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Observational Study

Effect of cognitive behavior therapy combined with exercise intervention on the cognitive bias and coping styles of diarrhea-predominant irritable bowel syndrome patients

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Abstract

BACKGROUND

Irritable bowel syndrome (IBS) is a common digestive system disease with a high incidence rate and is common in women. The cause of IBS remains unclear. Some studies have shown that mental and psychological diseases are independent risk factors for IBS. At present, the treatment of IBS is mainly symptomatic treatment. Clinically, doctors also use cognitive behavioral therapy to improve patients' cognitive ability to diseases and clinical symptoms. In recent years, exercise therapy has attracted more and more attention from scholars. Improving the symptoms of IBS patients through psychosomatic treatment strategy may be a good treatment method.

AIM

To explore the effects of an intervention of cognitive behavioral therapy combined with exercise (CBT+E) on the cognitive bias and coping styles of patients with diarrhea-predominant irritable bowel syndrome (IBS-D); and to provide a theoretical reference for the management of IBS.

METHODS

Sixty IBS-D patients and thirty healthy subjects were selected. The 60 IBS-D patients were randomly divided into experimental and control groups. The experimental group was treated with the CBT+E intervention, while the control group was treated with conventional drugs without any additional intervention.

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The cognitive bias and coping styles of the participants were evaluated at baseline and after 6 wk, 12 wk and 24 wk using the Automatic Thoughts Questionnaire (ATQ), Dysfunctional Attitudes Scale (DAS) and Pain Coping Style Questionnaire (CSQ) instruments, and the intervention effect was analyzed using SPSS 17.0 statistical software.

RESULTS

At baseline, the scores on the various scales showed that all subjects had cognitive bias and adverse coping styles. The IBS Symptom Severity Scale (IBS-SSS) scores, ATQ total scores, DAS scores and CSQ scores of the two groups were not significantly different ($P > 0.05$). Compared with baseline, after 6 wk of the CBT+E intervention, there were significant differences in the ATQ scores, the dependence and total scores on the DAS, and the catastrophization, distraction and prayer scores on the CSQ ($P < 0.05$). After 12 wk, there were significant differences in the scores for perfectionism on the DAS and in the scores for reinterpretation, neglect and pain behavior on the CSQ in the experimental group ($P < 0.05$). After 24 wk, there were significant differences in the vulnerability, dependence, perfectionism, and total scores on the DAS and in the catastrophization, distraction and prayer scores on the CSQ in the experimental group ($P < 0.01$). The IBS-SSS scores were negatively correlated with the ATQ and DAS total scores ($P < 0.05$) but were positively correlated with the CSQ total score ($P < 0.05$).

CONCLUSION

Intervention consisting of CBT+E can correct the cognitive bias of IBS-D patients and eliminate their adverse coping conditions. CBT+E should be promoted for IBS and psychosomatic diseases.

Key words: Irritable bowel syndrome; Cognitive behavioral therapy; Exercise; Cognitive bias; Coping style

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Core tip: Cognitive bias and negative coping styles are common in patients with irritable bowel syndrome (IBS). We have conducted continuous observation and research on the clinical somatic symptoms, cognitive bias and coping styles of patients with comprehensive treatment for 24 wk, and found that compared with single conventional treatment, it has better effect on relieving clinical symptoms, which proves that it is of great significance to improve cognitive bias and adverse coping styles of patients with diarrhea-type IBS through cognitive behavioral therapy combined with exercise intervention.

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INTRODUCTION

Irritable bowel syndrome (IBS) is a group of functional diseases with continuous or intermittent attacks of symptoms such as abdominal pain, abdominal distension, or changes in defecation habits or stool characteristics due to dysfunction of the nervous system^[1]. According to clinical characteristics, it can be divided into diarrhea-predominant IBS (IBS-D), constipation-predominant IBS (IBS-C), or mixed IBS (IBS-M); IBS-D is the most common. The etiology and pathogenesis of IBS remain unclear and may be related to gastrointestinal motility, visceral sensations, brain-gut regulatory abnormalities, inflammation, mental psychology, and other factors^[2]. Digestion and dysfunction of the intestinal tract in IBS patients are manifested as abdominal pain, diarrhea, constipation, and alternation of stool dryness and thinness.

Compared with organic gastroenteropathy, IBS is more prone to cognitive bias and emotional disorders, which often lead to "abnormal" psychological behavioral patterns, which mainly include anxiety, depression, fear, runaway emotions, sensitivity, hypochondriasis, somatization disorders, and other mental and psychological problems. These cognitive biases and negative coping styles affect the nervous system function of patients through the hypothalamus-pituitary-adrenal axis, causing increased vagus nerve excitability, stimulation of intestinal peristalsis and mucosal gland secretion, and gastrointestinal symptoms that often cannot be immediately relieved^[3]. Therefore, it is very important to correct patients' cognitive biases and coping styles for the fundamental treatment of these diseases. At present, the treatment for IBS is mainly limited to symptomatic treatment, including adjustments to diet structure, psychological and behavioral treatment, and simple drug treatment, and the effect has not been ideal. In recent years, cognitive behavioral therapy (CBT) has become an important modality of IBS treatment^[4]. CBT is a structured, short-term and cognitive approach to psychotherapy. It is considered to be an important component of therapy for IBS patients with moderate to severe disease or unresponsive to initial drug therapy and comorbid psychological factors. The application of exercise therapy in the treatment of chronic diseases has gradually attracted the attention of researchers. Aerobic exercise with moderate intensity and an appropriate duration has a positive effect on body and mind regulation^[5]. Based on these findings, this study used Health Qigong Baduanjin as an auxiliary therapy supplementing CBT therapy and carried out 24 wk of the combined intervention in IBS-D patients, observed the intervention effects on the cognitive bias and coping styles of IBS-D patients, and discussed the application value of CBT combined with exercise (CBT + E) in the prevention and treatment of IBS.

MATERIALS AND METHODS

Research subjects

Sixty patients with IBS-D were selected from January to October 2018 from the Digestive Department of the Fourth People's Hospital of Shenyang City, Liaoning Province, and 30 healthy subjects were recruited as controls. The sixty IBS-D patients were aged 30-40 years old and were divided into an experimental group (CBT + E) and a control group, with 30 people in each group. The inclusion criteria were as follows: (1) Compliance with the IBS-D Rome III diagnostic criteria published by the American Gastroenterology Academic Year 2006^[6]; (2) no restriction on sex, with patient age ranging from 30 to 40 years old; (3) illness lasting for 6-24 wk; (4) no organic diseases identified through endoscopy, X-ray, B-ultrasound, or laboratory examination; and (5) normal blood examination and normal heart, liver, and kidney function. The exclusion criteria included the following: (1) Inflammatory bowel disease or other organic diseases that would affect the evaluation of patient symptoms; (2) severe psychological diseases such as schizophrenia, bipolar affective disorder, and suicidal tendency^[7]; (3) psychological treatment for other diseases; (4) the occurrence of serious negative life events during treatment; (5) allergy history and drug and food allergy during the test period; and (6) pregnancy or lactation.

