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Effect of yoga on kinesiophobia in chronic low back pain patients

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Abstract

Background

Low back pain is a major public health problem worldwide. It is responsible for activity limitations and workplace absence leading to various losses. Kinesiophobia is more debilitating than the pain itself. It also predicts future disability and health status. Kinesiophobia has negative influence on the outcome of rehabilitation. Yoga offers a self-corrective and holistic approach to health and is shown to be effective in several chronic diseases.

The purpose of this study is to know the effect of yoga on kinesiophobia in chronic low back pain patients.

Results

60 patients having low back pain were selected to participate in the study. These patients had the kinesiophobia score more than 37. The mean age of the group was 40.73 ± 6.351. The mean score for pre-test was 30.08±1.797 and the mean score for post-test was 32.48 ± 3.955. statistical analysis done by Wilcoxin signed rank test shows significant difference between the values.

Conclusion

There is significant effect of yoga on kinesiophobia in chronic low back pain patients.

Keywords: Low Back Pain, Kinesiophobia, Yoga

Introduction

Low back pain is a major public health problem worldwide. [1] Most people will experience low back pain at some point in their lifetime. Two-thirds have recurrent episodes and one-third have periods of disability. [2] One year recurrence estimates range from 24% - 80%. [3] However, it has been noted that only the first episode is taken into consideration, while the recurrent episodes are not considered. This results in underestimation of low back pain episode incidence in that time period. [4]

Low back pain can be described as a long- term, recurrent condition that follows many different trajectories rather than as an acute, sub-acute or chronic condition. [5, 6] Cases in which low back pain never recurs are rare. Many patients change treatment to manage recurrences. Low back pain episode duration estimates range from a median of 42 days from the start of the episode [7] to 128.5 pain days for low back pain lasting between 3 to 6 months. [8] Remission at 1-year has been estimated at 54% -90%. [9] 85% population may expect low back pain once in their lifetime. Although 90% of the acute low back pain patients recover, 10% are at risk of chronic low back pain and disability. [10]

Factors affecting back pain across life course

- **Genetic factors**

In a classical twin study, the total contribution of genetic factors to the overall probability of developing back pain decreases from around 70% at age 16 to 36% at age 40. [11]

- **Associations between childhood factors and adult back pain**

Prospective studies report that childhood behaviour or adverse circumstances such as road traffic accidents or maternal death are responsible. Presence of symptoms such as abdominal pain or headaches is also associated with chronic widespread pain in adulthood. Two studies that used recalled information about childhood education, childhood health and socioeconomic circumstances, showed that these were linked with adult functional limitation or chronic disabling pain, a proportion of which is likely to be caused by musculoskeletal pain. [12, 13, 14, 15, 16]

- **Parental factors**

The offspring's susceptibility to disease was influenced by the mother's health and thus by the pre-term birth or by low birth weight. [17, 18] There are indications of a relationship between prevalence of back pain and parents' socioeconomic status, and

parental education. [19, 20]

- **Psychological factors**

Back pain is commonly reported in adults undergoing through stress, anxiety and depression. [21] Recent systematic reviews have noted that depression, psychological stress, passive coping strategies and fear avoidance beliefs are independently associated and responsible for the transition from acute to chronic back pain [22] and low levels of fear avoidance are associated with recovery from back pain. [23]

- **Social determinants**

Social determinants for back pain can be identified throughout life, although the nature probably changes during the life course. Problems with peer relationships in adolescents predict persistent back pain. [24] There are many studies on the factors relating to workplace. These factors include low job satisfaction and perceived workload. [25, 26, 27]

- **Low back pain after motor vehicle collisions**

For the majority of those injured, it is unlikely that this would be the first time they had experienced low back pain, and it is likely, but yet unproven, that previous low back pain is a risk factor for low back pain after traffic collisions.

