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Understanding the role of positive body image in chronic low back pain: A path-analytic model

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ABSTRACT

Chronic low back pain (CLBP) is a prevalent and disabling condition that significantly affects individuals' quality of life. Recently, the cognitive—behavioral model of body image and chronic pain has emphasized the influence of body image on the course of this condition. Nevertheless, the role of positive body image constructs, such as body appreciation and appreciation of body functionality, in CLBP remains underexplored. This study examined associations between body appreciation and functionality appreciation with pain intensity and interference in individuals with CLBP, with pain catastrophizing and kinesiophobia as potential mediators. A sample of 99 Spanish adults suffering from CLBP completed self-report measures. The path-analytic model showed an acceptable fit. While body appreciation showed no significant associations, functionality appreciation was negatively associated with pain catastrophizing, which in turn was positively associated with both pain intensity and interference. Indirect associations revealed that pain catastrophizing mediated the relationships between functionality appreciation and both pain outcomes. These results suggest the potential role of functionality appreciation in relation to pain outcomes in CLBP, with pain catastrophizing mediating these associations, highlighting the need for research examining whether targeting positive body image constructs, especially functionality appreciation, in pain management interventions could influence CLBP outcomes.

1. Introduction

Low back pain (LBP) is the leading cause of years lived with disability worldwide, with half a billion prevalent cases in 2020 and a projected increase of 36.4 % globally by 2050 (Ferreira et al., 2023). This musculoskeletal condition affects almost everyone at some point in their lives, but the highest number of LBP cases occurs between the ages of 50 and 55 years (Vos et al., 2020). Although most cases of acute LBP improve within a month, between 4 % and 25 % of individuals develop chronic low back pain (CLBP), with a global prevalence of 4–20 % (Meucci et al., 2015). This variability in prevalence reflects differences in age groups (from 4.2 % in young adults to 19.6 % in working-age populations), study populations, and methodological approaches across studies.

A crucial model of chronic pain is the fear-avoidance model, which postulates the central role of cognitions (i.e., fear of pain) in the development and maintenance of pain-related disability through activity avoidance (Lethem et al., 1983; Vlaeyen & Linton, 2012). Although this model has been extensively empirically supported, other psychological factors not included in this approach have also been shown to be relevant in chronic pain. For instance, emotional distress symptoms, particularly anxiety and depression, are highly prevalent in chronic pain conditions and consistently predict both increased pain intensity and pain-related disability (Lerman et al., 2015). Indeed, the fear-avoidance model has been recognized as open to expansion and improvement (Crombez et al., 2012; Wideman et al., 2013).

Notably, the need to approach pain from a holistic representation has led to the development of the cognitive-behavioral model of body image

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and chronic pain (Sündermann et al., 2020). It proposes that maladaptive pain-coping strategies gradually impact individuals' body image. In turn, this can lead to changes in the way pain is experienced and result in functional limitations, including disability and chronification, in a self-perpetuating cycle. The model identifies kinesiophobia and pain catastrophizing as central examples of such maladaptive strategies. However, these constructs might be better conceptualized as cognitive-affective processes. Kinesiophobia encapsulates fear-based beliefs about movement-related harm (Vlaeyen & Linton, 2012) and pain catastrophizing represents a set of exaggerated negative cognitive and emotional responses characterized by magnification of threat, helplessness, and rumination about pain (Quartana et al., 2009). Systematic reviews and meta-analyses have demonstrated that both constructs can be reduced across diverse chronic pain populations. Schütze et al. (2017) found that pain catastrophizing can be effectively reduced through various interventions after reviewing 79 randomized controlled trials (RCTs). Likewise, Xu et al. (2020) highlighted kinesiophobia as a primary treatment target in multimodal therapies, based on a review of 12 RCTs.

The model identifies two key aspects of body image that are affected: (1) perceived appearance and (2) perceived loss of functionality and mobility. The former has been largely investigated in other clinical conditions, such as dysmorphic or eating disorders (Sündermann et al., 2020). With respect to the latter, individuals experiencing chronic pain perceive their bodies as aged, handicapped, or frail, particularly if they engage in maladaptive pain coping behaviors, such as avoiding movements in bed or slouching (Linton et al., 2018). These findings suggest the interplay between body image (including perceived appearance and functionality), maladaptive pain coping strategies, and pain disability and chronicity.