The general demographic data of the subjects are shown in [Table 1](#). The basic conditions of the subjects in each group were similar, and there was no significant difference in age, body mass index (BMI), educational level, or course of disease between groups ($P > 0.05$). During the initial assessment, the purpose and significance of the study, the research methods, and some possible impacts on the patient were explained to the patients. The participants voluntarily participated in the study and signed an informed consent form. During the experiment, three subjects withdrew for different reasons. One person from the experimental group was unable to complete the experiment, and another patient suffered from other diseases and received treatment. One participant in the control group suffered from other intestinal diseases. There were 28 patients in the final experimental group, 29 patients in the conventional drug control group, and 30 subjects in the healthy control group.

CBT + E intervention program

In order to implement the whole experiment smoothly according to the training plan, a pre-experiment was carried out before the formal experiment. In the pre-experiment, the eight-part brocade movement demonstration and essentials were clearly explained and demonstrated for the subjects in the experimental group. Through the practice, the subjects were familiar with the training process and movement requirements, and the training time and arrangement were clearly defined. The subjects in the control group adopted the conventional comprehensive treatment

Table 1 General demographics of the subjects ($n = 87$, mean \pm SD)

Group	Number	Sex, male/female	Age, yr	Time of education, yr	BMI, kg/m ²	Course of disease, yr
CBT+E	28	7/21	33.75 \pm 2.57	14.57 \pm 2.54	21.67 \pm 1.38	8.68 \pm 1.80
Control	29	7/22	36.86 \pm 2.54	15.03 \pm 2.54	21.90 \pm 1.36	8.66 \pm 2.00
Healthy	30	7/23	35.30 \pm 2.75	14.93 \pm 2.55	22.27 \pm 1.63	-
t/χ^2		0.02	9.47	3.37	1.22	3.29
P value		0.98	0.48	0.18	0.29	0.77

scheme. First, drugs for regulating intestinal motility were used to address the symptoms of diarrhea and constipation. For patients with abdominal pain, symptomatic treatment, *e.g.*, antispasmodic and analgesic drugs, was used together with drugs for regulating intestinal flora. For patients with anxiety disorder, anti-anxiety and antidepressant drugs were used to reduce the sensitivity of internal organs. The subjects in the experimental group adopted CBT + E based on a conventional comprehensive treatment scheme. Among them, cognitive behavioral therapy is to improve the psychological problems by changing the patient's views and attitudes towards people, oneself, and things. The focus is to reduce the mental burden of the patient on the disease, explain the patient's illness in detail and patiently, eliminate the patient's doubts, block the vicious circle of bad psychology, and establish a good cognition of the disease. For example, CBT required doctors and laboratory personnel to first understand the cognitive characteristics and symptom-inducing factors of the subjects and evaluate their cognitive characteristics, emotional responses, and coping styles with regard to events; then, disease-related psychoeducation, the identification and correction of negative automatic thoughts, cognitive restructuring, and relaxation training were conducted in the subjects once a week to enable the patients to establish a correct adaptive cognitive mode. The Baduanjin training required the subjects to engage in the continuous exercise intervention no fewer than 4 times/wk, 2 times/d (in the morning and afternoon) and 45 min/session for 24 wk. Baduanjin professional coaches and medical staff provided comprehensive and systematic guidance on the technical essentials and duration of the Baduanjin exercises. The coaches, doctors, and nurses established good relations with the subjects, fully understood the disease condition, comprehended the emotional state of the patients, and obtained their trust and cooperation. During the tests, all the subjects in each group followed their doctors' advice, and the relevant test personnel provided safety education and relevant information and addressed matters requiring attention. Each subject in the CBT + E group received video data so that all the subjects could standardize and master the Baduanjin. The detailed exercises of the Baduanjin were explained to the patients so that they could use it in their daily study and exercise. Telephone supervision and return visits were regularly conducted, timely skill guidance was provided, random checks occurred, and each exercise was recorded. If any problems were encountered, the subjects could communicate with the doctors and coaches at any time.

Evaluations

Before the test, all the scale assessors received unified scale assessment training to standardize the evaluation of the test battery. The three groups of subjects were evaluated with the following scales at baseline and 6, 12, and 24 wk after the initiation of the intervention: (1) The IBS Symptom Severity Scale (IBS-SSS) was evaluated. The symptom severity score and symptom frequency score for IBS were divided into four grades. The scale was scored along five dimensions: The degree of abdominal pain, the frequency of abdominal pain, the degree of abdominal distension, the degree of satisfaction with defecation, and the degree of influence on life; (2) Cognitive and behavioral characteristics were assessed with the following: (I) The Automatic Thoughts Questionnaire (ATQ), which is a self-assessment questionnaire with all items describing negative experiences of depression, and the scores, categorized into five grades, have been positively correlated with the degree of depression; and (II) the Dysfunctional Attitudes Scale (DAS), which assesses potentially deeper cognitive structures, including vulnerability, attraction and exclusion, perfectionism, compulsion, approval seeking, dependence, autonomous attitude, cognitive philosophy, and other factors; and (3) Coping styles were assessed with the Pain Coping Style Questionnaire (CSQ), which includes eight dimensions: Reinterpreting pain, overcoming one's own state, ignoring pain perception, catastrophizing, increasing activity, engaging in pain behavior, distracting attention, and praying; this instrument

makes it possible to evaluate the coping style of IBS and chronic pain patients with regard to pain symptoms.

Statistical analysis

SPSS 17.0 statistical software was used to process the data. The measurement data are expressed as the mean \pm SD. The general demographic data of the patients were statistically analyzed by *t*-tests and χ^2 tests. Changes in the IBS-SSS, ATQ, DAS, and CSQ scores were analyzed by repeated-measures ANOVA within and between groups. A normality test of the values showed that all the data conformed to a normal distribution. For the differences, a standard significance level was adopted, with differences being considered significant at $P < 0.05$ and extremely significant at $P < 0.01$.

RESULTS

Changes in clinical symptoms of IBS patients before and after intervention

Table 2 shows the IBS-SSS symptom scores before and after intervention in each group of patients. As shown in Figure 1, there were no significant differences in IBS-SSS scores between the two groups at baseline ($P > 0.05$). Compared with the control group, after 6, 12, and 24 wk of the combined intervention, the IBS-SSS scores in the experimental group showed significant differences ($P < 0.01$). Compared with baseline value, the IBS-SSS scores in the experimental group were significantly different after 6, 12, and 24 wk of the intervention ($P < 0.05$). There was a significant difference in the scores of the experimental group at 6 and 12 wk of intervention ($P < 0.01$). The IBS-SSS scores at 12 and 24 wk in the experimental group also showed a significant difference ($P < 0.05$).

Table 3 shows the results of repeated-measures ANOVA, with the IBS-SSS score serving as the dependent variable in the experimental group. After the CBT + E intervention, there were extremely significant differences between different test points ($P < 0.01$). With regard to the time*group interaction effect, the IBS-SSS scores showed extremely significant differences ($P < 0.01$), while for the group effects, the IBS-SSS scores showed extremely significant differences between the test and control groups ($P < 0.01$).

