

Evaluating the Effectiveness of Neurofeedback Treatment on Depression, Anxiety, Stress and Abdominal Pain in Patients with Chronic Psychosomatic Abdominal Pains

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ABSTRACT

The aim of this study was to evaluate the effectiveness of neurofeedback therapy on depression, anxiety and stress in female patients with chronic clinical psychosomatic abdominal pain in Tabriz. This quasi-experimental study is a pre-test-post-test with a control group. The statistical population of this study was all women with chronic psychosomatic abdominal pain, from which a sample of 40 people was selected, from which the study was performed with 30 people (15 in the experimental group and 15 in the control group). These individuals were randomly assigned to two groups of 15 in the experimental group and the control group. In this intervention method, the experimental group underwent neurofeedback treatment for 10 weeks (three sessions of 40 minutes per week) and the control group did not receive any intervention and was placed on a waiting list. The experimental and control groups also completed the Depression, Anxiety and Stress Questionnaire in the pre-test and post-test. Analysis of MANCOVA was used to analyze the data. The results of analysis of MANCOVA showed that neurofeedback treatment was effective in reducing anxiety and depression ($P < 0.001$). In other words, 53% of the changes in depression and 57% of the changes in anxiety were due to neurofeedback; but neurofeedback had no effect on stress. Neurofeedback was able to reduce depression and anxiety in women with abdominal pain but had no effect on their stress level.

Keywords: Neurofeedback, depression, anxiety, stress, chronic psychosomatic abdominal pain.

INTRODUCTION

Chronic pain is one of the most important medical problems in the world, affecting millions of people every year. Chronic pain is a non-cancerous pain that is more or less persistent and is usually considered a 6-month period as a diagnostic criterion for chronic pain.¹ Psychiatric abdominal pain is pain that has not been definitively or possibly diagnosed despite a thorough examination, complete history, and initial laboratory tests and procedures. These pains make up about 13 to 40% of patients admitted to the emergency department.² Chronic abdominal pain is the presence of pain for at least 3 months or persistent pain for more than a month that causes a person to malfunction.³ Patients with chronic pain who have difficulty expressing and regulating their emotions show physical symptoms during times of emotional distress.⁴ Various studies have shown that chronic pain is associated with anxiety, depression and stress.⁵⁻¹¹ Various studies have shown that the levels of psychological symptoms, especially anxiety and depression in patients with chronic pain are high.¹²⁻¹⁵ Awareness of the role of psychosocial factors in pain and associated psychological problems can play a very important role in controlling and preventing disorders such as chronic abdominal pain. Anxiety, depression and stress can cause failure and incompatibility in a person and deprive her of most of her possibilities and abilities. Anxiety, depression and stress cause a decrease in efficiency. Methods of coping with depression, anxiety and stress can be divided into two groups: drug therapies and cognitive and behavioral therapies. Neurofeedback is one of the behavioral therapy methods used to deal with anxiety, depression and stress.¹⁶ And causes the person's performance to reach the optimal level.¹⁷ The goal of neurofeedback is to normalize abnormal nerve frequencies by increasing awareness of normalized EEG patterns.^{18,19}

Neurofeedback, which Neurofeedback by recording brain waves (EEG) provides brain function in the form of computer information and provides us with this physiological information that is reflected through brain waves.²⁰ The output obtained by the computer is based on the theory of factor conditioning and positive and negative amplification. Electrical impulses are prepared by neurotherapy and its amplitude is received in separate filtered frequency bands. As a result, this information is provided to the clients visually and audibly, and this helps the patient to adjust her brain waves through a computer. In the neurofeedback training session, clients can learn to condition their brain wave pattern and increase the optimal level.²⁰ Schwartz and Andrasik²¹ believe that neurofeedback is a technique that works by feedback from the brain's electrical activity during factor conditioning and to correct disturbed brain wave patterns. In fact, neurofeedback, through factor conditioning, simultaneously increases the sensory-motor rhythm of references or beta brain waves in specific areas of the brain that do not have a good frequency. This conditioning causes beta brain waves to decrease in normal areas when the frequency of motor or beta sensory rhythms is increasing.²¹ The goal of neurofeedback is the actual treatment of problems in order to manage the symptoms of medical disorders. Comprehensive exercises such as neurotherapy actually correct the causes of disorders.^{21, 22} Neurofeedback can be used in the treatment of depression, anxiety,²³⁻²⁵ Mood disorders,^{26,27} post-traumatic stress disorder,²⁸ treatment of offenders,²⁹ used obsessive-compulsive disorder treatment,³⁰ decreased pain perception³¹ and increased intelligence and attention.³² Narimani and Rajabi³³ investigated the effect of EEG biofeedback on reducing depression, anxiety, stress and tempting beliefs in people with substance abuse disorders. The results showed a