Body image is a multifaceted construct that encompasses both positive and negative dimensions. Nevertheless, research has traditionally focused on the negative dimension (Smolak & Cash, 2011), which typically refers to perceptual distortions and body dissatisfaction. In contrast, positive body image includes appreciating the uniqueness of the body for both its appearance and functionality, embracing and loving all its features, respecting the body's needs, and filtering information in a manner that protects the body, among others (Tylka & Wood-Barcalow, 2015b). The present study focuses on two constructs of positive body image in the context of LBP that align with the affected aspects of body image highlighted in the theoretical proposal by Sündermann et al. (2020): body appreciation and functionality appreciation. First, body appreciation involves a positive attitude and gratitude toward the body, shifting the focus from a solely appearance-driven viewpoint to a holistic appreciation of the body as a vehicle for experiencing the world and connecting with others (Tylka & Wood-Barcalow, 2015a). Notably, body appreciation has shown positive correlations with body image flexibility, adaptive emotion regulation, functionality appreciation, body satisfaction, and general well-being (Linardon et al., 2022). Given its comprehensive nature and relevance in improving wellbeing and decreasing psychopathology, some authors suggest that body appreciation could be a crucial target for promoting mental health in several clinical populations, including those experiencing chronic pain (Linardon et al., 2022). Second, functionality appreciation, which recently emerged as a dimension of positive body image, is defined as an attitude of respect, positive consideration, and appreciation of the body for what it is capable of doing (Alleva & Tylka, 2021). Going beyond mere functionality, functionality appreciation includes thoughts, feelings, and perceptions that individuals have toward their bodies, covering both physical and internal capacities (Alleva et al., 2017). Importantly, a high level of functionality appreciation is not limited to able-bodied individuals and is not discriminatory, since anyone with any level of musculoskeletal disability might have positive attitudes toward their body functionality (Alleva & Tylka, 2021).

Building upon both the cognitive-behavioral model of body image and chronic pain and the theoretical framework of positive body image, we propose that positive body image, including body appreciation and functionality appreciation, may influence pain experience by providing an alternative perspective to maladaptive pain-related cognitions. While individuals with chronic pain often engage in catastrophic thinking about their pain and kinesiophobia, both body appreciation, which involves accepting and respecting one's body regardless of its appearance and attending to its needs (Tylka & Wood-Barcalow, 2015b), and functionality appreciation, which emphasizes "respect and positive consideration of what the body can do" (Alleva & Tylka, 2021), could interrupt this cycle by: (1) fostering recognition and gratitude for what the body can still do despite pain, which may reduce catastrophic interpretations of bodily limitations, and (2) promoting a focus on engaging with valued activities rather than avoiding movement due to fear. This shift from a deficit-focused view (centered on pain and functional loss) to an appreciation-focused perspective may mitigate both pain catastrophizing and kinesiophobia, potentially decreasing pain intensity and interference. This pathway aligns with well-established evidence linking pain catastrophizing (Martinez-Calderon et al., 2019) and kinesiophobia (Luque-Suarez et al., 2018) to chronic pain intensity and disability.

Several empirical studies suggest that functionality appreciation and body appreciation might be relevant in the context of chronic pain. For instance, Markey et al. (2020) observed a positive association between pain acceptance and several aspects of body image, including functionality appreciation, in individuals with several chronic pain conditions. Alleva et al. (2018) reported that an intervention consisting of three functionality appreciation-focused writing tasks improved several aspects of body image in addition to functionality appreciation (i.e., body appreciation, body satisfaction, and body-self alienation) and reduced depressive symptomatology in women with rheumatoid arthritis. Moreover, two body image facets explored by Levenig et al. (2019), namely, physical efficacy and attitudes toward health (which can be considered to belong to the conceptual umbrella of functionality appreciation), were found to be reduced in CLBP patients compared with individuals with subacute LBP and controls. To summarize, these findings highlight the potential relevance of body appreciation and, especially functionality appreciation, in the experience of pain. While the emerging field of positive body image seems to be a promising target for the management of chronic pain, the specific role of body image dimensions (e.g., body appreciation, functionality appreciation) in CLBP and their relationship with well-known maladaptive pain coping strategies (i.e., kinesiophobia and catastrophizing) remain unclear.

The aim of this study was to examine the indirect relationships between two positive body image facets (i.e., body appreciation and functionality appreciation) and pain interference and intensity in patients with CLBP through mediating variables. Specifically, we explored these associations through the mediating roles of pain catastrophizing and kinesiophobia. We hypothesized that and functionality appreciation would be negatively associated with kinesiophobia and catastrophizing, which in turn would show positive associations with pain intensity and interference.

2. Methods

2.1. Participants

A total sample of 99 Spanish individuals experiencing nonspecific CLBP (69 women, 29 men, and 1 nonbinary) were recruited by medical doctors. The inclusion criteria for participation were as follows: (1) being 18 years of age or older and (2) being diagnosed with nonspecific CLBP according to the European COST B13 guidelines (COST B13, 2006), including disc degeneration, facet osteoarthritis, disc protrusion or herniation, spondylolisthesis, and spondylolysis. The exclusion criteria were the presence of at least one of the following: (1) a spinal tumor, infection, or fracture; (2) a systemic disease, whether autoimmune, infectious, vascular, endocrine, or metabolic; (3) a diagnosis of

fibromyalgia; (4) cauda equina syndrome; (5) a history of spinal surgery; or (6) lower extremity musculoskeletal injury. The sociodemographic information of the sample is shown in Table 1.

