



PHYSICIAN FACTSHEET: Type 2 Diabetes & Diet

How to prevent and treat type 2 diabetes with nutrition

Diabetes currently affects approximately 536 million people worldwide, which is projected to rise to 783 million people by 2045. That is 12.2% of the world's population (1).

Type 2 diabetes (T2D) accounts for up to 90% of all diabetes cases worldwide (1).

An unfavourable dietary composition and increased visceral adipose tissue are among the key risk factors for T2D, yet T2D is reversible with lifestyle modification (1).

T2D itself increases the risk of atherosclerosis, neuropathy, and diabetic foot syndrome, as well as nephropathy and retinopathy, a leading cause of visual impairment blindness (1).

Insulin resistance (IR) may occur decades before T2D becomes diagnostically apparent, so early preventive dietary strategies are of paramount importance.

In 2019, 4.2 million deaths were attributable to diabetes and its complications.

IDF Diabetes Atlas, 2021

Pathomechanisms Influenced by Diet

Adipose Tissue Dysfunction Over nutrition

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

- down-regulated secretion of insulin-sensitizing **adiponectin** (2).
- chronic tissue **inflammation** due to macrophage infiltration (3).
- release of **pro-inflammatory cytokines** causing impaired insulin signalling and **lipolysis** (2-4).
- **up-regulated lipolysis** leading to release of **free fatty acids** (FFAs) (3).

Lipotoxicity

Dietary Fat

Dietary **saturated fat** contributes to an oversupply of saturated FFAs (5).
• **saturated FFAs** cause IR through mitochondrial dysfunction, increased oxidative stress, and pro-inflammatory signalling (6).
Conversely, monounsaturated and **omega-3 polyunsaturated fatty acids** increase insulin sensitivity (5, 7).

Ectopic Fat

FFAs from adipocytes and dietary saturated fat are redirected to and accumulated at within and around organs as **ectopic fat** (EF)(3).
EF causes **lipotoxicity**, (5) which contributes to **organ dysfunction** and IR, resulting in **impaired insulin secretion** and **increased insulin needs** (3, 4).

Liver

• upregulated gluconeogenesis and glycogenolysis (4).

Skeletal muscle

- build-up of intramyocellular lipids, which interferes with GLUT4 translocation (3).
- decreased uptake of blood glucose and glycogen synthesis (3, 4).

Pancreas

- increased oxidative stress and lipoapoptosis of β -cells (4, 5).



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Pathomechanisms Influenced by Diet

Glucotoxicity

Rapidly Absorbable Carbohydrates such as simple sugars

- 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 (4).
- production of **advanced glycation end products (AGEs)**, which cause **glomerulosclerosis** and thus contribute to **diabetic nephropathy**.
- increased **oxidative stress** and **apoptosis of pancreatic β -cells**.

Glucolipotoxicity

Lipotoxic and glucotoxic effects cause progressive pancreatic β -cell dysfunction and death, which leads to the inability to compensate for **increased insulin needs**, resulting in the hallmark of type 2 diabetes: **hyperglycaemia**.

The Scientific Evidence

Epidemiological evidence

- Significant association between **abdominal obesity** and incidence of **T2D** (8, 9)
- 74% reduced risk of developing diabetes by long-term adherence to a **vegetarian diet** versus a meat-containing diet (10)
- Significant inverse association between higher adherence to a plant-based dietary pattern and risk of T2D (11)

Evidence from RCTs and meta-analyses

- Significant decrease in HbA1c when following a low-carbohydrate diet, low glycaemic index (GI) diet or Mediterranean diet compared to control diets (12)
- 0.4% reduction in HbA1c levels on low GI-diets compared to high-GI diets (13)
- Vegan, vegetarian, and Mediterranean diets show greater reduction in body weight and HbA1c levels, delayed requirement for diabetes medication, and improved glycaemic control compared to other diets (14).

General Recommendations

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 drinks.

Eliminate red and processed meat products such as burgers, sausages, bacon, ham, salami, dried meat, canned meat, and pastrami (15).

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).



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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 keep blood sugar levels under control.

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

Limit saturated fats, from both animal and plant sources as much as possible, (16, 17) 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 (16).

Make it a habit to eat beans, chickpeas, lentils, and split peas, as pulses help keep blood sugar levels stable (18).

Regularly include inulin-rich foods such as chicory root and Jerusalem artichoke. Inulin is an indigestible kind of fibre, which may help maintain steady blood sugar levels, (19) ameliorate IR and reduce LDL cholesterol (20).

Regularly season your food with the spice turmeric (1/4–2 tsp per day), as one of its active compounds **curcumin** has been shown to improve glycaemic control (21). Consult your physician if pregnant or lactating (22).

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