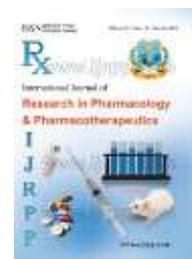




## International Journal of Research in Pharmacology & Pharmacotherapeutics



ISSN Print: 2278-2648  
ISSN Online: 2278-2656

IJRPP |Vol.3 | Issue 4 | Oct-Dec-2014  
Journal Home page: [www.ijrpp.com](http://www.ijrpp.com)

Review article

Open Access

### Review on non -pharmacological treatment for type-2 diabetes mellitus

**Kameswaran.R\*, SambathKumar. R, Sarah.Y**

Department of pharmacy practice, JKK Natraja college of pharmacy, Komarapalayam, Tamilnadu, India, 638183.

\*Corresponding author: **Kameswaran.R**

E-mail id: [kameswaran.r@jkkn.org](mailto:kameswaran.r@jkkn.org).

#### ABSTRACT

This study reviewed the research reports dealing with non- pharmacologic interventions aimed at preventing type 2 diabetes including diet and physical activity, for the prevention of Type-2DM. Lifestyle interventions reduce the rate of progression to type 2 diabetes in people with impaired glucose tolerance. People with impaired glucose tolerance have a high risk of developing type 2 diabetes, and consequently many trials of interventions for prevention of type 2 diabetes have focused on such individuals. Lifestyle interventions seem to be at least as effective as drug treatment. Exercise is perceived to be beneficial for glycemic control and weight loss in patients with type-2 DM. clinical trials on the effects of exercise in patients with type-2DM have had small sample sizes and conflicting results. India has the second largest diabetic population (61 million) and tobacco users (275 million) in the world.

**Keywords:** Exercise, lifestyle modifications, diabetes mellitus

#### INTRODUCTION

An estimated 1.2 billion people in the world are overweight, in that 300 million of them are obese<sup>(1,2)</sup>. In the world population the people living with diabetes is expected to rise from 366 million in 2011 to 552 million by the year 2030, if no urgent action is taken. This equals to approximately three new cases every ten seconds or almost ten million per year. In the South –East region one fifth of all adults living with Diabetes.<sup>(3)</sup>

Diabetes mellitus is a syndrome characterized by chronic hyperglycemia, due to absolute or relative deficiency or diminished effectiveness of circulating insulin. It is the most common serious metabolic

disease. Diabetes mellitus has been recognized as a clinical syndrome since ancient times and remains a crippling global health problem today. Diabetes may be divided into type 1 and type 2. Type 1 diabetes is caused by deficiency of insulin production, while type 2 diabetes is characterized by insulin resistance. This review paper highlighted the effectiveness of medicinal plants, the effectiveness of exercise therapy, diet and other lifestyle treatments for preventing diabetes and reducing mortality and morbidity among persons who are at an increased risk of developing the disease.

The role of non-pharmacological treatment in diabetes is well known and so is the ever increasing menace of diabetes.

Exercise not only reduces hyperglycemia, but reduces insulin resistance by reducing obesity. Therapeutic diet also is helpful in management of diabetes.

Lifestyle modification alone can prevent development of diabetes in impaired glucose tolerance patients. It can also be the sole therapeutic tool in early diabetes.

### **Basic educational requirements for diabetic patients**

The person with diabetes should acquire adequate knowledge and skills in the Non pharmacological treatment

1. Individual nutritional requirements and meal planning
2. Type and extent of exercise and physical activity
3. Interaction of food intake and physical activity with oral hypoglycemic drugs/insulin.
4. Improvements in lifestyle, for example harmful effects of smoking, obesity and alcohol intake
5. Self-monitoring and significance of results and actions to be taken
6. How to cope with emergencies (illness, hypoglycemia)
7. How to avoid complications and detect them at an early stage, e.g. how to take care of the feet.

