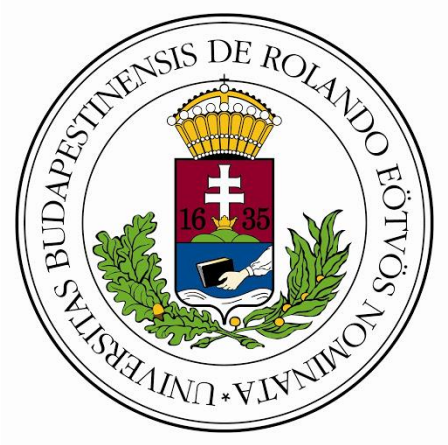

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DOCTORAL (PHD) DISSERTATION

THESIS BOOKLET

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Studies on the determinants of exercise addiction

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Studies on the determinance of exercise addiction

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General Introduction

The positive role that physical exercise can play in the prevention and treatment of a variety of medical conditions has received a great deal of attention over recent years, with numerous high-profile reports supporting the popular message that exercise is beneficial for your health. An active lifestyle has many health benefits (Bellocco et al., 2010; Lee et al., 2011). Several comprehensive reviews of exercise psychology literature have been published in the past decade, providing positive, although cautious support for the role that exercise can play in the promotion of positive mental health. This optimism is based on the growing number of controlled studies that have identified the positive effects of exercise (Scully et al., 2016). Regular physical activity and sport are also linked to better mental health and play an important role in the treatment of mild to moderate mental illnesses, especially depression and anxiety (Clow & Edmunds, 2013). Paradoxically, both sports and exercise could become a source of stress (Stevens et al., 2013). The need to exercise in increasingly higher volumes could become compulsive, leading to losing control over the activity. This transformation results in dysfunctional behavior, referred to as "exercise addiction" in the scholastic literature (Szabo, 2010; Szabo, Griffiths, Marcos, Mervó, & Demetrovics, 2015). Other synonyms used in the literature include "exercise dependence" (Adams, 2009), "compulsory exercise" (Murray et al., 2012), "obligatory exercise" (Thome & Espelage, 2007), and "exercise abuse" (Calogero & Pedrotty, 2004).

Sport as a coping technique

Stress is a serious challenge for everyone in everyday life. Sport was shown to be a type of coping strategy. In addition, several studies have found that exercise tends to influence stress responses (Scully et al., 2016).„In contrast to studies/ research on alcohol and drug abuse. The alcohol or drug users, in this case, the fundamental benefits of sport, are often emphasized too. Morgan, (1979) also cited numerous examples of runners who continue to run despite circumstances that suggest they should reduce or have time off from running. Several authors have also suggested that excessive exercise may serve as a defense against paralyzing depression, self-punishment, or as a way to cope with negative emotions such as anxiety, anger, or depression (Garner et al., 1983).

Definition of Exercise Addiction

Glasser (1976) believed that too much of a good thing is better than too much of a bad thing. Therefore, he describes the term positive addiction in the scientific literature to represent the personally and socially beneficial aspects of consistent and sustained exercise behaviour, in contrast to some self-destructive behaviours such as drug or alcohol abuse. Indeed, many athletes, for example many runners, claimed to be addicted to running when they were simp deeply committed to their chosen sport. Morgan (1979) has acknowledged that as a semantic issue, and in order to discuss the negative aspects of excessive exercise behaviour, he introduced the term "negative addiction", as opposed to Glasser's "positive addiction". Commitment to exercise is a measure of how devoted an individual is to activity. It is a measure of one's commitment to a healthy and beneficial activity that is part of one's daily life. During the activity, a committed person feels satisfaction, enjoyment andstrives to achieve happiness. This person is motivated by the thought, "This is good for me" Sachs (1981). believed that commitment to exercise stems from an intellectual analysis of the rewards gained from the activity, including social status, health, prestige, or even financial gains. The key point (main argument) is probably that committed exercisers control their activity rather than being controlled by it (Johnson, 1995). On the other hand, when feelings have more obsessive aspects, the negative aspects of too much (excessive) activity emerge. In Godman's (1990) view, addiction is a behavioural process that could provide pleasure /gratification or relief from internal discomfo. It is characterized by repeated failure to control and maintain that behaviour despite significant negative consequences. The key term is withdrawal symptoms, which occurs when an individual feels "I cannot stop", so the obstructive factor is not sports injuries or other aspects. According to Sachs' (1981) definition, committed exercisers (1) engage in exercise for extrinsic rewards, (2) consider their exercise an important but not central part of their lives, and (3) may not suffer from severe withdrawal symptoms when they are unable to exercise for some reason. In contrast to this, addicted exercisers are (1) more likely to exercise for intrinsic rewards, (2) view exercise as a central part of their lives, and (3) experience distressing feelings of deprivation when they are unable to exercise (Sachs, 1981). Szabo (1995) suggested that addicted exercisers experience more severe withdrawal symptoms than committed exercisers. A more thorough/ detailed way to distinguish between the two may be via the individuals' actions and motives for exercise, for example, Sachs' classification (1981). It is important to draw a separating

line between healthy committed exercisers and unhealthy "at risk" exercisers, as those addicted to exercise engage in exercise/activity that negatively alters their lifestyle, causing physical, medical, financial or social problems.

