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Exercise Addiction in Athletes: a Systematic Review of the Literature

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Abstract

Athletes train on a pre-determined training schedule. Scheduled behaviors are difficult to become "addictive" because urges and cravings cannot be scheduled. Still, many scholars think that elite or competitive athletes can become addicted to their sport or exercise. The aim of this systematic literature review was to analyze scholastic papers on exercise addiction in athletes with a special view on their focus and prevalence estimates. Four databases were scrutinized, including PsycINFO, PubMed/Medline, Crossref, and ScienceDirect, which resulted in 17 eligible articles based on the inclusion and exclusion criteria. The bulk of these studies compared athletes to non-athletes and employed a cross-sectional design. Their results suggest that the risk of exercise addiction is greater in athletes than non-athletes, along with a prevalence rate of up to >40%, which is ten times greater than that reported in a population-wide study. These findings are in discord with the definition and conceptualization of exercise addiction, which, according to previous calls, begs for the urgent clearer conceptualization of exercise addiction.

Physical exercise has beneficial effects on both physical and mental health (American College of Sports Medicine (ACSM), 2018; World Health Organization [WHO], 2018). However, exercising in exaggerated volumes and in an uncontrolled way could result in injury and damage to the physical, psychological, and/or social life of the affected individual (Egorov &

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Szabo, 2013). In the scholastic literature, this condition is referred to as exercise addiction (EA) or exercise dependence (Szabo et al., 2015). Although EA is viewed as a means of escape from a major life trauma or stress, as based on the interactional model (Egorov & Szabo, 2013), several studies reported that competitive exercisers and/or athletes demonstrate higher scores of EA than recreational or non-competing exercisers (De La Vega et al., 2016; Smith et al., 2010; Szabo et al., 2013). It was argued that this difference might be due to a different interpretation of the items on the assessment tools aimed at measuring the susceptibility to EA (Szabo, 2018; Szabo et al., 2015).

Exercise addiction is classified as a "behavioral addiction," similar to gambling, sex, or internet addiction (Egorov & Szabo, 2013; Freimuth et al., 2011; Griffiths, 2005). Affected individuals exhibit symptoms of salience, conflict, mood modification, withdrawal, tolerance, and relapse, which comprise the Components Model of Addiction (Griffiths, 2005). It was stressed that while those prone to EA might spend long hours exercising with high frequency and intensity, exercise volume itself is not indicative of EA unless it is accompanied by clear physical, psychological, or social harm to the person (Szabo et al., 2015; Szabo & Kovacsik, 2019) Therefore, EA can be conceptualized as an uncontrolled behavior characterized by urge-driven exercises that become dysfunctional and harmful to the individual (Freimuth et al., 2011; Juwono & Szabo, 2020; Weinstein & Weinstein, 2014). Although EA has been widely investigated, as indicated by more than 1000 published scholastic papers in the area (Szabo & Kovacsik, 2019), inconclusive findings and lack of consensual empirical support for the dysfunction prevented EA from being included in the latest version of Diagnostics and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013).

Early studies indicated that EA was frequently perplexed by the level of commitment to exercise (Szabo, 2010). Accordingly, those who are highly committed to exercise tend to demonstrate a higher risk of EA. Based on this view, athletes are supposedly more susceptible to developing EA compared to recreational exercisers, which is also supported by their higher scores on EA-measuring instruments in several earlier studies (De La Vega et al., 2016; Smith et al., 2010; Szabo et al., 2013). Athletes are usually coached with skill-based training plans and personalized relatively rigid training schedules that enable them to excel (win) in various competitions (Hackfort et al., 2019). Athletes represent a unique population in which mastery of motor and cognitive skills is crucial in achieving personal goals in sport (International Encyclopedia of the Social & Behavioral Sciences, 2001). Hence, they could be differentiated from amateur athletes and recreational exercisers as they strive for the highest achievement (i.e., personal best) in their chosen sport. It was suggested that the vulnerability to EA in athletes might be shadowed by the highly structured and intense training regimen, which ensures that they achieve their best performance during competitions (Lichtenstein et al., 2017).

