The Effect of Lifestyle Intervention on Glycemic Control in Type 2 Diabetic Patients

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ABSTRACT

Type 2 diabetes mellitus (T2DM) is one of the most serious health challenges of the 21st century. Diabetes is forecast to affect 537 million people in 2021, with the figure expected to rise to 643 million by 2030 and 783 million by 2045. A healthy diet and physical activity are essential aspects of the treatment. The aim of the study is to assess the effect of an educational programme on blood sugar and HbA1c levels. This study involved a three-month educational program intervention in a two-group, randomised controlled trial. It included two groups of subjects, one receiving an educational program and the other serving as a control group. Between November 2021 and February 2022, 100 patients with T2DM were recruited from Erbil, Iraq. The ethical approval from the College of Medicine at Hawler Medical University was obtained for this study. Patients with T2DM were randomly allocated to one of two groups: control (n = 50) or intervention (n = 50). The intervention group received an educational program with a publisher including, diet instruction, nutritional supplements, and an exercise recommendation as part of their intervention. For categorical data, a chi-square test was used to see if there was an association between the demographics of the two groups, and a t-test was used for numerical data to see if there was a difference between the two. Data are presented as mean ± SD. A two-tailed unpaired t-test was employed for comparison between groups. A two-tailed paired t-test was employed to compare groups at baseline. Means, standard deviations, and percentages were provided as crude values for descriptive statistics. For data entry and statistical analysis, the statistical package for the social sciences, version 25.0 (IBM, SPSS USA), was used, and p-values ≤ 0.05 were considered statistically significant. The intervention group had a statistically significant reduction in weight (-2.51 kg), waist circumference (-2.27 cm), random blood sugar (-29.64 mg/dL), haemoglobin A1c (-1.13 %), and serum triglycerides (-40.06 mg/dL). The result of the study suggests that lifestyle intervention and a low-carbohydrate diet for three months are beneficial in improving glycemic control in patients with type 2 diabetes when compared to the control group.

Keywords: Effect, Lifestyle, Glycemic, Type 2 diabetic

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is one of the most serious health challenges of the 21st century. Diabetes is forecast to affect 537 million people in 2021, with the figure expected to rise to 643 million by 2030 and 783 million by 2045[1]. Type 2 diabetes mellitus is a chronic disease that is becoming more common around the world[2]. The World Health Organization (WHO) anticipated that the prevalence of T2DM would rise by 2025, with a 120% increase in the number of people affected. Despite breakthroughs in pharmacotherapy and diabetes treatment devices, as well as a focus on treatment adherence during the previous decade, data from the National Health and Nutrition Examination Survey (NHANES) revealed that 43–45% of people with diabetes did not meet glycemic targets of HbA1C 7%[2,3]. In addition to pharmaceutical therapy, diet, regular exercise, and weight loss are applied as first-line treatments for T2DM. Medication can lower HbA1c in people with T2DM, but it is also associated with potential drug interactions, discomfort, increased costs, and a lower quality of life[4]. Complications are common in T2DM patients, and they are major causes of morbidity and death[5]. Diabetes of any form may cause complications in various parts of the body and raise the overall risk of death. Heart attack, stroke, renal failure, leg amputation, visual loss, and nerve damage are all potential consequences[6]. A healthy diet and physical activity are essential aspects of treatment[2]. Data show that getting enough sleep and exercising regularly may help people with T2DM improve their glycemic control and lose weight[7]. Type 2 diabetes mellitus (T2DM), a major comorbidity of overweight and obesity, has also witnessed remarkable increases in prevalence alongside these rises[8]. There is no doubt that T2DM negatively impacts patients' health and the economy[9]. A very low-carbohydrate ketogenic diet (LCK) with no caloric limits has been shown in certain studies to improve metabolic parameters in persons with type 2 diabetes and lower the requirement for diabetic medicines[10]. The major technique for glycemic management advocated by medical professionals and professional organizations is weight reduction. Examples include exercise, as well as ongoing diabetes education and support, with the purpose of avoiding or postponing the onset of T2DM. Overweight and obese people with type 2 diabetes can better control their blood sugar, lipids, and blood pressure if they lose at least 5% of their starting body weight over a year[11]. Chronic intake of a high-energy, high-fat diet and low levels of physical exercise results in alterations in energy balance with conservation of energy deposited as fat. Even before considerable weight gain occurs, excessive calorie intake induces insulin resistance. Diabetes is a common chronic medical illness that severely limits patients' activities. To control the condi-

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tions, significant education and behaviour modification are required. Lifestyle changes for all diabetes patients must include a careful diet plan, medication administration, and at-home blood glucose monitoring methods[12]. Physical activity, along with dietary and behavioural changes, has been shown to play an important role in the prevention of type 2 diabetes and obesity[13]. The purpose of this study was to assess the effect of an educational programme on blood sugar and HbA1c levels in type 2 diabetic patients.