2.2. Procedure

Ethical approval for the study was obtained from the Ethics Committee of Arnau Vilanova Hospital in Valencia, Spain (5.3 CEI, 30_2021). The study was not preregistered. The self-reported data were collected through a Qualtrics survey between January and December 2023. After providing informed consent, the participants were asked to complete the survey containing several questionnaires (see the Measures subsection), which also included attentional control items to ensure the quality of the responses (e.g., if you are reading this carefully, mark "sometimes"). The participants completed the survey voluntarily and received feedback on their responses (i.e., their total scores on the questionnaires) and psychoeducational material (i.e., an explanation of the constructs assessed with the questionnaires) via email.

2.3. Measures

2.3.1. Demographic data

Participants reported sociodemographic information, including age, duration of pain (in years), BMI, educational level, and occupation, which are shown in Table 1.

2.3.2. Functionality appreciation

The Spanish version of the Functionality Appreciation Scale (FAS; Alleva et al., 2017; Zamora et al., 2024) is composed of 7 items rated on a 5-point Likert scale ranging from 1 (*strongly disagree)* to 5 (*strongly agree)*. The overall score was computed as the average of the items, with higher scores reflecting higher levels of functionality appreciation. In the present study, internal consistency was excellent (α = .89; ω = .92).

2.3.3. Body appreciation

The Spanish version of the Body Appreciation Scale (BAS-2; Swami et al., 2017; Tylka & Wood-Barcalow, 2015a) is composed of 10 items rated on a 5-point scale ranging from 1 (*never*) to 5 (*always*). The overall score was computed as the mean of the scores for all the items, ranging from 1 to 5. Higher scores on this scale reflect greater body appreciation. In the present study, internal consistency was excellent (α = .92; ω = .94).

Table 1
Descriptive statistics of the sample.

Variable	*M (SD)*	Range	*n* (%)
Age	49.62 (11.89)	23–77	-
Time in pain (years)	8.45 (8.57)	.17–30	-
BMI	25.51 (4.44)	16.94–39.26	-
Educational Level			
No studies	-	-	1 (1.01)
Primary education	-	-	16 (16.16)
Secondary education	-	-	8 (8.08)
Bachelorette	-	-	6 (6.06)
Vocational training	-	-	27 (27.27)
Bachelor's degree	-	-	30 (30.30)
Master's degree	-	-	10 (10.10)
Doctorate	-	-	1 (1.01)
Occupation			
Student	-	-	3 (3.03)
Active worker	-	-	39 (39.39)
Unemployed	-	-	12 (12.12)
Occupational disability	-	-	10 (10.10)
Temporary off-work	-	-	21 (21.21)
Retired	-	-	10 (10.10)
Other	-	-	4 (4.04)
RMQ	6.01 (6.02)	-	-
PHQ-9	9.58 (7.23)	-	-
GAD-7	8.99 (6.21)	-	-

Note. M = mean; *SD* = standard deviation; BMI = body mass index; RMQ = Roland-Morris Questionnaire; PHQ-9 = Patient Health Questionnaire; GAD-7 = Generalized Anxiety Disorder Screener.

2.3.4. Pain catastrophizing

The Spanish version of the Pain Catastrophizing Scale (PCS; García-Campayo et al., 2008; Sullivan et al., 1995) is a self-report questionnaire used to measure 3 components of catastrophizing: rumination, magnification, and helplessness. It consists of 13 items rated on a 5-point scale from 0 (*never*) to 4 (*always*). The score of each item was summed up to calculate the total score, which ranges from 0 to 52. Higher scores indicate higher pain-related catastrophizing. In the present study, internal consistency was excellent (α = .96; ω = .97).

2.3.5. Kinesiophobia

The Spanish version of the Tampa Scale of Kinesiophobia (TSK-11; Gómez-Pérez et al., 2011; Hapidou et al., 2012) is a self-report questionnaire designed to assess fear of movement/(re)injury. It consists of 11 items on a 5-point Likert scale from 0 (strongly disagree) to 4 (strongly agree). The score of each item was summed up to calculate the total score, which ranges from 11 to 44. Higher scores indicate higher fear of movement. In the present study, internal consistency was excellent (α = .85; ω = .89).

2.3.6. Pain intensity and interference

The Spanish version of the Brief Pain Inventory (BPI; Badia et al., 2003; Tan et al., 2004) is an 11-item questionnaire used to measure pain intensity and interference. The items are rated on a scale ranging from 0 (no pain/no interference) to 10 (pain as bad as you can imagine/complete interference). The score is calculated as the average of the items composing each dimension separately, with higher scores indicating higher levels of pain severity and pain interference. In the present study, internal consistency was excellent (α = .92; ω = .95).

The following measures were administered to characterize the sample's clinical profile:

2.3.7. Depression symptoms

The Spanish version of the Patient Health Questionnaire (PHQ-9; Diez-Quevedo et al., 2001; Kroenke et al., 2001) is a 9-item self-report measure used to assess depressive symptomatology. The items are rated on a 4-point Likert scale ranging from 0 (not at all) to 4 (nearly every day). The score of each item was summed up to calculate the total score, ranging from 0 to 36. Higher scores indicate more severe depressive symptomatology. In the present study, the internal consistency was excellent (α = .93; ω = .95).

