100 Cases of Exercise Addiction: More Evidence for a Widely Researched but Rarely Identified Dysfunction

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Abstract
Exercise addiction is an extensively studied topic in the sport science and psychology literature as reflected by the more than 1000 papers published in the field. However, only about 12 cases were published in the area, which may suggest that there is difficulty in reaching and studying affected individuals. Relying on the Components Model of Addiction, we performed an extensive search on non-scholar websites (i.e. popular media websites) and identified 100 cases that met the eligibility criteria. These cases reflect the several physical, psychological and social consequences that may accompany the dysfunction, as well as numerous exercise activities to which individuals may become addicted. The findings also raise the question whether women are more affected than men, or perhaps women are more open than men to disclose their problem, as based on the four to one ratio of the identified cases. The current work supports the large volume of research in the field of exercise addiction, because either the prevalence of the dysfunction is greater than expected, or people are more open to disclose their problem on Internet sites.

Keywords Clinical · Components model · Dependence · Diagnosis · Morbidity

Exercise is a form of planned physical activity that requires energy expenditure to sustain the work of the muscles (Caspersen et al. 1985). Exercising to a level at which an individual loses control over the exercise behaviour turns into a compulsory activity, resulting in a dysfunction

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referred to as exercise addiction (Griffiths 1997; Szabo 2010) or exercise dependence (Hausenblas and Downs 2002). Exercise addiction is listed among behavioural addictions (Egorov and Szabo 2013) like gambling disorder, but due to inconclusive and limited scientific evidence for being a unique mental dysfunction, the condition is not listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association 2013). Apart from the characteristic symptoms of addictions (in general), such as salience, mood modification, withdrawal symptoms, tolerance and relapse, on which the Components Model of Addiction (Griffiths 2005) is based, to be classified as an addiction one’s exercise behaviour must trigger, physical, psychological, or social harm (Szabo 2010). Indeed, without negative consequence(s), even an excessive amount of exercise may not be considered dysfunctional (Szabo and Kovacsik 2019). Further, actual cases of exercise addiction (with identifiable negative consequences) are seldom reported in the literature and, therefore, the objective of this work was to explore whether such cases could be identified on popular media websites.

Although one study reported that out of 300 fitness centre participants 125 (42%) could be addicted to exercise (Lejoyeux et al. 2008), the estimated risk for exercise addiction is ‘relatively low’, ranging from 0.3 to 0.5%, as based on a Hungarian representative population-wide study (Monók et al. 2012). However, even this figure is enormously high. If one considers the population of the United Kingdom, which is almost 68 million (Worldmeters.com 2019), and that 13% of this nation’s population claims to exercise regularly (five or more times per week), while 34% claims to exercise with some regularity (one to four times per week) based on recent statistical data (European Commission 2018), then only among those who exercise five or more times per week we might find over 25 thousand people at risk or affected by exercise addiction (0.3% of the 13% of the 68 million)! However, if one searches the over 1000 articles published on exercise addiction (Szabo and Kovacsik 2019), will hardly find a few (i.e. 12) case studies published in scholastic papers. Consequently, one may conclude that there is an exaggerated research effort in the area, which based on the number of identified cases is not justified, and that the few cases reported in the literature are insufficient to support a clause for exercise addiction to be included in a future edition of the DSM.

Indeed, we could only identify a few published cases of exercise addiction. The first was reported by Veale (1995) on a 27-year woman who was disinterested in life apart from running. A later case covered the morbid exercise pattern of a 25-year-old female martial artist (Griffiths 1997). The case of a 50-year-old male cyclist was published 7 years later (Kotbagi et al. 2014). One year later, in a self-help book about exercise addiction, Schreiber and Hausenblas (2015) present nine cases of exercise addiction, which starts with the case of the first author. This latter was also published in an academic journal (Hausenblas et al. 2017). These cases add up to 12, suggesting that currently there is approximately one identified case of exercise addiction for every 100 article published in the area (Szabo and Kovacsik 2019).

