



# Exploring the Link Between Self-compassion and Compulsive Exercise Amongst Women

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Accepted: 12 May 2022  
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## Abstract

**Objectives** Self-compassion, defined as the ability to be accepting and loving towards oneself, has been identified as a potential protective factor against the development of body dissatisfaction and eating disorders (ED). In contrast, compulsive exercise is a core feature in the development and progression of EDs and is often employed as a maladaptive coping strategy for negative emotions and body image concerns. However, the relationships between self-compassion and compulsive exercise attitudes and behaviours are as yet unexplored.

**Methods** A total of 539 Spanish female university students ( $M_{age} = 20.03$ ,  $SD = 2.22$ ) completed measures of compulsive exercise, frequency of compensatory exercise, self-compassion, eating disorder symptoms, and anxiety and depression.

**Results** Hierarchical multiple regressions showed that lower levels of self-compassion significantly predicted some compulsive exercise elements (namely, weight control exercise and lack of exercise enjoyment) after controlling for ED symptoms, anxiety, depression and age. However, frequency of compensatory exercise was unrelated to self-compassion elements. Findings from the mediation models suggest an indirect effect of self-compassion on the association between compulsive exercise and ED symptoms.

**Conclusions** The findings suggest a significant link between low self-compassion and greater harmful exercise attitudes and behaviours towards exercise. Further research is needed to clarify whether self-compassion may be a core feature in the development and maintenance of harmful attitudes and behaviours towards exercise.

**Keywords** Self-compassion · Compulsive exercise · Frequency of compensatory exercise · Eating disorders

Compulsive exercise has been suggested as a key feature in the development and maintenance of eating disorders (EDs) (Davis et al., 1997; Meyer et al., 2011). Compulsive exercise is considered to be a multidimensional construct that includes (a) rigidity, typically characterised by inflexible exercise schedules; (b) exercise motivated by weight and shape concerns;

and (c) persistent continuation to exercise even despite illness and injuries in order to mitigate emotional distress and guilt when unable to exercise (Meyer et al., 2011). Contemporary definitions of compulsive exercise (e.g. Bratland-Sanda et al., 2019) highlight the importance of discriminating between exercise obsessions (e.g. rule-driven behaviours, inflexible exercise schedules and compulsivity) and compulsions (e.g. frequency of the compensatory exercise behaviour). In this line, evidence has been found that some individuals at risk of EDs experience high levels of exercise obsessions, but that those individuals may not be able to convert these exercise obsessions into action (Bratland-Sanda et al., 2019). In clinical populations, compulsive exercise has been linked to poorer treatment outcomes (Stiles-Shields et al., 2015), higher risk of relapse (Carter et al., 2004) and greater risk of treatment dropout (El Ghoch et al., 2013). In non-clinical populations, the presence of compensatory exercise has been associated with greater symptoms of anxiety, depression, suicidal ideation and non-suicidal self-injury (e.g. Ganson et al., 2021).

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However, despite the clinical relevance of compulsive exercise in eating psychopathology, it remains understudied compared to other psychopathological aspects of EDs (Heathers et al., 2018). Specifically, the relationships between self-compassion and the different dimensions of compulsive exercise have yet to be explored.

Although self-compassion is a relatively new construct for Western psychology (Neff, 2003a), self-compassion has been considered an important construct in Buddhist philosophy for centuries. From Buddhist tradition, compassion stems from the awareness and understanding of pain and suffering (Goldstein & Kornfield, 2001). Compassion is a natural response of an open heart that seeks to relieve suffering of being rather than avoiding or denying it (Goldstein & Kornfield, 2001). Contemplative practices derived from Buddhist philosophy have been considered effectively ways to cultivate compassion toward the self and others and to help to develop wisdom and steadiness of the mind and heart (Goldstein & Kornfield, 2001; Kabat-Zinn, 2003). Reaching back to Freud (1917), evidence has strongly supported that when individuals develop a hostile, contemptuous and critical approach to oneself, those self-critical attitudes toward the self may increase vulnerabilities to different mental health disorders (e.g. Gilbert, 2017, p. 48; Gilbert et al., 2017). According to Freud, it was important to cultivate awareness of the experiences in life and alleviate the instinctive (ego) or cultural (superego) burden they may contain (Miró, 2017).

Since then, self-compassion has been conceptualised from a variety of different approaches (for a review, see Gilbert, 2017). From an evolutionary-neuroscientific approach, self-compassion is characterised as a motivation and willingness that increases ‘a sensitivity to suffering in self and others with a commitment to try to alleviate and prevent it’ (Gilbert & Choden, 2013, p. 94). Neff (2003b) referred to the self-compassion as a non-judgemental and open attitude to one’s own suffering and failures, which involves kindness and acceptance of one’s conflicts as a part of the common human experience. In other words, self-compassion is a balanced state of mind characterised by three main components, each of which involves a positive and a negative pole: self-kindness versus self-judgement, a sense of common humanity versus isolation and mindfulness versus over-identification (Neff, 2003a, b, 2016b). Self-kindness refers to the degree of using kindness towards, and understanding of, the self, while self-judgement involves the degree of using harsh self-criticism and judgement towards the self. Mindfulness is characterised by keeping one’s painful feelings and thoughts in balanced awareness, whereas over-identification refers to whether individuals are over-identifying with one’s painful experience. Finally, while common humanity involves whether individuals recognise their own experiences as part of the human condition, isolation refers to whether individuals recognise their own experiences as isolating.

