

INTERMITTENT FASTING AND EXERCISE A NOVEL LIFESTYLE CHANGE TO CURE DIABETES MELLITUS -2 AND OBESITY

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ABSTRACT

Type 2 Non insulin-dependent diabetes mellitus (DM-2) is a metabolic condition in which there is insulin resistance, which causes obesity, microvascular, macrovascular and neuropathic complications. Apart from insulin resistance, there is inadequate release of insulin from the beta cells of pancreas and there is dysregulation of glucagon secretion (Morrison *et al.*, 2011).

Insulin levels are already very high in DM-2 patients which is due to insulin resistance, and giving more insulin to overcome insulin resistance is not the best way to overcome insulin resistance in DM-2. Insulin rise triggers adipocyte production and proliferation. This causes obesity in DM-2 patients over a period of time. It's time we stop blaming the diabetic patients for secretly eating fats and sweets at home and rather address the problem of insulin resistance in DM-2 and its complications.

We conducted this study in Andaman and Nicobar Islands Institute of Medical Sciences, Por Blair. In this study we initiated 10 patients suffering from DM-2 with failure to respond to insulin and oral hypoglycemic agent, to intermittent fasting and exercise. After 12 months these patients showed a dramatic improvement of insulin resistance and they all achieved a good blood sugar control. We could effectively stop insulin therapy in all of the study patients. We could significantly reduce the no and dose of other medications which the patients took for control of blood sugar. A significant weight loss was noted in all patients which was primarily due to loss of total body fat. The waist circumference decreased dramatically. This study highlights effectiveness of Intermittent Fasting and exercise reversal of DM-2 and obesity.

Keywords: *Intermittent Fasting, Insulin Resistance, Diabetes Mellitus – 2, Obesity, Exercise*

INTRODUCTION

Ten patients were enrolled in this study who were willing to participate in the study. They had DM-2 and were on oral hypoglycemic agents (OHA's) and Insulin therapy but the blood sugars were not controlled and they suffered from Obesity and other complications of DM-2. They all had various other comorbidities like hypertension, dyslipidemia, chronic kidney disease etc.

Patients were educated about the study and its goal in the out patient department over many follow ups when they came for checkups and medications. They were made to realize that the current form of therapy was slowly failing to control their blood sugars and the doses of medications and insulins was on the rise gradually over months and years. They were taught about DM-2 what causes it, insulin resistance, how obesity and insulin resistance are related. Patients were educated on local Indian foods which they consumed on daily basis, the macronutrients they contained in those foods in the form of carbohydrates, fats, protein. Importance of micronutrients and their role in maintaining healthy control of blood sugar levels and their role in fat burning was explained. They were also educated about what Intermittent Fasting was and how it can be practiced safely. They were told about the possible side effects like hypoglycemia, how to recognize it and take help. They were told to stop intermittent fasting if they felt unwell.

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They were told about the benefits of having good blood sugar control with intermittent fasting. They were told about the need to be in a prolonged state of fasting daily so that the insulin resistance could be corrected. For proper utilization of fat as primary fuel for energy, low levels of insulin are required which causes a 1500 to 2000 times rise of growth hormone, which helps in fat burning and muscle and tissue repair and growth. After completing the educational training, the patients were advised to follow the instructions for one year at least. During this time gradual changes were made to their diabetic medications and their dosages. Insulin doses were reduced as per blood sugar reports. Gradually insulin therapy could be stopped in all patients.

Patients were told to have their first meal at 1 PM and second meal between 6-7 PM.

The morning anti diabetic medications which the patients previously took with breakfast at 6 or 7 am were stopped altogether as there was no carbohydrate intake in the morning. They were told to take this dose at 1pm instead with lunch which was their first meal of the day.

Their fasting blood sugars was monitored at 7am when they woke up, then at 1Pm, 2hr after the lunch. HBA1c was checked once in two months. Routine blood tests were performed 6 monthly or as and when indicated in individual patients. Patients were advised to stop sugars in all form. They were told to abstain from bread, rice, chappati, idli, Maggie, pasta, oats and fruits. All of which have carbohydrates in some form or the other and cause insulin spike.

A short eating window period of 4-6 hrs was kept. During this time high protein diet and a healthy fats and fibre was recommended. Proteins 80 percent and 10-15 percent healthy fats and 5 percent complex carbs in the form of fibre was advised to avoid constipation. There was no caloric restriction during this eating window. The patients could drink as much as water they felt like during the whole day. Patients were encouraged to drink more water, as water restriction slows down the fat breakdown for energy. They would abstain from eating anything for 16 to 18 hours a day. This looked daunting to them at first but was made easy for them by making them realize that if they had dinner at 7pm and woke up at 7 am, they already have fasted for 12 hours, so to prolong another 4-5 hours looked like an easy job for them with the help of bulletproof coffee between 6-7 am. If they had a craving for breakfast then a “bulletproof coffee” was advised. Bulletproof coffee consisted of hot water with half tsf of coffee with 10 gm amul butter cube and 2 tsf of coconut oil. Coconut oil is medium chain triglyceride and is readily used up by cells for energy once trained. This has zero sugars practically and yet kept the subjects full and satiated till 1 to 2 PM.

