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Evaluating the impact of bioenergy economy-based health improvement (BEHI) as a mind-body intervention on laboratory, clinical and psychological factors in post-MI patients: A randomized controlled trial

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Original Article

Abstract

BACKGROUND: Patients with ischemic heart disease often exhibit various psychological factors that increase the risk of future cardiovascular events. Therefore, in addition to rehabilitation programs, there is a need for more interventional psychotherapy. Bioenergy Economy-based Health Improvement (BEHI) is a mind-body intervention that may address these issues. This study aimed to evaluate the effectiveness of the BEHI program on laboratory, clinical, and psychological factors in post-myocardial infarction (MI) patients.

METHODS: In this study, 52 post-MI patients were randomly divided into two groups. One group received cardiac rehabilitation combined with the BEHI program, while the other group received only cardiac rehabilitation. Laboratory data, clinical characteristics, and psychological variables were evaluated at baseline, immediately after the intervention, and four months post-intervention (follow-up).

RESULTS: Among the participants, the mean age was 59.97 ± 6.32 years, and 98.07% were male. The results showed a significant improvement in the mean scores of metabolic equivalents (METs), depression, and anxiety in participants who received the BEHI program and the rehabilitation program (p values: 0.006, 0.038, and 0.028, respectively).

CONCLUSION: These findings suggest that incorporating mind-body interventions like the BEHI program into cardiac rehabilitation can enhance physical and psychological outcomes for patients recovering from MI.

Keywords: Ischemic Heart Disease; Mind-Body intervention; Bioenergy Economy-based Health Improvement; Psychocardiology; Metabolic Equivalents; Anxiety; Depression

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Introduction

Cardiovascular disease (CVD), the leading cause of death in developing countries, is a major public health concern worldwide[1]. Previous research indicates that ischemic heart disease (IHD) is the primary cause of mortality and disability-adjusted life years (DALYs) among all cardiovascular diseases, both in Iran and globally[2,3]. Stressful events have both directly and indirectly impacted heart health and behaviors, potentially worsening heart disease[4]. Stress can influence factors such as high blood pressure, elevated cholesterol levels, smoking, a sedentary lifestyle, and overeating, all of which increase heart disease risk. Additionally, stress may

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lead to increased alcohol and cigarette consumption as a coping mechanism, further damaging artery walls[5]. Stress should be considered a significant risk factor for CVD and screened alongside other risk factors. Patients with CVD risk factors should receive training on improving their lifestyle and managing psychological stress[6].

Mind-body interventions, such as relaxation, imagery, biofeedback, meditation, hypnosis, tai chi, and yoga, can harmonize the mind and body by addressing emotional, mental, social, and spiritual factors that impact health[7,8]. These interventions can support patients with heart disease in making comprehensive lifestyle changes—such as adopting a low-fat vegetarian diet, quitting smoking, engaging in stress management training, and participating in moderate exercise—potentially leading to reversing coronary artery disease (CAD)[8]. Cognitive Behavioral Therapy (CBT) is a stress management tool for CVD patients that can reduce cardiac events and mortality[9,10]. Third-wave methods like Acceptance and Commitment Therapy (ACT), which incorporate mindfulness and forgiveness, can lower anger and hostility, reducing re-hospitalizations and medical costs[11]. Additionally, techniques such as meditation, therapeutic touch, and Reiki have been shown to decrease depression and anxiety, leading to lower blood pressure[12].

Bioenergy Economy-based Health Improvement (BEHI) - Previously introduced and studied under the title Bioenergy Economy (BEE)- is a holistic care system that promotes sustainable happiness through cognitive, behavioral, physical, energetic, and transpersonal methods[13-16]. The BEHI program, offered by Energy Medicine University and Danesh-e Tandorosti Institute, aims to achieve salutogenesis[1] and consciousness evolution by integrating body, narrative, relationships, and intentions[17]. Based on biosemiotics, BEHI uses a common meta-language to analyze physical and symbolic signs and functions, bridging molecular and cellular processes with symbolic and emotional meanings[18,19]. Recent studies have explored the effectiveness of BEHI in various health fields[20]. Clinical trials have demonstrated that BEHI enhances vegetative functions, forgiveness, and quality of life in chronic heart disease patients[21,22], and is effective in reducing anxiety, depression, and migraine symptoms[23,24]. Additionally, individualized BEHI programs have shown promise in alleviating physical issues and stress while improving quality of life in breast cancer patients[16,25,26].

