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Original Research Article

Impact of Diet and Exercise on Fasting, Postprandial Blood Glucose Levels, and Hba1c in Patients with Uncontrolled Type 2 Diabetes Mellitus

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Abstract

Background: According to estimates, the prevalence of diabetes among the Indian population reached around 77 million individuals in the year 2019. The projected estimate for this numerical value is anticipated to surpass 134 million by the year 2045. The implementation of dietary and physical activity modifications is crucial for the management of Type 2 Diabetes Mellitus (T2DM). Engaging in regular physical activity (PA) can delay the onset of diabetes-related chronic conditions such as neuropathy, retinopathy, and nephropathy, while also mitigating their advancement.

Methodology: In this 12-week prospective trial, 100 uncontrolled T2DM patients were randomly assigned to the Lifestyle Modification Group and Control. The LMG received supervised and guidance on lifestyle modification. Whereas the other group received Standard treatment and medication changes. HbA1c, FBS, and PPBS were measured at baseline and 12 weeks.

Result: The difference in the changes found in both the groups were statistically significant, as indicated by p-values less than 0.0001 for both blood sugar that is fasting and postprandial, p-value less than 0.001 for glycated hemoglobin (HbA1c).

Conclusion: A lifestyle modification program involving dietary changes and exercise demonstrated an improvement in blood glucose levels

Keywords: lifestyle modification, type 2 diabetes mellitus, sugar levels

Introduction

Type 2 diabetes mellitus (T2DM) is a prevalent health issue on a worldwide scale, distinguished by heightened levels of glucose in the bloodstream due to the presence of insulin resistance and compromised insulin production. In this study, we aim to investigate the impact of social media on mental health. Specifically, the prevalence of diabetes is significant on a worldwide scale and has a persistent upward trend, especially in emerging countries like India. The primary factor contributing to this trend is the increasing prevalence of overweight/obesity and the adoption of unhealthy lifestyles. According to estimates from 2019, the prevalence of diabetes in India was reported to be around 77 million individuals. [1] The anticipated figure is expected to exceed 134 million by the year 2045. The user did not provide any text to rewrite. The treatment of Type 2 Diabetes Mellitus (T2DM) has acknowledged the significance of lifestyle adjustments, which include alterations in food patterns and the adoption of a more active physical routine. The third point to consider is... The objective of this research was to evaluate the effects of a lifestyle modification programme glucose levels and HbA1c in individuals with uncontrolled type 2 diabetes mellitus (T2DM). [2]

Furthermore, it also encompasses beneficial effects on insulin sensitivity, regulation of blood sugar levels, and metabolic irregularities linked to type 2 diabetes (T2D). Therefore, due to compelling data, physicians who treat patients with type 2 diabetes generally recommend the adoption or escalation of physical activity, adherence to a nutritious diet, and, if necessary, the use of medication and/or insulin to regulate blood glucose levels. [3] Therefore, the responsibility for self-management outside of therapeutic care rests with the patient. Nevertheless,

research has indicated that people diagnosed with diabetes exhibit lower levels of physical activity compared to those without diabetes, leading more sedentary lives and experiencing inadequate metabolic regulation. This can be attributable to a range of personal, environmental, and psychosocial factors that may impede adherence to exercise guidelines, hence complicating diabetes care. [4]

Methodology

A total of 100 participants with uncontrolled T2DM (HbA1c >7%) were enrolled in this 12-week prospective study and divided into 2 groups: the Lifestyle Modification Group (LMG) and the Control Group (CG). The LMG received a structured program that included dietary counseling promoting balanced nutrition and portion control, as well as supervised exercise sessions three times a week, emphasizing both aerobic and resistance training. The CG received standard care, with medication adjustments as needed, but without any lifestyle intervention. FBS, PPBS, and HbA1c levels were assessed at baseline and 12 weeks.

Results:

The results of this research demonstrated statistically significant improvements in fasting blood sugar (FBS), postprandial blood sugar (PPBS), and glycated haemoglobin (HbA1c) levels among participants in the intervention group (LMG) compared to those in the control group (CG). The observed alterations were determined to possess statistical significance, as shown by p-values below 0.0001 for both fasting blood sugar (FBS) and postprandial blood sugar (PPBS), and a p-value below 0.001 for glycated haemoglobin (HbA1c). The data presented above demonstrate the effectiveness of lifestyle adjustments in improving glycemic control in persons with uncontrolled type 2 diabetes mellitus.

