

The Mediating Role of Passion in the Relationship of Exercise Motivational Regulations with Exercise Dependence Symptoms

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Abstract The present study examined the mediating role of obsessive passion in the relationship of introjected regulation to exercise with exercise dependence symptoms. A cross-sectional design was used. Questionnaires were administered in the context of private fitness centers and were completed before initiation of that day's exercise activities. Using non-probability sampling, 549 regular Greek exercise participants, men and women (approximately 70 % response rate), aged 18 to 61 years, completed the questionnaires. The Exercise Dependence Scale-Revised (Symons-Downs et al. 2004) was used to measure exercise dependence symptoms; the Passion Scale (Vallerand et al. 2003) was used to measure harmonious and obsessive passion for exercise; and the Behavioral Regulation in Exercise Questionnaire-2 (Markland and Tobin 2004) was used to measure types of behavioral regulations in exercise. Obsessive passion mediated the relationship between introjected regulation and exercise dependence symptoms (CFI=0.91–0.95, RMSEA=0.05-06). The present findings provided cross-sectional support to the mediating role of obsessive passion in the relationship of introjected regulation to exercise with exercise dependence symptoms.

Keywords Exercise dependence · Exercise addiction · Behavioral regulations · Passion · Self-determination theory

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By the time exercise dependence (ED) was identified by Baekeland (1970), a large volume of research has been devoted to its systematic examination. However, most of the studies have focused on the consequences of ED rather than the underlying causes responsible for its development (Rendi et al. 2007). Diagnostic criteria of ED have been drawn either from systematic observation (Veale 1995), or borrowed by general theories of addiction such as Brown's General Components of Addictions (Brown 1993), or by the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association [APA], 1994). As a result, Hausenblas and Symons-Downs (2002) have emphasized the lack of a strong conceptual model to guide the development of ED symptoms.

Exercise has been listed among 40 other activities as being potentially addictive (Brown 1993); despite that, ED has not been included in the DSM-IV (APA 1994). What is more, Hausenblas and Symons-Downs (2002) have defined ED as "a craving for leisure-time physical activity, resulting in uncontrollable excessive exercise behavior that manifests in physiological and/or psychological symptoms" (p. 90), and have borrowed DSM-IV criteria for addiction (APA 1994) to apply them on ED.

These criteria have been (a) *withdrawal* that appears when an exercise session is missed, so one has to continue exercising in order to avoid it; (b) *continuance* of exercise, even if repeated physical or psychological problems appear due to excessive exercise; (c) *tolerance*, i.e., the need for increased amounts of exercise in order to achieve the desired effect; (d) *lack of control* that reflects unsuccessful efforts to cut down on exercise; (e) *reduction in other activities* such as important social or occupational activities which are given up or being reduced because of exercise; (f) *time* spent in activities which are necessary to manage exercise for a longer period of time; and (g) *intention effects*, i.e., exercising over a period longer than was initially intended. Symons-Downs et al. (2004) proposed that only when an exerciser had high scores on at least three of these seven criteria, one could be classified as at risk for exercise dependence. Otherwise, the exerciser could be classified either as non-dependent symptomatic or as non-dependent asymptomatic, when having moderate or low scores, respectively.

Exercise dependence symptoms have been associated with health anxiety, body dissatisfaction, low self-image and self-esteem, compulsiveness, rigidity, perfectionism, extraversion, and agreeableness (Hall et al. 2009; Hausenblas and Giacobbi 2004; Hausenblas and Symons-Downs 2002; Pugh and Hadjistavropoulos 2011). They have also been associated with a high need for achievement, drive for muscularity, perceived exercise competence, self-esteem, an ego-involving exercise climate, and obsessive passion (Gonzalez-Cutre and Sicilia 2012; Groves et al. 2008; Hale et al. 2010; Hausenblas and Symons-Downs 2002; Paradis et al. 2013); mostly with introjected regulation motives to exercise (i.e., self-imposed pressure to exercise) (Edmunds et al. 2007; Fortier and Farrell 2009; Gonzalez-Cutre and Sicilia 2012; Hamer et al. 2002); feelings of stress before exercise, post-exercise positive affect, and negative affect (withdrawal symptoms) after missing an exercise session (i.e., lack of appetite, insomnia, sluggishness, fatigue, anxiety, depression, guilt, nervousness, and tension) (Hausenblas and Symons-Downs 2002). Most of those factors have been descriptive of exercise dependence (e.g., behavioral consequences, personality traits) with few of them considered causal such as motivational factors (e.g., the motive of introjected regulation to exercise) and obsessive passion.

