Mindfulness (2020) 11:709–719
https://doi.org/10.1007/s12671-019-01292-7

ORIGINAL PAPER

Self-Compassion and Depressive Symptoms in Chronic Pain (CP): A 1-Year Longitudinal Study

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Published online: 19 December 2019

Abstract

Objectives Self-compassion is associated with less depressive symptoms, better mental health outcomes, and less disability in chronic pain (CP). However, it remains longitudinally unexplored the role of self-compassion in CP. Also, although it acknowledged the conceptual overlapping between mindfulness and self-compassion, few studies have explored the role of self-compassion in CP while controlling for mindfulness in a longitudinal design.

Methods The current study conducts correlational and hierarchical linear regression analyses in a sample of 86 women with CP who completed an online battery of questionnaires that assess pain intensity, functional impairment, depressive symptoms, mindfulness, and self-compassion in three time points: baseline (T0), 6 months (T1), and 12 months (T2).

Results Results show that self-compassion (but not mindfulness) significantly predicts depressive symptoms at T1 and at T2 above and beyond depressive symptoms and functional impairment. Also, the interaction between functional impairment and self-compassion at T0 significantly predicts depressive symptoms at T1, but not at T2.

Conclusions These findings expand the current knowledge on the role of self-compassion in CP in showing that self-compassion is a significant predictor of later depressive symptoms in CP and suggesting its potential role in buffering the impact of functional impairment in future levels of depressive symptoms.

Keywords Chronic pain · Self-compassion · Mindfulness · Depression · Longitudinal design

Chronic pain (CP) is a debilitating medical condition characterized by constant or sporadic pain for at least 3 months (Merksey and Bogduk 1994) and is associated with functional impairment (e.g., Breivik et al. 2013) and depressive symptoms (Elliott et al. 2003; Jobski et al. 2017; Ohayon and Schatzberg 2010). The causal relationship between pain and depressive symptoms is an ongoing interest of pain research (e.g., Lerman et al. 2015; Wörz 2003), and it seems that both present reciprocal relationships (e.g., Kroenke et al. 2011) are influenced by psychological processes (see Gatchel et al. 2007 for a review). Indeed, the role of psychological phenomena in CP etiology is widely recognized, including in the fear-avoidance model (FAM), which postulates that CP disability results from a cascade of events produced by the perceiving of pain as threatening (Vlaeyen et al. 2016). For the past 30 years, the majority of research on psychological factors in CP has focused on beliefs and on the content of thoughts (e.g., Crombez et al. 2012). Nevertheless, there has been new research increasing our understanding by focusing on the psychological processes underlying different thoughts and beliefs. For example, recent evidence has expanded the FAM by including the role of attention regulation processes such as mindfulness in CP etiology (Schütze et al. 2010).

Mindfulness has been defined as the ability to pay attention to the present moment in a purposefully and nonjudgmentally manner (Kabat-Zinn 2002). Although comprising different components (see Coffey et al. 2010 for a topical discussion), the ability to intentionally self-regulate attention is the building block of mindfulness (Bishop et al. 2004), and it seems to predict less depressive symptoms in chronic illness (see Bohlmeijer et al. 2010 for a review), as well as in CP (e.g., McCracken et al. 2007; McCracken and Gutiérrez-Martínez

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2011). There is considerable amount of research showing the benefits of mindfulness in CP (see Hilton et al. 2017 for a meta-analytic review). Indeed, the ability to self-regulate attention seems to counteract the automatic and unaware nature of detrimental psychological phenomena involved in psychopathological symptoms in CP (McCracken and Vowles 2014).

