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REVIEW ARTICLE

Theoretical conceptualisations of problematic exercise in psychometric assessment instruments: A systematic review

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ABSTRACT

Background and aims: The aim of the present systematic review was to identify psychometric tools developed to assess problematic exercise in order to identify and compare their theoretical conceptualisations on which they are based. *Methods:* A systematic literature search was conducted in the electronic databases Web of Science, Scielo, PsychINFO, PsycTEST and SCOPUS from their inception to January 2020. *Results:* Seventeen assessment instruments met the eligibility criteria to be included in the present review. The instruments were classified according to their conceptualisation into five groups: (i) problematic exercise as an end of an exercise continuum, (ii) problematic exercise as a means of regulating body size and weight, (iii) problematic exercise as dependence, (iv) problematic exercise as a behavioural addiction and (v) no clear conceptualisation. *Discussion:* The results suggest that the conceptualisations of the assessment instruments have resulted in a strong dichotomy in relation to the primary or secondary character of the problematic exercise that might be limiting the capacity of the instruments to adequately capture the multidimensionality of this construct. *Conclusions:* Given the interest in understanding the complexity surrounding the problematic exercise, future research should develop more comprehensive definitions of this construct. This would allow a greater conceptual consensus to be reached that would allow progress to be made in the study of the problematic exercise.

KEYWORDS

exercise addiction, exercise dependence, compulsive exercise, commitment to exercise, excessive exercise, obligatory exercise, morbid exercise

Despite the proven health benefits of exercise, research has repeatedly reported that some individuals continue to exercise despite physical, psychological, social and emotional problems that arise as a result of this behaviour (Chamberlain & Grant, 2020; Lichtenstein, Nielsen, Gudex, Hinze, & Jørgensen, 2018). Examples of this may be seen among individuals who spend such a large amount of time in their lives exercising that they neglect other obligations (such as their occupation or education) and/or come into conflict with family members (Griffiths, 1997; Kotbagi, Muller, Romo, & Kern, 2014; Morgan, 1979). It can also include cases where exercise becomes an obsession in the individual's life, and which comes to dominate thoughts and actions for much of their daily life (Griffiths, 1997; Veale, 1995; Yates, Leehey, & Shisslak, 1983).

Although the possible negative effects of over-exercising were first indicated more than 50 years ago (Adams, 2009; Carmack & Martens, 1979; Estok & Rudy, 1986), it has never received formal recognition as a mental disorder in leading clinical manuals (e.g. American Psychiatric Association, 2013; World Health Organization, 2018). In 2013, the American Psychiatric Association incorporated gambling disorder along with substance-related disorders, while another group of repetitive behaviours, including exercise, were not included because of the lack of scientific evidence to establish the diagnostic criteria and

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course descriptions needed to identify these behaviours as mental disorders (American Psychiatric Association, 2013). Contributing to this paucity of evidence has been the lack of consensus on central issues in understanding when and why exercise may become problematic. In the context of problematic exercise, two debates have characterised the historical evolution of the definition of the construct and its assessment.

The first debate began in the 1970s, and raised the issue of whether a behaviour such as exercise, which was perceived as inherently healthy, when engaged in excessively, might lead to health problems and what kind of associated problems there might be. At the centre of this debate is the work of Glasser (1976) who used the term 'positive addiction' to highlight the beneficial effects of running, and by extension exercise, as opposed to addiction to other behaviours that might have negative consequences. Since Glasser's conceptualisation, there has been a continuous attempt to delimit the negative aspects of exercise as opposed to its more well-known positive effects (Adams, 2009; Estok & Rudy, 1986; Leedy, 2000). This debate raised awareness of what has been called 'the exercise paradox' (Egorov & Szabo, 2013) that is, the fact that an initial healthy and therapeutic activity such as exercise can lead, when control over it is lost, to pathogenic behaviour with negative consequences for the individual.

A second major debate, initiated in the 1980s, was whether the problems caused by problematic exercise are due to the exercise behaviour itself or to other associated disorders (Veale, 1995; Yates et al., 1983). Crucial to this debate was the differentiation that Veale (1987) made between problematic exercise in itself, which he called primary exercise dependence, and problematic exercise as a consequence of the existence of an associated disorder, which he called a secondary exercise dependence. Although some authors do not hesitate to state that exercise may be a primary source of problem for the individual (e.g. Griffiths, 1997), other authors maintain that this phenomenon has rarely been documented and it is difficult to differentiate it from a problematic exercise associated with other disorders (e.g. eating disorders) (Adams, 2009; Bamber, Cockerill, Rodgers, & Carroll, 2003; Blaydon & Lindner, 2002). While the debate initiated in the 1970s reached some consensus on the possible pathological nature that may derive from exercise behaviour, this second debate has not yet been resolved and keeps open the question of the relationship between problematic exercise and other already recognised disorders.

Attempts to explain problematic exercise from theoretical models (Egorov & Szabo, 2013; Freimuth, 2008; Freimuth, Moniz, & Kim, 2011; McNamara & McCabe, 2012; Meyer, Taranis, Goodwin, & Haycraft, 2011; Sussman et al., 2011) reflect to some degree the different ways in which this phenomenon is understood and assessed. Although there are papers summarising the different existing models (Symons-Downs, MacIntyre, & Heron, 2019; Szabo, Demetrovics, & Griffiths, 2018), to date, there have been no efforts that have compared the differences in conceptualisations of problematic exercise despite the fact that the models suggest different conceptualisations. For example, considering the motivation that leads the individual to exercise, the consequences associated with the behaviour, and the frequency and control over the behaviour, Freimuth (2008) proposed a heuristic model comprising four phases: recreational exercise; at-risk exercise; problematic exercise; and exercise addiction. These four phases were proposed as a clinical heuristic to explore when healthy exercise becomes problematic (Freimuth et al., 2011). The conceptualisation underlying Freitmuth's proposed model positions problematic exercise as the end of an exercise continuum. Under this conceptualisation, problematic exercise would always derive from exercise performed relatively frequently and over a long period of time (Freimuth, 2008; Freimuth et al., 2011). Contrary to Freimuth's model, Egorov and Szabo (2013) proposed an interactional model where the emphasis is placed on the determinants of the choice of exercise as a means of escape from hardship. Therefore, Egorov and Szabo emphasise the interaction between personal factors (i.e. personal values, past experience) and situational factors (i.e. social image, life situation) in determining whether the individual will use exercise for coping or resort to other means of dealing with stress (Egorov & Szabo, 2013; Szabo et al., 2018). What is noteworthy here, is that in contrast to the model proposed by Freimuth (2008), Egorov and Szabo's model delineates problematic exercise as something revolutionary, that is, that can suddenly surface. Consequently, Egorov and Szabo do not necessarily appear to conceptualise problematic exercise as a continuum that would be represented by an evolution or progression from healthy (or recreational) exercise to problematic exercise.

