
Role of Resistance Training (RT) in Type 2 Diabetes Mellitus with Normal Body Mass (BMI): A Report of 3 Cases

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Abstract: Background: DM is often treated with a range of anti-diabetic medications (ADD), which can be used alone or in combination with other medicines from various classes. However, there are several side effects related with the use of these ADDs, including dizziness, fainting, gastrointestinal distress, dyspepsia, diabetic ketoacidosis, and so on. Diabetic patients' quality of life is already impacted by uncomfortable symptoms. Comprehensive diabetic care (CDC) is an Ayurvedic treatment that combines Panchkarma (five internal bio-cleansing therapies), a purification procedure, the administration of herbal medications to patients, and nutrition therapy. Physical activity or exercise particularly resistance training (RT) is thought to be a good therapy regimen for T2DM. Case information: Case 1 was a 38-year-old male, who was known case of type 2 DM since 2 years came with chief complaint of generalized weakness. He was diagnosed with T2DM 2 years back. Case 2 was a 50 years old male who came with the chief complaints of arthralgia and dyspnea on exertion grade 1. The patient was known case of T2DM and hypertension since 2 years. Case 3 was a 52 years old male who came with the chief complaints of extreme pricking pain in both the lower limbs. The patient was known case of T2DM since 5 years. These patients had taken oral antidiabetic drugs in the past. All these patients were given comprehensive diabetes care (CDC) along with resistance training exercise on daily basis. Results: Body Mass Index and lean body mass was maintained in first two cases. HbA1c reduction was seen in all the three cases throughout the study period. 2 of 3 patients showed complete adherence to therapy. Conclusion: There is synergistic action of CDC therapy along with resistance training exercise in patients of type 2 Diabetes Mellitus with low to normal BMI.

Keywords: Comprehensive Diabetic Care, Panchkarma, Ayurveda, BMI, Diabetes Mellitus, Resistance Training

1. Introduction

Because of its morbidity and mortality, diabetes mellitus (DM) is feared. In diabetic patients, cardiovascular and renal problems are the leading causes of death [1].

DM is often treated with a range of anti-diabetic medications (ADD), which can be used alone or in combination with other medicines from various classes. However, there are several side effects related with the use of these ADDs, including dizziness, fainting, gastrointestinal distress, dyspepsia, weight gain, urinary tract infections,

diabetic ketoacidosis, and so on [2]. As a result, it is critical to find a successful alternative therapy that is free of the flaws of traditional therapy.

Comprehensive diabetic care (CDC) is an Ayurvedic treatment that combines Panchkarma, a purification procedure, the administration of herbal medications to patients, and nutrition therapy. These herbal medications are known to work by lowering blood sugar levels, similar to ADDs, except without the negative side effects [3, 4]. Also, physical activity or exercise particularly resistance training (RT) is thought to be a good therapy regimen for T2DM [5].

The overall populace in impoverished nations suffering

with T2DM has admittedly shown little enthusiasm in adopting the activity. The Asian continent has a scarcity of research. The reason for this might be due to a lack of public knowledge of exercise and Ayurvedic therapies throughout the world [6].

We present three instances of DM that were successfully treated with Ayurveda based CDC therapy and resistance training exercise.

2. Case Presentation

Case 1: A 38-year-old male, who was known case of type 2 DM came to Madhavbaug clinic with chief complaint of generalized weakness. He was diagnosed with T2DM 2 years back.

Case 2: A 50 years old female came to Madhavbaug clinic with the chief complaints of arthralgia and dyspnea on exertion grade 1. The patient was known case of T2DM and hypertension since 2 years. Patient had taken oral antidiabetic drugs in the past.

Case 3: A 52 years old male came to Madhavbaug clinic with the chief complaints of extreme pricking pain in both the lower limbs. The patient was known case of T2DM since 5 years. Patient had taken oral antidiabetic drugs in the past.

All these patients were given comprehensive diabetes care (CDC) along with resistance training exercise on daily basis. CDC consisted of Panchsutra treatment approach consisting of Prameha diet box, Panchakarma in the form of Snehana or therapeutic oleation, Swedana or sudation therapy, Basti or therapeutic enema, Yoga and exercise, use of herbal medicines and modern diagnostics like glycosylated hemoglobin (HbA1c).

Prameha diet box consisted of a one-month supply of food tailored to adhere to a low-carbohydrate diet a low-fat, low-calorie diet with a daily calorie consumption of 800 calorie diet. Resistance strength training was given as per details in table 1. Along with this case 1 and 2 were given 15 ml cow ghee daily. If patient had sedentary lifestyle, cardio exercise in the form of walking for first week, thereafter resistance training was gradually started from next week onwards.

Table 1. Resistance training exercise given to patients of present case studies.

