Reduction in HbA1c through lifestyle modification in newly diagnosed type 2 diabetes mellitus patient: A great feat

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ABSTRACT

A 45-year-old male, resident of Texas, U.S.A, was diagnosed with type-2 diabetes mellitus on September 05, 2020 with HbA1c 14.9%. His physician prescribed oral hypoglycemic agents (OHA) starting immediately due to his high HbA1c levels. However, the patient was reluctant to be on lifelong medications. Thus, he chose conservative management of lifestyle modification by enrolling in “World free of Obesity and Diabetes” campaign that advised “only two meals a day and exercise” regime for diabetes reversal. He followed the plan very meticulously and his HbA1c was successfully reduced by 9.8% (HbA1c from 14.9% to 5.1%) within 3 months without any medications. The patient follows the regime without any burden of compromising his quality of life and has maintained his HbA1c to 4.6% till April 2021. Diabetes reversal by lifestyle modification is a healthier option, and must be encouraged in all the patients in prediabetes group (HbA1c: 5.7%-6.4%) and those with newly diagnosed type 2 diabetes mellitus (HbA1c >6.5%) without any complications, thus promoting good health-seeking behavior. American Diabetes Association (ADA) suggests that metformin should be started to the prediabetes and newly diagnosed group of patients along with lifestyle modifications. However, there are evidences of complete diabetes reversal of the patients with HbA1c ranging from 8%-15% by just lifestyle modification and that too without any complications among the patients registered under “World free of obesity and diabetes” campaign, which challenges the current prescribed guidelines for the management of type 2 diabetes mellitus.

Keywords: HbA1c, lifestyle modification, type 2 diabetes

Introduction

According to the World Health Organization, diabetes mellitus is a chronic, metabolic disease characterized by elevated levels of blood glucose, which leads to the damage of vasculature, eyes, kidneys, and nerves. It is also closely linked to the epidemic of obesity that requires long-term medical attention.[1] Many of these complications arise from the combination of resistance to insulin action, inadequate insulin secretion, and excessive or inappropriate glucagon secretion. The prevalence of type 2 diabetes (T2D) in India is around 7.3%. The morbidity and mortality rates associated with it are fairly high.[2] A systematic review showed that the estimated country-level health care expenditure on diabetes mellitus in India after amending purchasing power difference was 31 billion US dollars in 2017, pushing India in fourth place globally after the USA, China, and Germany. Looking at the economic burden, in India, diabetes alone exhausts 5% to 25% share of an average Indian household earning.[3] Given the rising cost of these antidiabetic medicines and insulin, patients may potentially save significant money by disease remission. This lifestyle modification gives the patients liberty to live without any intensified restrictions, and transforms their lifestyle into a healthy one.

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Although lifestyle modifications are universally acknowledged to be the first-line treatment of T2D, it is not the current first line of practice in India. This might be attributed to the lack of information, education, and communication at a community level. The adaptation of population in urban as well as rural areas to the newer technologies has reduced the human effort—this has been a boon as well as bane. The incidence of obesity is on rise due to this. It has become a major adjuvant of T2D, due to a change in lifestyle to a more sedentary one. Medications manage the symptoms of diabetes, but they cannot prevent the progression of the disease and have rarely led to complete remission and reversal of the disease. Bariatric surgery is a treatment option for obese patients with T2D, but is invasive, costly, and comes with its risks. Lifestyle modification has the potential to fill this gap in diabetes care.

This case exemplifies that lifestyle modification can be practiced as a therapeutic alternative to antidiabetic medications and insulin therapy in T2D patients with obesity. “Daily only two meals and exercise” was a lifestyle modification proposed by the coauthor of this study under the “World free of obesity and diabetes” campaign. Enrollment was voluntary and patient was given the choice of his own meals after following the given sequence of few compulsory foodstuffs. The only restriction of this diet was abstinence from having any sugar or sugar substitute containing foodstuff. This diet did not promote starvation, as during fasting periods, patients were allowed to drink fluids such as water, coffee, tea, and watery buttermilk without any sugar or sugar substitutes. In the meal prep, patients were encouraged to eat a diet low in refined carbohydrates. The patient was encouraged to add a regular exercise routine in the form of 4.5 km walking in 45 min. He was also given the links of videos containing various exercises of similar intensity that could be done at home as an alternative, due to circumstantial obstacles to exercising outside due to COVID-19 pandemic. The dietary and exercise regimen used in this study has been published and is quoted in the references.

Therefore, patients with T2D can reverse their disease without the worry of side effects and financial burden of many pharmaceuticals, as well as the long-term risks and uncertainty of surgery, all by means of a simple therapeutic lifestyle modification. This can be a new treatment option prescribed by family medicine specialists as primary care for the patients with T2D.

