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Pain self efficacy in low back pain after yoga - an interventional trial

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Abstract

Background:
Better pain self-efficacy (PSE) improves the outcome in low back pain (LBP). Many patients have erroneous beliefs about LBP. The study assessed the relationship between beliefs about LBP and PSE (part 1) and the effect of yoga on PSE, LBP-related disability and pain intensity (part 2).

Methods
Assessments on LBP patients included questionnaires for (i) Back Beliefs, (ii) PSE, (iii) pain intensity (pain analogue scale) and (iv) disability (Rolland-Morris scale) on Day 1 and Day 7 of a residential yoga program for LBP.

Results:
Step-wise multiple linear regression analyses revealed that PSE is predicted by BBQ (ß = 0.365, 12.9% variance) and pain intensity (ß = -0.315, 14.4% variance). Following seven days of yoga and allied therapies, the pain self efficacy scores increased significantly ($p<0.001$, $t = -6.98$). Also, the Rolland-Morris scores ($p<0.001$, $t = 15.02$) and the pain analogue scale scores decreased significantly ($p<0.001$, $t = 10.73$) after 7 days of yoga and allied therapies.

Conclusion
In summary (1) PSE is higher in LBP patients who are correctly informed about LBP and

(2) a week of yoga is likely to improve PSE with a decrease in pain related disability and reduced pain intensity. Since PSE can improve the outcome in LBP, factors which influence PSE are of interest.

Keywords: Pain self-efficacy, Back beliefs, Pain intensity, Prediction linear regression, Paired t test

Introduction

Low back pain is a major cause of disability globally and almost everyone will, at some point in their life, experience low back pain [1]. The outcome in low back pain is influenced by multiple factors including patients' confidence in their ability to perform a task or specific behaviour despite pain (i.e., their pain self-efficacy) [2]. A high sense of PSE leads to desired outcomes, such as improved health [3, 4], whereas when self-efficacy is low, pain increases [5]. A review of twenty-four studies from multiple databases, which explored factors which increase self-efficacy in patients with chronic disease (not necessarily chronic pain), reported an association between knowledge about the illness and better self-efficacy [6]. We believe there is no report on how knowledge about back pain influences PSE for low back pain specifically. This is of interest since (i) a number of erroneous beliefs about back pain have been reported in patients with low back pain [7], and (ii) factors improving PSE in patients with back pain are worth investigating given that higher PSE improves the outcome [4]. With this background, the first part of the present study was designed to determine if correct knowledge about back pain can predict PSE in patients with low back pain in India.

Yoga has been tried in managing LBP to reduce pain and increase function. A systematic review and meta-analysis assessed the efficacy and safety yoga in managing LBP [8]. Thirty randomized controlled trials (with 2702 participants) searched from three bibliographic databases comparing yoga with a passive control (regular care or wait list) were reviewed. Yoga was associated with short-term improvements in pain intensity, pain-related disability, mental health and physical functioning). Except for mental health, all effects were sustained long-term. Compared with an active comparator, yoga was not associated with any significant differences in short-term or long-term outcomes.

A one-arm trial was conducted with 11 participants with cLBP who enrolled in a 12-week yoga intervention [9].

Data on subjective pain characteristics, quantitative sensory testing, and blood for analysis of differentially expressed genes and CpG methylation was collected prior to the start of the intervention and at study completion. The yoga intervention improved self-reported physical movement, reduced stress levels, reduced pain severity, and interference as well as improved PSE and emotion regulation. Hence the present study had two parts. Part 1 was aimed to determine the association PSE with attitudes and beliefs about the consequences of back pain in patients with chronic musculoskeletal back pain. Part 2 of the study was to assess the efficacy of one week of yoga and allied therapies on (a) pain self-efficacy, (b) pain-related disability and (c) pain intensity in patients with chronic musculoskeletal back pain.

