Abdelhaleem *et al.*
Bulletin of Faculty of Physical Therapy (2024) 29:37
https://doi.org/10.1186/s43161-024-00198-3

Bulletin of Faculty of Physical Therapy

ORIGINAL RESEARCH ARTICLE

Open Access

Effect of 8 weeks of cognitive behavioral therapy versus 8 weeks core stabilization training in the management of subjects with non-specific low back pain: a randomized controlled trial

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Abstract

Background Patients with chronic pain usually regard pain as a stressful situation. The literature revealed that chronic pain is associated with social and cognitive dysfunction. Recently, the literature started to support using cognitive behavioral therapy to reduce the effect of chronic nonspecific low back pain.

Objectives The study aimed to assess the effect of cognitive behavioral therapy versus core stabilization training in the treatment of subjects with non-specific chronic low back pain.

Methods Ninety subjects were enrolled in the current study, with mean age (32.30 ± 4.38) and mean weight (72.27 ± 10.88). They were equally randomized into three equal groups A, B, and C using opaque envelopes and computer-generalized numbers. Group A received cognitive behavioral therapy plus traditional treatment, group B received a core stabilization training program plus traditional treatment, and group C received only traditional treatment. Visual Analog Scale, Fear Avoidance and Belief Questionnaire, and Oswestry Disability Index were used pre- and post-treatment to measure the outcomes in response to the treatment plans.

Results Statistical analysis revealed that there was a significant decrease in the Visual Analog Scale, Fear Avoidance and Belief Questionnaire, and Oswestry Disability Index post-treatment compared with pre-treatment in group A ($P < 0.001$), group B ($P < 0.001$), and group C ($P < 0.001$). Also, the results revealed that there was a significant decrease in the Visual Analog Scale, Fear Avoidance and Belief Questionnaire work/lifestyle, and Oswestry Disability Index of group A compared with group B ($P < 0.05$) and group C ($P < 0.001$) and a significant decrease in outcome measures in group B compared with group C ($P < 0.05$).

Conclusion The results of the current study support the involvement of cognitive therapy in the management of chronic pain as it guides the patient to be aware of the underlying mechanism of chronic pain and the management maneuvers to overcome such pain. Also, the results provide credit to cognitive behavioral therapy in terms of long-term relief of chronic pain.

Keywords Biopsychosocial model, Long term, Chronic pain, Cognitive behavioral therapy, Core stabilization, Low back pain

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Background

Low back pain is an unpleasant sensation or discomfort that could be associated with disabilities or dysfunction and associated with many contributing factors, such as individual (e.g., age), psychological (e.g., pain catastrophizing), and biological/physical factors (e.g., habitual physical activity level and negative beliefs about cause and consequences of pain) [1].

Chronic low back pain (CLBP) is back pain that could persist for half days of the week or more for the past 6 months or longer and this pain oversees most of the low back pain associated with personal suffering as depression and anxiety. It is also related to cognitive dysfunction, loss of sleep and appetite, and social isolation [2].

In the same vein, patients with CNLBP tend to feel unable to practice their daily activities and often have a clear belief that any movement could worsen pain and cause physical impairment or dysfunction. As a result, subjects with CNLBP refuse to practice their common activities, resulting in pain, immobilization, and pain vicious circle [3].

Biopsychosocial models provide an explanation regarding the impact of chronic pain on a subject's health status, it was noticed that subjects with CNLBP develop chronic pain syndrome, which is related to negative thoughts and beliefs that control the patient mind-thinking and reflecting on this performance as these subjects develop a fear to move. They are scared to perform their activities as this performance will trigger pain and/or generate disease occurrence. These beliefs and behaviors bring physical and psychological disorders which in terms contribute to disease chronicity [4].

Healthcare providers who treat subjects with CNLBP should be concerned with the physical manifestations of this disorder and social/psychological relationships. The literature supports patient-centered plans of care in which patients are involved in the treatment plans, their emotional conditions, their major mood oscillations, and their hostility regarding others and themselves [5].

It was reported that all the clinicians who treat CNLBP patients usually prescribe nonspecific procedures (e.g., oral analgesics and physical therapy) or construct their plan of care depending on the imaging finding provided by (X-ray or MRI) as spinal degeneration or disc plugs. However, these plans of care seem applicable to patients, these approaches often result in unsatisfactory outcomes as the pathologies targeted are not specific to this type of pain [6–8].

