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ORIGINAL RESEARCH

Functional disability in patients with low back pain: the mediator role of suffering and beliefs about pain control in patients receiving physical and chiropractic treatment

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Abstract
Background: Low back pain is the leading cause of disability worldwide. There is evidence that depression, anxiety, and external locus of control are negative predictors of functional disability in low back patients.
Methods: This study focused on the mediator role of suffering and beliefs about pain control in the relationship between psychological morbidity and functional disability in patients receiving physical therapy and chiropractic treatment for chronic low back pain. The sample included 213 patients receiving chiropractic treatment and 125 receiving physical therapy, who answered the following instruments: Beliefs about Pain Control Questionnaire; Inventory of Subjective Experiences of Suffering in Illness; Oswestry Low Back Pain Disability Questionnaire; and the Hospital Anxiety and Depression Scales.
Results: Suffering was a mediator in the relationship between depression and functional disability in both treatment groups. Only beliefs related to external chance events mediated the relationship between depression and functional disability in the physical therapy group, but not in the chiropratic teratment group.
Conclusion: Intervention should focus on suffering regardless of the type of treatment and target beliefs about pain control, in patients receiving physical therapy treatment since they seem to play a key role in functional disability in patients with low back pain.

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Introduction

Low back pain (LBP) is one of the leading global causes of disability in most countries in 2015.[1] Most individuals experience low back pain at some point in their life.[2,3] The prevalence of LBP is increasing,[4] particularly in older individuals, being higher in men.[5] There are several risk factors for the development of LBP: psychological disorders, obesity, smoking, lack of exercise, age, and lifestyle.[4] Several treatments are recommended for LBP, which include conventional treatments (e.g. education, exercise, physical therapy) or complementary/alternative treatments (e.g. acupuncture, Pilates, yoga, chiropractic). Nevertheless, physical therapy (PT) is the most commonly used.[6,7]

PT aims to improve posture and mobility, reduce pain, and promote relaxation and muscle stabilization[8] through stretching and strengthening exercises, spinal mobilization, functional activities, interferential current, soft tissue mobilization and massage, ultrasound, heat, manual traction, and posture correction.[9] In this context, an approach called Longitudinally Supported Self-Management (LSSM) has emerged that aims to promote in the patient, through a support system, a self-management of their chronic illness and a change in their lifestyle, with favorable long-term results. This approach is marked by a strong therapeutic alliance between the patient and the physiotherapist.[10]

Chiropractic treatment (CT) is described as a less invasive method than surgery[11] that focuses on the treatment of disorders of the nervous system and/or musculoskeletal system. Generally, chiropractors maintain a unique focus on spinal manipulation and treatment of surrounding structures, adjusting the spine and related tissues, with the goal of correcting alignment problems, alleviating pain, improving function, and promoting wellness care.[12]

The literature reveals that disability is a complex and multifactorial phenomenon[13] and is associated with high economic costs.[4] In chronic LBP, functional disability can be partially explained by factors not related to the disease itself, such as psychosocial and professional factors,[14] and it can impose personal, professional, and family limitations.[4] A study found that 65% of the participants had functional disability, and of these, more than 80% had moderate to severe functional disability.[14] Patients with LBP often report physical discomfort and functional limitations,[15] as well as low levels of physical activity and a decrease in social participation.[14]

Beliefs about pain control also influence functional disability.[16] Specifically, pain control beliefs due to external events were significantly higher in patients with high functional disability[17] and have been directly related to anxiety and depression.[18] Increasing evidence indicates that patients with LBP report higher anxiety and depression[19] associated with pain intensity and functional disability.[20,21] However, the mediator role of pain control beliefs between psychological distress and functionality has not been fully understood.

Research has shown that suffering predicts a poor prognosis,[22] a higher utilization of health care,[23] as well as a negative impact on functional disability.[24] However, the mediator role of suffering in the relationship between psychological morbidity and functional disability has not been studied. A study found that changes in cognitive variables, such as catastrophization, did not mediate the relationship between pain knowledge and changes in pain reports.[25] The role of beliefs about pain control, however, has not been studied in patients receiving specialized treatments for LBP. Considering that most of the evidence in this area has poor or moderate quality,[25] this study focused on the mediator role of suffering and beliefs about pain control in the relationship between psychological morbidity and functional disability in patients receiving CT and PT treatments.

