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Original Article

A systematic review of exercise addiction: examining gender differences

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Abstract:
Exercise addiction is a rising preoccupation for researchers as a susceptible cause of serious health issues and negative consequences for individuals. Although there are numerous studies that have analysed exercise addiction, only a few have examined possible gender differences. To estimate if there is a prevalence difference between men and women relating to exercise addiction, a systematic review was conducted. Bibliographic searches were performed via PubMed and PsycINFO databases limited to English language, studies on humans, and since 2000, with the search terms: 'exercise addiction inventory' and 'exercise dependence scale', with a result of 590 potential relevant entries. Titles were then reviewed for duplicates and non-peer reviewed papers, which were then excluded. This resulted in a list with of 433 articles. Subsequently, abstracts and methods were reviewed using the following inclusion criteria: studies using the Exercise Addiction Inventory and/or the Exercise Dependence Scale, as these are the only available screening tools to identify the individual at risk of exercise addiction. The full text of the resulting 88 articles was then analysed, focusing on studies providing data about gender differences on the prevalence of exercise addiction (number of participants, percentages, and/or means and standard deviations). As reported by the 27 studies included in the final systematic review that met all the inclusion criteria, the effect size reflects variation in gender differences. Cohen's d was between .04 and .98, suggesting that men are more addicted to exercise than women. Only two studies reported that the prevalence for exercise addiction was higher in women than men. However, our study concludes that more research is needed to understand the gender differences on the prevalence of exercise addiction, and the nature of this potential disorder.
Keywords: addictive behaviour, exercise addiction, gender differences, systematic review

Introduction

Exercise has been widely considered to be beneficial to health (Biddle & Mutrie, 2007; Warburton, Nicol, & Bredin, 2006). When done without limit, however, exercise can be harmful; it can become a compulsive and addictive form of exercise behaviour, particularly when it is performed for body image improvements or as a stress reliever (Griffiths, 1996; Terry, Szabo, & Griffiths, 2004). Scientific research on body image has grown and highlights the importance of understanding unhealthy forms of exercise (Tylka, 2013; Tylka & Wood-Barcalow, 2015a, 2015b). Some authors affirmed that exercise addiction (EA) is a component of behavioural addiction (Szabo, Griffiths, & Demetrovics, 2016), whereas Griffiths (1996) believed that it should be treated similar to chemical addictions. Evidence of similarities between exercise addiction and drug addictions have been found in the literature (Sussman et al., 2011), with both conditions presenting the same symptomatology. However, while some authors argued that exercise, such as jogging, is a positive addiction (Glasser, 1977), those activities may have some negative effects (Szabo, 1998) when the individual loses control over the behaviour which becomes compulsory, potentially leading to physical and psychological damage (Griffiths, 1997), including physical injuries and negative consequences on interpersonal relationships (Ogden, Veale, & Summers, 1997). Some people may exercise with no limits and in a harmful way (Szabo, de la Vega, Ruiz-Barquín, & Rivera, 2013; Terry et al., 2004), becoming addicted to exercise (Griffiths, 1996, 1997; Terry et al., 2004) when the behaviour is repeated despite the difficulties or obstacles that are associated with it.

Different terminology is used in research literature when referring to EA, but all those synonyms seem to point to the same psychological condition (Szabo, Demetrovics, & Griffiths, 2018). Some authors described the concept as *exercise dependence* (Hausenblas & Downs, 2002a), whilst others use *exercise abuse* (Davis, 2000), *compulsive exercise* (Eberle, 2004; Taranis, Touyz, & Meyer, 2011) or even *pathological exercise* (Cunningham, Pearman, & Brewerton, 2016) to describe behaviour that lead to extreme exercise. However, using different terminology may be unproductive, as the term exercise addiction includes dependence and compulsion (Goodman, 1990; Szabo et al., 2018). Therefore, using only one term from the formula to describe the condition may result in the loss of the other component of this extreme exercise behaviour, and not all of

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those terms may be classified separately as addictions (Goodman, 1990). Consequently, in this paper we use the term *exercise addiction* (EA).