The 2017 clinical practice guidelines developed by the American College of Physicians recommended the biopsychological approach to evaluate and treat CNLBP, focusing not only on treating the physical pathology but also on using multidisciplinary rehabilitation programs that include psychological and other interventions that improve patients' ability to cope and function with chronic pain. This guideline provided a good guideline for the physical therapist to treat their patients as a whole unit (social/psychological and physical) not only as lumbar area or spinal disorders, but failure of such procedures will also add negative impact and help patients to believe more on their chronic pain and could lead them to give up seeking medical advice or help [3, 4, 6].

Chronic pain-related beliefs are central and are developed with CNLBP as these subjects become more irritable, threatened to move, functional disruption, and associated with safety-seeking behaviors. So, when the clinicians focus on patient's beliefs in their ability to control pain and perform the activity (pain self-efficacy) the fear of movement may decrease. This backing the idea of positive chronic back pain beliefs may be vital to reducing disability and dysfunction. Self-confidence and efficacy beliefs could be affected by beliefs and behaviors provided to these patients and guided by the treating providers [7–9].

The literature provides concrete evidence that pain education and cognitive behavioral therapy (CBT) should be considered a priority in the management of CNLBP. Cognitive behavioral therapy for CNLBP allows the patients to be active and participate in pain management and it could be delivered to the patient by a trained therapist during one-to-one or group sessions. Cognitive behavioral therapy has small to moderate effects on depressive symptoms, pain troublesomeness, and pain catastrophizing a cognitive and emotional pain response pattern that includes increased attention and feelings of pain helplessness [10].

The authors of the current study hypothesized that cognitive behavioral therapy (CBT) could be the main key player in managing the chronic pain that CNLBP patients suffer from. As the literature provided concrete support for the negative impact of chronic pain on patients' social and physical status it become necessary, from the authors' point of view, to address this impact by using CBT. To achieve these goals, the authors designed the current study into three groups, and they compared the effect of CBT with core stabilization training in treating patients with CNLBP. Core stabilization training is a well-established protocol used by the literature to treat CNLBP and prevent its recurrence [10–12].

Core stabilization training was used by authors to activate the transversus abdominus muscles and this activation improves the support to the lumbar spine and minimizes the pressure on the vertebra and its supporting structures. Considering multiple studies showing delayed or diminished activation of the lumbar multifidi and transversus abdominus in CLBP as well as loss of

physiologic tonic activation of the transversus abdominus during gait and extremities movement, core stability has become widely recognized in recent years. The loss of support for the lumbar spine and the increased strain and load on its joints and ligaments might result from the dysfunction of these muscles [13].

Therefore, the aim of the current study was to compare the effect of cognitive behavioral therapy and the effect of core stabilization training programs in the management of subjects with nonspecific chronic low back pain.

Methods

Study design

A three arm randomized controlled trial was the study design. Participants in the research study must have had low back pain for at least three months to be eligible. The study will run from August 1st, 2023, until November 30th, 2023. The Sohag Educational Hospital was the recruiting location for participants from July 20, 2023, until September 30, 2023. The research plan has been approved by the research ethical committee of Cairo University's faculty of physical therapy. It was granted approval on July 18, 2023, and is registered as an RCT (randomized controlled trials) with reference number P.T.REC/012/004701, which can be found on the pan-African clinical trials registry (PACTR202309770549011). September 21, 2023.

Statement of human and animal rights

The study was conducted following the Declaration of Helsinki. In this study, we obtain informed consent from all patients, protect their privacy and confidentiality, and respect their autonomy and diversity. These universal rights are inherent to us all, regardless of nationality, sex, national or ethnic origin, color, religion, language, or any other status.

Sample size calculation

The sample size calculation was done before the investigation started to prevent type II errors. To figure out the minimum clinically significant differences of 20mm in pain intensity between groups, the G*POWER statistical software (version 3.1.9.6, Dusseldorf, Germany) was used to estimate the sample size based on [post hoc-MANOVA: repeated measures, within-between interaction, 0.45 effect size, 20% beta error, and a two-sided 0.05 alpha error]. Pilot research was used to assess the effect size, with five volunteers in each group. The size was increased by 15% to account for dropouts, bringing the final sample size of 81 patients down to 90 patients. Three equal groups were randomly selected from among the ninety patients. The data collection process did not involve the author who developed the randomization. Throughout the investigation, a computer-generated block randomization with block sizes ranging from 6 to 9 was used to eliminate bias and lower the variance between the groups. Sequentially numbered, sealed envelopes were used to randomly assign patients. Next, the author providing treatment started by opening the envelopes and proceeded with the therapy based on the group classifications.

