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Lifestyle changes for managing prediabetes: when and how?

Type 2 diabetes mellitus (T2DM) is a global public health issue whose prevalence has increased in recent decades, making it one of the leading causes of morbidity and mortality in adults. Prediabetes involves an increased risk of developing T2DM. The diagnosis of prediabetes is based on the presence of impaired fasting glucose (100–125 mg/dL) and/or impaired glucose levels two hours after a 75-gram oral glucose load (140–199 mg/dL) and/or elevated HbA1c levels (5.7%–6.4%).

Prediabetes has a high prevalence, estimated at up to 34% in the adult population in the United States with a higher rate (48%) in people older than 65 years. In our setting, the Di@bet study estimates a prevalence of 14.8%.

Screening is recommended every 4 years for healthy individuals older than 45 years. Screening should be annual for those at high risk of T2DM (e.g., family history of T2DM, personal history of gestational diabetes, obesity, fatty liver, hypertension (HTN), hyperlipidemia, and polycystic ovary syndrome).

The risk of developing T2DM among individuals with prediabetes goes from **5% up to 10% per year**, yet progression is preventable: 25% progress to diabetes, 25% return to normal glucose tolerance, and the rest maintain the diagnosis of prediabetes.

There is a link between prediabetes and cardiovascular disease with increased cardiovascular (CV) and heart failure risk even before progressing to overt diabetes. The cause-effect relationship has been observed with coronary artery disease, stroke, and all-cause mortality. Cardiovascular risk factors (CVRFs) associated with T2DM are also linked to prediabetes: obesity (especially abdominal), dyslipidemia with elevated triglycerides and reduced HDL cholesterol, and HTN.

Early diagnosis of prediabetes is crucial to establish appropriate measures to **prevent or delay progression to T2DM**. The pathophysiological defect in prediabetes can be managed with lifestyle changes: **diet and exercise**. Weight loss and physical activity improve insulin sensitivity. It is essential to provide health care professionals with tools for preventive measures in this population.

Two studies support the role of lifestyle changes, including diet and exercise, as significant factors in halting the progression to T2DM.

The Finnish Diabetes Prevention Study is a randomized trial with 522 overweight individuals with prediabetes assigned to either an intensive lifestyle intervention group or a standard care control group (1). The intensive intervention group received individualized dietary counseling and advice on **resistance training and increased overall physical activity**. Aerobic exercise was initially high intensity for the first year, followed by a maintenance period with an additional goal of weight reduction. Dietary advice focused on **reducing fat intake and increasing fiber consumption**. The control group received general dietary and exercise advice along with an annual physical exam. At one and three years, there was a reduction in weight with improved lipid profiles and a 58% reduction in the risk of developing diabetes vs the control group. Diabetes-free subjects at the end of the intervention were followed for an additional 3 years. Over the total 7-year follow-up period, the incidence of diabetes was 4.3 vs 7.4 per 100 person-years in the intervention and control groups, respectively.

Although the Diabetes Prevention Program (DPP) replicated similar results with a similar design it also included a **metformin**-treated group (2), a group with intensive lifestyle intervention, and a placebo group. The lifestyle group achieved a 7% reduction in initial weight and at least 150 minutes of physical activity per week, resulting in a 58% reduction in the incidence of diabetes. This reduction was 31% in the metformin-treated group vs the placebo group. A more detailed analysis of the lifestyle group revealed a 16% reduction in diabetes risk per kilogram of weight loss. At the 10-year follow-up, the effects of lifestyle changes on diabetes prevention remained.

Evaluating the impact of sociodemographic, clinical, metabolic, and lifestyle factors on the persistence of prediabetes and progression to T2DM shows that risk increases with age, body mass index (BMI), triglyceride levels, and lower physical activity (less than 150 minutes/week) (3). **Modifiable factors** such as physical activity, diet, and BMI play a crucial role in the progression to T2DM. Implementing these changes is key to managing prediabetes. The implementation of DPP measures in a community setting (4) has been analyzed. Health care professionals with well-controlled diabetes and a healthy lifestyle were recruited to conduct a group intervention through an educational program for patients with obesity and prediabetes. The intervention included caloric restriction (1200-1800 kcal/day) and at least 180 minutes of physical activity per week. On average, at 6 and 12 months, par- »

EACH ADDITIONAL KILOGRAM OF WEIGHT LOSS WAS ASSOCIATED WITH A 43% LOWER LIKELIHOOD OF DEVELOPING DIABETES

» ticipants had a net weight loss of 6%, a 5 cm reduction in waist circumference, and a greater reduction in fasting glucose levels vs standard care. The real-world impact of lifestyle changes has been evaluated in a meta-analysis. Those who received group education had a 33% lower risk of developing T2DM vs the control group and lost 1.5 kg more weight with a significant decrease in fasting glucose levels. Each additional kilogram of weight loss was associated with a 43% lower likelihood of diabetes (5).