The academic literature presents a separation between two forms of exercise behaviour. There are studies that differentiated primary and secondary EA (De Coverley Veale, 1987). Primary addiction exercise is said to be related only to one form of addiction, the exercise itself. On the other hand, in the secondary addiction, exercise is related to other behaviours like eating disorders. There are other authors, like Cunningham et al. (2016), who considered primary *pathological exercise* more addictive and secondary addiction more compulsive. Accordingly, men and women can present both risks for EA, although women may present more compulsive exercise as a secondary addiction, and men more addictive exercise as primary addiction (Cunningham et al., 2016). Szabo et al. (2018) suggest that EA should not be classified in these two categories, as the exercise is used to achieve an end; for instance, the exaggerated practise of exercise being used in eating disorders with the purpose of controlling or losing weight.

Theoretical models that analyse Exercise Addiction (EA)

To explain EA, there have been various theoretical models developed over time, such as the *Sympathetic Arousal Hypothesis* (Thompson & Blanton, 1987), the *Cognitive Appraisal Hypothesis* (Szabo, 1995), the *Monoamine Model* (Cousineau et al., 1977; Szabo, 2001), the *Endorphin Model* (McNally & Akil, 2002; Saanijoki et al., 2014), the *Interleukin Six (IL- 6) Model* (Hamer & Karageorghis, 2007), the *Pragmatics, Attraction, Communication, Expectation (PACE) Model* (Sussman et al., 2011), the *Four Phases Model* (Freimuth, Moniz, & Kim, 2011), the *Biopsychosocial Model* (McNamara & McCabe, 2012), and the *Interactional Model of Exercise Addiction* (Egorov & Szabo, 2013). The *Four Phases Model* that Freimouth et al. proposed in 2011 attempts to explain how an individual can pass through the four phases of EA, from recreational exercise to exercise addiction. This model may help clinicians assert the phase the patient is currently in (as shown in Figure 1), distinguishing between a normal behaviour and an addictive behaviour.

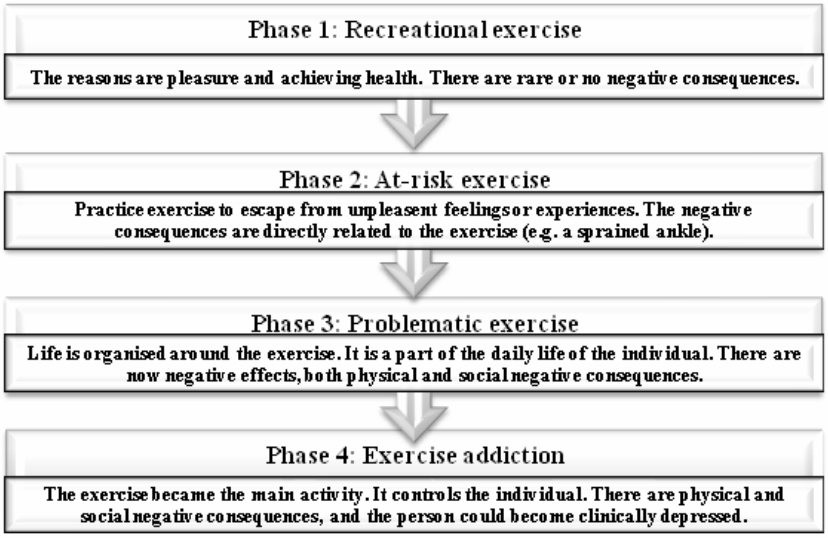

Fig. 1. The Four Phases Model of the exercise addiction (Freimuth et al., 2011)

Whilst the *Four Phases Model* focuses on the choice of exercise as means in itself, it does not explain the choice of exercise as a means to another purpose (e.g. losing weight), and so in 2013 Egorov and Szabo developed the *Interactional Model of the Exercise Addiction*. According to this model, there is an interaction among several factors such as personal (e.g. personality, needs and values, etc.) and social (e.g. accessibility, cost and image) that determine if exercise is used with therapeutic or mastery orientations, depending on the exercise motivation aspects, such as physical and psychological health, and social or performance aspects. They all determine how the individual will deal with stress, and subsequently use exercise as a coping mechanism. The authors highlight that each case is unique and, in order to predict EA for each patient, clinicians should treat them individually. They also point out that there is more research needed based on case studies to obtain a better understanding of where the line between *risk* and *morbidity* is drawn (Egorov & Szabo, 2013). This theoretical model could explain better gender differences because it takes into account subjective aspects, such as personality characteristics, social expectations, personal needs, ambitions and motivations.