Patients with defined CAD have different psychological factors that increase the incidence of CVD and the risk of future cardiovascular events, leading to increased risk of CVD and related mortalities[27-29]. The prevalence of major depressive disorders in myocardial infarction (MI) patients is 20%, with 31% of them suffering from depressive symptoms[30]. In 38% of post-MI patients, mild anxiety symptoms were reported, with 18% exhibiting both depression and anxiety symptoms[31].

The psychological status of patients with CVD, especially MI patients, results from several factors, including age, duration of disease, personality, the pattern of expressing emotion, family, job, as well as the attitudes of physicians and surrounding people towards the disease. These factors affect patients' perception and acceptance of the disease and can lead to psychological reactions such as depression and anxiety[32].

Given the high prevalence of CVD and its impact on quality of life, along with the bidirectional relationship between psychological factors and CVD, additional psychocardiology interventions are needed. We hypothesize that the BEHI program, with its behavioral, mindful, body-centered, and transpersonal components, could effectively support post-MI patients in both physical and mental health during rehabilitation. This study aims to evaluate the effectiveness of the BEHI method in improving laboratory, clinical, and psychological factors in post-MI patients.

Methods

Study Design

This study is a Randomized Controlled Trial (RCT) involving 60 MI patients referred to the Cardiac Rehabilitation Research Center at the Cardiovascular Research Institute of Isfahan University of Medical Sciences in 2018-2019. Patients were randomly selected using an allocation system with a list generated by software from statisticians at Hamedan

1. An approach to human health that examines the factors contributing to the promotion and maintenance of physical and mental well-being rather than disease with particular emphasis on the coping mechanisms of individuals which help preserve health despite stressful conditions (Merriam-webster dictionary)

University of Medical Sciences, Faculty of Pharmacy. Out of 60 patients, 52 eligible subjects were randomly assigned to either the experimental or control group. The experimental group (n=30) received the BEHI intervention along with a conventional rehabilitation program (CRP), while the control group (n=22) received only the CRP.

The study protocol was thoroughly explained to all participants, and written informed consent was obtained. The study was approved by the Ethics Committee of Isfahan University of Medical Sciences (IR.MUI.MED.REC.1398.001) and registered with the Iranian Registry of Clinical Trials (IRCT) under the registration number IRCT20100417003733N5.

Participants

Among the 60 patients, 52 were selected based on the following inclusion criteria: (1) Age 35 to 65 years, (2) Literacy, (3) Stable cardiac disease, and (4) Willingness to participate. Exclusion criteria included a history of disabling chronic diseases, recent MI (within two months), clinically recognized heart failure or arrhythmia, psychological disorders, malignancies, autoimmune diseases, immune deficiency diseases, and candidates for coronary artery bypass graft surgery.

Intervention

In this study, the BEHI program, a 90-minute educational and clinical training, was conducted weekly for six consecutive weeks. Participants were encouraged to exercise regularly throughout the week, and an audio file of each session was provided at the end of each session. The content of each session is detailed in Table 1. Additionally, the conventional rehabilitation program consisted of six weekly sessions focusing on lifestyle modification and nutrition for MI patients, following the protocol of the Cardiac Rehabilitation Research Center.