Self-compassion has been identified as an important protective factor in the development of a wide range of pathology, including eating psychopathology and body dissatisfaction (e.g. Albertson et al., 2015; Ferreira et al., 2013; Gilbert, 2017). Compulsive exercise is a common feature of eating psychopathology, but as yet there has been limited research to explore how the different dimensions of compulsive exercise might link with self-compassion. To our knowledge, only two studies have analysed the link between self-compassion and compulsive exercise. On the one hand, Magnus et al. (2010) found a significant negative link between the obligatory exercise and the overall levels of self-compassion. However, although there is an overlap between obligatory exercise and compulsive exercise constructs, the definitions of these terms are psychologically and clinically different (e.g., Meyer & Taranis, 2011). For example, excessive exercise frequency and intensity are key elements in the conceptualisation of obligatory exercise, while contemporary evidence has found that some individuals at risk of EDs may present high levels of exercise obsessions and a low frequency or a lack of compensatory exercise (Bratland-Sanda et al., 2019). Indeed, in non-clinical samples, no significant associations have been found between exercise beliefs and exercise behaviours (e.g. Naylor et al., 2011). Moreover, although obligatory exercise is associated with EDs, evidence has shown that compulsive exercise dimensions have an incremental predictive power over and above obligatory exercise, accounting for 21% additional variance of ED symptoms (Taranis et al., 2011). On the other hand, Linardon (2021) found that self-compassion predicted lower odds of frequency of compensatory exercise at an 8-month follow-up; however, the link between both constructs did not remain significant when body appreciation and intuitive eating were introduced in the model. A plausible reason for the lack of associations between constructs may be that frequency of compensatory exercise did not measure key dimensions of compulsive exercise (avoidance and rule-driven behaviours, rigidity, etc.). Given the multidimensional nature of compulsive exercise in EDs (Meyer et al., 2011), therefore, it is important to examine whether both exercise frequency motivated by the desire to burn calories (frequency of compensatory exercise) and exercise beliefs may be related to low levels of self-compassion.

Self-compassion has been recognised as the *heart* of mindfulness (Germer & Neff, 2019). Mindfulness is conceptualised as ‘the awareness that emerges through paying attention, on purpose, in the present moment, and not judgementally to the unfolding experience moment by moment’ (Kabat-Zinn, 2003, p. 145). The contrary of mindfulness is an autopilot state that may involve ruminating on past and future experiences, rather than being aware of the present moment. When ruminating, the mind may examine the discrepancies between how the things are and how we wish

them to be (Segal et al., 2002). The analysis of these discrepancies may trigger a sense of dissatisfaction and a constant search for tools that help to reduce these gaps (Segal et al., 2002). *Possible selves* refer to the personalised representations of one's self that reflect in what individuals would like to become or what individuals are scared to become in the future (Markus & Nurius, 1986). Within the ED context, the discrepancy between the 'real' body and the desired body may trigger harmful attitudes and behaviours to reduce these gaps, including harmful exercise attitudes and behaviours. If harmful exercise attitudes and behaviours are used to deal with negative emotions and experiences (Fairburn et al., 2003; Meyer et al., 2011), developing self-compassion, which has been suggested as an adaptive and trainable emotional strategy (Neff, 2003a), may benefit individuals by helping them to be aware and connect with their concerns and emotions towards the body (including destructive self-critical tendencies and feelings of discomfort when unable to exercise), and to embrace those experiences with kindness, love and equanimity rather than avoiding them (Neff & Davidson, 2016; Neff, 2003a) or using dysregulated emotion regulation strategies, such as harmful exercise attitudes and behaviours. As indicated by Goldstein and Kornfield (2001), contemplative practices can act as an antidote to the automatic pilot, helping to be aware moment by moment of the nature of mind and world.

A growing body of literature has identified self-criticism as a transdiagnostic feature across different psychopathologies, such as anxiety, depression and eating disorders (Goss & Allan, 2014). Individuals with greater levels of self-criticism may be engaged in (a) constant and harsh evaluation and scrutiny towards the self; and (b) having a persistent fear of being judged and disapproved (Blatt & Zuroff, 1992; Zuroff et al., 2021). According to Gilbert et al. (2004), self-criticism involves different forms (e.g. being self-critical, dwelling on failures or feeling self-hate and desire to hurt the self) and functions (desires to self-improve, or to self-harm because of feelings of failure). Self-criticism has emerged as a primary indicator of the dysfunctional perfectionism (e.g. Dunkley et al., 2006). Self-criticism has been linked to greater levels of compulsive exercise amongst regularly exercising females (Tarani & Meyer, 2010), suggesting that regular exercisers with high levels of self-criticism may experience higher levels of withdrawal symptoms (e.g. guilt and emotional discomfort). Furthermore, the positive link between self-criticism and compulsive exercise suggests that individuals with compulsive exercise may use rule-driven behaviours (e.g. exercise despite illness, increase exercise practice when lost sessions) when unable to exercise and in circumstances of imperfection (such as concerns towards the body). However, it is worth noting that not only regular exercisers but also individuals with sedentary behaviours may be at risk of compulsive exercise (Bratland-Sanda et al., 2019). Nonetheless, research examining

whether both harmful exercise attitudes and harmful exercise behaviours could be linked to self-compassion is still in its infancy. Exploring the potential link between self-compassion elements and harmful exercise attitudes and behaviours may help to identify whether self-compassion might be a promising element in the prevention of harmful exercise attitudes and behaviours.

