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Original Article

A Cognitive-Behavioral Intervention for Marital Adjustment Among Patients with Type 2 Diabetes: Model Development, Implementation, and Mixed Methods Assessment Within the Iranian Cultural Context

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Abstract

Introduction: Marital adjustment changes after serious diseases such as diabetes mellitus. Psychological therapies and training are required to aid couples in their marital adjustment. To improve marital adjustment in the context of type 2 diabetes within Iranian families, the present study designed and tested a training program centered on the cognitive-behavioral approach.

Methods: Adopting an exploratory mixed-methods approach, this study followed the six-step framework proposed by Talbot and Verrinder for program development. The initial phase involved a conventional qualitative inquiry to identify core themes. Subsequently, through a synthesis of literature, evidence-based practices, and two expert panel reviews, the intervention was developed and finalized. The program was then implemented using a quasi-experimental design involving 40 couples with type 2 diabetes. To assess effectiveness, marital adjustment was measured at baseline and at a one-month follow-up. Using SPSS version 22, independent and paired t-tests, along with ANCOVA, were employed to perform the necessary statistical computations for this study.

Results: A systematic framework was employed to identify the core components of the psycho-educational intervention. The resulting program, consisting of 11 structured sessions, was implemented to achieve measurable therapeutic outcomes. Quantitative analysis revealed that the cognitive-behavioral couple training significantly enhanced marital adjustment. Following the intervention, the treatment group's total DAS scores (95.9 ± 7.42) showed a marked improvement compared to the control group (62.1 ± 5.49) ($t = 0.14$, $P < 0.001$), and the study showed a robust effect size (Cohen's $d = 5.17$). Furthermore, statistical significance was maintained across all DAS subscales according to the ANCOVA results, even after neutralizing the influence of baseline variables ($P \leq 0.05$).

Conclusion: The evidence presented confirms that marital adjustment can be substantially enhanced through a CBT-informed psycho-educational intervention. Therefore, this approach holds promise as a valuable addition to multi-disciplinary rehabilitation programs for various patient populations.

Keywords: Marital adjustment, Diabetes mellitus type 2, Spouses, Cognitive-behavioral couple therapy, Cognition, Iran

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Introduction

As a chronic metabolic dysfunction, T2DM is marked by its progressive nature and a substantial burden of systemic complications, frequently co-occurring with various psychological morbidities (1-4). There is often significant latency between the pathophysiological onset of T2DM and its clinical manifestation. As a result, many individuals are identified only in the later stages of the disease, frequently manifesting overt complications ranging from renal and cardiac dysfunction to retinopathy and neuropathy (5-7). Diabetes can also cause various changes in people's lifestyles, concerns related to disease management, the occurrence of psychosocial problems, and the experience of low quality of life. All these changes can be considered stressful, costly, and time-consuming (2, 8-10), so that one of the adverse consequences of the disease is the increase in disability and communication problems (11).

This disease can also cause psychological problems and emotional disturbances between couples and alter the quality and stability of marital relationships by introducing intrapersonal and interpersonal challenges (12).

Marital adjustment is an important feature in the family of patients with chronic disease, but it has received little attention (13, 14). Marital adjustment is an important feature in the family of patients with chronic diseases, but it has received little attention (15). This broad term

refers to various aspects of marital life and is a process of development between husband and wife (16-20). It consisted of four aspects: marital consensus, cohesion, marital satisfaction, and affection expression (21). Different aspects of marital adjustment can be affected by social, cultural, and individual factors (22).

Understanding the interplay between marital harmony and morbidity underscores the necessity of involving spouses to maximize the effectiveness of medical interventions (13). The absence of the patient's spouse in the course of treatment and the lack of awareness may have a detrimental influence on the spouse's adjustment to the condition (23). Additionally, studies have established a correlation between marital adjustment, income, successful treatment, the presence of a spouse throughout therapy, other clinical outcomes, longevity, and a reduction in disease progression (24).

Meta-analytic evidence increasingly affirms the critical contribution of behavioral interventions to the optimization of diabetes management and associated clinical parameters (1). Couple therapy has been considered in some rehabilitation programs only for strengthening couples' sexual relations through sexual counseling (23). The critical nature of family and couple interactions prompted the development of cognitive-behavioral therapies to improve marital adjustment (15). This approach promotes the positive components of marital adjustment (25). Cognitive and behavioral approaches, as well as behavioral change strategies, such as communication skill trainig are combined with cognitive restructuring (26). Couples can withstand unwanted judgments by adhering to the principles of this approach. Couples should also make more clear and logical decisions to avoid misconceptions that contribute to marital frustration (27).

As a premier evidence-based psychotherapeutic strategy, Cognitive-Behavioral Therapy (CBT) has undergone exhaustive empirical validation, establishing its position as a cornerstone in the psychological care of individuals with diabetes (1). This intervention facilitates the restructuring of maladaptive cognitive schemata and dysfunctional behavioral patterns, fostering the development of adaptive coping mechanisms and enhanced emotional regulation (23).

Several studies have found Cognitive-Behavioral Couple Therapy (CBCT) as a potent intervention within dyadic and familial contexts to be helpful in marital and family settings. Bélanger et al. (2015) reported that implementing CBCT facilitates higher levels of marital adjustment by equipping couples with more effective functional strategies for problem-solving (28, 29). Khojasteh Mehr et al. (2013) investigated the effectiveness of CBCT in reducing depressive symptoms and emotional regulation in troubled couples in Iran (23). Other studies have tested and validated the effectiveness of this approach in boosting marital satisfaction (26), decreasing depression, and alleviating post-traumatic stress disorder (PTSD) (23).

Beyond the extensive body of research evaluating the efficacy of psychotherapeutic interventions on marital adjustment, emerging evidence has specifically scrutinized the impact of dyadic interventions on the multidimensional constructs of relationship quality and interpersonal intimac (30). Shafiei et al. (2019) further validated the utility of CBCT in the Iranian context reporting substantial gains in women's marital adjustment and its underlying components, namely cohesion, consensus, and affective communication (31). Lee et al. (2020) also concluded that cognitive-behavioral group training could be effective in changing the degree of dependence, anxiety, dysfunctional attitudes, and attachment styles of couples (32). Furthermore, Ahmaditabar et al. (2018) evidenced that cognitive-behavioral family interventions serve as a robust mechanism for improving not only relational adjustment but also the psychological resilience and life quality of the couple dyad (15).