significant improvement for anxiety and depression; but there was no significant improvement in the stress variable.³³ Salehian and Soleimani³⁴ showed the significant effect of neurofeedback exercises on competitive anxiety of beginner female karatekas.³⁴ Although the research mentioned in this study has shown that neurofeedback reduces depression, anxiety and stress, 1- No research has been done on the effect of neurofeedback on depression, anxiety and stress in patients with abdominal pain in Iranian society. Medication side effects and slow recovery have been reported in some patients with pain. 3- Drug interventions have had negative and adverse side effects and consequences,³⁴ therefore, the use of non-pharmacological interventions can be effective. 4. Studies have also shown that mood disorders such as anxiety, depression and stress have been associated with poor physical health and poor treatment outcomes in pharmacotherapy.^{6,7} Therefore, considering these cases, it is important to study the effect of neurofeedback on depression, anxiety and stress in women with chronic psychiatric abdominal pain. The present study seeks to answer the question of whether neurofeedback can reduce depression, anxiety and stress in women with chronic psychosomatic abdominal pain? In order to answer this question, the following hypotheses were followed: 1- Neurofeedback reduces depression in women with chronic psychosomatic abdominal pain, 2- Neurofeedback reduces anxiety in women with chronic psychosomatic abdominal pain, and 3- Neurofeedback causes Reducing stress in women with chronic psychosomatic abdominal pain.

MATERIAL AND METHOD

This study was a quasi-experimental pretest-posttest with a control group. The statistical population of this study was all women with chronic psychosomatic abdominal pain who referred to a doctor in a clinic in Tabriz. From this population, a sample of 40 people was selected. 15 people in the experimental group and 15 people in the control group. Women with abdominal pain were randomly assigned to experimental and control groups. Inclusion criteria were: receiving a diagnosis of chronic psychosomatic abdominal pain by a physician, willingness to participate in treatment sessions, having at least 3 months of chronic abdominal pain, minimum secondary education level, minimum age 18 and maximum 54 years, no anti-drug use Pain, not taking antidepressants, anxiety and stress, and no surgery on the abdomen. Exclusion criteria were: cancellation of all sessions, use of analgesics, depression, anxiety and stress, abdominal surgery. In the present study, neurofeedback therapy was performed on the experimental group during 10 weeks and three sessions of 40 minutes per week. All subjects (control

and experimental groups) completed the anxiety, depression and stress questionnaires in the pre-test and post-test stages. First, according to the International System 10-20,³⁵ electrodes were installed in F4 and PZ locations according to the treatment protocol. At the beginning of each session, basic electroencephalography was performed for two minutes and ten seconds with the eye open / closed in the F4 area. / PZ was registered. All subjects in the experimental group received the alpha / theta program in the PZ region in two windows for 15 minutes and the beta / theta program and the SMR program in the F4 region for 15 minutes. F4 area feedback is audio-visual. When a person can keep his SMR wave 0.05 seconds above the set threshold and the high beta waves keep the theta below the threshold at the same time, he can receive a reward and his task is one step ahead and a visual and audio feedback. Receive and thus the brain cells are conditioned and during 30 sessions of treatment, they will gradually be able to regulate the waves themselves. It also receives visual, auditory, meditation, and nature-sound feedback in the aftertaste area of alpha / theta training. The goal here is to coordinate the alpha / theta ratio (Demos, 2005).³⁵ Data were analysis of MANCOVA using SPSS 26 software. In this study, neurofeedback device and self-report scale of depression, anxiety and stress were used.

Neurofeedback device: In this study, the Canadian device of Thought technology company model (FlexComp Infiniti) 10 channels was used, which can be implemented with the help of computer system and related software. A neurofeedback device is a device that breaks down raw brain waves received through electrodes into different wave frequencies. These frequencies are the known known brain waves of alpha, beta, delta and theta.

