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Research Paper

Strength in Partnership: The Impressive Positive Impact of Couple-Based Interventions on Glycemic Control in Type 2 Diabetes Management

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ABSTRACT

Background: Social and familial support significantly improves type 2 diabetes (T2D) management, yet couple-based interventions remain underexplored. This study evaluates the effects of perceived social support, measured via the Multidimensional Scale of Perceived Social Support (MSPSS), on glycemic control, FBS, weight, and BMI among married couples with T2D. **Methodology:** A 90-day retrospective study involving six married couples (12 participants) enrolled in the SugarFit Diabetes Reversal and Management Program (SDRMP) was conducted over 90 days. Couples were categorized into high-support, moderate-support, and low-support groups based on MSPSS scores. Interventions included joint dietary plans, fitness routines, behavioral coaching, and emotional wellness sessions. Pre- and post-intervention measures of HbA1c, FBS, weight, and BMI were recorded. **Results**: Participants showed significant improvements in glycemic control and weight management. Couples receiving high/high support (both husband and wife) experienced notable HbA1c reductions (up to 3.5% in husbands, 1.8% in wives) and weight loss (up to 14.4 kg in husbands, 6.6 kg in wives), with MSPSS scores of up to 56 for husbands and 54 for wives. Moderate/moderate support led to more modest improvements (up to 0.7% HbA1c reduction and 1.4 kg weight loss in husbands, with stable weight in wives), with MSPSS scores up to 40 for husbands and 31 for wives. High/moderate support yielded intermediate results (up to 1.8% HbA1c reduction and 2 kg weight loss in husbands, 1 kg in wives), with MSPSS scores up to 47 for husbands and 39 for wives. Higher MSPSS scores were strongly correlated with greater reductions in HbA1c and weight, emphasizing the importance of spousal and family support, with couples receiving high/high support achieving the best outcomes. **Conclusion:** Couple-based interventions significantly improve glycemic levels and weight loss in T2D couples with high MSPSS scores. These findings emphasize the value of social support in diabetes care. Personalized interventions leveraging mutual support can

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enhance clinical and relational outcomes. Future research should explore long-term effects and broader demographic applicability.

Keywords: *Couple-based interventions, spousal mutual support, family support, shared health behaviors, glycemic control, weight loss, overall well-being*

Type 2 diabetes (T2D) has become an increasingly significant public health concern, as its prevalence has surged dramatically over the past three decades. From a mere 7% in 1990, global T2D prevalence has now escalated to 14% in 2022, highlighting the urgent need for innovative and effective management strategies to accommodate this chronic and multifaceted nature of diabetes [1]. The complexity of T2D arises from various interwoven factors, including genetic predispositions, environmental influences, and lifestyle choices, all of which serve to complicate its management [2].

Moreover, despite advancements in clinical management, such as the implementation of pharmacological treatments and lifestyle modifications aimed at improving blood glucose control, it has become increasingly clear that social and familial dynamics play a pivotal role in diabetes management. Within intimate relationships, particularly marriages, partners often share living environments that foster interconnected dietary practices, physical activity patterns, and adherence to medication regimens. This interdependence underscores the crucial impact of spousal involvement on effectively managing T2D, a factor that has been shown to directly influence the success of diabetes control efforts and ultimately promote better health outcomes [3].

Marital relationships serve as a vital source of support in managing T2D through both emotional and practical avenues [4]. Spouses provide essential emotional backing that can alleviate stress, promote self-care practices, and enhance treatment adherence. They often engage in collective responsibilities such as meal planning, exercising together, and managing medications—all vital components for achieving optimal glycemic control. Despite the recognized importance of spousal support, couple-based interventions remain largely underexplored. Existing literature tends to focus predominantly on individual-level interventions, neglecting the considerable potential of collaborative approaches aimed at engaging both partners in effective T2D management [5].

Research consistently suggests that individuals with supportive spouses are more inclined to adopt health-promoting behaviors—including nutritious eating, regular physical activity, and adherence to medication regimens [6]. However, rigorous implementation of structured couple-focused interventions geared specifically towards diabetes management for both partners is still in the exploratory phase. While prior studies link emotional support from spouses to improved self-care routines and glycemic outcomes, systematic investigations into couple-based interventions targeting clinical outcomes for both partners remain scarce. Moreover, the influence of family dynamics and emotional support on the efficacy of diabetes management practices is not comprehensively documented.

This study endeavors to fill this gap by meticulously examining the effectiveness of couple-based interventions on glycemic control within married couples affected by T2D. It specifically focuses on the impact of structured couple-centric programs in stabilizing or normalizing HbA1c levels among husbands and wives with diabetes. Additionally, the study will explore the correlation between spousal support—evaluated through the Partner

Subscale of the Multidimensional Scale of Perceived Social Support (MSPSS)—and advancements in glycemic control. By accentuating the dynamic aspects of spousal relationships and mutual support, the study aims to establish more effective, family-centered approaches to diabetes management that capitalize on the strengths inherent in intimate partnerships, ultimately fostering improved health outcomes.

Aim and Objective

This retrospective study aims to evaluate the effectiveness of couple-based interventions in improving glycemic control, particularly by normalizing HbA1c levels in couples with diabetes where both partners have type 2 diabetes (T2D). The study seeks to assess the impact of shared health management on both glycemic control and the overall well-being of couples with diabetes, exploring how spousal and family support, as measured by the Multidimensional Scale of Perceived Social Support (MSPSS), contribute to promoting joint health behaviors and managing diabetes.

