

Case Report

Effectiveness of Nitric Oxide Dumping Exercise and Vegan Diet In Type 2 Diabetes: A Case Report

Nigar Shikalgar¹, Safa Anwar², Rizwan Khan³, Shahin Shikalgar⁴

^{1,2,3}Physical Therapy Department, College of Applied Medical Science, Ash Shuqqah, Buraydah, Private Colleges, Qassim, Kingdom of Saudi Arabia

⁴Bharati Vidyapeeth Deemed Universit, Dhankawadi, Pune, Maharashtra, India

Received: 01 November 2022

Revised: 07 December 2022

Accepted: 19 December 2022

Published: 30 December 2022

Abstract - Along with medicine, lifestyle modification is the first line of treatment for Type 2 diabetes mellitus (T2DM) (diet and exercise). T2DM has now reached epidemic proportions due to a sedentary lifestyle and a lack of physical activity (PE) due to a lack of time, which acts as a barrier to regular participation. Nitric oxide dumping (NOD) exercises are a type of high-intensity interval training (HIIT); it is a quick way to elicit physiological changes similar to other workouts; very little is known about the impact of NOD exercise on T2DM. In this case report, a 42-year-old woman has diagnosed with T2DM, hyperlipidemia, hypothyroidism, and grade 1 obesity 5 years back. Until that, the patient adhered to routine diabetic treatment. The response to traditional therapy was poor, so NOD was combined with a vegan diet, which showed improvement in glucose level and other parameters

Keywords - HIIT, Metabolic disorder, Diet.

1. Introduction

T2DM places a heavy burden on individuals, their families, healthcare resources, and society as a whole [1]. T2DM is still on the rise in terms of prevalence and incidence and is a leading cause of human suffering and death. Despite significant investments in clinical care, research, and public health measures, the pace of increase appears to be increasing [2].

One of the leading causes of type 2 diabetes is physical laziness due to lack of time and a sedentary lifestyle. In addition to medication, diet and exercise are essential strategies for managing type 2 diabetes [3]. According to the American Diabetes Association (ADA), moderate-intensity exercise is currently the standard exercise [4], and high-intensity interval training (HIIT) is also becoming a popular exercise. HIIT can be tailored to your specific needs and does not have to cover all exercises [5]. Nitric Oxide Dump (NOD) is a new type of moderate high-intensity interval training (HIIT) that aims to increase the production of nitric oxide, which can catalyze and promote health [6].

However, we need to be defined innovative, timely and efficient exercise regimens that people can easily accomplish without exposing them to financial risk.

2. Case

A 42-year-old woman with type 2 diabetes, hyperlipidemia and hypothyroidism, and grade 1 obesity have been taking 500 mg of metformin and 50 mcg of eltraxine for 5 years. Before starting the protocol, a thorough

evaluation and blood tests such as fasting, postprandial glucose (PP), HbA1c, lipids, thyroid stimulating hormone (TSH), and a 12-lead electrocardiogram (ECG) were performed to rule out any cardiac problems. The patient completed the Physical Activity Readiness Questionnaire (PAR-Q). When the patient answered "no" to all the questions, the patient signed a written consent form, explained the task to the patient, and obtained ethical approval.

Under the guidance of a medical specialist, an expert nutritionist, and a physical therapist developed a 12-week protocol. The patient's blood glucose level was measured with a digital blood glucose meter 4 times a day, once fasting, 3 times after 2 hours of exercise, PP1 after breakfast (after meals), PP2 after lunch, and PP3 after dinner [7]. The patient performs NOD exercise after each meal, and the patient continues the other exercise regimen.

The exercise technique used was a 4-minute NOD of 70% HRR (maximum heart rate). It consists of 4 movements in each lesson - first 10 repetitions of each movement, then 20 repetitions - 4 cycles of repetitions. Exercises are 1. Squats 2. Alternate arm raises 3. Non-jumping jacks (raising the shoulder only but not lifting the feet off the ground), and 4. Shoulder press [6, 7, 9]. Warm up at 25% HRR and cool down at 25% HRR before starting the workout. Target HR training zones were calculated using the Karvonen HRR method [16] and followed the ADA's daily exercise protocol of 150 minutes per week, moderate to vigorous intensity, AE at least 3 days per week, and RE 2 days per week [16].