Patients

Ninety patients with CNSLBP made up our sample. Patients in the study had to be between the ages of 21 and 45 years, have CNSLBP, and have had chronic low back pain during the last 3 months. All demographic information, which included weight, height, age, and sex, was gathered during the baseline evaluation. To be eligible for enrollment in the current study all the patients should have a score of 30 or more on the Fair Avoidance Belief Questionnaire and a score of more than 3 to 7 out of 10 on VAS. Also, patients were requested to read and understand the English language to complete the questionnaires correctly

Allocation

All subjects were randomly allocated into three separate groups. Opaque envelopes are used to allocate subjects into groups. Group A: (experimental): 30 patients with CNSLBP received education on pain management and cognitive perception, for 8 weeks and three therapy sessions per week plus traditional therapy. Group B: (experimental) received both traditional therapy and core stability training and was administered to 30 patients with CNSLBP. Eight weeks of three treatment sessions, and group C was the control group and received traditional therapy was provided to 30 patients with CNSLBP. As illustrated in Fig. 1, 100 subjects were selected to participate in the current study, 10 out of 100 were excluded. Six persons did not meet the inclusion criteria and 4 refused to participate in the study. So, 90 subjects were enrolled in the current study as illustrated in the flow chart in Fig. 1. All subjects were blinded for the group's allocation and the allocation was performed by the first physical therapist. Assessment of the outcomes pre- and post-treatment were performed by a second physical therapist and the treatment procedures were delivered to groups by the third physical therapist who was well-trained in treating patients with CBT, the second and third therapists were blinded regarding the group allocations.

Patients were excluded from the current study if they had one of the following criteria: acute episodes of low back pain in the last 4 weeks, acute radiculopathy and numbness at each foot, history of cancer or metastasis,