METHODOLOGY

Design and Setting: This study involved a three-month educational program intervention in a two-group, randomised controlled trial. It included two groups of subjects, one receiving an educational program and the other serving as a control group. Between November 2021 and February 2022, 100 patients with T2DM were recruited from Erbil, Iraq. The ethical approval from the College of Medicine at Hawler Medical University was obtained for this study. Patients with T2DM were randomly allocated to one of two groups: control (n = 50) or intervention (n = 50). The intervention group received an educational program with a publisher including, diet instruction, nutritional supplements, and an exercise recommendation as part of their intervention.

Intervention Group: We randomly assigned 50 patients to receive educational programs. The intervention group was advised to consume low-carbohydrate foods based on the guidelines of the American Diabetes Association, which limit carbohydrate consumption and exercise daily. The authors also suggested that the number of meals should not exceed three. Moreover, they were given exercise: 30 minutes of daily walking. using lifestyle advice, such as brisk walking if possible, and behavioural adherence methods targeted at elevating positive affect regulation, which were also recommended to the intervention group.

Control Group: Patients in the control group, like those in the intervention group, had pre-and post-test assessments but did not receive diabetes instruction, exercise demonstrations, or a handbook. According to the researchers, the control group assesses whether the intervention has a meaningful impact on the experimental group.

Outcome Assessments: The study's main outcome variables were HbA1c levels, random blood sugar, a lipid profile, blood pressure, anthropometric measurements (BMI), and waist circumference. Blood tests were used to measure the subjects' HbA1c, RBS, and lipid profiles before and after the educational program. Anthropometric measurements, including body weight (kg) (electronic digital weighing scale Medel Cristal, ref: 92081, Italy), were measured at baseline and after three months. The BMI was calculated by dividing weight (kg) by height squared (m2). Waist circumference (cm) was measured at the baseline and after three months. An electronic beurer device (SR BM2 blood pressure monitoring, Germany) was used to measure blood pressure twice at baseline and three months later at 5-minute intervals. To reduce the chance of bias, the lab tests and measurements for the intervention group and the control group were done on different days.

Inclusion Criteria: Have Hba1c value of ≥ 6.5%, were in the age group of 30-65 years and were interested in participating.

Exclusion Criteria: Tired patients were excluded from the current study.

Statistical Analyses: For categorical data, a chi-square test was used to see if there was an association between the demographics of the two groups, and a t-test was used for numerical data to see if there was a difference between the two. Data are presented as mean ± SD. A two-tailed unpaired t-test was employed for comparison between groups. A two-tailed paired t-test was employed to compare groups at baseline. Means, standard deviations, and percentages were provided as crude values for descriptive statistics. For data entry and statistical analysis, the statistical package for the social sciences, version 25.0 (IBM, SPSS USA), was used, and p-values ≤ 0.05 were considered statistically significant[14-22].

RESULT

A total of 100 patients with comparable gender, socioeconomic level, smoking status, and physical activity were recruited for the study. Table 1 shows the baseline characteristics of the study patients. There were no statistically significant associations between the groups' characteristics. The mean age of the patients in the control group was 53.72 ± 6.60 years and 52.20 ± 7.73 years in the intervention group. Table 2 shows selected study outcomes at the baseline, three months, and the absolute change from the baseline. The intervention group had a statistically significant reduction in weight, waist circumference, random blood sugar (RBS), haemoglobin A1c (HbA1c), and serum triglycerides. Whereas those in the control group gained weight and increased waist size. Similarly, changes in random blood sugar,