Primary Objective

- To assess the impact of couple-based interventions on the reduction of HbA1c levels in husbands and wives with type 2 diabetes over a specified intervention period.

Secondary Objectives

- To evaluate the relationship between spousal support (as assessed by Partner Subscale of MSPSS) and improvements in glycemic control (HbA1c reduction) in both partners with diabetes, specifically exploring how emotional support from the partner impacts glycemic control.
- To investigate the correlation between family support (as measured by the Family Subscale of the MSPSS) and the overall management of diabetes within couples with diabetes, including the effects of family support on adherence to medication, lifestyle changes, and emotional well-being.
- To determine the influence of couple-based interventions on lifestyle changes, including diet, physical activity, and medication adherence, assessing how these modifications relate to improvements in glycemic control.

Background

T2DM is a complex chronic condition that extends far beyond the confines of individual medical management, particularly within the intricacies of married couples where both partners are affected by type 2 diabetes [7]. This extensive background delves into the multifaceted nature of couple-based diabetes management and its tangible impacts on glycemic control [8].

Recent years have witnessed a significant shift in the paradigm of diabetes management, increasingly acknowledging the essential role interpersonal relationships play in influencing health outcomes [9]. Emerging research substantiates that couple-based interventions can substantially enhance glycemic control and overall health outcomes, particularly when both partners are actively involved in the management process. This emerging understanding reflects a deeper comprehension of how intimate relationships shape health behaviors and outcomes [10].

Berry, E., et. al., pointed out that the dynamics within the relationship become uniquely intricate when both partners in a couple are simultaneously living with T2DM [11].

Investigations reveal that couples facing dual diabetes diagnoses confront distinctive challenges and opportunities in their shared health endeavors [12]. The mutual comprehension of each partner's condition not only cultivates heightened empathy and support but also introduces challenges in pursuing individual health goals within a shared environment [13].

Prior research has consistently highlighted the significance of spousal support in managing chronic conditions like T2D. In particular, the dynamics within couples where both partners are afflicted by diabetes have been the subject of increasing attention [14]. Studies indicate that couples who engage collectively in diabetes management programs experience enhanced outcomes across both clinical measures and relationship quality. This synergistic effect is especially pronounced when partners can share their experiences and strategies for navigating their joint health journey [15].

Moreover, the psychological consequences of managing diabetes as a couple give rise to unique challenges and opportunities [16,17]. Recent research underscores that invisible social control between partners can exert considerable influence on glycemic control, revealing that the subtle dynamics of spousal interaction play an essential role in determining health outcomes. In situations where both partners have diabetes, these psychological factors become even more complex, compelling each partner to navigate the simultaneous roles of both patient and caregiver [18].

Cultural contexts significantly shape the effectiveness of couple-based diabetes management, as research has shown that cultural beliefs and practices heavily influence couples' approaches to shared disease management, particularly in dietary choices, exercise habits, and medication adherence [19]. Understanding these cultural nuances is crucial in developing effective interventions that cater to diverse populations.

Recent advancements in couple-based diabetes management have led to innovative approaches that leverage technology-enabled interventions and structured couple-based programs showing promising potential for improving outcomes. When tailored to address the unique needs of couples where both partners suffer from diabetes, these interventions aim to harness the shared experience of living with the condition to enhance treatment adherence and lifestyle modifications [20].

Extensive research has highlighted the crucial role of the shared environment in managing diabetes within couples. For couples living with the condition, this environment presents both unique challenges and valuable opportunities for coordinated health management [21]. Numerous studies validate that couples involved together in intervention programs exhibit improved synchronization of health behaviors, resulting in better glycemic control for both partners. This synchronization becomes especially crucial when both partners manage diabetes, as their daily routines and dietary practices directly influence each other's health [21,22].

Despite the growing body of evidence favoring couple-based interventions, significant research gaps still abound. Current literature emphasizes the pressing need for longitudinal studies to elucidate the long-term effectiveness of couple-based interventions, particularly for couples where both partners are living with diabetes [23]. There remains a compelling

need to devise and validate culturally adapted intervention models capable of addressing the diverse needs encountered among different populations.

This evolving perspective on the dynamics of couple-based diabetes management reflects the necessity of developing targeted interventions that leverage the unique characteristics of relationships where both partners contend with T2DM. Evidence points to the potential of such strategies to positively influence health outcomes for both individuals while simultaneously fortifying their relationship through collective health management objectives.

METHODOLOGY

Study design and site:

Study Design

This retrospective study focused on evaluating the impact of couple-based interventions on glycemic control among married couples diagnosed with T2D. Couples with type 2 diabetes participated in the study, all of whom were enrolled in the SugarFit Diabetes Reversal and Management Program (SDRMP) following a standardized protocol. Both the husband and wife were assigned the same coach to ensure consistent guidance and support. The study was conducted over a period of 3 months, during which data were collected at baseline and at the end of the intervention phase to assess the outcomes. The interventions included behavioral coaching, dietary planning, exercise recommendations, and counseling, delivered through a virtual platform.

Study Population

The study involved 6 married couples, both individuals were diagnosed with T2DM, yielding a total of 12 participants (6 husbands and 6 wives). The **mean age and height** of the participants were recorded, providing demographic insights into the study population.