Defining the components model of the Exercise Addiction (EA)

In order to better understand EA, Griffiths (1996, 1997) redefined six general components of addiction in light of Brown's theory (1993) by adapted them to exercise behaviour. The following addictive components were identified by Griffiths (1997) through a case study on an exercise addict: *salience*, *mood modification*, *tolerance*, *withdrawal symptoms*, *conflict* and *relapse*. The author defines the six components of behaviour addiction as follows: 1) *salience* is when the exercise becomes the most relevant activity in a person's life,

overshadowing other activities; 2) *mood modification* is the subjective experience an individual has as a consequence of exercising; 3) *tolerance* is when the individual has to increase the amount of exercise in order to experience the desired effects; 4) *withdrawal symptoms* are the displeasing feelings or experiences caused by suspending or drastically decreasing exercise; 5) *conflict* is tension that may arise, as a consequence of exercise addiction, between the individual and close family (interpersonal conflict), or within the person (intrapsychic conflict); and 6) *relapse* is the tendency to exaggerate or repeat the same exercise patterns after a voluntary break due to a personal decision or after withdrawal from it due to injury. To measure the six addictive components, an instrument based on the theory of addiction to behaviours was developed by Terry et al. (2004), which is more aligned with the new classification system provided by the DSM-V (*Diagnostic and Statistical Manual of Mental Disorder-V*), the *Exercise Addiction Inventory* (EAI).

Measuring Exercise Addiction (EA)

According to DSM-5 (APA 2013), any negative consequences on the health of an individual should be treated as a morbid pattern. To provide intervention for people at risk of EA, it is important to be able to identify them, and for that, some authors (Blumenthal, O'Toole, & Chang, 1984; Coen & Ogles, 1993; Downs, Hausenblas, & Nigg, 2004; Hausenblas & Downs, 2002b; Ogden et al., 1997; Terry et al., 2004; Thompson & Pasman, 1991) have designed instruments that measure beliefs and attitudes related with exercise behaviour. However, only two of those instruments classify individuals at risk of exercise addiction: the *Exercise Dependence Scale* (EDS) (Hausenblas & Downs, 2002b), which has since been revised (EDS-R) (Downs, Hausenblas and Nigg, 2004); and the *Exercise Addiction Inventory* (EAI) by Terry, Szabo and Griffiths (2004). These two valid screening tools measure EA prevalence and classify individuals in relation to three categories: at risk of EA, nondependent-symptomatic and nondependent-asymptomatic.

In their study, Hausenblas and Downs (2002) used the term '*exercise dependence*' when they described an excessive and without control exercise. This instrument, the EDS, was developed according to DSM-IV (*Diagnostic and Statistical Manual of Mental Disorders – APA 1994*) criteria for substance dependence. The scale was proposed to differentiate among *at-risk*, *nondependent-symptomatic*, and *nondependent-asymptomatic* individuals dependent on exercise (Hausenblas & Downs, 2002b, 2002c). Two years later, Downs, Hausenblas, and Nigg (2004) reduced the 28 items of the EDS to 21 items of the EDS-R, answered on a six-point Likert scale, with a range from 1 (never) to 6 (always). Here, the higher the score the more exercise dependence symptoms appear. The EDS-R is an improved version with three items per each subscale or symptoms, according to the DSM-IV criteria for substance dependence (APA 1994): 1) *Tolerance*, 2) *Withdrawal*, 3) *Intention effects*, 4) *Lack of control*, 5) *Time*, 6) *Reduction in other activities*, and 7) *Continuance*. According to the diagnostic criteria, individuals with high scores on at least three of the seven diagnostic criteria are at-risk of exercise dependence. The EDS-R has similar internal reliability, Cronbach's alpha between .78 and .92, as the initial EDS (□□.89 – .92). Given the excellent psychometric properties of the EDS-R, the instrument was translated and validated in several cultural contexts, for example into a Spanish context (Sicilia & González-Cutre, 2011) with an excellent internal reliability (□□.92).