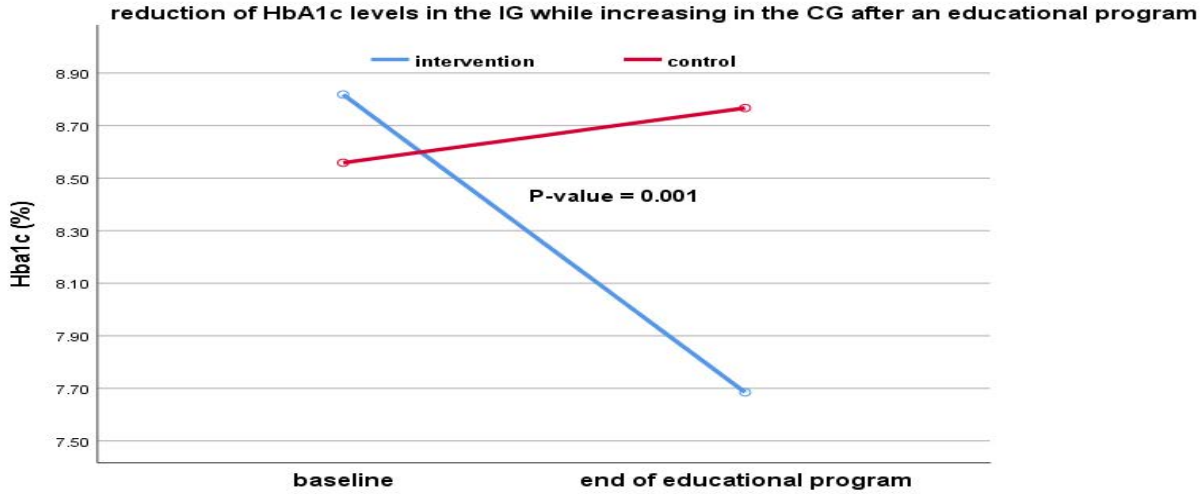

Figure 1: Effect of intervention within 3 months on HbA1c. Intervention group: blue line, control group: red line

Table 1: Baseline characteristics of patients type 2 diabetes allocated to the lifestyle intervention vs. control groups

Characteristics	Control group (n=50)	Intervention group (n=50)	P value
Age (years)	53.72 ± 6.60	52.20 ± 7.73	0.29
Gender			
Male NO. (%)	28 (56)	28 (56)	1
Female NO. (%)	22 (44)	22 (44)	
Socioeconomic classes			
Low class NO. (%)	34 (68)	30 (60)	0.397
Middle class NO. (%)	13 (26)	13 (26)	
High class NO. (%)	3 (6)	7 (14)	
Smoking status			
Smokers NO. (%)			0.812
Nonsmoker NO. (%)			
Physical activity	5 (10)	9(18)	0.24
Physical inactivity	45 (90)	41 (82)	
Duration of DM (years)	7.85 ± 6.12	6.83 ± 4.57	0.34
Weight kg (mean ± SD)	82.48 ± 14.85	87.02 ± 13.94	0.11
Waist cm (mean ± SD)	93.16 ± 10.21	93.16 ± 12.35	0.13
SBP (mmHg)	13.78 ± 1.51	14.06 ±1.45	0.33
DBP (mmHg)	8.69 ± 0.64	10.29 ±11.53	0.32
RBS (mg/dL)	163.43 ± 67.00	184.30 ± 71.77	0.13
Hba1c (%)	8.55 ± 1.57	8.81 ± 1.75	0.43
Serum LDL (mg/dL)	106.32 ± 34.27	112.56 ± 32.63	0.35
Serum HDL (mg/dL)	37.84 ± 9.16	38.88 ± 8.95	0.56
Serum triglyceride (mg/dL)	257.98 ± 128.52	270.84 ± 178.96	0.68
Total cholesterol (mg/dL)	167.52 ± 44.26	176. 10 ±43.08	0.328

Pearson chi-square was used to determine significance for categorical data. Characteristics are (gender, socioeconomic class, smoking status and physical activity). However, independent t-tests are used to analyses numerical data. values are Mean ± SD, all values are Mean ± SD; age, duration of T2DM, weight, Waist Circumference, SBP-Systolic blood pressure, DBP-Diastolic blood pressure, RPG-Fasting plasma glucose, Hba1c, LDL-low density lipoprotein, HDL-High density lipoprotein, triglyceride, and total cholesterol