Recently, there is a growing interest in exploring the role of self-compassion in CP. Self-compassion is described as the ability to be touched by and open to experience one's suffering (Dalai Lama 2001) with kindness (Neff 2003). In addition, self-compassion encompasses a motivation to alleviate personal suffering (Gilbert 2005) and the courage to engage with difficult emotions and overall internal experiences (Gilbert 2014). Research has found that self-compassion is negatively associated with psychopathological symptoms (see MacBeth and Gumley 2012), and it seems to be a relevant process in CP (Vowles et al. 2014). Indeed, research on CP have found that self-compassion is associated with less emotional distress and depressive symptoms (Costa and Pinto-Gouveia 2013), with less negative affect and pain disability (Wren et al. 2012), and was found to moderate the relationship between cognitive fusion and depressive symptoms (Carvalho et al. 2018b). However, the majority of research on self-compassion presents the limitations of cross-sectional designs. Few longitudinal studies have been conducted, but those that did conduct longitudinal studies suggest that it predicts more life satisfaction, less negative affect (Hope et al. 2014), and less disordered eating (Stutts and Blomquist 2018) in college students and less depressive symptoms in depressed outpatients (Krieger et al. 2016). However, one study found that self-compassion did not longitudinally predict depressive symptoms in a 1-year assessment in a sample from general population (López et al. 2018). It should be noted that in the López et al. (2018) study, the correlation between self-compassion and depression depended on how the authors used the self-compassion scale: a total score of the self-compassion scale was strongly correlated with depression at time 1 and time 2, while the positive "self-compassion" items alone (i.e., without the negative "self-criticism" items) presented a weak association with depressive symptoms – which, as the authors mention, may suggest that the strong correlation is mainly accounted by the negative items in the self-compassion scale. These different results and its nuanced interpretation suggest that more research is needed on the longitudinal relationship between self-compassion and depression. Additionally, to our knowledge, self-compassion has not yet been longitudinally explored in CP. Also, only one study has controlled for other related constructs (e.g., mindfulness) when exploring longitudinally the role of self-compassion in mental health (Zeller et al. 2015). Additionally, the role of self-compassion in CP has just recently been explored in a clinical context, with one uncontrolled study in a small sample ($N = 8$) suggesting its effect on decreasing depressive symptoms (Parry, and L.,, and Malpus Dr, Z. 2017) and one uncontrolled study in a small sample ($N = 12$) showing a decrease in pain severity and anger and increase in pain acceptance (Chapin et al. 2014). Although these are promising and seem to point out the usefulness of self-compassion in CP, more research is needed on both its clinical efficacy, as well as the mechanisms through which it produces positive outcomes. In fact, more research is needed on the operationalization of closely related psychological processes (e.g., mindfulness and self-compassion) in order to establish the specific contributions of each in CP.

The relationship between mindfulness and self-compassion is complex in both conceptual and empirical levels, and they seem to share overlapping dimensions, which urges for a better understanding of their differential role in mental health. Indeed, both mindfulness and self-compassion include practices that aim to cultivate awareness and acceptance abilities (see Neff and Dahm 2015 for a topical discussion), but self-compassion seems to involve an additional affective component (i.e., a caring and kind way of self-to-self relating) (Birnie et al. 2010) and an orientation to action (Pauley and McPherson 2010) that makes it a better predictor (than mindfulness) of quality of life and depression severity (Van Dam et al. 2011). Indeed, this action-orientation seems to mediate the relationship between self-compassion (but not mindfulness) and depressive symptoms in women with CP (Carvalho et al. 2018a). Nevertheless, although it is conceptually proposed that mindfulness is an inherent quality of self-compassion (Neff 2003) and it has emphasized the importance of intentionally cultivating an attitude of kindness and open heartedness in mindfulness (Kangas and Shapiro 2012; Kuyken et al. 2010), the specific predictive effect of each process (i.e., mindfulness and self-compassion) in CP has never been explored in a longitudinal design.

The current study aims to explore longitudinally the role of self-compassion as a predictor of depressive symptoms in a sample of women with CP. Specifically, this study aims to test the hypothesis that self-compassion at baseline (T0) is a significant predictor of depressive symptoms at 6 months (T1) and 12 months (T2), above and beyond pain intensity, functional impairment, depressive symptoms, and mindfulness at baseline (T0). Also, the current study aims to test the hypothesis that self-compassion at baseline (T0) moderates the effect of functional impairment at baseline (T0) on depressive symptoms at 6 months (T1) and 12 months (T2). In order to assure that we are indeed measuring self-compassion, rather than the absence of uncompassionate or self-critical responding (e.g., López et al. 2015; Muris et al. 2016), the current study will solely focus on the positive items of the self-compassion scale as a measure of self-compassionate attitude.

Method

Participants

A power analysis was not conducted previously to determine sample size needed. However, a post hoc analysis was calculated using G*Power in order to test the power of the hierarchical regression analyses.

The sample is composed of 86 women with musculoskeletal CP who completed an online battery of socio-demographic, medical, and self-report questionnaires at three time points: baseline (T0), 6 months (T1), and 12 months (T2). Inclusion criteria include (a) having constant or sporadic pain, unrelated to oncological disease, for 3 months or more; (b) age above 18 years; and (c) having access to an online device in order to complete the battery of questionnaires. The sample had a mean age of 50.73 ($SD = 10.84$). In terms of marital status, 51 were married (59.3%), 20 were divorced (23.3%), 13 were single (15.1%), and 2 were widowed (2.3%). The majority had a high school ($N = 26$; 30.2%) or bachelors' degree ($N = 37$; 43%) and were currently employed ($N = 63$; 73.3%). Of those who were not ($N = 23$; 26.7%), one was on work leave due to CP (1.2%). All participants reported having their CP diagnoses provided by one or more medical doctors, such as the rheumatologist ($N = 68$; 79.1%), general practitioner ($N = 14$; 16.3%), psychiatrist ($N = 7$; 8.1%), and/or by other medical specialties ($N = 70$; 81.4%). The majority of CP diagnoses included fibromyalgia ($N = 74$; 86%), low back pain ($N = 11$; 12.8%), arthrosis ($N = 10$; 11.6%), and/or rheumatoid arthritis ($N = 9$; 10.5%). Participants had CP for more than 10 years ($N = 51$; 59.3%), from 5 to 10 years ($N = 23$; 26.7%), and from 1 to 5 years ($N = 12$; 14%), and 49 had other chronic illnesses (57%).