Cognitive bias and coping styles of IBS-D patients

As shown in Table 4, the total ATQ, DAS, and CSQ scores of the experimental group before and after 24 wk of the intervention were statistically significant between the groups ($P < 0.05$). Compared with healthy people, IBS-D patients have significant negative automatic thinking ($P < 0.01$). Compared with healthy people, the dysfunctional attitude of IBS-D patients was widespread. The perfectionism score on the DAS scale showed no significant differences ($P > 0.05$) across the experimental and healthy control groups, and the remaining seven dimensions and the total score showed extremely significant differences ($P < 0.01$). Compared with the healthy control group, IBS-D patients chose particular coping styles more often, such as catastrophization and prayer ($P < 0.01$), and fewer other coping styles, such as diversion of attention ($P < 0.05$).

Changes in cognitive bias in IBS-D patients before and after intervention

Table 5 shows the changes of cognitive bias scores before and after the intervention. As shown in Figure 2, at baseline, there was no significant difference in the ATQ scores between the two groups ($P > 0.05$). Compared with the control group, after 6 wk of the combined intervention, the ATQ scores showed significant differences ($P < 0.05$), and after 12 and 24 wk, the ATQ scores also showed significant differences ($P < 0.05$). Compared with baseline values, after 12 wk of the intervention, the ATQ scores in the experimental group began to show significant differences ($P < 0.05$), and after 12 and 24 wk, the ATQ scores continued to show significant differences ($P < 0.05$).

As shown in Figure 3, at baseline, there were no significant differences in the scores for the DAS dimensions between the two groups ($P > 0.05$). Compared with the control group, there were significant differences in the vulnerability, dependency, and total scores after 6 wk of the combined intervention ($P < 0.05$). After 12 wk, the perfectionism scores showed a significant difference ($P < 0.05$). After 24 wk, the perfection scores showed a significant difference ($P < 0.05$), and the vulnerability, dependency, and total scores showed an extremely significant difference ($P < 0.01$). There were no significant differences in the other five dimensions of the DAS before and after the intervention ($P > 0.05$). Compared with baseline values, after 6 wk of the intervention, the vulnerability, perfectionism, dependency, and total scores of the CBT + E group showed significant differences ($P < 0.05$). After 12 wk, the perfectionism

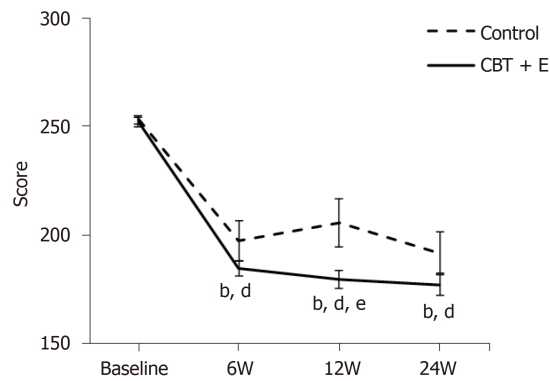


Figure 1 Irritable Bowel Syndrome Symptom Severity Scale score line chart. ^a $P < 0.05$, ^b $P < 0.01$ indicates the comparison between the CBT+E group and the control group at each time point; ^c $P < 0.05$, ^d $P < 0.01$ indicates the intragroup comparison before and after the initiation of the intervention at each time point; ^e $P < 0.05$, ^f $P < 0.01$ indicates a 12-wk and 6-wk comparison or a 24-wk and 12-wk comparison.

scores showed a significant difference ($P < 0.05$), and the vulnerability, dependency, and total scores showed extremely significant differences ($P < 0.01$). After 24 wk, the score changes showed results similar to those after 12 wk. Compared with baseline values, the other five dimensions of the DAS showed no significant differences ($P > 0.05$).

Table 6 shows the results of repeated-measures ANOVA, with the ATQ and DAS scores for each test group serving as the dependent variables. After the intervention, the ATQ total score and the DAS dimension scores and total scores had extremely significant differences between different test points ($P < 0.01$). With regard to the time*group interaction effect, there were significant differences in the ATQ total scores and DAS scores and total scores ($P < 0.01$). For the group effect, the total ATQ scores between the experimental group and control group were significantly different ($P < 0.05$). The vulnerability, perfectionism, dependence, and total scores on the DAS were significantly different ($P < 0.01$). There were no significant differences in the five dimensions of attraction and rejection, compulsion, seeking approval, autonomous attitude, and cognitive philosophy ($P > 0.05$).

Changes in coping styles of IBS-D patients before and after intervention

Table 7 shows the changes of coping style scores before and after intervention. As shown in Figure 4, at baseline, there was no significant difference in the CSQ scores between the two groups ($P > 0.05$). Compared with the control group, after 6 wk of the combined intervention, there were significant differences in the catastrophization, distraction, and prayer scores ($P < 0.05$). After 12 wk, there was a significant difference in four dimensions: Reinterpretation, neglect, increased activity, and pain behavior ($P < 0.05$); additionally, there was an extremely significant difference in the catastrophization, distraction, and prayer scores ($P < 0.01$). After 24 wk, the reinterpretation, neglect, increased activity, and pain behavior scores showed significant differences ($P < 0.05$), and the catastrophization, distraction, and prayer scores showed extremely significant differences ($P < 0.01$). There was no significant difference in the CSQ one-dimensional overcoming score before and after the intervention ($P > 0.05$). Compared with baseline values, the CBT + E group showed significant differences in the catastrophization, distraction, and prayer scores after 6 wk of the intervention ($P < 0.05$). Only after 12 wk of the intervention did significant differences in reinterpretation, neglect, increased activity, and pain behavior appear ($P < 0.05$). After 24 wk, there were significant differences in reinterpretation, neglect, increased activity, and pain behavior ($P < 0.05$) and extremely significant differences in the catastrophization, distraction, and prayer scores ($P < 0.01$).

Table 8 shows the results of repeated-measures ANOVA, with the CSQ scores in each group serving as the dependent variables. Significant differences in the CSQ dimension scores were observed between different test points under different interventions in each test group ($P < 0.01$). With regard to the time*group interaction effect, the scores on the CSQ dimensions showed extremely significant differences ($P < 0.01$). For the group effect, the catastrophization, distraction, and prayer scores in the experimental group were significantly different ($P < 0.01$), and the reinterpretation, neglect, increased activity, and pain behavior scores in the CSQ were significantly different ($P < 0.05$), while the overcoming scores were not significantly different ($P > 0.05$).

Table 2 Irritable Bowel Syndrome Symptom Severity Scale scores before and after the intervention in each group of patients (mean \pm SD)

Group	n	Baseline	6 wk	12 wk	24 wk
CBT+E	28	252.07 \pm 2.32	184.75 \pm 3.56	179.85 \pm 4.05	177.14 \pm 4.61
Control	29	253.13 \pm 1.97	197.51 \pm 9.04	205.68 \pm 10.89	191.89 \pm 9.39

Relationship between symptoms, cognitive bias, and coping styles of subjects in the experimental group before and after CBT + E intervention

After 24 wk of the CBT + E intervention, the cognitive bias and coping styles of the subjects in the experimental group changed to a certain extent. First, the 24-wk values of the above indexes in the CBT + E group were compared with the baseline values, *i.e.*, 24 wk-baseline, and then, the differences between the test groups were analyzed. The IBS-SSS scores were taken as dependent variables, and the average total scores of the ATQ, DAS, and CSQ were taken as independent variables for linear regression analysis.