Edmunds et al. (2006) have argued that controlling forms of motivation, such as introjected regulation, may lead to experiencing adjustment problems and problematic behaviors such as exercise dependence. Moreover, in line with theoretical suggestions (Vallerand 2010, 2012; Vallerand et al. 2003, 2011; Vallerand and Miquelon 2007) and research data (Paradis et al. 2013), exercise dependence shares characteristics with obsessive passion about an activity, such as rigidity, intention, and losing control. A differentiating element between the two

constructs is that passion is more heavily focused, in terms of content, on affect, whereas dependence symptoms on behavior.

Overall, SDT (Deci and Ryan 1985, 2000) and the Dualistic Model of Passion (Vallerand et al. 2003) provide firm theoretical grounds in order to examine the simultaneous influence of motivational variables (i.e., motivational regulations to exercise) along with variables of an affective nature (i.e., passion for an activity) on symptoms of exercise dependence.

Obsessive and Harmonious Passion as Determinants of Addictive Behaviors

In line with the dualistic model of passion (Vallerand et al. 2003), there are two types of passion for an activity that may act as determinants of addiction to the activity. These are obsessive passion (OP) and harmonious passion (HP). When led by HP, individuals freely choose to engage in the beloved activity without attaching any contingencies to it. That is, one's behavior originates from one's inner self and true interests, promoting positive affect and well-being (Vallerand 2010). In contrast, OP leads one to be driven by intrapersonal and/or interpersonal pressure and is related to certain contingencies that are attached to the activity (e.g., separate outcome such as a reward, approval from others, or avoidance of punishment) and negative affect (Stenseng et al. 2011; Vallerand 2008, 2010; Vallerand et al. 2003, 2007).

According to Vallerand (2010), OP could contribute to addictive behaviors such as pathological gambling, online shopping dependency, and excessive online gaming whereas HP would not. Indeed, research evidence has shown that OP predicted addiction to leisure activities (Stenseng et al. 2011) and online game addiction (Wang and Chu 2007), while HP did not. Philippe et al. (2010) have maintained that OP for an activity should not be confused with the concept of addiction while Ratelle et al. (2012) proposed that OP should be considered "a precursor to addiction".

Self-determination Theory Roots of Passion

In line with the dualistic model of passion (Vallerand et al. 2003), HP is grounded on an autonomous internalization of behavior, while OP is the result of a controlled internalization of the activity into one's identity. The terms of autonomous and controlled internalization have been drawn from SDT (Deci and Ryan 1985, 2000), where it is maintained that motivated behavior is determined by either intrinsic motivation (i.e., acting for pleasure and fun), extrinsic motivation (i.e., enacting the activity to attain something separable from the enjoyment of the activity), or amotivation (i.e., lacking intention to enact the behavior). Further, extrinsic motivation has been divided into the motives of external regulation (i.e. act so as to gain rewards or avoid punishments), introjected regulation (i.e. act to gain approval or avoid disapproval from significant others), identified regulation (i.e., act while identifying the activity value), and integrated regulation (i.e., act while being in harmony with all other life activities) (Deci and Ryan 2008; Ryan and Deci 2000). These motives reflect a continuum of internalization of behavior where behavior may be experienced as either controlled (external regulation and introjected regulation) or autonomous (identified regulation, integrated regulation, and intrinsic motivation) (Vallerand 1997).

Therefore, HP is rooted in autonomous forms of internalization of behavior (Vallerand 1997, 2008) while OP in controlled forms of internalization (Vallerand 1997; Vallerand et al. 2003). Given that amotivation and external regulation are not theoretically linked to any type

of passion, as they represent either lack of intention to enact a behavior or behavior pushed by other individuals, respectively, they are not expected to be related to any type of passion.

The Present Study

The lack of a theoretical model detailing the determinants of ED (Hausenblas and Symons-Downs 2002) and factors that may diminish this type of addiction calls for a better understanding of the mechanisms leading to experiencing symptoms of ED. Motivational regulations and passion toward exercise have been theorized to be determining factors of ED. Moreover, Vallerand (2012) has maintained that passion is integrated into one's self. However, self-determined motivation differs from passion in that it represents the underlying force energizing behavior that may be responsible for the extent to which a behavior may be integrated more or less into the self. Therefore, it seems prudent to examine both as distinct predictors of exercise dependence symptoms.