- **Physical activity**

Contrary to prior beliefs, and in support of the concept of 'lifetime perspective', occupational lifting does not seem to be an independent causative factor for the development of back pain. [28] Workload predicts back pain adolescents, [29, 30] whereas ergonomics does not play a role in relation to body comfort [31] and school-bag weight does not predict back pain. [32] Physical work demands such as twisting, bending, whole-body vibration or manual handling are likely low back pain risk factors. [33]

Usually, pain, stiffness and deformity in the back, along with pain parasthesia or weakness in lower limb are symptoms of back disorders. [34] Thereby, low back pain has become the largest category of medical claims. This places a major burden on individuals and healthcare systems. [35]

Personal and societal impacts

Low back pain is responsible for activity limitation and workplace absence in most parts of the world. The consequences of low back pain are so vast that they affect the individual, family, healthcare systems, industry and thus the economy. This can be attributed to restrictions in physical capabilities, participation, work related and financial burden, use of health-care resources, etc. Such impacts differ according to the access to healthcare, socioeconomic status and occupational distributions in the community. Factors such as costs of productivity losses, indemnity pay, litigation, retraining and other administrative costs are indirectly affected and thus low back pain becomes a burden. [36]

Kinesiophobia is ''a condition in which a patient has an excessive, irrational and debilitating fear of physical movement and activity resulting from a feeling of vulnerability to painful injury or re-injury''.

Vlaeyen *et al*., have elaborated on the kinesiophobia phenomenon. They defined it as a fear of movement/ (re)injury, a specific fear believed to cause injury or re-injury. [37]

Pain-related fear is a very salient predictor of pain disability in a chronic pain population. It is even more predictive than biomedical status and pain intensity. [37, 38] Pain-related fear is more disabling than pain itself. [39] In the general population, pain-related fear predicts future disability and health status. [40]

There are different terms for describing pain-related fear. Lethem *et al*., [41] had introduced the ''fear-avoidance'' model in 1983. The model had attempted to explain how and why some individuals develop a stronger psychological reaction to their pain problems than others. Later, Kori, Miller and Todd applied the ideas about fear-avoidance to chronic pain and physical movement. They later introduced the term ''kinesiophobia'' in 1990. [42]

It is also important to be able to differentiate between functional disabilities due to a sensory experience of pain and behaviours that are driven by fear-avoidance. It is necessary that they should be differentiated, from a psychological perspective. [41, 43]

This fear-avoidance model says that catastrophic thoughts about pain may lead to an increase of pain-related fear. And this fear is in turn associated with avoidance behaviours and hyper vigilance to bodily sensations and pain. Depression and disuse (i.e., a state of inactivity) may evolve, which in turn are associated with decreased pain tolerance and subsequently promote the painful experience. There are many research articles that have supported the relation between pain catastrophizing and pain-related fear, pain-related fear and disability, and between pain-related fear and increased body awareness and attentional focus toward pain and noxious body stimuli. [44]

The Fear-Avoidance Model of exaggerated pain perception experiences of severe pain involved both components of pain: pain sensation and an emotional reaction. The most important feature of the latter in terms of our model is fear of pain. With any type of fear, there are two extremes of coping response available to the individual, namely confrontation or avoidance. [41]

Such avoidance, motivated by fear, is viewed as having two components: -avoidance of pain experience (cognitive avoidance); -avoidance of painful activities (behavioural avoidance). Both types of avoidance lead the individual to minimize or avoid physical and social activities completely. Such extreme behavioural avoidance in turn leads to a number of physical and psychological consequences. The physical consequences of inactivity vary according to the nature of the symptoms. In the case of patients who have undergone spinal surgery, these can include loss of spinal mobility, the development of adhesions, loss of muscular strength and, for those who do not reduce their intake of food to match the lower levels of energy expenditure, gain in weight. Such physical consequences are likely to ensure that pain, if it is experienced, is more severe and thus reinforce the avoidance spiral. [41]

The association between kinesiophobia, disability and physical performance has been investigated previously.[45, 46] Kinesiophobia is said to have a negative influence on the outcome of rehabilitation. It would be of interest to investigate the occurrence.

Tampa Scale of Kinesiophobia

The Tampa Scale for Kinesiophobia (TSK) is a self-report measure developed to assess 'fear of movement-related pain' in patients with musculoskeletal pain (i.e., lower back pain). [47]

The TSK is a 17-item self-report checklist using a 4-point Likert scale that was developed as a measure of fear of movement or (re)injury. Kinesiophobia is defined by the developers as "an irrational and debilitating fear of physical

movement and activity resulting from a feeling of vulnerability to painful injury or re-injury" (Kori *et al*., 1990). The scale is based on the model of fear avoidance, fear of work-related activities, fear of movement and fear of re-injury (Vlaeyan *et al*., 1995). [47]