Procedure

The current study was approved by the Scientific and Ethics Committee of the University where the first author is affiliated. Five national CP associations were contacted and three accepted to collaborate by advertising the study and its online link through their mailing list. The study was accessed by 479 participants, of which 246 completed the battery of questionnaires (nonresponse attrition rate: 48.64%). In order to have a homogeneous sample in terms of gender and nationality, nine men and six non-Portuguese women were excluded from the study. Participants provided an email for the research team to send the link for the 6-months and 12-months online questionnaires. The sample size at baseline (T0) was $N = 231$. At the 6-months assessment (T1), $N = 113$ completed the questionnaires (dropout attrition rate: 51.08%). At 12-months assessment (T2), $N = 89$ participants completed the final assessment (dropout attrition rate: 61,47%). At the end of data collection, $N = 86$ participants responded to the battery of questionnaires in all three assessment points (dropout attrition rate: 62.77%). The current study was conducted with the final $N = 86$ who completed all three assessments. All participants provided informed consent and were assured of the confidentiality of data.

Measures

The following instruments were completed at baseline (T0), 6-months (T1), and 12-months (T2) assessment:

Numerical Pain Rating Scale (NPRS; Ferreira-Valente et al. 2011; Hartrick et al. 2003). The NPRS is a widely used 11-item unidimensional measure of pain intensity in adults. The scale comprises numbers from 0 ("No pain") to 10 ("Worst imaginable pain"). A single score of "average pain intensity in the last 24 h" was created from ratings of (1) current pain, (2) highest pain in last 24 h, and (3) lowest pain in last 24 h. Higher scores indicate greater pain intensity. Our study found good internal consistency: $\alpha_{T0} = 0.86$, $\alpha_{T1} = 0.87$, $\alpha_{T2} = 0.87$.

Work and Social Adjustment Scale (WSAS; Mundt et al. 2002). This is a 5-item measure that assesses five domains: work, home management, social leisure activities, private leisure activities, family, and other relationships. Each item is rated from 0 (no impairment) to 8 (very severe impairment). Higher scores on this scale indicate higher levels of functional impairment. The current study found values that indicate good internal consistency: $\alpha_{T0} = 0.88$, $\alpha_{T1} = 0.94$, $\alpha_{T2} = 0.92$.

Mindful Attention Awareness Scale (MAAS; Brown and Ryan 2003; Gregório and Pinto-Gouveia 2013). The MAAS is a 15-item measure of characteristics of dispositional mindfulness, i.e., abilities to present an open awareness of and attention to the present moment. The respondent is asked to rate the frequency of those experiences using a 6-point Likert-like scale (1 = Almost always; 6 = Almost never). The current study found good Cronbach's alpha values: $\alpha_{T0} = 0.91$, $\alpha_{T1} = 0.92$, $\alpha_{T2} = 0.93$.

Self-Compassion Scale – Short Form (SCS-SF; Castilho et al. 2015; Raes et al. 2011). This is a shorter 12-items version of the original 26-item Self-Compassion Scale (Neff 2003) that assesses self-compassion in a 5-point Likert scale (1 = "Almost Never"; 5 = "Almost Always"). The factor structure of the SCS has been an ongoing topic of discussion, with studies suggesting a six-factor or one-factor structure (Neff 2003), while others suggest the possibility of using SCS as a two-factor structure (Muris and Petrocchi 2017): a *self-compassionate* attitude (SCS-Pos: a composite of self-kindness, common humanity and mindfulness) and a *self-critical* attitude (SCS-Neg: that results from the sum of self-judgment, isolation and over-identification). The current study follows

the two-factor structure and will focus on the self-compassionate subscale, which presented good internal consistency: $\alpha_{T0} = 0.85$, $\alpha_{T1} = 0.87$, $\alpha_{T2} = 0.84$. It is noteworthy that the two-factor structure of the short version of SCS has not been extensively studied. However, to our knowledge, two studies did so and found the two-factor structure to present the best fit (Bratt and Fagerström 2019; Hayes et al. 2016).