The variety of perspectives and theoretical models explaining problematic exercise has resulted in a broad set of terms used to refer to and assess this phenomenon. Terms used include commitment to exercise (Corbin, Nielsen, Borsdorf, & Laurie, 1987; Davis, Brewer, & Ratusny, 1993), exercise addiction (Szabo, Pinto, Griffiths, Kovácsik, & Demetrovics, 2019; Terry, Szabo, & Griffiths, 2004), compulsive exercise (Meyer et al., 2016; Taranis, Touyz, & Meyer, 2011), obligatory exercise (Duncan et al., 2012; Pasman & Thompson, 1988), excessive exercise (McCabe & Vincent, 2002), problematic exercise (Chamberlain & Grant, 2020; Kotbagi, Kern, Romo, & Pathare, 2015), exercise dependence (Hausenblas & Symons-Downs, 2002a, 2002b), and morbid exercise (Alcaraz-Ibáñez, Paterna, Sicilia, & Griffiths, 2020; Szabo et al., 2018). In this paper, we use the term 'problematic exercise' for two main reasons. First, it serves as a generic term that covers (in a general way) the common characteristic of all these different denominations. Second, with this term we adopt an exploratory approach, so that far from positioning ourselves on any of the perspectives or theoretical models existing to date, we start only from the consensus reached in the 1970s that exercise, despite its clear positive consequences for health, can become a pathogenic behaviour with negative consequences for a minority of individuals.

However, the future incorporation of exercise behaviour as a mental health disorder appears to be contingent on the scientific community reaching some consensus on a conceptualisation of the phenomenon of problematic exercise, in such a way as to enable a clear rationale, supported by sufficient scientific evidence, that explains the mechanism by which healthy exercise can become problematic. Recent reviews and meta-analyses have highlighted the difficulty of comparing the results of different studies when they use instruments to assess problematic exercise with weak and/or different conceptualisations (Alcaraz-Ibáñez et al., 2020; Colledge, Buchner, Schmidt, & Walter, 2019), which might be seen as a clear limitation to further research in this field. Therefore, an exploration of the conceptualisations of problematic exercise underlying the psychometric assessment instruments appears necessary insofar as the scientific value of research will only be as good as the tools employed in the assessment of the constructs of interest.

While previous studies have reviewed the psychometric properties of problematic exercise assessment instruments (Hausenblas & Symons-Downs, 2002b), to date there are no known studies that have examined the conceptualisations of problematic exercise underlying psychometric assessment instruments. This is a gap in the literature, as knowing how many conceptualisations of problematic exercise underlie the psychometric assessment instruments and how these conceptualisations complement or differ from each other is a first step towards a necessary consensus. A consensus on the definition of problematic exercise would allow progress to be made in the assessment and research of this phenomenon. However, before any consensus can be reached, a prior step would be to map the different conceptualisations of problematic exercise underlying the psychometric assessment instruments. Therefore, the objectives of the present systematic review were to (i) identify psychometric tools developed to assess problematic exercise and (ii) identify and compare the theoretical conceptualisations on which the assessment instruments for problematic exercise are based. Given the exploratory nature of the present study, conceptualisations of problematic exercise were analysed in psychometric assessment instruments that were developed to be applied to any individual practising any type of exercise. This ensures that similarities or differences in the conceptualisations of problematic exercise in the assessment instruments are not due to the specifics of the type of exercise, but to different perspectives or view on the same phenomenon.

METHOD

The systematic review was conducted in accordance with the checklist from the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) (Moher, Liberati, Tetzlaff, & Altman, 2009) (see Appendix A in supplementary material).

Identifying studies

A systematic literature search was conducted in the electronic databases Web of Science, Scielo, PsycINFO, PsycTEST and SCOPUS from their inception to August 2020. A combination of the following search terms was used: 'problematic exercise', 'morbid exercise', 'exercise addiction', 'exercise dependence', 'compulsive exercise', 'compulsive physical activity', 'obligatory exercise', 'commitment to exercise', 'excessive exercise', 'questionnaire', 'validation', 'validity', 'psychometrics', 'scale' (see full search strategy in Appendix B in supplementary material). All references were checked and duplicate studies were removed using *EndNote X9* software. The second and third authors reviewed and selected the studies included in the review in two phases: (i) through visualisation of studies' title and abstract and (ii) by reviewing the studies' full-text in view of the eligibility criteria. Disagreements between reviewers were resolved by consensus and, when needed, by consulting with the first author. In addition, reference lists of all the retrieved studies were checked for possible eligible studies.

Eligibility criteria

The review gathered data from studies proposing psychometric instruments assessing symptoms of problematic exercise, that is, exercising to the point where the individual loses control over the behaviour such that the latter becomes obligatory and may lead to physical, mental and/or social damage (Szabo et al., 2018). In addition, psychometric studies proposing a modified factor structure of previously validated instruments were also considered (e.g. Exercise Salience Scale, Kline, Franken, & Rowland, 1994; Obligatory Exercise Questionnaire, Steffen & Brehm, 1999).

Inclusion criteria. Studies were considered eligible when the following three criteria were met: (a) studies proposed a self-reported instrument assessing a potential form of problematic exercise; (b) studies were written in English or Spanish (the two languages of the review authors); and (c) studies were published in a peer-reviewed journal.

Exclusion criteria. Studies were excluded on the basis of the following criteria: (a) the proposed instrument examined a potential form of problematic exercise in specific exercise or sport contexts; examples of the latter are the Exercise Dependence in Bodybuilders (Smith & Hale, 2004) or the Commitment to Running (CR, Carmack & Martens, 1979) and (b) the goal was to adapt a pre-existing self-reported instruments assessing a potential form of problematic exercise into a new language/culture (e.g. Sicilia & González-Cutre, 2011), exercise context (e.g. Dance Addiction Inventory, Maraz, Urbán, Griffiths, & Demetrovics, 2015), or subpopulation (e.g. youth version of the Exercise Addiction Inventory [EAI-Y], Lichtenstein, Griffiths, Hemmingsen, & Støving, 2018) and (c) the provided information did not allow the qualitative evaluation of the content (e.g. Excessive Exercise Scale [EES], Long, Smith, Midgley, & Cassidy, 1993).

Coding procedure

A preliminary search was conducted, and a coding sheet was developed based on the common characteristics of the studies found. The first and third authors systematically coded the data for all the retrieved studies using this coding sheet (see Appendix C in supplementary material). Disagreements in the data coding procedure were resolved by discussion between the two authors. Data from the studies were classified into the following categories: (i) instrument; (ii) author; (iii) sample size; (iv) conceptualisation; (v) item generation and (vi) factor structure.

RESULTS

The search conducted systematically identified 1,543 papers of which 65 were reviewed utilizing the full text. Finally, 17 papers met the eligibility criteria to be included in this review (see Fig. 1). Each of the 17 papers presents either the development of an instrument to assess problematic exercise or new versions of an existing one (e.g. by introducing modifications concerning the number of items and/or the factor structure). The instruments included in the present systematic review (see Table 1) were classified into five groups according to their underlying theoretical perspectives (i.e., problematic exercise as end of a continuum of exercise, problematic exercise as a behaviour to regulate body shape and weight, problematic exercise as a dependence/behavioural addiction, and no clear conceptualisation).