### **Non pharmacological approaches for diabetes mellitus**

#### **Lifestyle modification**

The major factors that increase cardiovascular risk in diabetes are:

1. Sedentary lifestyle
2. Over nutrition leading to obesity.<sup>4</sup>

#### **The lifestyle intervention goals were**

- 1) Reduction in weight of 5%
- 2) Total fat intake 30% of energy
- 3) Saturated fat intake 10% of energy
- 4) Fiber intake 15 g/1,000 kcal
- 5) Moderate exercise for 30 min/day.

#### **Exercise**

Physical exercise is the systematic, planned performance of bodily movements, postures. This will reduce health related risk factors of an

individual. Exercise is a major therapeutic modality in the treatment of diabetes mellitus<sup>5</sup> Exercise is frequently recommended in the management of type 1 and type 2 diabetes and can improve glucose uptake by increasing insulin sensitivity and lowering body adiposity. Physical inactivity and poor physical fitness have been related with increased mortality among persons with established type 2 diabetes<sup>6</sup>. Three recently published trials document that lifestyle modifications including regular physical activity combined with diet (cf supra) can clearly prevent diabetes in patients with impaired glucose tolerance (IGT) <sup>(7, 8, 9)</sup>. In the study of Tuomilehto et al., subjects in the «intervention group» were recommended a moderate exercise for at least 30 minutes per day <sup>(10)</sup>, while in the Diabetes Prevention Program Research Group Study, physical activity of moderate intensity (such as brisk walking) was encouraged for at least 150 minutes per week <sup>(11)</sup>. A recent meta-analysis suggests that exercise training per second reduces HbA1c by approximately 0.66%, an amount that would be expected to significantly reduce the risk of diabetic complications<sup>(12)</sup>. Therefore, exercising for 4 hours a week for 6 weeks increased insulin-mediated glucose uptake by 30%, as measured by euglycaemic clamp<sup>(13)</sup>. Exercise can reduce the free fatty acid load to liver and in this way reduce hepatic insulin resistance.<sup>(14)</sup> Exercise increases skeletal muscle glucose uptake and utilization by increasing the expression of the glucose transporter 4(GLUT4)<sup>(15)</sup>. The American College of Sports Medicine<sup>(16)</sup> advised a combination of both aerobic and resistive training as part of the exercise for most afflicted persons.

These exercises include resistance exercise, endurance exercise, aerobic exercise and vibration exercise. Before an exercise program, the person with diabetes mellitus should undergo a complete medical evaluation with suitable diagnostic studies. A careful medical examination including history, age, duration of disease, family history and physical examination should be carried out focusing on the symptoms and signs of disease affecting the heart and blood vessels, eyes, feet, nervous system and kidneys. Continuous fortitude type exercise training reduced blood glycatedhaemoglobin levels, LDL-cholesterol concentrations, bodyweight and leg fat mass, and increased VO<sub>2</sub> peak, lean muscle mass and skeletal muscle cytochrome c oxidase and citrate synthase

activity ( $p < 0.05$ )<sup>(17)</sup>. Exercise also produces anti-atherogenic blood lipid changes and decreases homocysteine plasma levels, a recognized cardiovascular risk factor<sup>(18)</sup>. Its benefits in improving the metabolic abnormalities are possibly greatest when used early in the progression from insulin resistance to IGT and then to diabetes<sup>(19)</sup>.

### **NUTRITION THERAPY**

Nutrition therapy is another key component in preventing or delaying type 2 diabetes in individuals with impaired glucose. Primary prevention of diabetes is possible with lifestyle modifications of which medical nutrition therapy is an integral part<sup>(20)</sup>. Proper nutrition requires the proper ingestion and equally important, the absorption of vitamins, minerals and food energy in the form of carbohydrates, proteins and fats. Dietary habit and choice plays a significant role in health. The food consumed by a person changes the blood sugar level in different ways. So it is important to learn how to make healthy food choices that helps to control the blood sugar level. To control the blood sugar level it is important to eat healthy food at the right time and in the right amount. It is beneficial to eat smaller, more frequent meals, rather than two or three big meals most people consume daily<sup>(21)</sup>. The total calorie intake can be divided as

