The Effectiveness of Cognitive Behavioral Therapy in Reducing Symptoms of Depression and Improving Quality of Life in Heart Failure Patients

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Quantitative Study

Abstract

Background: Heart failure (HF) refers to an enduring disorder associated with a high prevalence of comorbid depression, which negatively impacts patients' quality of life (QoL). The effectiveness of cognitive behavioral therapy (CBT) in tackling psychological well-being has been well-documented, with positive outcomes observed in various populations. This research aimed to evaluate the efficacy of CBT in reducing depressive symptoms and improving QoL among HF patients with comorbid depression.

Methods: Researchers conducted a randomized controlled trial at the Nasiriyah Heart Center in Iraq. A total of 160 patients presenting with HF and comorbid depressive symptoms were randomly allocated to either a 12-week CBT intervention or a control group receiving usual care. To assess the patients' depressive symptoms and QoL, the investigators used the Arabic versions of the Beck Depression Inventory-II (BDI-II) and the Minnesota Living with Heart Failure Questionnaire (MLHFQ) at baseline and post-intervention. Mixed-model ANOVA and ANCOVA were employed for data analysis.

Results: The CBT group demonstrated significantly greater reductions in depressive symptoms ($F(1, 158) = 72.6$, $P < 0.001$, $\eta p^2 = 0.32$) and improvements in QoL ($F(1, 158) = 45.8$, $P < 0.001$, $\eta p^2 = 0.23$) in comparison with the control group. The significance of the results was not diminished by adjusting for potential confounders (age, gender, and NYHA functional class) in the ANCOVA analyses.

Conclusion: CBT is an effective intervention for reducing depressive symptoms and improving QoL among HF patients with comorbid depression. Integrating psychological interventions, such as CBT, into the comprehensive care of HF patients may enhance

patient outcomes and reduce the healthcare burden associated with comorbid depression.

Introduction

Heart failure (HF) is a chronic and progressive condition characterized by the heart's inability to pump sufficient blood to meet the body's metabolic demands (Bereda, 2022; Lin & Fang, 2020). It is a significant global health burden, with an estimated prevalence of 71.4 million cases worldwide (Lippi & Sanchis-Gomar, 2020). HF patients experience a range of physical symptoms, like fluid retention, shortness of breath, and fatigue, which can severely impact their daily functioning and quality of life (QoL) (McGuinty et al., 2020). Additionally, HF is often accompanied by comorbid depression, which exacerbates the disease burden and adversely affects patient outcomes (Sbolli et al., 2020).

Depression, a frequently occurring mental health affliction, is marked by enduring feelings of gloom, resignation, and apathy concerning everyday engagements (Khune et al., 2023; Reus et al., 2018). The pervasiveness of depression in HF patients is estimated to be between 20% and 40%, which is considerably greater compared to the broader community (Freedland et al., 2021). The presence of comorbid depression in HF patients is associated with increased mortality, higher rates of hospitalization, and poorer QoL (Bahall et al., 2020). The intricate and multidimensional processes underpinning the association between HF and depression encompass biological, psychological, and social components (Sobolewska-Nowak et al., 2023; Stanca et al., 2024).

Several studies have investigated the effect of depression on QoL in HF patients. A review by Moradi et al. (2022) identified depression as a vital indicator of poor QoL in HF patients, with a pooled correlation coefficient of -0.50. The authors highlighted the need for effective interventions to address depression and improve QoL in this population. Similarly, research by Alemoush et al. (2021) showed that irrespective of sociodemographic and clinical factors, depressive symptoms were independently linked to decreased health-related QoL in individuals diagnosed with HF.

Given the significant impact of depression on the well-being and QoL of HF patients, effective interventions are crucial to address this comorbidity. Cognitive Behavioral Therapy (CBT) is a firmly grounded and research-backed psychological approach that has been established as a viable means of dealing with depression in various populations (Stikkelbroek et al., 2020).

CBT focuses on identifying and modifying maladaptive thoughts, beliefs, and behaviors that are instrumental in the origination and sustenance of depression (Panayiotou, 2021). The mechanisms through which CBT is thought to affect depression and QoL in HF patients are multifaceted and involve both cognitive and behavioral processes.