Problematic exercise as an end of an exercise continuum

Of the 17 instruments, three of them (i.e., Commitment to Physical Activity Scale, CPAS, Corbin et al., 1987;

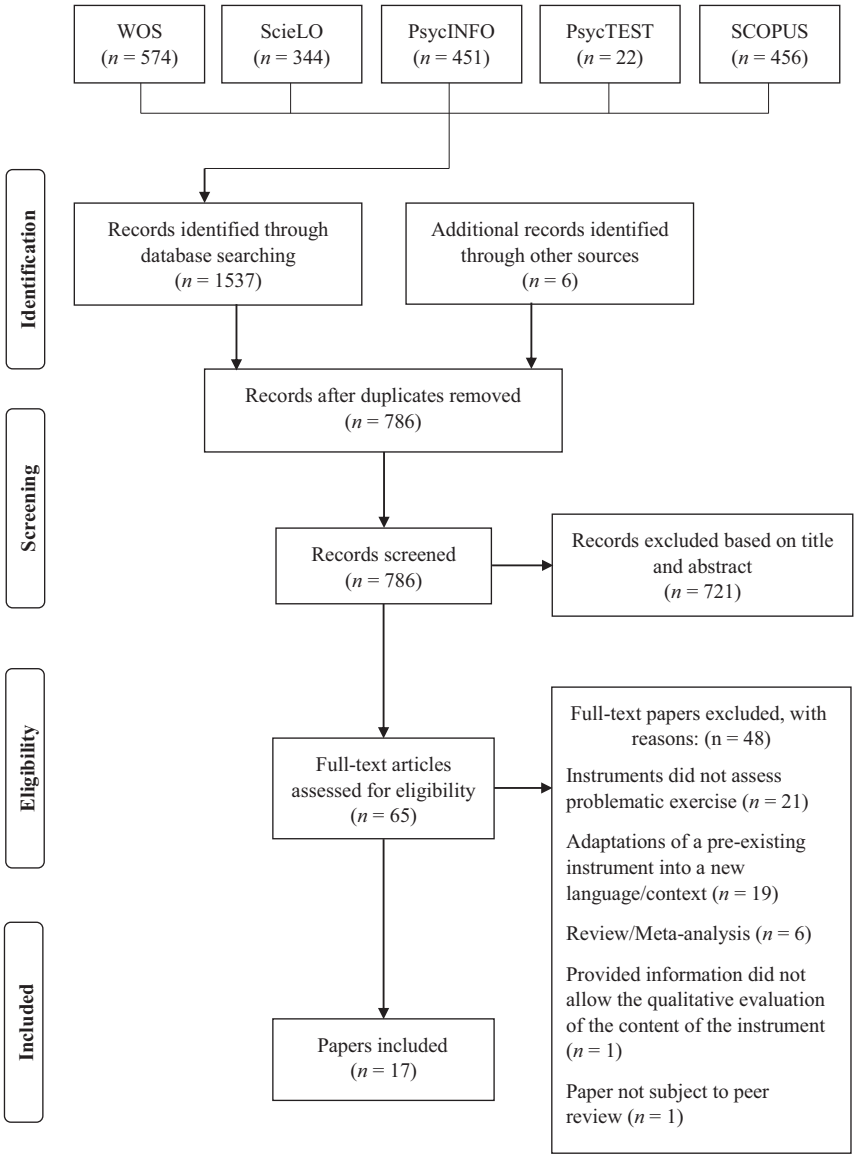

Fig. 1. PRISMA-based flow diagram of study selection

Table 1. Characteristics and conceptualisation of psychometric instruments assessing problematic exercise

Instrument	Authors	Sample size (characteristics)	Conceptualisation	Items Generation	Factor structure
Commitment to exercise scale (CES)	Davis et al. (1993)	185 Exercisers recruited from recreational facilities at University, health and fitness clubs and associations in Canada Men (N = 88; mean age = 28.93; SD = 9.42) Women (N = 97; mean age = 26.71; SD = 8.81)	Problematic exercise as end of a continuum of exercise	Examination of published case studies	8 items (visual analogue scale) with 2 factors: Obligatory; Pathological
Commitment to Physical Activity questionnaire (CPA)	Corbin et al. (1987)	450 College students enrolled in PE classes at an USA University (Men = 238; Women = 212)	Problematic exercise as end of a continuum of exercise	Adaptation of the items of Commitment to Running Scale	12 items (5-point scale) with unidimensional structure
Commitment to Physical Activity Scale -Revised (CPA-R)	DeBate et al. (2009)	937 Girls, aged 8 to 13, from different locations across USA taking part in an PA intervention program	Problematic exercise as end of a continuum of exercise	Review of the 12-item CPA structure	12 items (4-point scale) with 3 factors: Value of PA; Attitudes toward PA; Motivation regarding PA
Compulsive Exercise Test (CET)	Taranis et al. (2011)	367 young women (Mage = 20.76, SD = 2.39, range = 18–30), recruited from a UK university (68,8%) and Australian university (28,1%) engaged in regular exercise or sport over the last 4 weeks (M = 4.27 h/w). BMI = 21.86 (SD = 2.77; range = 16.3–38.2)	Problematic exercise as a behaviour to regulate body shape and weight	Pool of 31 items derived from the proposed theoretical model	24 items (5-point scale) with 5 factors: Avoidance and rule-driven behaviour; Weight control exercise; Mood improvement; Lack of exercise enjoyment; Exercise rigidity
Excessive Exercise Scale (EES)	McCabe and Vincent (2002)	413 secondary schools' students (*Boys* = 221; Mage = 13.76, SD = 1.07; Girls = 192; Mage = 13.81, SD = 1.10)	Problematic exercise as a behaviour to regulate body shape and weight	Pool of 10 items adapted from the Excessive Exercise Scale (Long et al., 1993)	8 items (5-point scale) with 2 factors: Need for exercise; Focus on exercise
Exercise Addiction Inventory (EAI)	Terry et al. (2004)	200 university students, (102 sport science students; 98 psychology students), age from 18 to 40, who reported regular participation in exercise. (Mage = 21.24, SD = 3.77); Men = 111 (Mage = 20.82); Women = 189 (Mage = 21.75)	Problematic exercise as a behavioural addiction	Pool of 6 items based on a modified version of the components of behavioural addictions (Griffiths, 1997)	6 items (5-point scale) with unidimensional structure

(continued)