Another valid instrument is the *Exercise Addiction Inventory* (EAI), which is a brief screening tool (Griffiths, Szabo, & Terry, 2005; Terry et al., 2004) based on the six general components or common symptoms of any addiction (Brown, 1993; Griffiths, 1996, 1997) described earlier: 1) *Salience*, 2) *Mood modification*, 3) *Tolerance*, 4) *Withdrawal*, 5) *Conflict*, and 6) *Relapse*. The scale is a short screening tool with six items, one per each component of addiction, answered on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The instrument suggests that individuals who score more than 24 are at risk of EA, the ones who score between 13 and 23 show some symptoms, and the ones with less than 12 do not show any symptoms of EA. Because of the easier administration of the scale, it was translated into other languages. The Spanish version (Sicilia, Alías-García, Ferriz, & Moreno-Murcia, 2013) of the practical and very short tool had an internal reliability of .70, a little bit lower than the original one (□□.84). Some authors (Griffiths et al., 2015) point to the fact that prevalence of EA measured with EAI is higher than when measured with EDS. However, it was demonstrated that EAI is a valid instrument to measure EA in different cultures despite the differences that may have appeared among the studies (Griffiths et al., 2015).

Focusing on gender differences, EA studies suggest that these differences can be explained, in part, by the instruments that were used to measure the addiction to exercise (Weik & Hale, 2009). However, the literature seems to agree that when measuring with EAI and EDS as instruments, women score lower than men on the prevalence of EA (Lichtenstein & Jensen, 2016; Shin & You, 2015; Szabo et al., 2013; Weik & Hale, 2009). Besides, the number of studies reporting women having a higher prevalence of EA than men is scarce (Costa, Hausenblas, Oliva, Cuzzocrea, & Larcan, 2015; Youngman & Simpson, 2014). As the aim of this systematic review is to determine if there are any differences between genders when it comes to addiction to exercise, we will review studies that use the two instruments described earlier (EDS and EAI), as those are the only screening tools that classify individuals according to the score obtained on the assessment of risk of EA. Knowing if there are gender differences relating to the prevalence of EA will be crucial for clinicians endeavouring to develop specific intervention strategies for both men and women.

Material and methods

The present study is based on a bibliographic search conducted by the first author, who was responsible for the entire literature search to ensure consistency. Computer and manual sources were consulted; the last search was performed on 26th July 2018. For the computer search, two major databases, PubMed via NCBI and PsycINFO via ProQuest, were consulted using the selection *All fields*, limited to English language, studies on humans and since 2000, with the search terms '*exercise addiction inventory'* and *'exercise dependence scale*', resulting in a list of 184 and 406 articles respectively (see Fig. 2). The terms *gender* and *sex* were not included in any search because it would have biased them toward articles that provided data about significant differences between men and women. Later, titles were reviewed to exclude duplicates and non-peer reviewed papers (e.g. book chapters, thesis, dissertations, etc.).

This generated a list of 433 appropriate sources, as 108 duplicates were excluded, 34 book chapter, and 15 thesis and dissertations. Subsequently, articles were analysed for inclusion criteria that were based on selecting articles using, besides other tools, the available two instruments developed to identify individuals at risk of EA: the EDS, including its revised version the EDS-R, and/or the EAI. According to these criteria, the abstracts and methods of 433 articles were reviewed, of which 345 articles were excluded because they did not use the EDS and/or EAI as tools. There were a few articles that did not have the full text available but the abstracts provided sufficient information about the instruments used and other essential data for inclusion or exclusion. The manual searches were based on the bibliographical sources most cited in the searched studies, obtained via three universities' library catalogues. From this, five additional articles were included.

The next set of inclusion criteria were based on analysing studies that examined both sexes and provided data according to sex, number of participants, prevalence of EA, means and standard deviations. According to these criteria, the full text of the 88 articles was reviewed. Four of them used both screening tools and 62 articles were excluded because of not examining both sexes or not providing the data mentioned earlier. Thus, twenty-six articles (twenty-seven studies, as one article reported two studies) were left to extract the applicable information to analyse the differences by sex; the selection process can be seen in Figure 2.

