"A SURVEY ON ALTERNATIVE MEDICINES FOR THE TREATMENT OF TYPE 2 DIABETES MELLITUS"

By

SIMRAN KAMAL KAUR (121753)

BHRIGU BHARDWAJ (121758)

Under the supervision of

Dr. UDAYABANU, M

To

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

WAKNAGHAT SOLAN – 173 234

HIMACHAL PRADESH INDIA

May, 2016

“THE BIGGEST FAILURE IN LIFE

IS THE FAILURE TO LEARN

FROM YOUR MISTAKES”

-Shri Jaiprakash Gaur ji

CERTIFICATE

This is to certify that the work entitled **"A survey on alternative medicines for the treatment of type 2 diabetes mellitus"** submitted by **Simran Kamal Kaur (121753), Bhrigu Bhardwaj (121758),** in partial fulfillment for the award of degree of Bachelor of Pharmacy of Jaypee University of Information Technology has been carried out under my supervision. This work has not been submitted partially or wholly to any other University or Institute for the award of this or any other degree or diploma.

Signature of supervisor .....

Name of supervisor Dr. Udayabanu, M

Designation Assistant Professor (Grade II)

Date .....

ACKNOWLEDGEMENT

It is with a sense of pride and pleasure when I look back to acknowledge those who have been a sense of encouragement in my entire endeavor. It is my great pleasure to express my deep sense of gratitude and sincere thanks to my respected magnanimous guide Dr. Udayabanu, M, Assistant Professor, Department of Pharmacy, Jaypee University Of Information Technology, Waknaghat for his unparalleled and excellent guidance, profound interest, meticulous care, support, creative criticism and encouragement

I express my sincere gratitude to Dr. R.S Chauhan, Head of Department of Biotechnology, Bioinformatics and Pharmacy, for his support at every step and insurmountable guidance, which has enabled me to complete my dissertation. My special thanks to Ph.D. Scholars Mr. Arun Sharma and Vineet Mehta for their support.

From the depth of my heart, I express my thanks and bow my head to the feet of my beloved mother and father, whose uncompromising life principles, love and affection have always been there and given me more than I deserved in my life.

Last but not the least I thank the 'Almighty' for giving me courage and blessings to achieve success.

Date: May 27, 2016

Simran Kamal Kaur (121753)

Bhrigu Bhardwaj (121758)

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CHAPTER 1: INTRODUCTION

1.1.1 What is diabetes?

Diabetes mellitus is a group of metabolic diseases characterized by high blood sugar (glucose) levels that result from defects in insulin secretion, or its action, or both. Diabetes mellitus, commonly referred to as diabetes was first identified as a disease associated with "sweet urine," and excessive muscle loss in the ancient world. Elevated levels of blood glucose (hyperglycemia) lead to spillage of glucose into the urine, hence the term sweet urine.

Normally, blood glucose levels are tightly controlled by insulin, a hormone produced by the pancreas. Insulin lowers the blood glucose level. When the blood glucose elevates (for example, after eating food), insulin is released from the pancreas to normalize the glucose level. In patients with diabetes, the absence of insufficient production of or lack of response to insulin causes hyperglycemia. Diabetes is a chronic medical condition, meaning that although it can be controlled, it lasts a lifetime.

1.1.2 What is the impact of diabetes?

Over time, diabetes can lead to blindness, kidney failure, and nerve damage. These types of damage are the result of damage to small vessels, referred to as micro vascular disease. Diabetes is also an important factor in accelerating the hardening and narrowing of the arteries (atherosclerosis), leading to strokes, coronary heart disease, and other large blood vessel diseases. This is referred to as macro vascular disease. Diabetes affects approximately 26 million people in the United States, while another 79 million have prediabetes. An estimated 7 million people in the United States have diabetes and don't even know it.

1.1.3 What causes diabetes?

Insufficient production of insulin (either absolutely or relative to the body's needs), production of defective insulin (which is uncommon), or the inability of cells to use insulin properly and efficiently leads to hyperglycemia and diabetes. This latter condition affects mostly the cells of

muscle and fat tissues, and results in a condition known as insulin resistance. This is the primary problem in type 2 diabetes. The absolute lack of insulin, usually secondary to a destructive process affecting the insulin-producing beta cells in the pancreas, is the main disorder in type 1 diabetes. In type 2 diabetes, there also is a steady decline of beta cells that adds to the process of elevated blood sugars. Essentially, if someone is resistant to insulin, the body can, to some degree, increase production of insulin and overcome the level of resistance. After time, if production decreases and insulin cannot be released as vigorously, hyperglycemia develops.