Given that the media also shows interest in exercise addiction, we hypothesized that we will be able to identify more cases of exercise addiction in the public media than in the scholastic literature. The rationale for this presumption was that academicians and researchers could hardly reach out for exercises addicts and that health professionals getting in contact with them might be preoccupied with helping the patients rather than doing research. The objective of the work was to reveal that the abundant scholastic research in the area may not be in vain, because there might be significantly more cases of exercise addiction than the dozen published in academic writings.
Method

We searched the Internet by using the Google search engine and employing relevant and appropriate search terms (Table 1), such as exercise addiction and exercise addict. The three key inclusion criteria were as follows: (1) articles must be in English language, (2) at least one of the six symptoms of the Components Model of Addiction (Griffiths 2005) must be identified through the reading of the article, and (3) the affected person must have had suffered at least one physical, psychological or social damage (negative consequence). We, the two authors, agreed 100% on the presence of the set criteria in the sequentially coded articles that can be verified in Table 2. While we did not impose a period limit, we imposed an upper limit to the search number, which was set to 100. This limit is a delimitation of the study set because it was deemed enough to expose a much wider existence of exercise addiction than currently could be estimated from the scholastic literature. In fact, this number is nearly nine (9) times more than the cases available in academic writings. The search strategy is summarized in Table 1. The link to each case is provided in the Appendix and it is also available, with a screenshot (a saved picture) of the page reporting the included article, at the Mendeley data repository (DOI: 10.17632/sdcj3vgchz.1).

Results

The results are summarized in Table 2. The table reveals that there are four times more cases of exercise addiction reported by women, or reported on women (81) than men (19) in the 100 cases found on the Internet. Only 35 articles reported the age of the individual, which ranged from 24 to 59 years (M = 34.65 ± SD = 9.24). Body building and running were forms of exercises involved in more than half of the 100 cases. Cycling was reported in 15 cases. More than half of the cases involved more than one form of exercise. In most cases, readers could

Table 1  Search strategy indicating the inclusion and exclusion criteria of articles located on the Internet

| Search strategy items | Description |
|-----------------------|-------------|
| Search keywords       | “exercise addiction”, “exercise addict”, “exercise dependence”  
“too much exercise”, “obsessive exercise”, and “compulsive exercise” on Google search engine  |
| Case identification   | All the relevant search results were examined one by one to identify the presence or absence of a case of exercise addiction |
| Time filter           | None |
| Type of exercise filter| None |
| Age or gender filter  | None |
| Record limit          | 100 |
| Inclusion criteria    | - Articles in English  
- Articles reporting at least one symptom of exercise addiction (salience, withdrawal, tolerance, mood modification, conflict, relapse), based on the Components Model of Addiction and…  
- Articles reporting at least one physical, psychological, or social consequence (damage) to the affected individual |
| Exclusion criteria    | - Cases that have been published in academic journals (i.e. peer-reviewed publications)  
- Articles in which negative consequences of the exercise behavior could not be established |
Table 2  Summary of the 100 cases of exercise addiction reported on the www