Methods

Sample and data collection

Ethical approval was given by the Portuguese Association of Chiropractors (2010, Portugal). The sample included outpatients (between 18 and 65 years of age) diagnosed with chronic LBP, according to the diagnosis criteria of the Portuguese Association of Rheumatology. This study included a convenience sample of 338 patients, of which 213 received CT treatment and 125 PT treatment. The design is cross-sectional. The inclusion criteria were as follows: age between 18 and 65, a diagnosis of common chronic LBP for a period of more than three months being attributed to muscle ligaments and mechanical and degenerative causes (according to the diagnostic criteria defined by the Portuguese Association of Rheumatology), receiving only PT or CT. The exclusion criteria were the following: critical limitation on movement or diagnosis of severe psychiatric illness according to the patient's medical chart.

Four chiropractic and four PT clinics in the north of the country were sent a letter that explained the design and the aims of the study, as well as the inclusion criteria. After approval of the review board of each clinic, the patients were informed about the study and those who met the inclusion criteria were invited by the physicians or chiropractic practitioners to take part in the study. Participation was voluntary and all eligible patients who agreed to participate signed an informed consent form. Patients were invited if they had a minimum of three treatment sessions, since three sessions was considered the minimum to produce pain reduction[26] and to control for the influence of pain reduction on the patients' perceptions of the cognitive and psychological variables of the study. The recruitment took place between 2010 and 2011.

Instruments

Sociodemographic and clinical questionnaire

This tool was developed for this study in order to carry out a description of the sample. It consists of 32 items and includes sociodemographic variables (i.e., age, sex, profession, education, professional activity, absence from work for not feeling able to perform the work tasks, and current activity) and clinical variables (i.e., frequency of pain, pain intensity, number of medical visits in the last three months, current health status, disease, and treatment duration).

Beliefs about Pain Control Questionnaire[27]
This questionnaire consists of 13 items divided into three subscales: beliefs about internal or personal control of pain management, belief that powerful individuals can control pain (e.g. health professionals), and beliefs that the pain can be controlled by luck or chance events.[27] High scores on the subscales indicate stronger beliefs. In the original version, the author found a Cronbach's alpha of 0.76 for personal or internal control, 0.82 for beliefs in powerful others and 0.56 for chance events.[27] In the Portuguese adapted version, Cronbach's alpha was 0.69 for internal control, 0.66 for powerful others, and 0.80 for chance events.

Illness Subjective Suffering Inventory[28]
This instrument measures the intensity of the subjective experience of suffering through 44 items grouped into five subscales (physical, psychological, existential, socio-relational, and positive experiences of suffering). Higher results indicate more suffering. In the original version, Cronbach's alpha ranged from 0.69 to 0.85 in the subscales and was 0.93 regarding the total scale. In this study, Cronbach's alpha ranged from 0.86 to 0.94 for the subscales and was 0.96 regarding the total scale.

Oswestry LBP Disability Questionnaire[29]
It consists of 10 items that assess disability regarding daily activities related to: pain intensity, personal care, weight lifting, walking, sitting, standing, sleeping, traveling, social life, and sex life. A higher result indicates greater disability. In the original version, Cronbach's alpha for the total scale was 0.87, and in this study, it was 0.86.

Hospital Anxiety and Depression Scales (HADS)[30]
This instrument consists of 14 items grouped into two subscales: anxiety and depression, with seven items each. A high result indicates greater anxiety and depression. Cronbach's alpha were 0.93 for anxiety and 0.90 for depression in the original version and 0.83 and 0.81, respectively, in the present study.

Data analysis

We used the PROCESS macro (model 4) for SPSS to assess the mediator role of suffering and beliefs about pain control (*M* – mediator variable) in the relationship between anxiety and depression (independent variable – *X*) and functional disability (dependent variable – *Y*). This add-on includes a bootstrap procedure (1000) for bias correction and 95% confidence intervals.[31] In a mediation model, *a* is the coefficient of *X* (anxiety and depression) that will predict the mediator variable (*M*: suffering or beliefs about pain control) and *b* and *c′* are the coefficients that predicted *Y* (functional disability) from both *M* (*b*) and *X* (*c′*). Therefore, *c′* is the direct effect of *X* on *Y*, whereas the product of $a \times b$ is the indirect effect of *X* on *Y* through *M*. When *c′* is not significant, it indicates a mediation effect.[31]

Results

Sociodemographic and clinical characterization of the patients receiving PT and CT

The average age of the PT group was 47.93 years old (SD = 12.94) and for the CT group, 46.16 years old (SD = 11.61). In the PT group, 70.4% were women, and in the CT group, 50.5%. Self-reported pain intensity was assessed as mild/moderate versus strong/very strong. The results showed that, in the CT group, 68.5% of patients indicated their pain to be essentially moderate compared to 68.6% of patients that reported their pain to be strong in the PT treatment, and the difference was significant ($X^2 = 42.51$, $p < 0.001$).