Eating psychopathology, negative affect and obsessive-compulsiveness have been suggested as core maintenance factors for compulsive exercise (e.g. Meyer et al., 2011). The links between eating psychopathology, negative affect and obsessive-compulsiveness are far more widely established (e.g. Ferreira et al., 2013; Kelly et al., 2014; Leeuw-erik et al., 2020). Indeed, self-compassion-focused therapies have shown successful results in the prevention and treatment for eating disorder symptoms and negative affect (e.g. Goss & Allan, 2014; Kelly et al., 2014; MacBeth & Gumley, 2012). Therefore, it is plausible to suggest that exercise obsessions and compulsions may be negatively linked to self-compassion.

The main aim of this study was to examine the relationships between self-compassion subscales with compulsive exercise dimensions and frequency of compensatory exercise. Based on the aforementioned evidence, it was predicted that self-compassion would significantly and negatively be linked to compulsive exercise and frequency of compensatory exercise. The second aim was to analyse whether the associations between self-compassion and harmful exercise attitudes and behaviours remain significant when controlling for key elements on the maintenance of compulsive exercise, namely, ED symptoms, depression and anxiety (Meyer et al., 2011). Finally, since exercise is less likely to be perceived as problematic compared to other compensatory behaviours (e.g. vomiting), evidence has suggested that compulsive exercise may be the first symptom to appear in the development of EDs, before the onset of other compensatory behaviours, such as restrictive diets (e.g. Davis et al., 1997); therefore, harmful exercise attitudes and behaviours may act as 'gateway' that eventually led individuals to use other potentially more harmful compensatory behaviours (Stiles-Shields et al., 2012). Thus, the third aim was to examine whether self-compassion may mediate the relationships between psychopathological exercise and ED symptoms.

## Methods

### Participants

After the ethics committee approval, participants were informed about the aims of the study and provided their consent to participate in the study. A sample size of 539 Spanish female university students ( $M_{age} = 20.03$  years,  $SD = 2.22$ )

were recruited from Castilla-La Mancha University (Spain). The age range of the sample was between 17 and 30 years. Undergraduate participants were voluntarily recruited from different degrees of the following subject areas: health sciences (54.9%), social sciences (43.6%), sciences (0.6%) and engineering (0.9%).

A series of one-sample  $z$  tests were imputed to examine whether self-compassion levels and overall eating disorder symptom score differ between the sample in this study from other samples in university women. Specifically, we compared the overall ED symptom score from this study with Villarroel et al.'s (2008) study, in which 798 university women participated. The mean self-compassion score from this sample was compared with the mean self-compassion score from Neff's (2003b) research, in which 225 university women were included. Results from the one-sample  $z$  test showed that the mean of the overall ED symptom score in this study was significantly higher ( $z$ -statistic = 3.9;  $p < 0.001$ ; Cohen  $d = 0.16$ ) compared to the sample in the study of Villarroel et al. (2011). The mean of the self-compassion global score was significantly lower ( $z$ -statistic = -3.16;  $p < 0.05$ ; Cohen  $d = -0.13$ ) compared to the sample included in Neff's (2003a) research.

## Procedures

Questionnaires were administered by three psychologists during practical classes and seminars. Students did not receive neither economic recompenses nor credits. After completing the questionnaires, participants were given a brief overview of the research in this area. Regarding missing values, participants with three or more missing items ( $n = 6$ ) in each scale were removed. The mean of each item was calculated for missing values when responses had two or fewer missing values.

## Measures

**Self-Compassion Scale (SCS; Neff, 2003a, b; Spanish Translation, Garcia-Campayo et al., 2014).** The 26-item SCS measures three polarised components of self-compassion: self-kindness (5 items) versus self-judgement (5 items); common humanity (4 items) versus isolation (4 items); and mindfulness (4 items) versus over-identification (4 items) (Neff, 2003a, b, 2016a). The SCS is answered using a 5-point Likert scale (from 1 = not like me at all to 5 = like me very much). Items were computed to calculate the overall self-compassion score and its six subscales. Previous psychometric evidence has shown that the overall SCS score is a reliable measure to examine self-compassion as a holistic state of being (Neff, 2019; Neff et al., 2019). In the current study, Cronbach alphas for the SCS-Global score and its subscales range from 0.70 (SCS-Common humanity) to 0.89

(SCS-Global score). McDonald's omega values range from 0.71 (SCS-Common humanity) to 0.89 (SCS-Global score).

