GSC Biological and Pharmaceutical Sciences

eISSN: 2581-3250 CODEN (USA): GBPSC2

Cross Ref DOI: 10.30574/gscbps

Journal homepage: https://gsconlinepress.com/journals/gscbps/

(REVIEW ARTICLE)

Check for updates

Comparative study of allopathy and ayurveda for treatment of diabetes mellitus

Yogesh N Sonawane *, Megha P Yeole, Piyush V Wagh, Mayuri A Sarode, Sagar A Sarode and Parag R Patil

KYDSCT's College of Pharmacy, Sakegaon, Bhusawal, 425 201, Dist. Jalgaon, MS, India.

GSC Biological and Pharmaceutical Sciences, 2024, 26(01), 253–267

Publication history: Received on 09 December 2023; revised on 18 January 2024; accepted on 20 January 2024

Article DOI: https://doi.org/10.30574/gscbps.2024.26.1.0023

Abstract

These days, one of the most prevalent non-communicable diseases is diabetes mellitus. It has an impact on people worldwide of all ages and their families, and it heavily strains national budgets and healthcare systems. In the short term, implementing a comprehensive healthcare management program for individuals with diabetes can result in significant improvements in clinical outcomes and costs. Millions of people throughout the world suffer from diabetes mellitus, a chronic metabolic illness. To avoid complications and enhance the quality of life for those with diabetes, management is crucial. The two main methods used to treat diabetes are Ayurveda, an ancient system of traditional medicine, and Allopathy, a conventional medical system. The purpose of this study is to compare and contrast these two methods for treating diabetes. The study includes a thorough analysis of the research on diabetes treatment in allopathy and ayurveda, as well as clinical studies and expert opinions.

Keywords: Diabetes; Allopathy; Ayurveda; Treatment

1. Introduction

The current study compares the use of natural herbs versus allopathic medications in the management of diabetes mellitus. The aim of the research was to evaluate the effectiveness of a current Sulfonylurea-Gliclazide drug against a polyhedral drug that is commercially available in the Indian market [1]. The medications used in the allopathic system are intended to treat a specific ailment, but they can also have an impact on other serious or fatal illnesses. Ayurveda is a traditional medical system that uses natural therapies to treat and prevent illness. It has a number of potential positive effects. When these two systems work together, they create a unique and amazing combination that makes the most of both and helps to build a healthy society [1-2].

Diabetes can be treated in many different ways, but full recovery might not be achievable [2]. In addition, adverse reactions to allopathic medications include kidney damage, poor absorption, gas, diarrhoea, and bloating in the abdomen. Anti-Diabetes plant-based therapies are less expensive and have fewer side effects than allopathic treatments while having a similar mode of action [2-3].

1.1. What Is Allopathy?

This is most likely one of the most widely used methods of medical care. The term "allopathic medicine" describes a medical practise in which physicians attempt to treat patients using medication, radiation, or surgery [3]. Doctors are able to prescribe a wide range of drugs, such as blood pressure, chemotherapy, Diabetes medications, antibiotics, and migraine remedies.

* Corresponding author: Yogesh N Sonawane.

Due to the fact that scientists and clinical researchers create medications, allopathy is a common therapeutic approach. It is an extremely genuine and successful modern medical practise that focuses on highly technological treatments [3-4].

Figure 1 Allopathy Medicines

1.2. What Is Ayurveda?

Figure 2 Ayurvedic Medicines

One of the ancient, conventional Indian treatment modalities is ayurvedic medicine and treatment. In this treatment, the mind, body, and spirit are seen as intimately connected. Rather than combating particular illnesses, this type of therapy aims to improve general health. Nonetheless, the treatment is taken into consideration to treat specific ailments [4].

It's possible that the technology or research behind this kind of medication is not scientific. Nonetheless, the fact that it is composed of natural ingredients lowers the possibility of adverse effects [4-5].

1.3. What Are the Differences Between Allopathy and Ayurveda?

Figure 3 Difference between Allopathy and Ayurveda

Table 1 Difference between Allopathy and Ayurveda

Parameters	Allopathy	Ayurveda
Meaning and Concept	The term comes from the Green word állos, which means other, and the word pathos, which means disease or suffering.	Ayurveda has its origin in India. It is derived from the Sanskrit word Ayus, which means life, and Veda, which means knowledge.
Treatment	Doctors usually concentrate on the symptoms of a disease instead of looking into its causes.	This treatment focuses more on the causes, trying to destroy them by creating a balance between the five areas.
Individuality of Patients	There is a lack of individualisation, as there is a specific treatment procedure for a disease. Two people suffering will receive similar treatment for a disease.	This treatment considers specific attributes of an individual's body, looking into their constitution (Vata, Pitta, and Kapha). The therapy, therefore, differs on an individual level.
Side Effects	Allopathy has possibilities of side effects, which is a major drawback here. There can be reactions to the components or side effects.	Ayurveda uses only natural ingredients and herbs to create medicines. This reduces the chances of having side effects.
Speed to show results	Allopathic treatments and medicines start showing actions within a day or two. So it is much faster than other types of treatment.	Ayurveda treatment takes a long time to start showing action. It can take about 2-3 months of treatment, which can be a drawback.

2. Diabetes mellitus

A series of metabolic illnesses collectively referred to as diabetes mellitus, or simply diabetes, are marked by persistently high blood sugar (hyperglycemia). Increased thirst, appetite, and frequency of urination are common symptoms [5]. Numerous health issues can arise from diabetes if it is not treated. Death, hyperosmolar hyperglycemia state, and Diabetes ketoacidosis are examples of acute complications. Severe long-term consequences can include nerve and eye damage, stroke, chronic kidney disease, foot ulcers, cardiovascular disease, and cognitive decline. Either insufficient insulin production by the pancreas or improper insulin cellular response are the causes of diabetes. Insulin is a hormone that facilitates the uptake of glucose from food into cells for energy production [5-6].

