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ORIGINAL ARTICLE

The Effectiveness of Motivational Interviewing Approach on Diabetes Management

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ABSTRACT

Background: The Healthy Community Clinic (HCC) program utilizes a motivational interviewing (MI) approach to encourage behavioral change among diabetic patients, enabling them for a better glycemic control and weight management. The present study aimed to assess the effect of MI approach on glycemic control and weight management in type 2 diabetes mellitus (T2DM) patients.

Methods: In a pre-post quasi-experimental design, 64 adult male and female diabetic patients who had completed the approach cycle were enrolled. The approach cycle was three MI sessions over three months. The effect of the intervention on glycemic control was tested by measuring the change in glycated hemoglobin (HbA1c) and fasting blood glucose (FBG) levels while the effect of the approach on weight management was tested by measuring the change in body weight (BW) and body mass index (BMI). Pre- and post-intervention data were collected from the patient's medical records.

Results: Glycemic indicators, including HbA1c and FBG levels, showed a significant decrease, with a mean difference of 0.69% and 35.47 mg/dL, respectively (p=0.013 and 0.018, respectively). Regarding weight-related outcomes, BW and BMI dropped with a mean difference of 2.01 kg and 0.73 kg/m², respectively, but it was not statistically significant.

Conclusion: This study demonstrated a promising impact of MI on glycemic control among people living with T2DM.

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Introduction

Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disturbance characterized by elevated blood glucose levels and impaired glucose tolerance (1, 2). In 2021, the global diabetes prevalence indicated that 537 million adults around the world have diabetes, with a future projection of reaching 783 million by 2045 (3). Vascular complications of T2DM, including cardiovascular diseases, retinopathy, kidney disease, and neuropathy, are the leading causes of morbidity and mortality among people with diabetes, causing substantial financial and health burdens for individuals and governments (4). Accordingly, this recalls the urgent need to develop new practical diabetes management approaches to limit the increase in diabetes prevalence globally and minimize serious complications (5).

Diabetes Management is a multifaceted approach that includes medications, regular checkups, and, necessarily, lifestyle modification (6-8). Appropriate nutritional knowledge, attitudes, and practices around T2DM management can minimize the development of disease-related complications (6, 7, 9). Motivational interviewing (MI) is a cooperative, Specific, Measurable, Achievable, Relevant and Time bound (SMART) goal-oriented communication approach highlighting individuals' autonomy by promoting self-efficacy, engagement, and innate motivation for behavioral change. The patient-centered directive method encourages individuals to determine and overcome their hesitation toward decision-making, specifically regarding health behaviors (10). Motivational interviewing may enhance T2DM management by encouraging patient engagement and self-efficacy. It motivates individuals in tackling their uncertainty towards lifestyle changes. Several studies have shown that MI may enhance glycemic control and metabolic outcomes. Furthermore, it also supports sustainable behavioral changes and minimizes diabetes-related comorbidities (11).

SMART goal setting as a part of the motivational interviews is a structured approach to establishing health related-objectives that ensure they are specific, measurable, achievable, relevant, and time-bound. This approach ensures specific milestones, motivation, and progress follow-up, enhancing health outcomes (12). A study that aimed to evaluate the effect of setting SMART goals on diabetes management indicated that patients who set SMART goals over three months demonstrated a 1.2% reduction in glycated hemoglobin (HbA1c) level, in comparison to a 0.85% reduction in the control group. The authors indicated that the SMART goal-setting approach may enhance glycemic control (13). When the combination role of MI and SMART goal-setting in weight and diabetes management are limited; integrating these two approaches may be beneficial. Royal Health Awareness Society and the Ministry of Health (MoH) in Jordan carried out the Healthy Community Clinic (HCC) program that utilizes MI approaches delivered at primary healthcare centers by well-trained nutritionists and nurses (14). Therefore, the aim of the present study was to assess the integrated approach's impact on glycemic and weight control among diabetic patients attending three comprehensive MoH health centers. Changes in glycemic biomarkers including HbA1c and fasting blood glucose (FBG) levels, and weight-related outcomes including body weight (BW) and body mass index (BMI) were evaluated.