From a cognitive perspective, CBT helps patients identify and challenge negative automatic thoughts and cognitive distortions that perpetuate depressive symptoms. These may include thoughts related to hopelessness, helplessness, and worthlessness, which are common among HF patients due to the chronic and debilitating nature of their condition. By teaching patients to recognize and reframe these maladaptive thoughts, CBT can help reduce the emotional distress associated with depression and improve overall mood (Palavras et al., 2021).

Moreover, CBT addresses the core beliefs and schemas that underlie depressive cognitions. In HF patients, these may include assumptions about the self (e.g., "I am a burden to others"), others (e.g., "No one understands what I'm going through"), and the future (e.g., "My condition will never improve"). By helping patients identify and

modify these deeper cognitive structures, CBT can promote more adaptive and realistic thinking patterns, leading to mood and QoL improvements (Wenzel, 2017).

From a behavioral perspective, CBT encourages patients to engage in activities promoting mastery, pleasure, and social connectedness. HF patients with depression often withdraw from meaningful activities and social interactions due to physical limitations, fatigue, and low motivation. CBT helps patients gradually increase their activity levels and engage in pleasurable and rewarding experiences, which can counteract the behavioral patterns that maintain depression (Geschwind et al., 2020).

Furthermore, CBT teaches patients problem-solving skills and coping strategies to manage the challenges associated with HF and depression. These may include techniques for managing symptoms, adhering to treatment regimens, and communicating effectively with healthcare providers and family members. By enhancing patients' sense of self-efficacy and control over their condition, CBT can improve QoL and reduce the impact of depression on daily functioning (Bahall et al., 2020).

A randomized controlled trial (RCT) by Helal et al. (2022) evaluated the capability of CBT to lessen depressive symptoms and improve QoL in HF patients with comorbid depression. The study found that CBT was correlated with significant reductions in depressive symptoms and improvements in QoL compared to usual care. Another survey by Locatelli et al. (2023) investigated the effects of a 12-week CBT program on depressive symptoms, QoL, and self-care behaviors in HF patients. The authors found that CBT significantly improved all outcome measures compared to the control group.

Despite the promising evidence supporting harnessing CBT in HF patients with comorbid depression, further research is still needed to establish its effectiveness and optimize its delivery in this population. A systematic review by Jeyanantham et al. (2017) highlighted the heterogeneity in the design and delivery of CBT interventions across studies, which may impact their effectiveness. The authors called for more rigorous, well-designed trials to establish the optimal duration, format, and delivery of CBT for HF patients with depression.

In light of the existing literature, the current study aims to ascertain the potency of a 12-week CBT program in improving QoL and reducing symptoms of depression in HF patients with comorbid depression. The main goals of the present investigation include:
1. To assess the impact of CBT on depressive symptoms, as measured by the Beck Depression Inventory-II (BDI-II), in HF patients with comorbid depression in comparison with a control group receiving usual care.
2. To evaluate the effects of CBT on health-related QoL, as measured by the Minnesota Living with Heart Failure Questionnaire (MLHFQ), in HF patients with comorbid depression compared to a control group receiving usual care.

Methods

Design study and participant: This study employed an RCT design to evaluate the capability of CBT to lessen depression symptoms and improve QoL in HF patients with comorbid depression. The research was performed at the Nasiriyah Heart Center, a tertiary care hospital in Nasiriyah, Dhi Qar Province, Iraq, between January 2023 and December 2023. The hospital serves a diverse population of patients from urban and rural areas in southern Iraq.

Participants were recruited using convenience sampling from the outpatient cardiology clinic at the Nasiriyah Heart Center. To be considered for the research, subjects had to be 18 years of age or above and have a corroborated HF diagnosis

(New York Heart Association [NYHA] class II-IV) (Caraballo et al., 2019), and fulfilled the DSM-5 diagnostic criteria (Diagnostic and Statistical Manual of Mental Disorders) for MDD (major depressive disorder) (Vahia, 2013). Exclusion criteria included severe cognitive impairment, unstable medical conditions, active suicidal ideation, and current participation in other psychological interventions.