The demonstrated utility of CBCT in managing marital discord suggests that incorporating this modality into healthcare frameworks could create a synergy between clinical care and patient education, ultimately improving long-term health outcomes (23, 26). The Talbot and Verrinder's health education framework provides a structured foundation for the development, execution, and assessment of a cognitive-behavioral couple-based intervention aimed at enhancing marital adjustment following Type 2 Diabetes Mellitus (T2DM). Researchers in this study have compiled a specific CBT manual for DM with characterized by a structured session-by-session framework that emphasizes active patient engagement through systematic home-based assignments (1).

By adopting this systemic and holistic perspective, this study introduces a novel intervention that concurrently targets the interplay between individual health, the pathophysiology of diabetes, and marital-familial dynamics. Unlike conventional interventions that often focus on a single dimension, this model allowed us to identify population-specific stressors and strengthen their marital adjustment resources by enhancing the spouses supportive skills. Consequently, this study presents not merely an educational program, but a systemic adaptation-based intervention. The research team chose a mixed-method study to explain the process of marital adjustment in the context of type 2 diabetes reflects the dyadic coping process to design and implement a cognitive-behavioral approach-based couple education program on marital adjustment of couples following diabetes for the following reasons: The concept of marital adjustment is a complex and abstract concept. Due to the novelty of this concept in nursing, a qualitative approach was identified as the most appropriate method to extract the lived and first-hand experiences of couples following diabetes. Since the researchers sought to explain marital adjustment of couples and design and implement a cognitive-behavioral approach-based couple education program based on the participants' experiences after a Type 2 Diabetes, conventional content analysis was

identified as the best method for this purpose. To design a cognitive-behavioral approach-based couple education program based on Talbot and Verrinder's model, we synthesized emergent themes and codes from the qualitative phase with extensive literature reviews and established evidence-based practices. The synthesis of the perspectives guided the preliminary drafting of the training curriculum. Accordingly, the present research was conducted to establish and validate a cognitive-behavioral couple-oriented intervention intended to strengthen the relational adjustment of partners facing the challenges of T2DM.

Methods

Study Design

To address marital adjustment challenges in couples coping with Type 2 Diabetes, this research integrated qualitative and quantitative phases through a sequential exploratory design to develop, and subsequently, test a cognitive-behavioral intervention. By integrating qualitative and quantitative paradigms, the study leveraged methodological complementarity, where the strengths of one approach mitigated the inherent limitations of the other. This synergistic framework facilitated more robust and nuanced interpretations regarding the underlying processes of post-diagnosis marital adaptation. In addition, the combination of these two methods increased the meaningfulness of the findings and thereby obtained a desirable sample using quantitative and qualitative sampling techniques. The clinical setting for this study was the Zahedan University of Medical Sciences in Southeastern Iran. The intervention was structured according to the six-stage Talbot and Verrinder's model, conducted during the spring and summer of 2023. The developmental phases included:

1. Needs Assessment: Identification and prioritization of the core planning themes.
2. Preliminary Design: Formulation of the initial program framework.
3. Validation and Refinement: Finalizing the curriculum based on the experts' consensus.
4. Program Launch: The intervention performance.
5. Monitoring and Supervision: The implementation process and continuous oversight.
6. Summative Evaluation: The program's efficacy assessment (33).

The synthesis of the cognitive-behavioral approach into this marital adjustment program followed the specific parameters illustrated in the procedural workflow (Figure 1).

Step 1: Qualitative Inquiry for Exploratory Needs Assessment

To delineate the educational requirements of the study population, the researchers employed conventional content analysis, according to Talbot and Verrinder's framework. This methodological choice is justified by its capacity to derive authentic and reliable themes from textual corpora. Furthermore, content analysis is uniquely suited for investigations that seek an in-depth exploration of lived experiences and a holistic understanding of the underlying reality of the phenomenon under study (23). The purposive sampling was used to select 30 participants (13 patients, 8 patients' spouses, 1 patient's daughter, 2 nurses, 1 head nurse, 1 educational supervisor, 1 university lecturer, 1 internal-surgical department manager, 1 insurance employee, and 1 social worker). The inclusion criteria were couples able to communicate verbally, married individuals aged 18 years or older, residing with their spouse, with a minimum post-diagnosis duration of six months for Type 2 Diabetes (either themselves or their spouse). To capture a comprehensive spectrum of experiences, a purposive sampling strategy with maximum variation was employed. Data generation involved semi-structured, open-ended interviews supplemented by field notes. Following the acquisition of informed consent and a comprehensive briefing on the research objectives, interviews were scheduled at the participants' convenience regarding time and venue. To ensure data integrity, all dialogues were audio-recorded, and subsequently transcribed with word-for-word accuracy. To ensure thematic saturation and alignment with research goals, the interviewer utilized aflexible interview guide while probing specific emergent narratives.

What were the problems that arose in your life after being diagnosed with this disease (yourself/your wife), and what were the experiences of you and your wife to solve these problems?

After the diagnosis of diabetes mellitus (yourself/your spouse), the degree of your agreement in important life and marital tasks, such as dividing work, spending free time, participating in marriage of children or important life decisions, fulfillment of duties and obligations, shopping, marital and private relationships, How has the type of interaction with the parties' families changed?

After the diagnosis of diabetes mellitus (yourself/your wife), what changes have there been in the level of love, interest, affection, and respect between you and your wife?

What changes has diabetes mellitus (yourself/your spouse) made in the order of your life together, taking care of the necessities of life (providing needs, welfare, and entertainment), the level of care and support you have for each other?

The analysis of qualitative data followed the inductive content analysis approach as delineated by Graneheim and Lundman. To uphold the study's rigor, we adhered to the evaluative framework of Lincoln and Guba (1985), ensuring that the interpretative process met the rigorous standards of credibility, dependability, confirmability, and transferability (34). Several strategies were implemented to enhance the trustworthiness of the findings; notably, prolonged involvement with the data and peer-led reviews provided depth and objectivity. Participant validation—facilitated by member checking—ensured the themes resonated with their lived experiences, while a rigorous search for conflicting evidence through negative case analysis further refined the results. For

