



## Research Paper: The Effects of Acceptance and Commitment Therapy and Biofeedback on Chronic Psychosomatic Low Back Pain



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**Citation** Mousavi SM, Shabahang R, Khodadadi-Hassankiadeh N. The Effects of Acceptance and Commitment Therapy and Biofeedback on Chronic Psychosomatic Low Back Pain. *Caspian J Neurol Sci*. 2019; 5(3):118-126. <https://doi.org/10.32598/CJNS.5.18.118>

**Running Title** ACT and biofeedback and Psychosomatic Low Back Pain

<https://doi.org/10.32598/CJNS.5.18.118>



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### ABSTRACT

**Background:** Mental processes can make the pain and quality of life of women with chronic psychosomatic low back pain better or worse. acceptance and commitment therapy (ACT) and biofeedback have on some psychosomatic disorder.

**Objectives:** The aim of this study was to investigate the effects of ACT and biofeedback on severity and duration of pain and quality of life among women with chronic psychosomatic low back pain.

**Materials & Methods:** This three-group Pre-test and post-test controlled quasi-experimental study was conducted from September 2016 to June 2017. Thirty women with chronic psychosomatic low back pain were conveniently recruited from Rasht pain clinic, Rasht, Iran, and randomly allocated to three ten-person groups including ACT, biofeedback, and control groups. Data were collected before and after the study intervention using the McGill Pain Questionnaire and the short version of the World Health Organization quality of life (QOL) survey. Data analysis was performed using the one-way analysis of variance as well as the Chi-square, the paired-sample Test, and post-hoc Scheffe Tests.

**Results:** Both ACT and biofeedback interventions significantly and similarly reduce severity and duration of pain and improve the quality of life. ACT had significant effects on the psychological, social, and environmental health domains of quality of life, while biofeedback had significant effects only on the physical health domain.

**Conclusion:** ACT and biofeedback are effective on psychosomatic low back pain. Unlike the ACT, biofeedback has significant effect on the physical health aspect of QOL and it has no effects on the other aspects of QOL.

**Keywords:** Acceptance and Commitment Therapy; Biofeedback; Pain; Low Back Pain; Women

#### Article info:

**Received:** 04 May 2019

**First Revision:** 28 May 2019

**Accepted:** 06 Jun 2019

**Published:** 01 Jul 2019

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## Highlights

- Acceptance and commitment therapy is effective on the severity and duration of pain and improving all aspect of quality of life among women with chronic psychosomatic low back pain.
- Electromyographic biofeedback is effective on severity and duration of pain and improving physical health aspect of quality of life among women with chronic psychosomatic low back pain.

## Introduction

**P**ain is among the main causes of seeking medical help [1]. According to the International Association of Pain Studies, pain is “an unpleasant sensory and emotional experience associated with actual or potential tissue damage”. Chronic pain is also defined as a pain with a duration of more than six months. The prevalence of chronic pain in the world is 5-33% [1-2]. Low back pain (LBP) is among the most common types of chronic pain. It is among the main causes of disability and absence from work and hence, imposes heavy financial burden on patients, healthcare systems, and communities [3]. It dramatically affects all aspects of life including daily activities, independence, cognitive and physical functions, work, relationships, parenting, and emotional and psychological well-being.

These problems, in turn, can cause confusion, restlessness, social isolation, social stigma, hopelessness, and anxiety even among people with good health and functional status [4]. Moreover, pain is associated with reduced quality of life (QOL) and depressive symptoms [5]. Psychosomatic form of low back pain is one of the prominent kind of low back pain. In fact, psychosomatic low back pain is used to mean a low back pain that is thought to be caused, or made worse, by mental factors [6].

There are different cognitive therapies for chronic pain management. These therapies include, but are not limited to, mind-body interventions, behavioral techniques, cognitive behavioral techniques, and acceptance and commitment therapy [7]. These therapies aim to help clients acquire abilities such as greater self-management, behavioral modification, and cognitive modification rather than direct pain eradication.