Case Report

A 45-year-old male, resident of Texas, U.S.A, with moderately sedentary lifestyle was consistent with routine health check-ups until COVID-19 pandemic. His lifestyle became extremely sedentary due to “work from home” with no exercise routine. The patient had symptoms of sudden loss of weight, polyuria, pain in extremities, and blurring of vision. He visited an ophthalmologist for blurring of vision, but there were no signs of diabetic retinopathy and was advised prescription lenses, in spite of which the blurring of vision continued. Hence, he visited the physician for a routine health check-up. He was diagnosed with type 2 diabetes mellitus with fasting blood sugar (FBS)-312 g/dL and HbA1c-14.9%. His physician prescribed him oral antihyperglycemic agents (OHA). But he was reluctant to take medicines and also anxious about his present health condition. He came across “Dixit diet” after discussing about his current situation with family and friends. He consulted with Dr. Dixit, principal investigator of this study, in India and explained his condition to him.

Dr. Dixit explained him the lifestyle modification popularly known as “Dixit diet” in the form of “daily only two meals a day” and an exercise routine of walking a minimum 4.5 km in 45 min every day. While following this regime he had to check his HbA1c levels monthly and blood sugar levels regularly (Daily pre- and post-meal by glucometer). The patient had taken one dose of medicines and he stopped them by himself to follow the “Dixit diet” plan. He started meticulously following the plan from September 07, 2020. On completion of 1st month, there was a reduction of HbA1c to 9.7% and FBS to 129 g/dL. These results encouraged him to follow the plan strictly in spite of his hectic work schedule. By 2nd month, the HbA1c was reduced to 6.4%, FBS-119 g/dL and by the 3rd month to 5.1% and FBS-121 g/dL. The decline in HbA1c continues till date with a reading of 4.6% in April 2021. Thus, the patient was successful in sustaining the path of diabetes reversal without medications and without any complication by strictly following “Dixit diet” plan.

Investigations

Patient’s HbA1c [Figure 1] and weight were measured monthly. FBS was tested every day with a glucometer early in the morning with 8–10 h of fasting, 2 h post 1st meal, and immediately before 2nd meal [Figure 2]. He was advised monthly health check-ups to rule out any complications.

Outcome and follow-up

On initiating and strictly following “Dixit diet” plan, HbA1c and weight were measured monthly to monitor the progress [Table 1 and Figure 1].

Treatment

The patient was enrolled in the diabetes reversal center (DRC) under the campaign. An initial educational seminar on T2D and counseling was conducted. The patient participated in the nutritional training seminar, which outlined many topics including the pathophysiology of diabetes, insulin resistance, education on macronutrients, and the principles of dietary management of diabetes as well as its safety.

After completing the educational training, the patient was followed in the DRC monthly. He was encouraged to visit the DRC physician in case he had any discomfort or in case of hypoglycemic episodes. The patient was also added to the WhatsApp groups of the assigned DRC, which included the physician at the DRC, so that they could clear if he had any other queries or concerns.
queries at the earliest. The primary intervention used in this case was medically advised dietary regimen and exercise routine. He was given detailed instructions on monitoring daily blood glucose and maintaining the findings in a diary.

The patient was given the following 2-OMEX lifestyle modification as a therapeutic approach for his diabetes remission:

**Dietary regimen**

Patient has to have 2 meals only in a day and each meal containing order of following foodstuffs:  
- 1st – 6–8 dry fruits (4 almonds and 4 walnuts) for omega fatty acids and micronutrients (excluding sugar-containing dry fruits like raisins, dates, apricot)  
- 2nd – 1 bowl salad for fibers and early satiety (excluding sugar-containing vegetables- beetroot, carrots)  
- 3rd – 1 bowl sprouted beans/pulses or 2 boiled eggs for proteins and micronutrients  
- 4th – Food items cooked at home for meal (cooked without sugar, jaggery, honey, sugar substitute).

Patient can only have fluids like water, tea or coffee without any added flavor, or diluted buttermilk in between these two meals. All of these are without sugar, jaggery, honey, or sugar substitute. This way patient feels satiated all the time without any starving or cravings, and can thus follow the diet plan meticulously.

| Date               | Weight (kg) |
|--------------------|-------------|
| 01-May-2020 (Before diagnosis) | 80.7        |
| 05-Sep-2020 (At diagnosis)     | 66.6        |
| 05-Oct-2020          | 66.2        |
| 05-Nov-2020          | 66.2        |
| 05-Dec-2020          | 64.4        |
| 02-May-2021          | 66.6        |

There was no significant weight loss within 3 months of initiation of lifestyle modification. Thus, it could be said that reduction in weight was not a contributing factor to reversal of insulin resistance, but the reduction of hyper-insulinemic episodes due to decreased frequency of meals was the contributing factor.