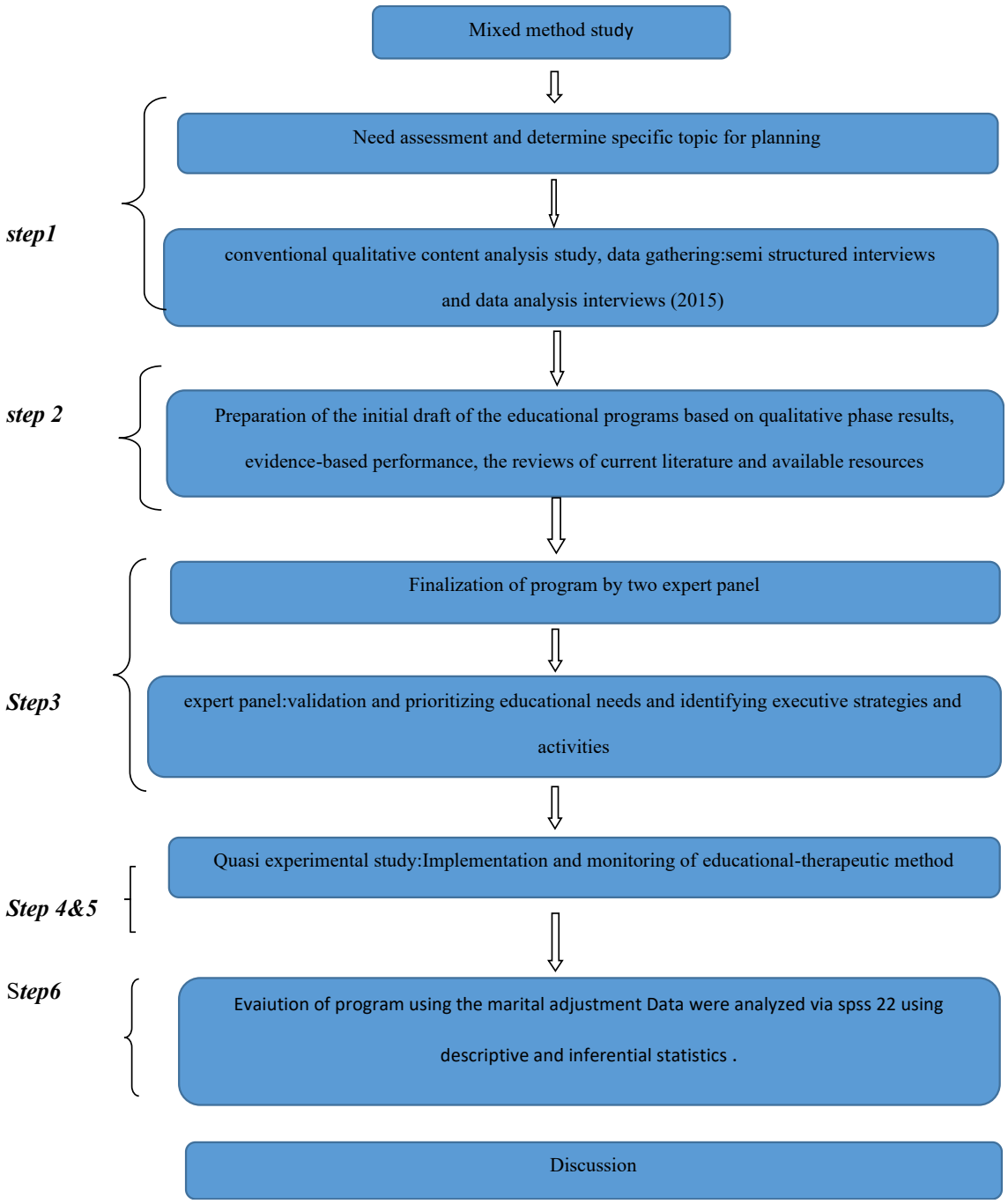

Figure 1. Diagram of the study

dependability, an external audit was conducted; all coding frameworks and thematic extractions were scrutinized by independent academic experts (peer check), ensuring consensus through the resolution of discrepancies. Confirmability was maintained via a comprehensive audit trail, where all research activities and analytical decisions were meticulously documented. To ensure transferability, the findings were reviewed by two external individuals (spouses of T2DM patients) not involved in the primary study, who confirmed the resonance of the results with their lived experiences. Ethical integrity was preserved through strict participant confidentiality. Data management and thematic synthesis were facilitated using MAXQDA 2020.

Step 2: Protocol Development and Initial Design

The second phase of the Talbot framework involved two strategic steps to operationalize the intervention. Initially, a preliminary draft of the marital adjustment program was constructed by synthesizing the qualitative thematic categories into structured quantitative parameters. This involved the formulation of overarching goals, distinct pedagogical objectives, and targeted behavioral activities. Subsequently, an integrative literature review was conducted to benchmark the intervention's content, structural delivery, and evaluative metrics against established global standards. By triangulating qualitative insights with existing clinical evidence, the researchers identified optimal strategies for embedding marital adjustment training within nursing

educational frameworks. The phase culminated in a prioritized draft that synthesized participant needs with feasible executive strategies.

Step 3: Refinement, Validation, and Finalization of the program

To create a holistic training program for couples, we merged qualitative and quantitative insights under a cognitive-behavioral approach. This integration was a core component of the Talbot program's third phase, which served to refine and validate the final intervention. This process incorporated evidence-based practices, expert consensus, and core CBT principles to ensure the intervention was robust for subsequent quantitative evaluation. Validation was achieved via a two-round expert panel technique. Using purposive sampling, we recruited a diverse panel including four cardiology nurses, one cardiologist, two dyads of T2DM patients and their spouses, six nursing faculty members, two psychologists, and two family counselors. In the first round, experts reviewed the preliminary program draft, leading to refined educational priorities and stabilized content. Following this, the research team structured the specific strategies, activities, and session timing. Finally, after aligning the content with established CBT resources and securing the second round of expert approval, the 'CBT-based Marital Adjustment Program' was finalized for implementation (Table 1).

Table 1. Thematic framework and pedagogical content of the CBT-based marital intervention sessions

