Journal of Spine
ISSN: 2165-7939

Karimi and Saeidi, J Spine 2013, 2:4
DOI: 10.4172/2165-7939.1000139

Review Article Open Access

# A Review of Relationship between Fear Avoidance Beliefs and Postural Stability in Non Specific Chronic Low Back Pain

**Abdolkarim Karimi[1] and Marzieh Saeidi[2]***

[1]Assistant Professor, School of Rehabilitation, Isfahan University of Medical Sciences, Iran
[2]Physiotherapist of Shariati Hospital, Management Treatment of Isfahan social security organization, Iran

## Abstract

**Introduction:** Low back pain (LBP) is one of the most prevalent diseases in most developed and developing countries, affecting 70% to 80% of adults at some time during their lives. Recent evidence suggests that psychosocial factors especially fear-avoidance beliefs (FAB) are important in predicting patients who will progress from an acute to a chronic stage as well as failure of interventions. The aim of this study is to review the Relationship between Fear Avoidance Beliefs and Postural stability in non specific Chronic Low Back Pain (CLBP).

**Methods:** In this narrative article we have searched PubMed, CINHAL, APTA and MEDLINE data bases. The key words included: chronic low back pain, fear avoidance beliefs, posture, stability, balance, motor control, center of pressure and force plate. The inclusion criteria were being related to FAB and postural stability and adults with non specific CLBP, in English language, up to 2013, regardless of their study design.

**Results:** The results showed that psychological factors such as FAB influence the chronicity of LBP, a group of studies indicated that FAB is related to pain and disability. Another group of studies indicated that postural stability is related to pain and disability. The only study on the relationship between postural stability and FAB did not found any significant relationship.

**Conclusion:** FAB is related to pain and disability. Postural stability is related to pain and disability. More studies with stronger methodology such as larger population with control group are needed for evaluating the relationship of FAB and postural control.

**Keywords:** Chronic low back pain; Fear avoidance beliefs; Stability; Motor control

## Introduction

Low back pain (LBP) is one of the most common health problems which affect 60% to 80% of adults at some time during their lives [1,2]. About 85% of patients with back pain are classified as non specific chronic low back pain [3]. Although most of the time, LBP is a self-limiting disorder and a majority of these patients will improve rapidly [4], half of them has a long history of multiple episodes [5] and in a small group of them (about10%), pain will become chronic [6-8]. This group of patients allocate about 80% of costs to themselves [9]. Consequently, LBP is a major public health problem with an immense socioeconomic burden in most developed and developing countries.

Studies on patients with acute or sub acute LBP reveal several factors influence on progression to chronicity of LBP such as: high level of psychological distress, dissatisfaction with employment, longer duration of symptoms, previous history of LBP, radiating pain and higher initial disability level [10-13], psychosocial factors like the patients attitudes and beliefs, pain and movement related fear, stress, depression, job satisfaction, self confidence and self assurance are very important in CLBP [14,15]. The cognitive-behavior concept of developing chronic pain is appearing as fear-avoidance behavior at early stage. Cox et al. explained in a model the reason of pain exaggeration and the reason of developing pain in to chronic stage in some of the patients while improving in others [16]. According to this model, the patient's fear of pain, and subsequent avoidance behavior, are determined by the relation between sensory and emotional components of pain. The hypothesis is that the patients believes and fears concerning symptoms and activity lead to unhelpful ways of managing symptoms, including avoidance behaviors, decreasing activities of daily living, job and recreation which reflect a state of not feeling well. Also failing to diagnose factors which influence their condition can lead to use an inappropriate treatment approach.

In individuals with LBP, the Fear-Avoidance Belief Questionnaire (FABQ) quantifies pain-related fears and believes about the necessity of changing the behavior of pain avoidance [17]. Pain related fear refers to a condition in which the patient has an excessive, irrational, and debilitating fear of physical movement and activity, resulting in feelings of vulnerability to painful injury or re-injury [18,19]. Biomechanical factors such as strength or endurance, flexibility spinal stability and neurophysiologic factors have been studied in several investigations [20-22]. It is important for physicians and physiotherapists to have enough information in this area in order to be able to recognize the obstacles of the patients' improvement and adopt an appropriate strategy accordingly.