**Exercise routine**

Patient has to walk for a minimum 4.5 km in 45 min every day. This suffices the criteria of at least 150 min moderate grade cardiovascular exercise per week as advised by the American Heart Association. In case of emerging COVID-19 pandemic situation and lockdown measures, if exercising outside was not possible, the patients were provided with the links to the videos of the exercises of similar intensity they could perform at home, created by volunteers of World free of obesity and diabetes campaign. Patients were encouraged to exercise in the gap between two meals.

This was based on the concept that any form of exercise is known to release the hormones— adrenaline, glucagon, growth hormone, and cortisol all of which are antagonists to insulin release, thereby inducing the utilization of blood glucose and decreasing the hypoglycemic episodes. This led to the reduction of insulin resistance, hyperinsulinemia, and associated dyslipidaemia. Most importantly, regular exercise induces the release of “endorphins,” the happy hormones, which helped the patients associate their happiness with this regimen. Thus, this lifestyle modification used the physiology of the human body to combat this lifestyle disease, without any side effects.

The patient was examined once a month and investigations were recorded. At each visit, patients’ daily blood sugar diaries were reviewed and weaning of diabetic pharmacotherapy was done under medical supervision. Blood sugars were measured by patients four times daily during this period. Target daily blood sugar levels were <120 mg/dL-fasting, and <200 mg/dL during the initial weaning phase, and <100 mg/dL-fasting and <140 mg/dL thereafter. In addition, patient’s weight, waist circumference, and blood pressures were measured and recorded at each visit and fasting insulin level after 3 months.

**Patient’s Perspective:** The patient quotes, “I now start my day at 6 am for regular walk, if I happen to miss my walk because I have to drop my kids at school, I ensure to make up for it after dinner, but I complete my target of 7–7.5 km/day. I do not feel...
my routine is impacted due to this change in lifestyle. I anticipate the change in my meal times in case of social situations, but I make sure that I stick to the routine otherwise.”

**Discussion**

The goals of diabetes care are to reduce symptoms and to prevent the progression of the disease to life-threatening complications. The main interventions for treating T2D have been lifestyle modification, pharmacological and in some cases surgical. However, in India, the pharmacological treatment has increased the out-of-pocket expenditure, and surgical treatment like pancreatic transplant is not easily available. Thus, the use of lifestyle modification to reverse the disease is a cost-effective and easily available treatment option. This present case series showed that 2-OMEX lifestyle modification can be a useful therapeutic option to reverse T2D and eliminate the need for diabetic medication.

Recent evidence suggests that remission and reversal of T2D is possible. Diabetes Prevention Program Outcomes Study (DPPOS)[19] in the United States and the Finnish Diabetes Prevention Study (FDPS)[20] have indicated that the benefits of lifestyle modification can last for periods from 10 to 23 years. Recently, the post-trial follow-up of the Indian short message service (SMS) study[21] also showed that the effect of lifestyle modification persisted for an additional three years after cessation of the active phase of the trial. Lifestyle modification has proven to be a successful, safe, cost-effective, and preferred prevention strategy in diabetes reversal.[14] The 2-OMEX plan proposed in this study is based on the hypothesis that meal frequency limitation will limit the insulin spikes and thus reduce the cause for insulin resistance and ultimately reduction in the resulting incidence of obesity. A study by Diwekar-Joshi and Warve[22] verifies this concept suggesting that insulin is a driver but not the navigator for a steady-state glucose level. This institutes that the current line of clinical action, which is to maintain normoglycemia by oral hypoglycemic agents or external source insulin, for the management of type 2 diabetes has limited success largely because it is based only on the concept of glucose-insulin relationship. Thus, by reducing the frequency of food consumption in 2-OMEX plan, the insulin secretion and consequently the insulin level is reduced, thereby reversing the effects of hyperinsulinemia.[16] A study was done by the authors of this study to verify this concept, which concluded that there is no linear correlation with insulin levels and quantity of food consumed.[17] Furmli et al.[18] used therapeutic intermittent fasting of “24-h fast” three times per week over a period of several months for cessation of insulin requirement and diabetes reversal, and reported that patients had no hypoglycemic episodes. In our study, the fasting period was subjective, that is the patient was asked to have his “only 2 meals” whenever he was really hungry. There were no hypoglycemic episodes reported by the patients.