Exercise Addiction Symptoms

Griffiths (1996, 1997, 2002, 2005) redefined Brown's 'General Components of Addictions' theory (1993) and adapted them to behaviours such as exercise, gambling, sex, and internet addictions. This model includes the following six components.

1. *Salience*
2. *Mood modification*
3. *Tolerance*
4. *Withdrawal symptoms*
5. *Conflict*
6. *Relapse*

Behaviour Addiction and Exercise Addiction

Exercise in appropriate quantity and of proper quality redounds significantly to the improvement of an individual's health. Excessive exercise, on the other hand, may be harmful to one's health. The term "exercise addiction" is becoming widely used to describe the latter phenomenon. Although exercise addiction is not currently recognized in diagnostic systems, it is important to include it among other disorders. Based on the previously mentioned diagnostic value symptoms, exercise addiction is classified as a behavioural addiction and has similar characteristics to gambling and shopping addictions (Demetrovics and Kurimay, 2008). Accordingly, among other behavioural and mental disorders, exercise addiction can be well described within the obsessive-compulsive spectrum. According to Hollander, the disturbances treated in the diagnostic systems and those observed outside of the DSM systems indicate similar characteristics. Based on these similarities, he created a spectrum based on common pathologies (obsessive disorder) and repetitive, compulsive traits where such behavioural disorders can be classified. Exercise addiction can also be best characterized on this spectrum. The researcher classified exercise addiction as an impulse-control disorder (ICD).

Gambling, shopping disorders, and sexual compulsion can all be found in this category (Hollander, 1993).

Assessment of Exercise Addiction

Although symptoms are important in assessing health conditions, exercise addiction is a combination of co-occurring symptoms and is a more precise index of maladaptive exercise. Some exercise addiction questionnaires, that are based on common symptoms, assess a certain level of addiction. However, these scores only show the degree of the *risk of* exercise addiction rather than positively diagnose the condition. I will briefly present the one most commonly used psychometrically validated questionnaire for assessing exercise addiction.

1. *Exercise Addiction Inventory EAI (Terry, Szabo and Griffiths, 2004)*

This is the shortest psychometrically validated questionnaire to date. It can be found in only six statements that correspond to Griffith's six-symptom model of addiction. Each statement had a five-point Likert response option. The statements were coded so that high scores reflected the characteristics of addictive exercise behaviour
: 1 = "strongly disagree", 2 = "disagree", 3 = "neither agree nor disagree", 4 = "agree", 5 = "strongly agree". The six statements that comprise the inventory are: 1) "Exercise is the most important thing in my life (salience), 2) "Conflicts have arisen between me and my family and/or my partner about the amount of exercise I do" (conflict), 3) "I use exercise as a way of changing my mood" (mood modification), 4) "Over time I have increased the amount of exercise I do in a day" (tolerance), 5) "If I have to miss an exercise session I feel moody and irritable" (withdrawal symptoms), and 6) "If I reduce the amount of exercise I do and then start again, I always end up exercising as much as I did before" (relapse). The EAI cut-off score for exercisers considered at risk of exercise addiction (REA) is 24. This score represents individuals whose scores are in the top 15% of the total scores. Individuals with a score of 13 to 23 were chosen to represent a potentially symptomatic person, and those with a score of 0 to 12 were chosen to represent an asymptomatic individual. The internal reliability of the original scale was high (α = .84) and ts concurrent validity was low r = .80. The EAI is the most commonly used and shortest questionnaire aimed at the assessment of the REA. I will use this tool to reveal some correlations of exercise addiction in my research.

Passion

Exercise addiction is often confused with "commitment" to exercise (Szabo, 2010), which entails passion and dedication to activity. McLaren (2007) warns that although exercise addiction is related to the volume of exercise, the latter is not an indicator of addiction. Passion for an activity is a concept that refers to engaging in a specific activity that one finds important and in which one invests time and energy. Research suggests that the risk of exercise addiction (REA) increases with the level of sport competition. Szabo et al. (2013) found that elite ultramarathon runners reported higher levels of exercise addiction than university athletes. Similar results were found for competitive and recreational runners (Pierce et al., 1993) as well as for professional and amateur triathletes (Blaydon and Lindner, 2002). In this study, competitive athletes reported higher levels of exercise addiction than the latter. In line with the recent argument, these differences may not demonstrate greater psychological morbidity in athletes compared to non-athletes, but I need to examine the reason for this difference.