2.1. Type-1 Diabetes

Because of the loss of beta cells, the pancreas is unable to produce enough insulin, which leads to type 1 diabetes. Earlier terms for this condition included "insulin dependent diabetes mellitus" and "juvenile diabetes". The autoimmune

response is what leads to the loss of beta cells. It is unknown what is causing this autoimmune reaction [6]. Type 1 diabetes can strike adults even though it typically first manifests in childhood or adolescence.

2.2. Type-2 Diabetes

Insulin resistance is the first stage of type 2 diabetes, a disorder in which cells do not react to insulin as they should [6-7]. Lack of insulin may also develop as the disease worsens. Previously, this type of diabetes was known as "adult-onset diabetes" or "non-insulin-dependent diabetes mellitus". Although type 2 diabetes is more common in older adults, there has been a notable rise in type 2 diabetes cases in younger people due to the high prevalence of obesity among children. Excessive body weight combined with inadequate exercise is the most common cause [7].

2.2.1. Signs and Symptoms

Objective evidence of a disease such as a rash or cough is a sign. Doctors, family members, and anyone experiencing signs can identify them. However, less noticeable disruption of normal functioning, such as abdominal pain, back pain, and malaise, is a symptom and can only be recognized by the affected individual [7-8]. Symptoms are subjective. That is, others can only know the symptoms when told by the affected person. This MNT Knowledge Center article describes the effects of signs and symptoms, and their history. The play also introduces different types of signs and symptoms, as well as their medical use [8].

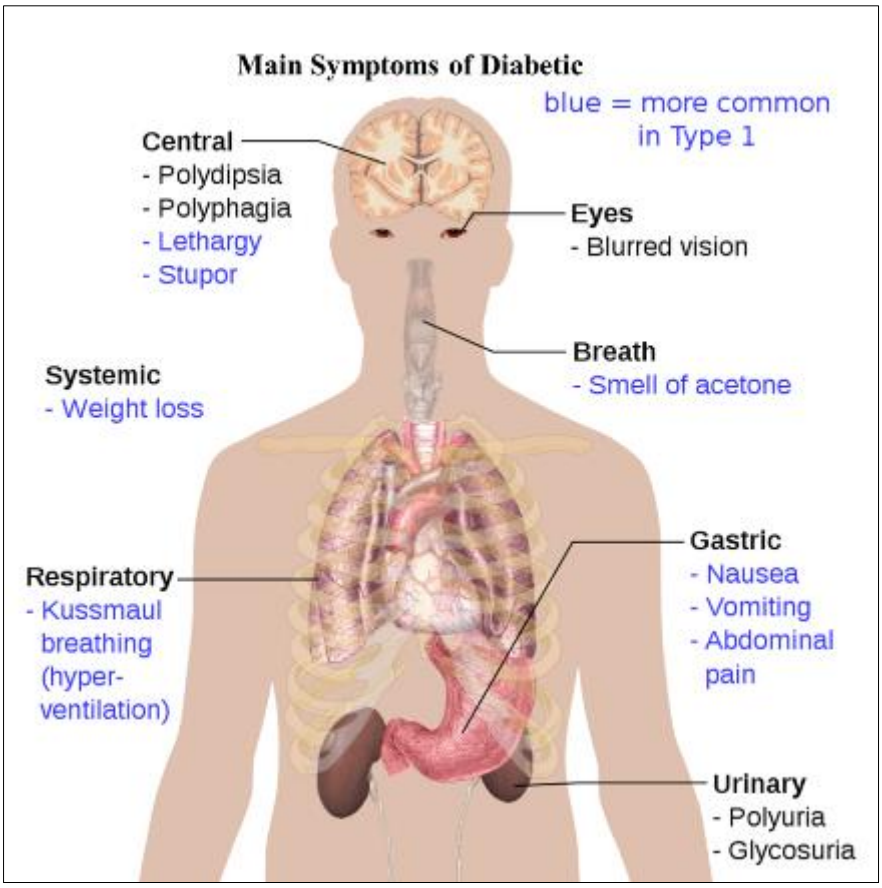

Figure 4 Main symptoms of Diabetes mellitus

2.2.2. Pathophysiology

A Diabetes patient may experience hyperglycemia. Since multiple factors can frequently contribute to the disease, the pathology of diabetes mellitus may be unclear [8-9]. Even on its own, hyperglycemia can damage insulin secretion and pancreatic beta-cell function. As a result, hyperglycemia creates a vicious cycle that impairs metabolic function. In this context, blood glucose levels greater than 180 mg/dl are frequently regarded as hyperglycemic; however, there's no precise cutoff point because there are so many different mechanisms.[9]. Higher blood glucose levels cause the nephron's glucose transporters to become saturated, which causes osmotic diuresis in patients 9-10. Serum glucose levels above 250 mg/dl are likely to result in polyuria and polydipsia symptoms, though the impact varies.