**Eating Disorder Examination-Questionnaire (EDE-Q-4; Fairburn & Beglin, 1994; Spanish Translation, Villarroel, 2008).** The EDE-Q was used to examine overall eating disorder symptoms and the frequency of driven or compensatory exercise. The measure assesses attitudes and behaviours over the last month. The global EDE-Q score consists of 22 items divided into four subscales (dietary restraint, eating, shape and weight concerns). The items are rated on a 7-point Likert scale (0 = no days to 6 = everyday). The frequency of compensatory exercise was assessed in terms of the average number of weekly episodes in which participants exercised in a 'driven' way as a means to control weight or shape over the past 4 weeks. Participants reported the average number of weekly episodes in which they have done exercise in a 'driven' or compulsive way as a means of controlling their weight, shape or amount of fat, or to burn off calories in the past 4 weeks. The EDE-Q has shown satisfactory internal consistency in Spanish university females (Villarroel et al., 2011). In this sample, both Cronbach alpha and McDonald's omega values for the overall EDE-Q score were 0.96.

**Compulsive Exercise Test (CET; Taranis et al., 2011; Spanish Version, Sauchelli et al., 2016).** The CET was used to assess harmful attitudes and behaviours towards exercise. The 24-item measure is answered using a 6-point Likert scale (from 0 = never to 5 = always). The CET consists of five subscales: (a) avoidance and rule-driven behaviour (e.g. exercising despite illness or injury, and to avoid negative withdrawal symptoms such as guilt, when unable to exercise), (b) weight control exercise (exercising to manage weight and shape), (c) lack of exercise enjoyment (exercising despite not wanting to), (d) mood improvement (experiencing positive affective responses of exercise) and (e) exercise-rigidity (exercising in a rigid, inflexible manner). The CET subscales have shown a good internal consistency in previous studies, with a Cronbach  $\alpha$  ranging from 0.75 to 0.88 (Meyer et al., 2011). In this study, the Cronbach alpha for the subscales range from 0.76 (CET-Lack of enjoyment) to 0.92 (CET-Avoidance), except the CET-Lack of enjoyment, whose Cronbach alpha value was 0.49. McDonald's omega values range from 0.60 (CET-Lack of enjoyment) to 0.92 (CET-Avoidance).

**Short Versions of the Patient-Reported Outcomes Measurement Information System (PROMIS)-Anxiety and Depression Scales (Cella et al., 2010).** The 7-item PROMIS-Anxiety scale measures perceived fear, worries, physiological hyperactivation and somatic symptoms related to arousal (e.g. fast heart rate, dizziness) over the last 7 days. The 8-item PROMIS-Depression scale assesses negative affect,



deficits in information processing, perceptions towards oneself and social cognitions over the last 7 days. Items on both PROMIS scales are rated on a 5-point Likert scale, ranging from 1 = *never* to 5 = *almost always*. Greater scores indicate higher levels of symptoms. Both PROMIS scales have previously been used in Spanish populations, with good reliability (e.g. Carretero et al., 2020). In this study, the PROMIS-Anxiety and PROMIS-Depression scales had a Cronbach alpha of 0.90 and 0.93, respectively. McDonald's omega values were 0.90 for PROMIS-Anxiety and 0.93 for PROMIS-Depression.

## Data Analyses

Descriptive statistics and Pearson correlations were imputed to explore associations between the key constructs (i.e. overall SCS score with all subscales of the CET, frequency of compensatory exercise behaviours, overall EDE-Q scores and anxiety and depression PROMIS scores).

A series of hierarchical regressions were then conducted to examine whether self-compassion was predictive of CET subscales and frequency of compensatory exercise, after controlling for ED symptoms and negative affect. The CET subscales and the frequency of compensatory exercise were entered as dependent variables in the hierarchical regressions. Overall levels of anxiety, depression, ED symptoms, age and degree were entered as covariates in the first block. Regarding the degree, three dummy variables were created. In the first dummy variable, scores of students from Health Sciences (0) were compared to the scores of students from Engineering (1); in the second dummy variable, scores from individuals studying Health Sciences (0) were compared to those who studied Social Sciences; and, in the third dummy variable, scores of students from Health Sciences (0) were compared to those who studied Sciences (1). Self-compassion was added in the second block.

The indirect effect of self-compassion on the association between compulsive exercise and eating disorder symptoms, while controlling for age, anxiety and depression, was examined through simple mediation models, using bootstrapping with 5000 resamples (Model 4, Process Macro; Hayes, 2017). Each CET dimension was introduced as the independent variable in each model, eating disorder symptoms as the dependent variable, self-compassion as the mediating variable, and age, anxiety and depression as covariates. Since the dependent variable in the mediation models (overall EDE-Q score) was positively skewed, and the final mediation models did not meet the homoscedasticity assumption for regressions, the overall EDE-Q was log-transformed. Before conducting the log-transformation, as the overall EDE-Q tended to zero, and it is not possible to get a log value of zero, a constant was added to this variable

before conducting the transformation [ $\log(X_i + 1)$ ] and to all the data in the models (Field, 2009).

## Results

### Preliminary Analyses

Table 1 shows descriptive statistics and correlations. The SCS-Global score was negatively and significantly associated with CET-Avoidance, CET-Weight control exercise, CET-Lack of enjoyment and CET-Exercise rigidity. The SCS-Self-kindness dimension was negatively and significantly linked to CET-Avoidance, CET-Weight control and CET-Lack of exercise enjoyment. The non-compassionated factors (SCS-Over-identification, SCS-Isolation and SCS-Self-judgement) were positively and significantly related to CET-Avoidance, CET-Weight control and CET-Lack of exercise enjoyment. Moreover, SCS-Self-judgement was significantly linked to CET-Exercise rigidity. The magnitude of correlations between SCS subscales and CET dimensions ranges from small to medium. The frequency of compensatory exercise was significantly positively related to total EDE-Q score and SCS-Self-judgement, and showed a small, negative association with the SCS-Global score and SCS-Self-kindness. Symptoms of both anxiety and depression were low, and positively associated with CET-Avoidance, CET-Weight control exercise and CET-Lack of enjoyment. No significant associations were identified between frequency of compensatory exercise with anxiety and depression.