"*Passion toward an activity is motion that refers to engaging in a beloved activity that one finds important and invests time and energy into."* (Ricardo de la Vega, 2016). Vallerand et al. (2003) presented a dual model of passion that includes harmonious passion and obsessive passion. According to some research, passion toward an activity surfaces when a person enjoys the activity, freely chooses it, and/or wishes to take part in it, as well as internalizes the activity into the self. Harmonious passion (HP) occurs when the activity is internalized into the self in an autonomous mode, when one engages in the activity flexibly, which is positively associated with positive affect, while it is negatively associated with negative affect (Stenseng, Rise, & Kraft, 2011; Vallerand et al., 2003; Vallerand et al., 2006; Vallerand & Miquelon, 2007). Obsessive passion (OP), on the other hand, emerges when one internalizes the activity in a controlled way, when participation is rigidly controlled, which is positively related to negative affect (Stenseng et al., 2011; Vallerand et al., 2003; Vallerand et al., 2007; Vallerand & Miquelon, 2007). Additionally, an obsessively passionate individual attaches great importance to activity contingencies such as self-esteem and escape from difficulties (i.e., stress), making it difficult to stop the passionate activity (Vallerand, 2010).

Passion and Exercise Addiction

The scholastic literature connects exercise addiction and passion. OP has been positively associated with exercise addiction in endurance sports and other recreational physical activities (Schipfer & Stoll, 2015; Stenseng et al., 2011). That was shown that OP is linked to all dimensions of exercise addiction (time, reduction in other activities, tolerance, withdrawal, continuance, intention effects, and lack of control), whereas HP was only related to time and tolerance (Paradis, Cooke, Martin, & Hall, 2013). Moreover, it was discovered that harmoniously passionate exercisers could increase the time spent on exercise without decreasing the time spent on other important life activities, whereas obsessively passionate exercisers spend an excessive amount of time on exercise while taking time away from/ neglecting other important life activities (Paradis et al., 2013). The gist of these studies was reinforced by a Greek study that demonstrated that OP bears a stronger relationship to exercise addiction than HP (Parastatidou, Doganis, Theodorakis, & Vlachopoulos, 2014).

The link between exercise addiction and passion as a function of the athletic level of competition was explored by examining a large sample of low and high-level competitive athletes and non-competitive leisure exercisers (De La Vega, Parastatidou, Ruiz- Barquin, & Szabo, 2016). The findings of de la Vega and his colleagues (2016) revealed that OP was a strong predictor of exercise addiction, predicting 37% of the total variance in the latter. In contrast, HP was not a significant component in the model. While athletes in formal competitive sports scored higher than leisure exercisers on all measures, no differences between exercise addiction and passion were disclosed between athletes competing at low and high levels. Finally, De La Vega et al. (2016) showed that athletes participating in team sports reported greater harmonious and obsessive passion levels than those taking part in individual sports.

Predictors of the Risk for Exercise Addiction and Passion

Motivation has been shown to be one of the key factors influencing behaviour (Fortier, Vallerand, & Guay, 1995), so it is reasonable to assume that athletes' motivations for engaging in sports might underlie their passion for sports and their risk for exercise addiction (REA). Following the well-established conceptual model of self-determination theory (SDT; Ryan & Deci, 2017), I can distinguish between intrinsic motivation (i.e., doing sports for the enjoyment and pleasure derived from it) and four

types of extrinsic motivation ranging from the more autonomous to the more controlled, including integrated (i.e., doing sports is congruent with one's values and self), identified (i.e., doing sports is personally valued), introjected (i.e., doing sports due to internal pressures), and external regulations (i.e., doing sports due to external pressures). Finally, amotivation refers to the complete lack of motivation and intention to perform exercises. Typically, more autonomous motivations (intrinsic, identified and integrated motivations) have been associated with positive outcomes, while controlled motivations (introjected, external and amotivation) with negative outcomes (Ryan & Deci, 2017).

Passion and Cultural Differences

The Collective Constructionist Theory (Kitayama, Markus, Matsumoto, & Norasakkunkit, 1997) suggests that day-to-day situations vary among cultures and generate specific learned expectations by yielding distinct psychological frameworks that systematically vary from culture to culture. People who adhere to their acquired cultural values and social expectations exhibit behavioural tendencies consistent with those values and expectations. Cultural differences in passion have indeed been shown to exist in romantic relationships, social life, risk-taking, and gastronomy (Aaker, Benet-Martinez, & Garolera, 2001). Cultural differences also exist in the strength of compliance with socio-political norms (Gelfand et al., 2011) and in the patterns of physical activity across nations (World Health Organization Regional Office for Europe, 2016a, 2016b).