2.3.8. Anxiety symptoms

The Spanish version of the Generalized Anxiety Disorder Screener (GAD-7; García-Campayo et al., 2010; Spitzer et al., 2006) is a questionnaire used to assess anxiety severity. It consists of 7 items, each rated on a 4-point Likert scale ranging from 0 (not at all) to 4 (nearly every day). The score of each item was summed to calculate the total score, ranging from 0 to 28. Higher scores indicate more severe anxious symptomatology. In the present study, internal consistency was excellent (α = .93; ω = .94).

2.3.9. Pain-related disability

The Spanish version of the Roland—Morris Questionnaire (RMQ; Kovacs et al., 2002; Roland & Fairbank, 2000) is a 24-item self-report measure that assesses functional limitations for daily activities, seeking help from others, changes in affect, and sleep disturbances due to LBP. The total score ranges from 0 (no disability) to 24 (maximum disability). In the present study, internal consistency was excellent (α = .90; ω = .91).

2.4. Analytic strategy

Data management and analyses were conducted using R 4.2.2 (R Core Team, 2024). First, descriptive analyses of the sociodemographic and clinical variables were performed. Moreover, Cronbach's alphas and McDonald's omegas were computed using the *psych* package (Revelle, 2024) as evidence of the internal consistency of the questionnaires in the sample.

Before testing the hypotheses, the univariate normality assumption was checked with Kolmogorov—Smirnov tests (suggested for sample sizes larger than 50), univariate kurtosis, and skewness ($\leq |2|$ and $\leq |7|$, respectively) (West et al., 1995). Multivariate normality was also checked with Mardia's coefficient (Mardia, 1970) using the *semTools* package (Jorgensen et al., 2022). Pearson's correlations between BAS-2, FAS, TSK-11, PCS, BPI interference and BPI intensity were computed. Additionally, correlations between demographic variables (gender, age, and educational level) and the main study measures were examined to identify potential covariates (see Table S1).

To test the proposed model, a path analysis was performed using the *lavaan* package (Rosseel, 2012). Two exogenous variables (i.e., BAS-2 and FAS) were included as predictor variables of pain catastrophizing (PCS) and kinesiophobia (TSK-11) (endogenous variables). These variables, in turn, were used as predictor variables of the perception of pain intensity and interference (BPI dimensions), which were the outcome variables of the model. All variables were entered as manifest variables. The model was estimated using the robust maximum likelihood (MLR) method. To evaluate the model fit, we used the normed model chi-square (χ^2/df; values < 3.0 considered indicative of good fit), the root mean square error of approximation (RMSEA) and its 90 % CI (values equal to or less than.06 considered indicative of good fit and up to.08 indicative of adequate fit), the standardized root mean square residual (SRMR; values $< .08$ indicative of good fit), and the comparative fit index (CFI; values close to or $> .95$ indicative of adequate fit) (Hu & Bentler, 1999). Finally, all indirect associations were computed using the bootstrap resampling method to calculate the 95 % confidence intervals (CIs), which is considered the most accurate method (MacKinnon et al., 2007). Additionally, to examine whether our hypothesized pathways remained significant when controlling for emotional distress, we tested an expanded model by adding depressive (PHQ-9) and anxious symptoms (GAD-7) as predictors of pain catastrophizing (PCS) and kinesiophobia (TSK-11). This approach allowed for the evaluation of whether the direct links between positive body image constructs and cognitive-affective mediators, and the indirect relationships between positive body image constructs and pain outcomes through cognitive-affective mediators, remained consistent when accounting for anxiety and depression.

3. Results

3.1. Descriptive statistics of the clinical variables

Table 1 shows descriptive statistics for the clinical variables (RMQ, PHQ-9, GAD-7). The sample had a low mean score on the RMQ, indicating an overall low level of disability. In addition, the mean score for depressive symptomatology was categorized as moderate, whereas the mean score for anxiety symptomatology fell within the mild to moderate range.

The results of the Kolmogorov—Smirnov test did not indicate a normal distribution for all the variables, except for the BAS-2 and BPI (both pain and interference). However, univariate skewness (i.e., $\leq |2|$) and kurtosis (i.e., $\leq |7|$) did meet the cutoffs for normality for all the variables (see Table S2). With respect to multivariate normality, Mardia's kurtosis and skewness were .49 ($p = .624$) and 105.01 ($p = .060$), respectively. Hence, multivariate normality was assumed.

3.2. Linear correlations between the study variables

Pearson's correlations between the study variables are shown in Table 2. The two positive body image variables, namely, functionality appreciation and body appreciation (as measured with the FAS and BAS-2, respectively), were strongly and positively correlated with each other. In addition, they were strongly and negatively correlated with pain catastrophizing (PCS). A moderate and negative correlation was also found between the two variables and BPI interference, with the FAS also correlating with BPI pain.