Materials and Methods

This preliminary study was conducted for quality control to determine how individuals respond to a MI approach including SMART-goal setting. Accordingly, the target group described in this study was part of a larger ongoing investigation. The present study was performed using a quasi-pre-post experimental design to measure the impact of a MI approach that utilized SMART-goal setting on glycemic and weight control. A convenient sample of diabetic patients attending three comprehensive MoH health centers implementing the HCC program was used. The study sample consisted of 64 participants (n=18 males, n=56 females) of both genders ranged from 35-70 years of age. Figure 1 demonstrates the study design, including the study population, intervention, participant selection, data collection and statistical analysis. The participants in the study completed the HCC program activities over three months and received data on their HbA1c, FBG, BW, and BMI before and after completing the intervention.

All participants in this investigation met the following criteria: (i) A confirmed diagnosis of T2DM as documented in the electronic health records system of the MoH, (ii) participation in the three planned HCC activities and (iii) availability of the pre-and post-intervention data in the MoH database. As illustrated in Figure 1, participants who fulfilled at least one of the following conditions were excluded: (i) Incomplete pre- or post-intervention data, (ii) pregnant and lactating women, and (iii) receiving insulin therapy. Figure 1 illustrates glycemic biomarkers and weight-related outcomes. Data were collected from the patient's medical records, including (i) pre-intervention data of HbA1c and FBG levels, BW and BMI (ii) post-intervention data of HbA1c and FBG levels, BW and BMI at the end of the intervention.

The HCC program was used as the intervention of this study and a model for the programs using MI approach to encourage diabetic patients to adopt healthier lifestyles and empower them towards controlling diabetes. This model is implemented in the MoH health centers by well-trained healthcare providers. The model includes three MI over 3 months. During the first SMART goal-setting session, SMART goals are established to guide the patient toward achieving desired health outcomes. Appropriate and detailed exercise and dietary plans are also provided during this session. In the subsequent two MI sessions, progress toward the SMART goals is monitored, obstacles are discussed, and strategies to overcome them are provided. Beneficiaries are also encouraged to stay motivated, as their achievements are acknowledged to reinforce positive behavior changes.