Methods

Study Design

The study was carried out in a yoga and allied therapy centre in north India. The study had two parts. The first part was a cross-sectional trial designed to determine the association of PSE with attitudes and beliefs about the consequences of chronic musculoskeletal back pain in patients with chronic musculoskeletal back pain. In this part of the study, the patients were individually assessed by a researcher for (i) PSE using the pain self efficacy questionnaire (PSEQ) [10,11], (ii) beliefs about the consequences of back pain using the back belief questionnaire (BBQ) [12], and (iii) pain intensity using a visual analog scale (VAS) [13] on the day of their arrival in the centre.

The second part of the study was a one arm longitudinal trial intended to assess the efficacy of one week of yoga and allied therapies on (a) pain self-efficacy, (b) pain-related disability and (c) pain intensity in patients with chronic back pain. In this part of the study, each patient was individually assessed before and after seven days of yoga and allied therapies for (i) PSE (using PSEQ), (ii) disability arising from back pain (using Rolland Morris Disability Questionnaire) and (iii) VAS for intensity of back pain.

Patients: Three hundred and twenty five patients with chronic musculoskeletal back pain (i.e., back pain ≥ 3 months) aged between 20 and 80 years (f:m=166:159; group average age±SD; 53.46±12.65 years)) participated in the first part of the study whereas one hundred and two patients with chronic musculoskeletal back pain aged between 20 and 80 years (f:m=52:50; group average age±SD; 53±13.96 years) formed the sample for the second part of the study. A researcher directly recruited the patients when they were sitting in the waiting hall of the yoga and allied therapy centre for registration. Participation in the study was voluntary, with no incentive. The patients were included in the trial if they had chronic musculoskeletal back pain (i.e., back pain ≥ 3 months) [14], based on (i) a semi-structure interview which was carried out to establish the cause and duration of back pain and (ii) the diagnosis of back pain from a physician including the case history, investigations, and treatment. The patients were excluded if they had back pain associated with malignancy, recent injuries or fractures, or post-surgical pain. The patients were also to be excluded if they had any psychological and physical health issues that would have prevented them from participating in the yoga and allied therapies. The signed informed consent from each patient was obtained after explaining the study. The study had prior approval of the ethics committee of the Institution (approval no. PRF/YRD/023/018).

Assessments

PSE questionnaire (PSE)

The pain self efficacy questionnaire is used to assess the self efficacy of the patients with pain. The questionnaire consists of 10 items to determine the current feelings of confidence in performing activities despite the presence of pain in patients with pain. Patients are asked to rate each item on a seven-point Likert scale ranging from 0 to 6. Total PSEQ scores vary from 0 to 60, with higher scores indicating increased pain self-efficacy [10, 11].

Back belief questionnaire (BBQ):

The BBQ is designed to determine the degree of agreement among patients with back pain about developing various inevitable statuses related to the pain in the future [12]. The questionnaire consists of 14 items to determine the patient's beliefs about the intensity of their back pain. Of the 14 items, nine are used for the score, whereas the remaining five are used as distractions and are excluded when computing the final score. The patients are asked to rate each item for their level of belief on a five-point Likert scale ranging from total disagreement to total agreement. The nine items are reversed scored and added to obtain the total BBQ score, where the higher scores show low fear and negative beliefs [12].

Roland-Morris Disability Questionnaire (RMDQ)

The RMDQ is a 24-item self-administered outcome measure that assesses pain-related disability arising from low back pain [15]. The items are rated 0 if left blank or 1 if endorsed. The total RMDQ score ranges from 0 to 24, where higher scores indicating

higher levels of pain-related disability.

Pain intensity

The pain intensity was assessed using a 10 cm horizontal analog scale varying from 0 (no pain) to 10 (the worst pain) [13]. VAS has been reported to have high inter observer reliability coefficient (r=0.88) and a change of 30 percent in VAS is considered clinically significant.