The aim of the present study was to provide a better understanding of the mechanisms leading to experiencing symptoms of ED, using the constructs of HP and OP from the dualistic model of passion (Vallerand et al. 2003), and the constructs of motivational regulations in exercise based on SDT (Deci and Ryan 1985). Specifically, we sought to examine whether OP would function as a mediator in the relationship of introjected regulation with symptoms of ED (see Fig. 1 for a representation of this conceptualization in diagram form).

The study hypotheses were that (a) introjected regulation would be the main predictor of ED symptoms, but intrinsic motivation and identified regulation would not appear as important predictors of ED symptoms; (b) OP would be mainly predicted by introjected regulation, but HP would be mainly predicted by intrinsic motivation and to a lesser extent by identified regulation; (c) OP would mediate the relationship between introjected regulation and ED symptoms; no mediation hypothesis has been forwarded regarding the relationship of intrinsic motivation and identified regulation with ED symptoms, given that these self-determined forms of motivation were not expected to appear as important predictors of ED symptoms.

Method

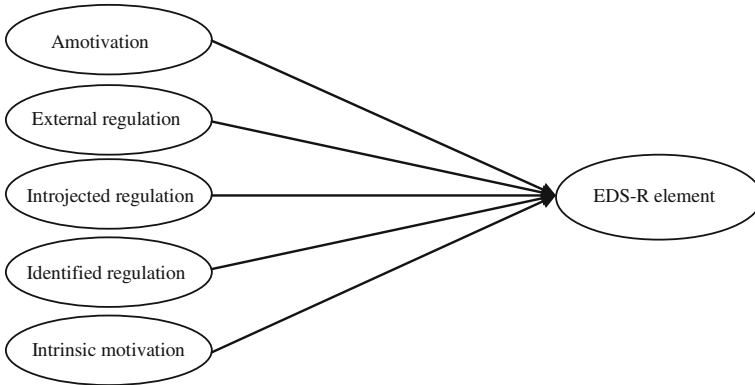
Participants

Data were collected from a sample of 549 typical exercisers at 14 private fitness centers in five towns in Northern and Western Greece. Non-probability sampling was used with a response rate of 70 %. There were 180 males (32.8 %) and 330 females (60.1 %) with 39 individuals (7.1 %) not reporting their gender. Participants' age ranged between 18 and 61 years ($M_{\text{age}} = 33.27$ years, $SD = 9.43$). Participants' height ranged between 150 and 195 cm ($M = 171.33$ cm, $SD = 8.62$) and weighed between 46 and 117 kg ($M = 68.61$ kg, $SD = 13.61$).

Overall, they had been exercising on average for 9 years ($M = 112.66$ months, $SD = 101.32$), while they attended the fitness center on average four times per week during the last 2 months. They participated in group-type activities (61.2 %) and in resistance exercise activities (45.2 %). Based on the classification suggested by Symons-Downs et al. (2004), 37 % of the participants were categorized as non-dependent asymptomatic, 49.4 % as non-dependent symptomatic, and 12.4 % as at risk for exercise dependence.

Based on their BMI values, 4.6 % were underweight, 68.3 % had normal weight, 21.5 % were overweight, and 4.2 % were obese. National statistics in Greece report that a 2 % of the population is underweight, 44 % have a normal weight, 40 % are overweight, and 14 % are

MODEL 1



MODEL 2

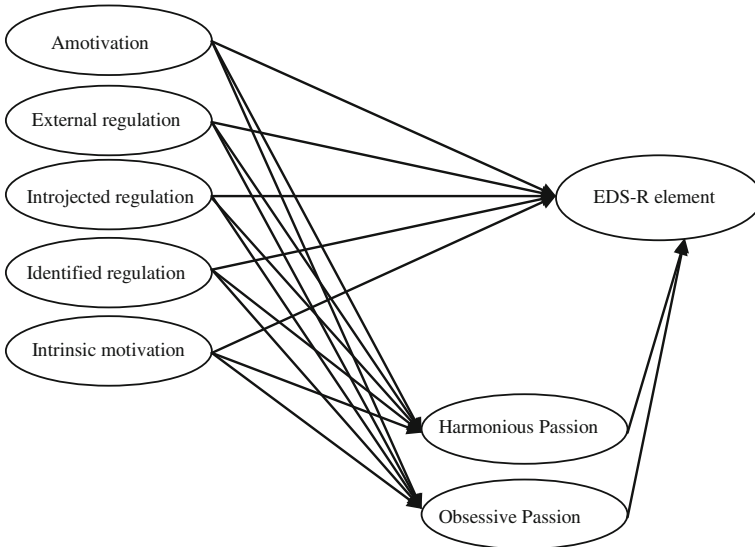


Fig. 1 Latent variable structural equation models testing the mediational role of passion in the association between motivational regulations and exercise dependence symptoms among exercise participants. Model 1 (direct effect model) tests for the direct effects of different types of motivation on the outcome variable. Model 2 (direct plus indirect effect model) tests for the mediational role of harmonious and obsessive passion

obese (De Saint Pol 2009). The present study values approach the national BMI statistics in Greece. The lower percentage values in the present sample may be justified by the fact that regular exercisers were sampled.