- **Inclusion Criteria:**
  - Both husband and wife must be diagnosed with T2D, indicated by an HbA1c level greater than 6.5%.
- **Exclusion Criteria:**
  - Diagnosed with advanced complications of diabetes, such as end-stage renal disease or severe cardiovascular conditions, which could impact the study's outcomes.
  - Participation in other diabetes management programs during the study period to avoid overlapping interventions.
  - Any acute medical condition requiring hospitalization within three months prior to enrollment in the study.

Assessment Methodology of Relationship Dynamics and Support in Couple-Based Diabetes Management using MSPSS survey

The MSPSS serves as a pivotal tool in assessing the influence of social dynamics on health outcomes. Designed to measure perceived support from two critical sources—Significant others (hereinafter referred to as partners), and Family—the MSPSS is particularly valuable in chronic disease contexts like diabetes management. It offers insights into how social support facilitates improved glycemic control, adherence to lifestyle modifications, and emotional resilience in individuals managing T2DM.

The MSPSS comprises strategically structured 8 items, grouped into three distinct subscales for couple-based interventions. The partner subscale measures emotional and practical support specifically from the spouse. The family subscale evaluates support received from immediate family members, reflecting the broader household's role in diabetes management. Each question is rated on a 7-point Likert scale, with responses ranging from "Very Strongly Disagree" to "Very Strongly Agree," providing a granular understanding of perceived support.

Scoring within the MSPSS is straightforward yet insightful. Subscale scores are derived by averaging the responses within each domain, while the overall score is the sum of all 8 items. The interpretation of scores further categorizes support levels: 8–24 indicates low support, often associated with challenges like poor adherence and increased distress; 25-40 reflects moderate support, suggesting moderate benefits but areas for growth; and 41-56 represents high support, typically linked to better mental health, stronger adherence to management plans, and improved glycemic outcomes.

The scoring breakdown within each subscale ranges from 1.0 to 2.9 for low support, 3.0 to 5.0 for moderate support, and 5.1 to 7.0 for high support. These categorizations serve as a foundation for tailoring interventions. For couples receiving low support, immediate consultation and guidance from health coaches, psychologists, and doctors would be essential. In contrast, couples with moderate support can benefit from enhanced behavioral coaching and relationship-building exercises to increase overall engagement. Finally, couples who score within the high support range would benefit from continuous reinforcement, advanced lifestyle interventions, and periodic check-ins to maintain and optimize their support structures and glycemic control.

The MSPSS thus enables targeted evaluations of the role of social relationships in health interventions, providing a foundation for strategies like couple-based programs that emphasize partnership and shared responsibility in chronic disease management.

Table 1: Computation of subscale and overall scores in the MSPSS survey (Note: 1 = Very Strongly Disagree; 2 = Strongly Disagree; 3 = Mildly Disagree; 4 = Neutral; 5 = Agree; 6 = Strongly Agree; 7 = Very Strongly Agree)

Subscale	Item assessed	MSPSS Questionnaire Items	Formula for Average Score
Significant others (Partner)	Items 1, 2, 5, & 7	1. My partner is always there for me when I need support. 2. I can share both the joys and challenges of life with my partner. 5. My partner is a reliable source of comfort and reassurance during difficult times. 7. My partner truly cares about my feelings and well-being.	$\frac{\sum (\text{Item Scores for 1, 2, 5, \& 7})}{4}$
Family	Items 3, 4, 6, & 8	3. My family is actively involved in helping me manage my diabetes. 4. I receive the emotional support I need from my family in	$\frac{\sum (\text{Item Scores for 3, 4, 6, \& 8})}{4}$

		managing 6. I feel comfortable discussing my concerns and struggles with my family. 7. My family is ready to support me in making important health decisions.	
Overall score	Items 1, 2, 3, 4, 5, 6, 7, & 8	As stated earlier	∑ (Item Scores for 1, 2, 3, 4, 5, 6, 7 & 8)

Personalized and joint support framework for couples with T2D

A *Personalized and Joint Support Framework* is designed to address the unique challenges couples face when managing diabetes together. This approach emphasizes tailored interventions that leverage the strength of their partnership. By combining mutual accountability with individual needs, the framework ensures that both emotional and practical support are integral to diabetes care. It integrates behavioral coaching, dietary adjustments, exercise routines, and emotional counseling, promoting shared responsibility and resilience. This strategy fosters better glycemic control, adherence to lifestyle modifications, and improved emotional well-being.

