Chronic Diseases Journal

DOI: 10.22122/cdj.v11i3.596 Published by Vesnu Publications

Effectiveness of biofeedback therapy on irritable bowel syndrome symptoms and mind rumination

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Original Article

Abstract

BACKGROUND: Patients with irritable bowel syndrome (IBS) are prone to certain physical and mental problems. This study was conducted with the aim to determine the effectiveness of biofeedback on the severity of IBS symptoms and mind rumination in people with IBS.

METHODS: The present research was conducted with a pretest-posttest design, a control group, and one-month budget follow-up. The population of this study included all people with IBS who were referred to specialized gastrointestinal clinics in Tehran, Iran, in 2019. Considering the inclusion and exclusion criteria, 30 volunteers were selected and 15 of them were randomly placed in experimental group 1 (biofeedback) and 15 in the control group. A standardized questionnaire for assessing the severity of IBS symptoms and a rumination questionnaire were used in the pretest, posttest, and follow-up stages. In this study, participants in the experimental group received 8 sessions of biofeedback or biofeedback relaxation. For data analysis, SPSS software was used.

RESULTS: Intervention in the biofeedback group reduced the severity of IBS symptoms and rumination in patients with IBS and this improvement continued until the follow-up stage ($P < 0.05$).

CONCLUSION: To better and more effectively improve patients with IBS, psychological therapies are required. These therapies require the cooperation of gastroenterologists, psychologists, and psychiatrists.

KEYWORDS: Biofeedback Therapy; Irritable Bowel Syndrome; Patients

Date of submission: 10 Apr. 2021, *Date of acceptance:* 25 Dec. 2022

Citation: Talebi M, Ashayeri H, Hashemian K. **Effectiveness of biofeedback therapy on irritable bowel syndrome symptoms and mind rumination.** Chron Dis J 2023; 11(3): 160-6.

Introduction

Irritable bowel syndrome (IBS) is one of the most common functional gastrointestinal disorders. It affects about 11% of people worldwide.[1,2] IBS is a functional disorder characterized by chronic and recurrent abdominal pain that improves with defecation or worsens with increased changes in stool frequency. This syndrome is generally divided into 3 subtypes; the first type is predominant diarrhea, the second type is predominant constipation, and the third type is a combination of diarrhea and constipation.[3] The prevalence of IBS in Iran is about 6% and according to the results of a study in Iran, IBS after reflux has been the most common diagnosis in outpatients referred to gastrointestinal clinics. IBS is a chronic disease and about 10% of patients have severe symptoms and are usually resistant to treatment. Since most patients are between 30 and 50 years of age, disability due to IBS imposes a heavy financial and work burden on the health system.[4,5] One of the problems of these patients is the problems caused by medical expenses. Moreover, the symptoms of

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IBS change over time; the severity of symptoms also varies and can impair the quality of life (QOL) of sufferers and lead to high care costs.[6, 7] Zotev et al. found that the incidence of IBS is significantly higher in people who have experienced stressful life events or trauma, or who have experienced adverse interpersonal relationships. Furthermore, due to the complex etiology of IBS and the lack of effective clinical indicators, patients with IBS have poor health-related QOL. Life stressors can affect the development of IBS through the interaction of biological, psychological, and social factors.[6]

Braunwald et al. have shown that the high effects of daily stressors can make a healthy person sick or increase the severity of the disease in infected people.[8] Dong et al. showed that rumination is a repetitive thought about the cause and consequences of depression and negative emotional symptoms that a person has recently experienced.[9] Cowdrey and Park have shown that individuals with disorders other than depression also experience rumination. Longitudinal studies show that the rate of rumination predicts the level of anxiety symptoms as well as the level of depressive symptoms. In recent years, the impact of rumination as a tendency to repeat negative thoughts on the onset, persistence, and recurrence of depression and anxiety has attracted the attention of many researchers theoretically and in practice.[10]