Although early researchers conjectured that athletes might develop EA (Conboy, 1994; Crossman et al., 1987), only a few studies examined EA among athletes. Indeed, most studies on EA focus on amateur athletes or leisure exercisers. The imbalance may be related to different views on the etiology and/or probability of EA among athletes (Lichtenstein et al., 2017; McNamara & McCabe, 2012; Szabo, 2018; Szabo et al., 2015). The aim of the current literature review is to examine the research on EA in competitive athletes. In this review, we define "athletes" as regularly exercising or training individuals whose training regimens are aimed at a successful participation in sports competitions. This literature review is conducted in accord with the Preferred Reporting Item for Systematic Review and Meta-analysis (PRISMA; Liberati et al., 2009; Moher et al., 2009, 2010, 2014; Shamseer et al., 2015).

Methods

Literature Search

The search was delimited to articles written in English and published in peer-reviewed journals. As the current review focuses on EA in athletes, articles are included only if they are original scholastic papers that include a measure of EA obtained from athletes from any sport. Conference papers, commentaries, dissertations, methodological papers, book chapters, abstracts, literature reviews, and non-English publications are excluded from the review. Table 1 illustrates the eligibility criteria for inclusion and exclusion of the reviewed articles.

Search Strategy

In the current PRISMA review, four databases were explored: PsycINFO, PubMed/Medline, ScienceDirect, and Crossref. An additional search was also conducted on Google Scholar. We used two clusters of search terms. The first cluster is EA. Since different terminologies were employed by different researchers to refer to this term (e.g., exercise dependence, obligatory exercise, compulsory exercise), we adopted these terminologies in identifying all potential articles. The second search cluster revolved around the concept of the athlete. The combination of the adopted search terms is illustrated in Table 2.

The search, replicated by two of the authors, resulted in 272 potential articles from the four databases. Another 20 articles were found from Google Scholar search. After removing 15 duplicates, 277 articles were screened based on the title and abstract, which resulted in the exclusion of 257 articles. Of the remaining 20 articles, three were removed because they did not report EA or similar datasets have been published under a different name. The final number of included studies for the current review is 17, dating from 2004 to 2020 (Fig. 1).

Data Extraction and Analysis

From the selected articles, author data (and year of publication), type of sport, participants' characteristics, instruments, the prevalence of EA, and key results of the study were extracted. The data were categorized into two main themes: prevalence of EA and correlates of EA. Two of the authors were extracting the relevant information from the selected articles by working on them separately, and then the results were matched with the help of the third author.

Table 1 Delimitations of the study. Inclusion and exclusion criteria for the eligible articles

Inclusion criteria	Exclusion criteria
English only articles	Abstracts
Published in peer-reviewed journals	Dissertations
Measures exercises addiction	Books (or chapters)
Examines athletes	Methodological papers
	Conference papers
	Literature reviews
	Examines amateur/leisure exercisers

Table 2 Search terms used in the current review

Exercise addiction, OR	AND	Athlete*
Exercise dependence, OR		Competitive athlete*
Compulsory exercise, OR		Professional athlete*
Obligatory exercise		Olympic athlete*
		Elite athlete*