Depression, Anxiety and Stress Scale (DASS): This scale was developed by Lovibond and Levy Bond⁴ and is a set of three self-report scales to assess depression, anxiety and stress. This scale consists of 21 questions and each of its subscales has 7 questions, the final score of each is obtained through the sum of the scores of the related questions. Each question is scored from zero (does not apply to me at all) to 3 (does not apply to me at all). In Iran, Asghari et al.³⁶ reported that the Persian version of the Depression, Anxiety and Stress Scale has desirable psychometric properties And Cronbach's alpha for the whole questionnaire and the factors of depression, anxiety and stress reported 0.94, 0.85 and 0.87, respectively.

Analyze data: Data on depression of subjects with DASS scale are presented in Table 1 and Figure 1.

Table 1 shows the statistical indicators of MANCOVA related to depression.

Table 1: Results of MANCOVA test on depression scale

| Variable | Source of change | Groups | F | Sig | Partial Eta Squared | Observed Power |
|------------|------------------|-------------------------|---------|-------|---------------------|----------------|
| Depression | Within Groups | Test time | 378.606 | 0.000 | 0.931 | 1.000 |
| | | Test time * Error group | 399.067 | 0.000 | 0.934 | 1.000 |
| | Between Groups | Error group | 14.481 | 0.001 | 0.341 | 0.957 |

* Interaction or combined effect of two factors

Based on the results of Table 1 in the experimental and control groups, the rate of depression in pre-test and

post-test shows a significant difference ($P < 0.01$). The mean scores of depression in the experimental group in the

post-test were significantly lower than in the pre-test. Also, changes in depression rates were significantly different between groups (control and experimental) ($P < 0.01$). Also, a significant interaction was observed between the test time and the group ($P < 0.01$). The value of Eta squared in

this case is equal to 0.934 and therefore about 93.4% of the changes in the dependent variable (depression rate) are explained by the independent variable of the experimental group (neurofeedback therapy).

