



IMPACT OF LIFESTYLE MODIFICATION ON HBA1C LEVELS IN INDIVIDUALS WITH DIABETES: A PROSPECTIVE COHORT STUDY

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ABSTRACT This prospective cohort study conducted at the Community Health Centre in Challapalli aimed to assess the impact of lifestyle modifications, specifically focusing on diet control and moderate physical activity, on glycated hemoglobin (HbA1c) levels in individuals with diabetes. A total of 132 participants were recruited, and HbA1c levels were measured before and after a 90-day intervention period. The study analyzed the data based on lifestyle modifications, medication consumption (metformin, glimepiride, insulin), and reported significant changes in HbA1c levels.

KEYWORDS : Diabetes, HbA1c, lifestyle modification, metformin, prospective cohort study, glycemic control

INTRODUCTION

The prevalence of diabetes has been rising globally, necessitating effective strategies for glycemic control. In India, the burden of diabetes has increased markedly exhausting most of the household average earnings. On an average, Indians are spending about 5% to 25% of their earnings to purchase antidiabetic medicines. Lifestyle modifications should be the first-line of treatment that could contribute towards the reversal of diabetes when in regular practice. Lifestyle modifications, including dietary changes and physical activity, are known to influence glycated hemoglobin (HbA1c) levels.

The International Diabetes Federation (IDF) estimated that the global prevalence of diabetes has risen even faster over the past 20 years, with more than half a billion people worldwide living with diabetes nowadays^{1,2}. Effective management of this progressive lifelong condition is of paramount importance for reducing risk of complications³.

Studies have shown that overweight and obesity account for 80% to 85% of an individual's risk of developing type 2 diabetes mellitus (T2DM)⁴. Weight reduction is fundamental for T2DM management and remission⁵. In overweight and obese patients with T2DM, weight loss has potential benefits towards a more favorable cardiovascular risk profile including improved glycemic and blood pressure control⁶. Race/ethnicity plays an important role in understanding disparities in health and medical care^{7,8}.

The coronavirus disease 2019 (COVID-19) pandemic has substantially affected daily lives of citizens all over the world; Japan is not an exception^{9,10}.

Daily lifestyle, including both physical activities and dietary habits, can considerably influence glycemic control and weight control in patients with diabetes^{11,12}. A study of approximately 200 patients has shown the influence of lifestyle changes on glycemic control and weight control during the COVID-19 pandemic¹³.

In recent years, various studies have shown that individuals with T2DM have a double the risk of depression compared to individuals

without T2DM; in fact, there is a two-way association between depression and T2DM, and each one increases the risk of the other¹⁴. Depressive symptoms in individuals with T2DM are associated with poor glycemic control, impaired physical functioning, low quality of life, hospitalizations, diabetic complications, and high rates of mortality. However, depression is poorly recognized in T2DM and it is usually untreated¹⁵.

According to the American Diabetes Association (ADA), HbA1c can be used as a diagnostic test for diabetes and also as a test for defining glycemic control in people with diabetes mellitus¹⁶.

In fact, there is evidence of the utility of HbA1c as a useful predictor of diabetes risk, and it can be used to identify prediabetes with other risk factors for type 2 diabetes¹⁷.

As depression and diabetes are reciprocally linked, after using HbA1c as proof of the glycemic condition in T2DM, an inverse correlation could be used between depressive symptoms and HbA1c levels^{18,19}.

Therefore, it is plausible to assume that there is a diabetes– HbA1c–depression connection. This relationship has been linked to negative moods²⁰.

HbA1c Test Highly Indicative of Future Diabetes in Asian Indian Subjects

Even as the world debates whether the 3 months average of blood sugar (HbA1c) can be a tool to identify people at high risk of diabetes, a study from Chennai has shown that the test is highly indicative of future diabetes in Asian Indian subjects with impaired glucose tolerance (IGT). The study by Ramachandran et al, published in world J Diabetes, concluded that HbA1c could show who among the prediabetics would go on to develop diabetes later.²¹

Lifestyle Tips to Take Note of If you are at Risk for Diabetes

1. Move more

Sitting is the new smoking. Regular exercise and workouts, approved by a trainer or doctor, help manage prediabetes by lowering blood glucose levels. Moreover, being active can improve the body's insulin

sensitivity. It can also help manage body weight, which is crucial to not slipping into diabetes. Try brisk walks, jogs, and runs and gradually move to do aerobic exercises such as dance and biking/bicycling.