### Regressions

Table 2 shows the hierarchical regression models predicting compulsive exercise subscales and frequency of compensatory exercise as outcomes. In the CET-Avoidance model, only EDE-Q emerged as a significant predictor in the final model, accounting for 22% of CET-Avoidance variance.

The final CET-Weight control model produced three significant predictors (PROMIS-Depression, EDE-Q and SCS-Global score). SCS-Global score accounted for 1% of the variance of CET-Weight control. For the CET-Lack of exercise enjoyment model, total EDE-Q scores, SCS-Global score and the covariates Health Sciences vs. Engineering and Health Sciences vs. Social Sciences were found to be significant predictors in the final model. Regarding the dummy variables, those results suggest that students from Health Sciences scored significantly higher on CET-Lack of exercise enjoyment than students from Engineering and significantly lower than students from Social Sciences. The final model predicted 9% of the

**Table 1** Descriptive statistics and Pearson correlations ( $n=550$ )

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) CET-Avoidance and rule-driven behaviour	.58**															
(2) CET-Weight control exercise	.52**	.39**														
(3) CET-Mood improvement	.05	.20**	-.38**													
(4) CET-Lack of exercise enjoyment	.66**	.50**	.60**	-.12**												
(5) CET-Exercise rigidity	.16**	.14**	.03	.13**	.04											
(6) PROMIS-Anxiety	.21**	.14**	.02	.12**	.06	.70**										
(7) PROMIS-Depression	.48**	.65**	.22**	.26**	.31**	.34**	.39**									
(8) EDE-Q Total score	-.23**	-.30**	-.07	-.22**	-.08*	-.54**	-.52**	-.45**								
(9) SCS-Global score	-.16**	-.26**	.00	-.21**	-.03	-.36**	-.38**	-.40**	.77**							
(10) SCS-Self-kindness	.35**	.32**	.21**	.13**	.18**	.52**	.49**	.45**	-.74**	-.46**						
(11) SCS-Self-judgement	-.00	-.15	.08	-.13**	.06	-.25**	-.25**	-.23**	.68**	.65**	-.20**					
(12) SCS-Mindfulness	.18**	.23**	.12**	.19**	.13**	.51**	.44**	.33**	-.75**	-.37	.66**	-.30**				
(13) SCS-Over identification	.07	-.05	.09*	-.07	.08*	-.09*	-.06	-.11**	.46**	.42**	-.03	.51**	-.10*			
(14) SCS-Common humanity	.28**	.23**	.13**	.19**	.14**	.48**	.52**	.33	-.74**	-.40**	.65**	-.28**	.65**	-.02		
(15) SCS-Isolation	.35**	.43**	.28**	-.02	.39**	.05	.07	.32**	-.09*	-.09*	.12**	-.00	-.07	-.01	.08*	
(16) Frequency of compensatory exercise	1.05	2.20	2.87	1.55	1.79	14.68	10.57	1.50	17.21	2.72	3.04	2.86	3.34	2.73	2.72	1.07
<i>M</i>	1.11	1.19	1.39	1.06	1.35	6.63	8.04	1.40	3.63	.83	.88	.78	.90	.80	.97	2.07
<i>SD</i>																

\* $p \leq .05$ ; \*\* $p \leq .01$ . CET, Compulsive Exercise Test; PROMIS, Patient-Reported Outcomes Measurement Information System; EDE-Q, Eating Disorder Examination-Questionnaire; SCS, Self-Compassion Scale