Passion for a sport or exercise reflects the extent to which individuals value that activity, devote substantial time and energy to it, and enjoy it (Vallerand, 2015). Vallerand et al. (2003) previously proposed a dual model of passion that comprises obsessive and HP. The surfaces when the activity is internalised into the self in an autonomous mode; when the individual engages in the activity with flexibility. It is positively related to positive affect, while being inversely associated with negative affect and self-compassion (Stenseng et al., 2011; Vallerand et al., 2003). The role of passion for sports and exercise has received a great deal of research attention in recent years. Knowledge about the effects of culture on the passion-exercise relationship is important in interpreting the findings of this and future studies. Moreover, for cultural reasons, gender roles and gender schema vary between men and women as well as across nations. Thus, gender, as a possible moderating factor in passion for exercise,

also merits explicit attention (Seguin Levesque et al., 2003; Office for Europe, 2016a, 2016b). It was reported that Italian football fans exhibited higher levels of OP and HP than French supporters (Vallerand et al., 2008), but these results cannot be applied to individuals' physical activity. Therefore, other researchers have speculated that there may be cultural differences in passion concerning physical activity based on research evidence and the Collective Constructionist Theory (Philippe, Vallerand, & Lavigne, 2009). To the best of my knowledge, no previous study has examined obsessive and HP in physical activity in a cross-cultural context, which is significant as it could moderate the interpretation of research findings on passion for exercise.

Passion and Gender

Some research has indirectly examined gender differences related to passion in physical activity. These studies have generally shown that there are no gender differences in exercise passion (De La Vega, Parastatidou, Ruiz-Barquin, & Szabo, 2016; Donahue, Rip, & Vallerand, 2009; Parastatidou et al., 2012; Stenseng, 2008), but such differences in passion related to other activities have been reported such as towards internet use (Seguin-Levesque et al., 2003). Gender may have an impact on passion in some activities, but not in others. Nevertheless, the *specific* testing of gender differences in obsessive and harmonious passion in physically active people is warranted (Philippe et al., 2009). According to this theory and past research in other domains, cultural differences and gender could influence research outcomes on passion.

Objectives of the current dissertation

1. The first study aims were to replicate recent findings in the area, which show that while HP is a good predictor of the REA, it has a small association (3-4%) with the latter.

2. The second study's objective was to confirm recent results in the field showing that HP is an indicator of REA but has only a minor impact on it. This research will add to previous studies by clarifying whether exercisers who participate in more sports have higher REA, exercise speed, and both OP and HP.

3. The third goal was to investigate the relationship between REA and exercise frequency in high- and low-exercise volume groups using two tests, one with and one without enthusiasm, as a covariate

4. In The fourth study's objective was to assess whether there are cultural and gender differences in OP and HP among people who engage in regular physical activity.

Should differences emerge, researchers should avoid extrapolating results from studies conducted in a single country. Further, knowing that certain people appear to be more passionate or feel more HP or OP for exercise may shed light on motivational aspects and commitment to exercise and provide insight into the etiology of exercise dependence.

5. Finally, I intended to show that a single weekly 90-minute training session increases enthusiasm and REA. This work aimed to show that motivation plays a role in the observed results as a partial mediator. Although the rise in passion is theoretically sound, the rise in REA could represent a conceptual misinterpretation of evaluation tool items and responses, rather than just the rise in OP.

Does Passion Predict Exercise Addiction? A Survey Within Team- and Individual Sports

Method: Athletes (n=190, 59% women, age=22.94±SD=4.64 years) represented six sports, three team- (cheerleading, soccer, and basketball; n=92) and three individual sports (running, gymnastics, and kettlebell; n=98). Participants completed the Exercise Addiction Inventory and the Passion Scale.

Results: A regression analysis revealed that obsessive- and harmonious passion were strong ($p<.001$) predictors of exercise addiction and together accounted for 39% of the variance in it. Separate regressions for team and individual sports, revealed that passion accounted for 25% of the variance in exercise addiction in the former, but for twice as much in the latter (50%). However, in both cases, harmonious passion had a weak contribution (4-3%). The prevalence of exercise addiction were identical (15%) in the two groups. Athletes in team sports scored higher on harmonious passion than those in individual sports ($p<.001$). All psychological measures correlated with the weekly hours of exercise ($p<.001$), which was not a predictor in the model for exercise addiction.

Means and standad deviatons in brackets F and p values (in brackets) and effects sizes (partial ETA squared) for three dependent measures.

	Team sport	Individual sport	F, p	ηp^2
Exercise addiction	20.80. (3.21)	19.99 (3.47)	0.05 (.817, NS*)	.000
Obsessive passion	25.42 (5.01)	22.74 (6.62)	2.31 (=.130, NS*)	.012
Harmonious passion	36.35 (2.96)	32.32 (5.94)	17.29 (< .001)	.086

*Note: NS = Not Significant

Conclusions: The findings support the emerging empirical results suggesting that obsessive passion largely determines exercise addiction. They expand the extant knowledge by distinguishing the predictive power of obsessive passion within team- and individual sports. The study also replicates recent findings revealing that athletes in team sports report greater harmonious passion than those practicing individual sports.

The Role of Passion in Exercise Addiction, Exercise Volume, and Exercise Intensity in Long-term Exercisers

Method: Respondents (n=360) completed the Exercise Addiction Inventory, Passion Scale, and Borg Scale, and reported their exercise volume.