Acceptance and commitment therapy (ACT) is one of the cognitive therapies. It aims at helping clients develop greater psychological flexibility and thereby, have more valuable and satisfactory lives. ACT improves psychological flexibility through the six core processes of accep-

tance, cognitive defusion, contact with present moment, self as a context, values, and committed action.

Studies showed that the acceptance of pain was associated with better QOL among patients with LBP, better functional status among patients with rheumatoid arthritis, greater involvement in personal activities, better maintenance of functioning, high levels of psychological well-being, and lower levels of pain, pain-related distress, and disability [8-13].

Electromyographic (EMG) biofeedback is another psychological therapy. In this therapy, data about nerves, muscles, and autonomic activities are collected and processed using electronic devices and are provided to patients and physicians as audio or visual feedbacks. This method is used to manage LBP, headache, anxiety disorders, muscular injuries, and urinary incontinence [14].

Unlike most medical treatments, this method helps clients acquire greater knowledge about autonomic activities of the body and hence, helps them develop greater control over their bodies and functions [15]. Previous studies reported the effectiveness of biofeedback in reducing non-cardiac chest pain and managing regional pain syndrome and phantom pain [16-18].

However, there is a paucity of information regarding the effectiveness of ACT and biofeedback in managing chronic LBP. Thus, the present study was conducted to investigate and compare the effects of ACT and EMG biofeedback on pain severity and duration and QOL among women with chronic psychosomatic LBP.

## Materials and Methods

This was a three-group Pre-test and post-test controlled quasi-experimental study. Study population consisted of all women with chronic psychosomatic LBP who referred from September 2016 to June 2017 to Rasht pain clinic, Rasht, Iran. According to the more prevalence and more presentation of low back pain in women [19], the study population consisted women with chronic psychosomatic LBP.

Moreover, lack of sufficient researches on women with chronic psychosomatic LBP is another reason for studying women population specifically. In this regard, thirty women with LBP were conveniently recruited and randomly allocated to three ten-person groups, namely an ACT group, a biofeedback group, and a control group.

Inclusion criteria were diagnosis of chronic psychosomatic LBP by an orthopedist or neurologist based on the criteria of the International Association of Pain Studies and considering psychological aspects of LBP [6, 20], an age of 23-34, educational level of secondary diploma or higher. Exclusion criteria were comorbid serious physical or mental problems [21], use of any psychological or counseling techniques during the study, use of psychiatric medications, history of referring to behavioral therapist during the last six months, and history of spinal cancer, spinal rheumatoid arthritis, spinal surgery, or other pathologic spinal conditions.

### Study tools

Four instruments were used for data collection. The first was a demographic questionnaire with items on age, educational level, marital status, and the duration of suffering from LBP. The second instrument was the modified McGill pain questionnaire (MPQ). MPQ includes twenty sets of pain-related words in the four main dimensions of pain, namely sensory perception of pain, emotional perception of pain, cognitive evaluation of pain, and different types of pain. The modified version of MPQ includes three main parts.

The first part contains fifteen verbal descriptors of pain in two main groups of sensory (eleven items) and emotional (four items) descriptors. Each descriptor is rated as "No pain" (scored 0), "Mild pain" (scored 1), "Moderate pain" (scored 2), and "Severe pain" (scored 3). The second part of this questionnaire is a visual analogue scale for pain assessment.

Each intended client is asked to rate his/her pain from "No pain" (scored 0) to "Severest possible pain" or "Intolerable pain" (scored 10). The third part of MPQ relates to the present pain intensity which is rated as "No pain" (scored 0), "Mild" (scored 1), "Discomforting" (scored 2), "Distressing" (scored 3), "Horrible" (scored 4), and "Excruciating" (scored 5). The total score of the questionnaire is calculated through adding up the scores of these three main parts [22].

The SF-MPQ has been validated and appears to correlate well with the original long-form MPQ. SF-MPQ able to discriminate between different types of pain syndromes and it is sensitive to changes in pain brought about by therapies [23]. In the research of Dworkin et al. Cron-

bach's alpha for SF-MPQ was 0.95 [22]. In Iran, the study of Tanhaee et al. provided evidence that supported the validity and reliability of the questionnaire [24].