Optimal postural control is an essential requirement to perform daily activities. Postural stability is a component of postural balance which indicates the ability of maintaining a certain posture and is described by center of pressure (COP) excursion [23,24]. Many factors may contribute to control postural stability including age, neurological or musculoskeletal disorders such as LBP and biomechanical factors such as muscle endurance [21,25]. The influence of LBP on postural balance is complex and affected by co-existing factors: pain, fear of pain, positive neurologic findings, adoption of an alternate movement strategy, and low muscular conditioning [24,26-30]. Several studies

***Corresponding author:** Marzieh Saeidi, Physiotherapist of Shariati Hospital, Management Treatment of Isfahan Social Security Organization, Iran, E-mail: pt_msaeidi@yahoo.com

**Received** April 30, 2013; **Accepted** July 08, 2013; **Published** July 10, 2013

**Citation:** Karimi A, Saeidi M (2013) A Review of Relationship between Fear Avoidance Beliefs and Postural Stability in Non Specific Chronic Low Back Pain. J Spine 2: 139. doi:10.4172/2165-7939.1000139

have shown that patients with CLBP have some problems for postural control [31,32]. Fear-avoidance believes have been hypothesized as the most important psychosocial factor in predicting disability and work time loss among patients with chronic low back pain (CLBP). So identifying potentially modifiable determinants of disability in patients with LBP provides an opportunity to expand strategies of controlling socioeconomic problems. Many studies have assessed the relationship of either impairment or psychosocial factors with disability and pain [33-36], but to our knowledge, relationship between the level of Fear-Avoidance Belief (FAB) and the parameters of postural stability is not well studied and it needs more studies. The aim of this study is reviewing the studies on the relationship between psychosocial factors especially pain related fear with postural stability in non specific chronic low back pain.

## Methods

In this narrative review article the PubMed, CINHAL, APTA and MEDLINE data bases were searched for articles on relationship between pain and pain related fear and postural stability. The related key words included: back pain, chronic low back pain, fear avoidance beliefs, postural stability, postural control, force plate and center of pressure. The criteria for evaluation of the articles were included: their title being related to the topic (defining the relationship between pain related fear, pain, disability, postural stability and postural control), with any design, up to 2013 published in English. Twenty five articles had the inclusion criteria. The studied out comes included activity and reaction time of trunk muscles, center of pressure excursion (sway), fear avoidance beliefs, pain and disability. Studies which did not evaluate the relation of these outcomes were excluded.

## Results

According to the inclusion and exclusion criteria 25 articles were found which met the inclusion and exclusion criteria. These studies were summarized in Table 1 and 2. The studies were divided in 3 categories: studies on relationship between pain, disability and FAB, studies on the relationship between pain, disability and postural stability and studies on relationship between FAB and postural stability.

### Pain, disability and fear avoidance beliefs

Psychological factors may be related to the onset, development, and treatment outcome of spinal pain. Strong evidence also shows that psychosocial variables generally influence more than biomedical or biomechanical factors on chronic back pain [37-43]. Recent evidence suggests that psychosocial factors are important in predicting patients who will progress from an acute to a chronic stage as well as failure of interventions [13,14]. Patients with chronic pain often demonstrate anxiety and depression [15].

Several studies have shown the relationship between pain, FAB and disability in patients with CLBP [38-43]. With regard to psychosocial factors, a growing body of published data has provided evidence that elevated pain-related fear predicted disability in patients with acute and chronic LBP [35,41-43]. People who experience pain-related fear will avoid activities they associate with increased risk for pain or (re) injury [18,19]. Therfore pain-related fear have a negative impact on the results of performance testing [35,44]. Correlation analysis in a study by Guclu indicated a significant but positive weak association between the severity of pain and fear avoidance (physical, work and overall) [45]. The relation between pain, pain related fear and functional performance is weak or non-existent in patients with CLBP [46]. A hospital case-control study in Iran, compared the psychological features in patients with low-back pain. Patients' levels of depression and anxiety were related to occupational background. Longer duration of illness was also accompanied by higher levels of anxiety and depression [33]. Another study indicated that Pain was positively related with fear-avoidance beliefs, catastrophizing, and anxiety. In addition, job had a moderating effect on the relationship between pain and anxiety so that job indicated 24.6% of pain variance [47]. Two review articles by Leeuw [48] and Akhbari [49] indicated that there is a positive relationship between