1. carbohydrates-45%-65%
2. proteins-10%-20%
3. And less than 30% fats, in which saturated fat should be less

### **Carbohydrates**

Carbohydrate is the nutrition term used for starch, sugar and fiber. Carbohydrate plays a very important role in the control of type-2 diabetes. High glycemic index (GI) foods break down quickly where low GI foods break down slowly. With low GI foods we feel full for a longer duration and our body's insulin has more time to perform its job and remove glucose from the blood. The first dietary rules for all patients with diabetes is to avoid all sugar and foods containing sugar, such as pastry, candy and soft drinks<sup>(22)</sup>. William and colleagues<sup>(23)</sup> reported that the low carbohydrate, ketogenic diet (LCKD) may be effective for improving glycaemia and reducing medications in patients with type 2 diabetes.

### **Fat and cholesterol**

Fatty acids are an important constituent of diet. Type and amount of fatty acids may have an effect on diabetes complications. Madigan and coworkers<sup>(24)</sup>. A linoleic acid diet (sunflower oil diet) may not be the best option and an oleic acid rich diet (olive oil diet) appears to be a more suitable option for patients with type-2 diabetes. Fasting blood glucose and insulin levels were significantly higher on the linoleic acid diet compared with the oleic acid diet.

Hu and coworkers<sup>(25)</sup> reported that women who consumed fish at least one to three times a month had a 40% lower risk of developing coronary heart disease compared to women with diabetes who ate fish less than once a month.

### **Protein**

Diabetes mellitus is basically a disorder of carbohydrate metabolism, but with development of the disease, protein found that rates of glycogen synthesis and glycogen metabolism are also affected. Digestion of protein and fat is slow thus keeps us feeling full and slows the release of glucose into blood. A number of studies in healthy individuals and in individuals with type 2 diabetes have demonstrated that glucose produced from ingested protein does not increase plasma glucose concentration but does produce increase in serum insulin responses<sup>(26,27)</sup>.

### **Alcohol**

Alcohol consumption has been constantly associated with a reduced risk of type 2 diabetes compared with abstaining consumption<sup>(28,29)</sup>. In individuals with diabetes, as with the general population, light to moderate alcohol intake (1–2 drinks per day; 15–30 g of alcohol) is associated with a decreased risk of coronary heart disease (CHD)<sup>(30)</sup>. A 7.5 g/day (approximately half a glass) increase in alcohol consumption over 4 years was related with lower diabetes risk among initial nondrinkers. Light drinkers who increased their intake to moderate levels (5.0–29.9 g/day) had a significantly lower risk of diabetes (HR 0.75; 95% CI: 0.62 – 0.90).

### **Alcohol is not recommended**

1. pregnant or breast feeding
2. High triglycerides
3. Liver problems

### Smoking cessation

The justification for the prevention and cessation of smoking among individuals with diabetes is for diabetic smokers.<sup>(31)</sup>substantial. The frequency of micro and macro vascular complications was significantly increased in smokers compared to non-smokers.<sup>(32)</sup> Health care providers should advice all diabetics not to initiate tobacco and accentuate stopping smoking in smokers as utmost priority

### Yoga

Yoga is an ancient Indian science and a number of controlled studies exist on the effectiveness of yoga. It is a rich heritage of Indian culture. Outside India, the term yoga is usually related with Hatha Yoga and

its asana (postures) or as a form of exercise. Several older books put together about the usefulness of yoga in the treatment of certain diseases and preservation of health in normal individuals. The yoga postures are slow rhythmic movements which highlight the stimulation of the organs and glands by easy bending and extensions which do not over stimulate muscles but concentrate on glandular stimulation<sup>(34)</sup>. The beneficial effects of yoga and traditional physical training (PT) exercise regimens in improving glycemic control by increasing percentage insulin binding receptor in patients with type 2 diabetes with no significant change in cortisol and thyroid hormones<sup>(35)</sup>.