Measurement Tools

Exercise Dependence The Exercise Dependence Scale-Revised (EDS-R; Symons-Downs et al. (2004) was used to measure ED symptoms. The EDS-R is based on the DSM-IV seven criteria for substance dependence (APA 1994). It comprises 21 items divided into seven

subscales: tolerance, withdrawal, intention effect, lack of control, time, reduction in other activities, and continuance. EDS-R responses are provided on a 6-point Likert scale ranging from 1 (*never*) to 6 (*always*). EDS-R was preferred between other recently developed ED measures, as it is not unidimensional such as the Exercise Addiction Inventory (EAI; Terry et al. 2004) and does not include factors irrelevant to ED (e.g., exercise for social and health reasons) as is the case with the Exercise Dependence Questionnaire (EDQ; Ogden et al. 1997). Past research has demonstrated for the translated-into-Greek EDS-R adequate internal consistency (Cronbach's $\alpha=0.68\text{--}0.88$) and a sound factor structure via confirmatory factor analysis (CFA item loadings ranging from 0.62 to 0.88) as well as concurrent validity, and high test-retest reliability over a 10-day interval (Parastatidou et al. 2012a).

Passion in Exercise The Passion Scale (Vallerand et al. 2003) was used to measure participants' passion for exercise. The scale includes two subscales measuring OP (e.g., "I am emotionally dependent on [this activity]"; "I cannot live without [this activity]") and HP (e.g., "[this activity] reflects the qualities I like about myself; [this activity] is a passion that I still manage to control") with 7 items for each subscale. The term "this activity" was substituted by "exercise". Responses were provided on a 7-point Likert-type scale ranging from 1 ("Do not agree at all") to 7 ("Completely agree"). The translated- into-Greek Passion Scale has shown adequate Cronbach's α values for OP ($\alpha=0.91$) and HP ($\alpha=0.88$), strong factorial validity via CFA, and adequate CFA item loadings for both passion subscales (HP=0.57–0.81, OP=0.42–0.91) when examined in exercise (Parastatidou et al. 2012b).

Behavioral Regulations in Exercise The Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2) (Markland and Tobin 2004) was used to measure the types of regulations underpinning individuals' participation in exercise. The BREQ-2 comprises five subscales; amotivation (4 items; e.g. "I think exercising is a waste of time"), external regulation (4 items; e.g. "I exercise because other people say I should"), introjected regulation (3 items; e.g. "I feel guilty when I don't exercise"), identified regulation (3 items; e.g. "It's important to me to exercise regularly"), and intrinsic motivation (4 items; e.g. "I find exercise a pleasurable activity"). Responses were provided on a 5-point Likert-type scale ranging from 0 ("Not true for me") to 4 ("Very true for me"). In the present study, the translation of the BREQ-2 into Greek (Moustaka et al. 2010) was used. The Greek BREQ-2 has evidenced good factorial validity through CFA, Cronbach's α values between 0.77 and 0.88, and CFA item loadings ranging between 0.63 and 0.90. Evidence has also emerged in favor of discriminant validity, simplex-like structure, and nomological correlations of BREQ-2 responses in a sample of Greek exercise participants (Moustaka et al. 2010).

Procedures

Firstly, contact with fitness center managers was established and permission for survey conduct was granted. Afterwards, exercisers were informed about the research study and those who had been exercising for the last 2 months and agreed to participate in the study, signed an informed consent form for their participation, and completed the questionnaire packet. Questionnaire completion took place before initiation of the exercise activities of that day and lasted for approximately 15 min. Participants were assured that their responses would remain confidential and were treated in accordance with American Psychological Association guidelines, while university research regulations were followed.