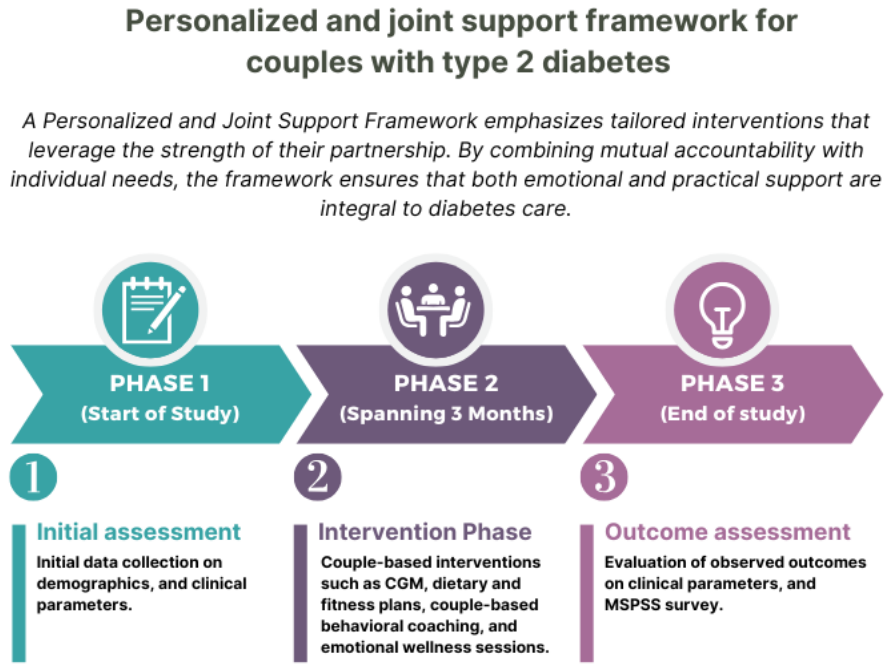

Figure 1: Conceptual Framework for Tailored Interventions in T2D Management

Phase 1: Initial Assessment

The initial phase of the study involves a comprehensive assessment of the couples' baseline health status. This includes the initiation of data collection, providing a foundation for subsequent interventions. Key information gathered includes demographic information, and clinical parameters such as glycated hemoglobin (HbA1c), fasting blood sugar (FBS), body mass index (BMI), and weight. This baseline data serves as a measurable benchmark of the study.

Phase 2: Intervention Phase

This intervention phase represents the core of the study, focusing on empowering couples to manage T2D through a combination of targeted strategies jointly. This phase involves structured activities and interactions aimed to enhance glycemic control, improve overall well-being, and foster stronger relationship dynamics. Below, each key intervention within this phase is detailed with emphasis on its relevance to couple-based approaches.

Continuous Glucose Monitoring (CGM) Installation

During this phase, both partners are equipped with CGM devices to track glucose fluctuations in real time over a 14-day period. CGM technology offers actionable insights by identifying patterns and triggers for hyperglycemia or hypoglycemia, enabling couples to make data-driven decisions. Sharing CGM data fosters a collaborative environment where partners can discuss trends, adjust meal timing, monitor exercise impact, and ensure medication compliance. This shared responsibility enhances mutual understanding and provides opportunities to celebrate progress, reinforcing their role as a team in diabetes management.

Couple-Based Dietary Plans

The dietary component of the intervention focuses on creating personalized meal plans that cater to both partners' needs and preferences, fostering a collaborative approach to healthy eating. These plans are designed to promote glycemic control by incorporating balanced macronutrients, low-glycemic index foods, and adequate fiber intake. By engaging in joint meal planning and preparation, couples develop shared accountability and a deeper understanding of each other's dietary needs.

To enhance effectiveness, couples are encouraged to prepare meals together, fostering teamwork and creating a supportive environment for adopting healthier habits. Education on mindful eating practices—such as portion control and eating slowly—helps partners manage their weight and blood sugar levels more effectively. This mutual involvement not only facilitates healthier eating patterns but also strengthens the couple’s bond, making dietary changes more sustainable and enjoyable over the long term.

Couple-Based Fitness Plans

The fitness plans are tailored to incorporate joint physical activities, encouraging couples to engage in regular exercise as a team. These plans are designed to accommodate varying fitness levels and preferences, ensuring that both partners feel included and motivated. Shared routines, such as brisk walking, yoga, or cycling, not only improve cardiovascular and metabolic health but also serve as bonding activities that enhance emotional connection. Partner-based strength training exercises are also introduced, focusing on partner-assisted movements to build muscle and improve insulin sensitivity. To sustain motivation, couples set realistic fitness goals and monitor their progress together. This collaborative approach not only improves physical health but also reinforces mutual encouragement and commitment to managing T2D effectively as a team.

Couple-Based Behavioral Coaching

Behavioral coaching sessions provide couples with tools and techniques to build and sustain healthy habits. Coaches guide couples in setting realistic goals, monitoring progress, and overcoming obstacles. This intervention emphasizes shared problem-solving and role delegation, such as one partner reminding the other about medication schedules, meal

preparation, or fitness sessions. These sessions also promote strategies for managing stressors associated with diabetes, ensuring that partners act as a support system rather than sources of additional stress.

Emotional Wellness Sessions

Emotional wellness sessions target the psychological challenges of living with diabetes, focusing on stress reduction, emotional resilience, and effective communication. Guided by a psychologist, these sessions teach couples mindfulness techniques, conflict resolution strategies, and ways to express appreciation and empathy. Strengthening the emotional bond between partners enhances their ability to face the demands of T2D management together. Couples learn practical skills like providing encouragement during difficult times and celebrating progress, helping to create a positive and empowering environment.

Ultimately, this phase aims to empower the partnership between couples as they navigate T2D management together. By integrating technology like CGM, developing shared health routines, and nurturing emotional well-being, the intervention phase not only enhances glycemic control but also fortifies long-term relational strength. The collaborative framework transforms couples into supportive teams, empowering them to address the challenges of T2D with resilience and mutual commitment, ensuring sustainable health improvements and a stronger partnership.

Phase 3: Outcome Assessment

The final phase of the study involves a comprehensive evaluation of the outcomes of the intervention. This includes reassessing clinical parameters, such as HbA1c level, FBS level, and weight, alongside the overall MSPSS questionnaire scores to track changes in the perceived support. Additionally, qualitative data may be collected through interviews or focus groups to gain insights into the couple's experiences and perceptions of the intervention. By comparing data from the baseline and post-intervention phases, the success of the couple-based interventions can be evaluated. This approach helps determine their effectiveness in improving glycemic control, enhancing the participants' quality of life, and strengthening the couples' relationships.