Regarding the pain-related variables (namely, coping strategies and pain measures), a strong and positive association was also found between pain catastrophizing (PCS) and fear of movement (TSK), as well as pain interference (BPI). In addition, pain interference and the level of pain (BPI) were strongly and positively correlated. Finally, we also observed a moderate positive association between pain catastrophizing (PCS) and the level of pain (BPI).

3.3. Path-analytic model

The standardized parameters estimated for the path analysis model are shown in Fig. 1. The fit indices were acceptable: $\chi^2_{(6)} = 5.43$, $p = .245$, CFI = .988, SRMR = .049, RMSEA = .060, CI 90 % [.000,.166]. With respect to the two exogenous variables (BAS-2 and FAS) in the path analysis, only the FAS score negatively predicted the PCS score, explaining 26.3 % of its variance. Among the coping strategies, pain catastrophizing (PCS), but not the fear of movement (TSK-11), was a positive and significant predictor of both BPI subscales. The total model explained 25.8 % of the variance in BPI interference and 13.5 % of the variance in BPI pain. Finally, two indirect associations were statistically significant: pain catastrophizing (PCS) mediated the relationships between FAS and BPI interference and between FAS and BPI pain. Indirect associations are reported in Table 3.

3.4. Path analytic model adjusted for anxiety and depression

To examine whether the pathways remained significant when including emotional distress variables in the model, we extended our analysis by adding depressive (PHQ-9) and anxious (GAD-7) symptomatology as additional predictors of pain catastrophizing and kinesiophobia. The standardized parameters estimated for this expanded model are presented in Fig. 2. Overall, the model exhibited poor fit, $\chi^2_{(12)} = 74.09$, $p < .001$, CFI = .82, SRMR = .219, RMSEA = .230, 90 % CI [.181,.281]. Regarding the exogenous variables, FAS negatively predicted PCS scores, while GAD-7 positively predicted both PCS and TSK-11 scores, and BAS-2 positively predicted TSK-11 scores. Notably, PHQ-9 did not show significant direct associations with either PCS or TSK-11. Collectively, these predictors explained 57 % of the variance in PCS and 23 % in TSK-11. Among the coping strategies, pain catastrophizing

Table 2
Pearson's correlations, means and standard deviations of the variables in the path analysis.

Variable	1	2	3	4	5	6
1. FAS						
2. BAS-2	.61**					
3. PCS	−.50**	−.39**				
4. TSK-11	−.07	.07	.43**			
5. BPI (pain)	−.29**	−.19	.37**	.15		
6. BPI (interference)	−.37**	−.36**	.51**	.19	.61**	
M (SD)	3.74	3.51	20.94	29.19	5.30	5.36
SD	.86	.83	13.13	6.42	2.01	2.76

Note. M = Mean; SD = Standard deviation; FAS = Functionality Appreciation Scale; BAS-2 = Body Appreciation Scale-2; PCS = Pain Catastrophizing Scale; TSK-11 = Tampa Scale of Kinesiophobia; BPI = Brief Pain Inventory. * Indicates $p < .05$. ** Indicates $p < .01$.

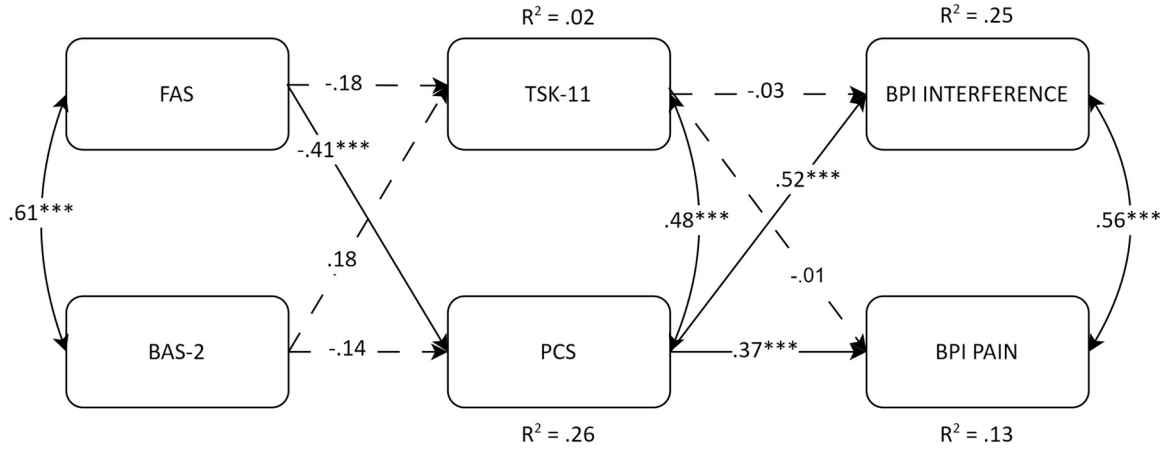

Fig. 1. Graphical representation of the path analytic model. *Note.* FAS = Functionality Appreciation Scale; BAS-2 = Body Appreciation Scale-2; PCS = Pain Catastrophizing Scale; TSK-11 = Tampa Scale of Kinesiophobia; BPI = Brief Pain Inventory. Continuous lines represent significant paths ($p \leq .05$), whereas dashed lines represent nonsignificant paths ($p > .05$). *** Indi*cates* $p < .001$.

