

Reduction in HbA1c in an Adolescent Male with Type-2 Diabetes by Lifestyle Modification

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ABSTRACT: An 18-year-old male, was diagnosed with Type-2 Diabetes Mellitus in September 2021 with HbA1c-14%. His physician prescribed insulin administration starting immediately due to his high HbA1c levels. However, the patients' parents were reluctant to initiate lifelong medications at such a young age. So, they chose conservative management of lifestyle modification by enrolling in 'World free of Obesity and Diabetes' campaign that advised 'two meals a day and exercise' for diabetes remission. He followed the plan very meticulously and his HbA1c was successfully reduced by 8% (HbA1c- from 14% to 6%) within 3 months without any medications. Diabetes remission by lifestyle modification is a healthier option especially for young adolescents. When encouraged and counselled this can be an effective way to manage diabetes in young patients and prevent further complications. American Diabetes Association (ADA) suggests that, metformin should be started to the pre-diabetes and newly diagnosed group of patients along with lifestyle modifications. But there are evidences of complete diabetes reversal of the patients with HbA1c ranging from 8- 15% by just lifestyle modification among the patients registered under 'World free of obesity and diabetes' campaign.

KEY WORDS: HbA1c, Lifestyle modification, Type 2 Diabetes, Adolescent

INTRODUCTION

According to the World Health Organization (WHO), 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, an excessive or inappropriate glucagon secretion. 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 anti-diabetic 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.

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 have 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 major adjuvant of T2D, due to 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. ^[4] Bariatric surgery is a treatment option for obese patients with T2D, but is invasive, costly and comes with its risks. ^[4] Lifestyle modification has the potential to fill this gap in diabetes care.

This case exemplifies that even in young adolescent lifestyle modification can be practiced as therapeutic alternative to anti-diabetic medications and insulin therapy in T2D patients with obesity. 'Daily 2-only meals- and exercise' was a lifestyle modification proposed by the co-author 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 of 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

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was encouraged to add a regular exercise routine in the form of 4.5 km walking in 45 minutes. The dietary and exercise regimen used in this study has been published and is quoted in the references. ^{[10], [5]}

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 medications which might add to the mental stress, by this lifestyle modification.

CASE REPORT

An 18-year-old male, with moderately active lifestyle and normal weight. He was diagnosed with Type 2 Diabetes Mellitus with Fasting Blood Sugar (FBS) - 258 gm/dl and HbA1c - 14%, C-peptide-0.88 ng/ml. His physician suspected him of Type 1 diabetes initially due to low C-peptide levels and young age, and prescribed him insulin injections starting immediately. However, he was further confirmed with the diagnosis of Type 2 diabetes. His parents came across '2-OMEX lifestyle modification' popularly known as 'Dixit lifestyle' in the form of 'daily two only meals a day' and an exercise routine of walking minimum 4.5 km in 45 minutes 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). Patient did not take any medicines and started meticulously following the plan from 09th September 2021. On completion of 1st month, there was reduction of HbA1c to 11%, FBS and C-peptide increased to 1.94 ng/ml. By 2nd month, the HbA1c was reduced to 8%, and by the 3rd month to pre-diabetes levels of 6%. Thus, the patient was successful in sustaining the path of diabetes remission without medications and without any complication by strictly following 'Dixit lifestyle' plan.

Investigations

Patient's fasting blood sugar was tested every day with a glucometer early in the morning with 8-10 hour of fasting, 2 hours post 1st meal and immediately before 2nd meal. HbA1c and weight was measured monthly. He was advised monthly health check-up to rule out any complications.

Outcome & Follow-up

On initiating and strictly following 'Dixit diet' plan, HbA1c and weight was measured monthly to monitor the progress.

TREATMENT

The patient was enrolled in the DRC under the campaign. An initial educational counselling was conducted for the patient and his parents regarding T2D. 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 hypoglycaemic episodes. The patient was also added in the WhatsApp groups of the assigned DRC, which included the physician at the DRC, so that they could clear if he had any 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 their diabetes remission:

Dietary Regimen

Patient has to have 2 meals only in a day. 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 fibres 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 flavour, or diluted buttermilk in between these two meals. All of these 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.