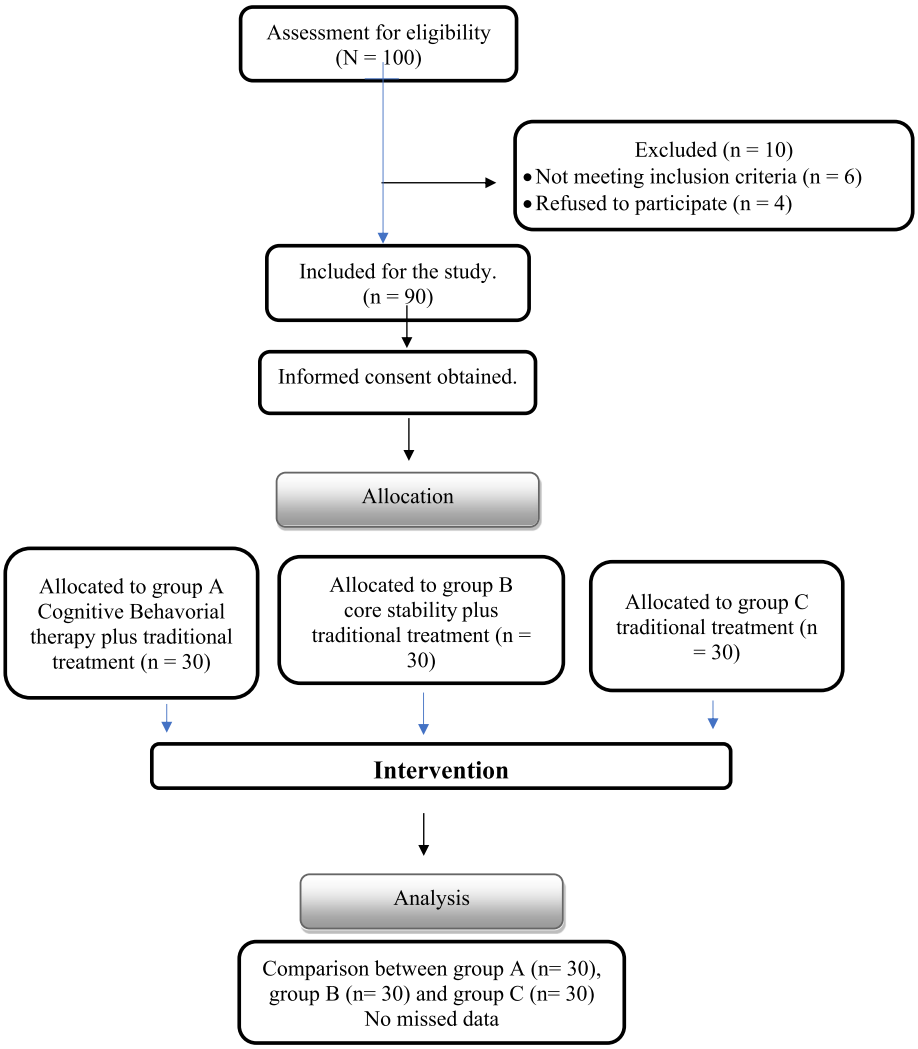

Fig. 1 Flow chart for enrollment of subjecst in the current study and the number of drop off

had the medical condition as DM, chronic obstructive pulmonary disease, congestive heart failure, and those who have undergone spinal surgery or who have severe spinal or neurological pathology.

Intervention

Group (A) (experimental technique): 30 patients with CNSLBP received cognitive perception training and pain control education in addition to traditional therapy (hot packs and transcutaneous electrical nerve stimulation (TENS) plus back and abdominal exercises). The treatment sessions were 30 to 45 min, and the patients were educated about the cognitive behavioral therapy procedure before the treatment started.

During the treatment procedure for this group, the session was performed as an educational session between the treating physical therapist who is trained in CBT, and the patient. The time of every treatment session was 30–45 min, and it was divided into two halves, the first half for delivering CBT to patients and the second half to providing the traditional treatment for patients. Yarns and his colleagues designed and published an empirically verified CBT protocol, from which the CBT manual used in this study was derived [10]. The treatment frequency for all patients was three times per week for 8 weeks (about 2 months) and each session was 30 to 45 min. According to Yarns et al., patients received education about chronic pain and training in pain management techniques like behavioral pacing, emotional awareness, and expression therapy sessions [10]. As a guide for more details about CBT, we added a supplemental document in Appendix 1 [14].

Group (B) (experimental technique): 30 patients with CNSLBP were allocated in this group. All of them

received core stability training in addition to traditional therapy (hot packs and transcutaneous electrical nerve stimulation (TENS) plus back and abdominal exercises). The treatment frequency for all patients was three times per week for 8 weeks (about 2 months) and each session was 30 to 45 min. The core stability training included five exercises: bird dog, side bridge, curl up, and supine extension bridge. The subjects were instructed to perform each exercise for 5 sets and each set included 10 repetitions with a rest for 10 s in between sets [12].

Group (C) (control group): 30 patients with CNSLBP were allocated to this group and treatment procedures were delivered to patients by a physical therapist. All patients were treated by traditional therapy (hot packs and transcutaneous electrical nerve stimulation (TENS) plus back and abdominal exercises). The treatment frequency for all patients was three times per week for 8 weeks (about 2 months) and each session was 30 to 45 min. Traditional therapy was applied on both sides of the back, the hot packs were applied for 15 min. On both sides of the painful area, TENS was applied for 15 min at low intensities, with a wavelength of 50–100 μs and a frequency of 80–100 Hz [15]. Next, five back and abdominal exercises were performed by the patients; three of them were performed from a supine position (knee to chest, supine sit up, and bridging exercises) and three from a prone position (hip extension and back extension exercises). Each exercise was to be performed 10 times in three sets [11, 12].

Outcomes measures

During the current study, we included the following outcome measure to assess all the subjects:

Visual Analog Scale (VAS), Fear Avoidance Beliefs Questionnaire (FABQ) for both work and physical activity and Oswestry low back disability questionnaire (ODI). All the outcome measures were analyzed initially before the treatment and after the treatment procedure. The data was collected by a physical therapist who was responsible for providing treatment to groups. The same therapist was responsible for collecting the scores and data from subjects and preparing it for statistical analysis.

Pain intensity using Visual Analog Scale (VAS)

The Visual Analog Scale (VAS) is used to evaluate LBP intensity. Study patients show their pain intensity by selecting a single number on a scale ranging from zero (no pain) to ten (maximum pain) [16].