Sessions	Content
1	Introduction, initial communication, explanation of the method and objectives of the pre-test. Commitment, familiarity with the principles, rules, and objectives of the sessions, and ethical issues such as confidentiality, brief discussion of the disease, its effects on the patient, and marital and family relationships to raise the awareness of the subjects.
2	Review of the previous session. The A-B-C[1] model was trained using examples given by group members. The next step identified destructive beliefs and values and examined why they were problematic. Training was provided on how to register inefficient thoughts, and then, a proportionate assignment was presented (a task about the ABC model and identifying absolute beliefs and values) (25). At this stage, couples' unrealistic expectations, beliefs, and perceptions of marital adjustment were also examined, and the effect of beliefs on emotions and behaviors was shown (23).
3	Rational and irrational thoughts and their differences were identified and discussed, and then, the effect of irrational thinking on the emotional turmoil of couples was explained. Then, the correct or incorrect expectations in marital life were explained. The effect of thought on emotion and behavior was briefly explained. Couples also come up with spontaneous thoughts and types of cognitive errors (arbitrary inference, mind reading, selective abstraction, overgeneralization, magnification, personalization, dichotomous thinking and labeling, and the role of these errors in the occurrence of negative emotions and behaviors) (23, 35).
4	The previous session and homework were reviewed, and then, communication and its types were trained. Guidelines were given to improve verbal communication, and the differences in verbal and non-verbal communication between men and women were explained (36). The concept of communication in family relationships and types of communication patterns were also reviewed and explained (reciprocal construct, avoidance, and expectation/withdrawal). Basic communication skills (listening, speaking, empathy, courtesy, and expression) were trained. Barriers to communication, including judging, providing solutions, and avoiding the other party's worries, and the components of each were discussed; the errors of the speaker and the listener were expressed, and finally, tasks appropriate to these techniques were presented (35) .
5	After reviewing the assignment of the previous session, members were asked to express their feelings and conclusions from the previous session. The concept of conflict was then explained to members. Then, the stages of marital conflicts, the types of couples in terms of conflict (pluralistic, protective, laisez-fair, and consensual couples), and the characteristics of each were explained (37, 38). Then, the types of conversations for resolving conflicts were explained (passive, aggressive, passive-aggressive, and explicit) (39). Similar to the previous sessions, the dysfunctional attitudes and permanent and solvable problems in married life were identified, and tasks appropriate to this session were presented.
6	The previous session and the assignments were reviewed. Then, the enrichment of marital relations and the principles of enrichment in married life were explained. The marital relationship enrichment program, as well as acceptance, tolerance, and change techniques were explained. Appropriate exercises were given proportional to the marital conflicts.
7	The previous session and assignments were reviewed. Intimacy, principles governing intimate relationships, and techniques to increase intimacy in various fields were discussed. Then, the love-making styles were explained, and the caring days technique was trained. Finally, the problem-solving and principles of brainstorming were explained to couples, and then, appropriate tasks were given to them at the end of the session (36, 38).
8	The previous session was reviewed, and then, the goals of the stress management program were explained to the participants based on cognitive-behavioral therapy. The sessions elucidated the fundamental nature of stress and established a taxonomy of stress types based on multi-level physiological and psychological indicators. In addition, the specific effects of stress on disease progression and recurrence were discussed, and the necessary information was provided to the participants. Then, the body's response to stressful conditions (general adaptation syndrome) was examined from the Hans Selye's point of view, and strategies to prevent stress were trained. The factors affecting the experience of stress were explained, and the necessary information about diaphragm breathing and gradual muscle relaxation was provided. Progressive muscle relaxation for 16 muscle groups was trained to the patients' spouses. After the exercise was done and the ambiguities were removed, the members were required to practice this method at least once a day until the next session, and to record the levels of psychological stress and pressure before and after each exercise (13, 23, 26).
9	The previous session and its feedback were reviewed, the assessment process of a stressful situation was trained, and controllable and adaptable dimensions of stress were identified. The curriculum delineated adaptive vs. maladaptive coping, emphasizing the transition from passive to active modalities. It addressed both problem-focused and emotion-focused strategies, alongside available resources, supported by practical homework assignments for skill internalization (35, 38).
10	The homework of the previous session was reviewed and the importance of sex was explained. Initial training focused on the physiology of sexual cycles and gender-based differences in sexual issues. Once sexual misconceptions were addressed and corrected, the program covered both the clinical aspects of sexual dysfunction and the positive impacts of healthy sexual relations. Finally, the couples were equipped with behavioral tools, including systematic desensitization, relaxation techniques, and attention-focusing strategies (40, 41).
11	In addition to reviewing the previous session, mental focus and the pubic muscle exercises were trained, and the couples were given a timetable to do sexual homework on certain days. Homework, such as stop-squeeze technique, was provided for couples (38, 40, 41).

1: According to the A-B-C model, emotional and behavioral disturbances (C) do not stem solely from external adversities (A); rather, they are primarily shaped by the irrational belief systems (B) through which individuals interpret such events.

Steps 4 and 5: Execution and Clinical Oversight of the CBT-Based Marital Adjustment Program (Quasi-Experimental)
This study adopted a pretest-posttest control group, quasi-experimental framework. The target population included T2DM patients and their spouses who referred to Zahedan University of Medical Sciences' affiliated cardiovascular clinics and academic hospitals between 2023 and 2024. The inclusion criteria included a definitive diagnosis of type 2 diabetes mellitus at least six months after its occurance, cohabitation at the time of the study, living in Zahedan, attendance at all couples therapy sessions, and no other physical or mental illnesses affecting marital adjustment, such as admission to psychiatric hospitals, cancer, or autoimmune diseases. The study's exclusion protocol prioritized maintaining a stable therapeutic environment; hence, couples facing major crises, addiction, or polygamy were excluded. Moreover, to ensure the integrity of the dyadic intervention, couples were disqualified if session attendance was inconsistent (missing > 2 sessions) or if participation was not dyadic in nature (wife or husband alone).

Following the acquisition of the requisite ethical clearance and formal administrative approvals, the primary investigator initiated the intervention phase. The researcher referred to the hospitals and cardiovascular clinics affiliated to Zahedan University of Medical Sciences. After selecting the samples, explaining the research method, and coordinating with couples for participating in educational sessions, the researcher provided patients and their spouses with a written consent form. Both groups were asked to complete the DAS in the pre-test stage. The convenience sampling, as well as randomized allocation, were used in this research. First, 55 couples were examined according to the inclusion criteria, of whom nine couples were excluded, and 46 couples were included in the study. A table of random numbers was used to randomly assign the samples to the intervention and control groups. A total of six couples (three per group) were excluded following the intervention phase due to non-compliance with the educational sessions and the onset of severe familial conflicts. Consequently, the final analytical sample comprised 40 dyads, with 20 couples successfully completing the protocol in each of the intervention and control groups (Figure 2).