The interpretation of this scale is done as follows: Results consist of a total raw score and two subscale scores. The total score ranges between 17 and 68. A high value on the TSK indicates a high degree of kinesiophobia. A cut-off score was developed by Vlaeyen (1995), where a score of 37 or over is considered as a high score, while scores below that are considered as low scores.[47] The original Tampa Scale of Kinesiophobia (TSK) was developed by R. Miller, S. Kopri, and D. Todd, in 1991. [47]

Yoga is originally a spiritual practice rooted in Indian philosophy. Yoga has been a traditional contemplative practice for thousands of years. [48] From the 20th century, it is now used as a therapeutic intervention and a health maintenance practice. In modern practice, its main techniques consist of postural exercises (asanas), breathing exercises (pranayama), and meditation (dhyana). [49, 50]

Yoga offers a self-corrective, holistic approach to health. It has been shown to be effective in several chronic lifestyle-related diseases (via well-designed trials) such as osteoarthritis [51], rheumatoid arthritis (RA) [52], essential hypertension [53], bronchial asthma [54, 55], irritable bowel syndrome [56], diabetes [57], coronary artery disease [58] and depression. [59]

The science of yoga has a systematic methodology to train a person to be established in the experiential knowledge of one's true nature. This is the state of unchanging state of bliss (sacchidananda). This is the major cognitive behavioural change which helps improve the quality of life where the participant becomes stable under all demanding situations (samatvam). [60]

Spinal pain is a common condition for which complementary therapies are being used. [61] Despite the ubiquity of back pain, it is one of the conditions that modern medicine does not treat well. The reasons for this are partly due to imprecision of diagnosis and relative ineffectiveness of most conventional treatments. Yoga may have the potential to ameliorate both chronic and acute pain in general. Even then the mechanisms by which this is affected remain hypothetical. [61] Nevertheless, today, yoga is quite commonly used as complementary treatment for spinal pain. [62]

There are many muscles in the low back. These include larger powerful muscles such as iliopsoas and erector spinae, as well as smaller muscles such as multifidi, semispinalis, and rotators. The stability of the spine as well as the spine's basic movements are carried out by these muscles along with the external and internal oblique and rectus and transverse abdominis. It is important for these muscles to be not only strong but also flexible. Any weakness or de-conditioning of these muscles leads to instability and injury and therefore they cannot efficiently stabilize the spine. Any muscular imbalances in strength and tone exert uneven forces on the bony or facial attachments. This contributes to poor body mechanics, injury and pain. The art and science of yoga have infinite possibilities for providing answers to most health problems, troubling modern humankind. However, we often misunderstand this science and want it to be a miracle pill. A pill that we take only once and want all the problems to vanish into thin air. Yoga is a holistic science and must be learned and practiced with a holistic view.

Numerous modern schools or styles of yoga exist. Iyengar, Ashtanga, Viniyoga, Bikram, Sivananda, Kripalu, Kundalini, among others, most of which are forms of traditional Hatha yoga. Each of these have their own distinct priorities in terms of the balance of inclusion of spiritual and physical practices, with some styles focusing more exclusively on physical postures despite the historical focus of yoga on inner development. Research performed on the psychophysiological benefits of yoga and meditation practices have revealed benefits in physical, mental, and emotional self-regulation. Demonstrated improvements in stress, anxiety, mood, and physical health and well-being have proven useful for therapeutic purposes, and this has led to the popular implementation of yoga as a primary or adjunctive therapy. [63]

All Hatha Yoga asanas require participants to hold and move between various stationary positions with the goal of developing strength, balance and flexibility. To ensure a total body workout, a mixture of standing, seated, kneeling, supine, and prone stationary positions are used, with transitions incorporating forward bends, back bends, side bends, twists, inversions and balances. All Hatha Yoga styles honour the importance of breathing exercises, mental concentration/meditation and relaxation. [64]

Ashtang yoga, as described by *Maharishi Patañjali*, comprises of 8 stages viz. *yam* (code of conduct, self-restraint), *niyam* (religious observances, commitments to practice, such as study and devotion), *asana* (integration of mind and body through physical postures), *pranayama* (regulation of breath leading to integration of mind and body i.e. controlled breathing), *pratyahar* (abstraction of the senses, withdrawal of the senses of perception from their objects), *dharana* (concentration, one-pointedness of mind), *dhyan* (meditation) and *Samadhi* (the quiet state of blissful awareness, superconscious state). [64]