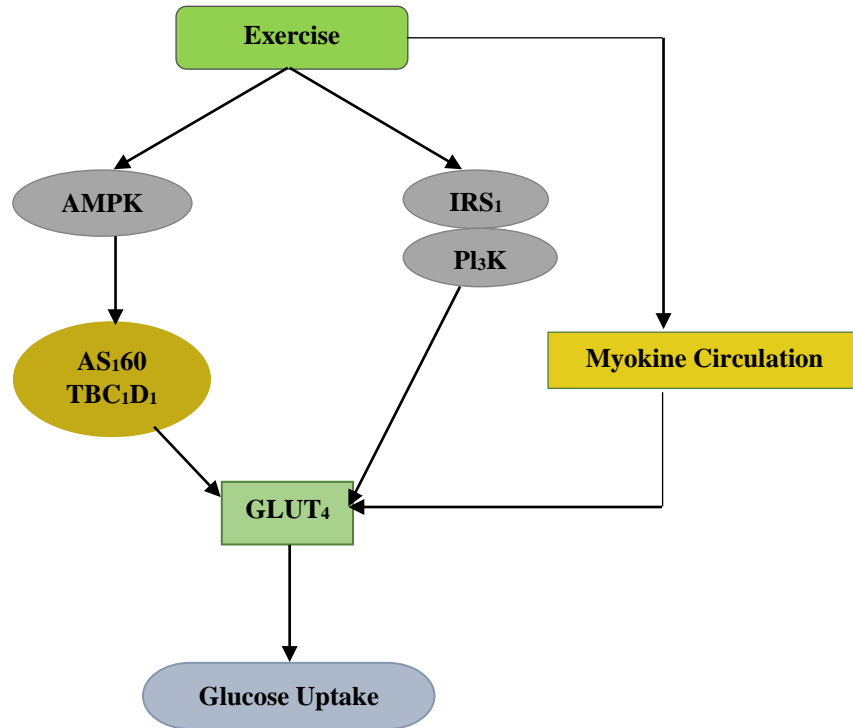


Fig. 1 Exercise Induce glucose uptake

3. Result

Blood glucose levels (BGL) begin to drop daily after starting the regimen, reducing the need for antidiabetic drugs. After a month, the diabetes medication was withdrawn entirely under the supervision of a doctor. The patient was constantly encouraged in terms of diet and activity. After 3 months, the test was repeated [Table 1], and a glucose tolerance test (GTT) [Table 2] was performed at the same time, and the parameters changed well without medication.

Table 1. Blood investigation

Sr.no	Parameter	Before	After 12 weeks
1	FS	99 mg/dl	87.7 mg/dl
2	PP	119 mg/dl	86 mg/dl
3	HbA1C	6.5 %	5.6%
4	Insulin fasting	7.32	3.60
5	TC	208 mg/dl	176 mg/dl
6	LDL	131 mg/dl	123 mg/dl
7	HDL	37 mg/dl	45 mg/dl
8	TG	201 mg/dl	95.4 mg/dl
9	TSH	3.97 uIU/mL	1.4 uIU/mL
10	Body mass index (BMI)	31 kg/m ²	27 kg/m ²
11	Body fat % (BF %)	30 %	25 %
12	Waist-hip ratio (WH)	0.9	0.8

Table 2. Glucose tolerance test

Fasting (mg/dl)	30 min (mg/dl)	1 hour (mg/dl)	2 hour (mg/dl)	Remarks
95.9	142	109.5	109.4	cleared

4. Discussion

The first line of non-pharmacological treatment for T2DM is a lifestyle change, which includes a balanced diet and adequate physical activity (PA) or physical exercises (PE) [11]. This trial demonstrates how a conservative management strategy involving a vegan diet and NOD activity is beneficial in demonstrating changes in blood parameters, anthropometry, and GTT clearance.

Dietary fiber lowers the glycemic index of carbohydrates by slowing the intestinal absorption of glucose; a vegan diet reduces exposure to persistent organic pollutants (POPs) due to the prevention of animal products. [7].

ADA daily exercise regimen followed by patients included AEs and REs. Many studies have found that combined AEs and REs are more valuable than AEs and REs in reducing blood glucose levels, HbA1c, and insulin resistance in T2DM [11].

HIIT-equivalent NOD exercise performed 1 hour and 45 minutes after the meal showed a decrease in postprandial blood glucose levels (PP) after 2 hours. In one of these retrospective studies, Sgrò P et al. claimed that exercise was an effective method for managing postprandial blood glucose [11]. HIIT consumes glucose faster than the liver can produce, so blood sugar levels drop [16]. During the NOD

exercise, mitochondria may produce proteins that keep muscles acting at their highest level, mainly for aging adults [6].

After 12 weeks, the GTT was normal. Madsen et al. used HIIT, which showed improved glycemic control and pancreatic cell function in patients with T2DM [14]. They speculated that the pancreas' capacity improved to awaken insulin-producing β -cells for tissue action without a compensatory drop in hyperglucagonemia [14].

Exercise is associated with improvements in BMI, WH, blood glucose levels (BGL), HbA1c, and lipids [15]. The

nature of the meal, timing, intensity, frequency, and duration of exercises, these all factors that may have played a role in improving all parameters [11].

5. Conclusion

NOD exercise after each meal has an additional effect, along with a vegan diet, on regulating BGL, reducing the need for antidiabetic drugs in T2DM patients. Because of the many adverse effects of medication, T2DM patients may benefit from short-term NOD exercise performed after each meal as if it were a medication.