Intervention

Yoga and allied therapies:

All patients practiced yoga in a group. The yoga practices were specially designed for the management of musculoskeletal back pain. In the yoga class, there were several yoga therapy trainers with a minimum of twelve months of training in administering yoga as a therapy. These trainers offered guidance and support to the patients in the yoga class, while instructions were given using a microphone and a large screen so that all the patients could see the demonstration. There were two yoga practice sessions per day, in the early morning and in the evening, lasting one hundred and twenty minutes and ninety minutes, respectively. Each session included (i) *asanas* (standing, sitting, supine, backward back bending and prone poses), (ii) *pranayamas* (a) *bhramari* (bumblebee yoga breathing), (b) *kapalbhati* (forehead cleansing breathing), (c) *bhastrika* (bellows yoga breathing), (d) *nadi shodhan* (subtle energy channel cleansing breathing), (e) *shitali* (cooling breathing), (f) *ujjayi* (victorious breathing), (g) *anulom-vilom* (alternate nostril breathing) and (h) *sheetkari* (hissing breathing) and guided relaxation.

In India yoga therapy is most often combined with other therapies which (i) make use of natural resources and (ii) intend to correct imbalances in physical and mental functioning [16].

In the present study also, patients received additional therapies based on the discretion of the yoga, *ayurveda* and naturopathy physician (who had five and a half years of training in administering yoga and naturopathy after twelve years of education). Patients could receive one or more of these discretionary treatments in a day. The discretionary treatments included: massage of the full body for 20 to 25 minute, medicated oil to the head (*sirodhara*) for 30 to 35 minute, enemas (intended to eliminate the accumulated/deranged *vata* concentrated in the lower part of the body (*basti*) for 30 to 35 minute), nasal oil application (*nasya*) for 10 to 15 minutes, medicated mud application for 25 to 30 minutes, application of a wet sheet pack to the full body for 45 minutes and a spinal bath for 15 to 20 minute.

Analyses of data

The analyses of data were carried out using SPSS (Version 24.0, SPSS Inc).

Part 1: Two types of analyses were performed for first part of the study:

(a) Pearson correlations were used to determine the zero-order correlations of PSE scores with (i) back belief questionnaire scores, (ii) pain analogue scale scores, (iii) age, (iv) years of education, and (v) duration of pain.

(b) Based on the results of the Pearson correlations, multiple linear regression analysis using a forward conditional selection criterion (with a probability-of-F-to-enter ≤ 0.05) was carried out to determine the unique contribution of the back belief questionnaire scores and pain analogue scores in explaining the variance in PSE scores.

Part 2: The efficacy of one week of yoga and allied therapies on (i) PSE (ii) disability related to pain and (iii) pain intensity was examined using paired t-tests.

Results

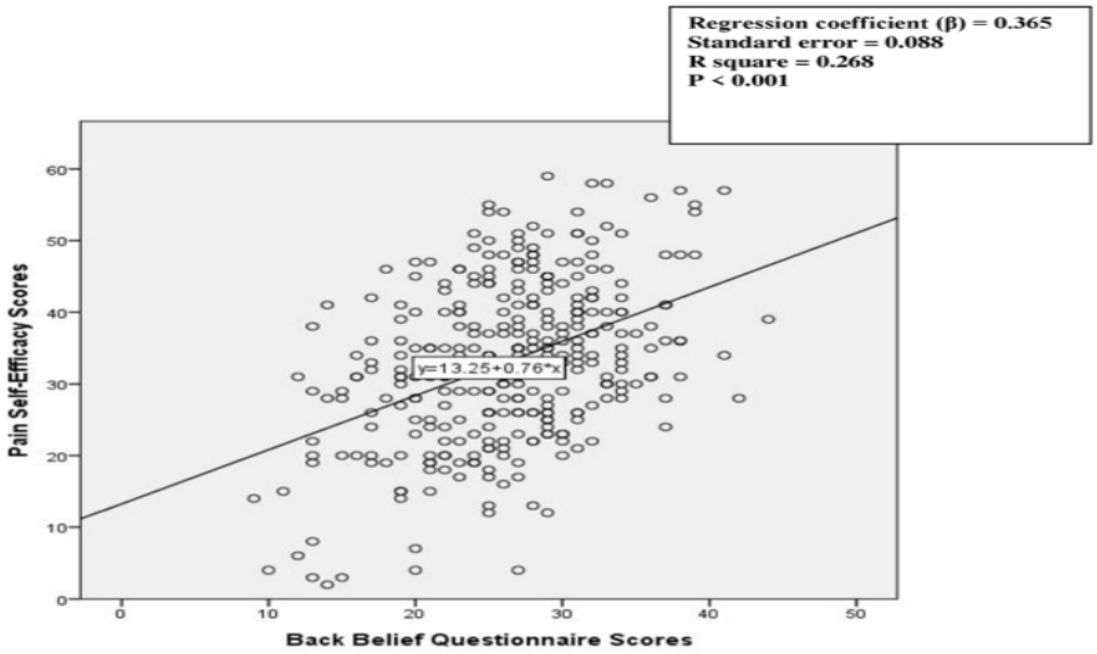
Three hundred and twenty five patients with chronic musculoskeletal back pain aged between 20 and 80 years completed the first part of the study whereas 102 patients with chronic musculoskeletal back pain participated in the second part of the study. The sample size was not calculated a priori. However, with an alpha = 0.05, Cohen's d = 0.52 (determined from change in PSE scores after one week of yoga and allied therapies in the second part of the study), the study had Power = 1. The baseline characterstics of patients are shown in Table 1.