The effect of cognitive-behavioral therapy (CBT) on the improvement of IBS and continuity of treatment results in the two groups with rapid response and the group with non-rapid response to treatment showed that 30% of patients rapidly responded to treatment; moreover, 90 to 95% maintained a rapid response to treatment after 6 months of follow-up. Although patients with a rapid response at baseline showed more severe symptoms of the disease, there was a significant reduction in IBS symptoms compared to patients with a non-rapid response to treatment.[11-13] One of the treatments that seem to be effective in helping to improve some of the symptoms of patients with IBS is biofeedback. Biofeedback as a therapeutic method, using electrical tools, provides information about the patient's physical functions in the form of audio or video feedback, thus increasing the patient's awareness of his/her body's automatic activities, and thus, resulting in voluntary control over these activities. Biofeedback can help users take control of some physiological processes, including sympathovagal balance. In addition, in other intestinal functional disorders, biofeedback has been shown to improve sympathovagal balance and symptoms. [14-16] Therefore, this research was conducted with the aim to survey the effectiveness of biofeedback therapy on IBS symptoms and mind rumination.

Methods

This quasi-experimental research was conducted with a pretest-posttest design, follow-up, and 2 groups. The statistical population of this study included all people with IBS who were referred to specialized gastrointestinal clinics in Tehran, Iran, in 2019. The sample size was determined using Cohen's table with an effect size of 0.80 and a test power of 0.5 (15 people in each group). The sampling method used was available sampling. Considering the inclusion and exclusion criteria , 30 volunteers were selected from among the eligible participants and 15 of them were randomly assigned to the feedback group and 15 to the control group. The inclusion criteria included a definitive diagnosis of IBS and the approval of an internal gastroenterologist**.** The exclusion criteria included previous surgery or being in the process of having surgery, hormonal disorders (menstrual cycle disorders, etc. in women), and the experience of a concussion.

A standardized questionnaire for assessing the severity of symptoms of IBS and a rumination questionnaire were used in the pretest, posttest, and follow-up stages.

Standard questionnaire for assessing the severity of symptoms of irritable bowel syndrome: This questionnaire consists of the 5 sections of pain, impaired bowel habits, the effect of daydreaming, bloating, life and symptoms outside the gut. The average score of each section is a maximum of 100 and the total score of the questionnaire is a maximum of 500. A score of 75-175, 176-300, and more than 300, respectively, indicates mild symptoms, moderate symptoms, and the presence of severe symptoms in the individual. The reliability of this instrument was confirmed by a Cronbach's alpha coefficient of 0.83.[17]

Mind Rumination Questionnaire: This questionnaire assesses 4 different types of negative mood responses. It consists of two subscales of rumination responses and distracting responses. The questionnaire consists of 22 items scored on a Likert scale ranging from never (1) to too often (4). The total score of this questionnaire ranges between 22 and 88. The reliability of the questionnaire was determined using Cronbach's alpha ($\alpha = 0.94$). Various studies have reported a test-retest correlation of 0.67 for the questionnaire. Based on empirical evidence, the mind rumination scale has high internal reliability and its Cronbach's alpha coefficient is in the range of 0.88-0.92.

Biofeedback-based intervention: Researchers have defined biofeedback as a process that enables people to learn how to modify physiological activities to improve health and function. It is an accurate instrument for measuring physiological activity such as brain waves, heart function, respiration, muscle activity, and skin temperature. This tool gives "information" to the user quickly and accurately. Providing this information, often accompanied by changes in thinking, excitement, and behavior, supports the expected physiological changes (AAPB, 2016). In this study, participants in experimental group 2 received 8 sessions of biofeedback or biofeedback relaxation.[17-19] To evaluate the effectiveness of the intervention programs and to control the effect of the pretest in the pretest-posttest-follow-up plan, the mixed-design analysis of variance (ANOVA) model, also known as a split-plot ANOVA was used. For data analysis, SPSS statistical software (version 24; IBM Corp., Armonk, NY, USA) was used (Thesis Code: 162365185).