RESULT

The results provide an in-depth analysis of the changes observed in demographics, social support dynamics, and clinical parameters among 6 couples after a 90-day intervention under the SDRMP. These findings underscore the program's positive effects on glycemic control, and weight management by perceiving social support in couples managing T2D.

Participant Demographics

The study included 6 couples, with equal representation of 6 husbands and 6 wives, totaling 12 participants. Key demographic variables such as age and height were assessed to provide context for the sample's characteristics. The average age of the husbands was 60.3 years, while the wives were slightly younger, with an average age of 56.3 years. This age difference aligns with typical patterns observed in marital relationships and meets the study's inclusion criteria. In terms of height, the husbands had an average height of 169.1 cm, while the wives' average height was 155.8 cm, reflecting common gender-based physical differences. These demographic details help contextualize the sample and provide a foundation for understanding the study population in relation to the therapeutic interventions

evaluated. This demographic data highlights the diverse yet balanced representation of T2D couples involved in the intervention.

Table 2: Demographic Characteristics of Study Participants

Variable	Husbands	Wives
Sample size	6	6
Age (years)	60.3	56.3
Height (cm)	169.1 cm	155.8 cm

MSPSS Score Assessment

In this study, couples were categorized into three groups based on their levels of perceived support. In the first group, both the husband and wife received high levels of support from their partner and family, reflected in high MSPSS scores, ranging from 41 to 56. In the second group, both the husband and wife received moderate support from their partner and family, resulting in moderate MSPSS scores between 31 and 40. Lastly, in the third group, the husband received high support while the wife received moderate support from both their partner and family, representing an intermediate level of support where one partner experiences high support and the other moderate, with scores ranging from 34 to 47. This variation underscores the nuanced role of perceived support in influencing self-management behaviors.

In the first group, both partners received high levels of support from their partner and family, with MSPSS scores ranging from 41 to 56 **(Table 3).** This group demonstrated a strong perception of social and familial support, potentially creating an environment conducive to effective self-management. Couple 1 recorded MSPSS scores of 41 and 42 for the husband and wife, respectively. Couple 2 exhibited scores of 53 for the husband and 45 for the wife. Couple 3 displayed the highest scores, with both partners scoring 56 and 54, respectively. These scores underline the importance of mutual support in fostering positive health outcomes.

Table 3: Representation of Partner score, Family score, and MSPSS score among couples both husbands and wives received high support

Couples	Partners	Partner score	Family score	MSPSS score
Couple 1	Husband	5.25	5	41
	Wife	4.75	5.75	42
Couple 2	Husband	7	6.25	53
	Wife	5	6.25	45
Couple 3	Husband	7	7	56
	Wife	6.75	6.75	54

The second group included couples, in which both partners reported moderate levels of support from their partner and family, with MSPSS scores between 31 and 40 **(Table 4)**. Couple 4 recorded scores of 40 and 31 for the husband and wife, respectively. The moderate levels of perceived support may suggest challenges in self-management behaviors compared to the high/high support group. This distinction highlights the variability in social support dynamics and their potential impact on diabetes management outcomes.

Table 4: Representation of Partner score, Family score, and MSPSS score among couples both husband and wife received moderate support

	Partners	Partner score	Family score	MSPSS score
Couple 4	Husband	4.75	5.25	40
	Wife	4	3.75	31

The third group was characterized by asymmetry in perceived support, where the husband received high support, and the wife received moderate support (**Table 5**). Their MSPSS scores ranged from 34 to 47, representing an intermediate level of support. Couple 5 recorded scores of 47 for the husband and 34 for the wife. Couple 6 reported scores of 46 for the husband and 39 for the wife. This group illustrates the nuanced role of differential support levels within a couple and their influence on individual self-management efforts.

Table 5: Representation of Partner score, Family score, and MSPSS score among couples in which husbands received high support and wives received moderate support

Couples	Partners	Partner score	Family score	MSPSS score
	Husband	5.5	6.25	47
Couple 5	Wife	2.75	5.75	34
	Husband	5.5	6	46
Couple 6	Wife	5.25	4.5	39

The study's categorization of couples based on MSPSS scores highlights the varied levels of perceived social support and its implications for diabetes management. High support from both partner and family appears to foster better outcomes, as reflected in the higher MSPSS scores. In contrast, moderate or asymmetric support may present challenges, emphasizing the need for tailored interventions to strengthen social and familial support networks for effective diabetes management. The detailed representation of MSPSS scores across the three groups provides a foundation for further exploring the relationship between perceived support and health outcomes in couples.

Clinical Parameter Assessment: HbA1c, FBS, and Weight Across Three Support Groups

This study analyzed the improvement in clinical parameters, including HbA1c, fasting blood sugar (FBS), and weight, across three distinct support groups of couples. The groups were categorized based on varying levels of support between the husband and wife, including high/high support, moderate/moderate support, and high/moderate support, respectively. By comparing the changes in these parameters from baseline (Q_0) to follow-up (Q_1), the study highlights how different levels of perceived support influenced health outcomes in couples managing diabetes.