Reference

- [1] Maximilian Andreas Storz, "Reduced Diabetes Medication Needs with a Plant-Based Diet," *Journal of the American College of Nutrition*, vol. 39, no. 6, pp. 574-577, 2020. *Crossref*, <https://doi.org/10.1080/07315724.2019.1698381>
- [2] Yan Meng et al., "Efficacy of Low Carbohydrate Diet for Type 2 Diabetes Mellitus Management: A Systematic Review and Meta-Analysis of Randomized Controlled Trials," *Diabetes Research and Clinical Practice*, vol. 131, pp. 124-131, 2017. *Crossref*, <https://doi.org/10.1016/j.diabres.2017.07.006>
- [3] Laura R Saslow et al., "Twelve-Month Outcomes of a Randomized Trial of a Moderate-Carbohydrate Versus Very Low-Carbohydrate Diet in Overweight Adults with Type 2 Diabetes Mellitus or Prediabetes," *Nutrition & Diabetes*, vol. 7, no. 12, 1-6, 2017. *Crossref*, <https://doi.org/10.1038/s41387-017-0006-9>
- [4] Sheri R. Colberg et al., "Physical Activity/Exercise and Diabetes: a Position Statement of the American Diabetes Association," *Diabetes Care*, vol. 39, no. 11, pp. 2065-2079, 2016. *Crossref*, <https://doi.org/10.2337/dc16-1728>
- [5] Monique E Francois, and Jonathan P Little, "Effectiveness and Safety of High-Intensity Interval Training in Patients with Type 2 Diabetes," *Diabetes Spectrum*, vol. 28 no. 1, pp. 39-44, 2015. *Crossref*, <https://doi.org/10.2337/diaspect.28.1.39>
- [6] Aesthetics Practitioners Advisory Network (APAN). [Online]. Available: <https://apanetwork.com/wisdom-for-life-and-business-in-changing-times/2020/what-is-the-nitric-oxide-ump#:~:text=cardio%2dvvascular%20health,to%20lower%20your%20blood%20pressure>
- [7] Tripathi P, Paranjape M, and Hiremath M. "Reversal of Metabolic Syndrome with Freedom from Diabetes (FFD) Protocol," *Elixir Endocrinology*, vol. 122, pp. 52217-19, 2018.
- [8] Yu-Mi Lee et al., "Effect of a Brown Rice Based Vegan Diet and Conventional Diabetic Diet on Glycemic Control of Patients with Type 2 Diabetes: a 12-Week Randomized Clinical Trial," *PLoS One*, vol. 11, no. 6, pp. E0155918, 2016. *Crossref*, <https://doi.org/10.1371/journal.pone.0155918>
- [9] Pramod Tripathi et al., "Extent of Diabetic Nephropathy Reversal in Type 2 Diabetes Mellitus Patients by Following the Freedom from Diabetes Protocol," *Indian Journal of Public Health Research & Development*, vol. 11, no. 8, pp. 97-105, 2020. *Crossref*, <https://doi.org/10.37506/ijphrd.v11i8.10903>
- [10] R.Nagalakshmi, and R.Priya, "Neck on the Line-Thyroid Gland Hormonal and Metabolic Ataxia," *International Journal of Engineering Trends and Technology*, vol. 68, no. 2, pp. 57-60, 2020. *Crossref*, <https://doi.org/10.14445/22315381/IJETT-V68I2P210>
- [11] Paolo Sgrò et al., "Exercise as a Drug for Glucose Management and Prevention in Type 2 Diabetes Mellitus," *Current Opinion in Pharmacology*, vol. 59, pp. 95-102, 2021. *Crossref*, <https://doi.org/10.1016/j.coph.2021.05.006>
- [12] J B Gillen et al., "Acute High-Intensity Interval Exercise Reduces the Postprandial Glucose Response and Prevalence of Hyperglycaemia in Patients with Type 2 Diabetes," *Diabetes, Obesity and Metabolism*, vol. 14, no. 6, pp. 575-577, 2012. *Crossref*, <https://doi.org/10.1111/j.1463-1326.2012.01564.x>
- [13] Jonathan P Little et al., "Low-Volume High-Intensity Interval Training Reduces Hyperglycemia and Increases Muscle Mitochondrial Capacity in Patients with Type 2 Diabetes," *Journal of Applied Physiology*, vol. 111, no. 6, pp. 1554-1560, 2011. *Crossref*, <https://doi.org/10.1152/japplphysiol.00921.2011>
- [14] Søren Møller Madsen et al., "High Intensity Interval Training Improves Glycaemic Control and Pancreatic B Cell Function of Type 2 Diabetes Patients," *PLoS One*, vol. 10, no. 8, p. E0133286, 2015. *Crossref*, <https://doi.org/10.1371/journal.pone.0133286>
- [15] Sayed Z A Shah et al., "Movement is Improvement: the Therapeutic Effects of Exercise and General Physical Activity on Glycemic Control in Patients with Type 2 Diabetes Mellitus: A Systematic Review and Meta-Analysis of Randomized Controlled Trials," *Diabetes Therapy*, vol. 12, no. 3, pp. 707-732, 2021. *Crossref*, <https://doi.org/10.1007/s13300-021-01005-1>
- [16] Romeu Mendes et al., "Exercise Prescription for Patients with Type 2 Diabetes-A Synthesis of International Recommendations: Narrative Review," *British Journal of Sports Medicine*, vol. 50, no. 22, pp. 1379-1381, 2016. *Crossref*, <https://doi.org/10.1136/bjsports-2015-094895>