The third study instrument was the world health organization quality of life-BREF (WHOQOL-BREF). This survey contains 26 items in four main domains of QOL, namely physical health (seven items), psychological health (six items), social health (three items), and environmental health (eight items) as well as two general items on QOL. Items 3, 4, and 26 are reversely scored. Higher scores indicate higher health [25].

Skevington, Lotfy, Connell, & WHOQOL group demonstrated the appropriate reliability and validity of the questionnaire. In the study of the Skevington et al. internal consistency by Cronbach's alphas' for domains and centers were 0.68 to 0.82 [26]. WHOQOL-BREF has been translated into nineteen languages and is used in different countries for QOL assessment. Nejat et al. translated it into Persian and confirmed that the Persian version has acceptable validity and reliability. The results of Nejat et al.'s study showed that the Cronbach's alpha for physical health, psychological health, social health, and environmental health were 0.77, 0.77, 0.75, and 0.84, respectively [25].

The fourth study instrument was an EMG device (Biofeedback Procomb) used for EMG feedback. EMG turns electrical signals of motor neurons which induce muscle contraction into interpretable sounds or images. It is considered as a diagnostic method for evaluating the health status of both muscles and nerves. During electromyography, needle electrodes are inserted into a muscle in order to detect and transfer electrical signals and thereby, to record the electrical activity of the muscle.

In neural conduction test, a subtype of EMG, surface electrodes are attached to the skin in order to measure the velocity and the strength of the signals transmitted between two or more points. EMG findings are used to diagnose the different types of functional disorders of nerves, muscles, or neuromuscular junctions [27].

### Procedure

The ACT intervention was individually provided to each participant in the ACT group in eight one-hour weekly sessions. The ACT protocol was developed based on Vowles and Sorrell's book entitled, "Life with chronic pain: an acceptance-based approach (therapist guide and patient workbook)" [28, 29]. On the other hand, the EMG biofeedback protocol was provided to

participants in the biofeedback group based on the protocol developed by the Biofeedback Society of California.

Accordingly, twelve twice-weekly 45-minute biofeedback sessions were held for each participant. Thus, EMG biofeedback training to the back muscles was completed in six successive weeks. Besides ACT or biofeedback, participants in the two intervention groups received routine care services provided to all patients in the study setting which included physical exercise, corrective exercises, physical therapy, massage, and laser therapy. Participants in the control group received the same routine care services without any ACT or biofeedback interventions. Data collection was done for all participants in all three groups both before and after the study intervention.

### Data analysis

The SPSS software V. 21 was used for data collection. Within-group comparisons were made through the paired-sample t-test, while between-group comparisons were made using the one-way analysis of variance as well as the Chi-square and Scheffe's tests.

### Results

The Mean $\pm$ SD of participants' age in the ACT, biofeedback, and control groups were 24.71 $\pm$ 6.85, 27.43 $\pm$ 11.54, and 33.43 $\pm$ 14.81, respectively. Most participants in these groups were married. The duration of their LBP was 6.5 $\pm$ 3.4 months, on average. There were no statistically significant differences among the study groups in terms of their demographic characteristics ( $P>0.05$ ).

At pre-test, the groups did not significantly differ from each other in terms of the mean scores of pain severity and duration, physical health, psychological health, social health, environmental health, and total QOL ( $P>0.05$ ). However, during the study, the mean score of pain severity and duration significantly decreased in the ACT ( $P=0.002$ ) and the biofeedback ( $P<0.001$ ) groups and significantly increased in the control group ( $P=0.05$ ).

The post-test mean score of pain severity and duration in the biofeedback group (14.20 $\pm$ 3.68) was significantly less than the ACT (25.30 $\pm$ 3.36) and the control (39.40 $\pm$ 4.25) groups ( $P<0.001$ ). Moreover, the pre-test and post-test mean difference of pain severity and duration in the biofeedback group (-22.80) was significantly greater than the ACT (-13.0) and the control (+8.50) groups ( $P<0.001$ ; Table 1). Thus, both ACT and biofeedback were effective in significantly reducing pain severity

and duration though the effects of biofeedback on pain severity and duration were stronger than ACT.