The study's sample size was derived using G*Power software, based on the parameters of a two-tailed independent samples t-test, a 0.05 alpha level, a power of 0.80, and an effect size classified as medium (Cohen's d = 0.5). The calculation yielded a minimum sample size of 64 participants per group. To account for potential attrition, we aimed to recruit 80 participants per group for 160 participants.

A computer-generated randomization sequence with a 1:1 allocation ratio was used to randomly assign participants to either the CBT intervention group or the control group receiving usual care. The randomization was performed by a researcher not involved in the study's data collection or analysis to minimize potential bias. Due to the nature of the intervention, participants and therapists could not be blinded to group allocation. However, the outcome assessors were blinded to participants' group assignments to reduce potential bias.

It is important to note that the convenience sampling method used in this study may introduce potential biases, such as selection bias, as participants who volunteered for the study may not be representative of the entire population of HF patients with comorbid depression. However, the randomization process helps to distribute these biases evenly between the intervention and control groups, minimizing their impact on the study's internal validity.

The CBT intervention consisted of 12 weekly individual sessions, each lasting approximately 60 minutes (Table 1). The sessions were conducted by licensed psychologists trained in CBT and with experience working with HF patients. The CBT protocol was adapted from Beck's "Coping with Depression" manual and customized to cater to the unique requirements and challenges of HF patients with comorbid depression. Key elements of the intervention included psychoeducation, cognitive restructuring, behavioral activation, problem-solving skills training, relaxation techniques, and relapse prevention strategies.

Participants in the control group received usual care, which consisted of standard medical management for HF, including pharmacotherapy, lifestyle modifications, and regular follow-up visits with their cardiologists. Throughout the study, subjects in the control group were not provided with any psychological interventions.

Instruments: Data were collected at baseline (pre-intervention) and post-intervention (12 weeks after baseline). The primary outcome measures were the severity of depressive symptoms and health-related QoL. Depressive symptoms were measured employing the Arabic version of the BDI-II (Naja et al., 2019), a 21-item self-report questionnaire with established reliability and validity in Arabic-speaking populations. Health-related QoL was measured using the Arabic version of the MLHFQ (Al-Sutari & Ahmad, 2017), a 21-item self-report questionnaire designed to assess QoL in HF patients.

In addition to the primary outcome measures, sociodemographic and clinical data were collected at baseline, including age group, sex category, matrimonial situation, educational credentials, occupational status, NYHA functional class, left ventricular ejection fraction (LVEF), and medical comorbidities.

Analysis: The researchers analyzed the collected data using IBM SPSS Statistics (version 26.0).

Table 1. An overview of the 12 weekly individual CBT sessions

Session	Topic	Content and activities
1	Introduction and Psychoeducation	- Establish rapport and discuss confidentiality - Provide an overview of CBT and its benefits for HF patients with depression - Psychoeducation about depression, HF, and their relationship - Introduce the concept of thoughts, feelings, and behaviors - Assign homework: mood monitoring
2	Cognitive Restructuring: Identifying Automatic Thoughts	- Review mood monitoring homework - Introduce the concept of automatic thoughts and their impact on emotions and behaviors - Practice identifying automatic thoughts related to HF and depression - Introduce thought records - Assign homework: complete thought records
3	Cognitive Restructuring: Challenging Automatic Thoughts	- Review thought records homework - Teach strategies for challenging and reframing automatic thoughts - Practice challenging automatic thoughts using thought records and guided discovery - Introduce the concept of cognitive distortions - Assign homework: continue completing thought records and challenging automatic thoughts
4	Behavioral Activation: Introduction	- Review homework and progress - Introduce the concept of behavioral activation and its role in managing depression - Discuss the relationship between activities and mood - Identify activities that the patient enjoys or finds meaningful - Assign homework: create an activity schedule for the upcoming week
5	Behavioral Activation: Implementing Pleasant Activities	- Review activity schedule homework - Discuss barriers to engaging in pleasant activities and develop strategies to overcome them - Practice problem-solving skills to address obstacles - Emphasize the importance of consistency and gradually increasing activity levels - Assign homework: continue implementing the activity schedule and monitor mood
6	Problem-Solving Skills Training	- Review homework and progress - Introduce the problem-solving model and its steps - Practice applying the problem-solving model to HF-related challenges and depressive symptoms - Discuss the importance of breaking down problems into manageable parts and generating alternative solutions - Assign homework: apply the problem-solving model to a current challenge
7	Relaxation Techniques and Stress Management	- Review homework and progress - Discuss the role of stress in HF and depression - Teach relaxation techniques, such as deep breathing, progressive muscle relaxation, and guided imagery - Practice relaxation techniques in session - Discuss stress management strategies, such as time management and assertive communication - Assign homework: practice relaxation techniques daily and implement stress management strategies
8	Cognitive Restructuring: Core Beliefs	- Review homework and progress - Introduce the concept of core beliefs and their influence on automatic thoughts and behaviors - Identify the patient's core beliefs related to HF and depression - Practice challenging and modifying core beliefs using cognitive techniques - Assign homework: continue identifying and challenging core beliefs