Data Analysis

Missing values per item ranged from 0.7 to 3.8 % in a total of 549 cases. Observation of missing data patterns showed no evidence of systematic non-response; therefore, missing data were treated as missing completely at random and were replaced using mean imputation (Tabachnick and Fidell 2013). Then, CFAs were computed on all three instrument responses using EQSWIN 6.1 (Bentler 2003). The factor variances were fixed to unity, the factor covariances were free to be estimated, and item error covariances were fixed to zero. CFA model fit was examined using the chi-square statistic; the Comparative Fit Index (CFI; Bentler 1990) with a value close to 0.95 indicating an excellent fit to the data (Hu and Bentler 1999) and a value of 0.90 or greater indicating a reasonable fit; the Root Mean Squared Error of Approximation (RMSEA) (Steiger and Lind 1980) with its accompanying 90 % confidence interval (RMSEA 90 % CI), a value less than 0.05 indicating a good model fit (Hu and Bentler 1999), and a value from 0.08 to 0.10 representing adequate fit (Browne and Cudeck 1993; Byrne 2000).

Following that, Cronbach's alpha values and Pearson's correlations were computed between ED symptoms, types of passion, and motivational regulation variables. The relationships between the study variables were examined using Structural Equation Modeling (SEM) via EQSWIN 6.1 (Bentler 2003). The goal was to examine the mediating role of passion in the relationship of motivational regulations with ED symptoms. In achieving this goal, the principles for testing mediation forwarded by Barron and Kenny (1986) were followed. According to these principles, to test for mediation (a) the mediator should be regressed on the independent variable; (b) the dependent variable should be regressed on the independent variable; and (c) the dependent variable should be regressed both on the independent variable and the mediator, concurrently.

To demonstrate mediation, the independent variable must affect the mediator; the independent variable must affect the dependent variable before the mediator enters the analysis; and the mediator must affect the dependent variable. Mediation is evident when the initial effect of the independent variable on the dependent variable is reduced when the mediator enters the analysis. Two latent variable structural equation models were tested each time (Fig. 1), once for each of the EDS-R factors, separately. In total, 14 structural equation models were tested. Latent variables were used to account for measurement error in the constructs studied. According to Barron and Kenny (1986), the use of mediators is important as it provides answers to questions pertaining to how or why particular effects occur. A mediator represents the mechanism through which a predictor influences an outcome variable.

In Model 1 (direct effect model; see Fig. 1), unidirectional paths were specified from the five behavioral regulation factors toward a single EDS-R factor that represents one symptom of exercise dependence. Therefore, seven "direct effect" models were tested, one for each EDS-R factor. Model 2 (direct plus indirect effect model; see Fig. 1) specified the same paths appearing in Model 1 plus unidirectional paths from the five behavioral regulation factors toward the HP and OP factors, and two unidirectional paths from HP and OP toward the single EDS-R factor. In terms of the conceptualization of Model 2, seven models were tested, one for each EDS-R factor. Therefore, two models (Model 1 and Model 2) were tested for each EDS-R factor. Fourteen latent variable structural equation models were tested in total. The aim was to examine whether the initial direct effects of regulations on ED symptoms would be reduced, when types of passion entered the model as mediators in the relationship of the five motivational regulation factors with the single ED symptom, each time. Reduction of the initial direct effect of regulations on ED symptoms would indicate a mediating effect of passion in the relationship of exercise regulations with ED symptoms.

Results

All subscales had internal consistency values greater than 0.70 (see Table 1) except identified regulation with an alpha of 0.65. Confirmatory factor analyses (CFA) showed an adequate fit of each scale responses to the data supporting good factorial validity for all three measurement tools. For the BREQ-2, and given multivariate non-normality of the data (normalized estimate of Mardia's coefficient of multivariate kurtosis=143.51) (Byrne 2006), CFA indices were: Satorra-Bentler scaled χ^2 (S-B scaled χ^2) ($n=549$)=231.551, $p<0.001$, $df=125$, robust CFI=0.938, robust RMSEA=0.039 (90 % CI=0.031–0.047). Factor loadings for the BREQ-2 ranged between 0.48 and 0.84. For the EDS-R (normalized estimate of Mardia's coefficient of multivariate kurtosis=56.65), CFA indices were: S-B scaled χ^2 ($n=549$)=398.63, $p<0.001$, $df=168$, robust CFI=0.955, robust RMSEA=0.050 (90 % CI=0.044–0.056). Factor loadings for the EDS-R ranged from 0.60 to 0.87. In relation to the Passion Scale (normalized estimate of Mardia's coefficient of multivariate kurtosis=40.00), CFA indices were: S-B scaled χ^2 ($n=549$)=502.88, $p<0.001$, $df=76$, robust CFI=0.900, robust RMSEA=0.101 (90 % CI=0.093–0.110). Factor loadings for the Passion Scale ranged from 0.42 to 0.90.