Efficacy Measures

Data were collected at three time points: baseline (Time 0), after treatment (Time 1), and at a 4-month follow-up (Time 2). Demographic and clinical factors, including body mass index (BMI), resting and maximum heart rate (HR), systolic and diastolic blood pressure (BP), ejection fraction (EF), and metabolic equivalent (METs), were assessed by an expert cardiologist at the Cardiovascular Research Institute. BP was measured twice after 15 minutes of quiet sitting using a standard mercury sphygmomanometer. BMI was calculated as weight (kg) divided by height $(m)^2$. EF was measured using echocardiography, and METs were assessed via exercise tests. METs represent the resting metabolic rate, approximately 3.5 ml O_2/kg/min for a 70 kg man[5]. Routine laboratory tests for fasting blood sugar (FBS), triglycerides (TG), total cholesterol,

Table 1. The contents of each session in BEE program

Session	Topic	Subject	Exercise
1	Relaxation	Work-burden/mind-body coordination, stress response/release	Abdominal breathing/gradual relaxation/body purification
2	Tensegrity	Somatic memory, armor/integrity-safety	Vibration/tensegrity exercises
3	Body awareness	Body sense, salutogenesis	Body awareness (superficial, deep, balanced and visceral senses)
4	Attention work	Attention skewness/conscious direction of attention, danger brain-communication brain/gratitude	Attention/gratitude exercises, Bioenergy work
5	Narrative work	Narrative skewness (resentment/blame/greed/melancholia), non-life/self-care bias, time and narration (memory reconstruction)/narration and body tune	Body caress, lack of interpretation, pragmatic speech, body awareness
6	Relation work	Relation-nature/selves/avoidance of rejection/limit and love/In-field and synergy/relational body	Positive no/sharing, biofield work
7	Liberation from non-life (forgiveness: inter-intrapersonal)	Death instinct?!/Repetition fate/stabilized anger/why we do not forgive/value bias/body bias	Biofield work/ refining resentments (forgiveness with guided imagination),body purification
8	Path of love (forgiveness: transpersonal)	Transpersonal dimension/openness to whole/unconditioned health providing/kindness: mature defense/submission/intentional force	Wholehearedness, love meditation (transpersonal forgiveness)

low-density lipoprotein (LDL), and high-density lipoprotein (HDL) were performed on 10 mL of blood using enzymatic methods. Depression and anxiety were measured using the Hospital Anxiety and Depression Scale (HADS)[33].

Data Analysis

Statistical analyses were conducted using SPSS software version 15 (IBM Corp, Armonk, NY). Quantitative data were expressed as mean ± standard deviation (SD), and qualitative data were expressed as percentages. Outliers and extreme values were identified using box plots, and the normality of quantitative data was assessed with the Shapiro-Wilk test. Baseline data for the two groups and simple main effects were analyzed using the Student's t-test or Mann-Whitney test, as appropriate. Time effects were examined with repeated-measures ANOVA, and Mauchly's Sphericity test was used to validate the repeated-measures analysis. A p-value of < 0.05 was considered statistically significant.

Results

In this study, 52 participants with a mean age of 59.97±6.3 years were evaluated, of which 98% (n=51) were male and 92% (n=48) were married. Demographic and baseline data, tabulated in Table 2, revealed no significant differences between the case and control groups. To determine whether the BEHI intervention can be considered a complementary program alongside traditional cardiac rehabilitation in post-MI patients, we assessed the impact of the BEHI intervention on laboratory, clinical, and psychological factors over time, with baseline adjustment.

Table 3 compares laboratory, clinical, and psychological data in the BEHI and control groups after intervention and at the 4-month follow-up. The data suggest a significant association between BEHI program participation and increased METs factor (P

Table 2. baseline characteristic of two group of study

	Control (n=22)	BEE (n= 30)	pvalue
Demographic data			
Gender, male (%)	95.4%(n=21)	Male:100%(n=30)	
Age (years)	60.71±6.75	59.44±6.02	
Education (years)	9.63±4.27	10.57±3.84	
Marital Status, Married (%)	90.9%(n=20)	93.3%(n=28)	
Laboratory data			
FBS (mg/dL)	117.91±25.83	121.47±45.34	0.361
TG (mg/dL)	193.45±105.10	170.35±72.41	0.707
Cholesterol (mg/dL)	161.32±36.73	162.06±38.82	0.813
LDL (mg/dL)	79.50±27.01	84.97±34.46	0.434
HDL (mg/dL)	35.32±7.73	36.77±7.29	0.344
Clinical factors			
Systolic blood pressure (mmHg)	116.39±14.33	124.17±13.75	0.162
Diastolic blood pressure (mmHg)	71.11±7.19	75.83±9.28	0.397
Ejection fraction	49.61±8.39	49.00±8.40	0.979
METS (kcal/kg/hour)	11.644±1.82	11.54±1.95	0.640
Resting heart rate (bpm)	75.35±11.88	74.65±9.84	0.601
Maximum heart rate (bmp)	133.06±16.58	133.59±20.57	0.976
Exercise duration (sec)	729.78±219.77	691.53±112.95	0.749
BMI (kg/m²)	27.85±3.49	28.63±4.51	0.702
Psychological factors			
Depression	8.04±3.45	8.20±3.15	0.673
Anxiety	4.25±3.51	5.29±4.09	0.158