| Author | Study design | Topic | Results |
|---|---|---|---|
| Lafond et al. [32] | Case-control | Postural balance during prolong standing in low back pain patients | Decreasing of Cop velocity, frequency and excursion |
| Della Volpe et al. [58] | Case-control | Postural control during dynamic standing in low back pain patients | Increasing of Cop excursion |
| Luoto et al. [33] | RCT, n=99(LBP), n=61(Healthy) | Reaction time and COP velocity | Postural control was weaker in CLBP and improved after rehabilitation |
| Mann et al. [24] | Case-control | Postural control in CLBP | Cop velocity was higher in CLBP |
| Brumagne et al. [26] | Case-control, n=52(LBP), n=33(Healthy) | Postural control in CLBP | Cop excursion was higher in CLBP |
| Brumagne et al. [54] | Case-control, n=21(LBP), n=24(Healthy) | Postural stability and postural control strategy in persons with recurrent LBP | persons with recurrent LBP use the same postural control strategy even in standing on an unstable support surface |
| Ruhe et al. [27] | Systematic review | Postural control in CLBP | Cop velocity and excursion were related to LBP but not pain intensity |
| Ruhe et al. [60] | Case-control, n=77(LBP), n=77(Healthy) | Is there a relationship between pain intensity and postural sway in patients with CLBP | COP mean velocity and sway area are closely related to self-reported pain scores. |
| Ruhe et al. [61] | Case-control, n=38 (LBP), n=38(Healthy) | Pain relief is associated with decreasing postural sway in patients with CLBP | Alterations in pain intensities are closely related to changes in postural sway. |
| Takala and Juntura [28] | Cohort, two year follow up, n=430 | Role of functional tests in prediction of LBP | Weak performance was related to low stability and endurance |
| Moseley et al. [30] | Comparative before and after, n=16 | Relationship between experimental pain and Postural control in CLBP | Pain causes delay in postural muscle activation |
| Mazaheri et al. [57] | systematic review | postural sway during quiet standing in LBP | Most studies reported an increased postural sway in LBP or no effect of LBP on postural sway. |

**Table 1:** Studies on Postural control, pain and disability.

| Author | Study design | Topic | Results |
|---|---|---|---|
| Crombez et al. [41] | Cross sectional,n=124 | Relationship between pain and fear of pain with disability in CLBP | Pain is related to FAB and disability |
| Klenerman et al. [42] | Cohort, one year follow up, | Role of fear avoidance beliefs in prediction of LBP | 7% become chronic (66% due to fear of pain) |
| Afshar Neghad et al. [64] | Cross sectional n=50 | Relation between fear of movement, pain and disability in chronic low back pain | fear of movement, pain intensity and age are related to disability |
| Akhbari et al. [49] | review | The Fear of Movement/Pain in Musculoskeletal Pain-A Review | fear of pain can be as disabling as pain itself |
| Gatchel et al. [14] | Cohort, one year follow up, n=221 | Role of psychological factors in CLBP | High prevalence of psychological diseases in CLBP |
| Linton [15] | Systematic review | Role of psychological factors in CLBP and neck pain | clear link between psychological variables and neck and back pain onset |
| Sajjadian et al. [47] | Cross sectional n=50 | fear-avoidance believes, pain catastrophizing and anxiety effects on chronic low back pain in women | Chronic low back pain can be predicted by fear-avoidance beliefs and catastrophizing |
| Guclu et al. [45] | Cross sectional n=105 | The Relationship Between Disability, Quality of Life and Fear-Avoidance Beliefs in CLBP | Higher levels of anxiety, depression, FABQ (work) leads to higher level of disability |
| Ramond et al. [38] | systematic review | Psychosocial risk factors for chronic low back pain in primary care | Depression,psychological distress, passive coping strategies and FAB were independently linked with poor outcome |
| Leeuw et al. [47] | Review Paper | The Fear-Avoidance Model of Musculoskeletal Pain: Current State of Scientific Evidence | pain-related fear is associated with catastrophic interpretations of pain, avoidance behaviors, pain intensity and disability |
| Davis et al. [62] | Cross sectional n=235 | Variables Associated With Level of Disability | Disability is related to duration of LBP, higher level of pain intensity and FAB, and stability (velocity in the forward direction |
| Maribo et al. [43] | Validity, n=97 | Postural balance in low back pain patients | No relationship between pain, FAB and COP excursion |
| Lamoth et al. [32] | Case-control | Relationship between pain and fear of pain with muscle coordination in CLBP | Pain intensity, kinsiophobia and disability were not related to postural muscle function but were due to LBP |

**Table 2:** Studies on pain and fear of pain and disability and postural control.

pain-related fear, pain intensity and disability; in addition, pain-related fear results in poor clinical outcomes.

## Pain, disability and postural stability

Several studies have shown that postural control parameters change in CLBP however, there is controversy on relationship between pain and postural control parameters, [32,37,50-56] so that some of them indicated increasing postural sway [53], others have shown decreasing postural sway [51] while in the other studies, there was not any significant relationship between pain intensity and postural sway [54]. Of course one of the two recent systematic review article has revealed that pain results in enhancement of cop excursion [27] while the other systematic review indicated that there is equal number of studies showing increased sway in LBP, or no effect of LBP on sway [57].