Glucose is a simple sugar found in food. Glucose is an essential nutrient that provides energy for the proper functioning of the body cells. Carbohydrates are broken down in the small intestine and the glucose in digested food is then absorbed by the intestinal cells into the bloodstream, and is carried by the bloodstream to all the cells in the body where it is utilized. However, glucose cannot enter the cells alone and needs insulin to aid in its transport into the cells. Without insulin, the cells become starved of glucose energy despite the presence of abundant glucose in the bloodstream. In certain types of diabetes, the cells' inability to utilize glucose gives rise to the ironic situation of "starvation in the midst of plenty". The abundant, unutilized glucose is wastefully excreted in the urine.

Insulin is a hormone that is produced by specialized cells (beta cells) of the pancreas. (The pancreas is a deep-seated organ in the abdomen located behind the stomach.) In addition to helping glucose enter the cells, insulin is also important in tightly regulating the level of glucose in the blood. After a meal, the blood glucose level rises. In response to the increased glucose level, the pancreas normally releases more insulin into the bloodstream to help glucose enter the cells and lower blood glucose levels after a meal. When the blood glucose levels are lowered, the insulin release from the pancreas is turned down. It is important to note that even in the fasting state there is a low steady release of insulin than fluctuates a bit and helps to maintain a steady blood sugar level during fasting. In normal individuals, such a regulatory system helps to keep blood glucose levels in a tightly controlled range. As outlined above, in patients with diabetes, the insulin is either absent, relatively insufficient for the body's needs, or not used properly by the body. All of these factors cause elevated levels of blood glucose (hyperglycemia).

1.1.4 What are the different types of diabetes?

There are two major types of diabetes, called type 1 and type 2. Type 1 diabetes was also formerly called insulin dependent diabetes mellitus (IDDM), or juvenile onset diabetes mellitus. In type 1 diabetes, the pancreas undergoes an autoimmune attack by the body itself, and is rendered incapable of making insulin. Abnormal antibodies have been found in the majority of patients with type 1 diabetes. Antibodies are proteins in the blood that are part of the body's immune system. The patient with type 1 diabetes must rely on insulin medication for survival.

1.1.5 Type 1 diabetes

In autoimmune diseases, such as type 1 diabetes, the immune system mistakenly manufactures antibodies and inflammatory cells that are directed against and cause damage to patients' own body tissues. In persons with type 1 diabetes, the beta cells of the pancreas, which are responsible for insulin production, are attacked by the misdirected immune system. It is believed that the tendency to develop abnormal antibodies in type 1 diabetes is, in part, genetically inherited, though the details are not fully understood.

Exposure to certain viral infections or other environmental toxins may serve to trigger abnormal antibody responses that cause damage to the pancreas cells where insulin is made. Some of the antibodies seen in type 1 diabetes include anti-islet cell antibodies, anti-insulin antibodies and anti-glutamic decarboxylase antibodies. These antibodies can be detected in the majority of patients, and may help determine which individuals are at risk for developing type 1 diabetes.

1.1.6 Type 2 diabetes

Type 2 diabetes was also previously referred to as non-insulin dependent diabetes mellitus (NIDDM), or adult onset diabetes mellitus (AODM). In type 2 diabetes, patients can still produce insulin, but do so relatively inadequately for their body's needs, particularly in the face of insulin resistance as discussed above. In many cases this actually means the pancreas produces larger than normal quantities of insulin. A major feature of type 2 diabetes is a lack of sensitivity to insulin by the cells of the body (particularly fat and muscle cells).

In addition to the problems with an increase in insulin resistance, the release of insulin by the pancreas may also be defective and suboptimal. In fact, there is a known steady decline in beta cell production of insulin in type 2 diabetes that contributes to worsening glucose control. (This is a major factor for many patients with type 2 diabetes who ultimately require insulin therapy.) Finally, the liver in these patients continues to produce glucose through a process called gluconeogenesis despite elevated glucose levels. The control of gluconeogenesis becomes compromised.

While it is said that type 2 diabetes occurs mostly in individuals over 30 years old and the incidence increases with age, we are seeing an alarming number patients with type 2 diabetes who are barely in their teen years. Most of these cases are a direct result of poor eating habits, higher body weight, and lack of exercise.

While there is a strong genetic component to developing this form of diabetes, there are other risk factors - the most significant of which is obesity. There is a direct relationship between the degree of obesity and the risk of developing type 2 diabetes, and this holds true in children as well as adults. It is estimated that the chance to develop diabetes doubles for every 20% increase over desirable body weight.

Regarding age, data shows that for each decade after 40 years of age regardless of weight there is an increase in incidence of diabetes. The prevalence of diabetes in persons 65 years of age and older is around 27%. Type 2 diabetes is also more common in certain ethnic groups. Finally, diabetes occurs much more frequently in women with a prior history of diabetes that develops during pregnancy (gestational diabetes).