Depression Anxiety Stress Scales (DASS-21; Lovibond and Lovibond 1995; Pais-Ribeiro et al. 2004). DASS-21 is a 21-item measure of depression, anxiety, and stress symptoms over the respondent's previous week. Items are rated on a 4-point scale (0 = "Did not apply to me at all"; 3 = "Applied to me very much, or most of the time"). Higher scores indicate higher psychological distress. Only the depression subscale was used in the present study. The current study found good internal consistency: $\alpha_{T0} = 0.94$, $\alpha_{T1} = 0.92$, $\alpha_{T2} = 0.92$.

Data analysis

The Statistical Package for the Social Sciences (SPSS IBM Corp. v.212012) was used to conduct all statistical analyses. There were no missing data given that the online survey could only be submitted if totally completed. Pearson correlation coefficients were analyzed to explore the associations between variables (Cohen 1988).

One hierarchical linear regressions were conducted in order to test the effect of the interaction between self-compassion and functional impairment at baseline (T0) on depressive symptoms at 6 months (T1) and 12 months (T2) (dependent variables) while controlling for pain intensity, mindful awareness, and depressive symptoms at T0 (Frazier et al. 2004). In the first step of each analysis, depression symptomatology at T0 was added in the model (to control for its effects), and then pain intensity and functional impairment at T0 were added in Step 2. At Step 3, mindful awareness and self-compassion at T0 were added in Step 3. Finally, at Step 4 the interaction of functional impairment and self-compassion was added to the model.

Results

Preliminary Analysis and Correlations

Skewness values varied between − 0.10 (WSAS at T0) and 0.75 (DASS-DEP at T2), and the values of kurtosis ranged from − 0.97 (WSAS at T2) and − 0.28 (NPRS at T0). The data distribution can thus be considered normal (Kline 2000). Variance inflation factor (VIF) values confirmed the absence of multicollinearity for all independent variables (VIF values ranged from 1.00 to 1.83) (Kline 2000).

Results from the correlation analysis (Table 1) showed that pain intensity at all assessment points was positively linked to functional impairment in all assessment points. Pain intensity at T0 and T1 was not associated with mindful awareness, self-compassion, or depression symptoms at all assessment points. Pain intensity at T2 was also not correlated with these variables with the exception of mindfulness awareness at T0, which presented a negative and significant correlation with pain intensity at T2 and depression symptoms at T1which had a positive and significant association with pain intensity at T2. Functional impairment at T0 was associated with all variables in study. Functional impairment at T1 and T2 was also correlated with all variables except with mindful awareness at T0. There were moderate to high correlations between mindful awareness, self-compassion, and depression symptomatology at all assessment points. Mindful awareness and self-compassion were positively associated with each other and negatively associated with depression symptoms.

Predicting Depression Symptomatology at T1 (6 Months)

In the first step of the regression model (Table 2), depression symptomatology measured at T0 was entered as a predictor of depression symptomatology measured at T1, which produced a significant model ($F_{(1,\ 84)} = 78.46$, $p < 0.001$) that explained 48% of the variance of the depression symptoms at T1. Depression symptoms at T0 significantly predicted depression symptoms at T1 with a significant effect of 0.70 ($p < 0.001$).

In the second step, pain intensity at T0 and functional impairment at T0 were further included as predictors of the model, which remained significant ($F_{(3,\ 82)} = 32.73$, $p < .001$) explaining 55% of the variance of depression symptoms at T1. Depression symptoms at T0 showed a significant effect of 0.56 ($p < 0.001$) on depression symptomatology at T1. Pain intensity at T0 was not a significant predictor of the model ($p = 0.724$). Functional impairment at T0 in turn significantly predicted depression symptoms at T1 with an effect of 0.27 ($p = 0.004$).

In the third step, mindful awareness at T0 and self-compassion at T0 were added to the model as predictors. The model remained significant ($F_{(5,\ 80)} = 22.67$, $p < .001$) and explained 59% of depression symptomatology at T1. Pain intensity ($p = 0.643$) and mindful awareness ($p = 0.967$) were not significant predictors of depression symptomatology at T1. The only significant predictors of this outcome were depression symptomatology at T0 ($\beta = 0.44$; $p < 0.001$), functional impairment at T0 ($\beta = 0.26$; $p = 0.005$), and self-compassion at T0 ($\beta = -0.24$; $p = 0.006$).