Excess fatty acids and proinflammatory cytokines cause insulin resistance by impairing glucose transport and speeding up the breakdown of fat. The body reacts to insufficient insulin response or production by mistakenly raising glucagon levels, which exacerbates hyperglycemia. Although insulin resistance is a part of type 2 diabetes, the disease's full impact occurs when the patient's insulin production is insufficient to offset their insulin resistance.[10]

2.2.3. Complications

Whatever the particular form of diabetes, complications include neuropathic, macrovascular, and microvascular problems. Nephropathy, retinopathy, neuropathy, and ASCVD events are examples of microvascular and macrovascular complications that vary depending on the severity and length of poorly controlled diabetes, particularly if it is accompanied by other comorbidities like dyslipidemia and hypertension.[10-11] Heart disease (ASCVD) is one of the most severe effects of diabetes mellitus (DM). A myocardial infarction or stroke will claim the lives of about two thirds of people with diabetes.[11] More than 100 mg/dl of fasting glucose increases the risk of ASCVD in people with type 2 diabetes; however, cardiovascular risk can appear before frank hyperglycemia.

In the US, diabetes is also the primary cause of amputations of limbs. This is mostly because of the neuropathy and angiopathy associated with DM. 48 Frequent foot exams are necessary for many patients who develop neuropathy in order to prevent infection from wounds that are missed.[11-12] The most significant risk factor for the development of Diabetes retinopathy is the length of diabetes. It typically appears in individuals with type 1 diabetes five years after the disease first manifests.[12] Consequently, it is advised that retinal exams begin in these patients about five years after diagnosis.

2.2.4. Treatment

A range of interventions are necessary for the effective management of diabetes due to its complex physiology and management. Patient participation and diabetes awareness are crucial for management. [12-13] If patients are able to independently monitor their blood glucose, regular exercise (more than 150 minutes per week), and diet (low carbs and general calorie restriction), they will see better outcomes.[13] Often, lifelong care is necessary to prevent unintended consequences. Blood glucose levels should ideally be kept between 90 and 130 mg/dl, and hba1c levels should be kept below 7%. Although controlling blood sugar is crucial, doing so too firmly can result in hypoglycemia, which can have dangerous or even fatal effects. Since insulin deficiency is the primary cause of T1DM, daily injections or insulin pump delivery are essential components of the treatment plan.[13-14]

Exercise and diet may be suitable therapies, particularly for type 2 diabetes in its early stages. Other therapies might focus on improving insulin sensitivity or raising the pancreas' production of insulin. Biguanide (metformin), sulfonylurea, meglitinide, α-glucosidase inhibitor, thiazolidinedione, glucagon-like peptide-1 agonist, dipeptidyl peptidase IV inhibitor (DPP-4), selective, and amilopril are some examples of particular drug subclasses.[14] SGLT-2 (sodium glucose transporter-2) inhibitors and peptides. The primary prescription medication for diabetes, metformin, lowers basal and postprandial plasma glucose levels. Patients with type 2 diabetes may also require insulin, particularly if their condition is advanced and their glucose control is inadequate.[14-15] Obesity surgery may be an option for patients with morbid obesity to return their blood sugar levels to normal. Suggested for patients with severe comorbidity who have not responded to previous treatments.[15]

3. Comparative study of Diabetes treatment allopathy vs ayurveda

Diabetes mellitus has emerged as a major global health concern that has substantial socioeconomic ramifications for both individuals and the community at large.[15-16] Diabetes mellitus is a chronic condition influenced by daily dietary modifications, physical activity, infections, and stress.[16] The illness known as diabetes mellitus, or diabetes, is characterised by the loss of muscle mass and sweet urine.

Insulin is a hormone secreted by the pancreas that regulates blood glucose levels. When blood glucose levels rise, the pancreas produces more insulin to keep blood glucose levels stable in patients with low or absent insulin production, a condition known as hyperglycemia.[16-17] Diabetes can be divided into two categories. While type-2, or non-insulin dependent diabetes mellitus, is characterised by varying degrees of insulin resistance, impaired insulin secretion, and increased glucose production, type-1, or insulin dependent diabetes mellitus (IDDM), is characterised by complete or nearly total insulin deficiency.[17]

Figure 5 Ayurveda vs Allopathy

Glucose, which is present in foods like breads, fruits, starchy vegetables, legumes, milk, yoghurt, and sweets, causes the body to produce insulin, which is necessary for converting glucose into energy in Diabetess.[17-18]

The body either stops producing insulin altogether or stops producing it in sufficient quantities. High blood glucose levels are the result of glucose remaining in the blood because it cannot be transformed into energy.[18] Diabetes mellitus can cause long-term harm, malfunction, and failure of several organs, such as the kidneys, nerves, and gastrointestinal system. Lack of safe and effective drugs and the incapacity to offer long-term clinical, biochemical, and histological care complicate the treatment of diabetes.[18-19]