Diet - Between 1pm to 7PM (permitted foods)

- 1 10 to 20 egg whites a day in different forms of preparation as to their liking with one egg yolk a day.
- 2 250 to 500 gm of fish / chicken/ meat a day.
- 3 Nutrella / Soya beans/ beans/ papaya/tomatoes/ coconut.
- 4 Cheese, peanut butter to their liking.
- 5 Cinnamon in Coffee, green tea as much as to their liking, this also accelerates fat burning.
- 6 Almonds as snacks (10 to 15 a day) they are good source of healthy fats and help in redistribution of fats.
- 7 A multivitamin supplement with micronutrients like zinc, magnesium, chromium was advised.
- 8 Tab L Carnitine 500mg twice a day was given as supplement as it has been shown to help in preferentially burning fats in the mitochondria.
- 9 Cap Omega 3 fish oil was recommended as healthy fats for cardiovascular health and to help in the initial process of fat burning.

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Exercise

- 1 Running – Brisk walking for 1 hr with brisk burst of sprints for 15 seconds. Preferably in a fasted state in the morning or afternoon before lunch (their first meal). If this was not possible then they were advised to exercise at anytime irrespective of whether they were in fasting state or not.
- 2 Body weight exercises like –
 - A Pushups: 5 repetitions x 3 sets gradually to increase to 20 repetitions x 3 sets, with 20 second rest in between each set.
 - B Chin-ups and dips: 3 - 5 repetitions x 3 sets gradually to increase to 10 repetitions x 3 sets, with 30 second rest in between each set.
 - C Planks: hold for 15 to begin with gradually increasing to 60 seconds breath hold.
 - D Skip rope: 100 repetitions x 3 sets with 60 second break in between each set. Gradually increasing the repetitions to 1000 or as tolerated.
 - E Burpees: 5 – 10 times x 5 sets. Gradually increasing the repetitions to 20 per set.

Significant weight loss was noted even as early as in the first week. Blood sugars started coming back to normal range and dose of insulin was titrated as per the reports. At the end of 1 year all patients had blood sugar levels in normal range and they lost a significant amount of body weight due to fat loss. Insulin could be stopped in all patients over a period of three months and as quickly as 15 days. Four patients insulin therapy was stopped in their second visit in OPD after 15 days. In five patients insulin therapy as well as OHA's could be stopped all together. There was a significant weight reduction seen in all patients in the study, mean of 20 % weight loss. Weight loss also varied depending on many other factors like sex of the patient, bone thickness, BMI, physical activity, other comorbidities etc. Patients lost weight ranging from 20 to 40 kg, on an average weight loss per month was 5-7 kgs/ month. On an average 50 – 60 % waist circumference was lost at the end of 1 year.

Patient study parameters

Patient	At Start HBA1c %	After 1 year HBA1c %	Initial Weight (kg)	After 1 year Weight (kg)	Initial Waist Circumference (cm)	After 1 year Waist Circumference (cm)	Insulin stopped after (days)	Stopped OHS's as well
1	9.9	6.2	84	65	114	70	15	No
2	11.5	7.1	102	68	120	77	29	No
3	13.4	5.9	104	77	126	80	15	No
4	10.0	6.6	90	64	114	74	30	yes
5	10.7	7.1	87	63	113	82	35	yes
6	12.5	6.4	110	72	119	89	28	No
7	8.0	5.0	92	70	117	99	60	yes
8	9.6	5.9	110	76	99	87	54	yes
9	10.9	6.0	93	71	98	74	15	no
10	11.0	5.9	99	72	99	76	15	yes

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Patient Details and Comorbidities

HTN- Hypertension, DLP – dyslipidemia, CKD- Chronic Kidney Disease, SLE- Systemic Lupus

Patient	Age	Sex	Years of DM-2	Comorbidities
1	70	F	15	HTN, DPL, Obesity
2	79	M	20	HTN, DLP, Gout, Obesity
3	76	F	34	HTN, CKD, Obesity, DLP
4	82	F	38	SLE, DLP, HTN, Obesity
5	59	M	26	Obesity, DLP
6	74	F	25	HTN, Obesity, DLP
7	89	F	40	CKD, HTN, Obesity
8	71	M	21	Obesity, HTN
9	65	M	22	DLP, Obesity
10	61	M	26	DLP, Neuropathy, Obesity

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All patients had long standing DM-2, and were above 50 years of age. Youngest in the study group was 61 years old and oldest was 89 years old. Male to female ratio was 50:50. All patients had other comorbidities, obesity was present in all patients. Hypertension and dyslipidemia was noted in 8 patients. Despite intermittent fasting sounding as a daunting activity, it was well tolerated and liked by all patients. No patient stopped fasting even after 1 year study time was over. All patients adhered to the program for one year and all of them chose to make it a life style change for themselves even after the study period of one year was over.