Correlation of IBS-SSS scores with cognitive bias and coping styles

According to Table 9, the Pearson correlation coefficients of the IBS-SSS scores with the ATQ, DAS, and CSQ scores were -0.330, 0.744, and 0.763, respectively, with a significant difference ($P < 0.05$), indicating significant correlations among the IBS-SSS, ATQ, DAS, and CSQ scores and reliable correlations among different variables.

Regression analysis of IBS-SSS scores, cognitive bias, and coping styles

The scores on the IBS-SSS, ATQ, DAS, and CSQ before and after the CBT+E intervention in the experimental group were analyzed and showed a linear relationship. Therefore, it is of practical significance to establish the corresponding linear regression model according to the fitting effect of the model.

As shown in Table 10, the adjusted $R^2 = 0.702$ conforms to the goodness-of-fit level for the regression equation ($F = 18.872$, $P < 0.01$). The linear relationships between the IBS-SSS scores and the ATQ, DAS, and CSQ scores were significant when the coefficients were different from 0, and a linear equation was established.

Table 11 shows the totality of the equation. The regression equation coefficient table shows that the significance levels of the regression coefficients for the ATQ, DAS, and CSQ scores were 0.033, 0.028, and 0.036, respectively. The significance test results were less than 0.05, which means that the variables were significantly correlated and consistent with the results obtained in correlation analysis. Linear regression equations can be established according to the following model, with X1 representing ATQ, X2 representing DAS, and X3 representing CSQ: $Y(\text{IBS-SSS}) = -95.862 - 0.261X1 - 0.393X2 + 0.305X3$. The research results showed that after 6, 12, and 24 wk of the CBT + E intervention, the IBS-SSS scores of the subjects in the experimental group were significantly negatively correlated with the ATQ and DAS scores and were significantly positively correlated with the CSQ scores. When the IBS-SSS scores changed, the ATQ and DAS scores decreased, and the CSQ scores increased. This finding shows that changes in cognitive bias (ATQ and DAS) and adverse coping styles can predict changes in the IBS-SSS scores in the study group. This analysis of the improvements in the clinical symptoms of the patients shows that a change in cognitive bias and a positive improvement in adverse coping styles can promote the recovery of the patients.

DISCUSSION

IBS is a group of intestinal dysfunction syndromes characterized clinically by abdominal discomfort or abdominal pain with abnormal defecation. From a physiological perspective, the gastrointestinal tract is the only organ under the combined control of the intestinal nervous system, autonomic nervous system, and central nervous system in the body, which has both sensory functions and motor functions. Therefore, IBS is a typical psychosomatic disease in the digestive system^[8,9]. Studies have confirmed that IBS patients generally have cognitive biases and negative coping styles, accompanied by negative emotions^[10]. Clinically, treatment is often limited to improving symptoms through drugs or a single session of CBT therapy. However, for patients, it is difficult to realize the integrated adjustment of the brain-gut axis if they cannot adopt a unified treatment strategy that combines mental and

Table 3 ANOVA of Irritable Bowel Syndrome Symptom Severity Scale scores in each test group (n = 57)

	Time main effect		Interaction		Group main effect	
	F	P value	F	P value	F	P value
IBS-SSS	3292.810	< 0.001	115.158	< 0.001	71.795	< 0.001

physical health^[11]. Even if the cognitive bias of patients is corrected, their negative coping styles cannot be improved, and the disease cannot be fundamentally treated. Studies have indicated that exercise can improve the mood of IBS patients and easily promote positive coping styles. Therefore, on the foundation of CBT, exercise therapy was used as an auxiliary therapy to correct patients' cognitive bias and generate positive coping styles, which may be an important strategy for IBS rehabilitation treatment. This study takes IBS-D patients as the research subjects. The most common clinical classification is diarrhea, and one of the main factors affecting the occurrence of IBS is intestinal flora. Some studies have confirmed that intestinal flora in IBS-D patients has more serious imbalances and more obvious differences than that in IBS-C and IBS-M patients, thus providing a theoretical basis for our study.

Effect of CBT + E intervention on somatic symptoms of IBS-D patients

The main clinical manifestations of patients with IBS-D are abnormal stool character, abdominal distension, abdominal discomfort, and abdominal pain. The etiological mechanism of the disease is relatively complex. It is presumed that the causes may be psychological factors, dietary factors, heredity, infection, visceral sensory abnormalities, and intestinal motility abnormalities^[12,13]. A large number of studies worldwide show that CBT is an effective treatment for IBS. Jones *et al*^[14] showed that in treating IBS patients, CBT combined with mebeverine is better than mebeverine alone. Mikocka-Walus *et al*^[15] found that CBT is more effective than general education. Behavioral therapy has been increasingly and more widely applied in the treatment of physical and mental diseases; in this regard, researchers have also paid an increasing amount of attention to sports interventions^[16]. As a form of traditional Chinese sports, Health Qigong Baduanjin has the good effects of calming the heart and Qi, improving breathing, calming the five major internal organs, and correcting body shape. It has obvious preventive and therapeutic effects on cardiovascular and cerebrovascular diseases, respiratory diseases, endocrine diseases, metabolic diseases, and digestive diseases^[17]. Among these effects, the third type, "regulating the spleen and lifting the stomach alone", can improve constipation symptoms, regulate intestinal flora, stimulate appetite, and have obvious improvement effects on gastrointestinal functions^[18]. Sun *et al*^[19], using quantitative culture methods and counting living bacteria, recorded changes in the intestinal flora of elderly participants after practicing Baduanjin for 24 wk. The results showed that practicing Baduanjin had a positive effect on the growth and distribution of intestinal flora in elderly patients and could effectively improve the intestinal microecological balance. Lackner *et al*^[20] carried out Baduanjin training twice a week for 60 min and 14 wk for subjects suffering from IBS, and they confirmed the effect of this exercise therapy in terms of improving patient symptoms and quality of life and reducing medical expenses^[21]. In this paper, fitness Baduanjin was selected as an adjuvant therapy for CBT treatment. It was found that the CBT + E intervention was better than CBT treatment alone in relieving clinical symptoms, which is consistent with the relevant research results.