Table1 Baseline characteristics of the patients.

Characteristics **Sample size**	**Cross-sectional trial** **N=325**	**One arm longitudinal trial** **N=102**
Age (years)		
Group mean age ±sd	53.46±12.65	53±13.96
Age range	20-80	20-80
Age category n(%)		
20-40 years	76(23.38)	19(18.62)
41-60 years	150(46.15)	49(48.03)
61 and above	99(30.46)	34(33.33)
Gender n(%)		
Male	159(48.92)	50(48.92)
Femle	166(51.07)	52(51.07)
Education n(%)		
Illiterate	36(11.07)	12(11.07)
Up to 12 years	110(33.84)	38(33.84)
Up to 15 years	93(28.61)	26(28.61)
Up to 17 years	82(25.23)	24(25.23)
More than 17 years	4(1.23)	2(1.23)

Part 1: Pearson correlation tests revealed a significant interrelation of PSE scores with (i) back belief questionnaire scores ($r = 0.420^{**}$, $p < 0.001$) and (ii) pain analogue scale scores ($r = -0.379^{**}$, $p < 0.001$). A scatter plot showing the linear relation of back belief scores with PSE scores is presented in Figure 1.

Figure 1: Scatter plot of linear regression analysis with Back Belief questionnaire scores



Legend for figure 1.

Scatter plot of linear regression analysis with Back Belief questionnaire scores predicting the total Pain Self-Efficacy scores (n=315).

There was no significant correlation of self-efficacy with (i) age (r = 0.015, $p > 0.05$), (ii) gender (r = -0.043, $p > 0.05$), (iii) years of education (r = 0.054, $p > 0.05$), and (iv) duration of pain (r = 0.034, $p > 0.05$).

In predicting the total self-efficacy scores, the entry of the pain analogue scale scores at the first step explained a significant proportion of the variance ($p < 0.001$; 14.4% of variance). At the second step, BBQ scores were selected for the entry, with a 12.9% increase in step change in R square ($p < 0.001$). The results of the final steps of the multiple regression analysis are presented in Table 2.

Table 2 Regression coefficients, standard errors, variance inflation factors and p-values for the multiple regression analysis with back belief and pain analogue score as predictors of pain self-efficacy.

Dependent variable	Predictor variables	Regression coefficient (ß)	Standard error	Tolerance	Variance inflation factors	*p*-value
PSEQ	BBQ (9-45)	0.365	0.088	0.969	1.032	<0.001
	PAS (0-10)	-0.315	0.271	0.969	1.032	<0.001

Tolerance values and variance inflation values for the predictors in the final regression models were examined to determine the collinearity. Tolerance values of less than 0.1 and variance inflation factor values of more than 5 were considered to suggest problematic collinearity [17], (no problems with collinearity were found within the analyses carried out).

Part 2: Following seven days of yoga and allied therapies, the pain self efficacy scores increased significantly ($p<0.001$, $t = -6.98$) whereas the Rolland-Morris scores ($p<0.001$, $t = 15.02$) and the pain analogue scale scores ($p<0.001$, $t = 10.73$) decreased significantly.