Note: *The plural of the term (i.e., athletes) was searched with the wildcard

Quality Assessment and Risk of Bias

Appraisal of the quality assessment of the included studies was done under the Mixed Methods Appraisal Tools (MMAT) procedure. The MMAT is a distinctive tool that enables researchers to assess the quality of various research methods of the included studies in systematic reviews and meta-analyses (Hong et al., 2018; Queiroga Souto et al., 2015; Stretton et al., 2018). In the process, two preliminary screening questions about the clarity of research questions need to be answered. Two authors performed the screening. In case of disagreement, the third author's opinion was sought. Subsequently, each study was evaluated based on five guiding questions. There are different guiding questions to different research designs. Each of the questions is answered with "Yes," "No," or "Uncertain" (Hong et al., 2018) (Table 3). To do this, two authors jointly evaluated each included study, and their appraisal was then further discussed with the third author. Since evaluations were done together by the authors, there is no interrater index of reliability; the differences were discussed thoroughly until the two assessors reached
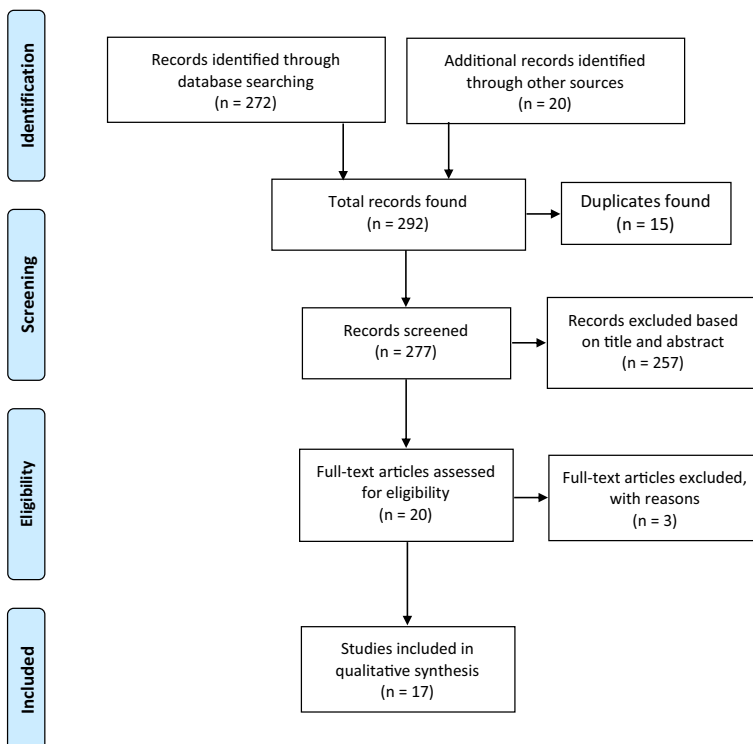

Fig. 1 Flowchart of the PRISMA review

an agreement in their ratings. The agreement was then further discussed with the third author. Hence, the quality of equality across the two authors, conducting the quality assessment of the studies, was also verified by the third author.

Results of the quality assessment showed that the included studies have clear research questions and the data collected were enough to answer the questions. However, the included studies suffered from issues related to sampling as most of them used an incidental sampling of athletes. Since the samples were non-representative of the population, the interpretation of the results of the included studies should be cautious.

Results

The inclusion-exclusion criteria-based literature search resulted in 17 cross-sectional reports. These are summarized in Table 4. The included studies examined participants from different sports. Nine of the included studies tested participants from mixed sports (Bingol & Bayansalduz, 2016; De La Vega et al., 2016; McNamara & McCabe, 2012; Müller et al., 2015; Orhan et al., 2019; Reche et al., 2018; Torstveit et al., 2019; Weinstein et al., 2015; Zeulner et al., 2016), three examined runners (Çetin et al., 2020; Smith et al., 2010; Szabo et al., 2013), one looked at elite bodybuilders (Smith & Hale, 2004), one focused on elite dancers (Akehurst & Oliver, 2014), and one examined triathletes (Youngman & Simpson, 2014). Two of the 17 studies did not report information on the type of sports the participants engaged in (Conesa et al., 2017; Levit et al., 2018).

The 17 studies also differed in the instruments used for measuring the risk of EA in athletes. The Exercise Dependence Survey (EDS; Hausenblas & Downs, 2002) was employed in eight studies (Akehurst & Oliver, 2014; Bingol & Bayansalduz, 2016; Conesa et al., 2017; Müller et al., 2015; Orhan et al., 2019; Reche et al., 2018; Smith et al., 2010; Torstveit et al., 2019), while the Exercise Addiction Inventory (EAI; Terry et al., 2004) was used in five studies (De La Vega et al., 2016; Levit et al., 2018; Szabo et al., 2013; Youngman & Simpson, 2014; Zeulner et al., 2016). The other four studies adopted the Exercise Dependence and Athletes Scale (EDEAS; McNamara & McCabe, 2012), the Bodybuilding Dependence Scale (BDS; Smith & Hale, 2004), the Exercise Addiction Scale (EAS; Tekkurşun Demir et al., 2018) used in the study by Çetin et al. (2020), and the Compulsive Exercise Scale (CES; Tuttle, 1992) which was used by Weinstein et al. (2015).