Effect of CBT + E intervention on cognitive bias in IBS-D patients

Cognitive bias is a phenomenon in which people often distort or fail to objectively perceive themselves, others, or the external environment due to their own or situational reasons^[22]. Most patients with IBS-D have a negative tendency when looking at problems, *i.e.*, patients have negative automatic thinking, ideas, and thoughts with regard to the disease, which reflect adverse reactions such as fragility, perfection, and dependence. They think that they cannot be cured. Therefore, they have fluctuating emotions, sensitive and suspicious mental and psychological problems, and persistent negative emotions and mental tension that often increase visceral sensitivity and aggravate the disease^[23]. CBT has a significant psychotherapeutic effect and a positive effect in relieving chronic pain. It is also helpful for improving patients' understanding and experience of pain behaviors, thus confirming that patients with chronic pain have some catastrophizing cognitive attitudes^[24]. Some researchers believe that functional disorder is a characteristic symptom of IBS and constitutes the disease's susceptibility to negative events. Beppu

Table 4 Comparison of the Automatic Thoughts Questionnaire, Dysfunctional Attitudes Scale and Pain Coping Style Questionnaire scores between the diarrhea-predominant irritable bowel syndrome patient and healthy control groups (mean \pm SD)

Scale	Dimensions	IBS-D (n = 57)	Healthy control (n = 30)	t	P value
ATQ		63.32 \pm 9.44	44.33 \pm 3.51	10.609	0.000
DAS	Vulnerability	17.96 \pm 2.36	14.67 \pm 1.26	7.099	0.002
	Absorption/rejection	15.46 \pm 3.67	11.17 \pm 2.26	5.837	0.000
	Perfectionism	16.98 \pm 2.98	15.87 \pm 2.30	1.785	0.059
	Mandatory	17.89 \pm 3.74	11.93 \pm 2.19	8.019	0.000
	Seek approval	18.09 \pm 3.47	13.40 \pm 2.31	6.652	0.002
	Dependence	18.30 \pm 2.62	13.20 \pm 2.02	9.276	0.043
	Autonomous attitude	18.56 \pm 3.74	12.83 \pm 2.70	7.410	0.041
	Cognitive philosophy	17.16 \pm 2.12	12.87 \pm 2.86	7.915	0.007
	Total score	137.39 \pm 17.30	113.67 \pm 10.35	6.875	0.008
CSQ	f1 Reinterpret	9.42 \pm 2.91	9.43 \pm 2.27	-0.019	0.513
	f2 Overcome	17.42 \pm 2.61	17.57 \pm 2.14	-0.262	0.205
	f3 Ignore	13.27 \pm 2.67	14.81 \pm 3.00	-2.358	0.337
	f4 Catastrophization	19.82 \pm 3.14	11.57 \pm 4.76	9.689	0.004
	f5 Increase activity	12.74 \pm 3.12	13.67 \pm 3.85	-1.215	0.175
	f6 Pain behavior	13.93 \pm 3.21	12.67 \pm 3.20	1.744	0.890
	f7 Divert attention	9.68 \pm 4.21	14.67 \pm 3.25	-5.642	0.025
	f8 Pray	12.74 \pm 3.12	9.27 \pm 2.11	5.452	0.005

ATQ: Automatic Thoughts Questionnaire; DAS: Dysfunctional Attitudes Scale; CSQ: Pain Coping Style Questionnaire.

et al^[25] believe that when faced with negative life events, if individuals hold extremely negative cognitive biases, including negative self-evaluation, generalization, and catastrophization, their negative life events will trigger unreasonable self-attribution and present a spiraling vicious circle of development, ultimately affecting the whole illness. Using a specific hypnotherapy, Harder *et al*^[26] found that hypnotherapy can significantly improve the cognitive bias of patients and eventually improve their gastrointestinal symptoms. Pimentel *et al*^[27] conducted biofeedback therapy in 60 IBS patients. Their results showed that biofeedback therapy can improve the symptoms of abdominal pain and emergency defecation, reduce the patients' worries about gastrointestinal function, and improve their overall well-being. All of these findings confirm that CBT has a positive effect on IBS patients. Some researchers have pointed out that during moderate aerobic exercise, most areas of the brain are in a relatively inhibited state, improving the functions of the frontal lobe and the parietal cortex of the brain, avoiding excessive nervous activity, regulating brain balance, promoting blood circulation, increasing gastrointestinal peristalsis, and thus effectively relieving the pain and discomfort of patients, allowing a gradual return to normal life^[28]. In this paper, a 12-wk period of Health Qigong Baduanjin combined with CBT therapy was selected as the intervention. It was found that the combined therapy was more effective in correcting the cognitive bias of patients, producing positive coping styles, and increasing treatment compliance.

Effect of CBT + E on coping styles of IBS-D patients

Coping style refers to the methods or means that people adopt in the face of various inevitable stressful scenarios and related situations of emotional distress^[29]. Patients with IBS-D often choose adverse coping styles, such as catastrophization and prayer, and give up active coping styles, such as overcoming their own state, ignoring adverse feelings, and diverting attention, thus causing the illness to repeatedly lead to poor therapeutic effects^[30]. Poor coping styles will cause many negative emotions, and vagus nerve excitability will continue to increase, which will lead to increased intestinal peristalsis and intestinal secretion, affect gastrointestinal digestion and absorption capacity, and cause gastrointestinal dysfunction and more serious symptoms^[31]. IBS patients often place difficulties in front of themselves when they encounter problems and are not good at adopting appropriate coping methods to face the current situation^[32]. CBT coping skill training, such as relaxation training, respiratory training, hypnotherapy, and biofeedback therapy, can help patients identify uncontrollable stressors. Johnston *et al*^[33] improved the abdominal discomfort and defecation habits of IBS patients through hypnotherapy, thus improving their

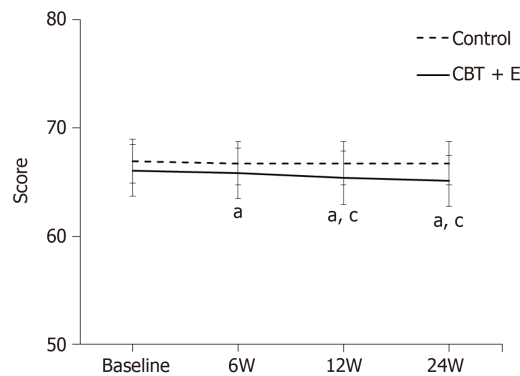


Figure 2 Automatic Thoughts Questionnaire Score line chart. "a" is the comparison between the CBT+E group and the control group at each time point ($^aP < 0.05$); "c" is the intragroup comparison before and after the intervention at each time point ($^cP < 0.05$).

overall well-being and positive coping styles. In the study of Gonsalkorale *et al.*^[34], 75 IBS patients were randomly divided into an intestinal hypnotherapy plus conventional drug therapy group and a simple conventional drug therapy group as the interventions. Their results showed that the former had more obvious intestinal symptoms and a positive coping attitude than the latter. This study found that IBS patients adopt more negative coping styles than healthy people, which suggests that IBS patients have poor coping styles that have a direct impact on the therapeutic effect of an intervention. Through the CBT + E intervention, the negative coping styles of patients were improved. At the same time, their ability to use some positive coping styles also improved, and the disease was effectively treated. In this study, a simple and easy-to-understand Baduanjin exercise to relieve mood and relax the body was used for adjuvant therapy. It was found that the CBT + E intervention has a more significant effect on the coping abilities of IBS patients, which is consistent with the relevant research results. In summary, this article selected Health Qigong Baduanjin as an auxiliary therapy supplementing CBT treatment and found that the CBT + E intervention can correct the cognitive bias of patients, alleviate intestinal pain, improve patients' normal adjustment ability to intestinal movement and autonomic nerve, correct intestinal dysfunction, effectively relieve dysfunctional attitudes, and generate positive coping styles. At the same time, through a good social support environment, patients are urged to use correct coping styles to reduce or relieve psychosomatic damage caused by symptoms, thus improving their quality of life^[35] and achieving a relatively satisfactory curative effect for IBS. The CBT + E intervention can be used as an effective treatment strategy for IBS and should be clinically promoted.