Table 1. Continued

Instrument	Authors	Sample size (characteristics)	Conceptualisation	Items Generation	Factor structure
Exercise Addiction Inventory (EAI-R)	Szabo et al. (2019)	277 young and adult individuals (Men = 243; Women = 34; aged from 22 to 45) recruited on social media and exercised regularly at least three times per week	Problematic exercise as a behavioural addiction	Pool of 6 items from EAI	6 items (6-point scale) with unidimensional structure
Exercise Beliefs Questionnaire (EBQ)	Loumidis and Wells (1998)	13 exercisers (Male = 7; Female = 6; aged from 21 to 40) recruited from a university sports centre and who reported exercised over three times a week.	Problematic exercise as a dependence	Pool of 28 items based on beliefs elicited from interviews to 13 exercisers to examine psychological factors associated with being unable to exercise	21 items with 4 factors: Social desirability; Physical appearance; Mental and emotional functioning; Vulnerability to disease and ageing
Exercise Dependence Questionnaire (EDQ)	Ogden et al. (1997)	449 young and adult participants (Male = 161; Mage = 32.85; Female = 288; Mage = 31.26) recruited from sports clubs, leisure centres, and ads in magazines, reported exercising more than 4 hours/week.	Problematic exercise as a dependence	Initial pool of 86 items from unstructured self-report questionnaires to subjects who considered themselves to be addicted to exercise	29 items (7-point scale) with 8 factors: Interference with social/family/work life; Positive reward; Withdrawal symptoms; Exercise for weight control; Insight into problem; Exercise for social reasons; Exercise for health reason; Stereotyped behaviour.
Exercise Dependence Scale (EDS)	Hausenblas and Symons-Downs (2002)	266 university students (57,7% men; Mage = 21.72, SD = 2.89	Problematic exercise as a dependence	Based on the DSM-IV criteria for substance dependence, an initial pool of 35 items from interviews and reviewing existing measures	31 items (6-point scale) with 7 factors: Tolerance; Withdrawal; Intention effects; Lack of control; Time; Reduction in other activities; Continuance.
Exercise Dependence Scale-Revised (EDS-R)	Symons-Downs et al. (2004)	408 university students (65.7% women; Mage = 20.2 years, SD = 2.5) participating in fitness classes at least three times per week	Problematic exercise as a dependence	Pool of 28 items from EDS	21 items (6-point scale) with 7 factors: Tolerance; Withdrawal; Intention Effects; Lack of Control; Time; Reduction in Other Activities; Continuance.
Exercise Salience Scale (ESS) (a)	Kline, Franken, and Rowland (1994)	74 university students (Men = 32, Women = 42) enrolled in undergraduate psychology courses (Mage = 23.17; SD = 6.31).	No clear conceptualisation	Pool of 40 items proposed by Morrow and Harvey (1990) in a popular fitness magazine	40 items (5-point scale) with 2 major factors (Response Omission Anxiety, and Response Persistence) and 4 minor factors (undefined)

(continued)

Table 1. Continued

Instrument	Authors	Sample size (characteristics)	Conceptualisation	Items Generation	Factor structure
Obligatory Exercise Questionnaire (OEQ)	Pasman and Thompson (1988)	90 volunteers, aged 18–60, 15 men and 15 women in each of the three following groups: obligatory runners (Mage women = 33.1, Mage men = 37.2); obligatory weightlifters (Mage women = 27.4, Mage men = 26.7); sedentary group (Mage women = 29.1; Mage men = 32.3).	Problematic exercise as a behaviour to regulate body shape and weight	Items adapted from the Obligatory Running Questionnaire	20 items (4-point scale) with one factor
Obligatory Exercise Questionnaire (OEQ-1)	Steffen and Brehm (1999)	250 high school students (Women = 133; Men = 117)	Problematic exercise as a behaviour to regulate body shape and weight	Review of the 20-item structure of OEQ	10 items (4-point scale) with 3 factors: Emotional element of exercise; Exercise frequency and intensity; Exercise preoccupation
Obligatory Exercise Questionnaire (OEQ-2)	Ackard et al., (2002)	586 female university students (Mage = 20.61; SD = 3.09). Actual BMI = 22.79; SD = 4.51. Ideal BMI = 20.31; SD = 2.17.	Problematic exercise as a behaviour to regulate body shape and weight	Review of the 20-item structure of OEQ	11 items (4-point scale) with 3 factors: Exercise fixation; Exercise frequency; Exercise commitment
Obligatory Exercise Questionnaire – Revised (OEQ-R)	Duncan et al. (2012)	241 exercisers (Men = 143 Mage = 29.95 SD = 11.12; Women = 97, Mage = 32.89, SD = 12.47; 1 case did not report gender).	Problematic exercise as a behaviour to regulate body shape and weight	Review of the 20-item structure of OEQ	10 items (4-point scale) with 3 factors: Preoccupation with exercise; Exercise behaviour; Exercise emotionally
Problematic Practice of Physical Exercise Scale (PPPE)	Kotbagi et al. (2015)	341 leisure exercisers (Men = 232; Women = 109) involved in activities such as yoga, cricket, soccer, gymnastics, swimming, tennis and dancing (Mage = 28.26; SD = 10.83)	No clear conceptualisation	Pool of 50 items that groups the 29 items of the EDQ (Ogden et al., 1997) and the 21 items of the EDS-R (Symons-Downs et al., 2004).	25 items (6-point scale) with 6 factors and 4 subfactors: Lack of control; Stereotypical behaviour (intention, and continuity); Motivation for health (physical health, and psychological health); Withdrawal; Interference with social life; Tolerance

Note: PE = Physical Education; USA = United States of America; UK = United Kingdom; BMI = Body Mass Index; PA = Physical Activity; DSM = Diagnostic and Statistical Manual of Mental Disorders.

Commitment to Exercise Scale, CES, Davis et al., 1993; Commitment to Physical Activity Scale Revised, CPAS-R, DeBate, Huberty, & Pettee, 2009) used the notion of a strong commitment to activity, or over-exercising, to conceptualise the problematic exercise. This term was adapted from the more specific term 'running commitment' (Carmack & Martens, 1979), which was one of the first labels used by the instruments to examine the speculations that had emerged institutionally and based upon years of personal running experience about the positively addictive nature of this activity (Glasser, 1976).

Out of the three instruments that use the term 'commitment to exercise', two of them were adaptations of the Commitment to Running Scale (CRS; Carmack & Martens, 1979), to the general scope of exercise. More specifically, the CPAS (Corbin et al., 1987) was the first adaptation of the CRS to the general scope of exercise, and maintains the one-dimensional structure of 12 items of the original instrument, only modifying the direction and wording of the items slightly (e.g. replacing the term 'running' with 'physical activity'). The revision of the CPAS (CPAS-R) by DeBate et al. (2009) maintains the original 12 items, only slightly altering the wording of the items in order to adapt them to school-age adolescents. However, instead of maintaining the original one-dimensional structure, DeBate et al. proposed a three-factor structure (i.e. value, attitudes, and motivation towards physical activity), although they did not offer a definition of each of these factors.

Unlike the CPA and CPA-R, the Commitment to Exercise Scale (CES; Davis et al., 1993) consists of eight items that were developed from the examination of a number of published case studies that collected the testimonies of men and women with clear pathological or excessive exercise habits (e.g. Morgan, 1979; Yates, 1991; Yates et al., 1983). Therefore, the CES moves even further away from the idea of exercise as a positive addiction, and takes the concept of problematic exercise a little closer to the end of a continuum, where excessive or over-exercising would be found to have negative consequences for the individual. The instrument was designed with the idea of evaluating the degree to which feelings of wellbeing are influenced by exercising, the degree to which exercise is performed despite the presence of adverse conditions to continue it, and the extent to which the exercise interferes with the individual's social commitments. As with the aforementioned two instruments, the instruments that conceptualise problematic exercise based on the exerciser's level of commitment focus on questioning the original concept of positive addiction suggested by Glasser (1976). However, apart from this general objective, the instruments within this group suffer from the absence of a conceptual basis and, in this sense, lack an organized and systematic representation of this construct.