In LBP patients, delayed contraction of trunk muscles, which results in reduced stiffness of the spine at the time of initiation of the movement, occurs when the equilibrium of the spine is disturbed by rapid movements of the upper or lower limbs [51,52]. In recent years, it has become evident that muscle pain can interfere with motor control strategies and different patterns of interaction are seen during rest, static contractions, and dynamic conditions [51].

Altered postural adjustments of the trunk muscles during pain are not caused by pain interference but are likely to reflect development and adoption of an alternate postural adjustment strategy [30]. Although postural activation of the deep trunk muscles is not affected when central nervous system resources are limited, it is delayed when the individual is also under stress [57,58].

In CLBP patients, postural stability under challenging conditions such as prolonged standing is maintained by an increased sway in anterior-posterior direction. This alteration in postural strategy may provide a dysfunction of the peripheral proprioceptive system or the central integration of proprioceptive information [59]. These findings point to possible neurophysiologic mechanisms that could help explaining why fear of pain is a strong predictor of pain-related disability [60] (Table 2).

Another study in 2011 has shown postural stability is related to higher level of pain intensity and lower level of pain intensity don't due to alteration of postural stability [61]. A new study showed that disability is related to duration of LBP, higher level of pain intensity, FAB and stability (velocity in the forward direction) [62].

## Studies on relationship between FAB and postural stability

The only study of concurrent and predictive validity of postural balance in LBP patients did not found any significant relationship between fear avoidance beliefs and postural stability (COP excursion and velocity) [50]. Baseline and 12-week follow-up results of 97 LBP patients were evaluated. The correlations between CoP measurements and pain, fear of pain, and physical function were poor. There were no significant differences in CoP measurements between patients with no change or deterioration and patients with improvement in pain and back-specific function [50]. Also another study has evaluated the relationship between kinesiophobia and trunk muscles function but they were not related significantly [32]. Correlation analysis in a study by Kusters showed that neither fear of movement and catastrophizing nor pain was related to either reaction time (RT) or movement time (MT) [63]. Another study by Afshar-nezhad also indicated that fear

of movement; pain intensity and age are related to disability [64]. Guclu showed that when fear-avoidance (physical, work and overal), increased, disability increased as well [45]. In the study of Crombez et al. [65] a moderately significant relation was found between physical and work fear-avoidance behavior and disability.

## Discussion

The aim of this study was to review the relationship between psychological factors focusing on FAB, pain, disability and postural stability.

According to the results, first group of studies showed that psychological factors such as FAB influence the chronicity of LBP; in addition FAB is related to pain and disability.

Another group indicated that postural stability is related to pain and disability. Also a few studies indicated that FAB is related to postural stability in subjects without CLBP but only one study has investigated this relationship in patients with CLBP in which there was not seen any significant relationship between FAB and postural stability.

Sajjadian et al. showed that Pain was positively related to fear-avoidance beliefs, catastrophizing, and anxiety [47]. In her study, fear-avoidance beliefs and catastrophizing explained 45.6% of the variance of the pain. In addition, she revealed that job had a moderating effect on the relationship between anxiety and pain. Her study carried out on women who reported higher level of FAB compared to men [47]. Sions and Hicks [66] explained the lack of a significant relation between fear avoidance and disability in their Hispanic patients, in these patients. It seems that pain intensity and ethnic characteristics are underlying factor for this controversy. Hicks et al stated that fear and avoidance behavior in work is a highly specific finding for disability [67]. George et al. [68] demonstrated that in patients with chronic low back pain, the single predictor of disability was fear avoidance behavior (work). As to the study of Waddell et al. [17], severity of pain and fear avoidance behavior was found to be predictors of disability [17]. The relationship between pain related fear and performance appeared stronger in studies where patients were observed under strictly controlled conditions, and weaker in studies where patients were observed in a less controlled environment [41,69]. However the relationship between pain, fear avoidance beliefs and postural stability was different in these studies. According to the study by Isableu and Vuillerme [70] in quiet standing, postural sway will decrease because of trunk stiffening strategy or ankle strategy but during standing on foam, postural stability will decrease in patients with CLBP compared to healthy subjects; while in another study by Brumagne et al. [54], the results showed that in both quiet standing in a stable surface and unstable surface (foam) is different in patients with CLBP compared to healthy subjects. These results support the hypothesis that in more complex postural conditions postural stability decrease in persons with LBP compared to healthy controls. Ruhe et al. demonstrated a linear relationship between pain intensity and postural sway velocities in both sagital and frontal plans [60], however, the sway velocity in frontal plan increased at a faster rate. In addition, his study confirms the altered postural sway characteristics previously reported in a systematic review of NSLBP sufferers [27]. The most important finding of his study was that higher intensity of pain perception is related to COP measurements which can describe why in some studies pain intensity was not related to the postural stability. Therefore the neurological alteration previously described [30,71-74] may only have an impact on COP measures at medium to high intensities (more than 5 in numeric rating scale of pain). These results are in agreement with observations of Lihavainen et al. [75] who conducted a similar study in a geriatric population, of course, pain was measured based on a subdivision into mild or moderate/severe pain only in their study and the studied population was different characteristically. However, according to using a protocol based on best evidence [60], future studies are not needed to confirm these findings using the same protocol. Considering the inclusion criteria, focusing on those with higher pain intensity to reach significance compared to controls more readily, the results may also interpret the results of studies (e.g. Brumange et al. [54] and Mok et al. [29]), in which there were not significant differences in postural sway between symptomatic individuals and healthy controls because of low pain intensities of the NSLBP participants enrolled. There is evidence that higher COP sway is associated with a higher risk of falling in the elderly [76] therefore the importance of suitable pain control in elderly pain sufferers to avoid falls. Furthermore, as pain interference appears a likely underlying mechanism, the focus of a rehabilitative approach in pain sufferers with increased COP excursions should be on pain reduction rather than proprioceptive training.