Table 3. Comparison of laboratory, clinical and psychological data in BEE and control group

Session	Topic	Subject	Exercise
1	Relaxation	Work-burden/mind-body coordination, stress response/release	Abdominal breathing/gradual relaxation/body purification
2	Tensegrity	Somatic memory, armor/integrity-safety	Vibration/tensegrity exercises
3	Body awareness	Body sense, salutogenesis	Body awareness (superficial, deep, balanced and visceral senses)
4	Attention work	Attention skewness/conscious direction of attention, danger brain-communication brain/gratitude	Attention/gratitude exercises, Bioenergy work
5	Narrative work	Narrative skewness (resentment/blame/greed/melancholia), non-life/self-care bias, time and narration (memory reconstruction)/narration and body tune	Body caress, lack of interpretation, pragmatic speech, body awareness
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8	Path of love (forgiveness: transpersonal)	Transpersonal dimension/openness to whole/unconditioned health providing/kindness: mature defense/submission/intentional force	Wholehearedness, love meditation (transpersonal forgiveness)

= 0.006). Additionally, the data show a statistically significant improvement in depression and anxiety among BEHI group participants (P-values: depression = 0.038 and anxiety = 0.028).

Comparing variables across three time points—before intervention (Time 0), after intervention (Time 1), and at follow-up (Time 2)—revealed several trends. METs improved at Time 1 but then decreased at Time 2 compared to Time 1, though they remained higher than at Time 0. Depression showed improvement at Time 1 and continued to decline further at Time 2 compared to both Time 0 and Time 1. Similarly, anxiety improved at Time 1 and further declined at Time 2 in comparison to both Time 0 and Time 1.

Discussion

This study aimed to assess the effects of the BEHI program on cardiovascular risk factors and psychological status in post-MI patients. The findings revealed that the BEHI program positively affected depression and anxiety levels, demonstrating significant reductions in both conditions. Additionally, there was an improvement in METs in the intervention group compared to the control group over time.

The BEHI program comprises four components: body awareness, coherent narrative, synergetic relationship, and non-dual intentionality. This approach seeks to reduce distress and enhance mind-body integrity, interconnected factors. The program's effects on anxiety, depression, and METs can be understood through three hypothetical pathways. First, by reducing distress, the BEHI program may directly improve depression, anxiety, and METs. Second, reducing stress and depression might impact psychoneuroimmunological processes, leading to decreased inflammation and improved METs. Lastly, the program may promote behavioral changes that contribute to improvements in functional factors such as METs.

Anxiety is prevalent among post-MI patients, and studies have shown there is a relationship between anxiety and the recurrence of CAD, as well as cardiovascular morbidity and mortality[34]. Adhering to several new lifestyles, including a healthy diet, physical activity, stress reduction, and medication adherence, can impose a great deal of anxiety on MI patients. Moreover, post-MI patients should take part in a rehabilitation program to improve their health and quality of life and reduce the risk of hospitalization, which can make these patients

