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Review

Role of Anti-Oxidant Activity in the Management of Diabetes Mellitus

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	Abstract
Published on: 21.02.2026	<p>This article defines diabetes mellitus, its types (Type I, II, and gestational), and the damage it causes to body systems like blood vessels, eyes, kidneys, heart, and nerves due to insulin deficiency or resistance. It emphasizes antioxidants' crucial role in neutralizing free radicals from hyperglycemia, preserving beta-cell function, enhancing insulin sensitivity, and preventing complications. The paper covers global and Indian diabetes statistics (e.g., 589 million adults worldwide in 2025, up to 212 million in India), anti-diabetic drugs market trends, herbal remedies like <i>Gymnema sylvestre</i> and <i>Momordica charantia</i>, top manufacturers, antioxidant sources (herbs, nuts, greens), and concludes on herbs complementary potential.</p>
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Introduction

Diabetes mellitus(DM) is commonest endocrine complaint that affects further than 100 million people worldwide(6 population). It's caused by insufficiency or ineffective product of insulin by pancreas which results in increase or drop in attention of glucose in the blood. It's set up to damage numerous of body

systems particularly blood vessels, eyes, order, heart and jitters.(1)

Types

Insulin dependent diabetes mellitus (IDDM, Type I) , Non-insulin dependent diabetes mellitus (NIDDM, Type II) and Gestational diabetes. Type I diabetes is an autoimmune illness marked by a local inflammatory response in and surrounding islets that

is followed by the selective death of insulin-secreting cells. In contrast to Type II diabetes, which is characterized by peripheral insulin resistance and decreased function. Gestational diabetes is high blood sugar during pregnancy. Eating healthy, well-balanced foods and getting exercise can usually keep it well managed. But sometimes, insulin is necessary to help you manage blood sugar levels. If left untreated, it can cause health problems for both you and the fetus.(2)

Role of Antioxidants in Diabetes

Anti-oxidant plays a crucial role in diabetes management by neutralizing excessive free radical, they help to preserve beta-cell function and enhance the insulin sensitivity. Hyperglycemia (high blood sugar) in diabetes promotes the auto-oxidation of glucose, leading to the formation of free radicals that can damage cells and tissues, contributing to both microvascular and macrovascular complications. Antioxidants neutralize excess ROS and free radicals, thereby reducing oxidative stress and protecting cellular structures, including pancreatic β-cells responsible for insulin secretion.

They help regulate glucose metabolism, improve insulin secretion, and decrease insulin resistance, which are crucial for managing diabetes(1). Antioxidants also support endothelial function, which is often impaired in diabetes, reducing the risk of vascular complications.(3)

Status Of Diabetic In Globally 2000 & 2025

In the year 2000, the global prevalence of diabetes among all age groups was estimated to be 2.8%. The total number of people with diabetes worldwide was approximately 171 million. For adults aged 20–79 years specifically, the estimate was about 151 million

people living with diabetes, with an age-standardised prevalence of 4.6%.(2)

In 2025, an estimated 589 million adults aged 20–79 years about 1 in 9 globally are living with diabetes. The prevalence rate among adults is approximately 11.1%. Over 4 in 5 (81%) adults with diabetes reside in low- and middle-income countries(2)

Status Of Diabetic In India 2000 & 2025

In 2000, India had the highest number of people living with diabetes globally, with estimates ranging from 31.7 million to 32.7 million adults affected. This figure positioned India ahead of China (20.8 million) and the United States (17.7 million) at that time.(4)

As of 2025, India is facing a significant diabetes epidemic, with estimates ranging from over 100 million diagnosed cases(5) to more than 212 million people living with diabetes, making it the nation with the second-highest prevalence of diabetes worldwide. The number of adults (aged 20–79) with diabetes in India is projected to be approximately 89.8 million in 2024, with forecasts suggesting a continued increase. The age-standardized prevalence rate is expected to reach about 6,960 per 100,000 population in 2025, reflecting a marked upward trend over previous years.(5)

By 2050, India is anticipated to see a dramatic increase in diabetes cases, with projections indicating a 73% rise from current situations. The number of adults living with diabetes is forecasted to reach approximately 156–185 million, up from around 90 million in 2024. India will account for about 1 in 7 of all adults living with diabetes worldwide, making it one of the countries with the highest diabetes burden globally.(6)

Global		India	
2000	2025	2000	2025
171 million	Not specified	Not specified	Up to 212 million (est.)
151 million	589 million	31.7-32.7 million	~89.8 million (2024 proj.)

Anti-Diabetic Drug In Indian Market

The Indian anti-diabetic drug market is a rapidly growing high value sector valued at approximately \$3.1 billion in 2024, driven by 6.5-8.2% annual

growth rate due to the rising prevalence of type-11 diabetes. The market is dominated by biguanides (metformin) and increasing use of SGLT-2 inhibitors.

Metformin (biguanides) remains the preferred widely used drug, holding ~36.8% share, while SGLT-2 inhibitors are leading revenue growth (projected > 11% CAGR).