The studies also differed in their analysis strategies, as eight studies compared the risk of EA in athletes to recreational exercisers (De La Vega et al., 2016; Levit et al., 2018; Müller et al., 2015; Smith & Hale, 2004; Smith et al., 2010; Szabo et al., 2013; Weinstein et al., 2015; Zeulner et al., 2016). The remaining studies did not use a non-athlete comparison group and only focused on the assessment of the risk of EA in athletes or athlete subgroups (Akehurst & Oliver, 2014; Bingol & Bayansalduz, 2016; Çetin et al., 2020; Conesa et al., 2017; McNamara & McCabe, 2012; Orhan et al., 2019; Reche et al., 2018; Torstveit et al., 2019; Youngman & Simpson, 2014).

Risk of EA in Athletes

Prevalence of the Risk Exercise Addiction in Athletes Eleven studies reported the prevalence of the risk of EA in athletes. The reported prevalence rates ranged from 2.7 (Zeulner et al., 2016) to 42% for competitive male runners and ≈35% for competitive female runners as

Table 3 Quality assessment of the included studies in the current review in chronological order

Study	Screening questions		Methodological quality criteria				
	S1 – Are there clear research questions?	S2 – Do the collected data allow addressing the research questions?	Q1 – Is the sampling strategy relevant to address the research question?	Q2 – Is the sample representative of the target population?	Q3 – Are the measurement appropriate?	Q4 – Is the risk of nonresponse bias low?	Q5 – Is the statistical analysis appropriate to answer the research question?
1. Smith and Hale (2004)	Yes	Yes	Uncertain	Uncertain	Yes	Yes	Yes
2. Smith et al. (2010)	Yes	Yes	Yes	No	Yes	Yes	Yes
3. McNamara and McCabe (2012)	Yes	Yes	Yes	Uncertain	Yes	Yes	Yes
4. Szabo et al. (2013)	Yes	Yes	Uncertain	No	Yes	Yes	Yes
5. Akehurst and Oliver (2014)	Yes	Yes	Yes	No	Yes	Yes	Yes
6. Youngman and Simpson (2014)	Yes	Yes	Yes	Uncertain	Yes	Uncertain	Yes
7. Müller et al. (2015)	Yes	Yes	Yes	No	Yes	Yes	Yes
8. Weinstein et al. (2015)	Yes	Yes	Yes	No	Yes	Yes	Yes
9. Bingol and Bayansalduz (2016)	Yes	Yes	Yes	No	Yes	Uncertain	Yes
10. de la Vega et al. (2016)	Yes	Yes	Yes	No	Yes	Yes	Yes
11. Zeulner et al. (2016)	Yes	Yes	Yes	No	Yes	Yes	Yes
12. Conesa et al. (2017)	Yes	Yes	Yes	No	Yes	Uncertain	Yes
13. Levit et al. (2018)	Yes	Yes	Yes	No	Yes	Yes	Yes
14. Orhan et al. (2019)	Yes	Yes	Yes	No	Yes	Uncertain	Yes
15. Reche et al. (2018)	Yes	Yes	Yes	No	Yes	Uncertain	Yes
16. Torstveit et al. (2019)	Yes	Yes	Yes	No	Yes	Yes	Yes
17. Çetin et al. (2020)	Yes	Yes	Yes	No	Yes	Uncertain	Yes