| Case  | Date    | Case accessed | Age | Sex | Type of exercise                             | Symptoms  | Physical damage | Psychological consequences | Social consequences | Report |
|-------|---------|---------------|-----|-----|----------------------------------------------|-----------|-----------------|--------------------------|---------------------|--------|
|       |         |               |     |     |                                              | S         | W               | T                       | M                   | C      |
|       |         |               |     |     |                                              | R         | Injr            | Dys                     | Imm                 | Uw     | Ame    | Anx    | Dep    | Gui    | Ina    | LoC    | LoSR   | LoJ    |        |
| Case 1| 2002    | 10/10/19      | NR  | M   | Swimming, cycling                            | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | SR     |
| Case 2| 2007    | 26/09/19      | NR  | M   | BB, CE                                       | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 3| 2007    | 26/09/19      | 30  | M   | BB                                           | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 4| 2007    | 26/09/19      | NR  | M   | Running, martial arts                        | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 5| 2007    | 26/09/19      | 59  | M   | Karate, BB, cycling                          | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 6| 2009    | 04/11/19      | NR  | F   | BB                                           | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 7| 2011    | 29/09/19      | 46  | M   | Triathlon                                    | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 8| 2011    | 29/09/19      | NR  | M   | Running                                      | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 9| 2011    | 29/09/19      | NR  | F   | Cycling, BB, running, yoga                  | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | SR     |
| Case 10| 2012   | 26/09/19      | 46  | F   | BB, kickboxing, triathlon                    | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 11| 2012   | 11/10/19      | NR  | F   | BB, running, swimming, CrossFit, cycling     | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | SR     |
| Case 12| 2013   | 14/10/19      | NR  | F   | BB, running                                  | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | SR     |
| Case 13| 2013   | 04/11/19      | 46  | F   | Running                                      | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 14| 2014   | 18/09/19      | 24  | F   | Running                                      | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 15| 2014   | 18/09/19      | NR  | M   | BB                                           | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 16| 2014   | 26/09/19      | 33  | F   | EM                                           | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 17| 2014   | 29/09/19      | 27  | F   | Running, triathlon                           | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 18| 2014   | 29/09/19      | 29  | F   | BB, cycling, Pilates, dance class            | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 19| 2014   | 29/09/19      | 28  | F   | Running                                      | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 20| 2014   | 29/09/19      | 27  | F   | BB, HIIT                                     | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 21| 2014   | 29/09/19      | 24  | F   | Swimming, Triathlon                          | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | Oth    |
| Case 22| 2014   | 11/10/19      | NR  | F   | Running, BB                                  | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | SR     |
| Case 23| 2014   | 14/10/19      | NR  | M   | Running, hiking                              | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | SR     |
| Case 24| 2014   | 14/10/19      | NR  | F   | BB                                           | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | SR     |
| Case 25| 2015   | 26/09/19      | NR  | F   | Running, BB, tae bo                          | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | SR     |
| Case 26| 2015   | 29/09/19      | NR  | F   | Running BB                                   | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | SR     |
| Case 27| 2015   | 29/09/19      | NR  | F   | Running, Cycling, Swimming                   | ✓         | ✓               | ✓                       | ✓                   | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      |        |        | SR     |
| Case | Date     | Case accessed | Age | Sex | Type of exercise | Symptoms | Physical damage | Psychological consequences | Social consequences | Report |
|------|----------|---------------|-----|-----|------------------|----------|-----------------|--------------------------|--------------------|--------|
|      |          |               |     |     |                  |          |                 |                          |                    |        |
| Case 28 | 2015 10/10/19 | 39 | F | Running | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | Oth |
| Case 29 | 2015 10/10/19 | 42 | F | Running, BB | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 30 | 2015 11/10/19 | NR | F | BB | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 31 | 2015 13/10/19 | NR | M | Running, Cycling | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 32 | 2015 14/10/19 | NR | F | Running | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 33 | 2016 17/09/19 | 36 | F | BB, running | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 34 | 2016 18/09/19 | NR | F | Running, Pilates, BB | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 35 | 2016 26/09/19 | 35 | F | BB, cycling | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 36 | 2016 26/09/19 | 24 | M | BB, cycling, triathlon | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 37 | 2016 26/09/19 | 35 | F | BB, yoga, Zumba, CrossFit, biking | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 38 | 2016 26/09/19 | NR | F | BB | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 39 | 2016 26/09/19 | NR | F | CrossFit, running | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 40 | 2016 26/09/19 | NR | M | BB, cycling | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 41 | 2016 26/09/19 | NR | F | BB, CrossFit | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 42 | 2016 26/09/19 | NR | F | Swimming, running, circuit | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 43 | 2016 10/10/19 | NR | M | Cycling, running | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 44 | 2016 10/10/19 | NR | M | Running, BB, rock climbing | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 45 | 2016 10/10/19 | NR | F | BB | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 46 | 2016 11/10/19 | NR | F | BB | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 47 | 2017 17/09/19 | 25 | F | CE | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 48 | 2017 17/09/19 | 25 | F | Running | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 49 | 2017 17/09/19 | 25 | F | BB, pole dancing | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 50 | 2017 17/09/19 | 35 | F | NR | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 51 | 2017 17/09/19 | NR | F | Running | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 52 | 2017 17/09/19 | NR | F | NR | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 53 | 2017 17/09/19 | 33 | F | Dancing | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case 54 | 2017 17/09/19 | NR | F | Running | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | ✓✓✓✓✓ | SR |
| Case | Date    | Case accessed | Age | Sex | Type of exercise                  | Symptoms | Physical damage | Psychological consequences | Social consequences | Report |
|------|---------|---------------|-----|-----|-----------------------------------|----------|-----------------|---------------------------|---------------------|--------|
| 55   | 2017    | 26/09/19      | NR  | M   | Running                           | ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 56   | 2017    | 10/10/19      | NR  | F   | Running                           | ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 57   | 2017    | 10/10/19      | NR  | F   | Gymnastic, BB, CE                 | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 58   | 2017    | 10/10/19      | NR  | F   | Cycling                           | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 59   | 2017    | 11/10/19      | 34  | F   | BB                                | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 60   | 2017    | 13/10/19      | NR  | F   | BB, running                       | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 61   | 2017    | 14/10/19      | NR  | F   | BB, running, yoga                 | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 62   | 2017    | 10/10/19      | NR  | F   | EM                                | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 63   | 2017    | 03/11/19      | NR  | F   | BB                                | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 64   | 2017    | 03/11/19      | 34  | M   | BB, fasted cardio, HIIT           | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 65   | 2017    | 29/09/19      | NR  | F   | BB                                | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 66   | 2017    | 29/09/19      | NR  | F   | BB                                | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 67   | 2017    | 29/09/19      | 34  | M   | BB, fasted cardio, HIIT           | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 68   | 2018    | 17/09/19      | NR  | F   | BB                                | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 69   | 2018    | 17/09/19      | 29  | F   | Running, BB, yoga                 | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 70   | 2018    | 17/09/19      | NR  | F   | BB                                | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 71   | 2018    | 17/09/19      | 33  | F   | Rowing                            | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 72   | 2018    | 17/09/19      | NR  | F   | Running, kickboxing               | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 73   | 2018    | 18/09/19      | NR  | F   | Boxing, running, Pilates, yoga    | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 74   | 2018    | 18/09/19      | NR  | F   | BB, HIIT                          | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 75   | 2018    | 18/09/19      | NR  | F   | NR                                | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 76   | 2018    | 26/09/19      | NR  | F   | Dancing, tennis, basketball, CE   | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 77   | 2018    | 29/09/19      | 40  | F   | Running, boxing, BB, fasted cardio, HIIT | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
| 78   | 2018    | 14/10/19      | NR  | F   | BB, yoga                          | ✓ ✓ ✓ ✓ ✓ ✓ | ✓               | SR                        | Oth                 |        |
Table 2 (continued)