Table 2: Adjusted mean change from baseline in anthropometric and biochemical indicators in the control and intervention groups

Characteristics	Adjusted mean change from baseline (End – baseline of study)			
	Control group NO. 50	Intervention group NO. 50	95% CI	p-value
Weight kg (mean ± SD)	0.60 ± 1.64	-2.51 ± 2.25	-3.89 to -2.33	0.001
Waist cm (mean ± SD)	1.02 ± 4.84	-2.27 ± 4.64	-5.17 to -1.40	0.001
SBP (mmHg)	-0.13 ± 1.11	0.49 ± 7.15	-1.40 to 2.65	0.541
DBP (mmHg)	0.21 ± 0.96	-1.82 ± 10.64	-5.03 to 0.96	0.181
RBS (mg/dL)	87.22 ± 359.05	-29.64 ± 60.74	-219.06 to -14.66	0.025
Hba1c (%)	0.20 ± 0.43	-1.13 ± 0.91	-1.62 to -1.05	0.001
Serum LDL (mg/dL)	5.02 ± 10.69	6.64 ± 55.96	-14.37 to 17.61	0.841
Serum HDL (mg/dL)	-0.92 ± 4.36	3.94 ± 4.75	3.04 to 6.67	0.001
Serum triglyceride (mg/dL)	11.88 ± 36.19	-40.06 ± 97.86	-81.22 to -22.65	0.001
Total cholesterol (mg/dL)	1.12 ± 28.69	-4.94 ± 27.13	-17.12 to 5.02	0.281

HbA1c, serum triglycerides, and decreasing HDL were also reported. The current study observed that patients in the intervention groups decreased serum cholesterol and diastolic blood pressure, but these were not statistically significant. There were no statistically significant inter-group differences noted for systolic blood pressure or serum LDL.

DISCUSSION

This study aimed to assess the impact of educational programmes on the glycemic outcomes of type 2 diabetes patients over a three-month period. The results of this study showed that three months after baseline, individuals in the intervention group had substantially lower HbA1c and RBS levels than those in the control group. The above finding agrees with those of previous large studies, which have shown that diabetic patients may benefit from aerobic exercise[23-27]. Furthermore, this finding is consistent with a previous meta-analysis study that discovered physical activity to be beneficial for diabetic patients[28]. A 12-month randomised trial of a moderate-carbohydrate versus very low-carbohydrate diet in overweight adults with type 2 diabetes or prediabetes revealed a significant reduction in HbA1c[10]. Also, these findings are consistent with the previous study, which showed that a low-carbohydrate diet has a significant impact on decreasing HbA1c[29]. In addition to better glycemic control, a low carbohydrate diet and physical activity may provide health advantages related to cardiovascular risk variables such as serum lipids and blood pressure when compared to the control group. On the other hand, these authors observed a decrease in serum cholesterol, but statistically not significant, while TG and HDL were significant[2,30]. An increase in LDL was noted, but it was not statistically significant. Those results are consistent with those found in studies by other authors[10]. However, another meta-analysis research found that lifestyle intervention had no effect on LDL[31-35]. In terms of weight and waist circumference, the authors observed a decreasing weight and waist circumference in the intervention group, which was statistically significant, while an increase was observed in the control group. Previous research has shown that T2DM can be effectively managed using intensive lifestyle interventions in severely obese people[36,37]. A full behavioural lifestyle change may result in clinically meaningful weight reduction study[38]. Limitations of the current study, a three-month research project would not be long enough to assess the intervention's long-term impact on glycemic control. Thus, a research period of 3 months without medication changes would be appropriate for assessing intervention effects among T2D patients.

On the other hand, exercise has been suggested as an effective strategy to help with glucose management in diabetes. The results of a meta-analysis by Boule et al. show that exercise training lowers HbA1c by an amount that is linked to a lower risk of complications from diabetes.

CONCLUSION

The current study found that lifestyle intervention and a low-carbohydrate diet for three months were beneficial in improving glycemic control in patients with type 2 diabetes when compared to the control group.

Authorship Contribution: All authors share equal effort contribution towards (1) substantial contributions to conception and design, acquisition, analysis and interpretation of data; (2) drafting the article and revising it critically for important intellectual content; and (3) final approval of the manuscript version to be published. Yes.

Potential Conflicts of Interest: None

Competing Interest: None

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