Limitations

This study has several limitations that need to be discussed. First, the number of research subjects is relatively small, and the observation indexes are not rich enough to reflect the actual clinical conditions of more subjects. Second, the subjects selected in this study are all patients with IBS-D, and there is no research and analysis on other types of the disease. Third, this test analyzed the different index data during 24 wk of intervention training, and did not carry out follow-up testing and analysis, which can be carried out in future research to further explore. For the test, the combination of pharmacotherapy may produce important bias, which requires longer time and more systematic test analysis to explore its internal change trend.

Conclusion

IBS-D patients generally have a certain degree of cognitive bias and adverse coping styles, thus affecting the therapeutic effects of any intervention and their daily quality of life. An intervention consisting of CBT combined with Baduanjin was more helpful in correcting the negative automatic thinking of IBS-D patients, forming appropriate coping styles, and effectively improving symptoms. The intervention consisting of CBT combined with Baduanjin is a therapeutic strategy for IBS-D that should be promoted for the clinical and family rehabilitation of some psychosomatic diseases.

Table 5 Changes in cognitive bias scores before and after the intervention (mean \pm SD)

	CBT+E (n = 28)				Control (n = 29)			
	Baseline	6 wk	12 wk	24 wk	Baseline	6 wk	12 wk	24 wk
ATQ	66.96 \pm 2.02	66.75 \pm 2.01	65.66 \pm 1.03	64.98 \pm 2.23	66.10 \pm 2.39	65.85 \pm 2.33	65.42 \pm 2.45	65.14 \pm 2.36
Vulnerability	20.39 \pm 1.66	18.25 \pm 1.66	14.75 \pm 1.97	12.75 \pm 1.77	21.27 \pm 1.68	21.10 \pm 1.65	21.06 \pm 1.68	20.99 \pm 2.10
Absorption/rejection	12.53 \pm 1.52	13.60 \pm 1.59	14.42 \pm 1.28	14.60 \pm 1.28	13.17 \pm 1.94	13.37 \pm 1.91	13.62 \pm 1.91	13.86 \pm 1.99
Perfectionism	20.28 \pm 1.46	19.39 \pm 1.72	17.57 \pm 1.98	17.35 \pm 1.92	19.75 \pm 1.72	19.41 \pm 1.84	19.17 \pm 1.69	19.00 \pm 1.64
DAS Mandatory	19.37 \pm 1.76	18.00 \pm 1.74	17.67 \pm 1.78	17.46 \pm 1.68	19.37 \pm 1.59	18.48 \pm 1.57	18.62 \pm 1.54	18.43 \pm 2.03
Seek approval	21.35 \pm 1.74	20.03 \pm 1.55	19.17 \pm 1.80	18.89 \pm 1.68	21.58 \pm 1.70	20.44 \pm 1.74	20.27 \pm 1.72	20.10 \pm 1.69
Dependence	21.67 \pm 1.65	20.10 \pm 1.42	16.32 \pm 1.65	14.82 \pm 1.41	22.55 \pm 1.80	22.01 \pm 1.45	21.90 \pm 1.22	21.03 \pm 1.65
Autonomous attitude	21.57 \pm 1.75	20.75 \pm 1.95	20.00 \pm 2.26	19.85 \pm 2.36	21.72 \pm 1.70	21.55 \pm 1.72	21.37 \pm 1.71	21.20 \pm 1.69
Cognitive philosophy	19.50 \pm 1.75	18.25 \pm 1.66	17.14 \pm 1.64	16.60 \pm 1.79	19.44 \pm 1.70	18.37 \pm 1.63	18.17 \pm 1.60	17.96 \pm 1.52
Total score	192.32 \pm 2.22	188.50 \pm 1.71	168.67 \pm 2.56	162.10 \pm 2.33	192.89 \pm 2.00	190.48 \pm 2.38	189.48 \pm 2.38	189.48 \pm 2.38

ATQ: Automatic Thoughts Questionnaire; DAS: Dysfunctional Attitudes Scale.

Table 6 Repeated-measures ANOVA of the cognitive bias scores of each test group (n = 57)

	Time main effect		Interaction		Group main effect	
	F	P value	F	P value	F	P value
ATQ	52.475	< 0.001	26.296	< 0.001	4.094	0.048
DAS	2240.350	< 0.001	2033.203	< 0.001	102.742	< 0.001
Vulnerability	190.521	< 0.001	59.642	< 0.001	0.409	0.525
Absorption/rejection	341.422	< 0.001	154.348	0.001	4.242	0.044
Perfectionism	246.569	< 0.001	35.920	< 0.001	2.321	0.133
Mandatory	432.932	< 0.001	33.320	< 0.001	2.722	0.105
Seek approval	1994.091	< 0.001	1859.358	< 0.001	94.206	< 0.001
Dependence	52.797	< 0.001	18.439	< 0.001	3.406	0.070
Autonomous attitude	526.055	< 0.001	66.836	< 0.001	2.001	0.163
Cognitive philosophy	24495.725	< 0.001	17739.892	< 0.001	456.001	< 0.001
Total score	52.475	< 0.001	26.296	< 0.001	4.094	0.048

ATQ: Automatic Thoughts Questionnaire; DAS: Dysfunctional Attitudes Scale.

Table 7 Coping styles of each group before and after intervention (mean \pm SD)

Dimensions	CBT+E (n = 28)				Control (n = 29)			
	Baseline	6 wk	12 wk	24 wk	Baseline	6 wk	12 wk	24 wk
Reinterpret	7.67 \pm 1.80	8.82 \pm 1.88	10.92 \pm 2.03	11.92 \pm 2.03	7.65 \pm 1.81	8.41 \pm 1.91	8.75 \pm 2.21	9.17 \pm 2.47
Overcome	15.03 \pm 1.31	15.17 \pm 1.30	16.10 \pm 1.22	16.25 \pm 1.20	14.82 \pm 1.25	14.96 \pm 1.26	15.17 \pm 1.39	15.31 \pm 1.31
Ignore	13.39 \pm 1.79	14.50 \pm 1.79	15.89 \pm 1.44	16.17 \pm 1.44	13.06 \pm 2.03	13.41 \pm 2.22	13.91 \pm 2.46	14.03 \pm 2.58
Catastrophization	27.57 \pm 1.91	26.35 \pm 1.66	23.32 \pm 1.65	22.32 \pm 1.51	28.79 \pm 2.00	28.58 \pm 1.97	27.89 \pm 2.07	27.68 \pm 2.05
Increase activity	14.96 \pm 1.59	14.07 \pm 2.22	13.35 \pm 2.34	12.46 \pm 2.28	15.58 \pm 1.91	15.10 \pm 1.98	14.89 \pm 1.98	14.75 \pm 1.82
Pain behavior	15.42 \pm 1.59	14.67 \pm 1.88	13.50 \pm 2.57	13.21 \pm 2.49	15.68 \pm 1.49	15.48 \pm 1.45	15.31 \pm 1.44	15.13 \pm 1.40
Divert attention	8.50 \pm 1.87	10.57 \pm 1.95	13.71 \pm 1.76	15.17 \pm 1.58	8.44 \pm 1.74	8.62 \pm 1.74	8.86 \pm 1.82	9.06 \pm 1.83
Pray	18.85 \pm 1.43	17.28 \pm 1.11	14.25 \pm 1.62	12.75 \pm 1.89	19.86 \pm 1.92	19.65 \pm 1.89	19.65 \pm 1.89	19.58 \pm 1.78