| Case  | Date accessed | Age | Sex | Type of exercise | Symptoms | Physical damage | Psychological consequences | Social consequences | Report |
|-------|---------------|-----|-----|------------------|----------|-----------------|--------------------------|-------------------|--------|
|       |               |     |     |                  | S        | W               | T            | M     | C     | R     | Injr | Dys | Imm | Uw | Ame | Anx | Dep | Gui | Ina | LoC | LoSR | LoJ |
| Case 80 | 2018 14/10/19 | NR  | F   | BB               | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 81 | 2019 17/09/19 | 32  | F   | BB, boxing       | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 82 | 2019 17/09/19 | NR  | F   | Running          | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 83 | 2019 17/09/19 | NR  | F   | Running          | ✓✓✓✓✓✓  | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 84 | 2019 17/09/19 | NR  | F   | Swimming         | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 85 | 2019 17/09/19 | NR  | F   | Running          | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 86 | 2019 17/09/19 | NR  | F   | Running          | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 87 | 2019 17/09/19 | NR  | F   | Swimming         | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 88 | 2019 17/09/19 | NR  | F   | Swimming         | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 89 | 2019 17/09/19 | NR  | F   | Swimming         | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 90 | 2019 17/09/19 | NR  | F   | Swimming         | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 91 | 2019 17/09/19 | NR  | F   | Swimming         | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 92 | 2019 17/09/19 | NR  | F   | Swimming         | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 93 | 2019 17/09/19 | NR  | F   | Swimming         | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 94 | 2019 17/09/19 | NR  | F   | Swimming         | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 95 | 2019 17/09/19 | NR  | F   | Swimming         | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 96 | 2019 17/09/19 | NR  | F   | Swimming         | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 97 | 2019 17/09/19 | NR  | F   | Swimming         | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 98 | 2019 17/09/19 | NR  | F   | Swimming         | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 99 | 2019 17/09/19 | NR  | F   | Swimming         | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |
| Case 100| 2019 17/09/19 | NR  | F   | Swimming        | ✓✓✓✓✓   | ✓✓            | ✓✓✓          | ✓✓✓   | ✓✓✓   | ✓✓✓   | ✓✓✓✓| ✓✓✓ | ✓✓✓ | ✓✓ | ✓   | ✓   | ✓   | ✓   | ✓   |     |     |     |     |