Table 4 Summary of the included studies in chronological order

1. Authors	Sports	Sample size		Comparison group			Instrument	EA prevalence	Major findings
		Sex	Mean age	Sex	Mean age	Notes			
1. Smith and Hale (2004)	Bodybuilding	♂ = 72 ♀ = 63	28.43 ± 7.03 27.50 ± 6.52	♂ = 87 ♀ = 63	28.11 ± 7.81 24.56 ± 5.19	FCA	BDS	NR	• Competitive bodybuilders had significantly higher EA scores (effect size not determinable) • No gender differences observed
2. Smith et al. (2010)	Running	♂ = 47 ♀ = 44	28.43 ± 6.83	♂ = 47 ♀ = 46	28.43 ± 6.83	NS	EDS, RAS	>42% for competing ♂ and ≈ 35% in ♀	• Competitive runners had significantly higher EA scores (effect size not determinable) • No gender differences observed
3. McNamara and McCabe (2012)	Mix	♂ = 118 ♀ = 116	22.55	-	-	-	EDEAS	34.84%	• High prevalence of athletes had high risk developing EA • Female are more likely to develop EA • Differences in psychological variables among "at risk" and "non at risk" group observed
4. Szabo et al. (2013)	Running	♂♀ = 95	27.54 ± 10.65	♂♀ = 147	27.54 ± 10.65	US	EAI	17 %	• Ultramarathoners had significantly higher EA than sports university students (d = 0.47) and non-sport university student (d = 0.52) • Men had higher risk developing EA than women (d = 0.32)
5. Akehurst and Oliver (2014)	Dancing	♂ = 50 ♀ = 50	20.88 ± 1.69	-	-	-	EDS	NR	• EA associated stronger with obsession passion (r =0.72) than harmonious passion (r = 0.42)
6. Youngman and Simpson (2014)	Triathlon	♂ = 589 ♀ = 684	37.93 ± 9.35	-	-	-	EAI	19.9%	• 19.9% triathletes had high scores of EA • A significant main effect of triathlon type to risk of EA was observed
7. Müller, et al (2015)	Mix	♀ = 29	22.90 ± 4.55	♀ = 32	24.00 ± 5.99	EDP	EDS	10.3%	• No differences observed in the risk of EA in elite athletes and EDP
8. Weinstein et al., 2015	Mix	♂♀ = 20	30.00 ± 10.10	♂♀ = 51	30.00 ± 10.10	NS	CES	NR	• Professional sport individuals scored significantly higher in EA measure (d = 1.22)
9. Bingol & Bayansalduz (2016)	Mix	♂ = 464 ♀ = 313	22.72 ±3.02	-	-	-	EDS	15.6%	• No differences in EA across gender • Athletes of individual sports are more prone to EA than athletes of team sports (d = 0.17)
10. De La Vega et al. (2016)	Mix	♂♀=174	NR	♂♀=139	NR	US	EAI	NR	• Athletes competing in international level had significantly higher EA scores than regional athletes (d = 0.36) and leisure exercisers (d = 0.63) • No differences observed between men and women

Table 4 (continued)

Authors	Sports	Sample size Sex	Mean age	Comparison group Sex	Mean age	Notes	Instrument	EA prevalence	Major findings
11. Zeulner et al. (2016)	Running, biking, triathlon	♂♀=528	NR	♂♀=503	NR	NS	EAI	2.7%	•No differences in EA scores observed between gender and level of competition
12. Conesa et al. (2017)	NS	♂=284 ♀=130	19.28±0.31	-	-	-	EDS	15.5%	•EA was positively related to competition and status motives of practice
13. Levit et al. (2018)	NS	♂♀=50	NR	♂♀=50	NR	US	EAI	14.9%	•No differences in EA scores between professional and amateur athletes
14. Orhan et al. (2019)	Kickboxing, Taekwondo, Muay Thai	♂=87 ♀=54	NR	-	-	-	EDS	13.5%	•No gender differences observed in the risk of EA
15. Reche et al. (2018)	Mix	♂=320 ♀=129	19.71±6.62	-	-	-	EDS	8.7%	•No gender and type of sports (individual-team) differences observed
16. Torstveit et al (2019)	Running, biking, triathlon	♂=53	35.30±8.30	-	-	-	EDS	NR	•"At risk' and "non at risk" group differed significantly in EDS subscales of withdrawal, tolerance, lack of control, reduction in other activities, and intention
17. Çetin et al. (2020)	Running	♂=55 ♀=19	21.91±2.80	-	-	-	EAS	NR	•Majority of participants belong to the "at risk" group of developing EA