Couples receiving high levels of support from both their partners and families showed substantial improvements in clinical parameters, including HbA1c, fasting blood sugar (FBS), weight, and BMI throughout the study (Table 6). In **Couple 1**, the husband's HbA1c reduced from 11.8% to 8.3%, while the wife's HbA1c dropped from 7.9% to 6.1%. The husband's FBS increased slightly from 182.1 mg/dL to 190.4 mg/dL, while the wife's FBS rose from 84.9 mg/dL to 93.9 mg/dL. Significant weight loss was noted, with the husband losing 6 kg (BMI reduction from 27.6 kg/m^2 to 24.9 kg/m^2) and the wife losing 2 kg (BMI change from 21.4 kg/m^2 to 22.2 kg/m^2). These reductions highlight the positive impact of high support on improving glycemic control and weight management.

In **Couple 2**, the husband's HbA1c decreased from 6.9% to 5.7%, and the wife's HbA1c improved from 7.4% to 6.6%. FBS levels showed marked improvements, with the husband's FBS dropping from 107.6 mg/dL to 85.9 mg/dL and the wife's FBS decreasing slightly from 137.6 mg/dL to 136.7 mg/dL. The husband lost 14.4 kg, resulting in a BMI reduction from 40.6 kg/m^2 to 31.5 kg/m^2, while the wife lost 4.95 kg, with a BMI change from 34 kg/m^2 to 32.3 kg/m^2. These results further emphasize the importance of high support in achieving better overall health outcomes. In **Couple 3**, both partners exhibited moderate but consistent improvements. The husband's HbA1c reduced from 6.9% to 6.3%, and the wife's HbA1c remained steady at 6.6%. FBS levels improved significantly, with the husband's FBS dropping from 130 mg/dL to 89.9 mg/dL and the wife's FBS from 120 mg/dL to 79.3 mg/dL. The husband lost 5.3 kg (BMI reduced from 23.13 kg/m^2 to 21.1 kg/m^2), and the wife lost 6.6 kg (BMI reduced from 32.7 kg/m^2 to 31 kg/m^2). These results demonstrate that high levels of partner and family support can lead to substantial improvements in glycemic control, weight, and BMI, further validating the role of collaborative management in diabetes care.

Table 6: Improvement in HbA1c, FBS, weight and BMI among couples both husbands and wives received high support

Parameter		Couple 1		Couple 2		Couple 3	
		Q_0	Q_1	Q_0	Q_1	Q_0	Q_1
HbA1c (%)	Husband	11.8	8.3	6.9	5.7	6.9	6.3
	wife	7.9	6.1	7.4	6.6	6.7	6.6
FBS (mg/dL)	Husband	182.1	190.4	107.6	85.9	130	89.9
	wife	84.9	93.9	137.5	136.7	120	79.3
Weight (kg)	Husband	73	67	132	117.6	69	63.7
	wife	55	53	87	82.05	83	76.4
BMI (kg/m^2)	Husband	27.6	24.9	40.6	31.5	23.13	21.1
	wife	21.4	22.2	34	32.3	32.7	31

In couples receiving moderate support from both partners and families, improvements in clinical parameters were more modest but still significant (**Table 7**). In Couple 4, the husband's HbA1c improved from 7.4% to 6.7%, while the wife's HbA1c decreased from 7% to 5.6%. FBS levels also showed notable improvement, with the husband's FBS dropping from 108 mg/dL to 94 mg/dL, and the wife's FBS declining from 74 mg/dL to 56 mg/dL. Weight changes in this group were less pronounced compared to couples receiving high support. The husband's weight decreased slightly from 74 kg to 72.6 kg, resulting in a BMI reduction from 28 kg/m^2 to 27.4 kg/m^2. The wife maintained her body weight consistently at 60 kg, with a stable BMI of 23.4 kg/m^2 throughout the study period, which emphasizes the role of **dietary interventions provided by SDRMP** in supporting healthy weight maintenance along with effective glycemic control. These findings highlight that **moderate support**, coupled with personalized dietary guidance, can lead to significant improvements in HbA1c and FBS levels, even if the changes in weight and BMI are less pronounced compared to couples receiving high support.

Table 7: Improvement in HbA1c, FBS, weight and BMI among couples both husband and wife received moderate support

Parameter		Couple 4	
		Q_0	Q_1
HbA1c (%)	Husband	7.4	6.7
	wife	7	5.6
FBS (mg/dL)	Husband	108	94
	wife	74	56
Weight (kg)	Husband	74	72.6
	Wife	60	60
BMI (kg/m^2)	Husband	28	27.4
	Wife	23.4	23.4

In the third group, where the husband received high support and the wife received moderate support, the clinical improvements were more varied (**Table 8**). In Couple 5, the husband's HbA1c decreased from 7.8% to 7.2%, and the wife's HbA1c improved from 7% to 6.5%. Similarly, Couple 6 exhibited changes in both partners, with the husband's HbA1c decreasing from 8.8% to 7%, and the wife's HbA1c reducing from 7.3% to 6.7%. However, FBS changes in this group were more inconsistent. The husband in Couple 5 saw an increase in FBS from 96.2 mg/dL to 106.9 mg/dL, while the wife experienced a dramatic reduction from 197 mg/dL to 147 mg/dL, which could reflect either improved management or possible measurement inconsistencies.

Regarding **weight and BMI**, marginal reductions were observed in **Couple 5**, where the husband's weight decreased from 63 kg to 61 kg, resulting in a BMI drop from 28 kg/m^2 to 27.3 kg/m^2. The wife's weight remained largely unchanged at 78.5 kg, with a minor reduction in BMI from 27.1 to 26.3, reflecting stable weight maintenance. In **Couple 6**, the husband maintained a stable weight at 75 kg, with a minor BMI change from 26.3 kg/m^2 to 26 kg/m^2, while the wife's weight slightly reduced from 76 kg to 75 kg, corresponding to a BMI decrease from 30.8 kg/m^2 to 30.2 kg/m^2.