#### Various types of pranayamas and yoga asanas included in yogic exercises for diabetes mellitus

sno	Name	Duration
1	Bhastrika Pranayama	3 - 5 mins per day  3 - 7 turns of each, the pose being maintained for ten seconds adding one turn each,
2.	Suryanamskar	every fortnight
3.	Kapal- Bhati	5 - 10mins per day
4.	Tadasana	¼ minute to one minute, adding ¼ minute per week
5.	Trikonasana	¼ minute to one minute for each side, adding ¼ minute per week
6.	Anulom Viloma	5 - 10 mins per day
7.	Bhramari	5 times a day
8.	Udgit-Om Uccharan	5 times a day
9.	Paschimottanasan	¼ minute to one minute for each side, adding ¼ minute per week
10.	Shavasana	3 - 7 turn of each, the pose being maintained for ten seconds adding one turn each, every fortnight
11.	Bhujangasana	3 - 7 turn of each, the pose being maintained for ten seconds adding one turn each, every fortnight

### Medicinal Plants

Plant-based medicinal products have been well-known to man since ancient times<sup>36</sup>. It is expected that 70 to 80% of the people worldwide rely chiefly on traditional health care system and largely on herbal medicines<sup>(37)</sup>. Plants have been the primary source of drugs and many other currently available drugs have been directly or indirectly derived from plants. More than 400 plant species having hypoglycemic activity have been available in

literature, however, searching for new anti-diabetic drugs from natural plants is still attractive because they contain substances which exhibit alternative and safe effects on diabetes mellitus. Most of the plants contain glycosides, alkaloids, terpenoids, flavonoids, cartenoids, etc. that are frequently implicated as having anti diabetic effect<sup>(38)</sup>. Medicinal plants useful in diabetes also possess strong antioxidant / free radical scavenging properties

## Some plants having hypoglycemic activities

s.no	Plant species	Common name	Part used	sample	Adverse effects
1.	Ocimum sanctum	Tulsi	Leaves	Patients with type 2 diabetes and alloxan diabetic rats	Leaf aqueous extract did not produce any acute toxic (100% survival) symptoms at doses up to 5 g/kg alcoholic extract was well tolerated (80% survival) up to a dose of 4g/kg on mice
2.	Pterocarpusmarsupium	Vijayasar	Leaves	Human patients with type 2 diabetes	There was no side effect specifically for trial drugs.
3.	Momordicacharantia	Karela	Fruit	Human patients with type 2 diabetes	Gastrointestinal complaints were the most common reported adverse events.
4.	Allium sativum	Garlic	Cloves	Human patients with type 2 diabetes	Garlic had no significant adverse effect. Excess and chronic administration of garlic because of gastrointestinal troubles. If patients suffered from hepatitis, kidney and heart diseases, intake of garlic should be prohibited
5.	Silybummarianum	Banyan	Seed	Human patients with type 2 diabetes	No side effects of the treatment were reported during the study

**CONCLUSION**

Non-pharmacological therapies for type 2 diabetes have been research in recent years. Ideal therapies should have a similar degree of efficacy without the troublesome side effects related with conservative treatments. Alternative treatments for diabetes have become increasingly popular in the past few years.

1. Regular exercise is important for patients with type 2 diabetes to improve insulin sensitivity, glycaemia and lipid levels.
2. People with type 2 diabetes are instructed to include low GI food in their daily intake such as legumes, fiber rich cereals (> 5 g of fiber per serving), fruits, vegetables and whole grain products.

Protein could be beneficial in persons with type 2 diabetes.

3 The efficacy of yoga on fasting blood glucose, lipid profile, oxidative stress markers and antioxidant status in patients with type 2 diabetes. These findings are short term or immediate diabetes outcomes. though, further research is needed to evaluate long term impact of yoga and its side effects in patients with type 2 diabetes.

4. Herbal medications are the most commonly used alternative therapy for blood sugar control; though, their safety and efficacy need to be further evaluated by well designed, controlled clinical studies.

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