Table 3
Indirect associations of the tested model.

Indirect associations	*β*	*b*	*p*	95 % CI
FAS → PCS → BPI pain	−.154	.063	.014	[−.276, −.031]
FAS → PCS → BPI interference	−.215	.070	.002	[−.353, −.078]
FAS → TSK-11 → BPI pain	.001	.020	.946	[−.038, .040]
FAS → TSK-11 → BPI interference	.006	.020	.783	[−.034, .045]
BAS-2 → PCS → BPI pain	−.053	.048	.270	[−.146, .041]
BAS-2 → PCS → BPI interference	−.074	.067	.270	[−.205, .057]
BAS-2 → TSK-11 → BPI pain	−.001	.020	.947	[−.040, .037]
BAS-2 → TSK-11 → BPI interference	−.005	.021	.794	[−.047, .036]

Note. *β* = standardized regression coefficient; *b* = unstandardized regression coefficient; *p* = *p* value; 95 % CI = 95 % confidence intervals; FAS = Functionality Appreciation Scale; BAS-2 = Body Appreciation Scale-2; PCS = Pain Catastrophizing Scale; TSK-11 = Tampa Scale of Kinesiophobia; BPI = Brief Pain Inventory.

(PCS) emerged as a significant positive predictor of both BPI interference and BPI pain, explaining 24 % and 14 % of their variance, respectively. However, TSK-11 was not a significant predictor of any of the BPI outcomes. Finally, four significant indirect associations were observed: pain catastrophizing (PCS) mediated the relationship between FAS and both BPI pain and BPI interference, as well as the relationship between GAD-7 and both BPI pain and BPI interference. Indirect associations are detailed in Table 4.

4. Discussion

The current study aimed to contribute to a better understanding of the role of positive body image, including body appreciation and functionality appreciation, in nonspecific CLBP. While several theoretical frameworks and empirical studies have identified multiple factors affecting chronic pain (e.g., Sündermann et al., 2020; Vlaeyen & Linton, 2012), a comprehensive understanding and a clear overview of the factors underlying pain worsening and evolution are still lacking

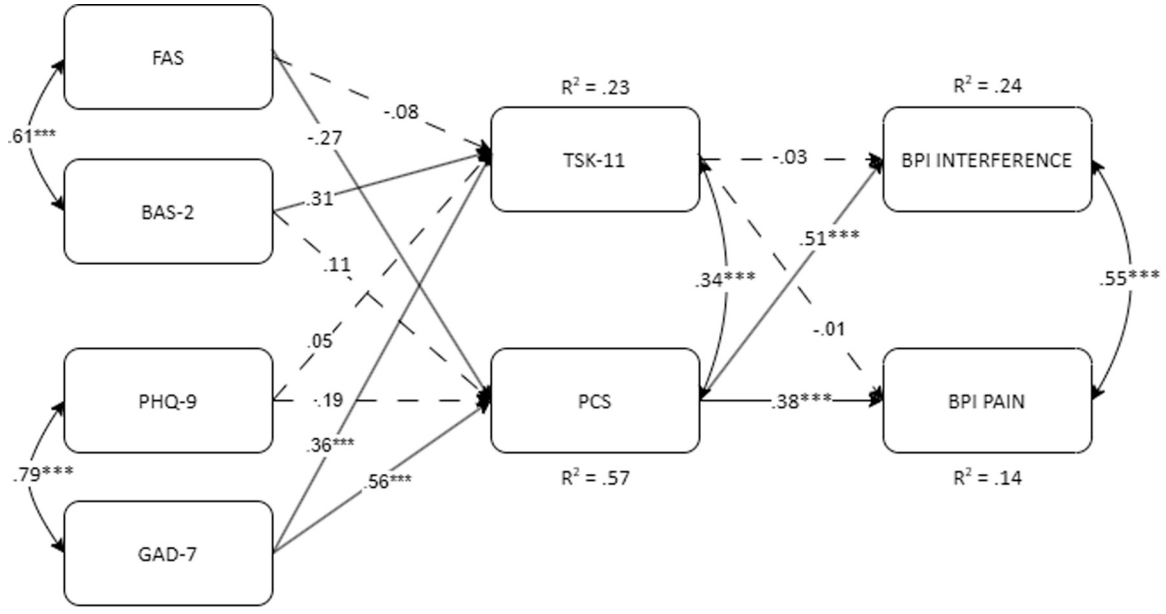

Fig. 2. Graphical representation of the path analytic model including anxiety and depression measures. *Note.* FAS = Functionality Appreciation Scale; BAS-2 = Body Appreciation Scale-2; PCS = Pain Catastrophizing Scale; TSK-11 = Tampa Scale of Kinesiophobia; BPI = Brief Pain Inventory; PHQ-9 = Patient Health Questionnaire; GAD-7 = Generalized Anxiety Disorder Screener. Continuous lines represent significant paths ($p \leq .05$), whereas dashed lines represent nonsignificant paths ($p > .05$). *** Indicates $p < .001$.