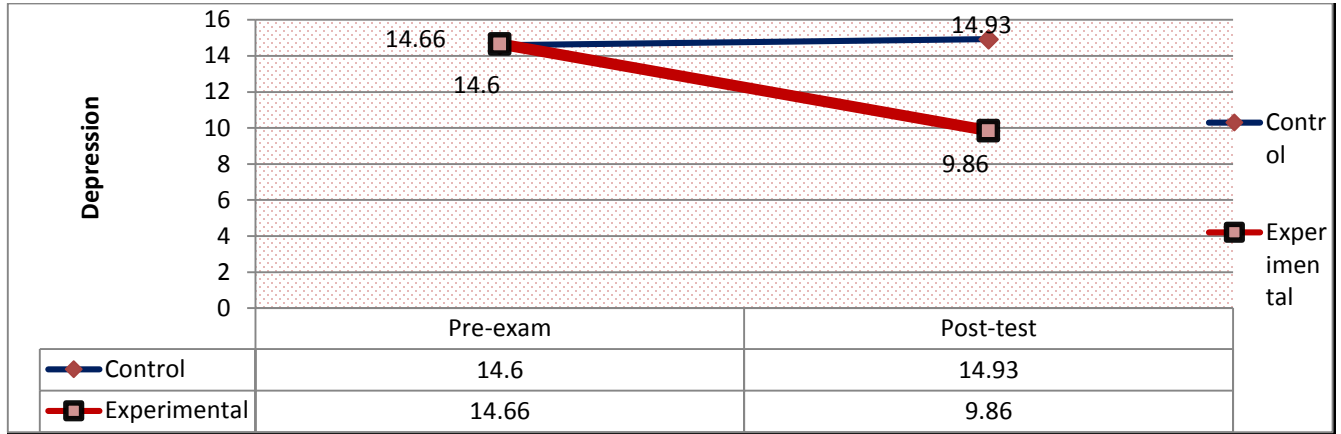


Figure 1: The rate of depression in two stages of the test by group

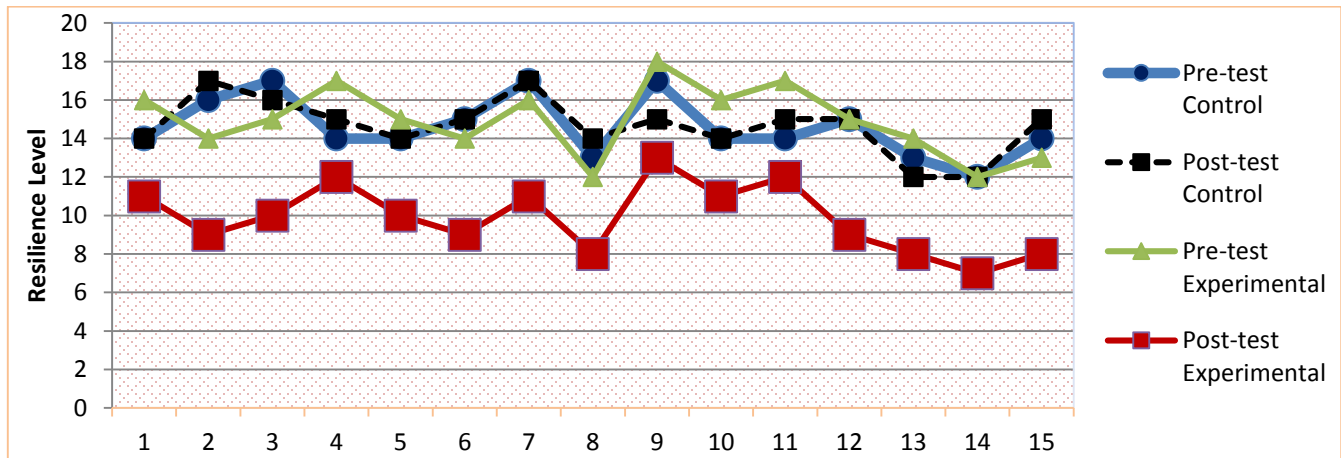


Figure 2: Depression rate in control and experimental groups

Data on anxiety of subjects with DASS scale are presented in Table 2 and Figure 3. Table (2) shows the statistical indicators of MANCOVA related to Anxiety.

Table 2: Results of MANCOVA test on Anxiety scale

| Variable | Source of change | Groups | F | Sig | Partial Eta Squared | Observed Power |
|----------|------------------|-------------------------|---------|-------|---------------------|----------------|
| Anxiety | Within Groups | Test time | 616.050 | 0.000 | 0.957 | 1.000 |
| | | Test time * Error group | 470.450 | 0.000 | 0.944 | 1.000 |
| | Between Groups | Error group | 19.844 | 0.000 | 0.415 | 0.990 |

* Interaction or combined effect of two factors

Based on the results of Table 2 in the experimental and control groups, the level of anxiety in the pre-test and post-test shows a significant difference ($P < 0.01$). The mean anxiety scores of the experimental group in the post-test were significantly lower than the pre-test. Also, changes in anxiety were significantly different between the groups (control and experimental) ($P < 0.01$). Also, a significant interaction was observed between the test time and the group ($P < 0.01$). The value of Eta squared in this

case is equal to 0.944 and therefore about 94.4% of the changes in the dependent variable (anxiety rate) are explained by the independent variable of the experimental group (neurofeedback therapy).