As the lower back motor tasks are often considered both painful and threatening by patients, it is hard to distinguish whether performance insufficiency is attributed to pain experience or to pain related cognitions. Only a few studies tried to enable analysis of pain effect apart from cognition effect. Lamoth et al. studied the influence of both parameters (pain and fear of pain) on gait in healthy subjects [77]. Their results show that only pain influenced on gait parameters. Considering subjects awareness of disappearing pain eventually, pain-related fear may not be representative for this population since pain is present continuously and pain-related fear is much more substantial. Kasters [63] and Luoto [33] indicated slower reaction time of patients compared to healthy subjects concluded that the reaction time in CLBP patients was not influenced by cognitions. The contradiction of their studies with findings of previous studies demonstrating a deteriorating role for pain-related cognitions and reaction time performance [64,78,79] may be due to differences in experimental design (i.e. different reaction time tasks).

In sum, there is lack of knowledge concerning the relation between pain, pain-related cognitions and deviations in CLBP patients' motor performance. As it is conceivable that managing pain demands a different treatment approach than managing pain-related cognitions, this knowledge might be useful to increase CLBP therapy effectiveness.

The only recent study of concurrent and predictive validity of postural balance in LBP patients revealed no association between COP measures and pain, fear of pain, and physical function. According to recommendations for COP measures were published in 2010 in order to reduce measurement errors, this recent study may have some errors such as being included all low back patients, not considering age groups and procedure of measuring COP (60 second sampling duration instead of 90 second and 2 trials instead of 3-5 trials) [27,61].

Also, a high level of anxiety increased postural sway in healthy individuals, with an increment of path length in the anteroposterior axis [80]. On the other hand, Lopes found a significantly reduced body sway area and mean power frequency thorough the experiment as well as a negative correlation between anticipatory anxiety and mean sway area when compared to control participants [81]. Levitan et al. also found that patients with social anxiety disorder showed a reduced sway area and a lower velocity in the mediolateral direction during presentation of all blocks of pictures compared to control [80]. His study showed that body sway in patients with social anxiety disorder is smaller than in controls independently of the presence and contents of visual information maybe because the stimulus of anxiety was not enough [80].

To become a short story, it seems that different results of the evaluated studies are due to the way of data collection, population characteristics (physical activity and fitness level and age), inclusion/exclusion criteria, the level of pain, postural stability and fear avoidance beliefs at the beginning of the studies. Also different instruments (the questionnaires and scales for fear avoidance, pain, force plates), different procedures of measuring postural stability (quiet standing or single leg stand or sitting, with open or closed eye and the position of the hands the number of trials, frequency of filtering and capturing) and different outcome measures for postural stability (muscle activity, reaction time, COP displacement, velocity, mean frequency) used in these studies can be consider for variability of their results.

## Conclusion

It can be concluded that pain related fear may be one of the factors of failure the treatments of patients with NCLBP. FAB is related to pain and disability. Postural stability is related to pain and disability. More exact studies are needed for evaluating the relationship of FAB and postural control.

## Limitations

One of the most important limitations of this study is lack of the statistical analysis and criterion evaluation of the included studies.

## Suggestions

It is recommended to evaluate more similar and related studies from other data bases which focus on the topic according to their power as well as using statistical analysis of their data where it is possible.

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