In terms of self-reported pain frequency, 34.7% of patients in the CT group reported having pain all the time compared to 58.4% in the PT group and the difference was significant ($X^2 = 27.73$, $p < 0.001$). Finally, in terms of disability, we found that in the CT, the mean was 23.17 (SD = 13.62) and in PT 40.96 (SD = 17.68) (Table 1).

Suffering as a mediator in the relationship between anxiety/depression and functional disability in the CT group

The results for suffering as a mediator in the relationship between anxiety and functional disability showed that the indirect effect of anxiety on functional disability was not mediated by suffering ($\beta = 0.97$, 95% CI [0.64, 1.38]). The results for suffering as a mediator in the relationship between depression and functional disability showed that the indirect effect of depression on functional disability was mediated by suffering ($\beta = 1.01$, 95% CI [0.65, 1.50]) (Table 2). The direct effect of depression on functional disability was not significant ($p = 0.22$), indicating a mediation effect (Fig. 1).

Suffering as a mediator in the relationship between depression/anxiety and functional disability in the PT group

The results for suffering as a mediator in the relationship between depression and functional disability showed that the indirect effect of depression on functional disability was mediated by subjective suffering ($\beta = 0.99$, 95% CI [0.38, 1.63]) (Table 2). The direct effect of depression on functional disability was not significant ($p = 0.13$), indicating a mediation effect. The indirect effect of anxiety on functional disability was not mediated by suffering ($\beta = 1.32$, 95% CI [0.70, 2.08]) (Fig. 2).

Beliefs about pain control as mediators between depression/anxiety and functional disability in the PT group

Beliefs related to chance events mediated the relationship between depression and functional disability ($\beta = 0.88$, 95% CI [0.45, 1.49]) (Table 2). The direct effect of depression on

Table 1 Sociodemographic and clinical characteristics.

Variables	CT group ($n = 213$)			PT group ($n = 125$)			χ^2	p
	Mean	SD	%	Mean	SD	%		
Age	46.16	11.61		47.93	12.94			
Gender								
Male			49.3			29.6		
Female			50.7			70.4		
Marital status								
Single			17.4			10.4		
Married			70.9			72.8		
Divorced			5.6			4.0		
Widowed			1.4			9.6		
Living with a partner			4.7			3.2		
Education								
1st–4th grade			18.3			46.8		
5th–9th grade			27.3			25.4		
10th–12th grade			25.4			9.8		
University			29.1			18.0		
Pain frequency							27.73	<0.001
Once/twice a day			34.3			10.4		
More than twice a day			29.6			31.2		
All the time			34.7			58.4		
Pain intensity							42.51	<0.001
Mild/moderate			68.5			32.0		
Strong/very strong			31.5			68.0		
Duration of illness								n.s
6 months to 1 year			17.4			19.2		
1–3 years			19.7			27.2		
More than 3 years			62.9			53.6		

CT, chiropractic therapy; PT, physical therapy; SD, standard deviation; ns, not significant.

Table 2 Bootstrap analyses of the magnitude and statistical significance of indirect fffect in chiropractic treatment and physical therapy.

Independent variable (*X*)	Mediator variable (*M*)	Dependent variable (*Y*)	*B* mean indirect effect	SE	95% CI mean indirect effect (lower and upper)
Chiropractic treatment					
Depression	Subjective suffering	Disability	1.02	0.22	0.66, 1.51
Physical therapy treatment					
Depression	Subjective suffering	Disability	0.98	0.31	0.38, 1.63
Depression	Beliefs about pain – Chance events	Disability	0.88	0.26	0.45, 1.49

functional disability was not significant ($p = 0.08$), indicating a mediation effect (Fig. 3). The indirect effect of anxiety on functional disability was not mediated by chance events beliefs ($\beta = 0.60$, 95% CI [0.24, 1.05]).