Table 1: Findings of the study

	Mean FBS (mg/dL)	Mean PPBS(mg/dL)	Mean HbA1c
Before lifestyle modification	156.53	288.67	9.3
Standard Deviation	47.36	40.28	0.7
After lifestyle modification	114.57	179.32	8.4
Standard Deviation	12.87	21.61	0.7
P value	<0.0001	<0.0001	<0.001

Discussion

Anti-diabetic medications have been the mainstay of treatment for type 2 diabetes mellitus, but they alone cannot control blood glucose in the long run, especially in a world of stress, unhealthy food, and unhealthy lifestyles. Patients were educated on the importance of a holistic approach involving personalized dietary therapy and physical activity in effectively managing blood sugar levels and reducing the risk of complications in patients with a previous diagnosis of type 2 diabetes mellitus (T2DM) [5]. The dietary therapy was specifically tailored to accommodate the patient's individual lifestyle and community, recommending the avoidance of simple carbohydrates, such as sugar, in favour of complex carbs obtained from natural, unprocessed sources. This entailed integrating a diverse range of vegetables, whole fruits, whole grains, and cereals with a low glycaemic index (GI), often 55 or lower, while abstaining from items that contain added sugars such as sucrose, fructose, and corn syrup. Patients were offered meal choices that had a low glycaemic index and were in line with Indian dietary preferences [6]. These alternatives included tomatoes, oranges, coconut, apples, raw carrots, beans, onions, and bell peppers. In addition, we recommended substituting red meat with more nutritious alternatives such as fish, seafood, and eggs. We also stressed the significance of limiting the consumption of processed foods such as packaged baked goods, salty snacks, and fast foods in order to decrease the likelihood of cardiovascular problems [7, 8].

In relation to physical activity, patients were advised to participate in consistent physical exercises that are customized to their lifestyle and capabilities, with the objective of enhancing blood glucose regulation. WHO guidelines for physical activity recommendations were followed, ensuring that patients received individualized exercise plans. Even a little rise in physical activity proved advantageous for inactive patients, with walking being identified as a viable type of sustained aerobic exercise. We suggested setting a practical objective of initiating a 20-minute vigorous stroll. To meet the recommended 150 minutes of aerobic activity per week, it is advised to start with 2-3 days a week of walking and progressively increase the duration to 30 minutes on most days. [9,10]

In addition, we recommended incorporating moderate-intensity resistance exercise, running, and activities such as 25 minutes of Surya Namaskar into your routine at least three times a week [11]. Patients were additionally counselled to implement uncomplicated modifications to their lifestyle, such as opting for stairs over elevators and engaging in a brief stroll following meals. It also stressed the

importance of monitoring blood glucose levels both before and after physical activity in order to properly manage low blood sugar and prevent dehydration. Ultimately, this comprehensive strategy, based on previous patient guidance and incorporating tailored nutritional therapy and individualized physical activity suggestions, has proven its ability to empower individuals with T2DM to successfully handle their condition, regulate blood sugar levels, and substantially decrease the likelihood of complications, ultimately promoting their overall health and well-being [12].

The highly significant reduction in FBS observed in the LMG is showing that dietary modifications, exercise can enhance insulin sensitivity, and improved glucose uptake by peripheral tissues, particularly skeletal muscle, can lead to lower fasting blood glucose levels. The results suggest that lifestyle modification can be particularly effective in addressing the basal hyperglycemia characteristic of T2DM [13]. The substantial reduction in PPBS in the LMG highlights the beneficial impact of lifestyle modification on post-meal glucose excursions. This is of critical importance since postprandial hyperglycemia has been associated with an increased risk of cardiovascular complications in T2DM patients. Dietary changes, coupled with regular exercise, can improve glucose disposal and reduce the spike in blood glucose levels following meals [14],as evidenced by the highly significant p-value.