2. Weight management

Gradually losing 5% to 10% of body weight can significantly improve your chances of delaying or reversing diabetes. Ask a trainer to help you focus on your midsection for belly fat, as a large waist circumference is known to put a person at an increased risk of diabetes.

3. Keep stress at bay

Stress can make you sick. An imbalance of stress hormones, cortisol and adrenaline – known for the fight or flight response – can trigger blood glucose levels to shoot up and remain high. Make time for laughter, and spend quality time with friends and family. Schedule time for walks, gardening, or other hobbies that help you to de-stress.

4. Watch what is on your plate

Consider the composition of your meals. For a healthy portion, one should fill half of their plate with non-starchy vegetables and leafy greens, and the rest with healthy carbohydrates, whole grains and lean protein. Stocking up on fiber will ensure satiety without raising blood sugar.

5. Avoid drinking your sugar

Added sugars must be avoided at all costs to avoid escalation into diabetes. Research says that substituting one daily serving of a sugary drink with low-calorie alternatives such as water, coffee or tea is linked with a 2% to 10% lower risk of diabetes²².

Not Just Sugar, Also Avoid High Salt Intake to Ward Off Risk of Type 2 Diabetes

Anti-inflammatory diet contains more fats specially omega-3 fatty acids, vegetables, whole grains. There is a well established association of high salt intake with hypertension and kidney disease. In order to prevent and control these risks one should follow the recommendations of World Health Organization (WHO) which suggests that the daily salt intake should be <2 g/day of which the sodium equivalent should be <5 g/day. It is also learnt that avoiding consumption of processed, frozen and packed food helps in reducing the salt intake. Promoting an anti-inflammatory diet along with reduction in salt intake could help to prevent the onset of type 2 diabetes. This conclusion is drawn from a study, which stated that consuming a pro-inflammatory diet containing processed foods, drinks with high sugars, refined carbohydrates and unhealthy fats was associated with about 18% higher risk of developing type 2 diabetes. This is in comparison with an anti-inflammatory diet²³.

This study was aimed to investigate the impact of such modifications on HbA1c levels in individuals with diabetes.

Methods

Study Design

A prospective cohort study with a pre-post design was conducted, assessing HbA1c levels at 90-day intervals before and after lifestyle modifications.

Participants

A total of 132 individuals diagnosed with type 2 diabetes participated in the study and were categorized based on lifestyle modifications and medication consumed. Informed consent was obtained, and participants were briefed about the study objectives.

Intervention

Participants underwent a 90-day lifestyle modification intervention, focusing on diet control and moderate physical activity.

Data Collection

Baseline data, including demographic information and medical history, was collected. HbA1c levels were measured at baseline and every 90 days during the intervention using standard laboratory procedures.

RESULTS

Out of 132 participants 52 with metformin had not practiced life style modification and 2 neither were on metformin treatment nor on practice of life style modification. 72 participant followed life style modification and were on metformin treatment and 6 were not on metformin treatment but practiced life style modification.

Table 1. Patients in Practice of Lifestyle Modification Consuming Metformin

Lifestyle modification	Metformin	
	No	Yes
No	2	52
Yes	6	72
Total	8	124

Out of 132 participants 25 with Glimepiride had not practiced life style modification and 29 neither were on Glimepiride treatment nor on practice of life style modification. 27 participant followed life style modification and were on Glimepiride treatment and 51 were not on Glimepiride treatment but practiced life style modification.

Table 2. Lifestyle Modification by Glimepiride

Lifestyle modification	Glimepiride	
	No	Yes
No	29	25
Yes	51	27
Total	80	52

Out of 132 participants 6 with metformin had not practiced life style modification and 48 neither were on metformin treatment nor on practice of life style modification. 8 participant followed life style modification and were on metformin treatment and 70 were not on metformin treatment but practiced life style modification.

Table 3. Lifestyle Modification by Insulin

Lifestyle modification	Insulin	
	No	Yes
No	48	6
Yes	70	8
Total	118	14

Table 4. HbA1c Before Lifestyle Modification

Number of persons	Mean	SD	Minimum	Maximum
132	8.02	0.41	7.20	9.00

Table 5. HbA1c After Lifestyle Modification

Number of persons	Mean	SD	Minimum	Maximum
132	7.27	0.61	6.00	8.80

Table 6. Difference in the levels of HbA1c with and without Lifestyle Modification on Consumption of Same Medication

Lifestyle modification	Subjects	Mean	SD	Minimum	Maximum
Absent	54	0.20	0.15	0	0.90
Present	78	1.13	0.22	0.20	1.80