The group mean±SD values for (i) the pain self efficacy scores, (ii) Rolland-Morris scores and (iii) the pain analogue scale before and after one week of yoga and allied therapies are presented in Table 3.

Table 3 Changes in self reported self-efficacy, disability and pain intensity after seven days of yoga and allied therapies in patients with chronic low back pain

Variables	Pre	Post	t-value	Sig. (2-tailed)
PSEQ	40.83±9.08	45.85±9.99	-6.985	P<0.001
RM	10.07±4.19	6.89±3.94	15.019	P<0.001
PAS	7.01±2.01	5.18±2.57	10.735	P<0.001

Discussion

In three hundred and and twenty five patients with low back pain, correct beliefs about back pain predicted better PSE, contributing to 12.9% variance as compared to pain intensity which contributed 14.4% of variance in PSE. Based on the understanding of the back beliefs questionnaire [12], the results suggest that patients who held fewer erroneous beliefs about the inevitability of negative consequences of back pain had higher pain self-efficacy; where PSE refers to beliefs held by people with chronic pain who are able to carry out certain activities, even when experiencing pain [18].

These results are comparable to findings of an integrative review covering twenty-four articles sourced from five databases reported an association between health literacy and self-management skills leading to recommendations to identify patients with low literacy so as to provide appropriate interventions to improve self-efficacy [19].The health conditions included in the review were arthritis, chronic obstructive pulmonary disease (COPD), chronic kidney disease, hypertension, diabetes, musculoskeletal conditions and chronic pain.

Health education programs hence are important in chronic disease management. However, the complexities of chronic disease often require more health education than is feasible for the short time available during out-patient contact with the practitioner [20]. Also new information may overwhelm the patient, making critical the timing of health education and the importance of targeting the specific beliefs and needs of each patient [21].

In the second part of the study, a week of yoga and allied therapies increased PSE and reduced pain-related disability in one hundred and two patients. These results can be compared to a previous one-armed trial of longer duration (i.e., 12 weeks as opposed to 1 week of the present trial) in eleven patients with LBP which reported improved PSE, self-reported physical movement, reduced stress levels, reduced pain severity, and improved emotion regulation [9]. A few studies have explored the mechanisms by which yoga might affect pain and functioning in LBP. The role of possible mediators, including cortisol, serotonin, brain derived neurotrophic factor (BDNF) and dehydroepiandrosterone (DHEA) have been reported [22].

In addition, the contribution of psychological factors in pain mediation in patients with LBP

have been studied. Several contributory psychological and lifestyle factors include stress reduction, cognitive appraisal measures (including PSE), positive affect, increased physical activity, and neuroendocrine function; though self-efficacy, and hours of exercise were the most significant contributors to the effect of yoga [22]. Hence self-efficacy appears to contribute to the benefits of yoga in LBP. In the present study one week of yoga and allied therapies increased PSE as well as reduced pain related disability. Improved self efficacy may have contributed to the reduced disability.

The findings are limited by the absence of controls and an alternate intervention.

In summary, the present results suggest that patients with few erroneous beliefs about back pain were more likely to have better PSE. Also, one week of yoga and allied therapies improved PSE and reduced pain related disability in patients with LBP, with better PSE possibly contributing to the decreased disability.

Conclusion

The present results suggest that (1) PSE is higher in patients who are correctly informed about LBP and (2) a week of yoga is likely to improve PSE with decrease in pain related disability in patients with LBP. Since PSE can improve the outcome in LBP, factors which influence PSE are of interest.

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Authors Contribution All authors contributed to the study conception and design. Data collection was performed by CA, research problem was defined by ST, SS. Data analysis done by CA and SS. Manuscript compilation was done by all authors. All authors read and approved the final manuscript. The manuscript was not previously submitted for publication to any other Journal.

Declarations

Conflict of Interest All authors declare that there is no conflict of interest. The authors have no relevant financial or non-financial interests to disclose.

Ethical Approval and Consent to Participate The study is approved by the institutional ethics committee (approval number: PRF/YRD/023/018).

Consent for Publication All authors gave written consent for submission of the manuscript. Informed Consent Informed consent has been obtained from the patients.

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