Table 8 Repeated-measures ANOVA of the coping style scores in each test group (*n* = 57)

	Time main effect		Interaction		Group main effect	
	<i>F</i>	<i>P</i> value	<i>F</i>	<i>P</i> value	<i>F</i>	<i>P</i> value
Reinterpret	358.691	< 0.001	102.798	< 0.001	6.319	0.015
Overcome	118.479	< 0.001	30.007	< 0.001	2.944	0.092
Ignore	178.747	< 0.001	42.734	< 0.001	6.807	0.012
Catastrophization	1493.579	< 0.001	625.333	< 0.001	46.485	< 0.001
Increase activity	115.845	< 0.001	38.786	< 0.001	6.688	0.012
Pain behavior	54.750	< 0.001	19.504	< 0.001	6.326	0.015
Divert attention	1393.227	< 0.001	973.004	< 0.001	47.800	< 0.001
Pray	676.394	< 0.001	568.470	< 0.001	75.735	< 0.001

Table 9 Correlation of Irritable Bowel Syndrome Symptom Severity Scale scores with cognitive bias and coping styles (*n* = 28)

	ATQ	DAS	CSQ
IBS-SSS	-0.330 ^a	-0.744 ^b	0.763 ^b

^a*P* < 0.05.^b*P* < 0.01. ATQ: Automatic Thoughts Questionnaire; DAS: Dysfunctional Attitudes Scale; CSQ: Pain Coping Style Questionnaire; IBS-SSS: Irritable Bowel Syndrome Symptom Severity Scale.**Table 10** Regression equation significance test analysis of the Irritable Bowel Syndrome Symptom Severity Scale scores of the subjects in the experimental group

<i>R</i>	<i>R</i> ²	Adjusted <i>R</i> ²	Standard error	<i>F</i>	<i>P</i> value
0.838	0.702	0.665	0.649	18.872	0.000

Table 11 Linear regression analysis of the Irritable Bowel Syndrome Symptom Severity Scale scores in the experimental group

Variable	Regression coefficient	Standard error	Normalization coefficient	<i>t</i>	<i>P</i> value
Constant	-95.862	4.871	—	-19.681	0.000
ATQ	-0.261	0.115	-0.256	-2.269	0.033
DAS	-0.393	0.168	-0.420	-2.343	0.028
CSQ	0.305	0.138	0.400	2.215	0.036

ATQ: Automatic Thoughts Questionnaire; DAS: Dysfunctional Attitudes Scale; CSQ: Pain Coping Style Questionnaire.

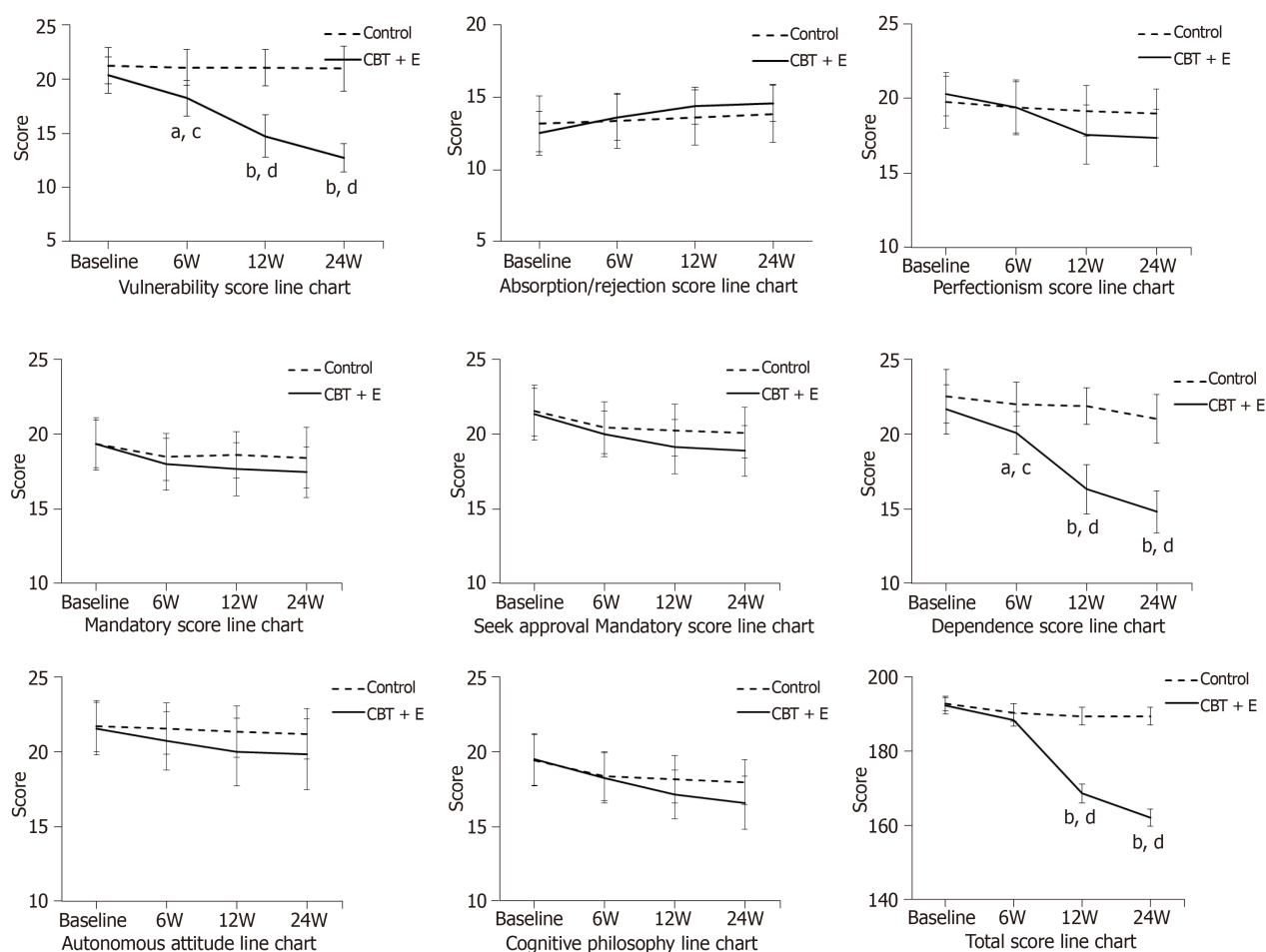


Figure 3 Score changes in the Automatic Thoughts Questionnaire and Dysfunctional Attitudes Scale dimensions. "a or b" is the comparison between the CBT+E group and the control group at each time point (^a $P < 0.05$, ^b $P < 0.01$); "c or d" is the intragroup comparison before and after the intervention at each time point (^c $P < 0.05$, ^d $P < 0.01$).