The meanscore of the physical health domain of QOL in the biofeedback group significantly increased during the study ( $P<0.001$ ), while it did not significantly change in the ACT ( $P=0.77$ ) and the control ( $P=0.72$ ) groups. Therefore, the post-test Mean $\pm$ SD score of physical health in the biofeedback group (30.00 $\pm$ 0.82) was significantly greater than the ACT (20.70 $\pm$ 3.59) and the control (19.40 $\pm$ 3.03) groups ( $P<0.001$ ).

The pre-test and post-test mean difference of physical health in the biofeedback group (+8.10) was significantly greater than the ACT (-0.50) and the control (-0.60) groups ( $P=0.004$ ; Table 1). These findings denote that biofeedback had significant positive effects on the physical health domain of QOL, while ACT had no significant effects on it.

The mean score of the psychological health domain of QOL significantly increased in the ACT group ( $P=0.001$ ), while it did not significantly change in the biofeedback ( $P=0.71$ ) and the control ( $P=0.13$ ) groups. Thus, the post-test Mean $\pm$ SD score of psychological health in the ACT group (25.00 $\pm$ 2.40) was significantly greater than the biofeedback (21.90 $\pm$ 2.85) and the control (13.30 $\pm$ 2.11) groups ( $P<0.001$ ). However, there was no statistically significant difference among the groups in terms of the pre-test and post-test mean difference of psychological health mean score ( $P=0.08$ ; Table 1).

These findings imply the effectiveness of ACT and the ineffectiveness of biofeedback in improving the psychological health domain of QOL among women with chronic LBP. The mean score of the social health domain of QOL significantly increased in the ACT group ( $P<0.001$ ), but did not significantly change in the biofeedback ( $P=0.36$ ) and the control ( $P=0.52$ ) groups. Hence, the post-test mean score of social health in the ACT group (14.60 $\pm$ 1.84) was significantly greater than the biofeedback ( $P=12.00\pm 1.70$ ) and the control (8.20 $\pm$ 1.23) groups.

Moreover, the pre-test and post-test mean difference of the social health mean score in the ACT group (+5.30) was significantly greater than the biofeedback (-0.80) and the control (+0.60) groups ( $P=0.01$ ; Table 1). These findings altogether denote the positive effects of ACT and the insignificant effects of biofeedback on the social health domain of QOL.

**Table 1.** Within and between-group comparisons respecting the mean scores of pain severity and duration and QOL

Variables	Group Time	Mean±SD			p*
		ACT	Biofeedback	Control	
Pain severity and duration	Pre-test	38.30±10.11	37.00±6.72	30.90±9.80	0.16
	Post-test	25.30±3.36	14.20±3.68	39.40±4.25	<0.001
	P value	0.002	<0.001	0.05	-
	Mean difference	-13.00	-22.80	+8.50	<0.001
Physical health domain of QOL	Pre-test	21.20±2.15	21.90±3.04	20.00±5.75	0.56
	Post-test	20.70±3.59	30.00±0.82	19.40±3.03	<0.001
	P value	0.77	<0.001	0.72	-
	Mean difference	-0.50	+8.10	-0.60	0.004
Psychological health domain of QOL	Pre-test	18.00±2.79	20.80±6.79	15.10±2.18	0.31
	Post-test	25.00±2.40	21.90±2.85	13.30±2.11	<0.001
	P value	0.001	0.71	0.13	-
	Mean difference	+7.00	+1.90	-1.80	0.08
Social health domain of QOL	Pre-test	9.30±2.00	12.80±6.46	7.60±2.46	0.14
	Post-test	14.60±1.84	12.00±1.70	8.20±1.23	<0.001
	P value	<0.001	0.36	0.52	-
	Mean difference	+5.30	-0.80	+0.60	0.01
Environmental health domain of QOL	Pre-test	23.50±5.50	26.40±2.91	24.70±5.08	0.38
	Post-test	32.00±4.52	28.70±5.60	20.40±2.22	<0.001
	P value	0.01	0.86	0.02	-
	Mean difference	+8.50	+2.30	-4.30	<0.001
Total QOL	Pre-test	72.00±9.31	81.90±18.62	67.40±12.81	0.08
	Post-test	92.30±6.93	83.60±5.06	61.30±4.35	<0.001
	P value	0.002	0.73	0.16	-
	Mean difference	+20.30	+1.70	-6.10	<0.001