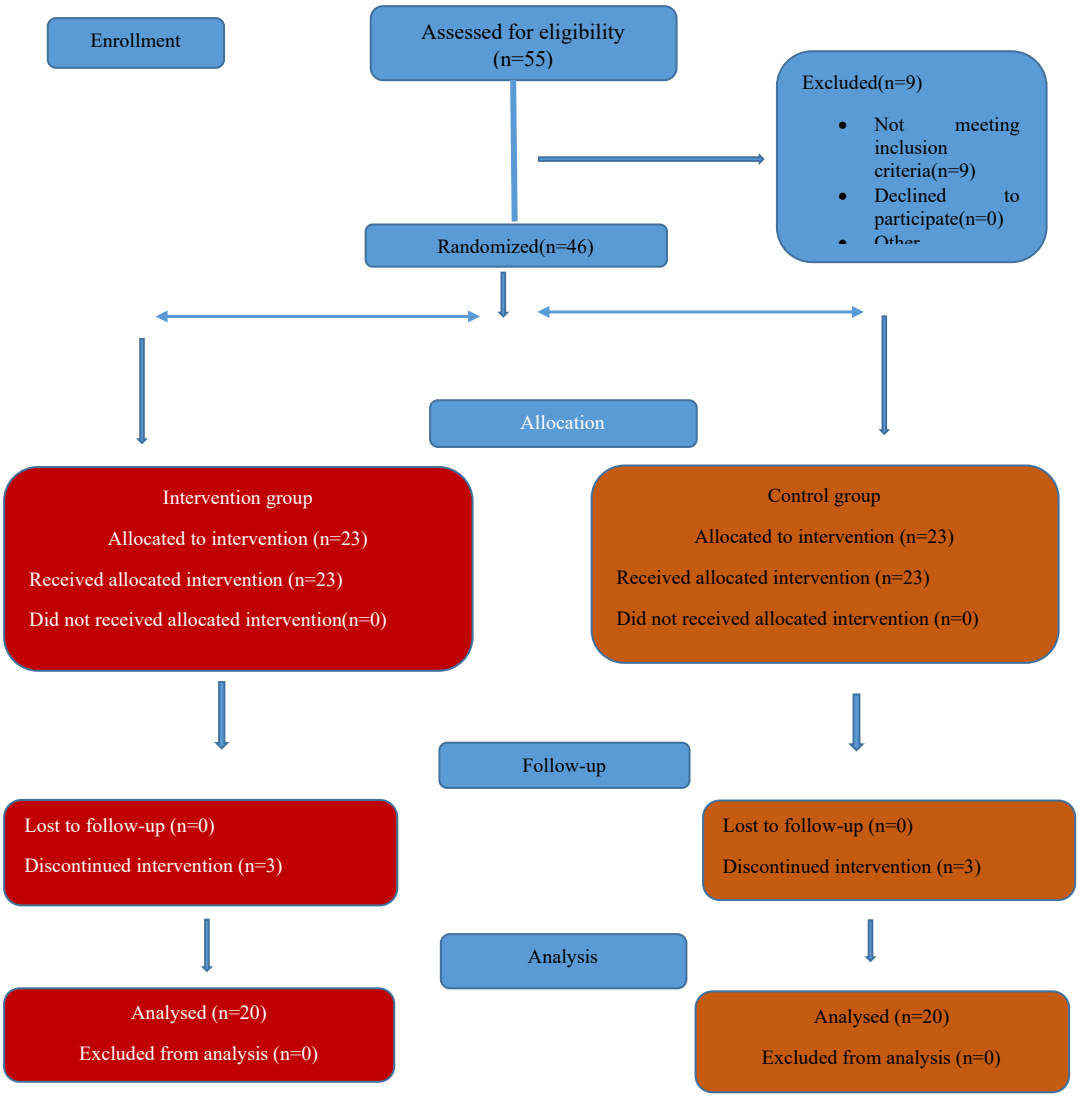

Figure 2. To maintain structural equivalence between the intervention and control groups, participants were recruited based on a stringent framework of eligibility and exclusion parameters.

The intervention cohort underwent a structured program consisting of 11 sessions of cognitive-behavioral couple therapy (CBCT). The training sessions' material was based on the cognitive-behavioral approach and available resources. It was possible to customize the quantity and content of sessions for each couple. The essential principles of cognitive-behavioral couple therapy were observed in each session, so the researcher managed the sessions in terms of the offered topics and their schedule. The therapeutic protocol integrated a consistent routine of assignment review and feedback. To facilitate dyadic participation, session timings were determined by the participants' mutual preferences. These sessions occurred thrice weekly, with a duration ranging from one to two hours per meeting. Table 1 outlines the structured protocol, specifying the thematic focus and content delivered during the training sessions.

The control group was under the observation of the researcher and was far from the independent variable intervention due to the respect of scientific principles, and the couples of the intervention group did not have any contact with the control group. Four weeks after the intervention, post-test was performed for both groups. Both groups were contacted to attend and complete the DAS. If the couples did not want to go to the hospital and complete the questionnaire, they could complete the questionnaire at home.

Step 6: The Efficacy of the Cognitive-Behavioral Couple Intervention Quantitatively Using the Marital Adjustment Scale

Marital adjustment and relationship quality were quantified via the 32-item Spanier Dyadic Adjustment Scale (DAS). This 32-item scale serves as a self-administered measure to quantify marital quality. It is applicable to diverse dyadic contexts, including husband-wife relationships and other forms of long-term cohabitation, ensuring a comprehensive evaluation of the dyad's interpersonal functioning (42, 43). The overall score of this scale ranges from 0 to 150, which is derived from all items (42, 44). This measure is graded on a 5-point Likert scale ranging from never (zero) to always (five) (31). Based on the Spanier's factor-analytic findings, the DAS encompasses four distinct dimensions of relationship health: dyadic satisfaction, consensus, cohesion, and the expression of affection (15, 31, 45, 46). He also employed the Locke-Wallace scale (1959) to determine the DAS construct validity. In married individuals, the correlation between the two scales was 0.86, whereas in divorced people, it was 0.88 (47).

The internal consistency of the scale was previously validated by Spanier, who reported a robust Cronbach's alpha coefficient of 0.96 for the total score, indicating excellent reliability. The subscales of marital satisfaction (0.94), marital consensus (0.90), marital cohesion (0.86), and affection expression (0.73) were all shown to be highly reliable (15, 48). This scale has been translated into Persian by Sanaei and widely utilized in Iranian research. Sanaei investigated the scale's content validity. Using the Locke-Wallace scale, he assessed the scale's concurrent validity and found a correlation of 0.79 between the two scales (44).

The reliability of this scale has been investigated in many studies in Iran, including a study conducted by Amoozgar and Hosseinnejad (1995). Statistical analysis showed a robust correlation coefficient of 0.86 for the total scale. Regarding the internal dimensions, the coefficients for marital satisfaction, cohesion, consensus, and affectional expression were 0.68, 0.75, 0.71, and 0.61, respectively (42). To evaluate the instrument's reliability within the present sample, internal consistency was assessed, yielding a Cronbach's alpha coefficient of 0.84.

To assess the sustained impact of the intervention, a follow-up evaluation was conducted one month after implementation. During this interval, participants were encouraged to integrate the cognitive-behavioral strategies into their daily dyadic interactions, after which they completed the post-intervention questionnaires.