A case review by Unwin and Tobin documented that they were able to “deprescribe” a 52-year-old man who was living with T2D for 14 years. He was suffering from gastrointestinal side effects from his metformin medication. Following a low-carbohydrate diet, the patient steadily lost a total of 16 kg over 7 months and successfully stopped all prescribed drugs, thereby achieving his goal of being medication-free.[19] 2-OMEX lifestyle modification also has a regimen with low carbohydrate; however, the benefit of this diet is that it restricts the direct sugar intake. The patient is allowed to eat complex carbohydrates because carbohydrates form the major building blocks, and are also required for the metabolism of various micronutrients, and restricting them completely would lead to their deficiency.

Obesity is the strongest risk factor for T2DM and is associated with metabolic abnormalities resulting in insulin resistance. There exists an inverse linear relationship between body mass index (BMI) and the age at diagnosis of T2DM.[20,21] Attempts made so far target the current trends of unhealthy diet and sedentary lifestyle as the drivers of overweight and obesity. These are the most important modifiable risk factors for the development of T2D. Caloric restriction and weight loss are important factors for remission of T2D, as recently demonstrated in an open-label Diabetes Remission Clinical Trial (DiRECT). This case series showed that there was approximate 8%–12% weight loss and 12%–14% waist circumference reduction by the 2-OMEX lifestyle. The DiRECT study showed diabetes remission and maintenance through caloric restriction (~840 calories/day) and weight loss in a noninsulin-dependent diabetic population.[22] However, caloric counting dietary measures have low compliance. Hence, we developed a chronology of low calorie and essential nutrient containing foodstuffs that would make the patient feel satiated before consuming the actual meal. This helped in reducing the caloric intake without the patient actually calculating each caloric consumed, and also could have a normal meal that is cooked for the family at home. This makes it easier for the patient to adapt to this lifestyle physically as well as mentally.

The most recent position statement issued by the American Diabetes Association (ADA) regarding standards of medical care in diabetes and a consensus statement by the American College of Endocrinology (ACE) and the American Association of Clinical Endocrinologists (AACE) recommend lifestyle intervention as the preferred treatment option for prediabetes and newly diagnosed diabetes up to 3 months because it has shown to be safe and highly effective in reducing the progression to T2DM by more than 40%.[23,24] In our study, there was one newly diagnosed patient who did not initiate any medications and his diabetic status was reverted to nondiabetic one within 3 months of 2-OMEX lifestyle intervention.

Till date, very few studies or cases have been documented or published with respect to therapeutic lifestyle modification as a treatment for the complete reversal of T2D, and eliminating the use of insulin and oral hypoglycemic agents. In our study, all the patients on medications had achieved adequate glycemic control and eliminated the need for medications after
initiation of 2-OMEX lifestyle modification. All the patients succeeded within 2 weeks and one in 8 days. Further, all patients improved in multiple other clinically significant health outcome measures, such as HbA1C, BMI, and waist circumference. This reduction in risk factors will likely reduce the risk for further complications. A study by Wing et al.[23] found that modest weight losses of 5%–10% have been associated with significant improvements in cardiovascular disease risk factors (i.e., decreased HbA1C levels, reduced blood pressure, increase in HDL cholesterol, decreased plasma triglycerides) in patients with T2D. In our present study, all the patients experienced weight loss of 9% or more.

ADA suggests that the journey of T2DM is unique to every patient, i.e., some patients respond well to lifestyle modification in terms of balanced diet and fitness goals, while some prefer oral medications or external source insulin injections. Hence, the treatment is offered by the cafeteria approach while managing these patients.[24] However, counseling by the treating doctor plays an important role in deciding the outlook of the patient toward his or her health. Educating patients about the benefits of lifestyle modification in the management of T2D may aid in the remission of the disease and curtail the use of pharmacological interventions. A systematic review suggested that patients with T2D who have a baseline HbA1C of greater than 8% may achieve better glycemic control when individual health education is given rather than the usual care.[25] Adherence to 2-OMEX lifestyle needs to be stressed because these lifestyle measures and modifications can have a large impact on the degree of diabetic control that patients can achieve, as seen in this case series. It improved the quality of life of the patient as it aided in good health-seeking behavior as well as gave him hope to combat this lifestyle disease. Therefore, 2-OMEX, due to its minimally restrictive regimen, improves the adherence. This case report will aid in commemoration of a simple lifestyle intervention for the lifestyle disease that is diabetes among the physicians and the patients.

Learning Points

- Patients who have developed T2DM due to their lifestyle must be given the first choice of medically supervised lifestyle modification for the remission of their condition and minimize the use of pharmacological interventions in patients with T2D.
- 2-OMEX is an effective and easy to adapt lifestyle modification and can aid in achieving better blood glucose control as compared to standard pharmacological agents.
- There is a chance of diabetes reversal, and lifestyle modification is a practically feasible strategy for that.
- With proper health education and counseling, we found compliance to this lifestyle modification better than the adherence to lifelong medications.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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