The goal of lifestyle intervention is to reverse prediabetes and prevent progression to T2DM by maintaining fasting glucose levels < 110 mg/dL, achieving a 5% up to 10% weight loss, and engaging in moderate-intensity physical activity. Additionally, control of other CVRFs such as HTN, dyslipidemia, and smoking is necessary. Cardiovascular risk should be calculated at 10 years using existing scales (e.g., Framingham, Regicor, SCORE).

The initial evaluation of a patient with prediabetes should include aspects of diet such as total daily caloric intake and frequency of consumption of different food groups. The same applies to physical activity, which should be quantified using simple questionnaires, pedometers, activity trackers, etc.

NUTRITION

The general dietary recommendation for people with prediabetes is a balanced, heart-healthy diet with restrictions on rapid-absorbing carbohydrates (sugars, sweets, juices) and limiting saturated fat intake, while encouraging the consumption of fruits, legumes, vegetables, and whole grains. **Mediterranean diet** is a good model to follow as the PREDIMED study (6) has shown that it can reduce the incidence of T2DM by up to 40%. Regarding weight loss, initial and follow-up assessments should include BMI and waist circumference calculations, which are predictors of cardiovascular risk and diabetes.

Caloric restriction diets and low-carbohydrate diets, low-fat diets with carbohydrate restriction, or the more balanced »

» Mediterranean diet with higher omega-3, fiber content, and other metabolic benefits are valid. Other recommendations include a hypocaloric balanced diet in the presence of overweight or obesity. Both the Dietary Approaches to Stop Hypertension (DASH) model and the Mediterranean diet and vegetarian or vegan diets improve glycemic control, LDL cholesterol levels, and reduce cardiovascular events. Additionally, it is recommended that the dietary model be agreed upon according to the patient's preferences 7().

In patients with a BMI > 30 kg/m², **drugs** like orlistat and GLP-1 analogs may be considered. Bariatric surgery should also be considered for patients with appropriate indications.

EXERCISE

Exercise prescription should be a priority in clinical practice to prevent or delay T2DM. A recent meta-analysis evaluated the beneficial effects of exercise in people with prediabetes and found insufficient data to determine the most beneficial type, intensity, duration, and frequency of exercise for glycemic control. Although the effect of different types of exercise (aerobic, resistance, high and moderate-intensity interval training) varies with different parameters (fasting glucose, HbA1c, postprandial glucose), it is evident that any physical activity vs no exercise improves glycemic control (8). Another meta-analysis suggests that aerobic exercise alone or combined with resistance exercise has a greater effect on some parameters (BMI, insulin levels, HOMA-IR, blood glucose, and HbA1c) vs resistance exercise alone. High-intensity interval training (HIIT) has shown a positive effect on insulin resistance and muscle strength.

The WHO recommends moderate-intensity aerobic exercise (150 to 300 minutes/week) or 90 minutes per week of high-intensity exercise, combined with resistance training at least 2 days/week. Prescription should be **individualized**.

Lifestyle interventions in managing prediabetes have proven to be cost-effective, even more so than pharmacological interventions (metformin). Lifestyle change programs based on the Diabetes Prevention Program (DPP) model are more cost-effective, whether implemented group-wise or individually. Indeed, any intervention targeting high-risk individuals has been shown to be cost-effective. Given the enormous cost associated with T2DM and limited health care resources, prevention is a highly efficient tool (10). D

CONCLUSIONS

Prediabetes is a prevalent condition with a risk of progression to T2DM. There are modifiable factors through lifestyle changes, including diet and exercise, that can halt or prevent this progression. Diet and exercise prescriptions should be individualized. Various dietary patterns have shown benefits in managing prediabetes, with particular emphasis on the Mediterranean diet. Both aerobic and resistance exercises, as well as their combination, have a beneficial effect on prediabetes. Lifestyle interventions for prediabetes are cost-effective and highly effective as preventive tools for T2DM.

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