**Table 2** Hierarchical regression analyses

Dependent variable	Model	Independent variables	<i>F</i>	Adj. <i>R</i> . <sup>2</sup>	St. <i>B</i>	<i>t</i>
CET-ARDB	Model 1	Age	23.71***	.22	-.03	-.81
		Health Sciences vs. Engineering			-.02	-.57
		Health Sciences vs. Social Sciences			-.01	-.34
		Health Sciences vs. Sciences			-.00	-.24
		PROMIS-Anxiety			-.02	-.48
		PROMIS-Depression			.04	.72
		EDE-Q Global score			.47	11.40***
	Model 2	Age	20.71***	.22	-.03	-.79
		Health Sciences vs. Engineering			-.02	-.57
		Health Sciences vs. Social Sciences			-.01	-.34
		Health Sciences vs. Sciences			-.01	-.25
		PROMIS-Anxiety			-.02	-.50
		PROMIS-Depression			.05	.68
		EDE-Q Global score			.42	10.85***
CET-WCE	Model 1	Age	57.92***	.42	.00	.22
		Health Sciences vs. Engineering			.00	.26
		Health Sciences vs. Social Sciences			-.01	-.44
		Health Sciences vs. Sciences			.01	.52
		PROMIS-Anxiety			-.01	-.40
		PROMIS-Depression			-.11	-2.35
		EDE-Q Global score			.69	19.35***
	Model 2	Age	51.89***	.43	.01	.52
		Health Sciences vs. Engineering			.00	.22
		Health Sciences vs. Social Sciences			-.01	-.41
		Health Sciences vs. Sciences			.01	.44
		PROMIS-Anxiety			-.05	-1.04
		PROMIS-Depression			-.13	-2.76**
		EDE-Q Global score			.67	17.88***
CET-LEE	Model 1	Age	7.41***	.08	.02	.48
		Health Sciences vs. Engineering			-.08	-2.03*
		Health Sciences vs. Social Sciences			.08	1.94
		Health Sciences vs. Sciences			.00	.18
		PROMIS-Anxiety			.06	1.14
		PROMIS-Depression			-.01	-.23
		EDE-Q Global score			.26	5.79**
	Model 2	Age	7.53***	.09	.03	.83
		Health Sciences vs. Engineering			-.08	-2.08*
		Health Sciences vs. Social Sciences			.08	1.99*
		Health Sciences vs. Sciences			.00	.09
		PROMIS-Anxiety			.02	.35
		PROMIS-Depression			-.04	-.72
		EDE-Q Global score			.22	4.77***
SCS-Global score	-.14	-2.77**				

Table 2 (continued)

Dependent variable	Model	Independent variables	<i>F</i>	Adj. <i>R</i> . <sup>2</sup>	St. <i>B</i>	<i>t</i>
Frequency of compensatory exercise	Model 1	Age	13.14***	.10	-.00	-.13
		Health Sciences vs. Engineering			-.02	-.64
		Health Sciences vs. Social Sciences			-.07	-1.76
		Health Sciences vs. Sciences			-.03	-.73
		EDE-Q Global score			.31	7.58***
	Model 2	Age	11.26***	.10	-.01	-.24
		Health Sciences vs. Engineering			-.02	-.60
		Health Sciences vs. Social Sciences			-.07	-1.78
		Health Sciences vs. Sciences			-.02	-.71
		EDE-Q Global score			.34	7.39***
		SCS-Global score			.06	1.33

\* $p \leq .05$ ; \*\* $p \leq .01$ . *CET*, Compulsive Exercise Test; *PROMIS*, Patient-Reported Outcomes Measurement Information System; *EDE-Q*, Eating Disorder Examination-Questionnaire; *SCS*, Self-Compassion Scale

CET-Lack of exercise enjoyment variance. SCS-Global score accounted for 1% of the variance.

In the frequency of compensatory exercise prediction, since anxiety and depression scores were not significantly linked with the frequency of exercise, those variables were not entered as covariates. The final model produced one unique significant predictor, the total EDE-Q score, explaining for 10% of the variance of the frequency of compensatory exercise.

### Mediation Models

Figure 1 displays the three mediation models and the standardised coefficients for each pathway between CET subscales, SCS-Global scores and ED symptoms, while controlling for age, anxiety and depression. Findings of 5000 bootstrapped samples indicated that the indirect effects of CET subscales on eating disorder symptoms through self-compassion were significant in the three models. Furthermore, in the three models, each CET subscale had a significant and negative direct path to SCS-Global score. SCS-Global score had a significant and negative direct path to ED symptoms in the three models. Moreover, the direct effects of the CET subscales on ED symptoms were significant when the mediator was not included in the models (c paths). The total effects of CET subscales when SCS-Global score was included as predictor (c' paths) were significant.

The associations between the covariates, self-compassion and ED symptoms can be found in the supplementary materials (Table S1, Table S2 and Table S3).