Table 1 Means, standard deviations, and intercorrelation scores ($N = 86$)

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. NPRS T0	5.28	1.81	–													
2. WSAS T0	24.95	8.32	0.38***	–												
3. MAAS T0	53.31	14.19	−0.05	−0.30**	–											
4. SCS T0	19.83	4.86	−0.03	0.27*	0.35**	–										
5. DASS-DEP T0	6.13	5.46	0.10	0.49***	−0.46***	−0.52***	–									
6. NPRS T1	5.14	1.91	0.61***	0.29**	−0.09	0.00	0.05	–								
7. WSAS T1	23.30	9.59	0.36**	0.75***	−0.21	−0.21*	0.40***	0.39***	–							
8. MAAS T1	53.08	14.87	0.00	0.36**	0.73***	0.39***	−0.44***	−0.08	−0.35**	–						
9. SCS T1	19.45	4.71	−0.08	−0.27*	0.37***	0.77***	−0.51***	−0.02	−0.32**	0.52***	–					
10. DASS-DEP T1	5.55	5.11	0.19	0.56***	0.36**	−0.54***	0.70***	0.16	0.55***	−0.47***	−0.54***	–				
11. NPRS T2	5.07	1.96	0.62***	0.42***	−0.26*	−0.12	0.21	0.70***	0.38***	−0.20	−0.09	0.22*	–			
12. WSAS T2	22.12	9.76	0.34**	0.75***	−0.21	−0.27*	0.42***	0.35**	0.78***	−0.34**	−0.25*	0.53***	0.47***	–		
13. MAAS T2	52.79	15.20	0.05	−0.41***	0.68***	0.45***	−0.47***	0.00	−0.36**	0.81***	0.50***	−0.50***	−0.19	−0.42***	–	
14. SCS T2	19.37	5.01	−0.07	−0.24*	0.36**	0.72***	−0.46***	−0.08	−0.22*	0.53***	0.75***	−0.45***	−0.21	−0.32**	0.51***	–
15. DASS-DEP T2	5.34	5.03	−0.12	0.49***	−0.32**	0.49***	0.68***	0.07	0.47***	−0.53***	−0.51***	0.74***	0.19	0.55***	−0.56***	−0.57***

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

T0 = baseline assessment; T1 = 6-month assessment; T2 = 12-month assessment

Table 2 Hierarchical multiple regression of the moderator effect of self-compassion on the relationship between functional impairment and depressive symptoms at T1 and T2, while controlling for depressive symptoms, pain intensity and mindfulness at T0 ($N = 86$)

	DASS-DEP at T1 (6 months)					DASS-DEP at T2 (12 months)				
	t	β (*p* value)	R^2 (R change)	sr^2	*F* (p value)	*t*	β (p value)	R^2 (R change)	sr^2	*F* (p value)
Step 1			0.48		78.46 (< .001)			0.47		73.22 (< .001)
DASS-DEP T0	8.86	0.70 (< .001)		0.48		8.56	0.68 (< .001)		0.47	
Step 2			0.55 (.062)		32.73 (< .001)			0.50 (.031)		26.99 (< .001)
DASS-DEP T0	6.47	0.56 (< .001)		0.23		6.41	0.58 (< .001)		0.25	
NPRS T0	0.36	0.03 (n.s.)		0.00		−0.15	−0.01 (n.s.)		0.00	
WSAS T0	2.92	0.27 (.004)		0.05		2.13	0.21 (0.04)		0.03	
Step 3			0.59 (.041)		22.67 (< .001)			0.52 (.026)		17.54 (< .001)
DASS-DEP T0	4.52	0.44 (< .001)		0.11		4.82	0.50 (< .001)		0.14	
NPRS T0	0.47	0.04 (n.s.)		0.00		−0.10	−0.01 (n.s.)		0.00	
WSAS T0	2.92	0.26 (.005)		0.04		2.12	0.21 (0.04)		0.03	
MAAS T0	0.04	0.00 (n.s.)		0.00		0.50	0.04 (n.s.)		0.00	
SCS T0	−2.80	−0.24 (.006)		0.04		−2.08	−0.19 (0.04)		0.03	
Step 4			0.61 (.024)		20.60 (< .001)			0.53 (.003)		14.61 (< .001)
DASS-DEP T0	4.62	0.50 (< .001)		0.21		4.80	0.50 (< .001)		0.23	
NPRS T0	0.52	0.04 (n.s.)		0.34		−0.09	−0.01 (n.s.)		0.00	
WSAS T0	2.97	0.90 (.004)		0.10		1.30	0.44 (n.s.)		0.02	
MAAS T0	0.30	0.02 (n.s.)		0.00		0.58	0.05 (n.s.)		0.00	
SCS T0	1,02	0.24 (n.s.)		0.01		−0.08	−0.02 (n.s.)		0.00	
WSAS x SCS T0	−2.20	−0.70 (.031)		0.06		−0.72	−0.25 (n.s.)		0.01	

n.s. = nonsignificant

DASS-DEP = depressive symptoms; NPRS = pain intensity; WSAS = functional impairment; MAAS = mindful awareness; SCS = self-compassion

T0 = baseline assessment; T1 = 6-month assessment; T2 = 12-month assessment

Predicting Depression Symptomatology at T2 (12 Months)

A similar analysis (Table 2) was conducted with depression symptomatology measured T2 (12 months later). In the first step of the regression model, a significant model was also produced ($F_{(1,\ 84)} = 72.22$, $p < 0.001$); this model accounted for 47% of the variance of the outcome. Depression symptoms at T0 significantly predicted depression symptoms at T2 with a significant effect of 0.68 ($p < 0.001$).