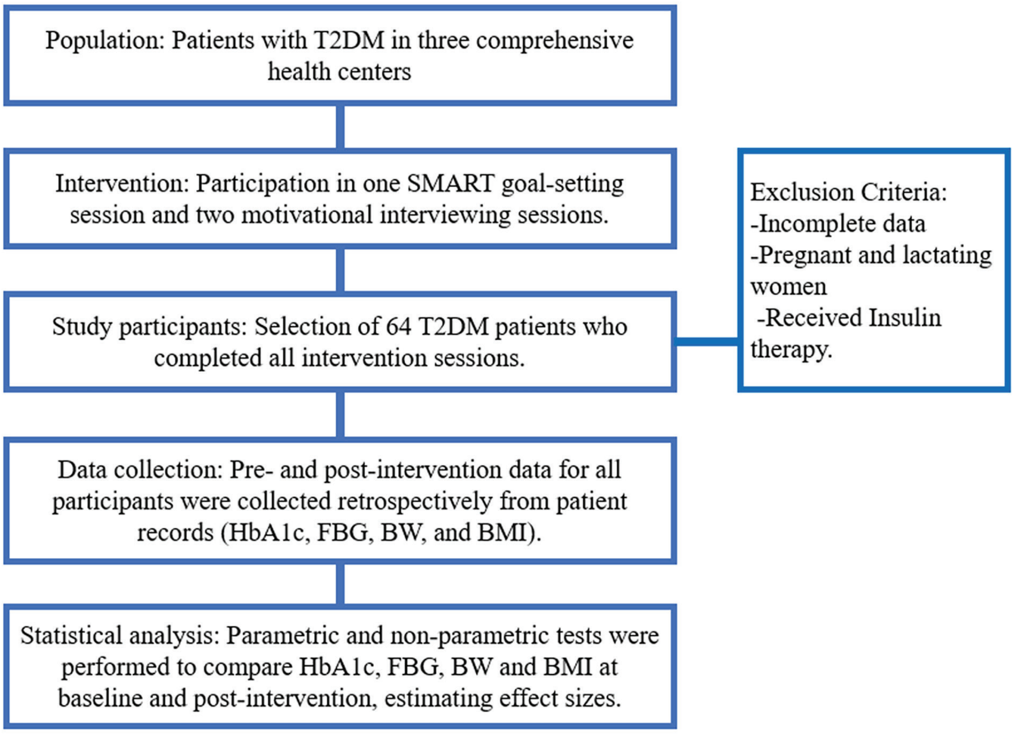

Figure 1: Flowchart of study design and data collection process. Abbreviation: T2DM: Type 2 diabetes mellitus, HbA1c: Glycated hemoglobin, FBG: Fasting blood glucose, BW: Body weight, BMI: Body mass index.

All eligible patients were requested to sign a consent form to participate in this study. The protocol was approved by the MoH Institutional Review Board (No. MOH/REC/2024/7, Amman, Jordan) according to the ethical guidelines stipulated in the Declaration of Helsinki. All data were also collected, retrieved, and confidentially reported. The statistical analyses of data were performed using the Graduate Pack SPSS software (Version 16.0 for Windows, Chicago, IL, USA). Depending on the normality test results, parametric tests (e.g., paired t-test and ANOVA) were used if the assumption of normality was met, and non-parametric tests (e.g.: Mann-Whitney and Kruskal-Wallis) were used if the assumption of normality was not met. Differences among groups were examined using analysis of variance (ANOVA) for continuous variables, and Chi-square test for categorical variables. Data were presented as mean±standard deviation and frequency distributions. Paired student t-test was used to compare pre- and post-intervention glycemic biomarkers and weight-related measurements. Hedges' g was calculated to estimate effect size, with correction applied for small sample bias. General benchmarks considered values around 0.2 as small, 0.5 as medium, and 0.8 or higher as large effects (15). To assess the relationship between pre- and post-intervention of HbA1c and FBG levels, regression models were used.

Table 1: Socio-demographic profile of participants.

Variable	**Category**	**n (%)**
Gender	Male	18 (28.1)
	Female	46 (71.9)
Age (years old)	30-39	3 (4.5)
	40-49	24 (37.5)
	59-59	20 (31.3)
	60-69	17 (26.6)
Smoking status	Smoker	22 (34.4)
	Non-smoker	42 (65.6)
Educational level	No formal education	5 (7.8)
	School level	43 (67.2)
	University\College level	16 (25)
Income level	Less than 500 JOD	47 (73.4)
	500-800 JOD	13 (20.3)
	More than 800 JOD	4 (6.3)

n: Sample size, JOD: Jordanian Dinar.

Table 2: The impact of motivational interviewing approach on diabetes and weight control indicators.

Indicator	Pre-intervention (n=64)			Post-intervention (n=64)			*P* value
	Mean	±	SD	Mean	±	SD	
Fasting blood glucose	8.09	±	1.72	7.39	±	1.36	0.013
Motivational interview	184.54	±	80.41	149.07	±	52.78	0.018
Jordan	84.26	±	16.72	82.24	±	16.59	NS
BMI (kg/m^2)	29.99	±	7.04	29.26	±	6.90	NS

HbA1c: Glycated hemoglobin, FBG: Fasting blood glucose, mg/dL: milligrams per deciliter, BW: Body weight, kg: Kilogram, BMI: Body mass index, kg/m^2: kilograms per square meter.

Results

Table 1 shows participants' demographics with an enrolment of 64 participants. Most participants were females (71.9%), while males comprised 28.1%. Regarding smoking status, a more significant proportion of participants were non-smokers (65.6%) when compared to smokers (34.4%). About age distribution, most participants fell within two age groups of 40-49 years old (37.5%) and 50-59 years old (31.3%). For educational level, majority of participants had a school educational level (67.2%), with a smaller proportion having a university/college level of education (25%) or no formal education (7.8%). Concerning income level, the majority (73.4%) had an income of less than 500 JOD, which is considered a low-income level. Meanwhile, 20.3% of participants had an income ranged between 500 and 800 JOD, and 6.3% had an income of more than 800 JOD.