Table 4
Indirect associations of the expanded model.

Indirect associations	β	b	p	95 % CI
FAS → PCS → BPI pain	−.154	.063	.014	[−.276, −.031]
FAS → PCS → BPI interference	−.215	.070	.002	[−.353, −.078]
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BAS-2 → TSK-11 → BPI interference	−.005	.021	.794	[−.047, .036]
PHQ-9 → PCS → BPI pain	.073	.051	.156	[−.028, .173]
PHQ-9 → PCS → BPI interference	.098	.069	.154	[−.037, .234]
PHQ-9 → TSK-11 → BPI pain	−.001	.006	.899	[−.012, .010]
PHQ-9 → TSK-11→ BPI interference	−.002	.007	.793	[−.015, .011]
GAD-7 → PCS → BPI pain	.210	.064	.001	[.086, .335]
GAD-7 → PCS → BPI interference	.284	.061	.000	[.164, .404]
GAD-7 → TSK-11 → BPI pain	−.005	.042	.905	[−.088, .078]
GAD-7 → TSK-11 → BPI interference	−.013	.041	.758	[-,093, .068

Note. β = standardized regression coefficient; b = unstandardized regression coefficient; $p = p$ value; 95 % CI = 95 % confidence intervals; FAS = Functionality Appreciation Scale; BAS-2 = Body Appreciation Scale-2; PCS = Pain Catastrophizing Scale; TSK-11 = Tampa Scale of Kinesiophobia; BPI = Brief Pain Inventory; PHQ-9 = Patient Health Questionnaire; GAD-7 = Generalized Anxiety Disorder Screener.

(Crombez et al., 2012; Wideman et al., 2013). Recently, body image has been included in theoretical models of chronic pain (Sündermann et al., 2020), and the number of empirical studies examining body image has grown significantly (e.g., Akkaya et al., 2012; Martínez et al., 2018). However, body image research has traditionally focused on its negative dimension (Smolak & Cash, 2011), whereas positive body image, as a distinct construct, also warrants investigation (Rumsey & Harcourt, 2012; Tylka, 2012).

The path analysis results highlighted two key findings: (1) the relevance of functionality appreciation rather than body appreciation in the context of CLBP, and (2) the role of pain catastrophizing as a mediating variable between positive body image and pain outcomes. Regarding the first finding, BAS-2 is the most appropriate measure for assessing overall positive body image, whereas FAS assesses a more specific facet (Swami et al., 2020), which appears to show stronger indirect associations with pain-related outcomes through pain catastrophizing in individuals with CLBP. This result both aligns with and extends Sündermann et al. 's (2020) model in two ways. First, it suggests the association between body image and pain catastrophizing while highlighting the relevance of functionality-related aspects of body image in chronic pain, though from a positive (i.e., functionality appreciation) rather than a negative (i.e., perceived loss of functionality) perspective. Second, the non-significant indirect pathways between body appreciation and pain outcomes through the hypothesized mediators suggests that in CLBP, specific functionality-related attitudes (i.e., appreciation of what the body can do) may be more relevant than general body appreciation. This is consistent with the approach taken by Alleva et al. (2018), who designed an intervention focusing specifically on functionality appreciation for women with rheumatoid arthritis that effectively improved various aspects of body image and reduced depression, suggesting that functionality-specific aspects of positive body image may be particularly relevant in chronic pain conditions. These findings suggest that Sündermann et al.'s model might benefit from including and distinguishing between different aspects of positive body image, particularly functionality appreciation in chronic pain conditions.

Regarding the second finding, the mediating role of pain catastrophizing in the relationship between functionality appreciation and pain outcomes might be understood through mechanisms outlined in our theoretical framework. Functionality appreciation's emphasis on respecting and valuing the body's capabilities might challenge the negative cognitive patterns typical of pain catastrophizing, such as rumination, magnification, and feelings of helplessness (Sullivan et al., 1995). Hence, functionality appreciation might operate through two pathways: (1) fostering recognition of what the body can still do despite pain, which might reduce catastrophic interpretations of bodily limitations, and (2) promoting engagement with valued activities rather than pain rumination. Through these pathways, functionality appreciation might be associated with lower levels of pain catastrophizing, which in turn —consistent with our findings— has shown associations with reduced pain intensity and interference in previous research (Martinez-Calderon et al., 2019).