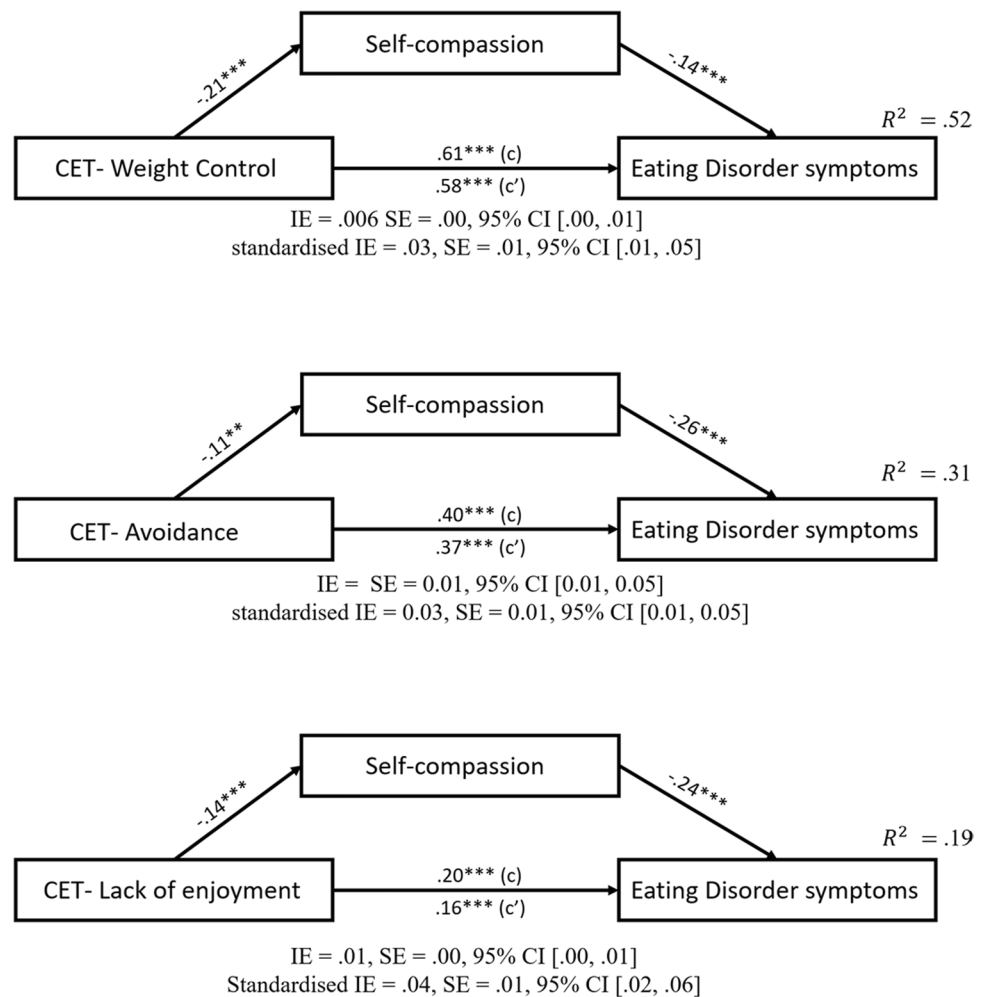
### Discussion

The main aim was to examine the links between self-compassion and harmful attitudes and behaviours towards exercise and ED symptoms. Our first hypothesis, that self-compassion would be significantly and negatively linked to compulsive exercise dimensions, was partially confirmed. Specifically, exercising to avoid affective withdrawal symptoms when unable to exercise, rule-driven behaviour, an increased tendency to exercise in order to reduce weight, and lack of exercise enjoyment were linked to lower self-kindness and greater levels of over-identification, isolation and self-judgement. This association may suggest that young women who engage in harmful exercise attitudes and behaviours may struggle with feelings of self-judgement, over-identification and isolation when unable to exercise or when they are experiencing body concerns. Moreover, compulsive exercisers may struggle to offer kindness and tenderness towards oneself in unpleasant exercise experiences and body concerns. Since self-compassion is considered 'a trainable state of mind in which maladaptive tendencies toward self-judgement, isolation, and over-identification are reduced' (Neff, 2016a., p. 794), cultivating compassion may help individuals to modify the way they relate to themselves (Neff, 2019), helping them to neutralise and embrace negative emotional patterns, and building more positive experiences and feelings of kindness, equanimity and connectedness (Neff et al., 2005).

Moreover, it was found that the associations between lower self-compassion and greater weight control exercise remained significant, even controlling for eating disorder symptoms, affect and age. Weight and shape concerns are



**Fig. 1** Mediation models when controlling for age, anxiety and depression scores. IE, indirect effect



a core feature in compulsive exercise (Meyer et al., 2011). Indeed, without these body concerns, exercise is not considered a clinical syndrome (Meyer et al., 2011). This finding is partially in line with Magnus et al.'s (2010) results, in which overall self-compassion score was significantly and negatively associated with global levels of obligatory exercise. However, this study expands on previous evidence by showing that self-compassion emerged as a significant predictor of exercising for weight control over and above ED symptoms and levels of anxiety and depression. Taken together, those results suggest that lower self-compassionate attitudes may play a potential role in the maintenance of compulsive exercise. As indicated by Albertson et al. (2015), developing self-compassion may help to accept themselves in spite of their imperfections and to alleviate concerns and suffering associated with body concerns. In turn, cultivating acceptance and kindness towards the selves may help to reduce dysregulated emotion regulation strategies, such as harmful exercise attitudes and behaviours. Moreover, cultivating the sense of common humanity may help individuals to be aware about harmful

and unrealistic ideals of beauty and that bodies come in all sizes and shapes (Albertson et al., 2015).

Furthermore, a *lack* of self-compassion was predictive of the lack of exercise enjoyment aspect of compulsive exercise. This finding is in line with Magnus et al.'s (2010) results, in which greater levels of self-compassion were linked to intrinsic motivations towards exercise (such as fun and enjoyment). This may suggest that individuals who are not engaged in self-compassionate attitudes and behaviours may experience difficulties in enjoying when exercising. However, it is also plausible to suggest that exercise without enjoyment could be related to extrinsic motivations towards exercise (e.g. exercising because other people said), which has been linked to lower levels of self-compassion (Magnus et al., 2010).

The *lack* of associations between self-compassion elements and frequency of compensatory exercise may reflect the exercise paradox (Bratland-Sanda et al., 2019), in which it is suggested that elevated exercise obsessions may not be linked to high frequency of compensatory exercise. Those results are in line with Linardon's (2021) findings, in which self-compassion was not retained as a significant

contributor in the prediction of frequency of compensatory exercise when body appreciation and intuitive eating were also included in the model. It is worth noting that previous evidence has found a significant positive link between physical activity levels and self-compassion in general population (Wong et al., 202). However, our findings along with Linaudon's (2021) results suggest that the positive link between physical activity and self-compassion may change when the frequency of exercise is motivated by body and shape concerns. Finally, since self-compassion was only negatively related to exercise obsessions (measured with the compulsive exercise test), but not compulsions (assessed with the EDE-Q), the results suggest the importance of separately evaluating exercise attitudes and behaviours.