As shown in Table 2, the mean HbA1c decreased from 8.09% (SD=1.72) to 7.39% (SD=1.36), where a significant decrease in HbA1c levels was noticed with a mean difference of 0.69% (p=0.013). Figure 2 presents a comparison of pre-intervention and post-intervention values for HbA1c levels, which illustrates the mean values, with error bars indicating the standard error of the mean (SEM). Furthermore, the mean FBG level decreased from 184.54 (SD=80.41) to 149.07 (SD=52.78), where a significant decrease in FGB levels was noticed with a mean difference of 35.47 (p=0.018). Regarding the weight-related outcomes, although the mean BW decreased from 84.26 kg (SD=16.72) to 82.24 kg (SD=16.59) with a mean reduction of 2.01 kg, but it was not statistically significant. Similarly, the findings indicated that the mean BMI dropped from 29.99 kg/m² (SD=7.04) to 29.26 kg/m² (SD=6.9), where the mean difference of 0.73 kg/m², but it was not statistically significant.

To assess gender differences in the intervention's impact on HbA1c level, an analysis was conducted comparing pre- and post-intervention levels between male and female participants as indicated in Figure 3. The analysis comparing pre- and post-intervention HbA1c levels between male and female participants

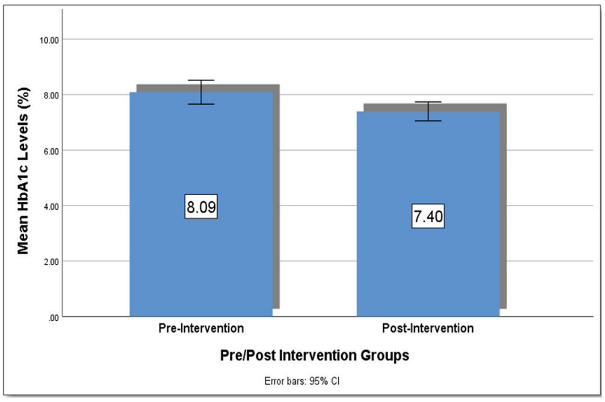

Figure 2: Comparison of pre-intervention and post-intervention values for HbA1c (%). Abbreviations: HbA1c: Glycated hemoglobin.

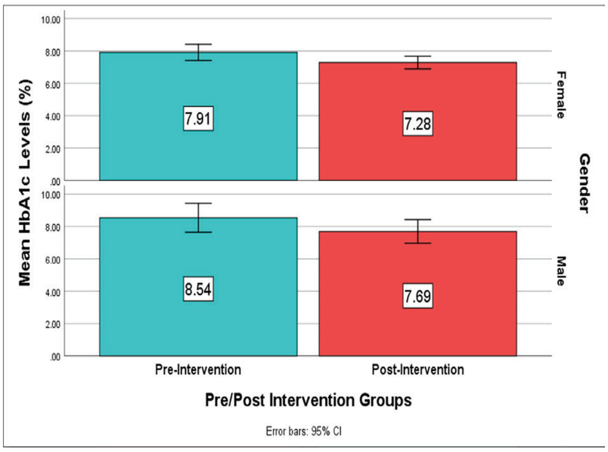

Figure 3: Pre- and post-intervention HbA1C levels by gender. Abbreviations: HbA1c: Glycated hemoglobin, CI: Confidence interval.

revealed no statistically significant differences. This suggests that the intervention had a consistent effect on blood sugar control across genders.

As the study had moderate sample size, the Hedges' g effect sizes and their corresponding 95% confidence intervals were measured to provide a more reliable estimate. As indicated in Table 3, a consistent positive effect across all indicators, with varying magnitudes were noticed. Regarding the HbA1c level, the intervention had a large significant effect size (Hedges' g=0.79, 95%CI: 0.51-1.07), indicating a meaningful change. The intervention had a moderate significant effect (Hedges' g=0.48, 95%CI: 0.22-0.74) on FBG level.

Table 3: Standardized effect size for glycemic and weight management indicators following intervention.