Need for the study

The Fear-Avoidance Model of Musculoskeletal Pain details potential psychological pathways leading to the development of chronic low back pain. [65] Pain related fear has been highlighted as an important construct in the FAM, as its presence is a primary factor leading to avoidance behaviour. In turn, continued avoidance behaviour is hypothesized to be associated with depressive symptoms, elevated pain intensity, greater physical impairments, and continued disability. [37, 41]

According to cognitive behavioural models such as fear avoidance, painful experiences can cause a fear of movement and injury in certain individuals, which often leads to behavioural agitation and in the long run, depression and increased levels of functional disability. Furthermore, fear avoidance beliefs and kinesiophobia are relevant factors regarding chronic pain complaints in the general population. Therefore, it is necessary to develop strategies for prevention so that kinesiophobia does not develop in patients with low back pain. [66] For low back pain, these prevention initiatives would change beliefs and attitudes about low back pain. [67, 68]

Yoga, which is a mix of physical exercise and breathing exercise, is a popular alternative form of "mind-body" therapy. Yoga combines exercise with achieving a state of

mental focus through breathing. [69]
There are many studies on various effects of yoga. But there is dearth in studies on the effects of yoga on kinesiophobia, especially in patients having low back pain. Hence, there is need to investigate the effects of yoga on kinesiophobia in chronic low back pain patients.

Method

Methodology

Study design- Experimental study
Duration of study – 12 months
Study place – Metropolitan city
Sampling technique – Convenient sampling
Sample size – 60
Using the formula, $4pq/L^2$
where p = prevalence of kinesiophobia in chronic low back pain patients
q = 100 – p
L = permissible error (5-20%)
Hence, sample size = 4 × 17 × 83 / 10 ×10
= 56.44 ~60 subjects

Sampling population – Subjects with chronic mechanical low back pain

Inclusion Criteria

- Age group – 30-50 years
- Duration of pain should be more than 3 months
- Score on Tampa Scale of Kinesiophobia should be more than 37.

Exclusion Criteria

- Subjects with neurological diseases
- Any type of recent fractures, chronic cancer pain
- Unable to follow instructions
- Bed-ridden patients

Outcome measures

Tampa Scale of Kinesiophobia

Study protocol

Approval of the ethical committee and Head of institution was taken prior to commencement of the study.
As per the inclusion and exclusion criteria, subjects were identified.
The study procedure was explained to the participants.
Participants willing to give an informed consent were included in the study.
These participants were asked to fill the Tampa Scale of Kinesiophobia. Those participants whose score on the Tampa Scale of Kinesiophobia was more than 37, were further included in the study.
These participants were then explained the yoga protocol and it was done in the following manner:

- Deep breathing (Pranayam)
- Shavaudarakarshanasana (Crossed leg lumbar stretch)
- Bhujangasana (Cobra pose)
- Ardha chakrasana (Half wheel pose)
- Naukasana (Boat pose)
- Uttanapadasana (Raised leg pose)
- Shavasana (Corpse pose)

Each of these asanas was done 10 times with a hold of 10 seconds. Deep breathing and shavasana were done for 10 minutes each. This was done 3 times a week. For those participants who could easily hold the yoga asana for 10 seconds were progressed to holding it for 15 seconds.
At the end of one month, the participants were asked to fill the Tampa Scale of Kinesiophobia again. The change in kinesiophobia was calculated and data analysis was done.

Statistical analysis

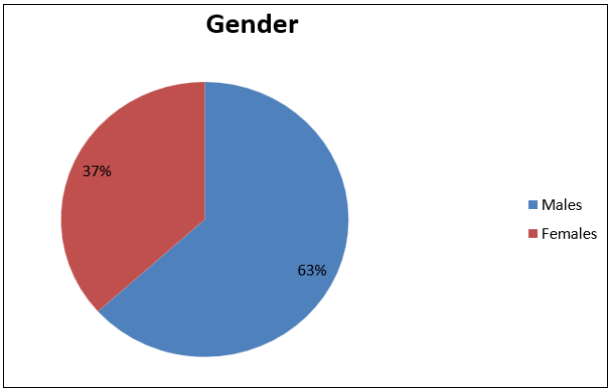
The data was entered using Microsoft Excel version 2016 and was analysed using the statistical package for social science (SPSS) software trial version 19.
Data was tested for normality using the Shapiro Wilk test. Level of significance was set at level less than 0.05 (<0.05).
Non parametric tests were used in this study since data did not pass normality.
The analysis of the outcome measures was done by using Wilcoxin signed rank test.
In the entire study, the p value less than 0.05 was considered to be statistically significant.