Fear Avoidance Beliefs Questionnaire (FABQ)

It is a patient-reported questionnaire used to assess how an individual's fear avoidance beliefs about physical activity and work contribute to their LBP and resulting disability (Waddell et al. 1993). The FABQ assesses fear of pain in addition to avoidance of physical activity, covering various areas such as daily activities, behavior, health, mental well-being, and much more. There are sixteen items in the questionnaire, and patients are asked to rate their level of fear avoidance using a 7-point Likert scale. It consists of two subscales: a 7-item work subscale (FABQw) and a 4-item physical activity subscale (FABQpa). The scoring method for fear-avoidance beliefs concerning work items 6, 7, 9, 10, 11, 12, and 15, and for fear-avoidance beliefs concerning physical activity items 2, 3, 4, and 5 are counted (Arabic and English versions of FABQ) [15].

Oswestry low back disability questionnaire

It is a scale of 10 questions assessing functional performance level (Fairbank and Pynsent, 2000). The questions cover various areas such as pain severity, individual care, lifting, walking, sitting, standing, sleeping, social life, traveling, as well as employment/homemaking. The scoring of each question is based on a scale of 0 to 5, with a greater score showing larger disability. The total score is used to determine the disability level, ranging from no disability (0) to complete disability (50) (Arabic and English versions of the Oswestry low-back disability questionnaire) [17].

Data analysis

Prior to analysis, the normality of data was checked using the Shapiro-Wilk test. Levene's test for homogeneity of variances was conducted to test the homogeneity between groups. Data were normally distributed and there was homogeneity of variance. MANOVA test was conducted for comparison of the subject characteristics between groups. Two-way mixed design MANOVA was used to investigate the effect of treatment on VAS, FABQW, FABQPA, and ODI. Post-hoc tests using the Bonferroni correction were carried out for subsequent multiple comparisons. The level of significance for all statistical tests was set at $p < 0.05$. Statistical analysis was performed through the Statistical Package for Social Studies (SPSS) version 25 for Windows.

Results

Subject characteristics

Table 1 shows the subject characteristics and baseline data of groups A, B, and C. There was no significant difference between groups in subject characteristics ($p > 0.05$). Also, there was no significant difference in baseline data between groups ($p > 0.05$).

Effect of treatment on VAS, FABQW, FABQPA, and ODI

Mixed MANOVA revealed that there was a significant interaction between treatment and time (Wilk's $A = 0.33$, $F = 15.16$, $p = 0.001$, $\eta^2 = 0.42$). There was a significant main effect of time (Wilk's $A = 0.08$, $F = 235.24$, $p = 0.001$, $\eta^2 = 0.92$). There was a significant main effect of treatment (Wilk's $A = 0.65$, $F = 4.86$, $p = 0.001$, $\eta^2 = 0.19$).

Within group comparison

There was a significant decrease in VAS, FABQW, FABQPA, and ODI post-treatment compared with that pretreatment in group A ($p > 0.001$), group B ($p < 0.001$), and group C ($p < 0.001$) (Tables 2 and 3).

Table 1 Demographic and baseline clinical characteristics of subjects ($N = 90$)*

	Group A ($n = 30$) mean ± SD	Group B ($n = 30$) mean ± SD	Group C ($n = 30$) mean ± SD	*F* value	*P* value
Age (years)	32.30 ± 4.38	33.20 ± 6.33	31.47 ± 4.32	0.86	0.42
Weight (kg)	72.27 ± 10.88	72.70 ± 9.64	70.10 ± 8.19	0.62	0.53
Height (cm)	167.70 ± 9.97	169.63 ± 6.95	168.60 ± 4.98	0.48	0.61
BMI (kg/m^2)	25.78 ± 3.74	25.22 ± 2.65	24.60 ± 2.02	1.23	0.29
Duration of illness (months)	6.30 ± 2.62	7.30 ± 3.59	5.77 ± 2.13	2.24	0.11
Sex, *N*(%)					
Females	18 (60%)	17 (56.7%)	18 (60%)	$\chi^2 = 0.09$	0.95
Males	12 (40%)	13 (43.3%)	12 (40%)		
VAS	6.06 ± 1.09	5.94 ± 1.21	6.34 ± 0.93	1.05	0.35
FABQW	32.43 ± 5.74	31.47 ± 7.12	32.00 ± 6.11	0.17	0.84
FABQPA	14.83 ± 4.13	16.20 ± 4.39	16.97 ± 3.63	2.12	0.12
ODI	23.10 ± 6.54	22.80 ± 7.33	23.67 ± 7.04	0.12	0.88