Table 1. An overview of the 12 weekly individual CBT sessions (continue)

Session	Topic	Content and activities
9	Interpersonal Skills and Assertiveness Training	- Review homework and progress - Discuss the impact of HF and depression on interpersonal relationship - Teach assertiveness skills and effective communication techniques - Practice assertiveness and communication skills through role-plays - Discuss the importance of social support and strategies for building and maintaining a support network - Assign homework: practice assertiveness skills and reach out to supportive others
10	Cognitive-Behavioral Strategies for Self-Care	- Review homework and progress - Discuss the importance of self-care in managing HF and depression - Identify the patient's current self-care practices and areas for improvement - Teach cognitive-behavioral strategies to enhance self-care, such as self-monitoring, goal-setting, and self-reinforcement - Develop a personalized self-care plan incorporating these strategies - Assign homework: implement the self-care plan and monitor progress
11	Relapse Prevention and Maintenance	- Review homework and progress - Discuss the concept of relapse and its warning signs - Identify the patient's potential triggers for relapse and develop a relapse prevention plan - Emphasize the importance of maintaining treatment gains and continuing to practice the skills learned in therapy - Develop a long-term maintenance plan, including strategies for coping with setbacks and seeking support when needed - Assign homework: finalize the relapse prevention and maintenance plan
12	Termination and Review	- Review the patient's progress throughout the course of therapy - Discuss the patient's accomplishments, challenges, and lessons learned - Address any concerns or questions about termination and future challenges - Reinforce the patient's ability to apply the skills learned in therapy independently - Provide resources for ongoing support and follow-up, if needed - Celebrate the patient's success and emphasize their resilience and strengths

They condensed the participants' clinical and sociodemographic characteristics using descriptive statistics. Chi-square tests and independent samples t-tests were used to analyze the variations in baseline characteristics between the CBT and control groups.

The primary analysis was conducted using a mixed-model analysis of variance (ANOVA) with group (CBT and control) as the between-subjects factor and time (baseline and post-intervention) as the within-subjects factor. The primary focus of the study, the time-by-group interaction effect, as well as the main effects of group and time, could be investigated using this methodology. The mixed-model ANOVA was performed separately for each primary outcome measure (BDI-II and MLHFQ scores). Effect sizes were calculated using partial eta-squared (ηp^2), with values of 0.01, 0.06, and 0.14 representing small, medium, and large effects, respectively (Rajati et al., 2013).

To account for potential confounding variables, such as age, gender, and NYHA functional class, secondary analyses were conducted using analysis of covariance (ANCOVA), with the post-intervention scores as the dependent variable, group as the independent variable, and baseline scores and relevant confounding variables as covariates.

Missing data were handled using the intention-to-treat (ITT) approach, with the

last observation carried forward (LOCF) method used to impute missing values. In cases where participants dropped out of the study before the first post-baseline assessment, baseline values were carried forward. Sensitivity analyses were performed using complete case analysis to assess the robustness of the findings. Additionally, we compared baseline characteristics between participants with full data and those with missing data to evaluate any potential differences that could influence the interpretation of the results. A p-value threshold of 0.05 was utilized to determine statistical significance in all two-tailed tests. Bonferroni correction was applied to adjust for multiple comparisons, where appropriate.