Results: Regression analysis demonstrated that exercise intensity, obsessive passion, and harmonious passion were significant predictors (r^2 =.381, p<.001) of the REA with obsessive passion being the strongest predictor (r^2 =.318). Exercisers classified as at REA reported higher obsessive passion, harmonious passion, and exercise intensity ($p\leq$.001) than those classified as symptomatic, who in turn scored higher on these measures ($p\leq$.006) than asymptomatic exercisers. Participants reporting greater volumes of exercise also scored higher on obsessive passion, harmonious passion (p<.001), exercise intensity (p=.032), and REA (p=.042) than individuals who exercised less. Finally, women exercising between low and high intensities exhibited greater obsessive passion and harmonious passion ($p\leq$.005) than men reporting similar exercise intensities.

Means (M), standard deviations (SD) and statistically significant differences between high (n = 202) and low (n = 158) exercise volume groups in four dependent measures (df = 1, 356).

Dependent measure	High exercise volume ($M \pm SD$)	Low exercise volume ($M \pm SD$)	F	p	η_p^2	Power (1 - β)
Obsessive passion	24.15 (6.10)	20.84 (6.46)	16.98	< .001	.046	.984
Harmonious passion	35.02 (4.31)	31.72 (5.68)	29.9	< .001	.078	1.000
Exercise intensity	8.22 (1.21)	7.77 (1.42)	4.62	= .032	.013	.572
Risk for exercise addiction	16.94 (4.09)	15.78 (4.09)	4.15	= .042	.012	.528

Concluison: These findings support the recently reported relationship between passion and REA. They also expand the current knowledge by demonstrating that obsessive passion and harmonious passion are greater in the individuals who exercise at higher volumes and with higher intensities of exercise.

When Passion Appears Exercise Addiction Disappears: Should Hundreds of Studies Not Considering Passion be Revisited?

Methods: By merging the data from two studies (Kovacsik et al., 2018a,b) the total number of cases included in the current re-analysis was 591. However, after grouping based on exercise volume, by using a median split and excluding the cases falling right on the median (*Mdn* = 6), the final sample size was 495 (277 men and 217 women). The instruments used to assess exercise addiction, obsessive- and harmonious passion are described in detail in the original studies (Kovacsik et al., 2018a,b). Briefly, the two instruments used were: 1) the Exercise Addiction Inventory (EAI; Demetrovics, & Kurimay, 2008; Terry et al., 2004) and 2) the Passion Scale (PS; Marsh et al. 2013; Orosz, Vallerand, Bőthe, Tóth-Király, & Paskuj, 2016).

Results: High- and low exercise volume groups differed in exercise addiction even after controlling for age and gender ($p < .001$). However, after adding obsessive- and harmonious passion as continuous predictor variables, the statistical significance vanished, whereas both predictors emerged to be significant ($p < .001$).

Result of two Bootstrap (1000 Bootstrap samples) ANCOVAs for the risk of exercise addiction scores comparing high- and low exercise volume groups. In the upper part (A) obsessive- and harmonious passion are taken into consideration, while in the lower part (B) they are used as continuous predictor variables (covariances)

					Bootstrap Confidence Intervals (95%)	
	Statistic		Bias	Standard Error	Lower	Upper
A. Covariantes: age, gender						
High exercise volume group	Mean	18.78	-.003	.297	18.16	19.37
	SD	4.44	-.014	.203	4.01	4.83
Low exercise volume group	Mean	1.68	.011	.266	16.18	17.24
	SD	4.24	-.010	.176	3.88	4.56
Covariantes are: age, gender, obsessive passion, harmonious passion						
High exercise volume group	Mean	18.78	.0012	.297	18.19	19.36
	SD	4.44	-.021	.203	4.01	4.81
Low exercise volume group	Mean	1.68	.011	.263	16.14	17.17
	SD	4.24	-.016	.172	3.87	4.55

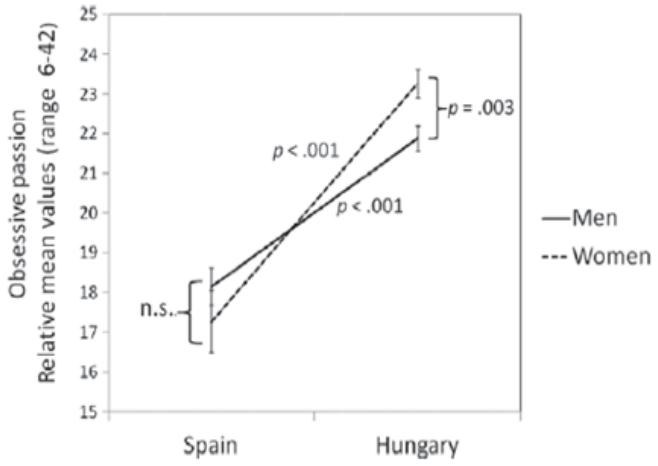
Conclusion: Further, when controlling for the effect of passion, the correlation between exercise addiction and weekly exercise volume emerged to be negative. Therefore, a conceptual confound between the presumed risk for exercise addiction and passion could render the results of several hundreds of published works questionable.