The indirect effect of anxiety on functional disability was not mediated by personal control beliefs ($\beta = 0.04$, 95% CI [−0.03, 0.30]). The indirect effect of depression on functional disability was not mediated by personal control beliefs ($\beta = -0.01$, 95% CI [−0.19, 0.09]).

Finally, the indirect effect of anxiety on functional disability was not mediated by powerful others beliefs ($\beta = -0.02$, 95% CI [−0.24, 0.16]). The indirect effect of

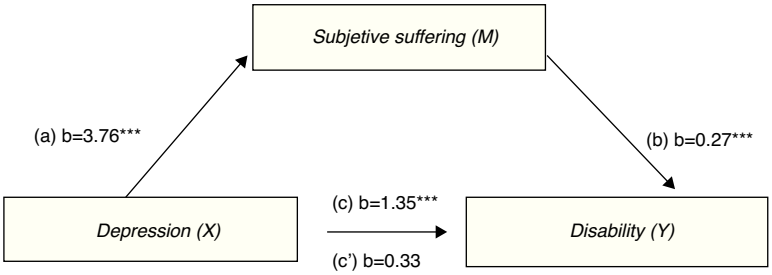

Figure 1 Mediation effects of subjective suffering in the relationship between depression and functional disability in CT ($n = 213$). Bootstrap results: indirect effect of depression on functional disability through subjective suffering: 1.01 [SE = 0.22; 95% CI (0.66, 1.51)].
***$p < 0.001$; *X*, independent variable; *M*, mediator variable; *Y*, dependent variable; Path *a*, effect of *X* on *M*; Path *b*, effect of *M* on *Y*; Path *c*, total effect of *X* on *Y* in the absence of the mediator variable (*M*); Path *c'*, effect of *X* on *Y* controlling for the mediator variable (*M*).

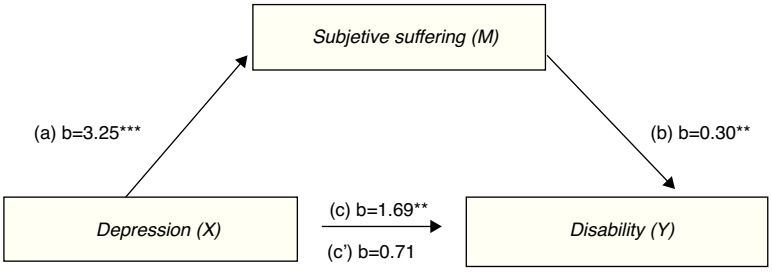

Figure 2 Mediation effects of subjective suffering in the relationship between depression and functional disability in physical therapy ($n = 125$). Bootstrap results: indirect effect of depression on functional disability through subjective suffering:0.98 [SE = 0.31; 95% CI (0.38, 1.63)].
**$p < 0.01$; ***$p < 0.001$; *X*, independent variable; *M*, mediator variable; *Y*, dependent variable; Path *a*, effect of *X* on *M*; Path *b*, effect of *M* on *Y*; Path *c*, total effect of *X* on *Y* in the absence of the mediator variable (M); Path *c'*, effect of *X* on *Y* controlling for the mediator variable (*M*).

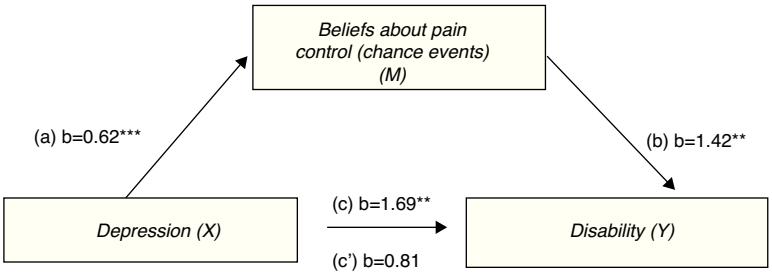

Figure 3 Mediation effects of beliefs about pain control on the relationship between depression and functional disability in physical therapy ($n = 125$). Bootstrap results: indirect effect of depression on functional disability through beliefs about pain control: $\beta = 0.88$ [SE = 0.26; 95% CI (0.45, 1.49)].
**$p < 0.01$; ***$p < 0.001$; *X*, independent variable; *M*, mediator variable; *Y*, dependent variable; Path *a*, effect of *X* on *M*; Path *b*, effect of *M* on *Y*; Path *c*, effect total of *X* on *Y* in the absence of the mediator variable (*M*); Path *c'*, the effect of *X* on the *Y* controlling for the mediator variable (*M*).

depression on functional disability was not mediated by powerful others beliefs ($\beta = -0.03$, 95% CI [−0.26, 0.06]).