Statistical Analysis

Quantitative data were processed via SPSS version 22. To address the research questions, a comprehensive analytical framework was adopted, incorporating ANCOVA to adjust for baseline variances. Group comparisons were facilitated via independent and paired t-tests, supplemented by the Chi-square analyses for proportional data. Descriptive metrics were also used to provide an overview of the sample characteristics ($P \leq 0.05$). The researcher also held training sessions for the control group to observe ethical considerations in the research and to appreciate the collaboration of the couples in the control group.

Results

During the preliminary stage of the study, 36 semi-structured interviews were executed with a cohort of 30 individuals, who were identified through a purposive sampling strategy to ensure data richness. The cohort included 13 patients, eight spouses, four nurses, two nursing faculty members, as well as a social worker, an insurance representative, and a patient's daughter. This diverse range of perspectives ensured a comprehensive data set. Detailed sociodemographic and professional characteristics of the participants are summarized in Tables 2 and 3.

A total of 19 specialists participated in two expert panels to refine the program. These experts possessed significant clinical and academic experience (mean age: 48.7 years; mean experience: 23 years), with a gender composition of eight males and eleven females.

The demographic profile and educational background of the individuals involved in the program's evaluation phase are presented in Table 4. Preliminary analyses indicated no statistically significant differences between the two groups regarding demographic and clinical characteristics, including educational attainment,

Table 2. Socio-demographic and professional profiles of the qualitative phase participants (step 1)

Group Demographic variables	Patient		Wife/	Husband	Patient's daughter	Nurse	Faculty member	Social worker	Insurance worker
Gender	Male	8(26.6)	5(16.6)		-----	1(3.33)			1(3.33)
	Female	5(16.6)		3(10)	1(3.33)	3(10)	2(6.66)	1(3.33)	
Education level	Uneducated	6(20)	1(3.33)		1(3.33)	-----	----	----	----
	Writing & reading literacy	1(3.33)	---	-----	-----	----	----	----	----
	Middle/high school	1(3.33)	1(3.33)	-----	-----	-----	-----	-----	-----
	Diploma	3 (10)	2(6.66)	2(6.66)	-----	-----	-----	-----	-----
	Academic	1(3.33)	1(3.33)	-----	-----	4(13.3)	2(6.66)	1(3.33)	1(3.33)
Job	Employed	1(3.33)	1(3.33)	-----	-----	4(13.3)	2(6.66)	1(3.33)	1(3.33)
	Retired	1(3.33)	-----	2(6.66)	16 (20)	-----	-----	-----	-----
	Housewife	5 (16.6)	4(13.3)	-----	1(3.33)	-----	-----	-----	-----
	Self-employed	6(20)	-----		-----	-----	-----	-----	-----

Table 3. Demographic characteristics of interviewees in the qualitative study (step 1)

Quantitative variables	Mean ± SD			Mean ± SD			
	Patient	Wife	Husband	Nurse	Faculty member	Social worker	Insurance worker
Age (year)	56.5 ± 4.99	47.2 ± 5.73	63.3 ± 4.24	47.6 ± 3.34			
Marriage duration	30.7 ± 6.43	28.6 ± 4.52		-----			
Number of children	4.92 ± 1.96	4.37 ± 1.35		-----			
Illness duration	7.38 ± 3.34	7.00 ± 3.32		-----			

Table 4. Comparative Analysis of Socio-Demographic Characteristics Between the Intervention and Control Groups

Group Demographic variables		Intervention (percent) number	Control (percent) number	Total (percent) number	Chi-squared test results
Education level	Uneducated	5 (12.5)	8 (20)	13(16.3)	0.656
	Writing & reading literacy	4(10)	4 (10)	8 (10)	
	Middle/high school	8 (20)	7 (17.5)	15 (18.8)	
	Diploma	11 (27.5)	14 (35)	25 (31.3)	
	Academic	12 (30)	7 (17.5)	19 (23.8)	
Occupational status	Employed	9 (22.5)	13 (32.5)	22 (27.5)	0.550
	Retired	10 (25)	6 (15)	16 (20)	
	Housewife	9 (22.5)	11 (27.5)	20 (25)	
	Self-employed	12 (30)	10 (25)	22 (27.5)	
Quantitative variables	**Mean ± SD**		**Mean ± SD**		**t-test**
Age (year)	8.08 ± 49.9		48.9 ± 7.73		0.47
Marriage duration	23 ± 6.43		20.5 ± 5.62		0.06
Number of children	5.27 ± 1.96		5.12 ± 1.85		0.72
Illness duration	7.80 ± 3.64		7.35 ± 3.52		0.57

occupational status, age, and marriage duration. Similarly, the cohorts were comparable in terms of the number of children and the duration of illness, confirming baseline homogeneity (Table 4) ($P \geq 0.05$).

The development, execution, and assessment of the cognitive-behavioral couple intervention were guided by the six-stage framework proposed by Talbot and Verrinder. This model provided a structured approach to the program's design, monitoring, and final evaluation (Figure 1).

Steps 1.2.3

A detailed appraisal of the couples' educational needs, combined with an exploration of the clinical and academic contexts of cognitive-behavioral approaches, formed the basis of the needs assessment. This allowed the researchers to tailor the intervention's activities and contents effectively. The needs assessment incorporated insights and practical recommendations from a multidisciplinary team, including nurses, cardiologists, psychologists, family counselors, and faculty members. By integrating their clinical experiences with real-world case studies and scenarios, the researchers developed a curriculum that resonated with the participants' lived experiences, thereby reinforcing the training's impact

on marital adjustment. The qualitative phase revealed a complex array of individual, familial, social, and cultural factors influencing the relationships of couples managing Type 2 Diabetes Mellitus (T2DM). These qualitative themes ranging from fears and misconceptions to interpersonal conflicts were systematically translated into specific therapeutic objectives. Ultimately, by synthesizing these findings with expert consensus, literature reviews, and established cognitive-behavioral principles, a comprehensive intervention program was formulated to address the multifaceted challenges of marital adjustment in this population. The educational content designed by challenging the beliefs, thoughts, and views of the couple taught cognitive-behavioral methods so that people can challenge the above-mentioned items based on the ABC model in the form of homework and make the necessary cognitive changes in their view create their own beliefs and feelings. Doing homework in each couple training session led to the stabilization of cognitive and behavioral changes created in couples. Six major thematic areas were identified to constitute the final CBT-oriented program, aiming to achieve a singular central outcome. The comprehensive overview of the training's content is presented in Table 1.