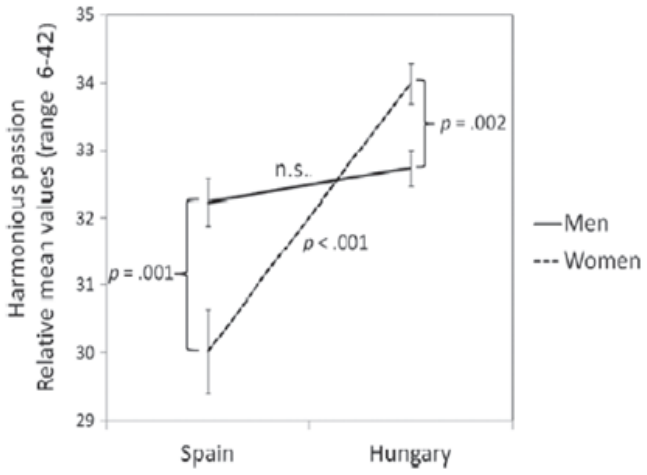
The current findings send an important message to scholars in the field: Studying exercise addiction without controlling for passion could yield false results.

Obsessive and harmonious passion in physically active Spanish and Hungarian men and women: A brief report on cultural and gender differences

Methods: Using a nation by gender between-participants design, this study examined differences in obsessive- and harmonious passion in Spanish and Hungarian physically active individuals. Participants (*n*=1002) completed the Passion Scale, reported their gender, age, and weekly hours of physical activity.

Results: Multivariate analysis of covariance revealed that the experiencing of physical activity-related obsessive- and harmonious passion differed between the two countries, and Hungarian women scored significantly higher on harmonious and obsessive passion than Spanish women. However, Hungarian men scored significantly higher on obsessive passion, but not harmonious passion than Spanish men.





Conclusion: The present study suggests that there are cultural and gender differences related to passion in physically active people. Although cultural differences in obsessive- and harmonious passion were not examined in the context of physical activity, such differences may be expected since passion is not independent of the social–cultural environment (Aaker et al., 2001; Burke et al., 2015). These findings seem to indicate that Hungarian women, in general, are more passionate about their sport and exercise than their Spanish counterparts, while Hungarian men only exhibit greater obsessive passion than Spanish men. Such differences reveal the importance of studying passion with a view on the possible moderating role of culture,even though the constituents could not be identified in this preliminary investigation.

Development of Exercise Addiction and Passion in Newly Adopted Sports: A Longitudinal Investigation

Methods: The research was conducted at a large university's athletic club[1] incorporating nine organized sports (aerobics, badminton, basketball, cheerleading, futsal, kettleball, running, tennis, and volleyball). Systematic randomization was used to solicit beginners starting up one of the nine extracurricular sport activities. In total 149 eligible volunteers (53 men and 96 women; mean age = 21.08, SD = 2.98 years) completed the study. Three psychometrically validated questionnaires, described below,

[1] *Information withdrawn for anonymity.*

were completed three times during the 12-week long study. The Exercise Addiction Inventory (Terry, Szabo, & Griffiths, 2004), Passion Scale (Marsh et al., 2013), Sport Motivation Scale II (SMS-II; Pelletier, Rocchi, Vallerand, Deci, & Ryan, 2013). At the start of the study, hereafter referred to as *baseline*, participants read and signed the written informed consent form, answered the demographic questions, and completed the three questionnaires in their natural training environments before their scheduled training. Four and 12 weeks later they completed the three questionnaires again. Names were replaced with codes which were used for electronic recording of the data. One experimenter entered and verified the data and another experimenter re-verified them again before subjecting them to statistical analyses. For model evaluation, commonly used goodness-of-fit indices were interpreted: the comparative fit index (CFI), the Tucker–Lewis Index (TLI), and the root mean square error of approximation (RMSEA) with its 90% confidence interval.

Results: Latent growth modeling showed that REA and passion were high at baseline and showed a slight increase over the 12 weeks. Motivational factors predicted passion, whereas REA was predicted by gender, team sport participation, exercise intensity, and identified motivation.

Goodness-of-Fit Statistics for the Estimated Models.

	χ^2	df	CFI	TLI	RMSEA	90% CI of RMSEA	SRMR
Unconditional Latent Growth Models							
Harmonious passion	8.555*	2	.969	.954	.148	.057-.257	.036
Obsessive passion	10.313*	2	.960	.939	.167	.077-.274	.042
Passion criteria	0.449	1	1.000	1.010	.000	.000-.188	.006
Risk of exercise addiction	2.042	1	.990	.969	.084	.000-.252	.022
Conditional Latent Growth Models							
Harmonious passion	16.978	12	.986	.961	.053	.000-.106	.025
Obsessive passion	30.702*	12	.953	.870	.102	.058-.148	.030
Passion criteria	8.392	12	1.000	1.025	.000	.000-.060	.025
Risk of exercise addiction	8.340	11	1.000	1.039	.000	.000-.068	.027

Conclusion: The current study shows that a single weekly session of 90 minutes of training results in a modest, but statistically significant increase in passion and the risk for exercise addiction (REA). Motivation is a partial mediator in the observed effects. While the rise in passion is theoretically sound, the rise in REA could reflect a conceptual misinterpretation of the items and responses on the assessment tools and not merely the rise in obsessive passion (OP), which shares a relatively large proportion of the variance with the REA in committed or long-term exercisers, but less so in beginners, as shown in the current work. This longitudinal inquiry shows that OP and REA are independent constructs in the early stage of exercise. The disputed 'evolutionary' aspect of REA (Egorov & Szabo, 2013) gains support in the current work. It is unlikely that a single session of weekly training increases the REA, despite the fact that this is the message of the current results. This dilemma raises an important question for the many scholars working in the field concerning the REA's conceptualization and the assessment tools' internal validity (Szabo, 2018).