Note: ♀ women, ♂ men, *BDS* Bodybuilding Dependence Scale, *CES* Compulsive Exercise Survey, *EA* Exercise Addiction, *EAI* Exercise Addiction Inventory, *EAS* Exercise Addiction Scale, *EDEAS* Exercise Dependence and Athletes Scale, *EDP* eating disorder patients, *EDS* Exercise Dependence Scale, *F* female, *FCA* fitness center attendees, *M* male, *NR* not reported, *NS* not specified, *US* university students

based on calculation from a figure (Fig. 1, pg. 67; Smith et al., 2010). The average prevalence rate reported in 11 studies can be closely estimated[1] to be 16.50%, with a range of 35.80%.

Above and beyond prevalence rates, a few studies compared the risk of EA in athletes to recreational exercisers. Smith and Hale (2004) found that competitive bodybuilders scored higher on the BDS than their non-competitive counterparts. Similar findings surfaced from a study on competitive and non-competitive runners (Smith et al., 2010). Weinstein et al. (2015) reported that professional athletes scored higher on the CES than leisure exercisers. However, Levit et al. (2018) reported no difference in EA risk between professional and amateur athletes. Further, Müller et al. (2015) found no difference in the risk of EA between athletes and patients suffering from eating disorders.

Correlates of EA in Athletes

Gender Differences Several correlates were associated with the risk of EA in athletes. Levit et al. (2018) found no difference in the frequency of EA between the sexes. This result is consistent with other studies that found no difference between male and female athletes in the risk of EA (Bingol & Bayansalduz, 2016; De la Vega et al., 2016; Orhan et al., 2019; Reche et al., 2018; Smith et al., 2010; Smith & Hale, 2004; Zeulner et al., 2016). However, two studies reported that female and male athletes might differ in their risk of EA. The results of these two investigations are contradictory. While Szabo et al. (2013) found that male athletes were at greater risk of EA than female athletes, McNamara and McCabe (2012) reported that female athletes were more at risk of EA than male athletes.

Biological, Social, and Psychological Markers McNamara and McCabe (2012) also reported biological, social, and psychological markers that differentiate athletes at risk of EA from those who are not at risk. The former had a significantly higher body mass index (BMI) than the latter. Further, those at risk of EA felt greater pressure from their coach and teammates while also reporting lower social support than athletes who were not at risk of EA. Finally, athletes at risk of EA had more maladaptive beliefs than those who were not at risk.

Type of Sports Two studies tested if the type of sport (individual sport versus team sport) is associated with the risk of exercise addiction, though the two offer contradicting results. While Bingol and Bayansalduz (2016) reported that athletes in individual sports are more prone to developing exercise addiction than team sports athletes, this finding was contradicted by Reche and colleagues (2018).

Motive of Exercising In an exploration of association between exercise addiction and exercise motive, Conesa and colleagues (2017) found that exercise addiction was positively correlated with the competitive and status motive of exercising. Those who were exercising at higher levels of competition, or had a higher perceived status, were more at risk of developing EA.

Competition Status The level of competition also seemed to affect the risk of EA. Youngman and Simpson (2014) found that triathletes who participate in the sprint category (the shortest)

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[1] Exact value cannot be determined because in one study, the prevalence rate is estimated from a graph (Fig. 1, pg. 67; Smith et al., 2010) study. However, the error may be less than one percent (1%).

had a lower risk of EA than participants who competed at Olympic, Half-Ironman, and Ironman levels. Similarly, De La Vega et al. (2016) found that athletes who competed at the international level scored higher on the risk of EA than athletes who competed in local/regional level or recreational exercisers. Further, Weinstein et al. (2015) found that competitive athletes scored higher on CES than recreational exercisers. Two other studies showed that competition status (competitive/professional vs. recreational/non-competitive) might contribute to the risk of EA in bodybuilders (Smith & Hale, 2004) and runners (Smith et al., 2010). Although it appears that competition status might impact the risk of EA in some sports, such claim should be treated with caution because contrary results also exist. For example, Levit et al. (2018) reported that competition status (professional and amateur) was not a significant predictor to the risk of EA when examining a sample of mixed athletes and exercisers.