3.1. Classification of diabetes mellitus

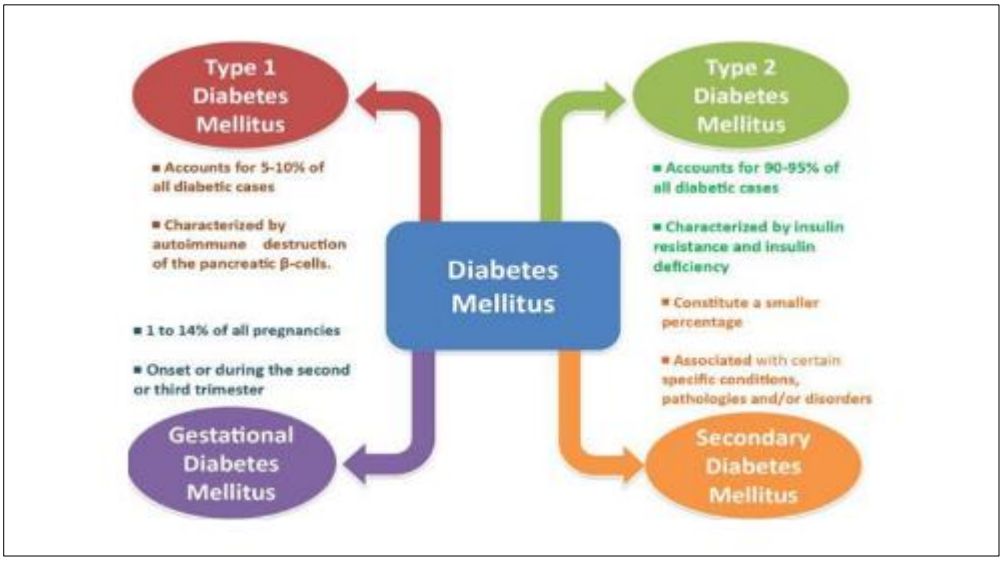

Figure 6 Classification of Diabetes mellitus

- B- cell destruction (Type 1 diabetes - IDDM)
  - Immune mediated (autoimmune type)
  - Idiopathic
- Insulin resistance or insulin deficiency (Type 2 diabetes - NIDDM)
- Hybrid forms of diabetes
  - Slowly evolving immune-mediated diabetes of adults
  - Ketosis prone type 2 diabetes
- Other specific types
  - Monogenic diabetes

- -Monogenic defects of β-cell function
- -Monogenic defects in insulin action
    - Disease of exocrine pancreas
    - Endocrine disorders
    - Drug –or chemical-induced
    - Infections
    - Uncommon specific forms of immune-mediated diabetes
    - Other genetic syndromes sometimes associated with diabetes
- Unclassified diabetes
    - This category should be used temporarily when there is not a clear diagnostic category especially close to the time of diagnosis of diabetes
- Hyperglycemia first detected during pregnancy
    - Diabetes mellitus in pregnancy
    - Gestational diabetes mellitus.

3.2. Type 1 diabetes mellitus

Insulin-dependent or juvenile diabetes are other names for type 1 diabetes. When the pancreatic beta cells are damaged to the point where the body is unable to produce enough insulin, diabetes results.[19] A hormone called insulin is in charge of controlling blood glucose, or blood sugar.

3.2.1. Symptoms

Vision problems, an increase in appetite, increased weariness, increased or intense thirst, fruity breath or odour, Abnormal reduction in weight, frequent and increased urination.[19-20]

3.2.2. Pathophysiology of type 1 diabetes mellitus

Glycogen levels are limited in type 1 diabetes, despite the liver's potential to produce glucose. Blood glucose levels rise and gluconeogenesis becomes uncontrollable in the absence of insulin.[20]

Muscle and fat cells cannot absorb available blood glucose at the same time due to the presence of glucosetransporter 4 (GLUT4). Extremely high blood glucose levels cause the body to be unable to expel it, starving adipose tissue and peripheral muscles of glucose.

Blood glucose levels have no bearing on glucagon secretion. Since insulin controls glucagon secretion, glycogen synthesis is suppressed when glucagon is in opposition to a counter-regulatory hormone like growth hormone, cortisol, or catecholamine.

Lipolysis, glycogenolysis, and glucoseneogenesis are all induced. Free fatty acids in the blood rise as a result of increased lipolysis.[20-21]

Some of the fatty acid molecules are absorbed by the liver and then integrated into lipoproteins, increasing levels of LDL and VLDL, two lipoproteins that are associated with an increased risk of heart disease.

Ketone bodies are produced by excessive lipolysis and cannot be suppressed without insulin. An extremely serious condition known as ketoacidosis may arise from excessively high ketone levels.[21]

Injecting the body with exogenous insulin is the only available treatment option.

Unfortunately, elevated blood glucose and cholesterol levels damage tissues and have negative medical effects even with the best of intentions.

3.2.3. Allopathic treatment of type 1 diabetes

Figure 7 Allopathic treatment of Type-1 Diabetes

Treatment for type 1 diabetes

- Taking insulin
- Frequent blood sugar monitoring
- Eating healthy foods
- Protein, fat and carbohydrate counting
- Exercising regularly and maintaining a healthy weight

Examples of insulin includes

- Short-acting (regular) insulin include – Humulin R and Novolin R.
- Rapid-acting insulin include – Insulin glulisine (Aphidra), Insulin and insulinaspart(Novolog).
- Intermediate- acting (NPH) insulin include – Novolin N, Humulin N
- Long- acting insulin include – Insulin glargine (Lantus, Toujeo Solostar), insulin
- Detemir(Levemir) andinsulin degludec(Tresiba)

Insulin

One can use insulin on its own or in conjunction with oral hypoglycemic medications. If some beta cell function is still present, basal insulin augmentation therapy can be beneficial. Swapping out the basal-bolus.[21-22] In the event of beta cell exhaustion, insulin becomes required. In cases of glucose toxicity, replacement therapy—which aims to replicate the regular release of insulin by the pancreatic beta cells—is required for rescue therapy. There are four injectable forms of insulin: long acting, intermediate acting, short acting, and rapid acting. Compared to the short acting forms, the long acting forms have a lower risk of causing hypoglycemia.[22]

Insulin analogue

The capacity of insulin therapy to replicate typical physiological insulin secretion was found to be restricted. The peaks of action of traditional intermediate- and long-acting insulins, such as NPH insulin, lente insulin, and ultralente insulin, can cause hypoglycemia due to their uneven absorption.[22-23] The new insulin analogues have different pharmacokinetic profiles from regular insulins, and they have varying rates of onset and durations of action. There is currently one long-acting insulin analog, insulin glargine, and two rapid-acting insulin analogs, insulin lispro and insulin aspart.[23]