General Discussion

Passion and Exercise Addiction

The first key finding emerging from the current dissertation is that obsessive passion (OP) is a significant component of exercise addiction, especially in individual sports. Athletes in organized team sports report greater harmonious passion (HP) than athletes in individual sports. This dissertation also demonstrates that the weekly amount of exercise needs to be taken into account when examining the link between passion and exercise in organized sports. The shared variance is relatively high (15%) and there is no distinction when comparing participants in team sports with participants in individual sports.

The dissertation replicates the recently obtained results by De La Vega et al. (2016). Similar to their findings, my results show that OP is a significant component of exercise addiction scores as determined by the Exercise Addiction Inventory (EAI) (Terry et al., 2004). In fact, OP determines more than one-third of the variance (37% in de La Vega et al. and 34% in the current work) in exercise addiction. These results

corroborate past reports linking Obsessive Passion (OP) to exercise addiction (Paradis et al., 2013; Schipfer & Stoll, 2015; Stenseng et al., 2011). They also agree with the results obtained by Parastatidou et al. (2014), which show that OP demonstrates a more substantial relationship to exercise addiction than HP. Indeed, in the De La Vega et al. study, HP was not a significant predictor of exercise addiction. In the current dissertation, despite statistical significance, it accounted for only 3% of the variance in the dependent variable. Therefore, while OP and exercise addiction overlap to a large extent, the latter is relatively independent of HP. In this dissertation the results showed that OP predicted the risk of Exercise Addiction. Therefore, it is very important to use the Passion Scale (to determine passion) when examining the risk of exercise addiction.

Passion and the Risk of Exercise Addiction

In this dissertation it was found that OP and HP increase along with the levels of REA classifications (Terry et al., 2004). This finding shows that apart from a mere correlation between passion and the REA (which occurs stronger for OP than for HP), passion scores parallelthe REA. These findings may suggest that what today is conceptualized as 'risk' for exercise addiction may be a complex yet untangled hybrid of exercise parameters and passion.

Long term, Intensity and the Risk of Exercise Addiction

The prevalence of REA in my work was 4.2% and this value is similar to the values reported elsewhere in the literature for leisure exercisers ranging from 1.9% to 3.2% (Szabo et al., 2015). However, it is lower than that reported for athletic populations ranging between 17.0% and 41.4%. (Blaydon & Lindner, 2002; Costa, Hausenblas, Oliva, Cuzzocrea, & Larcan, 2015; McNamara & McCabe, 2012). My results echo the findings from previous research, showing that long-term and high-intensity exercise are related to both forms of passion (Parastatidou, et al., 2012; Vallerand et al., 2003). In my dissertation, I have found that exercise intensity has a different relationship with HP and OP in individuals with a long-term exercise history.

Exercise Volume, weekly hours and Risk of Exercise Addiction

In my dissertation, the weekly hours of exercise correlated with all psychological measures in the first study. The second study I have seen that more sport,

higher OP, HP Exercise Intesity, REA. The high and low exercise volume groups differed in EAI after controlling for age and gender in my third study. My study shows that if passion for exercise is not considered, researchers obtain significant differences in the *presumed* REA between those who spend about 10 hours exercising each week versus those who exercise less than half of that. Such results prompt scholars to conclude that higher-volume exercise is linked to increased REA, which is in line with the basic conceptualization of exercise addiction (Lichtenstein, Larsen, Christiansen, Støving, & Bredahl, 2014; Terry et al., 2004), but it contradicts the theories that propose a revolutionary, rather than an evolutionary model for exercise addiction (Egorov & Szabo, 2013). There was a slight but statistically significant *positive* correlation between the weekly hours of exercise and the risk scores for exercise addiction, which is in line with earlier reports in the literature reporting a positive association between exercise volume and exercise addiction in my dissertation. (Allegre, Therme, & Griffiths, 2007; Costa, Hausenblas, Oliva, Cuzzocrea, & Larcan, 2015; Terry et al., 2004). Suppose more exercise is associated with a lower REA when controlling for passion. In that case, one can simply conclused that the higher scores in the direct (uncontrolled) correlation reflect the impact of passion. This correspondence fully agrees with the main analysis results demonstrating that differences in the REA between high and low exercise volume groups exist, when passion is used as a continuous predictor variable. Passion, however, differentiates between high and low exercise volume groups, suggesting that those who exercise longer hours have a greater passion for exercise. These findings agree with the conjecture that training volume does not reflect addiction to exercise (Szabo et al., 2015). Indeed, I have seen this connection in my dissertation's third study, in which the relationship between the REA and weekly exercise volume emerged to be a negative.