Results

60 patients having chronic low back were selected to participate in the study. These patients had the kinesiophobia score more than 37.

Table 1: Demographic data: Gender distribution

Gender	Number
Male	38
Female	22



Graph 1

The above table and graph show that there were 63% males and 37% females, i.e., 38 males and 22 females.

Table 2: Age statistics

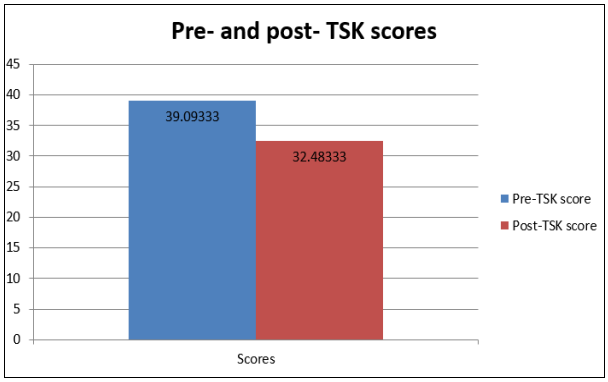
	Mean	SD	Min	Max
Age	40.73	6.351	30	50

It is seen in Table 2 that the mean age of the group was 40.73 ± 6.351 (Mean ± SD). The p value shows that there is significant difference amongst the values (<0.05).

Table 3: Pre-test and post-test scores of Tampa scale of Kinesiophobia

	Mean	SD	Min	Max	p value
Pre- TSK	39.08	1.797	35	43	0.004
Post- TSK	32.48	3.955	26	40	0.000

Graph 2: Pre-test and post-test scores of Tampa Scale of Kinesiophobia



Graph 2

It is seen in the above table and graph that the mean score for pre-test was 39.08 ± 1.797 and the mean score for post-test was 32.48 ± 0.3.955. The p value shows that there is significant difference between the values (<0.05).

Table 4: Comparison of pre-test and post-test scores

	Mean	SD	Mean difference	SD difference	Significance (Z – test) p value
Pre- TSK	39.08	±1.797	6.6	±2.158	0.000
Post- TSK	32.48	±3.955			

Discussion

The present study was done to study the effect of yoga on kinesiophobia in chronic low back pain patients. The results showed that there was significant effect of yoga on kinesiophobia in chronic low back pain patients. Hence the null hypothesis was rejected and alternate hypothesis was accepted.

A total of 60 subjects participated. These subjects filled the Tampa scale of Kinesiophobia before and after the yoga intervention. There were 38 males and 22 females. The mean average age of these subjects was 40.73 ± 6.351.

Taking note of the effect of Kinesiophobia on the patients with chronic low back pain, the study conducted produced the result that yoga is quite effective in treating it.

There are many studies on how yoga reduces pain and improves the condition of patients with chronic low back pain. A number of Indian authors have found out that different yoga therapy schools incorporate various limbs of yoga like asanas, pranayama, meditation, lectures on yoga philosophy including codes of conduct. For e.g., Iyengar yoga uses more of the physical practices combined with breathing. Vini yoga uses a smooth flow of postures followed by relaxation and meditation. International association of yoga therapy incorporates all the components to offer a holistic therapeutic module. With such a holistic approach, it is noted that there is simultaneous muscle strengthening and relaxation. Careful body movement together with active mindfulness both strengthen spinal and abdominal muscle and promote deeper relaxation.[70] This may explain observed improvements in both spinal mobility and pain levels. This is also seen in studies done by Raghuraj P *et al.*, [71], where stamina and strength were imposed and by Chaya MS *et al.*, [72], where decreased metabolism was noted. According to studies done by Krisanaprakornkit T *et al.*, [73] and Nagaratna R *et al.*, [74], in psychiatric patients with anxiety disorders, stress reduction was consistently observed and yoga was observed to correct disturbed moods. In another similar study by Sharma VK *et al.*, [75], yoga reduced stress in psychiatric patients with major depressive illness. Thus, yoga is beneficial even in pathological level of stress. It suggested that yoga has the ability to reverse the interlinked downward spiral, whereby chronic low back pain causes depression, which gives rise to further back pain, resulting in increased depression, and so on. Telles *et al.*, [76] found reduced physiological arousal and improved autonomic stability. Together, all these studies provide strong evidence for yoga's stress reducing effects. This indicates that it can neutralize the chronic low back pain psychological impact as well as its physical symptoms. Telles *et al.*, [77] sees chronic pain not simply as a neurophysiologic state, but one including sensory, affective, behavioural and cognitive factors influencing the way the patients cognizes the world and assigns meaning to events. [78]