Indicator	Hedges' g (95%CI)	%Change (SD)	*P* value
HbA1c (%)	- 0.79 (0.51-1.07)	8.65±(0.86)	<0.001
FBG (mg/dL)	- 0.48 (0.22-0.74)	19.22±(73.35)	<0.001
BW (kg)	- 0.47(0.21-0.72)	2.4±(4.25)	<0.001
BMI (kg/m^2)	- 0.45 (0.19-0.71)	2.43±(1.59)	<0.001

CI: Confidence interval, HbA1c: Glycated hemoglobin, FBG: Fasting blood glucose, mg/dL: Milligrams per deciliter, BW: Body weight, kg: Kilogram, BMI: Body mass index, kg/m: Kilograms per square meter.

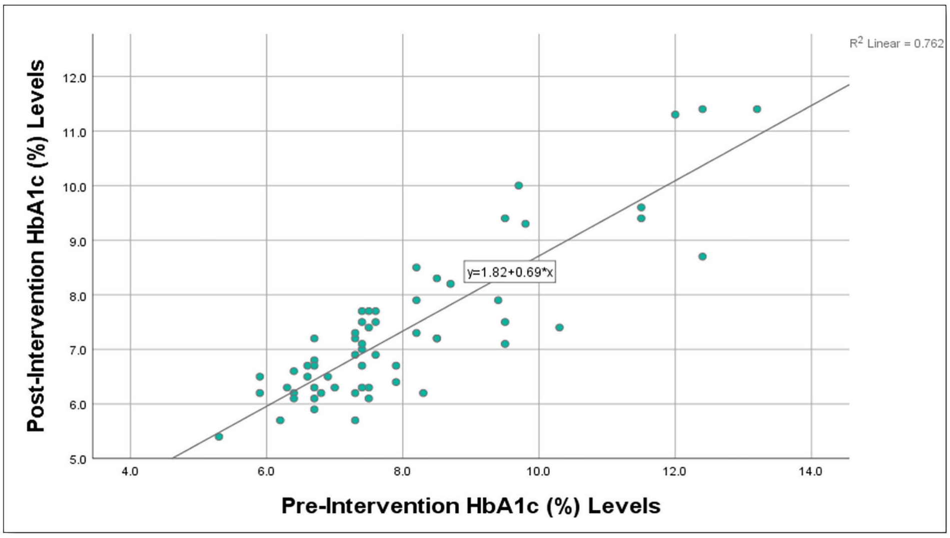

Figure 4: Correlation between pre- and post-intervention HbA1c measurements. Abbreviations: HbA1c: Glycated hemoglobin.

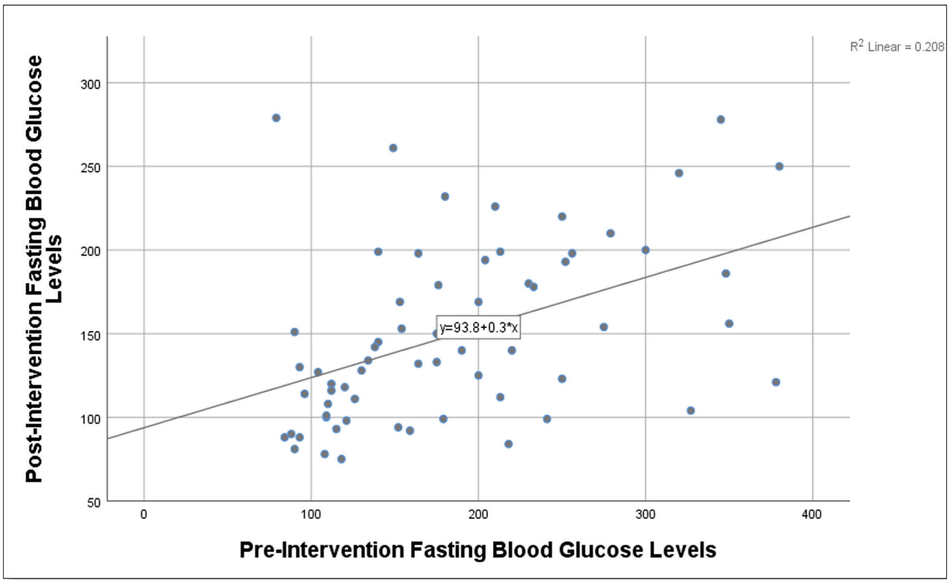

Figure 5: Correlation between pre- and post-intervention FBG measurement. Abbreviations: FBG: Fasting blood glucose.