Bivariate correlations were calculated between all study variables (Table 1). OP was more strongly related to all EDS-R subscale mean scores compared to HP. Introjected regulation was most strongly related to OP while intrinsic motivation to HP. Introjected regulation was most strongly correlated with EDS-R subscales, while correlations of EDS-R with identified regulation and intrinsic motivation were of a moderate magnitude. External regulation and amotivation displayed generally weak correlations with EDS-R subscale scores, except "reduction in other activities" which was more strongly correlated to amotivation and external regulation compared to identified regulation and intrinsic motivation. Furthermore, correlations between behavioral regulation subscale mean scores supported a simplex-like pattern of relationships with adjacent variables resulting into stronger and positive correlations compared to variables more distal on the self-determination continuum (Vallerand 1997). Such correlations provide support in favor of the validity of the BREQ-2 scores (Moustaka et al. 2010) in the present sample.

Mediation Analyses Through Structural Equation Modeling

Structural equation modeling results supported the study hypotheses. Direct effects of regulations on ED symptoms (see Model 1 in Fig. 1) showed that introjected regulation was the main predictor of ED symptoms while external and identified regulations as well as intrinsic motivation were non-significant predictors of ED symptoms (Table 2). These findings supported hypothesis (a). Amotivation also predicted significantly almost all ED symptoms but more weakly than introjected regulation (Table 2). OP was more strongly predicted by introjected regulation, while HP was most strongly predicted by intrinsic motivation and weakly by introjected regulation, thus supporting hypothesis (b) (Table 2). Additionally, not being part of the hypotheses, OP and HP both predicted ED symptoms with OP appearing systematically as a predictor of all ED symptoms stronger than HP, except "tolerance" which was more strongly predicted by HP (Table 2).

When OP entered the model, the initial strong effects of introjected regulation on ED symptoms were substantially reduced (e.g., withdrawal, continuance) and in most cases diminished (e.g., lack of control, reduction in other activities, time, and intention effects), indicating partial and full mediation of OP, respectively, supporting hypothesis (c) (Table 2). Goodness-of-fit indices for all 14 models were acceptable and are presented in Table 3.

Table 1 Internal consistency, descriptive statistics, and Pearson's correlations between behavioral regulations in exercise, passion for exercise, and exercise dependence symptoms

Study variables	α	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Amotivation	0.81	0.27	0.49	-												
2. External regulation	0.80	0.41	0.58	0.57**	-											
3. Introjected regulation	0.73	2.48	0.98	-0.06	0.03	-										
4. Identified regulation	0.65	3.47	0.51	-0.30**	-0.25**	0.44**	-									
5. Intrinsic motivation	0.78	3.29	0.60	-0.24**	-0.24**	0.23**	0.55**	-								
6. Harmonious passion	0.86	4.91	1.21	-0.05	-0.08*	0.34**	0.40**	0.53**	-							
7. Obsessive passion	0.90	3.97	1.59	-0.00	-0.02	0.53**	0.34**	0.31**	0.60**	-						
8. Withdrawal	0.80	3.10	1.33	0.10*	0.11**	0.30**	0.16**	0.15**	0.25**	0.35**	-					
9. Continuance	0.84	2.48	1.33	0.13**	0.16**	0.36**	0.16**	0.13**	0.28**	0.45**	0.30**	-				
10. Tolerance	0.83	3.79	1.19	0.04	0.03	0.29**	0.26**	0.17**	0.35**	0.37**	0.23**	0.36**	-			
11. Lack of control	0.79	2.98	1.27	0.10*	0.07	0.39**	0.25**	0.19**	0.40**	0.57**	0.36**	0.54**	0.55**	-		
12. Reduction in activities	0.70	2.26	1.10	0.20**	0.19**	0.31**	0.14**	0.10*	0.32**	0.53**	0.30**	0.52**	0.39**	0.61**	-	
13. Time	0.84	3.33	1.28	0.05	0.02	0.33**	0.27**	0.21**	0.42**	0.53**	0.23**	0.45**	0.56**	0.67**	0.62**	-
14. Intention effects	0.83	3.11	1.21	0.10*	0.08*	0.31**	0.21**	0.14**	0.36**	0.47**	0.27**	0.46	0.57**	0.66**	0.61**	0.83**