Following our primary analyses, we tested an expanded model including measures of emotional distress (anxiety and depression) as variables directly associated with pain catastrophizing and kinesiophobia to examine whether the observed associations remained consistent when including these well-established correlates (Bilgin et al., 2019; Dong et al., 2020). Despite the expanded model's suboptimal fit indices, several noteworthy patterns emerged. First, the significant indirect association from functionality appreciation to pain outcomes through pain catastrophizing remained statistically significant even when including anxiety and depression in the model. Second, anxiety showed significant associations with pain catastrophizing and demonstrated comparable indirect statistical relationships with pain outcomes, consistent with extensive literature documenting associations between anxiety and pain experience (Lerman et al., 2015). Nevertheless, the poor model fit suggests that the complexity of the interplay between emotional distress, body image, cognitive-affective pain processes, and pain outcomes is not well captured by this model. For instance, anxiety and depression may be both predictors and outcomes of maladaptive pain coping. Future studies should collect longitudinal data to better capture the dynamic relationships between these variables.

Despite the contributions of this study, several limitations should be noted. First, our cross-sectional design prevents us from drawing cause-effect relationships between the variables studied. Importantly, although we considered functionality appreciation (and body appreciation) as a predictor of pain-related outcomes in the model tested, the direction of the links tested is not guaranteed due to the cross-sectional nature of the data. This means that the relationships found in this study might be bidirectional or in the opposite direction (e.g., pain catastrophizing and pain outcomes may also influence how individuals appreciate their body functionality). Second, our sample consisted primarily of Spanish adults recruited from medical settings, which may limit the external validity and generalizability of our findings to other cultural contexts and recruitment settings. Third, we did not measure potentially relevant positive pain-related constructs such as pain self-efficacy or pain acceptance, which have shown beneficial effects on pain-related outcomes (Martinez-Calderon et al., 2017; McCracken & Eccleston, 2003) and could provide additional insights into the relationship between positive body image and pain outcomes. Fourth, a power analysis to determine the sample size was not conducted. Although there are some rules of thumb for sample size recommendations (e.g., 10 cases per variable), model characteristics are known to affect the accuracy of the parameter estimates and model fit (e.g., MacCallum et al., 1999), making rules of thumb inadequate. However, our sample size is consistent with a Monte Carlo simulation study by Wolf et al. (2013), which found that a simple single-indicator mediation model requires a small sample size to detect small direct and indirect associations (e.g., 50 and 70 observations, respectively), assuming a reasonable level of reliability (between.81 and.90). The reliability of the variables in our (single-indicator) model is in this range or even higher. Furthermore, although the model tested in this study differs from the study by Wolf et al. (2013) in that it has multiple (rather than single) mediation, we have consistently included a few more observations. Future research should develop accessible methods to determine the appropriate sample size in path analysis models.

Acknowledging these limitations, several directions for future research emerge from the present findings. First, longitudinal designs are needed to examine these relationships over time (both between and

within subjects). Moreover, experimental designs involving random assignment to specific manipulations or conditions are required to establish causal relationships. If the findings of this study are supported by future research, it would suggest that functionality appreciation could be a promising target for the treatment of CLBP. Second, to enhance external validity, future research should employ larger, more diverse samples across different cultural contexts and clinical settings. Third, studies should test expanded versions of this model by including variables that potentially play a pivotal role in the interplay between positive body image and pain experience (e.g., sociodemographic variables, emotional distress). Fourth, future studies should investigate whether functionality appreciation contributes unique variance to pain outcomes beyond other established protective factors. For instance, it would be valuable to examine the relationship between functionality appreciation and both pain intensity and interference while controlling for well-known positive pain-related constructs, such as pain self-efficacy and pain acceptance. This would help determine the uniqueness of functionality appreciation as a protective mechanism in chronic pain beyond other positive pain beliefs. Fifth, assessing acute and subacute LBP populations when examining the role of positive body image in pain experience could provide valuable insights into how positive body image evolves over the course of the condition and its impact on pain. This broader perspective is essential for developing more comprehensive theoretical frameworks and identifying new therapeutic targets for CLBP management.

5. Conclusion

This study pioneers the examination of positive body image constructs in pain models, offering an initial exploration of the roles of body appreciation and functionality appreciation in CLBP. The findings suggest associations between positive body image factors, particularly functionality appreciation, and lower pain intensity and interference in CLBP, with pain catastrophizing as a mediating variable. This research opens new possibilities for understanding the role of positive body image factors in CLBP. Further experimental and longitudinal studies are needed to determine whether incorporating these factors into treatments could enhance patients' well-being and quality of life.

CRediT authorship contribution statement

Rocio Herrero: Writing – review & editing, Validation, Supervision. **Marta Miragall:** Writing – review & editing, Supervision, Investigation. **Rosa Baños:** Writing – review & editing, Supervision, Project administration, Funding acquisition. **Angel Zamora:** Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Giulia Parola:** Writing – review & editing, Data curation, Conceptualization. **Lorena Desdentado:** Writing – review & editing, Supervision, Formal analysis, Data curation.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Angel Zamora Martinez reports financial support was provided by Spain Ministry of Science and Innovation (FPU20/05798). Rosa Banos Rivera reports financial support was provided by Spain Ministry of Science and Innovation (PID2020-115609RB-C21). If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.bodyim.2025.101879.

Data availability

The data is available on the Open Science Framework at https://osf.io/rx6tw/.

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