Future Outlook

The request is anticipated to reach \$ 3.91 billion by 2030, driven by

an growing population, life changes, & enhanced access via government enterprise. (8)

Drug/Class	Example Brands/Combinations	SALES VOLUME(INR)	
		IN 2000	IN 2025
Metformin	Metrose 500	7,770cr	3.46lakhscr
Sulfonylureas	Glyzee	8,080cr	3.60lakhscr
DPP-4 Inhibitors	Sitazee M 1000	approval in 2006	99,000cr
SGLT2 Inhibitors	Dapazee	approval in 2014	1,70,150cr
Insulin/Insulin Analogues	Human Mixtard	-	1.49lakh cr
GLP-1 Agonists	Oral semaglutide	approval in 2005	5.23lakh cr(9)

Anti-Diabetic Herbal Drug In Indian Market

Indian herbs plays an significant role in managing diabetes by regulating blood sugar, enhancing insulin sensitivity, and reducing oxidative stress, often acting as complementary to conventional treatments. While the mainstream diabetes market is led by allopathic drugs, there is also significant demand for herbal and Ayurvedic anti-diabetic formulations in India. (10)

Top 5 Anti-Diabetic Herbal Drug

Gymnema sylvestre (Gurmar)

Momordica charantia (Bitter melon/Karela)

Allium sativum (Garlic)

Trigonella foenum-graecum (Fenugreek/Methi)

Syzygium cumini (Jamun)

These ingredients are often found in popular Ayurvedic formulations like Diarex (Himalaya), Diabecon (Himalaya), and BGR-34

(developed by CSIR and AIMIL Pharmaceuticals). However, these herbal products do not appear in the lists of the most sold or leading diabetes drugs in the Indian pharmaceutical market, which are dominated by allopathic medications. (11)

Role Of Indian Herbs In Diabetes

Indian herbs from Ayurvedic traditions help manage diabetes by regulating blood sugar levels, improving insulin sensitivity, and combating oxidative stress through antioxidant and anti-apoptotic actions. These effects position them as valuable complements to conventional treatments.

Herbs and Roles

Gudmar (*Gymnema sylvestre*): Blocks sugar absorption in the intestines and stimulates insulin secretion from pancreatic beta cells.

Karela (*Momordica charantia*): Contains insulin-like compounds that enhance glucose uptake by cells and lower fasting blood sugar.

Methi (Trigonella foenum-graecum): Slows carbohydrate digestion via fiber and improves insulin sensitivity.

Guduchi (Tinospora cordifolia): Protects beta cells from oxidative damage and supports glucose regulation.

Haldi (Curcuma longa): Reduces inflammation-linked insulin resistance with its curcumin antioxidant properties.[\(12\)](#)

Top 5 Anti Diabetic Drug Manufacture And Its Sales Volume In 2024-2025

Leading Manufacturers

Based on the latest industry reports and market analysis, the top five anti-diabetic drug manufacturers active in the Indian market for 2024–2025 are:

Novo nordisk, Sanofi, Eli lilly, Astrazeneca & Boehringer ingelheim

These companies are recognized for their dominance in both insulin and oral anti-diabetic drug segments, offering products like insulin analogues, SGLT-2 inhibitors, and GLP-1 receptor agonists.

Sales Volume and Market Growth

The anti-diabetic drugs segment is a major growth driver in the Indian pharmaceutical market, with over ₹155 crore in value growth reported recently

While specific company-wise sales volumes for anti-diabetic drugs in India are not publicly broken down in detail, these multinational companies consistently lead the market due to their strong portfolios and established brands

Indian pharmaceutical giants such as Sun Pharma, Dr. Reddy’s Labs, Cipla, and Zydus Lifesciences also have significant revenue and a robust presence in the generic anti-diabetic drug market, but the multinational companies above are the primary leaders for patented and innovative diabetes therapies.[\(13\)](#)

Rank	Manufacturer	Brand Name	Sales volume(2024-2025)
1	Novo nordisk	Ozempic, Victoza	26% at constant exchange rate
2	Sanofi	Dupixent, Lantus	\$47.922billion
3	Eli lilly	Mounjaro, Prozac	IN 2024 - \$45.0billion IN 2025 -\$61.0billion
4	Astrazeneca	Crustor, Brilinta	Over Rs1700cr
5	Boehringer ingelheim	Jardiance, Ofev	(\$27.7-\$28.2billion) (14)

Anti Oxidant

A substance that protects cells from the damage caused by free revolutionaries (unstable moles made by the process of oxidation during normal metabolism). Free radicals may play a part in cancer, heart disease, stroke, and other diseases of aging. Antioxidants include beta-carotene, lycopene, vitamins A, C, and E, and other natural and manufactured substances.[\(15\)](#)

S.NO	HERBS	NUTS	GREEN LEAVES
1	Cloves	Almond	Kale
2	Pepper mint	Pistachios	Microgreens
3	Allspice	Walnut	Collard greens

4	Cinnamon	Cashew	Spinach
5	Oregano	Pecans	Cabbage
6	Thyme	Macadamianuts	Beetgreens
7	Sage	Brazilnuts	Watercress
8	Rose mary	Hazelnuts	Romaine lettuce
9	Saffron	Pinenuts	Swiss chard
10	Parsley	Chestnuts	Arugula (16)

Conclusion

Based on the provided search results, the conclusion regarding anti-oxidant herbs for diabetes is that they represent a promising, cost-effective, and generally safe complementary approach to managing blood sugar levels and preventing complications by reducing oxidative stress. These herbs are rich in phytochemicals specifically flavonoids, terpenoids, alkaloids, polyphenols which are responsible for anti-oxidant activity(17)

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