more anxious[35,36]. Among cardiac patients, anxiety can result in increased dietary cholesterol intake, elevated total energy intake, a sedentary lifestyle, reduced physical activity, and a lower likelihood of adhering to some risk-reducing recommendations after MI[37-39]. Studies show several pathophysiological pathways that justify the effect of stress and anxiety on CVD. One pathway is that increased endothelial dysfunction was reported, and anxiety can impair flow-mediated dilation of the vasculature[40]. Another path is that anxious individuals had higher platelet aggregation during acute stress and changes in platelet activity[41]. Besides anxiety, there is evidence suggesting that treating depression can reduce the risk of cardiac events by addressing factors such as high BMI, lack of exercise, and smoking cessation[42]. Studies indicate that 17-27% of CAD patients experience depression following an MI, and after three months, 36% exhibit minor or major depressive symptoms[43]. Major depressive disorder in post-MI patients is associated with harmful lifestyle factors, including smoking, sedentary behavior, unhealthy diet, diabetes mellitus, metabolic syndrome, and poor adherence to medication, all of which can hinder disease improvement[44]. A cohort study found a link between CVD and depression, noting that depressed patients often have limited physical activity, reduced quality of life, and overall poor health, which can exacerbate cardiovascular conditions[45].

Evidence has shown that cardiovascular-specific psychotherapy is effective in reducing stress, anxiety, and depression in patients with CVD. This suggests that integrating psychotherapy with conventional medical care can help mitigate the adverse effects of these conditions on cardiovascular patients[46]. Our study demonstrates a relationship between the BEHI program and reduced anxiety and depression in post-MI patients. A similar study evaluating the effectiveness of the BEHI program for attention bias modification in patients with high anxiety sensitivity reported a decrease in anxiety sensitivity[23]. Another study on the efficacy of BEHI in patients with myofascial pain syndrome showed reductions in anxiety levels, depression, and pain[47]. Additionally, Derakhshan et al. reported that the BEHI program effectively reduced the mean scores of pain, anxiety, and depression in migraine patients[24]. Given the positive effects of BEHI on anxiety in MI patients, it is plausible that reduced anxiety may lead to increased attendance and completion of rehabilitation sessions, as well as improved adherence to medications, a healthy diet, and physical activities[48,49].

There is limited evidence on the effects of the BEHI program on clinical and laboratory factors related to CVD. One study on patients with CAD demonstrated that group audio training based on Bioenergy Economy-based Health Improvement has significant effects on reducing heart rate and improving forgiveness and quality of life. However, in our study, changes in heart rate were not significant[21]. It is noteworthy that a previous part of this study evaluated the effect of BEHI on cardiac function and inflammatory factors by comparing two groups before and immediately after the intervention. The results showed no significant differences in total cholesterol, TG, HDL, and LDL after the intervention compared to before the intervention in either the case or control groups. Additionally, Intercellular Adhesion Molecule 1 (ICAM-1) and Vascular Cell Adhesion Molecule 1 (VCAM-1) did not change during the intervention in either group ($P > 0.05$). This earlier paper demonstrated that the psychological intervention based on the BEHI program had no significant effect on cardiac function and inflammatory factors in patients with MI[50].

In our study, METs improved at the end of the intervention in both the case and control groups, but the change was statistically significant only in the intervention group. To our knowledge, this is the first study to evaluate the effects of a psychological method on METs, demonstrating the efficacy of the BEHI method in enhancing this variable. The observed reduction in METs at follow-up (Time 2) compared to immediately after the intervention (Time 1) in the experimental group underscores the need for extending the intervention beyond two months, with consideration for monthly session supervision.

This study had several limitations. Firstly, the small sample size limits the generalizability of the findings to the broader population. Secondly, there was a lack of extended monitoring of patients after the intervention. Therefore, future studies should incorporate more extended follow-up periods to more accurately assess the effects of the BEHI program.

Conclusion

In conclusion, incorporating the BEHI program into a comprehensive cardiovascular rehabilitation program can help post-MI patients manage anxiety and depression while improving their heart's functional capacity through psychological and lifestyle changes. However, further research is needed to understand these effects better. Future studies could benefit from including strategies such as exercise reminders, online or in-person booster interventions, and self-help groups to maximize the benefits of BEHI for post-MI patients.

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Conflict of interests

The authors declare no conflict of interest.

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Author's Contributions

MHJ conceptualized the study with assistance from MS and HR. MHJ and ADJ conducted the study, collected data, and performed the statistical analysis. MF wrote the first draft.All authors reviewed, provided comments, and approved the final version.

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