Problematic exercise as a means of regulating body size and weight

The instruments grouped in this conceptualisation adopt different names to refer to problematic exercise, although they often use the terms compulsory, excessive and compulsive exercise interchangeably. This group includes the Obligatory Exercise Questionnaire (OEQ, Pasman & Thompson, 1988), and its subsequent revisions (Ackard, Brehm, & Steffen, 2002; Duncan et al., 2012; Steffen & Brehm, 1999), the Excessive Exercise Scale (EES, McCabe & Vincent, 2002) and the Compulsive Exercise Test (CET, Taranis et al., 2011). In all of these instruments, there is a shared idea that the problematic exercise is associated with the phenomenon of body image disturbance. Therefore, it is considered that problematic exercise may be associated with elevated dissatisfaction with appearance and, consequently, engage in excessive exercise and dieting in order to modify their figure. Thus, the instruments are mainly oriented to assess common elements between problematic exercise and chronic dieters. In fact, in the development of each instrument, along with the items that assess the problematic character of the exercise, are included measures that assess constructs related to body image and eating disorders (e.g. eating disorders, drive for thinness, drive for bulimia, body satisfaction). A brief summary of the development of these instruments is outlined below.

Obligatory Exercise Questionnaire. The original version of the OEQ (Pasman & Thompson, 1988) is a modification of the Obligatory Running Questionnaire (ORQ, Blumenthal, Toole, & Jonathan, 1984), which was developed in response to the suggestion that compulsive runners share psychological and behavioural dispositions to patients with anorexia nervosa (Yates et al., 1983). Since the original instrument by Pasman and Thompson (1988) there have been three modifications to the OEQ, all of which have proposed reduced versions of the instrument (Ackard et al., 2002; Duncan et al., 2012; Steffen & Brehm, 1999).

Excessive Exercise Scale. McCabe and Vicent (2002) consider that exercise, together with dieting, are two of the most common ways of modifying body size and shape. However, they understand that excessive exercise should not only be studied in its relationship to eating disorders, but also to other disorders associated with modifying body size and shape. Therefore, whereas dieting appears to be the most common way for females to lose weight, exercise is the most common strategy for males to achieve their ideal body type. The authors modified, through two studies, items contained in the EES, developed by Long et al. (1993), to adapt it to adolescent populations. It should be noted that the ESS is an instrument developed to examine exercise behaviour, attitudes and motivation to exercise among anorexic and normal samples, and is basically an adaptation of three standardized scales existing at that time. Therefore, as in the case of the OEQ, the EES by McCabe and Vicent (2002) is an adaptation of another existing instrument, so beyond identifying with the general idea that problematic exercise is a means of modifying the weight and body shape, there is no theoretical development on the components that define the construct. To our knowledge, there have been no further revisions or new developments of this instrument.

Compulsive Exercise Test. The CET is based on a cognitive behavioural conceptualisation of excessive exercise (Meyer et al., 2011) and was designed to assess the core maintaining factors for excessive exercise. Similar to the other instruments included in this group, the conceptualisation underlying the CET is that excessive exercise is a primarily a weight control behaviour maintained by weight and shape concerns (Taranis et al., 2011). This measure was specifically designed for use within the eating disorders domain. However, while weight and shape concerns remain an essential component of excessive exercise, it considers other key factors, such as negative affect and compulsivity. Consequently, the CET is based on a multidimensional construct that involves 'an association with weight and shape concerns, and persistent continuation in order to: (a) mitigate the experience of extreme guilt and/or negative affect when unable to exercise and (b) avoid the perceived negative consequences of stopping' (Meyer et al., 2011, p. 184). Although it is recognized that negative affect regulation involving withdrawal effects is a recurrent element in other conceptual frameworks, such as those that conceptualise the problematic exercise as a dependence or addiction, Meyer et al. consider that it is unlikely that a primary exercise dependence exists, that is, problematic exercise does not exist in the absence of eating disorders. Therefore, for these authors, withdrawal symptoms are more likely a component of compulsivity, such that it constitutes a primary maintenance factor for exercise.

Unlike the OEQ and EES, for the development of the CET, Taranis et al. (2011) developed a pool of 31 items that were generated through interviews with eating disorder patients, review of literature on eating disorder and exercise, existing scales, and analysis of the construct validity of these scales (see Meyer et al., 2011). With this pool of items, the authors expected to assess the hypothesized maintenance factors for excessive exercise: (i) compulsivity (e.g. rigid adherence to a strict and repetitive exercise routine, continuing to exercise despite illness or injury, lack of exercise enjoyment, extreme guilt when unable to exercise, making up for missed exercise sessions), (ii) affect regulation (e.g. the positive and negative reinforcement properties of exercise) and (iii) weight control exercise (e.g. compensatory exercise). The functioning of the items was examined through three empirical studies with independent samples of women, proposing a final model of 24 items grouped into five factors.

Problematic exercise as a primary dependence/addiction

Of the 17 instruments accounted for in this review, six instruments were oriented towards assessing primary problematic exercise (i.e. problematic exercise regardless of whether other disorders co-occur). Therefore, these are considered together in the "Results" section given that all six instruments were classified according to the conceptualisation of problematic exercise as either dependence or addiction. Of these six instruments, in the development of the Exercise Beliefs Questionnaire (EBQ, Loumidis & Wells, 1998), the terms 'addiction' and 'dependence' are used interchangeably, in the development of the Exercise Dependence Questionnaire (EDQ, Ogden, Veale, & Summers, 1997), the Exercise Dependence Scale (EDS, Hausenblas & Symons-Downs, 2002b), and the Exercise Dependence Scale – Revised (EDS-R, Symons-Downs, Hausenblas, & Nigg, 2004), problematic exercise is conceptualised based on substance dependence criteria (American Psychiatric Association, 2000), while in the Exercise Addiction Inventory (EAI, Terry et al., 2004) and in the Exercise Addiction Inventory–Revised (EAI-R, Szabo et al., 2019) the components model for behavioural addictions (Griffiths, 2005) is used to define and operationalize problematic exercise. The following is a brief summary of each of these six instruments.

General use of dependence/addiction. In developing the Exercise Beliefs Questionnaire (EBQ), Loumidis and Wells (1998) conceptualised problematic exercise in terms of a maladaptive behaviour associated with both physical and psychological risk, which was not secondary to eating disorder. Although they mostly use the term 'exercise dependence', they associated it with the term 'addiction', without establishing a differentiation with the latter. In the attempt to develop an instrument to assess primary exercise dependence, the authors relied on the Beck's schema theory (Beck, 1978) of emotional disorder as a basic framework to develop a cognitive conceptualisation of exercise dependence. In this sense, the instrument attempts to assess beliefs and attitudes that predispose to, and maintain, exercise dependence. Using an imagery technique, beliefs elicited from exercisers associated with being unable to exercise were used to construct a pool of 28 items grouped in four dimensions. Through different empirical studies the factor structure of the instrument was examined and the items were reduced to 21 in the final version of the instrument, although the four-factor structure was maintained.

Assessment instruments based on substance dependence criteria. Three instruments conceptualise problematic exercise in terms of dependence – the Exercise Dependence Questionnaire (EDQ), the Exercise Dependence Scale (EDS), and the revised Exercise Dependence Scale (EDS-R). These are partially or totally based on the clinical criteria for substance dependence listed in the DSM-IV (American Psychiatric Association, 2000). Both instruments assess primary exercise dependence (Veale, 1987, 1995). However, as the authors recognize, the instrument should be used alongside other measures that assess mental disorders that may be associated (e.g. eating disorders), and therefore rule out secondary dependence (i.e. the concern with exercise is not better accounted for by other disorders).