WARM UP	UPPER BODY	LOWER BODY	CORE	COOL DOWN
Spot Jog	Wall push up	Step up	Cycling on floor	Foam rolling
Jumping Jacks	Rowing standing	Chair Squat	Hip Raise	Ball rolling for calf
	Lateral pull with thera band	Supported Lunges	Alternate Leg Raise on floor	Stretching.
	Shoulder press with or without weights	Hip Raise	30 sec planks	
	Side lateral raise with or without weight	Calf raise	Crunches	
	Front raise			

Body Mass Index and lean body mass was maintained in first two cases. HbA1c reduction was seen in all the three cases throughout the study period (table 2). 2 of 3 patients showed complete adherence to therapy.

Table 2. Changes in various parameters in cases of the present study after administration of Comprehensive Diabetes care and resistance exercise training.

Sr. No.	Patient	Time point	BMI (kg/m ²)	LBM (kg)	AG (in cm)	HbA1c (%)
1	Case 1	Day 1	24.16	53.41	92	7.2
		Day 90	24.09	53	89	5.6
		Day 120	23.99	52.92	88	6.3
2	Case 2	Day 1	21.79	39.34	78	10.9
		Day 90	20.63	38.34	77	6.6
		Day 120	22.63	39.09	82	6.5
3	Case 3	Day 1	24.9	51.3	78	12.5
		Day 90	17.4	49.72	70	7.6
		Day 120	18.7	49.56	68	9.3

3. Discussion

Exercise has been demonstrated in several studies to be beneficial in the treatment of T2DM. Exercise not only improves glycemic management, but it can also enhance insulin sensitivity and help to reverse diabetes consequences including cardiovascular disease, which is one of the most serious problems [7].

In this study, Panchakarma in the form of Swedana, or sudation treatment was utilized, which works by raising the core body temperature by 2-3 degrees Celsius. This activates the hypothalamic temperature regulating center, which then

promotes the vasodilation of cutaneous blood vessels, which play an important role in thermoregulation. Swedana's vasodilation along with enhanced permeability aids in the removal of salt, which calms the vascular endothelium and reduces the risk of vascular problems [8]. Snehana is thought to reduce stress level by its anxiolytic effect, while *Azadirachta indica* is known for its antimicrobial properties so neem oil can help to prevent skin infection in diabetic patients [9]. Basti aids in the improvement of nephron function, hence assisting in the relief of nephropathy [10].

Benefits in insulin sensitivity with RT have been seen in T2DM patients especially with normal to low BMI without a change in maximum oxygen uptake (VO₂ max), weight

reduction, or body composition when relative to sedentary control [6]. It's probable that a gain in lean body mass following RT is a key mediator of better glycemic control. Since the carrier protein GLUT4 expression at the plasma membrane is associated to fibre diameter in human skeletal muscle fibres [6], a rise in the number of GLUT4 carriers is explicitly highlighted.

Possible mechanisms for beneficial effect of resistance training/exercise in type 2 Diabetes mellitus with normal to low BMI are enhanced insulin signaling in glucose homeostasis, increased lean body mass, reduced or maintained abdominal fat as measured by abdominal girth, improved mitochondrial function, etc. All these factors help in effective glucose disposal at molecular level [6].

Case 1 was on 800 calorie diet and 15ml cow ghee daily. BMI was normal so 800 calorie diet could have causes excess muscle loss to cause hyperglycemia. Ghee is low glycemic index food with high calorie value so these calories had to be utilized by strength training which would have helped to prevent muscle loss and reduced HbA1c.

Case 2 was already lean so weight loss was not feasible, but to reduce insulin resistance negative calorie balance had to be maintained by 800 calorie diet. So we had to cut down carbohydrates, we added 15ml ghee every day along with strength training session, this helped to maintain BMI and LBM and reduction in HbA1c.

Case 3 was non-compliant to exercise so he did everything as earlier patients but did not follow strength training sessions. Consequently, he lost weight, BMI and LBM, this is the reason despite of weight loss, he couldn't achieve good glycemic control.

The most significant difficulty of chronic therapy in developing countries such as India is the rising expense of treatment, which most patients cannot pay and resistance training is least expensive. Furthermore, the substantial side effects associated with antidiabetic medications exacerbate the situation [11-15]. As a result, patient compliance is low in these disorders. In this sense, CDC along with resistance training in low to normal BMI in T2DM patients can be beneficial since it reduced allopathic drug reliance, lowering both costs and side effects, and therefore improving patient compliance/adherence to therapy as evidenced by present study findings.

4. Conclusion

Thus, there is synergistic action of CDC therapy along with resistance training exercise in patients of type 2 Diabetes Mellitus with low to normal BMI. Both act by increasing glucose uptake at tissue level thus help in lowering blood glucose levels.

Patient Consent

Written informed consent was taken from the patient prior to the preparation of manuscript.

Conflicts of Interest

Authors have no conflicts of interest.

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