These findings emphasize that even moderate support can lead to positive outcomes, particularly when supplemented by high support for one partner. This highlights the value of individualized lifestyle interventions, such as those offered by the SDRMP, in managing T2D effectively. Despite both couples remaining in the overweight BMI range, slight reductions were achieved, demonstrating that consistent mutual support, combined with tailored guidance, can foster gradual improvements in weight, BMI, and glycemic control over time.

Table 8: Improvement in HbA1c, FBS, weight and BMI among couples in which husbands received high support and wives received moderate support

Parameter		Couple 5		Couple 6	
		Q_0	Q_1	Q_0	Q_1
HbA1c (%)	Husband	7.8	7.2	8.8	7
	wife	7	6.5	7.3	6.7
FBS (mg/dL)	Husband	96.2	106.9	150	138
	wife	197	147	106	94
	Husband	63	61	76.5	75

Weight (kg)	wife	78.5	78.4	76	75
	Husband	28	27.3	26.3	26
BMI (kg/m^2)	wife	27.1	26.3	30.8	30.2

The analysis of clinical parameters across the three support groups highlights the significant impact of perceived social support on diabetes management outcomes. Couples with high support from both partners and families demonstrated the most substantial improvements in HbA1c, FBS, and weight, suggesting that strong partner and familial support is crucial for better diabetes control. Moderate support also resulted in positive changes, though less pronounced, indicating that the level of support correlates with the magnitude of health improvements. In couples where the husband received high support and the wife received moderate support, the results were more mixed, emphasizing the complex nature of individualized support in managing diabetes. These findings underscore the importance of tailoring support strategies to optimize diabetes care and improve health outcomes for individuals with T2D.

Impact of MSPSS Scores on HbA1c and Weight Reduction in Couple-Based Diabetes Management

The analysis of MSPSS scores and their correlation with clinical outcomes highlights the significance of perceived social support in diabetes management. Couples with higher MSPSS scores consistently demonstrated greater reductions in HbA1c level, and weight, underscoring the pivotal role of mutual support in improving health outcomes. This finding emphasizes that cohesive, collaborative efforts between partners can substantially enhance glycemic control and weight management. The data reveal a direct association between the degree of perceived support and the magnitude of clinical improvements, reflecting the profound influence of social dynamics on diabetes self-management.

High Support Couples: Enhanced Glycemic and Weight Management

In couples where both partners reported high MSPSS scores, significant reductions in HbA1c and weight were observed **(Table 9)**. The high MSPSS scores in this group (ranging from 41 to 56) underline the importance of a robust support system in fostering significant health improvements. These results suggest that a strong mutual understanding and shared commitment to diabetes management can yield measurable benefits for both partners.

Table 9: Correlation of reduction in HbA1c, and weight among couples both husbands and wives received high support

Couples	Partners	HbA1c drop	Weight drop	MSPSS score
Couple 1	Husband	3.5%	6 kg	41
	Wife	1.8%	2 kg	42
Couple 2	Husband	1.2%	14.4 kg	53
	Wife	0.8%	4.95 kg	45
Couple 3	Husband	0.6%	5.3 kg	56
	Wife	0.1%	6.6 kg	54

Moderate Support Couples: Variability in Outcomes

Clinical improvements were modest but consistent for couples with moderate levels of support from both partners (Table 10). The MSPSS scores for these couples were relatively lower (31 to 40), which may account for the less pronounced improvements compared to

those observed in couples with higher perceived support. These findings reinforce the idea that perceived support levels are directly proportional to the magnitude of health benefits.

Table 10: Correlation of reduction in HbA1c, and weight among couples both husband and wife received moderate support

Couples	Partners	HbA1c drop	Weight drop	MSPSS score
	Husband	0.7%	1.4 kg	40
Couple 4	Wife	1.4%	0	31

Mixed Support Couples: Moderate Improvements

In couples where one partner reported high MSPSS scores and the other reported moderate scores, clinical improvements were less pronounced and more variable (**Table 11**). The variability in outcomes within this group indicates that while support remains beneficial, differences in perceived support levels may influence the extent of clinical improvements. This suggests that balanced support between partners could optimize health outcomes further.

Table 11: Correlation of reduction in HbA1c, and weight among couples in which husbands received high support and wives received moderate support

Couples	Partners	HbA1c drop	Weight drop	MSPSS score
	Husband	0.6%	2 kg	47
Couple 5	Wife	0.5%	0.1 kg	34
Couple 6	Husband	1.8%	1.5 kg	46
	Wife	0.6%	1 kg	39

The results validate the hypothesis that couple-based interventions significantly enhance diabetes management by fostering mutual support. There is a strong concordance between higher MSPSS scores and greater reductions in HbA1c and weight, especially when both partners report high levels of support. In contrast, moderate support shows slight discordance, leading to less consistent improvements, which highlights the need for personalized strategies to address disparities in perceived support. The study underscores the critical role of partner and family dynamics in managing T2D, indicating that incorporating social support frameworks into diabetes care programs may be crucial for optimizing health outcomes. These findings pave the way for future interventions that capitalize on partner and family social support to improve glycemic control and overall well-being in individuals with diabetes.