Beliefs about pain control as mediators between depression/anxiety and functional disability in the CT group

The indirect effect of anxiety on functional disability was not mediated by chance events beliefs ($\beta = 0.05$, 95% CI [−0.02, 0.21]). Similarly, the indirect effect of depression on functional disability was not mediated by chance events beliefs ($\beta = 0.11$, 95% CI [0.01, 0.32]).

The indirect effect of depression on functional disability was not mediated by personal control beliefs ($\beta = 0.09$, 95% CI [−0.00, 0.29]). The indirect effect of anxiety on functional disability was not mediated by personal control beliefs ($\beta = 0.04$, 95% CI [−0.04, 0.19]).

Finally, the indirect effect of anxiety on functional disability was not mediated by powerful others beliefs ($\beta = 0.02$, 95% CI [−0.02, 0.13]). The indirect effect of depression on functional disability was not mediated by beliefs in powerful others ($\beta = 0.03$, 95% CI [−0.02, 0.15]).

Discussion

This study focused on the mediator role of suffering in the relationship between psychological morbidity (anxiety and depression) and functional disability as well as the mediator role of beliefs about pain control in the relationship between psychological morbidity and functional disability in both treatment groups. The results showed that suffering was a mediator in the relationship between depression and functional disability in both treatment groups.

The literature has shown that higher levels of anxiety/depression predicted functional disability in acupuncture and PT treatment groups and that psychological morbidity had a mediator role in the relationship between functional disability and quality of life.[32] This finding is corroborated by other studies that showed depression predicting functional disability in patients with chronic LBP.[33,34] This association may be due to the patients' difficulty in performing their daily activities, which may contribute to depressive feelings and consequently to greater isolation and less motivation to be actively involved in treatment and finally to functional disability.[35] In fact, depression is associated with functional disability, pain severity,[36] and suffering,[24] hence the mediator role of suffering. In fact, patients with chronic functional disability have suffering often associated with adaptation (or maladaptation) to functional limitations and the social and emotional consequences of their clinical status.[37] In addition, patients with more suffering show worse therapeutic results, reporting persistent symptoms after three months of intervention.[38]

The present study also showed that beliefs about pain control, in particular chance events beliefs, mediated the relationship between depression and functional disability in the PT group. Chance events were found to be significantly higher in patients with greater functional disability,[17] as in the present study, since in the PT group patients showed higher levels of functional disability.

The literature has shown that higher internal and low external control beliefs were linked to positive outcomes one month after a multidisciplinary rehabilitation program for chronic back pain.[39] The nature of the relationship established between the patient and the health professional may also be related to pain control beliefs. Patients attending treatment showed more external control beliefs and lower internal control beliefs compared to patients awaiting treatment.[16]

Chance events beliefs were a mediator only in the PT group. This result may be due to the fact that, unlike the CT group, patients are referred by their physician or a physiatrist and are prescribed medication. One may hypothesize that patients are more externally focused on drugs and not focused on their ability or powerful others, such as doctors, to control their pain[40] compared to the CT group.[41] Future studies should assess whether coping may mediate the relationship between pain control beliefs and functional disability in both treatment groups.

Limitations

This study has some limitations that should be taken into consideration, including the cross-sectional nature of the design, the use of only self-report questionnaires, the convenience sample, and the fact that patients in the CT group were recruited from private clinics, which could bring some bias but CT treatment is not offered in public health clinics. Longitudinal studies are warranted to assess the mediator role of pain beliefs and suffering as the disease.

Conclusion

This study may provide a better understanding of LB patients receiving PT and CT treatments. The results showed that suffering mediated the relationship between psychological morbidity and functional disability in both treatment groups and that pain control beliefs were only a mediator in the PT group. According to the results, intervention should target psychological and cognitive factors in functional disability regarding LBP patients. Although suffering and pain control beliefs may play a role in the association between psychological distress and functional disability, future RCTs will be needed to assess the impact of a specific treatment. Furthermore, a deeper understanding of the dimensions of suffering and how it influences functional disability may be used to optimize treatment.

Conflicts of interest

The authors declare no conflicts of interest.

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