\*The results of the one-way analysis of variance; ^The results of the paired-sample t-test



The mean score of the environmental health domain of QOL significantly increased in the ACT group ( $P=0.01$ ); however, it did not significantly change in the biofeedback group ( $P=0.86$ ) and significantly decreased in the control group ( $P=0.02$ ). The post-test mean score of environmental health in the ACT group ( $32.00\pm 4.52$ ) was significantly greater than the biofeedback ( $28.70\pm 5.60$ ) and the control ( $20.40\pm 2.22$ ) groups ( $P<0.001$ ).

The pre-test and post-test mean difference of the mean score of environmental health in the ACT group (+8.50) was also significantly greater than the biofeedback (+2.30) and the control (-4.30) groups ( $P<0.001$ ; Table 1). Based on these findings, ACT was effective and biofeedback was ineffective in significantly improving the environmental health domain of QOL among women with chronic LBP.

Although the total mean score of QOL significantly increased in the ACT group ( $P=0.002$ ), it showed no statistically significant change in the biofeedback ( $P=0.73$ ) and the control ( $P=0.16$ ) groups. Consequently, the post-test mean score of QOL in the ACT group ( $92.30\pm 6.93$ ) was significantly greater than the biofeedback ( $83.60\pm 5.06$ ) and the control ( $61.30\pm 4.35$ ) groups ( $P<0.001$ ).

In addition, the Pre-test and post-test mean score of the QOL mean score in the ACT group ( $+20.30$ ) was significantly greater than the biofeedback ( $+1.70$ ) and the control ( $-6.10$ ) groups ( $P < 0.001$ ; Table 1). These findings indicate that ACT had significant effects and biofeedback had insignificant effects on QOL among women with chronic LBP.

## Discussion

The aim of this study was to investigate the effects of ACT and biofeedback on pain severity and duration and QOL among women with chronic psychosomatic LBP. Findings revealed that both ACT and biofeedback significantly reduced pain severity and duration among these women. Of course, there was no significant difference between these two therapies respecting their effects on pain severity and duration.

In line with these findings, a former study reported that ACT significantly reduced pain among women with chronic headache [30]. One reason behind the positive effects of biofeedback is that it contains a relaxation component. Relaxation techniques such as diaphragmatic breathing and progressive muscular relaxation can significantly reduce pain. Besides, during biofeedback, patients learn how to deliberately identify and manage LBP symptoms and prevent their exacerbation.

Study findings also indicated the positive effects of both ACT and biofeedback on QOL among women with chronic psychosomatic LBP. Our literature search revealed that none of the previous studies had compared the effects of these two therapies on QOL among patients with LBP. However, several studies had investigated the effects of either ACT or biofeedback on QOL.

For instance, a study reported that the acceptance of LBP following ACT use significantly improved QOL among patients with chronic LBP [8]. Several other studies also reported the positive effects of ACT on QOL [31-34], anxiety symptoms, psychological strains and distress [32-34], and depression [24]. Other studies revealed that mindfulness-based stress reduction was effective in allevi-

ating stress and improving QOL and physical, subjective, spiritual, and emotional well-being [35-37].

Therapies like ACT and biofeedback help patients evaluate physiologic reactions inside their bodies and then, attempt to control them [36]. ACT also exerts its positive effects on different patient outcomes, such as anxiety and depression, through improving psychological flexibility and deliberate attention to the present moment [32, 39]. ACT contains six core processes which can promote psychological flexibility and committed behavioral performance.