The EDQ (Ogden et al., 1997) adopts a conceptualisation of problematic exercise based on some of the criteria for substance dependence included in the DSM-IV, but also includes other factors based on motivational dimensions (e.g. motivation for physical and psychological health). More specifically, Ogden et al. conceptualise exercise dependence as a combination of problematic elements of exercise (e.g. withdrawal, tolerance, repetitive behaviour, excess), but also

incorporate a psychosocial perspective that recognizes psychological consequences and effects on interpersonal relationships. For the development of the EDQ, Ogden et al.'s items are based on unstructured self-report questionnaires that were completed by 131 participants who considered themselves to be addicted to exercise. On the basis of their statements and the commitment themes emerged, a pool of 86 items were developed. After exploratory factor analysis the final EDQ comprised 29 items and eight factors (as described in Table 1).

Unlike the EDQ, the EDS (Hausenblas & Symons-Downs, 2002b) presents a multidimensional conceptualisation of exercise dependence that is based entirely on the seven symptoms for substance dependence listed in the DSM-IV. By operationalizing exercise dependence according to all the criteria established in the DSM-IV, it adopts a conceptual structure that reinforces the rationality of the measure. Consequently, the EDS provides information on the average of each of the symptoms or the average of the total score. Considering the first option, the EDS allows for differentiating individuals into three groups: (i) at-risk for exercise dependence, (ii) symptomatic and (iii) asymptomatic. Since its inception, the factorial structure of EDS has been represented by the seven diagnostic criteria established for substance dependence in the DSM-IV. The number and sensitivity of items that comprise the instrument has varied throughout different studies that have been published in two papers. The revised version of the EDS (EDS-R, Symons-Downs et al., 2004) proposed a total of 21 items (three items per factor).

Assessment instruments based on behavioural addiction components. Both the EAI (Terry et al., 2004) and its subsequent revision (EAI-R, Szabo et al., 2019) are instruments that assess the risk of exercise addiction and utilize the components model for behavioural addictions as its theoretical framework (Griffiths, 2005, 2019). Both instruments represent a one-dimensional latent measure (i.e. exercise addiction) that comprises six items. Each of the six items of the instrument theoretically reflects one of the six criteria that are claimed to be present in all behavioural addictions (i.e. salience, mood modification, tolerance, withdrawal, conflict, and relapse).

No clear conceptualisation

There are two instruments, the Problematic Practice of Physical Exercise Scale (PPPE, Kotbagi et al., 2015), and the Exercise Salience Scale (ESS, Kline et al., 1994) that did not describe any clear operational definition of problematic exercise. Both instruments review previously existing measures without informing the readers how the items already created fit into their own conceptualisation of this construct.

In the PPPE, Kotbagi et al. (2015) started from a pool of items formed by the combination of the 21 items of the EDS-R (Symons-Downs et al., 2004) and the 29 items of the EDQ (Ogden et al., 1997). Although the two instruments used by the authors include partially or totally the criteria established in the DSM-IV for substance dependence (American Psychiatric Association, 2000), the selection that the authors made to group these two instruments lacks any theoretical foundation and, as they themselves recognized, the selection was made because (i) they were instruments applicable to any individual doing exercise, because they are not directed toward one particular physical activity; (ii) they had satisfactory psychometric properties; (iii) they were multidimensional and (iv) they were widely used internationally, which makes cross-cultural comparisons possible (Kotbagi et al., 2015).

The development of the ESS (Kline et al., 1994) reflected the examination of the factor structure of 40 items from the Exercise Involvement Questionnaire (EIQ, Morrow & Harvey, 1990). Morrow and Harvey's (1990) work, which was excluded from the present review because it was published in a magazine that does not meet the criteria of being published in a peer-reviewed journal, does not detail the process of how its items were generated. In addition to modifying the name of the instrument (from 'Exercise Involvement Questionnaire' to 'Exercise Salience Scale'), Kline et al. modified the response range from a three-point scale to a five-point Likert scale without presenting any reason for the change. Through an exploratory factor analysis (EFA), the authors found that many of the 40 items were loaded with factors that were difficult to identify and only two factors were defined: (i) response omission anxiety, which reflects expecting negative consequences if the exercise routine is broken and (ii) response persistence, which reflects a determination to exercise, even when there is adversity.

DISCUSSION

The aim of the present study was to conduct a systematic review of psychometric instruments that assess problematic exercise in order to identify and compare the theoretical conceptualisations on which these instruments are based. Seventeen self-reported psychometric instruments assessing symptoms of problematic exercise were reviewed. Overall, the instruments reviewed show in their development different theoretical conceptualisations about problematic exercise, which highlights the absence of a clear consensus at the time of operationalizing the measure of problematic exercise. The results also show that the course of different conceptualisations has finally resulted in a strong dichotomy concerning the primary or secondary character of problematic exercise that might limit the capacity of the instruments to capture the complete multidimensionality of this construct, as well as the complexity of its process. We address these issues below, and suggest possible alternatives to the way existing instruments conceptualise and assess problematic exercise.

Competing conceptualisations of problematic exercise and the resulting dichotomy

The results of the analysis of the instruments reviewed suggest that, with the exception of two instruments that did

not present a clear conceptualisation (i.e. the EES and the PPPE), the remaining 15 instruments fit into three different groups that conceptualised problematic exercise as either (i) the end of an exercise continuum; (ii) a behaviour to modify weight and/or body shape or (iii) an addiction/dependence that implies a disorder in its own right.

The first group of instruments, conceptualising problematic exercise as the end of an exercise continuum, is clearly associated with the debate initiated in the 1970s that attempted to determine whether apparently healthy behaviour, such as exercise, may cause problems for the individual when it is carried out to an excessive degree (Adams, 2009; Estok & Rudy, 1986; Glasser, 1976). In this way, when these instruments include the term 'excessive exercise' it is similar to 'over-exercising', that is, the point where exercise begins to lose its healthy character and shows damage not only physically, but in other spheres of the individual's life (Davis et al., 1993). However, even though the use of the term 'over-exercising' can be found in the literature that develop these scales (i.e. CES, CPAS, and CPAS-R), the preferred term they adopt in their instrument's title is 'commitment'. This term was precisely the one coined by Carmack and Martens (1979) in the development of the Commitment to Running Scale, instead of the traditional term used in the 1970s of 'positive addiction' (Glasser, 1976). As Carmack and Martens recognized, with this term they tried to move away from the idea of a positive addiction, and to examine the assumption that running, developed with a strong commitment, might also have symptoms of a negative addiction. Therefore, the three instruments gathered in this group extend the debate on the possibility that the exercise may reflect symptoms of negative addiction and, in this sense, develop instruments that allow this construct to be assessed in the more global scope of exercise.

Unlike the instruments listed in the first group, the instruments included in the other two groups are identified with the debate generated in the 1980s as to whether the problems caused by problematic exercise are due to the exercise behaviour itself or to other associated disorders (Veale, 1987, 1995; Yates et al., 1983). This debate is partly the result of the debate that began a decade earlier, so that, assuming the problematic nature that exercise may have, the question of debate advanced to determine the problematic nature of this activity. However, the debate generated in the 1980s produced a strong dichotomy in the conceptualisation of problematic exercise on which the assessment instruments are based. This dichotomy becomes evident in view of the similar effort that appears to be made in the development of instruments under each of the theoretical positions identified.