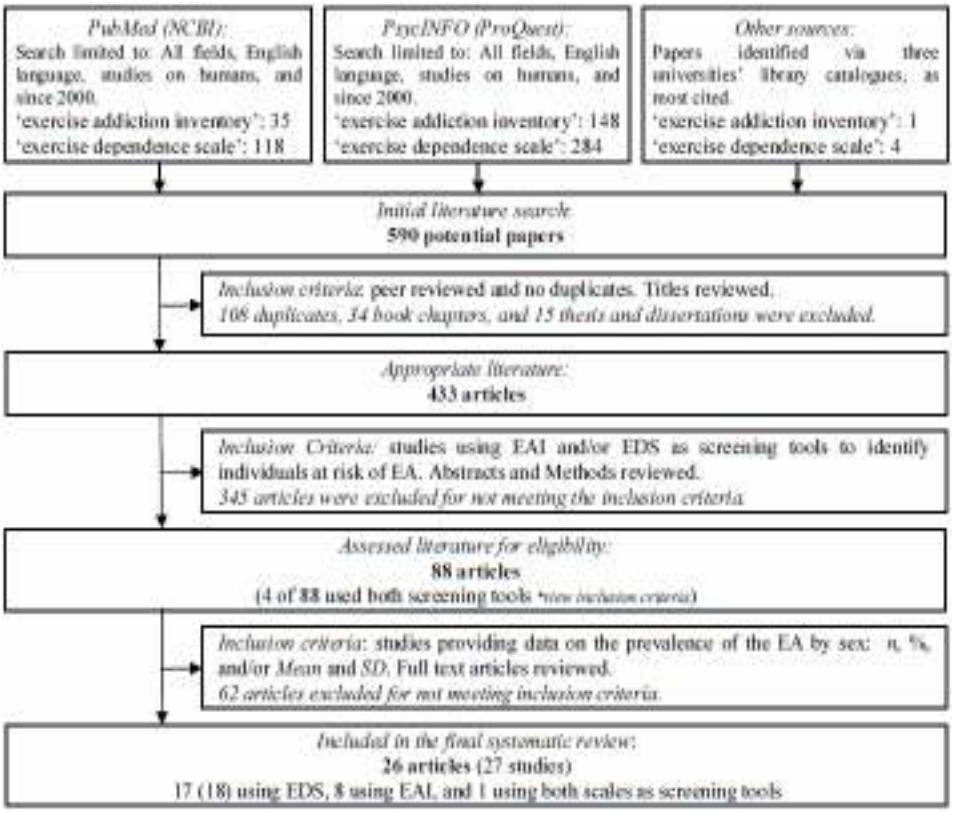

Fig. 2. Flow chart of literature search

Results

This systematic review focused on differences by gender, analysing articles obtained via computer searches or manually, that used '*Exercise Addiction Inventory*' (EAI) and '*Exercise Dependence Scale*' (EDS and EDS-R) as screening tools. Only 26 articles (27 studies) of the 88 full text reviewed articles provided data about gender differences on EA prevalence as seen in the table below.

Table 1. Summary table of the systematic review about gender differences on the prevalence of EA