Abbreviations: *VAS* visual analog scale, *FABQW* The Fear-Avoidance Beliefs Questionnaire-Work Subscale, *FABQPA* The Fear-Avoidance Beliefs Questionnaire-Physical Activity Subscale, *ODI* Oswestry Disability Index, χ^2 chi-squared value

Table 2 Clinical characteristics of subjects after intervention ($N = 90$)*

Outcome	Group A ($n = 30$) mean ± SD	Group B ($n = 30$) mean ± SD	Group C ($n = 30$) mean ± SD	*F* value	*p* value
VAS	3.46 ± 1.01	4.29 ± 1.05	5.15 ± 0.76	23.91	0.001
FABQW	20.93 ± 4.30	24.17 ± 5.03	28.47 ± 5.22	18.12	0.001
FABQPA	7.87 ± 2.36	11.83 ± 2.78	14.37 ± 3.07	42.54	0.001
ODI	13.03 ± 4.79	16.80 ± 5.65	20.60 ± 6.14	13.92	0.001

Abbreviations: *VAS* visual analog scale, *FABQW* The Fear-Avoidance Beliefs Questionnaire-Work Subscale, *FABQPA* The Fear-Avoidance Beliefs Questionnaire-Physical Activity Subscale, *ODI* Oswestry Disability Index

Table 3 Within groups changes pre–post-intervention

Outcome	Group A		Group B		Group C	
	MD (95% CI)	*p* value	MD (95% CI)	*p* value	MD (95% CI)	*p* value
VAS	2.6 (2.29, 2.92)	0.001	1.65 (1.34, 1.96)	0.001	1.19 (0.87, 1.50)	0.001
FABQW	11.5 (10.01, 12.99)	0.001	7.3 (5.81, 8.79)	0.001	3.53 (2.04, 5.02)	0.001
FABQPA	6.96 (6.14, 7.79)	0.001	4.37 (3.54, 5.19)	0.001	2.6 (1.77, 3.42)	0.001
ODI	10.07 (9.18, 10.95)	0.001	6 (5.12, 6.88)	0.001	3.07 (2.18, 3.95)	0.001

Abbreviations: *VAS* visual analog scale, *FABQW* The Fear-Avoidance Beliefs Questionnaire-Work Subscale, *FABQPA* The Fear-Avoidance Beliefs Questionnaire-Physical Activity Subscale, *ODI* Oswestry Disability Index, *MD* mean difference, *CI* confidence interval, *p* probability value

P < 0.05 indicates statistical significance

Between groups comparison

There was a significant decrease in VAS, FABQW, FABQPA, and ODI of group A compared with that of group B ($p < 0.05$) and group A with group C ($p < 0.001$); and a significant decrease in group B compared with group C $p < 0.05$) (Table 4).

Discussion

The primary aim of the current research work was to assess the effect of cognitive behavioral therapy and core stabilization training program on the management of subjects with chronic nonspecific low back pain, and if there is any difference between both procedures in the outcomes measures as pain, social, psychological aspects, and functional status of these subjects.

This study results revealed that there was a significant decrease in VAS, FABQW, FABQPA, and ODI post-treatment compared with pre-treatment in group A, group B, and group C, there was a significant decrease in VAS, FABQW, FABQPA, and ODI of group A compared with that of group B and group C and a significant decrease in group A compared with that of group B compared with that of group C.

Pain is a primary generator; it is considered an ideal alarm that alerts individuals from potential harm or threat. Fear of movement may trigger catastrophic beliefs and anxiety about pain, giving rise to pain-related thoughts, and may influence persistent pain perception and avoidance attitude through daily activity at work and home. Fear-avoidance beliefs and psychological disruptions could be addressed with different strategies and interventions, Alamam and his colleagues recommended CBT and perceived pain efficacy to manage and relieve chronic pain and avoid the impact on their quality of life [1, 18–21].

It was reported that subjects with musculoskeletal pain develop chronic pain syndrome, which is related to fear avoidance and anxiety from performing activities that may trigger pain and generate disorders recurrence. These behaviors and attitudes result in physical disability and contribute to pain chronicity. Chronic pain could cause markable changes in the brain and CNS, and because of that chronic pain is usually associated with depression and anxiety. In the same vein, chronic pain could induce chronic stress that affects the body's ability to heal which causes pain persistence [22, 23].