Severity of Symptoms Recently, Torstveit and colleagues (2019) reported that athletes scoring higher on the risk of EA reported greater severity of withdrawal symptoms, tolerance, less control, reduction in time dedicated to other activities, and intention subscale than athletes with lower scores. This group also reported greater difficulty concentrating on the task at hand, increased exercise time, difficulty to stop exercising, and higher reduction of interest in other activities compared to the "low risk" group of athletes.

Obsessive and Harmonious Passion Akehurst and Oliver (2014) studied the relationship between dance addiction and passion for dance in 100 dancers. The authors tested whether EA involves high intrinsic interest toward dancing while being externally regulated (known as *obsessive passion*) or high intrinsic interest that is well integrated into aspects of the dancers' lives (known as *harmonious passion*). Their findings revealed that the risk of dance addiction was related to both types of passion, but the obsessive passion was more closely linked to EA ($r = 0.72$) than harmonious passion ($r = 0.42$).

Depression and Anxiety Weinstein and colleagues. (2015) observed that elite athletes showed different pattern of association between their EA scores and depression and general anxiety compared to recreational exercisers. Whereas recreational exercisers exhibited moderate association among EA scores and depression only, the elite athlete showed a strong association to depression symptoms and general anxiety.

Discussion

Despite the possibility of missing some articles, this literature review indicates that only a limited number of studies have assessed the risk of EA in athletes. These studies reported prevalence rates, stemming from heterogeneous samples, ranging from 2.7 (Zeulner et al., 2016) to as high as >40% in another study (Smith et al., 2010). The lowest rate is in accord with the results of a population-wide study (Mónok et al., 2012), while the estimated average risk of EA in athletes appears to be exaggerated (Szabo et al., 2015). Further, risk rates over 30% (McNamara & McCabe, 2012; Smith et al., 2010) simply make no sense. It is illogical to expect *one in three* athletes to become addicts (a psychological dysfunction!). Instead, as suggested by Szabo et al. (2015) and Szabo (2018), athletes are very likely to interpret the items on the EA-measuring instruments different from non-athletes. The two most popular

instruments, the EDS and EAI, were developed by testing non-athlete samples, which may be why athletes respond differently than non-athletes. Expecting a greater prevalence of EA in athletes—despite such findings emerging from this review—is also illogical on the grounds of *control*. While non-athletes can engage in escape behaviors, including exercise, when the urge arises, athletes train by following a *rigidly (and often externally) controlled schedule* that requires their personal life to be scheduled around their training regimen. Urges of addiction cannot be fulfilled on schedule. Therefore, these higher scores of risk of exercise addiction that were reported in the literature and are substantiated by the current literature review *must reflect something else than pathological tendencies*. Indeed, they may merely reflect keen passion, commitment, or dedication to the sport in which the athlete wants to excel, around which the athlete's life revolves. In accord with earlier calls for the reconceptualization of exercise addiction in athletes (Szabo, 2018; Szabo et al., 2015), we also advocate urgent action to identify the factors that contribute to a higher risk of EA scores in athletes than in leisure exercisers. The wrong interpretation of these scores may unfairly pathologize healthy and respectable athletes.