Steps 4 and 5

The instructional framework was distributed across 11 sessions designed to yield measurable therapeutic changes. For the intervention group, a specialized CBT-based curriculum was administered through separate weekly encounters for each couple at the Ali Ibn Abi Talib (AS) Medical Center. Every session consistently followed the core principles of cognitive-behavioral therapy to maintain the integrity of the educational intervention.

The sessions start by reviewing the assignments of the previous session and end by presenting the assignments for the next session and taking feedback. It was possible to change the number and content of sessions in a specialized way for each couple. The time of the meetings was set based on their opinion, considering that both couples should be present, and each meeting was set between one and two hours on average. The researcher managed the meetings in terms of the discussions presented and their timing. Four weeks after the end of the counseling sessions, the intervention and control groups answered the aforementioned questionnaire again. It was worth mentioning that this therapeutic-educational method was carried out in the form of various sections, including collecting background information, determining the scope of the problem, comparing each person›s perception of the problem, listening to their own and their spouse›s distorted beliefs, etc.

Step 6

To determine the impact of the cognitive-behavioral training sessions, the study utilized a standardized Marital Adjustment Scale. This facilitated an objective measurement of the program's success in improving couple-related outcomes. The pre- and post-intervention mean scores and standard deviations for the DAS and its four domains are summarized in Table 5, highlighting the distribution between the treatment and control groups. The mean scores of DAS subscales were lower in the intervention group before cognitive-behavioral couple therapy-based training. The results of the paired t-test showed a statistically significant difference in all subscales before and after the test ($P<0.001$). The mean scores of DAS subscales were not significantly different in the control group before and after cognitive-behavioral couple therapy-based training. The paired t-test analysis revealed that scores across all subscales remained statistically stable within this group, with no significant longitudinal variations observed between the pre- and post-intervention assessments ($P\geq0.05$).

The mean and standard deviation of marital adjustment in the intervention (95.9 ± 7.42) and control (62.1 ± 5.49) groups were obtained. Statistical appraisal via independent t-testing confirmed that the mean scores of the intervention and control cohorts were significantly distinct, highlighting a clear separation between the two groups $t(78)=0.14$, $P<0.001$. To quantify the magnitude of this difference, Cohen's d was 5.17, indicating a very large effect size.

Data presented in Table 6 indicate that while pre-intervention mean scores exhibited no significant disparities between the two cohorts, the post-test results showed a marked improvement in the intervention group, significantly outperforming the control group. The ANCOVA test was used to evaluate the significance of this difference. Shapiro-Wilk and Levene tests were used to test the assumptions of analysis of covariance.

The results of the analysis of covariance (ANCOVA)

Table 5. Comparative Analysis of Mean DAS Subscale Scores: Longitudinal Changes Within and Between the Intervention and Control Groups

Group DAS subscales	Intervention			Control		
	Before	After	Paired t-test *P*-value	Before	After	Paired t-test *P*-value
	Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	
Satisfaction	25.3 ± 6.71	30.3 ± 7.98	$P<0.001$	25.3 ± 6.45	25.3 ± 9.78	0.72
Cohesion	10.7 ± 1.89	17.6 ± 2.36	$P<0.001$	10.3 ± 2.54	9.62 ± 2.00	0.14
Consensus	24.6 ± 4.97	37.3 ± 5.05	$P<0.001$	21.8 ± 5.34	20.6 ± 3.99	0.13
Affection expression	6.42 ± 1.86	10.2 ± 1.75	$P<0.001$	1.77 ± 6.02	1.63 ± 5.92	0.73
Total score of DAS	67.3 ± 6.89	95.9 ± 7.42	$P<0.001$	63.8 ± 7.09	62.1 ± 5.49	0.14

Table 6. The results of ANCOVA in the intervention and control groups

Variables	Groups	Total Squares	Freedom degree	Mean squares	F	Significance level	Eta	Test's power
Total DAS score	Pretest	15.457	1	15.457	0.377	0.54	0.219	1
	Pretest* group	193.877	1	193.877	4.726	0.12		
	Group	873.596	1	873.596	21.295	0.0001		
Marital satisfaction	Pretest	1.541	1	1.541	0.103	0.74	0.07	1
	Pretest* group	43.722	1	43.722	2.932	0.09		
	Group	90.117	1	90.117	6.043	0.01		
Cohesion	Pretest	2.316	1	2.316	0.480	0.49	0.17	1
	Pretest* group	3.593	1	3.593	0.745	0.39		
	Group	78.060	1	78.060	16.187	0.0001		
Consensus	Pretest	56.487	1	56.487	2.917	0.09	0.284	
	Pretest* group	81.217	1	81.217	4.195	0.64		
	Group	582.790	1	582.790	30.100	0.0001		
Affection expression	Pretest	14.425	1	14.425	5.31	0.02	0.21	
	Pretest* group	4.394	1	4.394	1.819	0.18		
	Group	55.023	1	55.023	20.282	0.0001		

confirmed that the CBT-based training program led to a significant improvement in marital adjustment scores, demonstrating its therapeutic potency for couples post-T2DM diagnosis. The results showed that the total score of the DAS ($F = 21.295$, $P = 0.0001$) was obtained from F with freedom degrees of 1 and 78. It has a significance level of less than 0.01, with 99% confidence. Therefore, there was a significant difference in the mean pretest and posttest scores of the intervention group, and cognitive-behavioral couple therapy-based training increased the marital adjustment of couples in the intervention group. Eta squared showed a 21-point increase in marital adjustment of participants in the intervention groups.

Regarding the DAS subscales, including marital satisfaction ($F = 6.043$, $P = 0.01$), cohesion ($F = 16.187$, $P = 0.0001$), consensus ($F = 30.100$, $P = 0.0001$), and affection expression ($F = 20.282$, $P = 0.0001$), there was a significance level less than 0.01, with 99% confidence. Therefore, there was a significant difference in the mean pretest and posttest scores of the intervention group, and cognitive-behavioral couple therapy-based training increased the DAS subscales in the intervention group following a type 2 diabetes mellitus.

Discussion

This research was conducted to develop, execute, and appraise a CBT-oriented dyadic intervention aimed at enhancing marital adjustment in the context of Type 2 Diabetes Mellitus (T2DM). By synthesizing qualitative data, existing literature, and expert consensus, the program was specifically tailored to the needs of these couples. A pivotal finding was the extraordinary impact of the intervention, which yielded a Cohen's d effect size of 5.17. This value substantially surpasses the traditional benchmark for a 'large' effect (0.8), suggesting that the program provides not only statistical significance but also profound clinical utility for improving the relationship dynamics among Iranian couples managing T2DM.