Assessing patients with CNLBP by using brain MRI has led the providers to the understanding that chronic pain patients display brain changes regarding both function and structure. In addition, these neuroplastic changes are shown to be related to the persistence of pain, long after the initial nociceptive input has disappeared [24]. Even more importantly, there is abundant evidence for a positive association between pain duration and the extent of measured brain changes, implicating that the longer pain continues, the more the brain changes [25]. Besides its association with brain changes, pain duration, and its chronicity are related to maladaptive cognitive and emotional components, like pain catastrophizing, Kinesio phobia (fear of movement or injury), and maladaptive pain perceptions [26].

It was concluded that there is moderate evidence for a correlation between pain catastrophizing and changes in gray matter morphology in the Dorsolateral Prefrontal Cortex DLPFC, but evidence is inconclusive regarding the direction of this relation. Additionally, there is some evidence of a negative relationship between pain catastrophizing and gray matter volume in brain areas involved in somatosensory, motor, and pain processing [27, 28].

It is vital to observe that psychological and social factors contribute significantly to pain intensity, response to rehabilitation and conservative treatment, persistence of pain, and liability to develop disability. In the same vein, self-confidence and efficacy have been determined as a mediator in the relationship between psychological disorders and affective pain intensity. For example, subjects who had higher self-esteem and

Table 4 Between groups effects after intervention

Outcome	Group A vs B		Group A vs C		Group B vs C		Partial eta square
	MD (95% CI)	*p* value	MD (95% CI)	*p* value	MD (95% CI)	*p* value	
VAS	− 0.83 (− 1.41, − 0.25)	0.003	− 1.69 (− 2.27, − .1.11)	0.001	− 0.86 (− 1.44, − 0.27)	0.002	0.355
FABQW	− 3.24 (− 6.23, − 0.24)	0.03	− 7.54 (− 10.53, − 4.54)	0.001	− 4.3 (− 7.29, − 1.31)	0.003	0.294
FABQPA	− 3.96 (− 5.66, − 2.27)	0.001	− 6.5 (− 8.19, − 4.81)	0.001	− 2.54 (− 4.23, − 0.84)	0.002	0.494
ODI	− 3.77 (− 7.19, − 0.35)	0.03	− 7.57 (− 10.99, − 4.15)	0.001	− 3.8 (− 7.22, − 0.38)	0.02	0.242

Abbreviations: *VAS* visual analog scale, *FABQW* The Fear-Avoidance Beliefs Questionnaire-Work Subscale, *FABQPA* The Fear-Avoidance Beliefs Questionnaire-Physical Activity Subscale, *ODI* Oswestry Disability Index, *MD* mean difference, *CI* confidence interval, *p* probability value

$p < 0.05$ indicates statistical significance

confidence were significantly more tolerant of pain and able to practice their daily life routine and in contrast, subjects who had higher levels of fear-avoidance/catastrophizing may perceive and report a higher pain intensity [29, 30].

Abdallah and his colleagues performed a study to investigate the relationship between the social aspects and pain perception in subjects who suffer from CNLBP and the functional performance of these patients. The authors aimed to assess how much the correlation between the biopsychosocial status and how these subjects practice their life and work. The findings of this study proved that there is a strong relationship between how patients with CNSLBP feel and perceive chronic pain and how they practice their daily life routine at home with family and at work [18]. These results came in agreement with the current study's main goal as the authors constructed the procedure depending on the conclusion that revealed that in dealing with patients who suffer from chronic low back pain, clinicians are needed to examine their pain perception status and cognitive awareness of the changes that occurred by chronic pain.

The current study results agreed with the results of the study performed by Yarns et al. In their study, Yarnes et al. compared the effect of emotional awareness expression therapy and cognitive behavioral therapy in treating chronic musculoskeletal pain. However, the subjects' features are different in both studies, Yarns and his colleagues enrolled older subjects in their study, and both studies support the positive effect of CBT in the management of chronic pain [31].