Ethics: The Institutional Review Board of the Nasiriyah Heart Center and the Iraqi Ministry of Health Ethics Committee approved the study protocol. All participants provided written informed consent before enrollment in the study. Participants were informed of their right to withdraw from the study without affecting their medical care. To ensure the safety and well-being of participants, those who reported active suicidal ideation or experienced significant worsening of depressive symptoms during the study were promptly referred to appropriate mental health services.

Results

160 participants were enrolled in the study; 80 were randomly allocated to the control group and 80 to the CBT intervention group. The mean age of the participants was 57.9 years (SD = 10.5) in the CBT group and 58.9 years (SD = 9.9) in the control group. Males constituted 65.0% of the CBT group and 60.0% of the control group. The control and CBT groups did not exhibit statistically significant differences in their sociodemographic and clinical characteristics at baseline (Table 2).

The mixed-model ANOVA revealed a significant time-by-group interaction effect for both the BDI-II ($F_{(1, 158)} = 72.6$, $P < 0.001$, $\eta p^2 = 0.32$) and the MLHFQ ($F_{(1, 158)} = 45.8$, $P < 0.001$, $\eta p^2 = 0.23$) scores, indicating that the CBT group showed significantly greater improvements compared to the control group (Table 3).

The secondary analyses using ANCOVA, adjusting for age, gender, and NYHA functional class, yielded similar results (Table 4). The CBT group had significantly lower post-intervention BDI-II scores ($F_{(1, 155)} = 68.4$, $P < 0.001$, $\eta p^2 = 0.31$) and MLHFQ scores ($F_{(1, 155)} = 42.7$, $P < 0.001$, $\eta p^2 = 0.22$) compared to the control group, after controlling for the covariates and baseline scores. The sensitivity analyses using complete case analysis (n = 152) produced consistent findings, with significant time-by-group interaction effects for both the BDI-II ($F_{(1, 150)} = 70.2$, $P < 0.001$, $\eta p^2 = 0.32$) and the MLHFQ ($F_{(1, 150)} = 44.1$, $P < 0.001$, $\eta p^2 = 0.23$) scores, favoring the CBT group (Table 5).

Table 2. Baseline sociodemographic and clinical characteristics of the study participants

Characteristic	CBT group (n = 80)	Control group (n = 80)	P-value
Age, years (mean ± SD)	57.9 ± 10.5	58.9 ± 9.9	0.54
Gender, male (n, %)	52 (65.0%)	48 (60.0%)	0.51
Marital status, married (n, %)	64 (80.0%)	61 (76.3%)	0.56
Education level (n, %)			0.68
Primary or secondary	55 (68.8%)	58 (72.5%)	
Tertiary or higher	25 (31.3%)	22 (27.5%)	
Employment status (n, %)			0.74
Employed	30 (37.5%)	28 (35.0%)	
Unemployed or retired	50 (62.5%)	52 (65.0%)	
LVEF, % (mean ± SD)	33.2 ± 8.6	32.4 ± 8.2	0.55
NYHA functional class (n, %)			0.62
II	35 (43.8%)	32 (40.0%)	
III-IV	45 (56.3%)	48 (60.0%)	

Table 3. Changes in depressive symptoms and QoL from baseline to post-intervention

Outcome measure	CBT group (n = 80)	Control group (n = 80)	Time x group interaction
BDI-II			
Baseline	28.5 ± 7.2	27.9 ± 6.8	F(1, 158) = 72.6
Post-intervention	14.3 ± 6.4	24.7 ± 7.1	p < 0.001, ηp² = 0.32
MLHFQ			
Baseline	52.8 ± 12.4	53.6 ± 11.9	F(1, 158) = 45.8
Post-intervention	35.2 ± 10.6	48.4 ± 12.2	p < 0.001, ηp² = 0.23

Discussion

This study demonstrates that CBT significantly reduces depressive symptoms and improves QoL in HF patients with comorbid depression. These findings support the integration of CBT into standard care for HF patients. These findings were consistent across both the primary mixed-model ANOVA and the secondary ANCOVA analyses, after adjusting for potential confounding variables such as age, gender, and NYHA functional class, and align with prior research that has demonstrated the efficacy of CBT in reducing depressive symptoms and improving QoL in HF patients (Ebrahimi et al., 2015; Tavakolizadeh et al., 2021).