N=549, α =Cronbach's alpha, * $p < 0.05$; ** $p < 0.01$

Table 2 Standardized structural coefficients for structural equation Models 1 and 2 tested for each exercise dependence symptom separately

Endogenous variable	Predictor variables						
	Amot.	Ext.	Introj.	Ident.	IM	HP	OP
Model 1 (direct effects of regulations on ED symptoms)							
Withdrawal	0.155	0.024	0.405*	-0.135	0.228	-	-
Continuance	0.168*	0.060	0.508*	-0.171	0.206	-	-
Tolerance	0.151*	0.013	0.180	0.339	-0.045	-	-
Lack of control	0.242*	-0.074	0.475*	0.000	0.198	-	-
Reduction in activities	0.324*	0.030	0.418*	-0.037	0.169	-	-
Time	0.231*	-0.072	0.289*	0.166	0.115	-	-
Intention effects	0.193*	0.006	0.247*	0.104	0.084	-	-
Model 2 (direct plus indirect effects of regulations on ED symptoms mediated by passion)							
Withdrawal	0.133	0.044	0.284*	-0.087	0.138	0.055	0.147
Continuance	0.130	0.101	0.305*	-0.102	0.107	-0.009	0.305*
Tolerance	0.104	0.048	-0.019	0.407	-0.248	0.228*	0.187*
Lack of control	0.164*	0.001	0.130	0.108	0.013	0.019	0.516*
Reduction in activities	0.231*	0.112	0.071	0.072	-0.018	0.010	0.541*
Time	0.148	0.001	-0.061	0.268	-0.110	0.111	0.484*
Intention effects	0.134	0.053	0.003	0.183	-0.122	0.176*	0.289*
HP	0.081	-0.022	0.323*	-0.136	0.622*	-	-
OP	0.148	-0.148*	0.651*	-0.184	0.326*	-	-

Amot. amotivation, *Ext.* external regulation, *Introj.* introjected regulation, *Ident.* identified regulation, *IM* intrinsic motivation, *HP* harmonious passion, *OP* obsessive passion

* sig at $p < 0.05$. $N = 549$

Discussion

Given the need to better understand the mechanisms leading to the onset of ED symptoms, the concepts of behavioral regulations embedded within SDT, and the constructs of harmonious passion (HP) and obsessive passion (OP) embedded within the dualistic model of passion, were used in the present study. The study primarily examined whether OP would mediate the relationship of introjected regulation with predictors of ED symptoms in a sample of regular exercise participants. It was shown that introjected regulation was a major determinant of ED symptoms with OP functioning as a strong mediator between them.

Practically, it was shown that, when interpersonal and intrapersonal pressure was a strong motive to exercise (i.e., exercising to reduce age anxiety, promote self-esteem, be accepted by significant others and by society that promotes norms of being fit and having an ideal body shape) participants reported greater levels of ED symptoms. This means that, exercisers that mostly pursued attaining contingent self-esteem via exercise participation were more prone to experience ED symptoms. These findings are in line with findings from other studies on exercise dependence (Edmunds et al. 2007; Fortier and Farrell 2009; Gonzalez-Cutre and Sicilia 2012; Hamer et al. 2002).

As regards to the mediational role of OP, it seemed that the effects of introjected regulation on symptoms of ED were mainly transmitted via OP. Substantially, the mediational analysis

Table 3 Goodness-of-fit indexes for latent variable structural equation models tested for each exercise dependence symptom separately

Structural equation model	χ^2	Satorra Bentler Scaled χ^2	<i>df</i>	Robust CFI	Robust RMSEA	Robust RMSEA 90 % CI
Model 1 (direct effects of regulations on ED symptoms)						
Withdrawal	455.85	291.89	174	0.949	0.035	0.028–0.042
Continuance	465.48	302.77	174	0.946	0.037	0.030–0.044
Tolerance	464.90	308.29	174	0.943	0.038	0.031–0.044
Lack of control	473.90	310.21	174	0.942	0.038	0.031–0.044
Reduction in activ.	505.62	324.04	174	0.929	0.040	0.033–0.046
Time	497.14	330.07	174	0.936	0.040	0.034–0.047
Intention effects	459.64	303.93	174	0.946	0.037	0.030–0.044
Model 2 (direct plus indirect effects of regulations on ED symptoms mediated by passion)						
Withdrawal	1693.98	1299.18	532	0.891	0.051	0.048–0.055
Continuance	1717.07	1318.63	532	0.890	0.052	0.048–0.055
Tolerance	1695.87	1302.48	531	0.892	0.051	0.048–0.055
Lack of control	1706.39	1309.19	532	0.892	0.052	0.048–0.055
Reduction in activ.	1782.10	1358.95	532	0.880	0.053	0.050–0.057
Time	1750.88	1348.48	532	0.888	0.053	0.049–0.056
Intention effects	1701.84	1312.59	532	0.891	0.052	0.048–0.055