3.2.4. Herbal treatment of type 1 diabetes mellitus

Figure 8 Herbal Treatment

Table 2 Herbs used for treatment of diabetes with their mechanism of action

Sr.no	Scientific Name	Common Name	Family	Mechanism of Action
1.	Trigonella foenum-graecum[24]	Fenugreek	Fabaceae	Stimulate the secretion of insulin, reduce insulin resistance and Decrease blood sugar levels.
2.	Aloe barbadensis Miller[33]	Aloe vera	Asphodelaceae	Improvement in impaired glucose Tolerance.
3.	Gemnema sylvestre[26]	Gurmar	Apocynaceae	Prevent the absorption of excess glucose. Increase secretion of insulin, it promotes regeneration of Islet cells.
4.	Tinospora cordifolia[5,27]	Guduchi	Menispermaceae	Lower blood glucose level.
5.	Coriandrum sativum[28]	Coriander	Apiaceae	Improving and regenerating the β cell in pancreas and inhibiting the α-Glucosidase enzyme in small intestine

6.	Indian ginseng or Winter cherry[29]	Ashwagandha	Araliaceae	Decrease the blood glucose and body weight; increased the immune cell population and GLUT1 expression. Enhance beta-cell proliferation and Glucose tolerance

3.3. Type 2 diabetes mellitus

Diabetes type 2 is also referred to as adult-onset diabetes or non-insulin-dependent diabetes. A long-term illness that influences how the body uses glucose, or blood sugar.[23-24]

One of the most prevalent metabolic diseases in the world, type 2 diabetes mellitus (T2DM) is mainly brought on by a combination of two main factors: the pancreatic β-cells' impaired ability to secrete insulin and the tissues' incapacity to react to insulin.[24]

3.3.1. Symptoms:

Heightened desire, urinating frequently, Constantly feeling peckish, blurry vision, extreme fatigue, Wounds and cuts heal slowly.[24-25]

3.3.2. Pathophysiology of type 2 diabetes mellitus

In type 2 diabetes, insulin resistance causes the body to respond as though it doesn't have enough insulin, even though it does.

This type of diabetes is similar to type 1 diabetes in many ways, but it is different in that insulin controls lipolysis and the liver can still produce glycogen.

Insulin, which is synthesised as pre-proinsulin, is produced by β-cells. B-cell death has historically been linked to β-cell dysfunction.

As previously mentioned, insulin secretion needs to be precisely regulated to meet metabolic demand. Consequently, the maintenance of islet integrity is necessary for β-cells to react to metabolic demands.[25]

The mechanism mentioned above has the potential to compromise pancreatic islet integrity and organisation under pathogenic conditions. This could lead to poor regulation of insulin and glucagon release, impair optimal cell-to-cell communication within the islets, and ultimately exacerbate hyperglycemia.

The primary cause of β-cell failure and a key feature of type 2 diabetes is insulin secretory dysfunction, which can be brought on by errors in the synthesis of insulin or its precursors, as well as problems with the secretion mechanism.

For instance, a decrease in the GLUT2 glucose transporter's expression would impact the downstream signalling pathway, and its failure would do the same. Obesity and poor diet often result in elevated plasma lipoprotein levels.

Type 2 diabetes is not typically associated with ketoacidosis, although it can occur as a result of other metabolic stressors. The production and secretion of insulin are decreased in the event of pancreatic failure. An unhealthy condition known as hyperosmolar hyperglycemic nonkitotic syndrome can arise in elderly individuals with type 2 diabetes.

Urine is the body's method of trying to get rid of excess sugar. Usually, a medical infection or other factors cause this illness.

3.3.3. Diabetes prevention

As of right now, there is no known way to prevent type 1 diabetes. On the other hand, type 2 diabetes is preventable in certain situations.[25-26]

- Consume a wholesome diet rich in fibre and low in fat to keep your weight at or near normal.
- Exercise on a regular basis is crucial for preventing type 2 diabetes.

- Minimise the amount of alcohol you consume.
- Decide not to smoke.
- If a person has high blood pressure or high blood fat levels (e.g., high cholesterol), take all prescribed medications as directed.
- People with prediabetes can prevent diabetes by changing their lifestyle and taking certain medications.
- Give up smoking.
- Brush and floss your teeth every day.
- Consume plant-based foods.

3.3.4. Allopathic treatment of type 2 diabetes mellitus

Table 3 Allopathic preparations, mechanism of actions and their benefits and adverse effects.

Sr.no.	Drug class	Available formulations	Mechanism	Benefits	Adverse effects and cautions
1.	Biguanides	Metformin	Insulin sensitizers. Inhibition of hepatic glucose production and promotion of Skeletal muscle glucose uptake.	Weight loss Decreased progression from prediabetis	Gastrointestinal upset(diarrhoea) Lactic acidosis (higher risk with chronic kidney failure) B12 orfolate deficiency
2.	Thiazolidine diones	Pioglitazone Rosiglitazone	Increase in Glucose uptake And utilization. Activation of	Decreased progression From prediabetes to	Weight gain (fluidand adipose)Fluidretention Chronic heart failure exacerbation

Biguanides

Biguanides, of which metformin is the most often prescribed medication for patients who are overweight or obese, improve glucose absorption, boost insulin sensitivity, and inhibit the production of glucose by the liver. Through phosphorylating GLUT-enhancer factor, which also raises fatty acid oxidation and lowers gastrointestinal absorption of glucose.39 A 2008 study reveals another way that metformin works: it activates AMP-activated protein kinase, an enzyme involved in the expression of hepatic gluconeogenic genes.[26]

Sulfonylureas

These are usually well tolerated, but there is a chance of hypoglycemia because they increase the body's natural production of insulin. Compared to younger patients, elderly DM patients receiving sulfonylurea treatment have a 36% higher risk of hypoglycemia. When glipizide is used instead of glycoride, hypoglycemia rates are higher with glycoride. Age-related impaired renal function, using insulin or insulin sensitizers simultaneously, being older than 60, having recently been released from the hospital, abusing alcohol, restricting calories, taking multiple medications, or taking medications that intensify the effects of sulfonylureas are some risk factors for hypoglycemia.