Yoga texts highlight a major change in perspective: "Happiness is an inner state, not depending on external situations." [82] Since anxiety and depression, factors forming kinesiophobia are significant causes of chronic low back pain, the OM meditation [77], cyclic meditation [79, 80], mind sound resonance technique [81] and yogic counselling helps in stress management. The Upanishads has 'Happiness Analysis [82] which encourages participants to recognize sources of their emotional surges, restore freedom to remain unaffected and change habituated patterns of response to chronic pain. This new perspective might reduce the fear of movement/ re-injury.

Yoga is as much preventive as curative. Pain reduction is observed. Part may have been produced by neural impulses from stretch proprioceptors interfering with, and blocking, impulses on the ascending pain pathway, as hypothesized in gate control theory, as stated by Melzack R and Wall PD. [83]

A second level of explanation for yoga's efficacy in pain reduction may lie in endorphin production at a cortical level, which is known to result from alternate stretch and relax procedures of yoga asanas. [84] A previous short term out-patient yoga study (3-4 hours/day for 9 days) by Gupta N *et al.*, [85] observed reduction in trait anxiety in patients with chronic disease. This may be considered evidence for the power of yoga interventions to reduce deep – rooted stress and thus kinesiophobia. Gosling J *et al.*, [86] have stated in their 2017 study that kinesiophobia and anxiety are both modifiable psychological factors that can be addressed using cognitive restructuring and exposure based behavioural interventions.

A study done by Lim SA and Cheong KJ [87] investigated the beneficial effects of yoga on both physiologic and psychological health status. For psychological health aspects, such as regulations of breath and meditational practice, the program design considered previous similar studies of Bilderbach AC *et al.*, [88] and Danucalov MA *et al.*, [89] Lim SA and Cheong KJ [87] found that nitric oxide levels were significantly decreased by yoga practice. Abman SH [90] and Demple B [91] found that nitric oxide benefits the human body by aiding the blood stream. However, excessive generation of NO leads it to act as a free radical that causes oxidative stress and damages normal cells or tissues.

The stress related hormone that are provoked by excessive psychological stress and emotional reactions are important ingredients for maintaining well-being in life. Yoga reduces the release of these hormones. Adrenaline is a known stress hormone, which plays a role in the fight – or – flight

response from the sympathetic nervous system. Plasma adrenaline levels are significantly lowered by yoga practice. [92] Serotonin has a benefit for psychological disorders such as depression and anxiety. Yoga practice causes a significant increase in the plasma serotonin levels. [93] Gard T *et al.*, [94] stated that yoga practice has been shown to broadly decrease physiologic arousal, decreasing activity of Sympathetic Nervous System and Hypothalamic Pituitary-Adrenal axis, which is implicated in the calming, relaxing effect of yoga.
On the basis of our innovative findings, a broader treatment perspective based on biopsychosocial principles should be suggested after discharge in order to support interventions that also deal with a patient's individual concerns (beliefs, fears, and worries) in an attempt to overcome dangerous barriers to full recovery. One means of doing this is to add the therapeutic control of kinesiophobia to rehabilitative management, and encourage patients to take responsibility for their mistaken thoughts with the aim of developing correct behaviours and reducing their perception of pain and disability. The persistent positive findings should be seen in the light of a rehabilitative approach aimed at developing a precise model of change by linking specific cognitive modifications (fear-avoidance) with specific outcomes (disability and kinesiophobia).

Conclusion
There is significant effect of yoga on kinesiophobia in chronic low back pain patients.

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

Authors' Contributions
All the authors made substantial contributions in the study. They have been involved in drafting and revising the manuscript. The authors have given final approval of the study to be published.

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