$N=549$. χ^2 =Chi Square

df degrees of freedom, *CFI* Comparative Fit Index, *RMSEA* Root Mean Squared Error of Approximation, *CI* Confidence Interval, *Reduction in activ.* Reduction in activities

showed why and how introjected regulation had effects on predictors of ED. Individuals who exercised because of a controlled internalization mode, provided high scores on the OP subscale (Vallerand et al. 2003) reporting an irresistible need to exercise, feeling that they could not live without doing so, that trying to reduce exercise was out of their control, and that exercise actually took control over them and their mood. These feelings indicating OP for exercise, strongly predicted symptoms of ED (e.g., conflict with other important life activities because of excessive exercise, frequent and persistent injuries due to overtraining, and inability to cut down on exercise). This finding is in line with results by Paradis et al. (2013) who showed that OP was the type of passion that most strongly predicted ED symptoms.

Thus, the present findings offer support in favor of the OP as an immediate determinant of ED symptoms compared to the more distal role of introjected regulation and as a major transmitter of the introjected regulation effects on ED symptoms. On the other hand, intrinsic motivation was more strongly related to HP (rather than OP) and did not predict ED symptoms. This is in line with findings by Vallerand and associates (Vallerand 2010; Vallerand et al. 2003), who maintain that HP seems to reflect greater levels of experiencing moments of sheer pleasure, valuing exercise as life-enriching, and harmony with other significant life activities.

Last but not least, a further systematic finding was observed that was not part of the hypotheses. Amotivation predicted weakly but systematically all ED symptoms except withdrawal symptoms, showing that it may also play a role in the prediction of ED symptoms, though at a lesser extent compared to introjected regulation. However, when passion entered the model, almost all of the direct effects of amotivation on exercise dependence symptoms

were extinguished. These initial weak effects may be explained by the fact that amotivation corresponds to either feeling negatively during exercise or indifferent toward exercise. Given, that exercise dependence symptoms may indicate behavior enacted by motives reflecting self-initiated pressure to exercise, the relationships with amotivation which may also share elements of negative experience, may be of no surprise.

Limitations, Practical Applications, and Future Directions

Study limitations include the fact that the sample used has not been randomly selected from the population of Greek adult exercise participants, and hence it is not formally representative of this population. However, inspection of the percentages of individuals in variables strongly related to exercise behavior such as BMI, shows that the distribution of individuals within each BMI category approaches national statistics on this parameter. Additionally, the lower values in comparison to the national statistics are justified by sampling regular exercise participants. Lastly, the present findings rely on a cross-sectional design where variables have been measured concurrently. Thus, not cause-and-effect conclusions should be drawn from the present data.

Based on the present findings, exercise dependence symptoms may derive from non-positive feelings about exercise that may be shaped in the context of non-autonomous forms of motivation. It seems that targeting the promotion of autonomous forms of regulation might lead to a more positive outlook toward exercise that is exercise being in harmony with other life activities and reduction of the possibility that one may exhibit symptoms of exercise dependence. Promoting autonomous forms of motivation and maintaining levels of intrinsic motivation may necessitate adopting an interpersonal style of communication with exercise participants that supports the participants' needs for autonomy, competence, and relatedness (Edmunds et al. 2008; Moustaka et al. 2012; Vansteenkiste et al. 2004).

Future work in this area may replicate the study using a longitudinal design that may allow greater time intervals for behavioral regulations and types of passion to exert their effects on ED symptoms and monitor the development of ED symptoms over time. Given that the present study provides a description of a mechanism via which ED symptoms may develop, future work may attempt to examine the effectiveness of exercise instruction approaches embedding SDT principles of psychological need support aiming to enhance self-determined motivational regulations and weaken controlling forms of motivation for exercise participation. Such an approach may achieve enhancing HP and minimizing OP, possibly leading to reduced ED symptoms. To sum up, based on SDT principles, effective ways may be found to deal with ED symptoms and transform regular exercise behavior into a healthier form of lifestyle. The present findings may also be used to advance understanding of other forms of behavioral addictions, aspiring to identifying new paths to cope with addiction.

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