Repaglinide

Similar to sulfonylurea, but with a different binding site, repaglinide and nateglinide are non-sulfonylurea secretagogues that stimulate the release of insulin from pancreatic beta cells by acting on the ATP-dependent K-channel. Meglitinides reduce the risk of hypoglycemia because of their quick onset and brief (4-6 hours) duration of action. Before meals, meglitinides are administered to control blood glucose levels after a meal. In the event that a meal is missed, preprandial administration permits flexibility without raising the risk of hypoglycemia. With the exception of patients with end-stage renal disease, repaglinide is mostly metabolized in the liver and only very little is eliminated through the kidneys. As a result, dose adjustments are not required in patients with renal insufficiency.[26-27]

Thiazolidinediones

Insulin sensitivity is exhibited by thiazolidinedione, which selectively binds to transcription factors, peroxisomes, and proliferator-activated gamma. These medications are the first to address the fundamental issue of insulin resistance in patients with type 2 diabetes. The class of these medications currently consists primarily of pioglitazone, as the Food and Drug Administration (FDA) recently advised against the restricted use of rosiglitazone due to an increase in

cardiovascular events associated with the medication. Because pioglitazone is well tolerated by older adults and does not cause hypoglycemia, it can be used in cases of renal impairment. On the other hand, its use in older adults with DM may be restricted due to worries about peripheral edema, fluid retention, and fracture risk in women. Pioglitazone is contraindicated in patients with congestive heart failure and should be avoided in older patients.

Dipeptidyl-Peptidase IV Inhibitors

Dipeptidyl peptidase IV (DPP) inhibitors block DPP-4, a widely distributed enzyme that quickly deactivates GLP-1 and GIP, raising the active concentrations of these hormones and, enhances islet function and glycemic control in type 2 diabetes as a result.A novel class of anti-diabetogenic medications called 50 DPP-4 inhibitors has efficacy levels comparable to those of existing therapies. When combined with metformin, thiazolidinediones, and insulin, they can be used as adjuvant therapy or as monotherapy for patients whose diabetes is not well controlled by diet and exercise. The DPP-4 inhibitors are weight neutral, well tolerated, and have a minimal chance of causing hypoglycemia.[27]

Herbal treatment of type 2 diabetes mellitus

Table 4 Herbs used for treatment of diabetes with their mechanism of action.

Sr.no	Scientific name	Common name	Family	Mechanism of action
1.	Allium sativum[10,37]	Garlic	Liliaceae	Improve plasma lipid metabolism and plasma antioxidant activity. Decreased serum triglyceridesand cholesterol.
2.	Allium cepa[25, 33]	Onion	Liliaceae	Stimulating the effectsonglucose utilizationand Antioxidant enzyme.
3.	Zingiber officinalis[38]	Sunth	Zingiberaceae	Increases the insulin level.
4.	Eugenia jambolana[5, 39]	Jamun	Myrataceae	Inhibited insulinase activityfrom liver and kidney. Increase ininsulin level. Control blood sugar level.
5.	Cinnamomum cassia[40]	Cinnamon	Lauraceae	Increases the sensitivityof insulin receptor.Decreased the Glucose level.
6.	Brassica juncea[41]	Mustard	Brassicaceae	Increased activity of Glycogen synthetase.
7.	Momordica charantia[42]	Bitter gourd, melon	Cucurbitaceae	Reduce plasma glucose concentrations and improve response to an oral glucose load.Lower blood glucose Level.
8.	Ocimum sanctum[34]	Holy basil, tulsi	Lamiaceae	Increased insulin release.
9.	Mangifera indica[43]	Mango	Anacardiaceae	Reduction in the intestinalabsorption of glucose. Improve beta cellregenerat on.
10.	Azadirachta indica[44]	Neem	Meliaceae	Reduce blood sugar level.

4. Some marketed herbal formulations and their uses :-

- Pancreatic Tonic (Ayurvedic supplement): Currently marketed as a food supplement, pancreas tonic is a concoction of traditional Ayurvedic herbs.
- Diabetes, an Ayurvedic remedy marketed as a capsule containing immune modulator, antidiabetogenic, anti-stress, anti-hyperlipidemic, and heptoprotective plant-based ingredients.
- Himalaya's Diabetescon is said to improve glucose uptake, encourage B-cell resturtion, and raise C-peptide levels. Additionally, it protects beta cells from oxidative damage.[27-28]
- Episulin produced using a Swastika formula. Through an increase in cathepsin activity, it contributes to the conversion of proinsulin to insulin. It is a treatment for diabetes type 1 and type 2.
- Med. Lab Pvt. Ltd.'s Sharang Dyab-Tea Plant. Encourage the production of insulin.
- Jambu made from herbal hills by Isha Agro Developers. Lower the level of blood and urine sugar.
- Vitalize Herbs Pvt. Ltd. Produces Stevia-33. Encourage pancreatic β cells.
- Herbal FIT produces Diab-FIT. Keep your blood sugar levels within normal range.