In the current review, we also found several correlates of EA in athletes. Those who reported higher EA symptoms were more likely to perceive more significant pressure from the coach, teammates, and other social sources (McNamara & McCabe, 2012). Similarly, Conesa et al. (2017) reported that the risk of EA increases with the level of competition. Now let us stop for a moment and evaluate these findings from the perspective of an elite athlete. The message of these findings is that the higher the level of your (the elite athlete's) athletic competition, the more likely you are to develop morbid exercise patterns. To prevent that, you need to control, refrain, or reduce your exercise (training regimen), or else you may become addicted. Absurd! Such a conjecture simply does not make sense. The higher level of athletic competition is probably mistakenly related to a higher risk of EA by an ambiguous relationship between the two. These high EA scores may not reflect any dysfunctional tendencies, like in leisure exercisers who use their exercise to run away from stress (i.e., Egorov & Szabo, 2013), but the increasing (with progressively increasing higher levels of athletic challenges) devotion and passion for achieving the best athletic performance. However, aspects of athletic training might also have secondary stress-mediating effects in this population.

A similar argument can be made concerning the higher severity of symptoms (Torstveit et al., 2019). Higher scores on the assessment instrument are "naturally" related to the greater severity of symptoms. An athlete giving a maximum rating on salience (i.e., "Exercise is the most important in my life." EAI; Terry et al., 2004) simply and proudly declares that her/his life revolves around her training regimen that is a lifegoal, the very hard work toward the uttermost achievement for which she/he trains for long hours every day. It is normal that salience will increase with the level of competition in the life of an athlete, but high salience in a leisure exerciser may indeed reflect an abnormal relationship to the adopted exercise behavior.

The results of this review also suggest that obsessive passion (Akehurst & Oliver, 2014) and depressive symptoms (Weinstein et al., 2015) may be linked to the risk of EA in athletes. However, the study with dancers (Akehurst & Oliver, 2014) also showed a relationship to harmonious passion. In our view, high obsessive passion paired with high harmonious passion reflects the absolute commitment and enjoyment of the activity. Still, there are insufficient results in athletes concerning the relationship between the risk of EA and passion. Concerning depressive symptoms, again, it is one study that disclosed a relationship with the risk of EA.

This study comes from a unique sample recruited in a nation at constant risk of war, which may predispose one to gravitate toward athletics for anticipated support, reassurance, safety, and escape from chronic stress. More research is needed to evaluate the nature of the relationship between the risk of EA and depression in athletes.

A limitation of the study is related to searching for the terms "athlete" and its derivatives. We may have missed studies that examined athletes but called them in sport context names. For example, judo athletes can be called judokas, or baseball athletes can be called baseball players. Studies that did not use the word athlete, or one of its derivatives, were probably missed. The delimitations set by the authors (Table 1) may also be considered as limitations. Further, we did not search research papers on Scopus and SportDISCUS, which potentially could have added more articles eligible for inclusion. Finally, we opted not to conduct a meta-analysis because of the heterogeneity of the few studies, but this method could have added further information.

Conclusions

The prevalence of the estimated risk of EA in athletes appears to be far higher than that reported in a population-wide study for both the general and the habitually exercising population (Mónok et al., 2012). Despite this conclusion stemming from the current review, these findings should be given serious conceptual consideration because addictive behaviors are destructive and urge- or craving-initiated. In contrast, athletic training is constructive, and it is performed according to a carefully designed and *scheduled* training regimen. All the 17 studies included relied on questionnaires, and none was complemented by interviews. There is at least one study reporting that the questionnaire data can project an artificially high risk of EA, which is not supported by the interview record (Szabo, 2018). Both motives to compete and participate in higher levels of competition were positively associated with EA in some of the studies. However, this relationship may reflect the athletes' passion and dedication to the chosen sports, as disclosed by a strong relationship between passion and EA in a study with dancers (Akehurst & Oliver, 2014). Overall, the conceptualization of EA in athletes should be urgently revisited because the here disclosed high risk of EA in athletes might never materialize in pathological exercise addiction. Indeed, currently, these authors are not aware of any published case of exercise addiction in an elite athlete who competes at a professional level for a sports club and/or athletic association. In these settings, mentors, coaches, and fellow athletes would—most likely—recognize the signs of the dysfunctional behavior in time and provide or ask for help if needed.

Declarations

Conflict of Interest The authors declare no competing interests.

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