



FACT SHEET: Type 2 Diabetes Mellitus & Diet

How to prevent and treat type 2 diabetes with nutrition

Key Points

Diabetes currently affects approximately 463 million people worldwide, and the number is projected to rise to 700 million people by 2045—that is 10.9% of the world’s population.¹

Type 2 diabetes mellitus (T2DM) accounts for up to 90% of all diabetes cases.²

An unfavorable dietary composition and increased visceral adipose tissue are reversible and among the key risk factors for T2DM.³

T2DM itself increases the risk of atherosclerosis, neuropathy, and diabetic foot syndrome, as well as nephropathy and retinopathy, a leading cause of visual impairment blindness.⁴

Insulin resistance (IR) may occur decades before T2DM becomes diagnostically apparent, so early preventive dietary strategies are of paramount importance.

**In 2019
an estimated
4.2 million
deaths were
attributable
to diabetes
and its
complications.⁵**

Pathomechanisms That Are Influenced by Diet

Adipose Tissue Dysfunction

Overnutrition

Diets high in **fat, simple sugars, and processed foods** are calorically dense and facilitate energy surplus and **adipose tissue (AT) dysfunction** resulting in:

- **downregulated** secretion of insulin-sensitizing **adiponectin**^{6, 7}
- chronic **tissue inflammation** due to macrophage infiltration^{8, 9}
- release of proinflammatory **cytokines** causing **impaired insulin signaling** and **lipolysis**^{10, 11, 12, 13}
- **upregulated lipolysis** leading to release of **free fatty acids** (FFAs)^{14, 15}

Lipotoxicity

Dietary Fat

dietary **saturated** fat contributes to oversupply of saturated FFAs^{16, 17}

- **saturated** FFAs cause **IR** through mitochondrial dysfunction, increased oxidative stress, and proinflammatory signaling^{18, 19} on the contrary, monounsaturated and omega-3 polyunsaturated fatty acids **increase insulin sensitivity**^{20, 21, 22}

Ectopic Fat

FFAs from adipocytes and dietary saturated fat are redirected to and accumulated at multiple anatomic sites as **ectopic fat** (EF)^{23, 24}

EF causes **lipotoxicity**,²⁵ which contributes to **organ dysfunction** and **IR**, thus resulting in both **impaired insulin secretion** and **increased insulin needs**^{26, 27}

- liver
 - upregulated gluconeogenesis and glycogenolysis²⁸
- skeletal muscle
 - build-up of intramyocellular lipid, which **interferes with GLUT4 translocation**^{29, 30, 31}
 - decreased uptake of blood glucose and glycogen synthesis^{32, 33}
- Pancreas
 - increased **oxidative stress** and **lipopoptosis** of β -cells^{34, 35, 36}



Pathomechanisms That Are Influenced by Diet

Glucotoxicity

Rapidly Absorbable Carbohydrates

cause **increased insulin needs** (increasingly difficult to meet in lipotoxic state)

can induce **de novo lipogenesis** leading to increased accumulation of AT

contribute to **chronically elevated blood glucose levels** resulting in **glucotoxicity**^{37, 38}

- production of **advanced glycation end products** (AGEs), which cause **glomerulosclerosis** and thus contribute to **diabetic nephropathy**
- increased **oxidative stress** and **apoptosis** of β -cells

Glucolipotoxicity

lipotoxic and **glucotoxic** effects cause progressive β -cell dysfunction and death, which leads to the **inability to compensate for increased insulin needs** resulting in the hallmark of T2DM: **hyperglycemia**

The Scientific Evidence

Epidemiological Evidence

significant association between abdominal obesity and incidence of T2DM^{39, 40}

74% reduced risk of developing diabetes by long-term adherence to a vegetarian diet vs. meat-containing diet⁴¹

significant inverse association between higher adherence to a plant-based dietary pattern and risk of T2DM⁴²

Evidence from RCTs and Corresponding Meta-Analyses

significant decrease in HbA1c when following a low-carbohydrate diet, low glycemic index (GI) diet or Mediterranean diet compared to control diets⁴³

7.4% reduction in HbA1c levels on low GI-diets compared to high-GI diets⁴⁴

vegan, vegetarian, and Mediterranean diets show greater reduction in bodyweight and HbA1c levels, delayed requirement for diabetes medication, and improved glycemic control compared to other diets⁴⁵

General Recommendations

Eat predominantly or entirely from a wide variety of whole plant foods: Maximize the intake of high-quality plant foods such as vegetables, whole grains, legumes, fruits, nuts, seeds, herbs, and spices; your health will benefit from every step towards more whole plant foods.

Eliminate or limit all processed foods, refined carbohydrates, and sugar-sweetened foods and beverages.

Eliminate or limit red and processed meat products (such as burgers, sausages, bacon, ham, salami, dried meat, canned meat, and pastrami).

Eliminate or limit other animal products such as poultry, fish, eggs, cheese, and dairy.

Make sure to cover potentially critical nutrients with a wide variety of plant foods, enriched foods/drinks, or supplements (especially vitamin B12 and vitamin D); find more information in our [Nutrition Library](#).

Disease-Specific Recommendations

Eliminate chronic excessive calorie intake. This is best achieved by choosing plant foods with low calorie density such as green vegetables, starchy root vegetables, legumes, and fruit with lower sugar content such as berries and citrus fruits.

Aim for optimal body weight, which is best achieved by consuming predominately whole plant foods—losing weight helps keeping blood sugar levels under control.

When eating carbohydrates, choose low glycemic food options such as fruits, vegetables, legumes, minimally processed whole grains, and nuts. Those will help control blood sugar levels and also promote weight loss.



Disease-Specific Recommendations

Limit saturated fats, from both animal and plant sources as much as possible,^{46, 47} and replace them with monounsaturated and omega-3 polyunsaturated fats from nuts and seeds or high-quality carbohydrates such as whole grains, as this has been shown to ameliorate IR.^{48, 49}

Make it a habit to eat beans, chickpeas, lentils, and split peas, as pulses help keep blood sugar levels stable.

Regularly include inulin-rich foods such as chicory root and Jerusalem artichoke. Inulin is an indigestible kind of fiber, which may help maintain steady blood sugar levels,⁵⁰ ameliorate IR,⁵¹ and reduce LDL cholesterol.⁵²

Regularly season your food with the spice turmeric as one of its active compounds curcumin has been shown to improve glycemic control^{53, 54} (1/4–2 tsp per day; not during pregnancy, lactation, and childhood and not for people with liver disease or gallstones).

For more details on how to implement a whole food, plant-based diet, have a look at [our brochure](#).

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