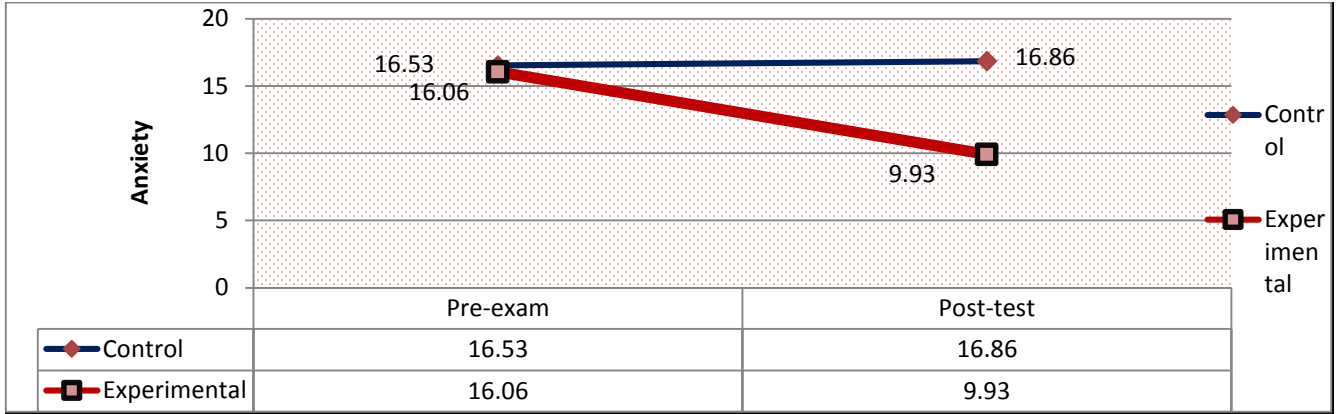


Figure 3: The rate of anxiety in two stages of the test by group

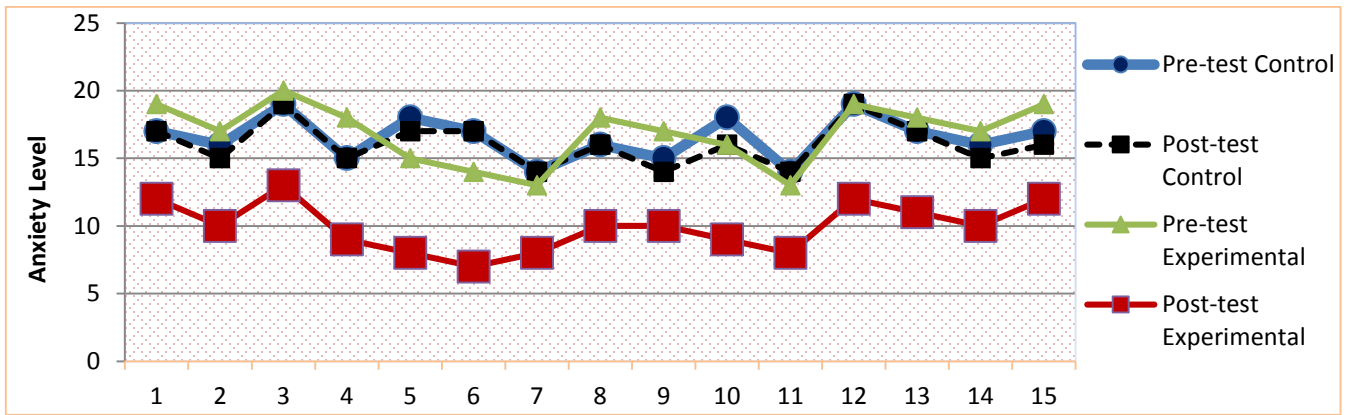


Figure 4: Anxiety rate in control and experimental groups

Data on stress of subjects with DASS scale are presented in Table 3 and Figure 5. Table 3 shows the statistical indicators of MANCOVA related to stress.

Table 3: Results of MANCOVA test on stress scale

| Variable | Source of change | Groups | F | Sig | Partial Eta Squared | Observed Power |
|----------|------------------|-------------------------|--------|-------|---------------------|----------------|
| Stress | Within Groups | Test time | 13.785 | 0.001 | 0.330 | 0.948 |
| | | Test time * Error group | 0.215 | 0.646 | 0.008 | 0.073 |
| | Between Groups | Error group | 4.038 | 0.054 | 0.126 | 0.492 |