Feedback from their close family members was positive and appreciative. Patients said they experienced high energy levels and were more passionately perusing a fitter and healthy body, mind and biochemistry.

The following parameters were monitored:

1. Time taken for cessation of insulin.
2. Fasting blood glucose, Serum A1C level (% , mmol/mol).
4. Patient weight (kg) and waist circumference (cm).

DISCUSSION

Management of DM-2 is a costly affair and a painful journey for the patients. Burden of cost of insulins, penfills, syringes etc is immense. Frequent checking of blood sugar is often required which means painful pricks and vene punctures. Intermittent fasting abates the painful pricks for blood sugar monitoring and hence alleviates avoidable patient suffering. DM-2 is a metabolic condition in which there is insulin resistance, which causes obesity, microvascular, macrovascular and neuropathic complications. Apart from insulin resistance, there is inadequate release of insulin from the beta cells of pancreas and there is dysregulation of glucagon secretion (Morrison *et al.*, 2011) and (Canadian Diabetes association 2016).

Other measures like intermittent fasting with low carbohydrate diet and regular exercise, living a stress free life, ensuring 6-7 hours of quality sleep are all important for successful treatment of DM-2 and

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reversing insulin resistance. Medications and Bariatric surgery help manage the symptoms of diabetes, but they cannot prevent the progression of the disease (Brethauer *et al.*, 2013).

Intermittent Fasting is non invasive and cost effective. Its a better option than bariatric surgery for DM-2 patients with insulin resistance and obesity. Intermittent fasting is defined as the controlled and voluntary abstinence from all calorie-containing food and drinks from a specified period of time (Fung J, Moore J. 2016) and (Ku *et al.*, 2017).

Unwin and Tobin documented that following a low-carbohydrate diet a steady weight loss is possible. Their patient a 52 year old diabetic lost a total of 16 kg in 7 months and all the medications were tapered off and finally stopped, thereby achieving his goal of being medication-free (Unwin and Tobin 2015).

Caloric restriction and weight loss are important factors for remission of DM-2, as recently demonstrated in an open-label Diabetes Remission Clinical Trial (DiRECT). The DiRECT study showed diabetes control and maintenance through caloric restriction (~840 calories/day) and weight loss in a non-insulin-dependent diabetic population.⁷ This differs from starvation, which is works for a short period of time. The body quickly learns to slow down the metabolic rate and then patients gain weight back again eventually. Even modest weight loss of 5%–10% significantly improves coronary risk factors. Reduced HbA1C levels, reduced blood pressure, increase in HDL cholesterol, decreased plasma triglycerides in patients with DM-2 are all noted. Risk factor reduction was even more with losses of 10%–15% of body weight. HbA1C of greater than 8% may achieve better glycaemic control when given individual education rather than usual care (Duke *et al.*, 2009).

Micronutrients play a crucial role, a low plasma zinc level is seen in obesity (Chen *et al.*, 1997; Marreiro *et al.*, 2002). Zinc may regulate serum leptin concentration (Mantzoros *et al.*, 1998) and appetite control. Zinc (Zn), an essential micronutrient and a component of many enzymes, is involved in the synthesis, storage and release of insulin (Song *et al.*, 2005). Studies have reported that Zn has been implicated in altered lipid markers, insulin resistance, oxidative stress, inflammatory markers (Hashemipour, *et al.*, 2009) And (Kelishadi *et al.*, 2010), adiposity and serum leptin level (Tallman and Taylor 2003). Magnesium intake may particularly be beneficial in offsetting risk of developing diabetes among those at high risk of developing DM-2 (Hruby *et al.*, 2013). Beneficial effect of L-carnitine on weight loss and body composition of rats fed a hypocaloric diet were noted (Brandsch *et al.*, 2002).

Take Home Message

- 1 Medically supervised, Intermittent Fasting is a safe and cost effective way of managing DM-2.
- 2 Intermittent Fasting can reverse type 2 diabetes (DM-2) and decrease the medication used for blood sugar control.
- 3 Intermittent Fasting should be made first line of management of diabetes, obesity and insulin resistance.
- 4 It is important to spend time with the patient and individualize the treatment
- 5 Proper patient motivation and education is important for success of Intermittent Fasting implementation as a lifestyle change.

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