DISCUSSION

The rising prevalence of T2D poses a major public health challenge, requiring innovative management approaches. This study examined couple-based interventions to improve glycemic control by strengthening social support, emphasizing the importance of partner involvement in diabetes management. Participants, mainly couples over 50, brought valuable life experience and maturity, enhancing their ability to engage with the intervention. Their collaborative approach to managing T2D underscored the importance of mutual support in tackling health challenges. However, societal roles, particularly in the Indian context, often hinder self-care, highlighting the need for spousal support in managing chronic conditions like diabetes

The findings revealed significant reductions in HbA1c levels, with reductions of up to 3.5%, among participants engaged in the couple-based intervention program. These improvements surpassed typical outcomes seen in individual-focused interventions, aligning with recent research by Whitaker et al. (2023), who found that couple-focused interventions can effectively improve metabolic outcomes [10]. Collaborative efforts in diet planning, fitness routines, and mental wellness activities contributed to these outcomes, showcasing the potential of shared accountability and support in achieving better glycemic control. Additionally, when compared to the study by Liu et al. (2023), which reported an HbA1c reduction of only 0.5%, the magnitude of improvement in our study underscores the amplifying effect of partner involvement in diabetes management strategies [24].

Participants also achieved notable weight reductions, with losses of up to 14.4 kg observed during the intervention, as compared to the study highlighted by Liu, Y., et. al., showing that reduction in weight was minimal, amounting to only 0.5 kg, falling short of even 1 kg. This result reflects the efficacy of spousal collaboration in promoting healthier dietary and exercise habits. The integration of structured physical activity and nutritional support as part of the intervention highlighted the importance of mutual accountability in driving sustainable lifestyle changes.

Perceived social support, as measured by the MSPSS, emerged as a critical factor in fostering adherence to diabetes management plans. Spousal support provided emotional and psychological benefits, creating a buffer against diabetes-related distress and improving treatment adherence. This aligns with Gupta et al.'s (2019) review, which highlights the influence of partner support on therapeutic lifestyle interventions [25]. Addressing these psychosocial factors is essential for holistic diabetes care.

Engagement in joint activities such as exercise and meal planning proved pivotal in enhancing glycemic outcomes and weight management. By fostering teamwork and reinforcing healthy behaviors, couples created a supportive environment that strengthened their collective ability to manage diabetes. Recent systematic reviews, including Pratiwi et al. (2024), corroborate the positive impact of spousal collaboration in chronic disease management [26]. Compared to individual-based interventions, the couple-based approach demonstrated higher attendance and retention rates, attributed to the active involvement of spouses and the high spousal concordance scores observed. This finding is consistent with prior systematic reviews and trials indicating the added value of spousal involvement in diabetes management (Trief et al., 2016; Wing et al., 1991) [27,28].

The integration of couple-based approaches into routine diabetes care has significant implications for clinical practice. Studies like Song et al. (2017) emphasize the impact of social support on self-care behaviors, suggesting that formal incorporation of partner involvement in diabetes education and management programs could enhance adherence and outcomes [29]. Healthcare providers should consider tailored interventions that leverage spousal support as part of comprehensive diabetes care protocols.

Despite promising results, the study's small sample size and three-months intervention period limit the generalizability of findings. Additionally, the demographic homogeneity of the participants restricts the applicability to diverse populations. Similar challenges in partner-focused research, as noted by Arden-Close and McGrath (2017), underscore the

need for larger, long-term studies to better understand the dynamics of couple-based diabetes management [30].

This study highlights the transformative potential of couple-based interventions in T2D management, demonstrating significant reductions in HbA1c (up to 3.5%) and weight (up to 14.4 kg), along with enhanced social support. By integrating psychosocial assessments and fostering mutual accountability, these approaches address both the physiological and emotional aspects of diabetes care. The findings advocate for broader adoption of couple-focused strategies, offering a holistic path to enhanced clinical outcomes and quality of life for individuals with T2D.

CONCLUSION

The study underscores the efficacy of couple-based interventions in managing T2D, with pronounced improvements in glycemic control and weight management associated with robust mutual support as perceived by both partners. High MSPSS scores correlate with better health outcomes, suggesting that a strong support network is crucial in managing diabetes. This intervention showcased the potential for enhanced adherence and outcomes through joint participation in health-related activities, emphasizing the significance of partner involvement in diabetes management plans.

We are confident that 'Diabetes Together' contains appropriate and persuasive content to help couples make and sustain (healthy) lifestyle changes to improve T2D self-management. The findings suggest that healthcare providers should integrate social support frameworks into diabetes care, advocating for tailored interventions that harness spousal support to optimize clinical outcomes. This approach not only improves health outcomes but also strengthens relationships, offering a comprehensive solution to managing chronic diseases.

Strengths and Limitations

The study's strengths include a robust design that highlights the influence of spousal support in diabetes management, offering empirical evidence for integrating partner-based strategies into health programs. However, limitations include the sample's demographic homogeneity, primarily consisting of older couples, which may limit the generalizability of the findings to younger populations or different cultural contexts. Additionally, the short 90-day intervention period provides limited insight into the long-term effects on glycemic control and relationship dynamics, which could be explored further in future studies. Furthermore, the absence of a control group makes it difficult to conclusively attribute observed improvements to the couple-based interventions, emphasizing the need for future research that includes a control group to validate the core claims of the study. Further investigations are needed to explore these dynamics across more diverse demographics and to assess the lasting impact of such interventions.

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