* Interaction or combined effect of two factors

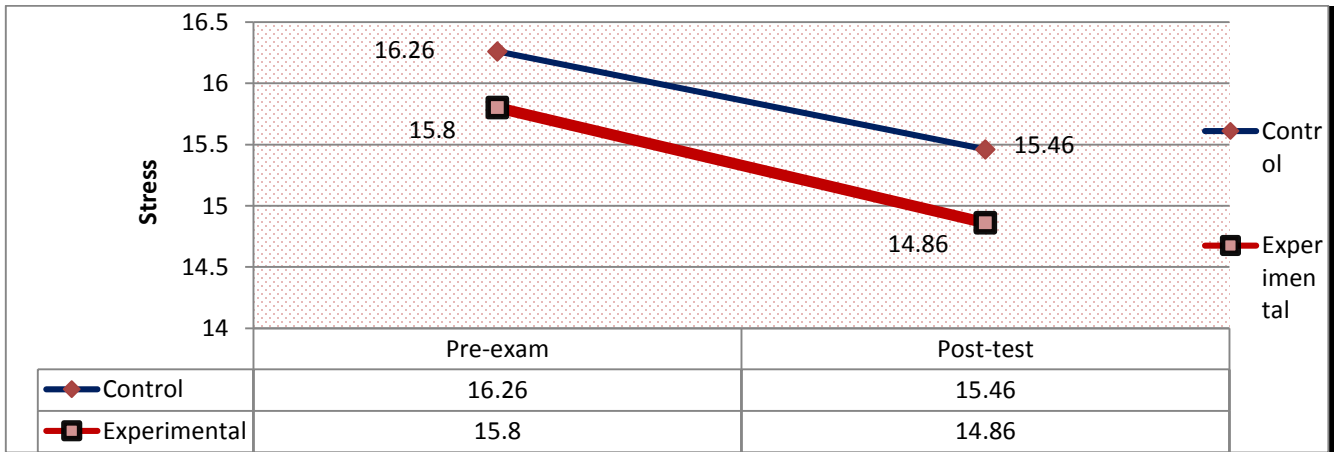


Figure 5: The rate of stress in two stages of the test by group

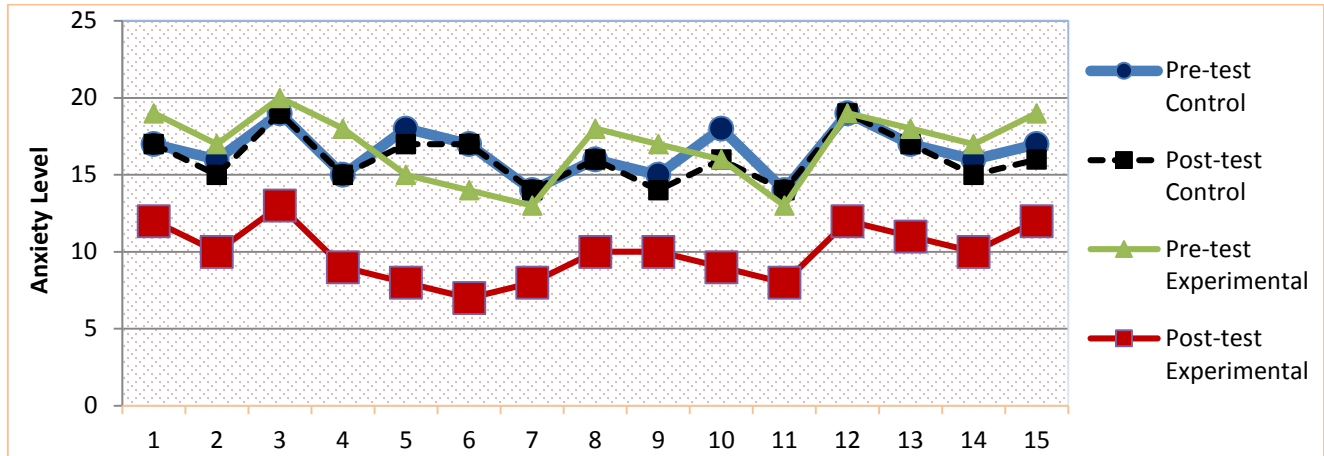


Figure 6: Stress rate in control and experimental groups

Based on the results of Table 3 in the experimental and control groups, the amount of stress in the pre-test and post-test shows a significant difference ($P < 0.01$). The mean stress scores of the experimental group did not change significantly after the test. Also, changes in stress levels were not significantly different between the groups (control and experimental) ($P > 0.05$). Also, the interaction between test time and group was not significant ($P > 0.05$). Finally, ten weeks of neurofeedback therapy has no effect on the stress of patients with chronic psychosomatic abdominal pain. This hypothesis is not accepted and is rejected.

CONCLUSION AND DISCUSSION

The aim of this study was to evaluate the effectiveness of neurofeedback therapy on depression, anxiety and stress in female patients with chronic psychosomatic abdominal pain referred to a clinic in Tabriz. The findings of this study showed that neurofeedback treatment could significantly reduce depression and anxiety in women with chronic psychosomatic abdominal pain; but this therapeutic intervention had no significant effect on stress. These results were consistent with previous findings.^{16, 23, 24, 25, 26, 27} Our findings show the effectiveness of neurofeedback therapy in reducing depression in women with chronic abdominal pain. Neurofeedback is effective in improving brain function and significantly improving the clinical symptoms of various disorders, including major depression.⁶ Thus, neurofeedback training is actually the strengthening of self-regulatory underlying mechanisms for effective brain function.^{37, 38} As some studies have shown, arousal of the left forehead lip in the range of 15 to 18 Hz (beta) can cause mood swings.³⁹ The brain is the central regulator of emotions, physical symptoms, thoughts and behaviors that explain many psychological problems. Neurofeedback is based on the accepted idea of mind-body communication and involves training the mind to act in optimal ways to improve behavioral, physical, cognitive, and emotional functions, and in fact increases the mind's ability to regenerate, change, and heal itself.³⁵ The results of the present study revealed the effectiveness of neurofeedback on reducing anxiety in female patients with