4.1. Advantages of herbal drugs

- The goal of Ayurvedic medicine is to treat a patient's ailment effectively and permanently. It also suggests a healthy lifestyle for us to enhance our general well-being. On the other hand, the aim of allopathic treatment is to eradicate the pathogens, bacteria, viruses, and other microorganisms that caused the illness in order to provide quick relief. It does not, however, ensure that the condition will be cured.[28]
- Because ayurvedic remedies are made from a wide range of readily available plants and herbs, they are typically less expensive.
- 3 3. Natural herbs and fruit, vegetable, spice, and other plant extracts are the main ingredients of Ayurvedic medications, which help treat illnesses without having any negative side effects. All allopathic drugs have some adverse effect, even though most of them are synthetic.[28-29]
- The allopathy industry is very profitable. The development of a healthy lifestyle, however, is the selfless service provided by Ayurvedic medicine.[29]
- Because Ayurvedic treatments use organic ingredients, they are safe for the environment and help prevent harmful chemical contamination of the forest and atmosphere.
- Whereas certain allopathic medications only partially cleanse our bodies, Ayurvedic remedies detoxify them.
- Ayurvedic treatments aim to treat the root cause of an issue in order to heal a particular body system and prolong our excellent health. Conversely, allopathy focuses more on the symptoms than the underlying cause.
- Ayurvedic medicines are incredibly effective in treating chronic diseases, especially liver ailments, when compared to allopathic treatment. This is because certain Ayurvedic medications include compounds that help to rejuvenate our livers.
- Allopathic medicines are artificially produced in laboratories and may contain chemicals, even though some of them are made with natural ingredients. In contrast, all of the ingredients in ayurvedic medications are natural, and none of them contain chemicals.[30]
- Allopathy is a relatively new kind of medicine that treats certain illnesses quickly but only temporarily. For instance, they are unable to offer a long-term cure for serious conditions like arthritis, jaundice, piles, and so forth. Conversely, Ayurveda has the ability to treat a wide range of diseases. The effects of ayurvedic medications come on gradually but steadily.

4.2. Future prospectives

Because diabetes affects a large portion of the population, it is expensive for both the people who have the condition and our healthcare system. There is ongoing discussion about an attempt, but with the increasing number of people going undetected, it's also critical to consider the prevalence of the condition, how it affects patients' quality of life, and how much diabetes costs the healthcare system overall. Given the severe effects of diabetes, it is imperative that preventive and therapeutic measures be implemented in every nation. This could entail asking eateries to disclose the number of calories shown on their menus and limiting the availability of high-calorie, high-fat meals in school cafeterias. The final solution to the diabetes problem will surely involve changing one's lifestyle, and more substantial remedies will depend on basic science's capacity to steer prevention and treatment in new ways.

5. Conclusion

This study suggests that prevention is better than treatment. Allopathic medications used to treat diabetes, including metformin, sulphonylurea, insulin and its analogues, and tzds, have a number of side effects and have been linked to

some of the most serious illnesses, including cancer. It has been found that natural compounds produced by plants can help treat conditions like diabetes and cancer. Vegetables, fruits, grains, and spices are examples of plant-based foods that contain a wide range of phytochemicals that may provide health benefits beyond basic nutrition, like reducing the risk of various chronic diseases. The fact that herbal medicines don't have any adverse effects is their best feature. Thus, always eat for your health in order to maintain it.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Newre AB, Jejurkar AS, Pagar AS, Gavali AS, Kawde RM. A Comparative Study of Diabetes Treatment–Allopathy vs. Ayurveda. A Comparative Study of Diabetes Treatment–Allopathy vs. Ayurveda. 2023 Jun 11;1(10):1-.

[2] Sandhya Rani M, Pippalla S, Krishna Mohan G, B Gaikwad S, Prasad B. Comparative Quality of Life Assessment of Herbal Drugs with Allopathic Drugs for the Treatment of Diabetes Complications. Pharmaceutical Crops. 2014 Nov 14;5(1).

[3] Kaur M, Valecha V. Diabetes and antidiabetes herbal formulations: an alternative to Allopathy. Eur. J. Med. 2014;6(4):226-40.

[4] Clancy CM. Ayurvedic, Allopathic & Integrated Treatment of Diabetes in Northern India: Practitioner Perceptions.

[5] Debnath P. *Assessment of Quality of Life Among Type 2 Diabetes Patients Attending Ayurvedic and Allopathic Hospitals* (Doctoral dissertation, Rajiv Gandhi University of Health Sciences (India)).

[6] Sharma N, Sharma M, Bindal MC. Potential antidiabetes herbal drugs: A comparative review of marketed products. Research Journal of Pharmacognosy and Phytochemistry. 2010;2(2):115-21.

[7] Sharma R, Amin H, Ruknuddin G, Prajapati PK. Efficacy of Ayurvedic remedies in type 2 diabetes: a review through works done at Gujarat Ayurved University, Jamnagar. Journal of medical nutrition and nutraceuticals. 2015 Jul 1;4(2):63.

[8] Sharma H, Chandola HM, Singh G, Basisht G. Utilization of Ayurveda in health care: an approach for prevention, health promotion, and treatment of disease. Part 2—Ayurveda in primary health care. The journal of alternative and complementary medicine. 2007 Dec 1;13(10):1135-50.

[9] Ojha A, Ojha U, Ojha H, Chandrashekar A, Mohammed R, Trivedi R, Ugaonkar S, Desai M, Sreevidya R, Sahu P. Role of AYUSH therapies in modern medicine: a qualitative study to explore the awareness and attitudes of doctors towards the utilization of alternate system of medicine for diabetes mellitus. International Journal of General Medicine. 2020 Jan 13:1-8.

[10] Suvarna R, Shenoy RP, Hadapad BS, Nayak AV. Effectiveness of polyherbal formulations for the treatment of type 2 Diabetes mellitus-A systematic review and meta-analysis. Journal of Ayurveda and integrative medicine. 2021 Jan 1;12(1):213-22.