Weiners and his colleagues were the first authors who examined the relationship between biopsychosocial aspects and gait cadence in subjects with CLBP. They concluded that only subjects with depression and leg-length discrepancy have lower gait and mobility scorings and they recommended applying a biopsychosocial model when evaluating subjects with CLBP and using CBT for them to achieve impactful treatment for these patients. The results of this study showed that differences between groups were not only statistically significant, but clinically as well and the result of the current study agrees with Weiners et al.'s study results [30].

The results of the current study match the results of Fracaro and his colleagues' study that was published in 2013. They examined the functional performance as a 6-min walk test and psychological variables such as mood perception and level of disability and they performed this study between both groups, one group with low back pain and the other group were normal subjects. They concluded that low back pain subjects were presented with higher levels of disability and poorer signs of fatigue, anxiety, and mental confusion [32].

In their study, Fracaro and his colleagues revealed that low back pain subjects are characterized by depression, anger, fatigue, tension, and mental confusion and they clarified that these signs could be due to pain chronicity and mental health dysfunction associated with CLBP. The current study agrees with Sarda Jr, Kupek, and Cruz's results as both studies revealed that there is a linear correlation between low back pain symptoms and patients' psychological changes [32].

On the same side, the results of the current study agree with the results of the performed by Van-Erp and his colleagues. Van-Erp et al. performed a pilot randomized control trial to compare the effectiveness of the biopsychosocial model treatment and physiotherapy treatment as usual in a subgroup of patients with CLBP. Fifteen patients were included in their study and their baseline assessment revealed that all of them experienced negative psychosocial and social dysfunctions that influence their daily life functioning [33].

The study of Lane and Terry came in agreement with the objectives of the current study. They indicated that low back pain subjects could suffer from fatigue. They concluded that fatigue among these patients could be exhaustion, apathy, and low levels of energy and associated with concentration deficits, sleep, and memory disorders. On the same side, these subjects complain about irritability which could initiate psychosomatic, physical, and psychological disorders [34].

Resembling the current study results and design, Fersum and his colleagues did a randomized control study to compare the effect of CBT, manual therapy, and exercises on CLBP. They enrolled one hundred twenty patients in their study, and they concluded that CBT is more effective at reducing disability, depression/anxiety, and pain-related fear, in patients with CLBP, at a 3-year follow-up. The results of Fersum et al. Supports the long-term effect of CBT in the management of CNLBP [14].

There are some limitations regarding the current study which include: (1) short-term study design which was only 8 weeks (about 2 months). Small sample size and the current study did not include a variety of age groups (young and elder groups) as Weiner et al. 2019 assumed that older adults tend to have more robust pain coping skills than younger patients with chronic pain [30]. Also, this study is missing using objective assessment tools to study the function of the lumbar region as an isokinetic system which could provide more relative data regarding core muscles strength and function.

Conclusion

This study's results revealed a conclusion that adding a biopsychosocial model as an assessment tool and treatment procedure (cognitive behavioral therapy) could improve pain perception in patients with CNLBP. This could improve the quality of treatment provided to these patients and could reflect on their life and work productivity .

Abbreviations

CLBP	Chronic low back pain
NCLBP	Non-specific chronic low back pain
CBT	Cognitive behavioral therapy
MANOVA	Multivariate analysis of variance
VAS	Visual Analog Scale
FABEQW	Fear Avoidance and Belief Questionnaire/Work
FABEQP	Fear Avoidance and Believe Questionnaire/Physical Activity
ODI	Oswestry Disability Index
TENS	Transcutaneous electoral neuromuscular stimulation

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s43161-024-00198-3.

Supplementary Material 1: Appendix 1. A guide for more details about CBT.

Acknowledgements
The authors would like to thank all the participants for their help and consistency in the current study and the authors are thankful to the professors at the faculty of Physical therapy at Cairo University for their help and guidance.

Authors' contributions
All authors conceived and designed the study, conducted the data collection, and analyzed and interpreted the data in addition to reviewing the final draft and results. The authors read and approved the final manuscript.

Funding
This research was not funded.

Availability of data and materials
All row data and materials for the current study are available upon request.

Declarations

Ethics approval and consent to participate
Ethics approval and consent to participate in the study was approved by faculty of physical therap at Cairo university Supreme Council of Postgraduate Studies and Research and Human Research Ethics Committee (P.T.REC/012/004701). All participants signed written informed consent before starting the study.

Competing interests
The authors declare that they have no competing interests.

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Received: 18 March 2024 Accepted: 26 April 2024
Published online: 05 July 2024

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