Results

The mean and standard deviation of the age of participants in the biofeedback group was 3.83 ± 32.15 years, and the control group was 5.86 ± 35.17 years. ANOVA showed no significant difference between the groups in terms of age [$p < 0.05$; $F (1 \text{ and } 23) = 2.354$], in other words, the groups were homogeneous in terms of age. Regarding the variables of education, the results showed that, in the biofeedback group, 3 people had postgraduate degrees and 10 people had a bachelor's degree. In the control group, 1 individual had a graduate degree, 10 had bachelor's degrees, and 1 had a Master's degree and higher. The use of the chi-square and Pearson tests showed that there was no significant difference between the two groups in terms of education ($P > 0.05$). The results also showed that most participants in both groups were employed, and the use of the chi-square and Pearson tests showed that there was no significant difference between the groups in terms of employment status ($P > 0.05$).

Standard deviation and Shapiro-Wilk index of the severity of IBS and rumination symptoms in the biofeedback and control groups in the 3 stages of pretest, posttest, and follow-up are presented in table 1. The Shapiro-Wilk index is not significant for the severity of IBS symptoms for the biofeedback

and control groups in the pretest, posttest, and follow-up stages, respectively, at the level of 0.05. The result of levene's test also shows that the difference in the variance of the severity of the symptoms of IBS at the level of 0.05 is not significant.

These findings indicate that the assumption of homogeneity of error variances among the data of the present study is established. Moreover, the Shapiro-Wilk index of rumination related to the biofeedback and control groups is not significant at the pretest, posttest, and follow-up stages at the level of 0.05. The results of the Loon test show that the difference in the variance of mind rumination error at the level of 0.05 is insignificant. These findings indicate that the assumption of homogeneity of error variances among the data of the present study is established (Table 1).

To test the hypothesis, a mixed ANOVA with repeated measures was used. Multivariate analysis of variance (MANOVA) was used to compare the effect of an independent variable on the severity of ISB and rumination. As can be seen in table 2, the results of MANOVA show that the interactive effect of time × conditions on rumination [Wilks' lambda = 0.066; η^2 = 0.934; P = 0.001; F (2 and 22) = 156.486] and the severity of IBS (Wilks' lambda = 0.246; η^2 = 0.754; P = 0.001; F (2 and 22) = 33.802) at the level of 0.05 is significant.

Subsequently, the condition of sphericity or equality of the error variance matrix was evaluated using Mauchly's sphericity test. It showed that the value of chi-square related to rumination (P < 0.01; $\chi^2(2)$ = 9.133; Mauchly's index: 0.660) was significant at the level of 0.01, and therefore, the spherical hypothesis was not established, for this reason, the degree of freedom associated with it was modified using the Greenhouse–Geisser estimation method. However, Mauchly's sphericity test showed that the value of chi-square related to the severity of IBS (P < 0.01; $\chi^2(2)$ = 3.087; Mauchly's index: 0.869) was not significant at the level of 0.01, and therefore, the assumption of sphericity was valid. The interactive effect of conditions × time on mind rumination [F (1/493) = 256.186; P = 0.001; η^2 = 0.918) and the severity of IBS symptoms [F (2) = 45.345; P = 0.001; η^2 = 0.663) was significant at the level of 0.05. The results showed that the independent variables in the group of patients are applicable in biofeedback, and reduces symptoms of IBS and mind rumination in participants with IBS. Furthermore, biofeedback intervention has been effective in reducing rumination and the severity of IBS symptoms and has maintained its effectiveness during the follow-up phase (Table 2).

Table 1. Descriptive findings on the severity of symptoms of irritable bowel syndrome and mind rumination in biofeedback and control groups