The effect size for BW change was moderate (Hedges' g=0.47) and statistically significant where the 95% confidence interval (0.21-0.72). Similarly, the effect size for BMI reduction was moderate (Hedges' g=0.45) and significant, where the 95% confidence interval (0.19-0.71) suggests that the intervention effectively reduced BW and BMI.

The effect of MI approach including SMART-goal setting on glycemic and weight management was examined using a univariate linear regression model. The overall models for pre- and post-intervention of HbA1c and FBG levels were significantly predictive. As presented in Figure 4, each unit of pre-intervention HbA1c level was associated with 0.69 change in post-intervention HbA1c level (β=0.0.69, *p*=0.000). Similarly, each unit pre-intervention FBG level was associated with 0.30 change in post-intervention level (β=0.0.30, *p*=0.000) (Figure 5).

Discussion

T2DM is a disease of inadequate control of blood levels of glucose. The classic symptoms include polydipsia, polyuria, polyphagia, weight loss, and blurred vision. If left untreated, it can cause several health complications, including disorders in kidney, eye, cardiovascular system and nervous system (16). MI is a self-centered behavior modification approach that supports patients in gaining insight into others' perspectives and priorities of T2DM management plans (17). SMART Goals refer to a structured framework for setting objectives and creating action plans that are specific, measurable, achievable, relevant, and time-bound (18).

Utilizing SMART goals in MI empowers patients to develop more applicable, realistic, patient-centered roadmap plans to reach desired health outcomes. For example, rather than setting an imprecise aim like "exercise more", a SMART goal would be to "walk briskly for 30 minutes 5 times a week for the next month". This specificity helps in tracking progress and maintaining motivation (18). This study assessed the impact of integrating MI in diabetes care on glycemic control and weight-related outcomes among individuals living with T2DM. Statistically significant improvements were observed following the intervention in glycemic biomarkers, including HbA1c and FBG levels. On the other hand, no significant changes in weight-related outcomes were observed but the effect size analysis indicated clinically relevant trends.

The intervention resulted in significant reductions in both HbA1c and FBG levels, with a large effect size observed for HbA1c and a moderate effect size for FBG. These outcomes confirm the effectiveness of MI-based interventions in enhancing glycemic control. Of particular note, the strong association between pre- and post-intervention readings of both glycemic biomarkers suggests a uniform response pattern across patients instead of random variability. These findings are consistent with previous studies that support the effectiveness of structured lifestyle and behavior change programs in improving glycemic outcomes (16).

A randomized controlled trial by Chen *et al.* (2020) found that a 12-week MI-based lifestyle program significantly reduced FBG level in patients with poorly controlled T2DM, highlighting the role of behavioral engagement in improving FBG levels (20). Furthermore, no significant gender-based differences were detected in HbA1c levels either at baseline or following the intervention. This suggests that the implemented approach was equally effective across male and female participants. While some literature indicates that women may achieve smaller reductions in HbA1c level than men (21). The findings of this study align with data suggesting that when baseline glycemic values are comparable, gender differences may be attenuated.

Despite the observed enhancement in the weight-related outcomes, including BW and BMI, these improvements did not yield a statistically significant difference. Nevertheless, analysis of effect size showed moderate significant effects, indicating that the intervention could still possess practical implications in weight management. The absence of statistically significant changes in BW and BMI aligns with the study reporting that improvements in glycemic control might emerge without dependence on weight reduction. For example, a systematic review by Phillips and Guarnaccia demonstrated that MI can improve HbA1c level even without significant weight loss (21).