Cultural and gender differences related to passion

A novel and unexpected finding in the dissertation was that women reported greater passion when they exercised below the median value of the reported range of exercise intensities than men exercising the same intensity. These findings contradict reports in the literature that show no gender differences in passion (Philippe, Vallerand, & Lavigne, 2009; Vallerand et al., 2008).

My finding in the dissertation is that by adding OP and HP as covariates to the model, the statistical significance of the difference in the risk scores for exercise

addiction between high and low exercise volume groups disappears. However, the two covariates emerged as statistically significant predictor variables even after gender and age control.

The cultural and gender differences were related to passion in physically active people. Although cultural differences in OP and HP have not been examined in the context of physical activity, I expected such differences since passion depends on the socio-cultural environment (Aaker et al., 2001; Burke et al., 2015). In the dissertation's results, physically active Hungarian women and men scored higher on OP than their Spanish counterparts. In terms of HP, men from the two countries did not differ from each other, whereas Hungarian women scored higher on HP than their Spanish counterparts. While further research is required to determine which cultural aspects are responsible for the differences observed here, passion for exercise appears to be different in the two nations compared, except for HP in men, which did not differ between the Spanish and the Hungarians. In my dissertation seem to indicate that Hungarian women, in general, are more passionate about sport and exercise than their Spanish counterparts, while Hungarian men exhibit only greater OP than Spanish men.

Furthermore, the results revealed gender differences in both OP and HP. Hungarians scored higher than the Spanish, this finding cannot be explained by the difference in exercise patterns between the two populations (World Health Organization Regional Office for Europe, 2016a, 2016b), since in the current example, the Spanish exercised more than Hungarians. Although this may sound contradictory to population exercise patterns, it is plausible that those who exercise do it more intensely in Spain than in Hungary. However, the difference is more likely due to the age difference between the Spanish (older) and Hungarian sample, based on the inverse relationship between age and both forms of passion.

Longitudinal Study

Starting a new sport could provide athletes new experiences and opportunities, which in turn might lead to a potential increase or decrease in passion for sport and in REA. Therefore, it is essential to examine the development of passion and REA in an initial period of sports activity in order to understand their nature and their temporal changes better. In my dissertation is that after adopting a new sport, with a very low-frequency involvement (only once a week), a small but significant change can be observed in HP, OP, and passion in general as well as in REA, showing that people

became more passionate and had elevated REA over the relatively short 12 weeks. While OP and REA showed similar growth trends, these were not identical, and the two variables were predicted by different motivations, suggesting that these two concepts overlap, but not to the extent that they would be redundant. These findings lead to a number of key implications.

To the best of my knowledge, this was the first longitudinal study on REA that integrates motivation into examining the changes over a short period after starting a new sport activity. The REA showed a small, yet significant increase over a 12-week period, indicating that athletes' REA increased marginally. These results contrast with a similar previous work, which shows that obligatory exercise was not predicted by exercise-related imagery over time (Rodgers, Hall, Blanchard, & Munroe, 2001). However, Rodgers et al.'s participants have already been exercising between 6 months to 14 years, and 93% of them reported exercising twice or more per week, in contrast to my participants who were beginners of a new sport activity exercising only once a week.

Similar to REA, my findings also show that all three measurements of passion were elevated at baseline, suggesting that participants were highly passionate about the sport they adopted. Furthermore, all slopes were statistically significant, indicating that passion for sports increased over the 12-week period. My results concur with those of Schellenberg and Bailis (2015), who examined passion for academic subjects over the course of five months and reported only minor changes in some students, while passion was highly stable for the majority of the participants. The common point between Schellenberg's and Bailis' (2015) and my dissertation is that both focused on passion in the initial (adoption) period. Even though athletes only exercised once a week, their passion for sports still increased, underscoring the importance and the changes in the initial periods of adoption.

The trajectories of OP and REA were similar. Accumulating evidence on OP and problematic behaviors suggest that OP only fulfills the so-called peripheral criteria of addictions, namely euphoria and cognitive salience (Ferguson, Coulson, & Barnett, 2011). Empirical studies in the online gaming literature (Brunborg et al., 2013; Charlton & Danforth, 2007) have supported the distinction between high engagement and addiction, the latter including additional components such as withdrawal symptoms that manifest when the individual is unable to engage in the given activity. In addition, while addiction is often associated with negative outcomes, this is not necessarily the case with high engagement (e.g., Deleuze, Long, Liu, Maurage, & Billieux, 2018; Gillet,

Morin, Sandrin, & Houle, 2018). For these reasons, OP might be considered as a potential precursor of addiction. In my dissertation, the longitudinal data provide information on the etiology of REA and on passion in the function of motivation.

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