M male, F female, n.d. no date, NR not reported, S salience, W withdrawal, T tolerance, M mood modification, C conflict, R relapse, Injr injury, Dys internal organ dysfunction, Imm immune problems, Uw underweight, Ame amenorrhea, Anx anxiety, Dep depression, Gui guilty feeling, Ina inability to concentrate, LoC loss of control, LoSR loss of social relationship, LoJ loss of job, SR self-reported case, Oth case reported by other(s), HIIT high-intensity interval training, BB body building, CE cardio exercises, EM elliptical machine.
identify four or more symptoms from the Components Model of Addictions (Griffiths 2005), and most cases involved an identifiable loss or damage in two out of three categories (i.e. physical, psychological or social). Finally, nearly one fifth (19) of the cases exposed a loss or damage in all three categories.

Discussion

In appreciating the current results, one should keep in perspective that the bulk of the over 1000 articles published in the field reported cross-sectional studies using questionnaires to assess the risk for exercise addiction on a Likert scale spectrum. Two of the extensively employed tools are the Exercise Addiction Inventory (Terry et al. 2004) and Exercise Dependence Scale (Hausenblas and Downs 2002). The results based on these tools could often trigger a ‘false alarm’ in that high-risk scores may not necessarily reflect problematic exercise behaviour (Szabo 2018). Indeed, questionnaires are not diagnostic tools. However, since exercise addiction is not listed in the DSM, there is no ‘official’ diagnosis criteria for the dysfunction. Experts in the field rely on the DSM criteria form gambling disorder (Hausenblas and Downs 2002), or the symptom-based Components Model of Addiction (Griffiths 2005), which was also adopted in the current study. In addition to symptoms, the peer-reviewed published case studies all contain some sort of harm or damage to the individual due to her/his exercise habits (Szabo 2018). This criteria of at least on damage or negative consequence, whether physical, psychological or social, was also set in the current study. However, even those meeting the selection criteria (all included 100 cases) of experiencing one or more symptoms and negative consequences cannot be diagnosed in lack of accepted clinical diagnosis criteria. It is obvious that the 100 cases reported here are not superior to the 12 already published cases, but they are not inferior either, because neither in the scholastic publication nor in these Internet articles could the diagnosis of exercise addiction be established, while in both sources there were symptoms as well as negative consequences to the affected individual stemming from her/his unhealthy exercise behaviour.

One is likely to appreciate the fact that not all cases of exercise addiction surface on the Internet. Only a few affected individuals may feel that their case could help them (writing it out) or others (warning, preventing) by sharing their story. Consequently, we may expect more similar cases to exist, which may partially dissolve the concern about the disproportionally high number of research articles on exercise addiction (> 1000) in contrast to the reported cases (12; Szabo and Kovacsik 2019). Nevertheless, the path of researchers and that of the exercise addiction-affected individuals may seldom cross. The latter group when awaking to the problem turns to specialized health professionals and not to researchers, while researchers try to screen for exercise addicts within healthy exercising samples. Moreover, the screening tools used by researchers merely screens for individuals at risk (and stops there), who might never become addicted to exercise (Szabo 2018), and therefore, prevalence estimates based on this method may be inaccurate (Maraz et al. 2015).