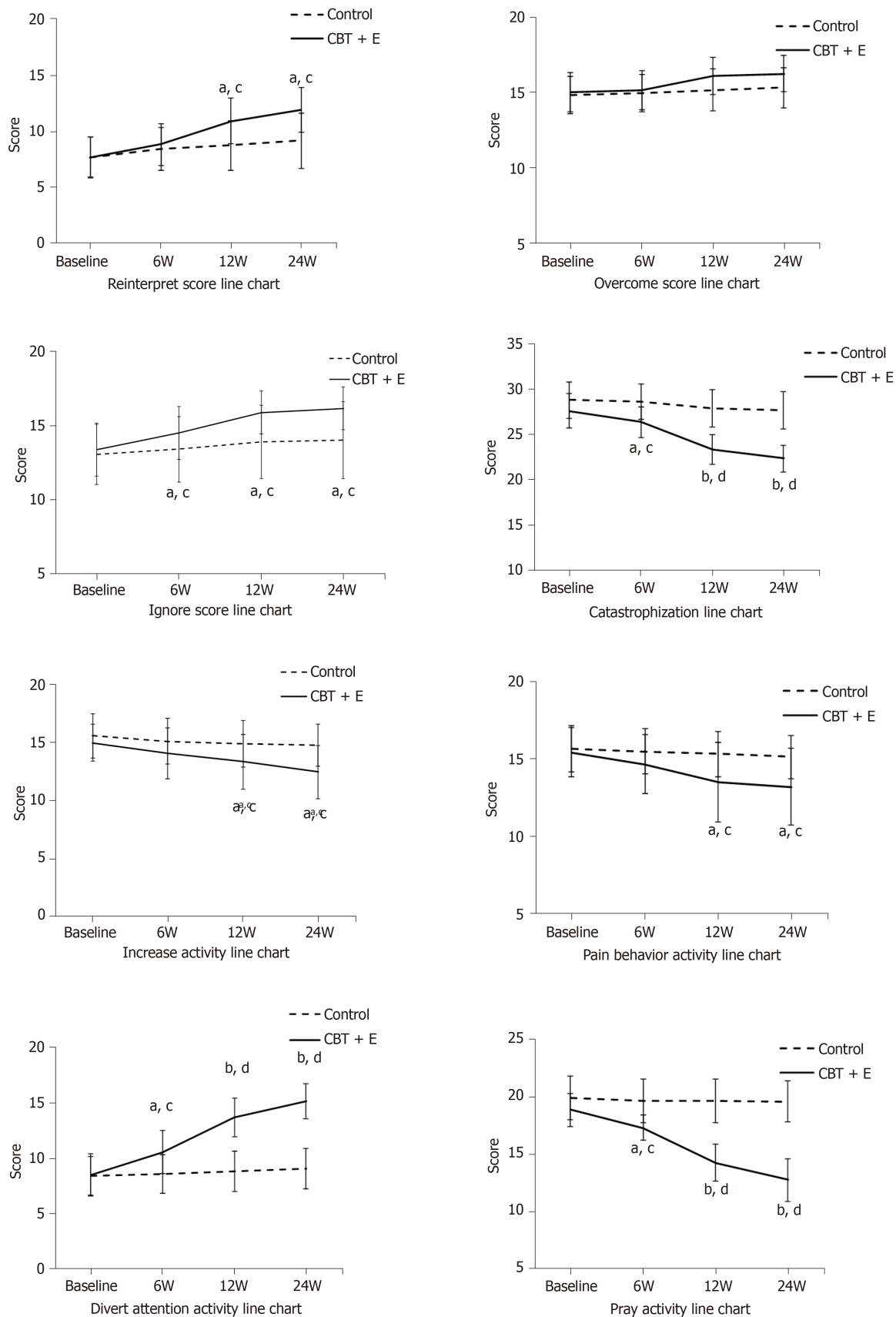


Figure 4 Pain Coping Style Questionnaire scores in each experimental group before and after intervention. "a or b" is the comparison between the CBT+E group and the control group at each time point (^a $P < 0.05$, ^b $P < 0.01$); "c or d" is the intragroup comparison before and after the intervention at each time point (^c $P < 0.05$, ^d $P < 0.01$).

ARTICLE HIGHLIGHTS

Research background

Compared with organic gastroenteropathy, irritable bowel syndrome (IBS) is more prone to cognitive bias and emotional disorders, which can lead to "abnormal" psychological behavior patterns. IBS can affect the nervous system function of patients through the hypothalamus-pituitary-adrenal axis and so on, cause increased vagus nerve excitability, and stimulate intestinal peristalsis and mucosal gland secretion. Therefore, it is very important to correct patients' cognitive biases and coping styles for the fundamental treatment of diseases.

Research motivation

Studies have confirmed that IBS patients generally have cognitive biases and negative coping styles, accompanied by negative emotions. Clinically, the improvement of symptoms is often limited to drugs or single CBT therapy. However, if the treatment strategy of combining mental psychology and body cannot be adopted in a way of both body and mind, it is difficult to realize the integrated regulation of the brain-intestine axis, and the disease cannot be fundamentally solved. According to some research reports, exercise can improve the mood of IBS patients. Therefore, on the basis of cognitive behavioral therapy, exercise therapy is used as an auxiliary therapy to correct the cognitive bias of patients and produce positive coping styles, which may be an important strategy for rehabilitation treatment of IBS.

Research objectives

The research objective of this study was to explore the effect of cognitive behavioral therapy combined with exercise intervention on cognitive bias and coping styles of patients with IBS-D to provide a theoretical reference for the prevention and treatment of this disease.

Research methods

We retrospectively analyzed 60 patients with IBS-D aged 30-40 years and 30 healthy subjects recruited from January 2018 to October 2018. They were randomly divided into an experimental group and a control group. All subjects received 24 wk of continuous intervention program. Statistical analyses were conducted through repeated measurement variance analysis, and correlation and regression analyses were used to determine correlation.

Research results

Our study found that patients with IBS had obvious cognitive bias and negative coping styles compared with normal people. IBS-SSS symptom score was significantly correlated with ATQ, DAS and CSQ scores.

Research conclusions

Cognitive behavioral therapy combined with exercise intervention can well correct the cognitive bias of IBS-D patients and eliminate the adverse coping conditions of patients, which is of great significance for the treatment of IBS and psychosomatic diseases.

Research perspectives

The number of subjects included in our study is relatively small, the intervention time is relatively short, and there are not enough observation indicators to more fully reflect the clinical situation of patients. In future research, more attention should be paid to the above deficiencies.

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