Author (s)	*n*	*Age (yr)*		*P*	*Type sport*	*ofQTR*	*Prevalence of EA*		*Men*		*Women*	*d*			
	All	*M*	*F*						*%*	*M*	*SD*	*%*	*M*	*SD*	
Cook, Hausenblas, & Rossi, 2013	513	49	38	19.9	University students	NM	EDS	NM	55.7	18.3	NM	38.0	18.2	.98	
		22	49					NM	46.7	11.6	NM	45.0	14.0	.13	
		51	304					NM	48.4	12.8	NM	45.4	15.3	.20	
Cook, Karr, et al., 2013	2,660	894	1,766	38.8	Runners	Marathon	EDS	1.3	50.7	12.3	1.4	49.1	12.3	-**	
									61.5	12.3		58.5	15.9		
Costa, Cuzzocrea, Hausenblas, Larcan, & Oliva, 2012	519	262	257	36.9 37.4	Gym users	NM	EDS	6.5	NM	NM	6.6	NM	NM	-	
Costa, Hausenblas,	409	51	50	18-24 25-44	Gym users	NM	EDS	NM	54.4	13.3	NM	49.4	15.8	.35	
Oliva, Cuzzocrea, & Larcan, 2013		84	81	45-64				NM	53.9	18.1	NM	46.5	15.0	.44	
		74	69					NM	48.6	18.1	NM	41.8	14.6	.42	
Costa, Hausenblas, Oliva, Cuzzocrea, & Larcan, 2015	262	135	127	20.9	Competitive athletes	Team sports	EDS	17	NM	NM	18.9	NM	NM	-	
Costa, Hausenblas, Oliva, Cuzzocrea, & Larcan, 2016	348	178	170	20,6	Gym and sport associations	Gym and team sports	EDS	4.5	NM	NM	1.8	NM	NM	-	
Cunningham et al., 2016	1,497	608	885	33.2	General population and exercise enthusiasts	NM	EAI	NM	NM	NM	NM	NM	NM	.13*	
							EDS	NM	NM	NM	NM	NM	NM	NM	
Downs et al., 2004 (S1)	408	140	268	20.2	College students	Fitness classes	EDS	5	NM	NM	3	NM	NM	-	
Downs et al., 2004 (S2)	855	427	428	21.4	College students	Fitness classes	EDS	3.6	NM	NM	1.5	NM	NM	-	
	30	16	14	20.7											
Downs, Savage, & DiNallo, 2013	805	435	370	15.1	High school students	NM	EDS	8	58.1	20.9	4	52.4	19.4	.28	
Di Nicola et al., 2017	996	240	756	16.5	High school students	NM	EAI	6.4	NM	NM	6.1	NM	NM	-	
Giardino & Procidano, 2012	46	35	11	23.322.2 20.520.2	Weight lifters	Body building	EDS	NM	36.8	14.2	NM	26.4	15.4	.74	
	67	43	24					NM	37.0	18.2	NM	31.2	15.8	.30	
Lichtenstein, Christiansen, Bilenberg, & Støving, 2014	396	247	149	28.4	Fitness users	Fitness	EAI	7.7	NM	NM	3.5	NM	NM	-	
	194	108	86		Not full time professional athletes	Football									
Lichtenstein & Jensen, 2016	572	312	260	NM	Crossfitters	CrossFit	EAI	7.1	NM	NM	2.7	NM	NM	-	
Maselli, Gobbi, Probst, & Carraro, 2018	427	229	198	26.3	Sport associations and fitness club, not elite athletes	Endurance, aesthetic, team sports and fitness	EDS	NM	61.5	17.5	NM	56.1	15.7	.32	
Mayolas-Pi et al., 2017	1,577	1,058	519	37.237.4	Amateur cyclists	Road Cycling	EAI	17	19.2	NM	16	18.3	NM	.20*	
Meulemans, Pribis, Grajales, & Krivak, 2014	517	227	290	19.7	College students	NM	EDS	4.4	NM	NM	2.4	NM	NM	-	
Müller, Loeber, Söchtig, Te Wildt, & De Zwaan, 2015	128	79	49	26.5	University students fitness users	NM	EDS	8.9	53.9	16.7	6.1	45.8	14.1	.52	
Nuzzo, Schindler, & Ryan, 2013	396	177	219	20.8	University students	NM	EDS	NM	68.351.2	13.217.3	NM	62.951.9	14.620.9	.38* .04*	
Reche, De Francisco, Martínez-Rodríguez, &	449	320	129	19.7	Athletes	Individual and team sports	EDS	8.5	70.2	17.9	8.8	68.6	16.5	.09	

Ros-Martínez, 2018														
Rudolph, 2017	1,008	559	449	29.4	Fitness users	NM	EAI	NM	21.4	5.7	NM	20	5.8	.24*
Shin & You, 2015	402	257	145	32.8	University students and sports clubs	Mixed sports	EDS	18.7	NM	NM	9.7	NM	NM	-
Smith, Wright, & Winrow, 2010	184	47	44	28.1	Distance runners	Running more than 5km	EDS	NM	86.7	16	NM	85.4	15.1	.09
	47		46					NM	72.6	15.5	NM	66.9	11.6	.42
Szabo et al., 2013	242	164	78	27.5	University athletes and elite ultra-marathon runners	Team and individual sports Ultra-marathon	EAI	21	19.4	3.5	7	18.2	3.7	.32
Villella et al., 2011	2,853	1,711	1,142	16.7	High school students	NM	EAI	10.1	NM	NM	6.3	NM	NM	-
Weik & Hale, 2009	193	101	92	39.2	Health club users	Aerobic and anaerobic workouts	EDS	11.4	65.3	16	0.5	50.3	14.7	.98
Youngman & Simpson, 2014	1,285	589	684	37.9	Triathletes	Triathlon	EAI	17.9	NM	NM	21.7	NM	NM	-

Abbreviations: EA = Exercise Addiction; ED = Exercise Dependence; *n* = number of cases; *yr* = years; NM = Not mentioned or not clear; QTR = Questionnaire; EAI = Exercise Addiction Inventory; EDS = Exercise Dependence Scale; (S) = Study; *M* = Mean; *SD* = Standard Deviation; *d* = Cohen's *d*; * = Cohen's *d* provided by the authors; **couldn't be calculated for missing data (*n* per group).