In the second step of the analysis, the model remained significant ($F_{(3,\ 82)} = 26.99$, $p < .001$) explaining 50% of the variance of depression symptoms at T2. In this step, depression symptoms at T0 presented a significant effect of 0.58 ($p < 0.001$) on the outcome. Pain intensity at T0 was not a significant predictor ($p = 0.879$), while functional impairment at T0 was with an effect of 0.21 ($p = 0.036$).

In the third step, the model remained significant ($F_{(5,\ 80)} = 17.54$, $p < .001$) and explained 52% of depression symptoms at T2. Pain intensity ($p = 0.921$) and mindful awareness ($p = 0.619$) were not significant predictors of depression symptomatology at T2. The only significant predictors of the model were found to be depression symptoms at T0 ($\beta = 0.50$; $p < 0.001$), functional impairment at T0 ($\beta = 0.21$; $p = 0.037$), and self-compassion at T0 ($\beta = -0.19$; $p = 0.040$).

The Moderator Effect of Self-Compassion

In Step 4, the moderation hypothesis was tested. Results from regression analyses testing the effect of the interaction between self-compassion and functional impairment on depressive symptoms showed that self-compassion (T0) moderates the association between functional impairment (T0) and depressive symptoms at 6 months (T1) while controlling for pain intensity, mindful awareness, and depressive symptoms at T0 ($\beta = -0.70$; $p = 0.031$), and the model is a significant one ($F = 20.60$, $p < .001$) and explains 61% of depressive symptoms (see Table 2). The post hoc G*Power analysis showed a power of 99.9% for the tested interaction, assuming an $f^2 = 0.59$ ($R^2 = 0.61$), an $\alpha = 0.05$, and a sample size of $N = 86$.

See Fig. 1 for a visual representation of the moderator effect of self-compassion on the association between functional impairment (T0) and depressive symptoms at 6 months (T1).

Figure 1 seems to indicate that for the same levels of functional impairment at T0, those who presented higher levels of

self-compassion at T0 also presented lower levels of depressive symptoms 6 months later. A conditional effect analysis was conducted to examine the significance of slopes. Results show that the relationship between functional impairment and depressive symptoms is still significant regardless self-compassion being low ($t = 6.09$, $p < 0.001$), medium ($t = 5.72$, $p < 0.001$), and high ($t = 3.00$, $p = 0.004$).

Regarding depressive symptoms at 12 months (T2), the final model is significant ($F = 14.61$, $p < .001$), but the effect of the interaction was not ($\beta = -0.25$; $p = 0.476$).

Discussion

The current study explored, in a longitudinal design, the relationship between self-compassion and depressive symptoms in a sample of women with CP while controlling for baseline levels of depressive symptoms, pain intensity, functional impairment, and mindful awareness. Correlational analyses echoed the existing literature suggesting the association between pain and functional impairment (e.g., Breivik et al. 2013) by showing the significant association between these variables in all assessment points. Interestingly, pain intensity at baseline was not significantly associated with depressive symptoms in any assessment point. This seems to corroborate the complexity of the etiology of depression in CP, in which more than the intensity of pain itself, mental health in CP is more strongly predicted by psychological mechanisms underlying the adjustment to pain cues (Gatchel et al. 2007; Vlaeyen et al. 2016). More interestingly, results seem to suggest that, in our sample, and contrarily to the proposition that depression in CP results from pain (e.g., Wörz 2003), depressive symptoms at T1 were positively associated to pain intensity 6 months later (T2), which seems to echo other longitudinal studies (e.g., Lerman et al. 2015). Nevertheless, more research is needed in order for us to draw unequivocal causal conclusions regarding the maintenance of depressive symptoms in CP. Future studies should explore the comorbidity and/or causal relations between depression and pain by designing studies able to explore the role of chronic inflammation as a potential mechanism of this association (Walker et al. 2014). Additionally, mindful awareness at baseline (T0) was not significantly associated to neither pain intensity nor functional impairment at 6 months (T1) and 12 months (T2), which seems to suggests that the mere attentional component of mindfulness does not play a crucial role in later pain intensity and adjustment. Also, mindful awareness and self-compassion were positively associated at all time points, and both negatively correlated with depressive symptoms, which is in line with previous research suggesting the close relationship between both psychological processes (Neff and Dahm 2015), and with depression (e.g., McCracken and Gutiérrez-Martínez 2011).