Despite the finding that in accord with the 12 published cases, the current 100 cases also suggest that more women may be affected than men, we think that an alternative explanation may be that women are keener to disclose their story than men. Nevertheless, a literature review suggests that women may be more prone to exercise addiction than men (Fattore et al. 2014), but contrary evidence also exists (Szabo et al. 2013). Apparently, the gender differences in exercise addiction call for more research in the future. The present study also confirms that
body building, running and cycling may be linked most closely to exercise addiction. However, in most cases there were multiple forms of exercise involved. While age was only disclosed in 35 out of the 100 cases, it appears that adults of any age could be affected.

The current study was able to identify 100 cases of exercise addiction based on symptoms and consequences criteria accepted in the literature. This number is nearly nine times higher than the number of cases of exercise addiction reported in scholastic writings over the past 25 years. The disproportion may be related to the search medium. In a research setting, it is hard to meet individuals affected by exercise addiction. In the public media, like the Internet, victims of the dysfunction apparently share their experiences for various reasons. If we could locate 100 cases meeting the criteria for exercise addiction, it is likely that the number of affected exercisers may be much higher. Therefore, we can reinforce that exercise addiction is a real problem that affects numerous individuals. Research to date could not produce enough evidence, as illustrated by only 12 cases published in 25 years, which might be one reason why the dysfunction is not included in the DSM-5. The 100 cases reported here may stimulate a new avenue of research on public media where scholars can have an easier access to exercise-addicted individuals.

The current study has some limitations stemming primarily from its delimitations. For example, we examined only English websites, used only the Google search engine and limited the number or records to 100. It is possible that more and/or more severe cases could be located if one uses other search engines and other sets no language delimitation. Another limitation, beyond the authors’ control, is the reliability of the publicly reported cases.

Conclusion

This study identified 100 cases of exercise addiction, meeting the current research (not clinical) classification of the dysfunction, on non-academic websites. This finding, contrasted with the meagre number of earlier reported cases, justifies the wider existence of exercise addiction as a real problem for the affected individuals. It also justifies the abundant research in this scholastic area, as reflected by over 1000 publications in field. Simultaneously, it warns researchers in the area that they may be searching in the dark, because screening out real addicts from among a group of healthy exercisers, especially with a risk-assessing instrument, is unlikely to be fruitful. Indeed, it was recommended that questionnaire-screening should be followed up with interviews to identify the addicted exercisers (Szabo et al. 2015). All cases presented here include symptoms and consequences of dysfunctional exercise and support the existence of exercise addiction as a real, and perhaps more prevalent than estimated, problem. Future investigations should examine these individuals more closely to develop a set of robust clinical criteria which will help in the diagnosis, and inclusion in the next DSM, of the disorder.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no competing interests.

Ethics The current study uses publicly available data, which is not subject to ethical clearance.
Appendix