Results from the mediation analyses showed that self-compassion may partially mediate the association between harmful exercise attitudes (namely, avoidance rule driven exercise and weight control exercise) and eating disorder symptoms. However, it is noteworthy to highlight that the indirect effects were weak in the three models. The age of the participants may influence the weak indirect effect of self-compassion on the link between compulsive exercise and ED symptoms. In this line, evidence has found that in children and adolescents exercise is the most frequently compensatory behaviour used (Stiles-Shields et al., 2012). A plausible reason may be that young individuals are under the supervision of their parents and exercise is perceived as less harmful and more socially acceptable than other compensatory behaviours, such as vomiting (Stiles-Shields et al., 2012). Therefore, it is possible to suggest that relationships between self-compassion and compulsive exercise may be greater amongst youth compared to university students. Although further longitudinal and experimental research amongst youth is needed to unpack the causal links between self-compassion, harmful exercise attitudes and behaviours and eating symptoms, these results suggest that self-compassion may be a promising preventative element of both harmful attitudes and behaviours towards exercise and eating disorder symptoms.

A growing body of evidence has robustly shown that contemplative practices could positively impact in mental health and well-being. This assumption has been strongly supported in the last decade. For example, Albertson et al. (2015) in a randomized controlled trial of a brief 3-week self-compassion intervention in women found that the participants in the self-compassion intervention experienced significantly increased body appreciation and significantly decrease body dissatisfaction, body shame and contingent self-worth based on appearance compared to the control group. Indeed, those changes were maintained 3 months later. Gilbert and Procter (2006) applied the Compassionate Mind Training in individuals with high

levels of shame and guilt. The results showed a significant impact on the reduction of depression, anxiety, self-attacking, self-criticism, feelings of inferiority, submissive behaviour and shame (Gilbert & Procter, 2006). A recent meta-analysis evaluating 27 randomised controlled trials for self-compassion-based interventions found that those interventions have large effect sizes in the reduction of eating disorder symptoms and rumination and moderate effect sizes for symptoms in the reduction of self-criticism, stress, depression and anxiety outcomes (Ferrari et al., 2019). Based on the aforementioned studies that have adopted self-compassion-based approaches intervention, it is plausible to suggest that applying a self-compassion approach in compulsive exercisers may help to (1) being aware of negative emotions when unable to exercise or in other negative experiences; (2) reduce self-criticism and feelings of guilt when unable to exercise and self-tolerate, self-accept and embrace those unpleasant emotions rather than avoiding them; (3) teach to treat themselves with kindness and tenderness and forgive themselves when unable to exercise rather than using rule-driven behaviours; (4) perceive exercise as a tool to promote one's well-being (not just for body image reasons); and (5) accept imperfection as a part of the human experience and increase reassurance towards the self.

## Limitations and Future Research

Several limitations should be noted. Firstly, given that measures were assessed by self-report questionnaires, further research based on clinical interviews may help to reduce any social desirability biases (e.g. Podsakoff et al., 2012). Secondly, given that the CET-Lack of exercise enjoyment showed a poor Cronbach alpha value, the findings related to this subscale should be interpreted with caution. Thirdly, since self-compassion and compulsive exercise were assessed cross-sectionally, causal relationships between the variables cannot be established. Further experimental studies are needed to clarify whether interventions focused on developing self-compassion may be helpful in reducing compulsive exercise attitudes and behaviours. Fourthly, given some evidence suggest that men may experience higher levels of compulsive exercise compared to women (e.g. Lavender et al., 2010; Murray et al., 2014), exploring the link between self-compassion and compulsive exercise amongst men is needed. Finally, given that this study was based on female university students, it is uncertain whether our results can be generalizable to other populations, such as female adolescents. Therefore, further research is needed to clarify the link between self-compassion and compulsive exercise in different populations.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s12671-022-01906-7>.

**Author Contribution** CCZ: designed the study, assisted with the data analyses, and wrote the paper. JR: designed the study and writing of the study. MP: collaborated with the design of the study. MP and AT: collected the data and writing of the study. CRP: collaborated in the writing and editing of the manuscript.

**Funding** Open Access funding provided thanks to the CRUE-CSIC agreement with Springer Nature. This work was supported by the Castilla-La Mancha Department of Education, Culture and Sports and the European Regional Development Fund under SPBLY/19/180501/000181 grant and the Spanish Ministerio de Ciencia, Innovación y Universidades (Spain) under PID2019-103956RB-I00 grant.

**Data Availability** The authors were not allowed to publicly publish the datasets generated and analysed in the current study following the ethics protocol and informed consent procedure; therefore, those datasets are not publicly available. We will be glad to reply any questions from the analyses and to share unpublished information from this dataset upon request.

## Declarations

**Ethics Approval** This research was approved by the Albacete Hospital Ethics Committee.

**Consent to Participate** Before the data collection, all participants provided a written informed consent.

**Conflict of Interest** The authors declare no competing interests.

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