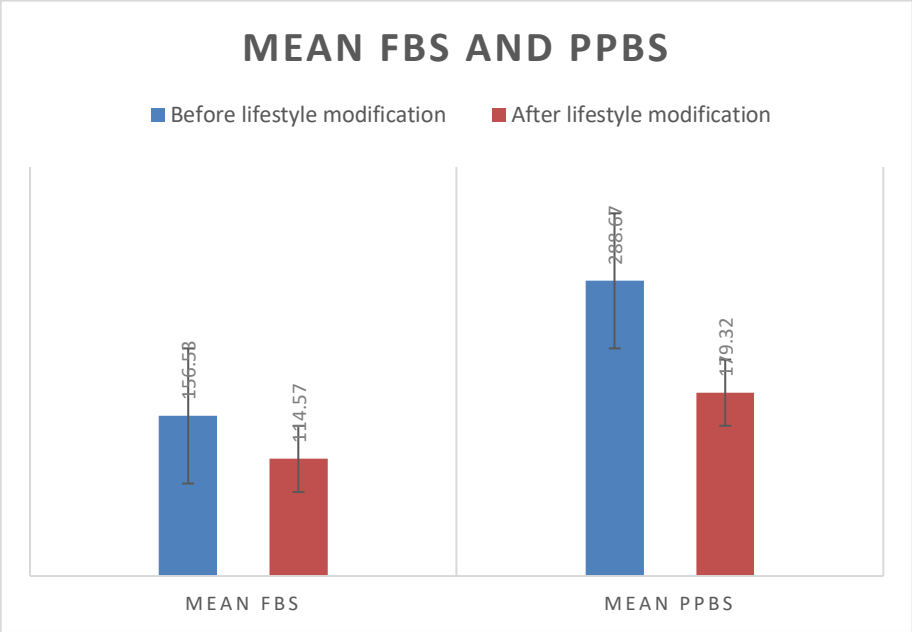

Figure No.1: Comparing mean FBS and PBS in both the group

The significant enhancement in postprandial blood sugar (PPBS) levels holds great significance. Postprandial hyperglycemia, a frequently underestimated yet medically significant condition, has been linked to an increased susceptibility to cardiovascular complications among individuals who had T2DM [15]. The substantial decrease in postprandial blood sugar (PPBS) levels observed in the LMG highlights the program's efficacy in enhancing glucose disposal and mitigating postprandial hyperglycemia. The aforementioned effect has the potential to make a substantial contribution towards mitigating the likelihood of cardiovascular events and improving the overall quality of life for individuals diagnosed with type 2 diabetes mellitus (T2DM).

In addition, the decrease in levels of glycated haemoglobin (HbA1c) that was observed, while slightly less statistically significant in terms of p-value, holds significant clinical implications. Hemoglobin A1c (HbA1c) serves as an indicator of extended glycemic regulation, encapsulating an individual's mean blood glucose levels over a span of multiple months. The observed reduction in HbA1c levels, which is statistically significant, suggests a promising trajectory towards long-term glycemic enhancement, despite the relatively limited duration of the study. Prolonged periods of implementing such reductions have the potential to significantly decrease the likelihood of microvascular and macrovascular complications linked to type 2 diabetes mellitus (T2DM), thereby highlighting the enduring advantages of lifestyle modifications. [16]

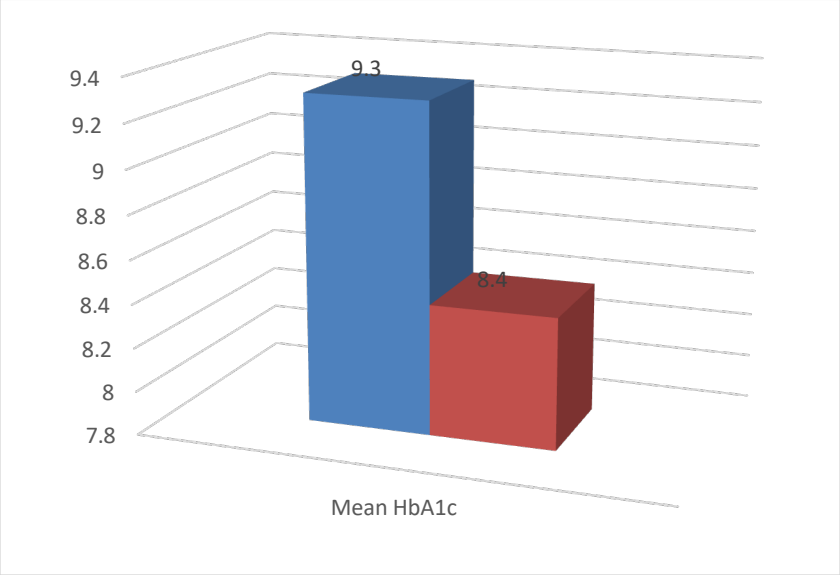

Figure 2: Comparing the HbA1c levels in both the groups

The decrease in HbA1c in the LMG, while still highly significant, had a slightly higher p-value compared to FBS and PPBS. This may be attributed to the relatively short duration of the study. HbA1c reflects long-term glycemic control, and it often takes several months to see substantial changes. Nevertheless, the observed reduction is promising, as it indicates a trend toward better long-term glycemic control, which may further reduce the risk of diabetes-related complications. The findings of this study underscore the importance of a lifestyle medicine approach in the management of uncontrolled T2DM. By addressing both fasting and postprandial hyperglycemia, as well as long-term glycemic control, lifestyle modifications can significantly reduce the burden of diabetes and its associated complications. [17] Furthermore, the highly significant p-values support the robustness of the observed effects, strengthening the case for incorporating lifestyle modification programs into standard T2DM management. Successful implementation of lifestyle modifications relies on patient education and adherence. Participants in the LMG received structured guidance on diet and exercise, which likely contributed to the remarkable improvements observed. Future studies should focus on strategies to enhance patient engagement and long-term adherence to lifestyle changes. [18]

Conclusion

The present research investigated the effects of a lifestyle modification programme on individuals with uncontrolled type 2 diabetes mellitus. The programme included implementing dietary modifications and engaging in regular exercise. The results of the study revealed a substantial and statistically significant reduction in fasting and postprandial blood glucose levels, as well as HbA1c, among the participants. The aforementioned results underscore the significance of lifestyle medicine as an essential element in the treatment of Type 2 Diabetes Mellitus (T2DM), facilitating improved glucose control and mitigating the likelihood of complications associated with diabetes. Additional investigation is necessary to examine the enduring impacts and viability of these therapies within authentic clinical environments.

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