Tests		Group	Mean ± SD	Shapiro-Wilk index	Loon test
The severity of bowel syndrome symptoms	Pretest	Biofeedback	258.11 ± 24.87	0.836 (P = 0.044)	F (1,23) = 0.627 (NS)
		Control	271.67 ± 24.38	0.931 (NS)	
	Posttest	Biofeedback	218.63 ± 21.45	0.887 (NS)	F (1,23) = 0.341 (NS)
		Control	273.1 ± 26.79	0.986 (NS)	
	Follow-up	Biofeedback	202.48 ± 24.18	0.859 (P = 0.044)	F (1,23) = 0.055 (NS)
		Control	270.01 ± 26.97	0.982 (NS)	
Mind rumination	Pretest	Biofeedback	63.00 ±5.66	0.879 (NS)	F (1,23) = 1.611 (NS)
		Control	59.67 ± 4.37	0.907 (NS)	
	Posttest	Biofeedback	43.69 ± 6.65	0.822 (P = 0.013)	F (1,23) = 2.527 (NS)
		Control	59.92 ± 3.78	0.929 (NS)	
	Follow-up	Biofeedback	45.00 ± 5.34	0.904 (P = 0.008)	F (1,23) = 0.561 (NS)
		Control	59.00 ± 3.86	0.898 (NS)	

SD: Standard deviation

Table 2. Comparison of the pair of adjusted means of the severity of irritable bowel syndrome symptoms

Quality of life components	Group	Mean difference	P
Mind rumination	Biofeedback control	-45.188	0.001
The severity of irritable bowel syndrome symptoms	Biofeedback control	-45.19	0.001

Information related to mental rumination syndrome at the group level in the follow-up phase was analyzed using the Bonferroni method.

Discussion

The results of this study showed that the implementation of independent variables in the biofeedback group in comparison with the control group decreased the pressure of IBS symptoms and mind rumination. Biofeedback plays an effective role in reducing the symptoms of IBS and mind rumination. These findings are in line with the results of Khoshsorour in 2018,[5] and Alneyadi et al. in 2021,[20] which have investigated the effectiveness of this treatment in reducing the symptoms of anxiety. Moreover, these findings are in line with the results of the research by Ashoori in 2016,[21] and Altayar et al.[22] on the effectiveness of this treatment in reducing the symptoms of anxiety. Due to the high prevalence of IBS and the profound effects it has on the QOL of patients, and because biofeedback treatment can improve gastrointestinal symptoms and QOL in these patients, this treatment should recieve more attention in the treatment of this syndrome. To explain these findings, it can be said that this treatment is effective in reducing anxiety symptoms, and since anxiety has physical, psychological, and behavioral components, this reduction in anxiety in turn improves physical symptoms and mind rumination.[23,24] The findings of this study are also consistent with the results of Moss-Morris et al. that have shown that CBT based on self-control combined with standard treatment leads to a significant reduction in IBS symptoms after the intervention and in the follow-up phase (6 months after treatment).[12]

The etiology of IBS is not yet fully understood and several domains may be involved, including intestinal disorders, severe visceral, immunological, and dietary allergies, as well as elements of brain metabolism.[16] Nevertheless, researchers believe that biofeedback can help people with IBS gain control of certain physiological processes, including the balance of the vas deferens. Therefore, it can be said that in addition to biofeedback, psychological approaches can also improve the physical and psychological symptoms of IBS, which should be considered during treatment.[17] Regarding the positive effects of biofeedback on reducing the severity of IBS symptoms and rumination in people with IBS, which was obtained in this study, it can be argued that biofeedback therapy can help patients to control and manage physiological indicators and indirectly manage the performance of psychological indicators. According to the relevant evaluations and results, biofeedback can increase the ability of clients to pay attention to their bodies during anxiety and manage the body's response to anxious situations.[22-24] Of the limitations of the present study, we can mention the limitations of the statistical population and available sampling, as well as the quasi-experimental research method that raises limitations in the field of generalization and interpretation of variables. In future research, it is suggested that follow-up studies be followed over longer periods, and other variables and psychological approaches be evaluated.

Conclusion

Given that mental disorders such as anxiety disorders are associated with the severity of

IBS, psychological therapies along with medical treatments have an role important in achieving better and more effective improvement in patients with IBS. This requires the cooperation of gastroenterologists, psychologists, and psychiatrists.

Conflict of Interests

Authors have no conflict of interests.

Acknowledgments

We would like to thank the directors at the Roudehen Branch, Islamic Azad University, Tehran, Iran, for their assistance and collaboration.

Financials support and sponsorship

This study was not financially supported.

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