Six of the 17 instruments included in the present review conceptualise problematic exercise as a behaviour that individuals use to modify weight and/or body shape and, in this sense, understand problematic exercise as a possible disorder associated with other types of primary disorders, such as eating disorder or body distortion. Although in the literature where these instruments are developed reference can be found to the term 'excessive exercise', unlike the instruments included in the first group, here the term is assimilated to the use that the main clinical manuals use to describe the exercise associated with feeding and eating disorders (i.e. anorexia and bulimia nervosa) (American Psychiatric Association, 2013; World Health Organization, 2018). Within this conceptualisation, the instruments contain the terms 'obligatory' (OEQ, OEQ-1, OEQ-2 and OEQ-R), 'excessive' (EES) and 'compulsive' (CET) in the names of their scales. Although the term 'excessive' is somewhat more generic and has also been used to develop instruments under the first conceptualisation (Davis et al., 1993), the terms 'obligatory' and 'compulsive' are specific to this conceptualisation, and refer to the forced nature and, generally, the lack of attraction that the individual feels for exercising. As acknowledged by Yates (1991), 'obligatory runners' was the term chosen by a group of researchers after interviews with hundreds of long-distance runners. As Yates recognizes, with this term, the researchers wanted to highlight the inability of runners to stop exercising. In turn, the term 'obligatory' was associated with the term 'compulsive', since the extreme form of exercise of the runners was assimilated to the compulsive character that many women with eating disorders presented (Yates et al., 1983).

In a similar number to the previous conceptualisation group, six instruments have been developed utilizing a problematic exercise conceptualisation in terms of dependence/addiction. The authors who developed this group of instruments consider that a problematic exercise by itself, without being associated with another type of disorder, can occur. Three of the instruments included in this group (i.e. EDQ, EDS and EDS-R) base their items on the criteria of substance dependence established in the DSM-IV (American Psychiatric Association, 2000) and, consequently, use the term 'dependence' in the name of their scale. In contrast, two instruments (i.e. EAI, EAI-R) developed their items based on the addiction components model for behavioural addictions (Griffiths, 2005), and use the term 'addiction' in the name of their scales.

Some authors assimilated the use of 'dependence' and 'addiction' during the development of their scales (Loumidis & Wells, 1998). However, the confusion and undifferentiated use that has existed in recent decades between dependence and addiction appears to lean towards the use of the latter term, at least in the latest edition of the DSM (American Psychiatric Association, 2013). In the DSM-5, the categories of substance abuse and substance dependence were eliminated and replaced by a new category named substance-related and addictive disorders. The grouping of behavioural addictions together with substance-related disorders appears to be based on the idea that an excessively performed behaviour can produce, as with specific substances, the general direct activation of the brain's reward system, which is involved in behavioural reinforcement and memory production (American Psychiatric Association, 2013). Therefore, problematic or pathological behaviours appear to activate the reward systems in a similar way to psychoactive drugs of abuse, and produce behavioural symptoms similar to those of substance use disorders (e.g.

family conflicts, work conflicts, etc.). In this way, the working group in charge of this section of the DSM-5 highlights the similarities between repetitive behaviours, among which exercise is cited, and substance use disorders in clinical expression, aetiology, comorbidities, physiology and treatment (Petry et al., 2014). From the new category of DSM-5, authors are likely to begin using the term 'addiction' more frequently. In any case, the research used to develop this group of instruments, even though they were developed prior to the DSM-5 proposal, do not devote space to the task of differentiating the terms 'dependence' and 'addiction', but rather to the common task of developing an instrument that is sensitive to the assessment of a problematic exercise by itself (i.e. independently of other possible associated disorders).

Despite the efforts to look for similarities between substances and addictive behaviours, the strong conceptual dichotomy existing around the primary or secondary character of problematic exercise is striking, which has affected the development of the instruments to assess this construct. From this dichotomous position it is assumed that either the origin of the problem in the exercise behaviour lies in the specific properties of the behaviour itself or, conversely, the problem must be sought in the properties associated with another disorder (e.g. eating disorder). Therefore, although today there is a consensus concerning the multidimensional character of problematic exercise, each perspective attempts to define its specific components (Griffiths, 2005; Hausenblas & Symons-Downs, 2002b; Taranis et al., 2011). However, the strong dichotomy in the conceptualisation of problematic exercise shown by the development of assessment instruments may bring about some drawbacks that should be pointed out.

Limitations associated with a dichotomous conceptualisation of problematic exercise

A dichotomous view of the problematic exercise encourages those in the field to treat problematic exercise behaviour differently according to its possible aetiology and, in this way, accentuates the differences more than its potential similarities. In the same way that a debate is beginning in defence of a broader perspective of behavioural addictions, which considers that in addictions and dependence similarities should be given precedence over the differences (Griffiths, 2017; Petry et al., 2014), conceptualisations could also be thought of that are far from the dichotomization that defines the problematic exercise based on the existence or not of an associated disorder. In other words, a broad perspective of problematic exercise would not discard the possibility that so-called 'excessive exercise', referenced in the major mental disorder manuals to refer to exercise associated with eating disorders (e.g. anorexia and bulimia nervosa) (American Psychiatric Association, 2013; World Health Organization, 2018), might actually be an expression of an underlying addiction syndrome. There is some evidence in the literature that would support such a perspective (Chamberlain & Grant, 2020; Davis et al., 1993; Klein et al., 2004; Oberle, Watkins, & Burkot, 2018; Scharmer, Gorrell, Schaumberg, & Anderson, 2020).

For instance, Klein et al. (Klein et al., 2004) adapted the Substance Dependence Severity Scale (SDSS), an instrument that assesses the severity of substance use disorders according to the DSM-IV (American Psychiatric Association, 2000) and ICD-10 (World Health Organization, 1993), in order to assess symptoms of exercise dependence amomg a group of women with anorexia nervosa. The results of Klein et al.'s study showed that 48% of the women assessed in the study endorsed symptoms consistent with exercise dependence during the past month. In the same vein as Klein et al.'s study, Scharmer et al. (2020) showed that eating disorder pathology was associated with qualities of pathological exercise assessed using both the CET and the EDS. Chamberlain and Grant (2020), using the EAI measure, found that individuals with eating disorder traits shared defined symptoms for behavioural addictions (Griffiths, 2005). Finally, Oberle et al. (2018) showed that university students with high scores in orthorexia symptomatology (i.e. obsessive fixation on eating healthy that includes compulsive behaviour and concern with restrictive eating practices), had higher problematic exercise scores assessed with both the EAI and CET. In part, findings of the aforementioned studies appear to have been corroborated in a recent meta-analysis by Alcaraz et al. (2020), which evaluated the relationship between self-reported symptoms of problematic exercise as assessed by different instruments (i.e. CES, CET, EAI, EDS-R and OEQ) and eating disorders. The results of this meta-analysis showed medium-sized relationships between eating disorders and problematic exercise assessed by all instruments, although larger effect sizes were observed with problematic exercise assessed using the CET. All these studies suggest that exercise performed by individuals with eating disorder symptoms and compulsive-obsessive behaviour traits would maintain defined properties in instruments under a different theoretical conceptualisation, including instruments that conceptualise problematic exercise under models of addiction/dependence.