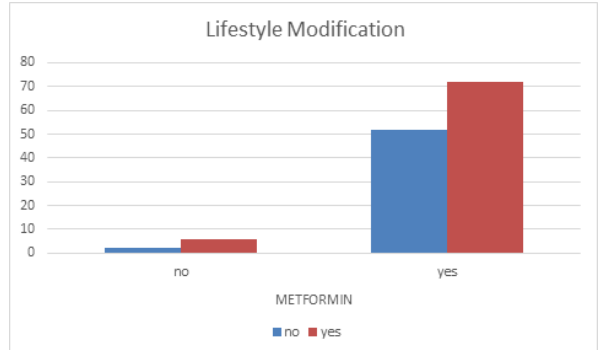


Figure 1. Lifestyle modification by metformin.

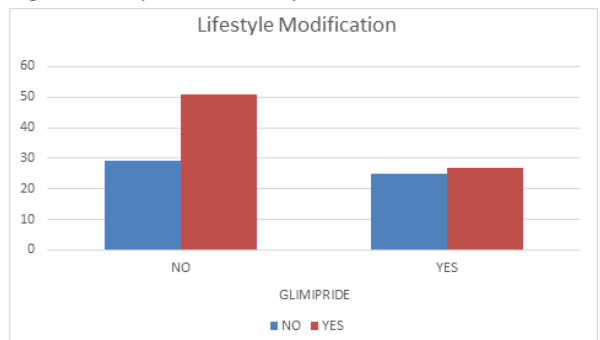


Figure 2. Lifestyle modification by glimepiride.

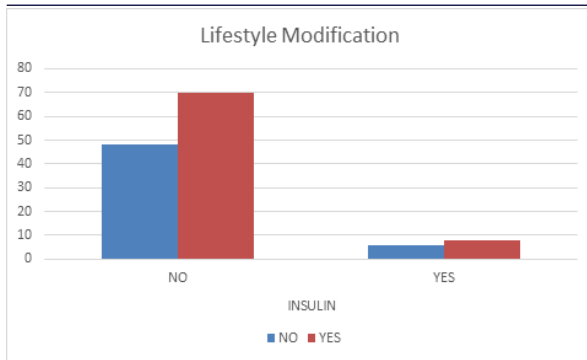


Figure 3. Lifestyle modification by insulin.

The mean HbA1c level before lifestyle modification was 8.03, which significantly decreased to 7.27 after the intervention.

Effect of Medication

Participants were further categorized based on medication consumption. Those consuming metformin exhibited a notable reduction in HbA1c levels (mean difference [MD] = 0.92). Similar reductions were observed for glimepiride (MD = 0.79) and insulin (MD = 0.62).

Difference in HbA1c Based on Lifestyle Modification

Participants with lifestyle modifications showed a substantial decrease in HbA1c levels compared to those without modifications (MD = 0.93). Notably, the group with lifestyle modifications combined with metformin demonstrated the most significant reduction (MD = 1.13).

DISCUSSION

The findings highlight the effectiveness of lifestyle modifications, particularly diet control and moderate physical activity, in improving glycemic control in individuals with diabetes. Hyperglycemia i.e., increase levels of glucose in circulation is linked with various metabolisms. For instance it contributes to synthesis of fat; the increase in fat synthesis thereby causes beta-cell dysfunction and insulin resistance, which is similar to the effect of high fat content. This is a common conclusion drawn by various researchers^{24,25}. However, medication alone is not the sole remedy to control the toxic effects of diabetes. Balanced diabetic diet with regular physical activity can only hold a good control irrespective of any antidiabetic medicines²⁶. The results also suggest synergistic benefits when combining these modifications with specific medications, such as metformin. The study clearly states that diabetes is better controlled if the treatment is in combination of medication along with diet and physical activity in short medication with lifestyle modification is recommended for diabetic patients to lead a healthy life with reduced complications. The changes were notable, significant and positive with lifestyle modification in HbA1c levels, irrespective of the anti-diabetes drug consumed by the patients. Hence, this practice of lifestyle modifications along with medication would be a good practice to tackle with metabolic syndrome like diabetes.

CONCLUSION

This study emphasizes the positive impact of lifestyle modifications on HbA1c levels in individuals with diabetes. Integrating these changes into routine care could prove beneficial for managing glycemic control, potentially reducing the reliance on certain medications. Long-term practice of lifestyle modifications may produce promising results and may help in reversing diabetes too. Hence, it is recommended to implement lifestyle modification practice along with antidiabetic medication to reduce the burden of diabetes.

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