The study extends the existing literature by providing evidence for the effectiveness of CBT in an Iraqi population, where research on psychological interventions for HF patients with comorbid depression is limited. The cultural adaptation of the CBT protocol and the use of validated Arabic versions of the outcome measures ensure the relevance and applicability of the findings to the local context.

However, the study has several limitations to consider when interpreting the results. The generalizability of the findings may be limited due to the single-center design, the predominantly male sample, and the specific cultural and healthcare context of Iraq. Convenience sampling and reliance on self-report measures may have introduced selection and response biases. Additionally, the lack of long-term follow-up assessments and comparing CBT to usual care rather than an active control condition are limitations that future research should address.

To build upon the current findings, future research should focus on replicating the study in diverse settings and populations, conducting longer-term follow-up assessments, and investigating the mechanisms of change underlying the effectiveness of CBT. Comparative effectiveness studies evaluating CBT against other active treatments and implementation science research exploring strategies for disseminating and implementing CBT in real-world cardiac care settings are also needed.

Conclusion

The present study provides evidence for the effectiveness of CBT in reducing depressive symptoms and improving QoL among HF patients with comorbid depression. The findings highlight the importance of integrating psychological interventions into the comprehensive care of HF patients and suggest that CBT could be a valuable addition to the standard treatment approach.

Table 4. ANCOVA results for post-intervention BDI-II and MLHFQ scores, adjusting for age, gender, and NYHA functional class

Outcome measure	CBT group (n = 80)	Control group (n = 80)	ANCOVA
BDI-II	14.3 ± 6.4	24.7 ± 7.1	F(1, 155) = 68.4
			p < 0.001, ηp² = 0.31
MLHFQ	35.2 ± 10.6	48.4 ± 12.2	F(1, 155) = 42.7
			p < 0.001, ηp² = 0.22

Table 5. Sensitivity analysis using complete case analysis for time-by-group interaction effects on BDI-II and MLHFQ scores

Outcome measure	CBT group (n=76)	Control group (n=76)	Time x group interaction
BDI-II			
Baseline	28.3 ± 7.1	27.8 ± 6.7	F(1, 150) = 70.2
Post-intervention	14.1 ± 6.3	24.5 ± 7.0	p < 0.001, ηp² = 0.32
MLHFQ			
Baseline	52.6 ± 12.2	53.4 ± 11.8	F(1, 150) = 44.1
Post-intervention	34.9 ± 10.5	48.1 ± 12.1	p < 0.001, ηp² = 0.23

Future research should explore the long-term effects of CBT on HF patients and identify the most effective delivery methods for this population. Additionally, studies should focus on addressing the current study's limitations, such as increasing sample diversity, employing more representative sampling methods, and incorporating objective outcome measures to complement self-report assessments.

From a clinical perspective, incorporating CBT into routine care for HF patients could significantly improve patient outcomes and reduce healthcare costs associated with comorbid depression. Healthcare providers should consider screening HF patients for depression and referring those with comorbid depression to mental health professionals trained in delivering CBT. Integrating mental health services into cardiac care settings and promoting interdisciplinary collaboration between cardiologists, nurses, and mental health professionals could facilitate the implementation of CBT and other psychological interventions for HF patients.

In conclusion, this study underscores the potential of CBT to enhance the psychological well-being and quality of life of HF patients with comorbid depression. By addressing the mental health needs of this population, healthcare systems can improve patient outcomes, reduce healthcare costs, and promote a more holistic approach to cardiac care. Future research and clinical efforts should focus on refining and expanding the use of CBT and other evidence-based psychological interventions in the management of HF patients with comorbid depression.

Conflict of Interests

Authors have no conflict of interests.

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