Comparable conclusions were reached in other studies, indicating that glycemic control may improve through enhanced dietary adherence and increased self-efficacy rather than weight change per se (22-24). Several plausible explanations may account for the non-significant findings in BW and BMI. One of them is the short duration of the intervention. A 3-month intervention period may not be sufficient to elicit statistically significant reductions in body weight. It was shown that more extended interventions are often required to induce meaningful changes in BW and BMI (23, 25). Furthermore, MI primarily promotes internal motivation and behavior change rather than directly targeting weight loss. A study examining a similar intervention has reported a non-significant weight reduction at 12-month follow-up despite initial behavioral improvements (26). However, slight weight loss can have considerable health advantages in T2DM populations as indicated before (27). The Look AHEAD trial (Action for Health in Diabetes study) demonstrated that an average weight loss of 2-5% was associated with improvements in glycemic control in individuals with T2DM (28). Similarly, Franz *et al.* (2007) reported that a weight loss of ≥2.5 kg was associated with improved glycemic outcomes, even in the absence of pharmacological changes (29). Moreover, the American Diabetes Association recognized that a modest 2-5% weight loss could produce clinically relevant improvements in metabolic risk factors and overall diabetes management (30).

The strong association between pre- and post-intervention measurements for HbA1c and FBG suggest consistency in participant responses and reinforce the reliability and internal validity of the observed effects. Participants who entered the program with elevated biomarker levels tended to maintain relatively higher levels post-intervention, although the majority exhibited reductions. Notably, individuals with higher baseline values of HbA1c and FBG levels frequently demonstrated greater post-intervention improvements. It was shown that following a high-dose behavioral weight loss treatment, participants with higher pre-intervention HbA1c level demonstrated significantly more significant reductions in both HbA1c and FBG levels (31).

The effect sizes observed for HbA1c, FBG, BW, and BMI underscore the intervention's clinical significance. The observed effect sizes, particularly for HbA1c, reflect a meaningful degree of improvement. Prior behavioral research has suggested that effect sizes exceeding 0.5 indicated clinically relevant changes, even without statistically significant *p* values (32). These results highlight the value of integrating MI into T2DM management protocols, providing quantifiable benefits in glycemic control and weight-related outcomes. The findings of this study are in alignment with regional evidence from Middle Eastern countries, where structured, culturally tailored diabetes management interventions have demonstrated effectiveness in improving glycemic outcomes and promoting lifestyle modification. A systematic review highlighted the important role of lifestyle modifications in T2DM management in Middle Eastern populations, underscoring the value of contextually and culturally relevant strategies. In-depth, well-designed T2DM programs reflecting cultural relevance have shown efficacy in enhancing glycemic outcomes, including FBG and HbA1c, and promoting lifestyle transformation (33).

Despite the promising findings, the limitations of this study should be taken into consideration for future directions. The relatively short duration may have hindered the investigation of significant changes in BW and BMI indicators. Therefore, extended follow-up periods are recommended to capture the full effect of behavioral changes on weight management indicators. Furthermore, the moderate sample size may restrict the generalizability of the findings. Future studies should evaluate the impact of integrating MI and SMART goal-setting with pharmacological treatments to assess synergistic effects. Long-term follow-up and more diverse populations would also help to validate and expand upon these findings.

Conclusion

The present study revealed notable reductions in HbA1c and FBG levels following MI and SMART goal-setting program. Data highlighted the efficacy of integrating MI into a T2DM management plan, which may be an effective way to restore glycemic outcomes in individuals living with T2DM. Future research involving larger sample sizes and longer follow-up periods is recommended to validate these results and evaluate their long-term effects. Further researches with larger sample sizes and longer follow-up periods are warranted to explore potential impact on weight-related outcomes.

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This study was conducted without any financial support. Data was extracted from the medical records of patients.

Authors' Contribution

S.G.A (The Ph.D. candidate) collected the sample data, analyzed and interpreted the data, and wrote the initial draft of the manuscript. R.H.M served as an advisor to the Ph.D. candidate; designed the study, developed the theoretical framework, supervised various stages of the work, interpreted the data, and reviewed the manuscript. B.A He served as a co-advisor to the Ph.D. candidate and contributed to the interpretation, revised, and approved the final version.

Conflict of Interest

The authors declare no conflict of interest.

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