Results from hierarchical regression analyses showed that self-compassion at baseline predicted depressive symptoms 6 months (T1) and 12 months (T2) later, while mindful awareness did not, and this significant effect was above and beyond depressive symptoms and functional impairment at baseline. This seems to corroborate other cross-sectional studies suggesting that self-compassion is a better predictor of mental health than mindful awareness (e.g., Carvalho et al. 2018a; Van Dam et al. 2011). To our knowledge, this is the first study to explore longitudinally the role of self-compassion in CP, and only one other study controlled the effect of mindfulness while exploring longitudinally the role of self-compassion in mental health (Zeller et al. 2015). These results seem to corroborate the theoretical proposition that self-compassion has the potential to be particularly beneficial in CP. Indeed, the theoretical rationale for considering self-compassion a relevant predictor of positive outcomes in CP stems from experimental evidence suggesting that self-compassion is associated to higher levels of natural opioids (e.g., oxytocin) (Rockliff et al. 2011) and parasympathetic vagal toning measured through heart rate variability (e.g., Kirby et al. 2017), which produces positive affect (e.g., calmness, safeness) associated to opiate functioning (Depue and Morrone-Strupinsky 2005).

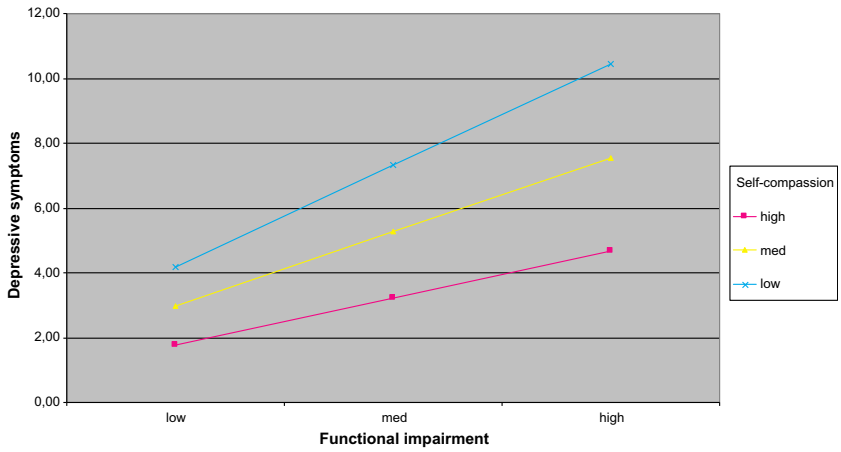

Fig. 1 The moderator effect of self-compassion (T0) on the relationship between functional impairment (T0) and depressive symptoms at 6 months (T1)

Also, a possible interpretation for the result that self-compassion, but not mindfulness, significantly predicted later levels of depressive symptoms is that self-compassion has an action-orientation (Pauley and McPherson 2010). Indeed, it seems that both behavioral activation approaches and self-compassion training share neural pathways involved in reward systems of positive emotions (e.g., Gawrysiak et al. 2012; Longe et al. 2010; Lutz et al. 2008), while on the other hand, mindfulness seems to operate in neural pathways involved in executive functioning (e.g., Tang et al. 2012). It may also be the case that self-kindness, which is measured by SCS but not by MAAS, might have been contributing to these results. Future studies should test this hypothesis by using the longer version of SCS in order to examine the role of self-kindness. It should be noted that, although a significant predictor, self-compassion accounted for a relatively small variance in depressive symptoms. Nevertheless, these results should be interpreted having in mind that the current study not only controlled for depressive symptoms at baseline but also controlled for well-known predictors of depressive symptoms in CP (e.g., pain-related functional impairment). Also, the current study measured self-compassion exclusively with the positive dimension of the scale, which assures us that we are indeed assessing the presence of self-compassion, and results are not due to statistical artifacts such as high correlations between the negative dimension of the scale and depressive symptoms.