Self as a context is one of these processes. It makes clients aware of their thoughts, feelings, and desires and requires them to avoid controlling or avoiding them. After using this process, clients are subjected to another core process of ACT, i.e. cognitive defusion, which helps modify reactions to behaviors. In fact, instead of focusing on the validation or challenging of the thoughts, ACT focuses on performances.

Another core process of ACT is the acceptance of unavoidable situations like pain. Contact with present moment, determination of personal values, and committed action are the other core processes of ACT. Contact with present moment helps clients focus on the present moment instead of struggling with the past or probable events in the future. These six core processes improve psychological flexibility and QOL [8].

Patients with chronic LBP usually have limitations in doing their activities; thus, they may experience mood problems, reduced self-confidence, loss of employment, concerns over poor health status, and fear over attending social events. These problems can eventually lead to anxiety. Anxiety, in turn, aggravates patients' physical conditions and reduces QOL [14].

On the other hand, chronic LBP negatively affects sleep quality, psycho-emotional status, and social relationships [39-42]. Given the association of LBP with these psychological conditions, pure biomedical approach may be ineffective in the successful management of LBP and its associated problems and hence, psychological therapies must be taken into account for LBP management [40]. Psychological therapies such as ACT and biofeedback improve psychological flexibility and thereby, alleviate chronic pain, enhance physical health status, improve QOL, and help people have more satisfactory lives [8, 43].

Another justification for the positive effects of biofeedback on pain and QOL among patients with LBP is the positive effects of this therapy on stress. Psychological and environmental stresses are among the predictors of LBP and its associated problems. Therefore, stress management and relaxation techniques can contribute to LBP management.

Effective management of stress not only reduces physical symptoms of LBP (such as pain severity and duration), but also improves QOL and physical and psychological well-being. During biofeedback, clients learn different stress management strategies and learn how to use them for managing psychological and environmental stressors during daily life and how to develop their resistance to such stressors.

One of the study limitation was sampling from female patients with psychosomatic LBP in only one city in Iran. Thus, findings may have limited generalizability to male patients and patients with other types of LBP and other types of pain. Further studies are needed to compare the effects of ACT and biofeedback on other disorders and on patients from different age and gender groups. The strength of this study was the comparison of the effects of ACT and biofeedback on chronic LBP for the first time.

## Conclusion

This study shows the effectiveness of both ACT and biofeedback in significantly reducing pain severity and duration and improving QOL among female patients with chronic psychosomatic LBP. Of course, while biofeedback has significant effects on the physical health aspect of QOL, it has no significant effects on the other aspects of QOL.

Contrarily, ACT significantly improves all aspects of QOL, except for the physical health aspect. These therapies can be used in specialty clinics and psychological services centers to manage symptoms and improve QOL among patients with chronic psychosomatic LBP. The findings of the present study highlight the necessity of using interdisciplinary approaches for managing chronic health problems caused by different physical and psychosocial etiologies.

## Ethical Considerations

### Compliance with ethical guidelines

The study procedures were in compliance with the ethical guidelines of the Declaration of Helsinki 2013. Moreover, this study was approved by the Ethics Committee of Rasht Islamic Azad University, Rasht, Iran (Code: IR.IAU.RASHT.REC.1395.70). All participants were ensured that their data would be confidentially managed and solely used for the purposes of the present study

### Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for profit sectors.

### Authors contributions

Draft: Seyedeh Maryam Mousavi, Reza Shabahang, Naema Khodadadi-Hassankiadeh; Writing review and editing: Seyedeh Maryam Mousavi, Reza Shabahang; Resources: Seyedeh Maryam Mousavi, Reza Shabahang, Naema Khodadadi-Hassankiadeh; Supervision: Seyedeh Maryam Mousavi, Naema Khodadadi-Hassankiadeh; Data collecting: Reza Shabahang.

### Conflict of interest

The authors have no conflict of interest.

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