On the other hand, a dichotomous approach to problematic exercise may be limited in capturing the idea that the different components or symptoms that define the problematic exercise may actually emerge in a wide and varied combination of components. Therefore, each approach usually describes the emergence of problematic exercise as a process, understanding the phenomenon as a unit or global construct (Freimuth et al., 2011; Meyer et al., 2011). Most of the research on problematic exercise may have been driven by the orientation of the instruments used, so that, within each perspective, studies often report the value of each symptom in isolation or the aggregated or mean scores of the whole set of symptoms (Griffiths et al., 2015; Mónok et al., 2012; Terry et al., 2004). However, scholars have also suggested that the different symptoms caused by problematic exercise may not necessarily emerge simultaneously and symptoms may not be equally relevant in terms of their contribution to explaining the problematic exercise (Blaydon, Lindner, & Kerr, 2004; Magee, Buchanan, & Barrie,

2016; Paradis, Cooke, Martin, & Hall, 2013; Szabo et al., 2018).

Little research has so far examined clusters of individuals based on their problematic exercise symptom profiles (Blaydon et al., 2004; Blaydon & Lindner, 2002; Magee et al., 2016; Maraz et al., 2015; Sicilia, Alcaraz-Ibáñez, Chiminazzo, & Fernandes, 2020). However, the results of these investigations suggest that individuals may present simultaneously high and low levels of the symptoms that form a set of criteria, which appears to challenge the conceptual division that implicitly or explicitly dominates the assessment instruments (i.e. individuals with greater or lesser symptoms of problematic exercise). The results of these studies suggest that the symptoms or components assessed utilizing these instruments not only reflect quantitative differences in problematic exercise, but may indicate qualitative differences depending on how these symptoms or components being assessed are combined in different individuals. In addition, these results show that the associations of problematic exercise with health-related correlates may be better explained by the complex association formed by its components. Despite this evidence, the instruments developed so far are limited in studying a combination of patterns derived from components from different perspectives. Therefore, it is likely that the dichotomy of problematic exercise (i.e. primary and secondary problematic exercise) does not adequately capture the multidimensionality and complex process that underlies problematic exercise.

Outlining comprehensive alternatives and its implications

Some authors suggest that problematic exercise can have different aetiologies (e.g. primary and secondary addiction) (Veale, 1987, 1995). However, research has also shown overlaps between these ways of defining problematic exercise (Klein et al., 2004; Scharmer et al., 2020). Despite evidence of these overlaps, the authors emphasize component differences and there are no alternative proposals to the dichotomous view that dominates instrument development and validation to date. The suggestion pointed out by Shaffer et al. (2004), of considering addiction as a syndrome containing different expressions, may be a useful idea to transfer to the study of problematic exercise, and perhaps may serve as inspiration to develop and test new instruments with a broader conceptualisation. As Shaffer et al. recognize, a syndrome should be seen as a cluster of symptoms, signals or components related to an abnormal underlying condition. In this way, just as not all symptoms or components will be present in every expression of the syndrome, and some manifestations of a syndrome will have a unique combination of symptoms and components, it is likely that the different symptom of problematic exercise will form a different combination depending on whether the exercise is associated with another type of disorder. The idea of considering problematic exercise as a syndrome provides an alternative way of thinking about this reality and allows for a broader conceptualisation that considers problematic exercise as a broad family of different expressions that are individually distinguished by the specific combination of their factors. Therefore, although different expressions of problematic exercise would have different symptoms (i.e. primary and secondary problematic exercise), these manifestations of problematic exercise could also share common elements.

Based on the findings of the present study, some future lines of research are proposed. Case studies may assist in the identification of common patterns in problematic exercise. However, there have been very few such studies to date compared to studies using psychometric assessment instruments. The few case studies carried out to date indicated that characteristics such as the salience of exercise in the individual's life or unpleasant feeling states when exercise is reduced or stopped appear to be criteria or components present in problematic exercise (Griffiths, 1997; Kotbagi et al., 2014; Morgan, 1979; Veale, 1995; Yates et al., 1983). Further evidence from qualitative studies could corroborate whether these identified criteria hold for problematic exercise among individuals with different backgrounds and aetiology. Along with the proliferation of more qualitative studies, future research could address comparative analyses of the components or criteria covered in the psychometric assessment instruments to examine which components of problematic exercise are shared by instruments with different theoretical conceptualisations and which components differ. Such analyses have recently been conducted on instruments assessing other problematic behaviours, such as gaming and pornography use (Fernandez & Griffiths, 2019; King, Haagsma, Delfabbro, Gradisar, & Griffiths, 2013). An identification of common and specific components in psychometric assessment instruments with different conceptualisations of problematic exercise may help to interpret the results when using different instruments. In addition, identifying common and different criteria or components of problematic exercise among instruments with different conceptualisations could serve to further examine how different combinations of components relate to different variables, and to explain qualitative differences among groups or individuals.

With better assessment instruments under broader conceptualisations of problematic exercise, clinicians could advance a diagnostic aetiological classification that would help intervention programs for this problematic behaviour, in addition to treating other associated disorders. Therefore, conceptualising problematic exercise as a syndrome may have implications for treatment. Individuals who are treated for eating disorders are sometimes neglected from problematic exercise because it is thought that this problem will disappear when the primary disorder (e.g. eating disorder) is resolved. This type of treatment focuses on the specific secondary character of the problematic exercise and does not take into account the addictive component that may co-occur with the primary disorder. From a syndrome perspective, effective treatment would encompass a multimodal approach that includes both treatment specific to the primary disorder (e.g. eating disorder) and more general

treatment of the addictive nature of the associated exercise. This conceptualisation requires clinicians to develop multidimensional treatment plans and to repeatedly assess the impact of these relationships. This aetiological strategy is different from the current multidimensional consensus approach that tends to identify the common elements of primary and secondary problematic exercise, and, within each, tends to give equal weight to the diagnostic criteria that have been defined. In addition, a multimodal perspective might contemplate components that are shared, but also characteristic of other forms of problematic exercise associated with disorders other than eating disorders (e.g. body dysmorphic disorder) (Foster, Shorter, & Griffiths, 2015).

Limitations

The present systematic review had strict selection criteria and only covered self-report scales that assess some type of problematic exercise, without considering instruments developed for a specific exercise (e.g. running) or sport contexts (e.g. bodybuilders). Therefore, instruments developed to assess problematic exercise in specific exercise were not evaluated in the present review. Second, the electronic databases used for the search and the languages selected (i.e. English and Spanish) may not have identified studies published in other languages. Third, to the best of our knowledge, the lack of criteria to assess the risk of bias in conceptual reviews prevented the evaluation in terms of methodological quality of the studies in which such definitions are presented. Finally, the fact that we were unable to assess the risk of bias in studies that could have been of very low quality led us to opt for not including the grey literature (e.g. dissertations, conference abstracts). It is therefore possible that some other existing instruments would not have been included in the review.

CONCLUSION

The results of the present systematic review show different theoretical conceptualisations in the assessment instruments that evidence a lack of consensus on the definition of problematic exercise, resulting in a strong dichotomy around the primary or secondary character of the problematic exercise. The existing dichotomous conceptualisation may limit the possibility of adequately capturing the complex process that underlies this potential disorder. Given the interest in investigating the problematic exercise in all its forms, it is critical for future research to develop a comprehensive definition of problematic exercise that enables advances to the study and assessment of the multidimensionality and complexity of this construct.

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APPENDIX A: SUPPLEMENTARY MATERIAL

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