Finally, results seem to suggest that self-compassion moderated the effect of functional impairment (T0) on depressive symptoms 6 months later (T1). This seems to be in line with previous studies that suggest that self-compassion is a significant predictor of less depressive symptomatology (e.g., Costa and Pinto-Gouveia 2013) and less pain disability (e.g., Wren et al. 2012), as well as it seems to corroborate the proposition that self-compassion might play a useful role in clinical approaches to CP management (Chapin et al. 2014; Parry and Malpus 2017). These results seem to indicate that having the ability to be kind and warm toward oneself when facing difficulties related to pain leads to less depressive symptoms. A possible explanation is that self-compassion seems to stem from an affiliative system that regulates threat (e.g., Gilbert 2005) and interrupts the cascade of fear-avoidance responses (Vlaeyen et al. 2016) by producing physiological (e.g., Kirby et al. 2017) and positive affect (e.g., López et al. 2018) that result in less depressive symptoms. However, it should be noted that the significance of slopes show that functional impairment still significantly predicts depressive symptoms 6 months later, regardless of low, medium, or high levels of self-compassion. Nevertheless, these results seem to indicate a trend: although still significant, the relationship between functional impairment (T0) and depressive symptoms (T1) seem to be weaker when self-compassion is high. This seems to point toward the potential-buffering effect of higher levels of self-compassion in the relationship between functional impairment and depressive symptoms 6 months later. Finally, the interaction term was not significant for depressive symptoms at 12-months (T2), which may be due to the fact that other variables (both intra and interpersonal) might be playing a role in this interaction. Indeed, 12 months may be a too long period for exploring processes that can be contextually influenced such as self-compassion. It may be the case that other processes, such as commitment to engage in valued actions, may help understand the relationship between self-compassion, functional impairment, and depressive symptoms in such a long period. Although self-compassion encompasses the motivation to action (e.g., Pauley and McPherson 2010), one should explore how temporally stable these actions are in order to better understand the effect of the interaction between self-compassion and functional impairment on depressive symptoms 12 months later. Also, one should consider that the current longitudinal study was not conducted in the context of a clinical study, thus not involving the cultivation of self-compassion through daily practices, i.e., the long-term impact of self-compassion, was not observable. More research is needed in order to better understand the long-term relationship between self-compassion, functional impairment, and depressive symptoms.

Limitations and Future Research

The current findings should be interpreted with caution and consideration of the limitations of the study. Firstly, the high attrition rate should be considered when interpreting these results. Some studies point out a 50% attrition rate in web-based health interventions and suggest that randomized control clinical trials (RCTs), as well as the interaction with a therapist throughout the study, increase adherence (Kelders et al. 2012). This might explain the high attrition rate (62.77%) in our study, which lacked contact with a therapist. Also, the attrition rate might be explained by the inability to contact participants. The link of the online questionnaires was sent to the email contact previously provided by the participants, which could have been discontinued or changed. In addition, participants were not compensated in any way for participating in the study, which might contribute to lack of adherence from T0 to T2. Future studies should include a call from a counselor between assessment points and compensation and guarantee other sources of contact other than email, in order to diminish attrition rates and attain a larger sample size that would allow for more robust statistical analyses (e.g., Cross-Lagged Panel analyses using Structural Equation Modeling). Indeed, results from the moderation analyses should be interpreted with caution, given the small effect of the interaction (which was,

nonetheless, significant), as well as the significance of the slopes. These results seem to indicate that functional impairment is still a significant predictor of depressive symptoms 6 months later when self-compassion is present, although results seem to suggest that higher levels of self-compassion might attenuate this relationship. Nevertheless, this study should be replicated in a larger sample before it can establish a definitive conclusion on the role of self-compassion in the relationship between functional impairment and depressive symptoms.

In addition, the sample is all female, thus drawing generalizable conclusions to other genders is unwarranted. Another limitation is the fact that the current sample was composed of mostly educated participants, which prevents us from generalizing these results to CP patients. In addition, it should be noted that although the mean scores for functional impairment suggest a moderately severe impairment of our sample, only one participant was absent from work due to CP. Future studies should consider including a clinical interview to assess functional impairment, in order to have access to more nuanced information that a questionnaire is not able to provide. Also, this was an online self-reported study; thus it should be replicated in a sample where CP diagnoses were established through a clinical interview. Additionally, these results should not be extrapolated to mindfulness as a whole, since the current study measured a very specific component of mindfulness (i.e., mindful awareness). Future studies should consider using other measures of mindfulness that assess the construct in its different qualities. Specifically, when conducting studies focusing on self-compassion, future studies should consider using a measure of nonjudgment (e.g., FFMQ; Baer et al. 2006), and one that measures acceptance (e.g., PMS; Cardaciotto et al. 2008), as these two qualities (nonjudgment and acceptance) overlap with some dimensions of self-compassion. Future studies should continue exploring in depth the differences and similarities between mindfulness and self-compassion and their impact on mental health outcomes. Also, it is worth noting that the current study used the short version of the SCS, which does not allow for more in-depth analyses of different self-compassion domains. Specifically, future studies should use the longer version of SCS to clarify which self-compassion components better predict psychopathological symptoms and compare a measure of mindfulness with the mindfulness subscale of the SCS.

Authors' Contributions SC designed, executed, and analyzed the data and wrote the manuscript. IT analyzed data and wrote the manuscript. DG and JPG designed and consulted the execution of the paper. PC designed, wrote, and consulted the execution of the paper. All authors participated in paper revision and approved the final version.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures followed the ethical standards of the institutions and national research committees (Faculdade de Psicologia e Ciências da Educação da Universidade de Coimbra), as well as the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Statement of Informed Consent All participants provided informed consent.

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