and the same type of instructions. The group must follow the instructions that they received, if not what is the reason. The second group will not receive instructions, and the third group will find instructions online. Then make comparisons. The researcher hopes that the present study has reflected light on the need for further research in this field.
References


INSTRUCTION AND DEVELOPMENT OF CONCUSSION SYMPTOMS TODAY