Exercise Routine

Patient has to walk for minimum 4.5 km in 45 min every day. This suffices the criteria of at least 150 minutes moderate grade cardiovascular exercise per week as advised by the American Heart Association. ^[7] 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 antagonist to insulin release. ^[8] Thereby inducing the utilization of blood glucose and decreasing the hypoglycaemic episodes. This led to reduction of insulin resistance, hyperinsulinemia, and associated dyslipidaemia. Most importantly, a regular exercise induces release of 'endorphins,' the happy hormones, which helped the patients associate their

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happiness with this regimen. Thus, this lifestyle modification, used the physiology of human body to combat this lifestyle disease, without any side effects.

DISCUSSION

Type-2 Diabetes is a complex, chronic illness associated with unhealthy lifestyle. It requires continuous medical as well as self-care. Therefore, self-management education and support are the important pillars to prevent and reduce the risk of long-term complications. Significant evidence exists, that supports a range of interventions to improve the outcomes in T2DM patients. Recent guidelines by ADA on population health and diabetes has advised healthcare professionals to ensure that the treatment decisions are timely, rely on evidence-based guidelines, include social community support, and are made collaboratively with patients based on individual preferences, prognoses, comorbidities, and informed financial considerations.^[16] This principle is followed by the 'World free of diabetes and obesity' campaign since its establishment. Thereby, proposing the 2-OMEX lifestyle intervention which is easy, feasible, affordable, and patient-centric. This study shows that, patients who were otherwise unable to reduce HbA1C level and the number of anti-diabetic medications or molecules, were able to reduce them within 3 months of 2-OMEX intervention.

T2DM is basically established to be a lifestyle disease, since it is associated primarily with unhealthy lifestyle due to availability of a modernized and effortless human life. Having easy access to services and reduction of human effort should give humans more time to focus on their health, however such evidences are rare. Therefore, 2-OMEX lifestyle intervention is designed in such a way so as to promote an individually-catered and culturally acceptable healthy lifestyle practice. It is based on the principle that frequent eating results in repeated secretion of insulin. Raised level of insulin leads to obesity, insulin resistance and then T2DM. Thus, by reducing the frequency of food consumption, the insulin secretion and consequently the insulin level is reduced thereby reversing the effects of hyperinsulinemia.^[10-12] This intervention also manages the fasting period between the meals by allowing patients to consume fluids with no sugar or sugar substitutes with minimal calories, keeping them full for longer periods of time. Therefore, there were no incidents of hypoglycaemia reported by the patients. This study shows that weight reduction and reduction of HbA1C resulting from the lifestyle intervention are separate outcomes and have no statistically significant correlation. In contrast, some other studies have shown that a linear relationship exists between weight loss and HbA1c reduction, with an estimated mean HbA1c reduction of 0.1 percentage points for each 1 kg of reduced body weight for the overall population.^[16]

The American Diabetes Association (ADA) recommends a consistent HbA1c goal of less than 7% for patients with T2DM to prevent progression of the disease by lifestyle intervention.^[17] However, this goal is adjusted depending on certain patient factors. However, the results of this study showed that after initiation of 2-OMEX intervention, there was a significant reduction in HbA1C and persistent euglycemic state. This might challenge whether pharmacotherapy is more effective, affordable, or feasible option for secondary prevention of disease than that of lifestyle intervention only.

The proposed lifestyle intervention helped the patient to not only to prevent from lifelong dependence on the insulin injections, but also improved adherence to a healthy lifestyle. It gave a hope of remission and maintenance of remission further in his life by just being consistent in following a simple lifestyle change. Thus, this study gives an accessible and affordable, solution without creating the problem of food insecurity, that is unavailability or inaccessibility to healthy food, which is commonly reported by the patients when advised lifestyle modifications like calorie restricted diets, or diets that allow specific foodstuff.^[18] This case was reported in view of conveying a simple lifestyle solution to a lifestyle disease that is Type-2 diabetes mellitus to the modern evidence-based medicine practices while keeping 'population-health' related issues under perspective.

CONFLICT OF INTEREST

Dr J. V. Dixit, co-author of this study conducts the 'World free of Obesity and Diabetes' campaign. However, the findings of the study presented are not affected by this.

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