abdominal pain. Evans⁴⁰ showed that anxiety is most often associated with decreased alpha strength of the right frontal lobe, and a beta of 30-30 in the right or left forehead is associated with anxiety and restlessness.⁴⁰ Also, Moore⁴¹ has shown that in the treatment of anxiety disorders with neurofeedback, which training alpha / theta increase has a greater effect than placebo and is considered an effective and sustainable treatment to reduce anxiety in anxiety disorders. The results also showed that neurofeedback was effective in reducing social anxiety by targeting waves in the frontal lobe of the brain and increasing hemispheric symmetry.^{40, 41} In general, it can be said that in addition to the therapeutic effect, neurofeedback creates indoctrination and belief in improvement in the individual.⁴² In fact, by creating the expectation of improvement in people, these people believe that neurofeedback has positive effects, face their anxiety situations with more confidence, and better analyze and interpret their experiences, and as a result, their avoidance is further reduced. Slowly; Therefore, neurofeedback may reduce anxiety in women with chronic abdominal pain. In our study, neurofeedback could not have a significant effect on stress in women with chronic abdominal pain. However, it should be borne in mind that stress in women with chronic abdominal pain may be due to various other sources of stress besides abdominal pain that have affected the effectiveness of neurofeedback; Therefore, identifying different factors in these patients can help clarify the findings further. Neurofeedback helps people to adapt adaptive mental reactions, mood control skills, and reduce mood disorders such as anxiety and depression by conditioning brain waves. In this way, people can reduce their anxiety and depressions by focusing on the animation provided in certain situations, and increase their relaxation time by repeating the sessions. In protocols that are effective in reducing anxiety and depression, it can be observed that people experience relaxation after about 1 minute of exercise. Anxious and depressed person can increase his relaxation after getting acquainted with his physiological and nervous changes by practicing and repeating this method, this method is safe and completely painless and at the same time no harm has been reported from it.⁴³ In neurofeedback therapy, the anxious and

depressed person consciously and completely learns how to reduce their anxiety and depression without any chemicals. Finally, it can be noted that neurofeedback can help a person to safely control their psychological state and the ability to deal with anxiety and depression during daily life.⁴⁴ Neurofeedback is a way to learn to actively and consciously control different states of the brain. The creators of this method claim that by providing a specific sound or image in exchange for receiving feedback from the neuronal activities of the brain, brain waves can be directed to the desired frequency and the pattern of brain activity can be changed. Neurofeedback is a technique that uses feedback from the brain's electrical activity during factor conditioning to correct disturbed brainwave patterns. In fact, neurofeedback, through factor conditioning, simultaneously increases the sensory-motor rhythm of references or beta brain waves in specific areas of the brain that do not have a good frequency. This conditioning causes theta brain waves to decrease in normal areas when the frequency of the sensorimotor rhythm or beta is increasing. These changes are initially stable for a short time, but with practice and training, these changes can be made permanent;^{27,45} Therefore, regulating brain waves through neurofeedback may reduce depression and anxiety in women with abdominal pain. This method can be suggested to people like medication, psychotherapy and other therapeutic and relaxing techniques. It is possible to offer it to patients in psychological and psychiatric clinics along with other treatment methods and even in combination with other methods for the individual. This study has some limitations according to these points: 1- This study was conducted only on women's community and studies have shown that there are differences between men and women in the field of moods such as anxiety and depression, 2- Tools Data collection was self-report questionnaires, 3- Participants were clients who could not be accessed for follow-up test and 4- This study was a cross-sectional study; Therefore, longitudinal studies are needed to clarify this method as much as possible; But despite these limitations, this study was able to reveal the effectiveness of neurofeedback therapy in reducing depression and anxiety in women with chronic psychosomatic abdominal pain.

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