[11] Ahmad AS, Sharma R. Comparative analysis of herbal and allopathic treatment systems. European Journal of Molecular & Clinical Medicine. 2020 Dec 23;7(7):2869-76.

[12] Munshi R, Karande-Patil S, Kumbhar D, Deshmukh A, Hingorani L. A randomized, controlled, comparative, proof-of-concept study to evaluate the efficacy and safety of Nisha-Amalaki capsules in prediabetes patients for preventing progression to diabetes. Journal of Ayurveda and Integrative Medicine. 2023 Nov 1;14(6):100806.

[13] Elder C. Ayurveda for diabetes mellitus: a review of the biomedical literature. Alternative Therapies in Health & Medicine. 2004 Jan 1;10(1).

[14] Furst DE, Venkatraman MM, mcgann M, Manohar PR, Booth-laforce C, Sarin R, Sekar PG, Raveendran KG, Mahapatra A, Gopinath J, Kumar PK. Double-blind, randomized, controlled, pilot study comparing classic ayurvedic medicine, methotrexate, and their combination in rheumatoid arthritis. JCR: Journal of Clinical Rheumatology. 2011 Jun 1;17(4):185-92.

[15] Adiga T. *A Comparative Clinical Study to Evaluate the Efficacy of Mustamalaki Takradhara and Chandanadi Choorna Pradeha in Diabetes Neuropathy* (Doctoral dissertation, Rajiv Gandhi University of Health Sciences (India)).

[16] Devi K, Santhini E, Manikandan R, Prabhu NM. The prevalence, awareness and potential of complementary alternative medicine in type 2 Diabetess living in Madurai, India. European Journal of Integrative Medicine. 2015 Oct 1;7(5):469-73.

[17] Jayasuriya EJ, Waliwita WC, kelaniyayakkala S. A COMPARATIVE CLINICAL STUDY OF AROGYAVARDHINI VATI AND IKSHUMEHA KASHAYA IN THE MANAGEMENT OF TYPE 2 DIABETES MELLITUS.

[18] Walia P, Kumari R, Singh M. Prevalence, Pattern, and Predictors of Ever Use of Complementary and Alternative Medicine in Diabetes and Hypertension: A Cross-Sectional Study. Indian Journal of Community Medicine. 2023 Jul 1;48(4):627-32.

[19] Mustadi Kwatha FB, PPBS H. Comparative study to Evaluate the effect of an Indigenous Compound Mustadi Kwatha in the treatment of Madhumeha wsr Diabetes Mellitus (NIDDM). Deprescribing PPI-Why, When and How!. 2020 Jun;117.

[20] Raju VN, Sharma RS. A Comparative Clinical Study of Vamana & Virechana with and without Shilajit Yoga in the Management of Madhumeha wsr to Type-2 Diabetes Mellitus. MJF Ayurved College & Hospital Chomu, Jaipur. 2016.

[21] Rahaman MT. *The efficacy of Ayurvedic single and compound drugs to control diabetes mellitus* (Doctoral dissertation, University of Rajshahi).

[22] Verma RS, Parveen S, Rehman S, Khan P, Singh R, Afza S, Akhtar J, Khan AA. Comparative evaluation of efficacy and safety of A Unani coded drug UNIM-221and Metformin in cases of Diabetes mellitus type-II: A preliminary study.

[23] Kulthe N, Khair K, Mandole R, Ghadigaonkar P. Efficacy of Comprehensive Diabetes Care (CDC) Therapy in Patients of Type II Diabetes Mellitus: Relapse of the.

[24] Kaur SK, Bhardwaj B. Survey on Alternative Medicines for the Treatment of Type 2 Diabetes Mellitus.

[25] Vaibhavi B, Satyam T, Sanjibkumar P, Raghuram N, Ramarao NH. Effect of Holistic module of yoga and ayurvedic panchakarma in type 2 diabetes mellitus—a pilot study.

[26] Leve S, Banga H, Shankar P, Dixit R. An experimental study of a novel combination of a herbal drug with an allopathic drug to evaluate the antihyperglycemic effect of irbesartan plus curcumin and comparison with glibenclamide. Int. J. Basic Clin. Pharmacol. 2013 Mar;2(182):2319-003.

[27] Naresh KK, Jaiprakash S, Harish B, Shankar MD. CLINICAL EVALUATION OF DIABECARE YOGA (KALPITA YOGA) IN THE MANAGEMENT OF AHITAAHARAJA APATHYANIMITTAJA PRAMEHA WSR TO TYPE-2 DIABETES MELLITUS AS A NAIMITTIKA RASAYANA.

[28] Gill D, Choudhary A, Mahto RR. Efficacy of antidiabetes Ayurvedic Medicine in Diabetes Mellitus (Type 2): A Case Study. AYUHOM. 2022 Jan 1;9(1):41-5.

[29] Tripathi R, Verma S, Easwari TS, Shah H. Standardization of some herbal antidiabetes drugs in polyherbal formulation & their comparative study. International Journal of Pharmaceutical Sciences and Research. 2013 Aug 1;4(8):3256.

[30] Kumar S, Eranezhanth SS, Vishwanathan VK, Kakarla MS, Chenthamarakshan C, Selvaraj L, Satheeshan B, Unniappan I, Purushotham B, Pīrāgs V, Furst DE. A Prospective, controlled, pilot study of personalized add-on Ayurveda treatment in high-risk Type II Diabetes COVID-19 patients. Journal of Herbal Medicine. 2023 Dec 23:100836.