Consistent with prior research, the utilization of psychosocial models is recommended to guide the design and implementation of health-related training. These models offer a systematic approach to assessing client values and cognitive functioning. Integrating these insights allows for a more tailored clinical approach, where collaborative problem-solving replaces traditional didactic methods, thereby enhancing the relevance of the intervention (34, 49). As highlighted by Tessier et al. (2021), conducting a needs assessment facilitates a deeper comprehension of the participants' concerns, thereby enhancing the pedagogical value of the program. This preliminary phase also plays a crucial role in establishing a conducive educational environment, as it solidifies the relationship between the trainers and the couple, ensuring higher engagement (50).

The results of this study showed that CBCT-based training was effective in increasing the marital adjustment and its subscales in spouses following T2DM, and improved marital adjustment of couples in the intervention group. These results are consistent with the findings of Durães et al. (2020) who reported that CBCT was effective in improving marital adjustment and its subscales in married students (51). Ostadi et al. (2014) also demonstrated that cognitive-behavioral training had an effect on couples' attachment style and their dysfunctional attitudes, changed unsafe styles to safe ones, and reduced dysfunctional attitudes (52). Consistent with our results, Ahmaditabar et al. (2018) demonstrated that interventions rooted in cognitive-behavioral family therapy function as a potent catalyst for enhancing marital harmony. Their findings underscore the efficacy of this approach in simultaneously bolstering resilience and the overall quality of life among participating couples (15). Salimi et al. (2012) showed that by increasing communication skills and resolving conflicts between couples, cognitive-

behavioral approach reduced dissatisfaction and increased adjustment (53). This result is consistent with the results of several studies (30, 54-60).

Cognitive-behavioral therapy (CBT) is skill-based. By training cognitive skills, restructuring couples' communication and activating speaker-listener skills, problem solving (54) and positive change in thinking (55), CBT helps couples to correct and replace their wrong thoughts, beliefs, and attitudes (56). In addition, with positive behavioral changes and pleasurable marital activities (57) and appropriate self-disclosure that were trained in the present study, CBT caused couples to easily express their feelings and emotions in their marital relationships, which strengthened the marital relationship and intimacy (58).

Participating in a CBCT-based training program also increased communication skills, conflict resolution skills, love-making, created positive and negative emotions in the right way, removed egocentrism, created empathy, responsibility, and cooperation in couples, disappeared negative experiences, and increased the couples' sexual skills and awareness of themselves and their spouse in the intervention group. Training skills such as reciprocal communication, reciprocal strengthening, and listening, correct expression of needs and feelings increase interaction and the marital adjustments (59). This type of training also equips couples with basic skills and extends them to other levels of married and social life. Therefore, couples feel confident and hopeful in dealing with conflicts and try to solve problems (60). CBT helps couples to be active observers, evaluate their cognitions, and modify their behavioral interactions to create more positive cognitions and emotions about each other, and thus, create a more satisfying marital relationship (61). In other words, the couples' marital adjustment to the stressful sources of the relationship increases by correcting defective cognitions (62).

The results of the present study also showed that the CBCT-based training program could make a difference in the subscales of marital adjustment between the intervention and control groups. This result is consistent with the results of the study by Safak et al. (2017) (63), Shafiei et al. (2019) (30), and Mokari et al. (2015) (64).

Miri et al. (2016) showed that relationship enrichment was effective in increasing marital adjustment and its subscales, including marital satisfaction, marital cohesion, marital consensus, and affection expression (65). However, Shamohammadi showed that communication skills training had a positive effect on the consensus and affection expression of couples, but it did not have a positive effect on marital satisfaction and marital cohesion(66).

The robust effectiveness of this intervention stems from its multi-dimensional design, which meticulously integrated cognitive restructuring with behavioral skill-building. By addressing maladaptive attributions and unrealistic relationship standards, while simultaneously equipping couples with systematic problem-solving and conflict-resolution strategies, the program fostered a comprehensive improvement in marital adjustment. Among the limitations of this study in the quantitative part, we can mention the large number of couple training sessions and the fatigue of some samples, who were encouraged to continue the treatment after talking with the couples, and the practical and positive effects of the sessions in their life process. The primary limitation of the present research is the absence of a longitudinal follow-up phase. Consequently, future studies should incorporate multi-stage assessments (e.g., at 6 and 12 months) to evaluate the sustainability of the intervention's benefits. Furthermore, conducting large-scale randomized controlled trials with more rigorous control over confounding variables is essential to confirm the long-term efficacy of CBT-based dyadic training in maintaining marital adjustment among patients with T2DM.

It is worth mentioning that the quantitative phase faced many issues and challenges due to the self-reporting nature of the marital adjustment questionnaire, including the fact that individuals might give incorrect answers and make their marital adjustment status appear much better than normal because individuals did not want their incompatibilities in their married life to be revealed. For this reason, given the complexity of the research question, the researchers decided to obtain the answer in a more advanced way than words in qualitative studies and numbers in quantitative studies. Since in this qualitative research, participants were free to express their experiences and were not limited to the questions of the questionnaire; many aspects related to the marital adjustment of couples following T2DM were discovered and used in the design of the program.

Conclusion

This research underscores the utility of the Talbot and Verrinder framework in the systematic development and appraisal of a CBT-based intervention for marital adjustment. By integrating a diverse range of perspectives from participating couples to multidisciplinary experts this model facilitated a tailored approach to needs assessment and curriculum design. The significant statistical divergence between the study groups validates the efficacy of these instructional strategies, confirming the program's potential to substantively enhance relationship quality in the clinical management of couples. These findings have important practical applications. It is proposed that this intervention be integrated as a complementary service package within Iran's healthcare system (delivered by nurses in primary health centers and by psychologists in diabetes clinics). Furthermore, with cultural adaptation, it has the potential to be implemented in the healthcare systems of other countries. To investigate the long-term sustainability of the effects, future studies with larger samples are recommended. Therefore, this educational-therapeutic method is suggested to be used in rehabilitation programs in addition to other psychological and non-pharmacological interventions.

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Competing Interests
The authors declare that they have no conflict of interests.

Data Availability Statement
The data presented in this study are uploaded during submission as a supplementary file and are openly available for readers upon request.

Ethical Approval
The project was approved by the Ethics Committee of Zahedan University of Medical Sciences (Ethical approval code: IR.ZAUMS.REC.1404.335). https://ethics.research.ac.ir/IR.ZAUMS.REC.1404.335.

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