All the listed web addresses were active on November 23, 2019

Case 1 https://www.theguardian.com/society/2002/sep/18/health.lifeandhealth
Case 2-4 https://www.theguardian.com/lifeandstyle/2007/dec/04/healthandwellbeing.health
Case 5 https://www.wsj.com/articles/SB118277761367847006
Case 6 https://www.youtube.com/watch?v=1SVh-YOh3uw
Case 7-8 https://www.wsj.com/articles/SB10001424052748703439504576116083514534672
Case 9 https://lifeinsight.co.uk/2011/09/how-i-became-an-exercise-addict/
Case 10 https://www.prevention.com/life/a20435802/what-is-exercise-addict/
Case 11 https://www.katyhaldiman.com/blog/tales-of-an-exercise-addict-with-autoimmune-disease
Case 12 https://www.runningwithspoons.com/2013/03/12/guest-post-overcoming-exercise-addiction/
Case 13 https://eu.usatoday.com/story/news/nation/2013/05/06/mika-brzezinski-eating-disorders/2126465/
Case 14-15 https://www.youtube.com/watch?v=ne4pJ9QZQMM
Case 16 https://www.everydayhealth.com/news/addicted-exercise-carries-story/
Case 17-20 https://www.self.com/story/how-to-know-addicted-to-exercise
Case 21 https://www.thefix.com/content/biggest-loser-or-biggest-addict
Case 22 http://katalysthealthblog.com/from-exercise-addict-to-fitness-lover/
Case 23 https://www.wired.com/2014/10/my-strava-problem/
Case 24 https://www.psychologytoday.com/intl/blog/diet-is-4-letter-word/201406/walking-the-thin-line-exercise-addiction
Case 25 https://hello-giggles.com/news/exercise-addiction/
Case 26 https://jessicapatay.com/?p=457
Case 27 https://www.huffingtonpost.in/jia-singh/diary-of-an-exercise-addict_6407332.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referer_sig=AQAAAMW0TPyNpXej4y
Case 28 https://www.runnersworld.com/women/a20800575/are-you-addicted-to-running/
Case 29 https://www.theguardian.com/lifeandstyle/2015/mar/07/fitness-addiction-ill-scarlett-thomas
Case 30 https://www.theodysseyonline.com/self-diagnosed-exercise-addict
Case 31 https://www.washingtonpost.com/news/to-your-health/wp/2015/05/11/a-fitbit-fanatics-cry-for-help/
Case 32 https://greatist.com/connect/exercise-addiction-recovery#1
Case 33 https://www.telegraph.co.uk/health-fitness/body/i-was-addicted-to-exercise-heres-how-to-spot-the-signs/
Case 34 https://www.thehealthymaven.com/exercise-addiction/
Case 35-36 https://www.thehealthymaven.com/exercise-addiction/
Case 37 https://www.todaysdietitian.com/newarchives/0916p62.shtml
Case 38 https://emilyfonnesbeck.com/returning-to-exercise-after-exercise-addiction-and-disordered-eating/
Case 39-41 https://blonyx.com/blogs/blonyx-blog/5-signs-youre-addicted-to-working-out
Case 42 https://www.thetimes.co.uk/article/confessions-of-a-midlife-fitness-addict-g9vn6wpnwh7
Case 43-44 https://www.tfflifestyle.com/tff036/
Case 81  https://www.bustle.com/p/ellie-goulding-talked-about-exercise-addiction-on-her-instagram-stories-not-enough-people-know-about-it-15690437
Case 82  https://www.smh.com.au/lifestyle/health-and-wellness/i-wouldn-t-wish-an-exercise-addiction-on-anyone-20190224-p50zxy.html
Case 83  https://www.vice.com/en_us/article/mbmv53/i-thought-running-was-a-release-it-was-really-an-addiction
Case 84  https://www.bucketliststummy.com/how-i-overcame-exercise-addiction/
Case 85  https://www.beateatingdisorders.org.uk/your-stories/recovery/exercise-double-edged-sword
Case 86  https://exerciseright.com.au/how-i-overcame-exercise-addiction/
Case 87-88  https://consumer.healthday.com/encyclopedia/exercise-and-fitness-18/misc-health-news-265/addicted-to-exercise-644431.html
Case 89  https://www.independent.co.uk/life-style/demi-moore-exercise-addiction-inside-out-memoir-eating-disorder-a9119066.html
Case 90  https://www.balancedpursuits.com/episodes/stephanie-dankelson
Case 91  https://www.dailytelegraph.com.au/lifestyle/health/jane-curnow-54-reveals-how-her-journey-as-a-bodybuilder-and-fitness-model-changed-her-life/news-story/c65c1064982230b272f02eb4598141f3
Case 92  https://qz.com/quartzy/1595689/how-to-beat-a-marathon-training-addiction/
Case 93  https://moosegazette.net/are-gyms-doing-enough-to-protect-members-with-eating-disorders-and-exercise-addiction/5782/
Case 94  https://ffc.com/member-stories-news/member-stories-how-i-overcame-anorexia-exercise-addiction-and-changed-my-life/
Case 95  https://ownitbabe.ca/i-didnt-work-out-for-a-year-and-here-is-what-happened/
Case 96  https://www.msn.com/en-us/health/fitness/i-was-a-cardio-addict-heres-how-my-body-changed-when-i-began-strength-training/ar-BBV1PeI
Case 97  https://www.professorshouse.com/exercise-addiction/
Case 98  http://www.exercise-addiction.com/2014/09/09/lies-really-exercised-excessively/
Case 99-100  https://www.fitnessmagazine.com/health/conditions/exercise-addiction/

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