As shown in Table 1, approximately 30% of the studies reviewed, 26 articles with 27 studies, reported the prevalence of exercise addiction separated by gender. Among these 27 studies, 18 used EDS, eight EAI, and one used both instruments as screening tools to assess the prevalence of EA. There were 20,238 participants (athletes, students or fitness users) from Italy, USA, Mexico, Denmark, Spain, Germany, UK and Korea, of whom 9976 were men and 10246 were women. To measure the impact of the gender differences on the prevalence of EA, the effect size was analysed. The Cohen's *d* for the studies that provided data was calculated. It took values between .04 and .98, differences varied from small to large, according to Cohen's classification (Cohen, 1988), suggesting that men are more at risk of EA than women. In general, comparing data in each study, the prevalence of EA among men has been found to be significantly higher than among women or similar, except for two studies that reported the contrary (Costa et al., 2015; Youngman & Simpson, 2014). EA's prevalence percentage was taking values between 1.3 and 21 for men and between 0.5 and 21.7 for women. However, gender differences in the prevalence of EA were ambiguous due to the lack or nonexistence of data about gender differences.

Discussion and Conclusions

Understanding aspects that are related with physical activity behaviour may be relevant for public health, as EA is an exaggerated exercise pattern that could harm the individual, both physically and psychologically (Szabo et al., 2016). Exercise addiction researchers provided valid tools to assess the prevalence of EA, which is low, ranging between 0.3% and 0.5% among the general adult population (Mónok et al., 2012) and between 3.0% and 6.0% among athletes or regular exercisers (Szabo et al., 2016). Nonetheless, this prevalence rate may reach over 20% in elite endurance athletes such those participating in triathlon and/or ironman races (Blaydon & Lindner, 2002; Youngman & Simpson, 2014). However, very few of these studies analysed gender differences. Almost all the data provided on EA prevalence percentage suggested that men report more or similar EA to women except for the Youngman and Simpson (2014) and Costa et al. (2015) studies. Those authors reported a higher prevalence of EA in women in triathletes (21.7% vs. 17.9%) and competitive athletes in team sports (18.9% vs. 17%). However, it resulted in a non-significant pattern of relationship between gender and EA ($\chi 2$ (2) = 2.601, p = .27; and $\chi 2(1)$ =.24, p=.62, respectively). Therefore, considering the mean score differences of EA and the effect size (Cohen's *d*), studies suggest that men generally show higher scores in EA than women. It is worth noting, though, that most of the studies focus on university students and recreational exerciser samples. There are few studies conducted with elite athletes or athletes that compete in endurance races, and these ones seem to suggest that the differences between men and women could be lower than in the rest of the studies that include recreational exercisers. In fact, at a recreational level, women tend to have a lower frequency of exercise than men (Buckworth & Nigg, 2004; European Commission, 2018), whereas exercise frequency could be similar between genders when we refer to elite athletes that compete in endurance races. Previous studies using other instruments to measure EA also reported higher levels of EA in women athletes who compete in endurance races compared to men. For example, the study by Pierce, Rohaly, & Fritchley (1997) found that female marathon runners reported significantly higher EA scores than the male runners. Several possible interpretations could explain the higher prevalence of EA in women when compared to men in endurance sports. One possible explanation could be that the lower social approval of exercise for women precipitates higher prevalence among women who overcome the social prejudices associated with the physical practice. Another possible reason could be that higher EA in women participating in endurance sports may rest

on an association with eating disorders and, therefore, a secondary EA. These are possible hypotheses that future studies should test.

This systematic review was limited to PubMed and PsycINFO databases, and also to studies that examined both sexes. Another inclusion criteria was that either one or both of the exercise addiction instruments (EAI and/or EDS) were used given that they are the only screening tools that identify individuals at risk of EA. As Szabo et al. (2016) adverted, none of the theoretical models in the existing literature could fully explain the EA because the causes that provoke this behaviour are different among individuals. In summary, we propose that gender should be treated separately when examining EA, as there are notable differences in the physical activity behaviours of women when compared to men. As most of the research is based on screening tools, it would be easy to examine the differences by gender on the risk score with the correspondent statistical analysis. However, the instruments only measure the prevalence of EA, and more research is needed to discover the nature of this potential disorder. That will further help clinicians to identify individuals with addictive exercise behaviours, and provide an integrated treatment for those at risk of EA.

Conflicts of interest: The authors have no conflicts of interest to declare.

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