1.1.7 Other types of diabetes

Diabetes can occur temporarily during pregnancy, and reports suggest that it occurs in 2% to 10% of all pregnancies. Significant hormonal changes during pregnancy can lead to blood sugar elevation in genetically predisposed individuals. Blood sugar elevation during pregnancy is called gestational diabetes. Gestational diabetes usually resolves once the baby is born. However, 35% to 60% of women with gestational diabetes will eventually develop type 2 diabetes over the next

10 to 20 years, especially in those who require insulin during pregnancy and those who remain overweight after their delivery. Patients with gestational diabetes are usually asked to undergo an oral glucose tolerance test about six weeks after giving birth to determine if their diabetes has persisted beyond the pregnancy, or if any evidence (such as impaired glucose tolerance) is present that may be a clue to the patient's future risk for developing diabetes.

"Secondary" diabetes refers to elevated blood sugar levels from another medical condition. Secondary diabetes may develop when the pancreatic tissue responsible for the production of insulin is destroyed by disease, such as chronic pancreatitis (inflammation of the pancreas by toxins like excessive alcohol), trauma, or surgical removal of the pancreas.

Diabetes can also result from other hormonal disturbances, such as excessive growth hormone production (acromegaly) and Cushing's syndrome. In acromegaly, a pituitary gland tumor at the base of the brain causes excessive production of growth hormone, leading to hyperglycemia. In Cushing's syndrome, the adrenal glands produce an excess of cortisol, which promotes blood sugar elevation.

In addition, certain medications may worsen diabetes control, or "unmask" latent diabetes. This is seen most commonly when steroid medications (such as prednisone) are taken and also with medications used in the treatment of HIV infection (AIDS)

1.1.8 What are diabetes symptoms?

- The early symptoms of untreated diabetes are related to elevated blood sugar levels, and loss of glucose in the urine. High amounts of glucose in the urine can cause increased urine output and lead to dehydration. Dehydration causes increased thirst and water consumption.
- The inability of insulin to perform normally has effects on protein, fat and carbohydrate metabolism. Insulin is an anabolic hormone, that is, one that encourages storage of fat and protein.
- A relative or absolute insulin deficiency eventually leads to weight loss despite an increase in appetite.

- Some untreated diabetes patients also complain of fatigue, nausea and vomiting.
- Patients with diabetes are prone to developing infections of the bladder, skin, and vaginal areas.
- Fluctuations in blood glucose levels can lead to blurred vision. Extremely elevated glucose levels can lead to lethargy and coma.

1.1.9 How is diabetes diagnosed?

The fasting blood glucose (sugar) test is the preferred way to diagnose diabetes. It is easy to perform and convenient. After the person has fasted overnight (at least 8 hours), a single sample of blood is drawn and sent to the laboratory for analysis. This can also be done accurately in a doctor's office using a glucose meter.

- Normal fasting plasma glucose levels are less than 100 milligrams per deciliter (mg/dl).
- Fasting plasma glucose levels of more than 126 mg/dl on two or more tests on different days indicate diabetes.
- A random blood glucose test can also be used to diagnose diabetes. A blood glucose level of 200 mg/dl or higher indicates diabetes.

When fasting blood glucose stays above 100mg/dl, but in the range of 100-126mg/dl, this is known as impaired fasting glucose (IFG). While patients with IFG or prediabetes do not have the diagnosis of diabetes, this condition carries with it its own risks and concerns, and is addressed elsewhere.

The oral glucose tolerance test

Though not routinely used anymore, the oral glucose tolerance test (OGTT) is a gold standard for making the diagnosis of type 2 diabetes. It is still commonly used for diagnosing gestational diabetes and in conditions of pre-diabetes, such as polycystic ovary syndrome. With an oral glucose tolerance test, the person fasts overnight (at least eight but not more than 16 hours). Then first, the fasting plasma glucose is tested. After this test, the person receives 75 grams of glucose. There are several methods employed by obstetricians to do this test, but the one described here is

standard. Usually, the glucose is in a sweet-tasting liquid that the person drinks. Blood samples are taken at specific intervals to measure the blood glucose.

For the test to give reliable results:

- The person must be in good health (not have any other illnesses, not even a cold).
- The person should be normally active (not lying down, for example, as an inpatient in a hospital), and
- The person should not be taking medicines that could affect the blood glucose.
- The morning of the test, the person should not smoke or drink coffee.

The classic oral glucose tolerance test measures blood glucose levels five times over a period of three hours. Some physicians simply get a baseline blood sample followed by a sample two hours after drinking the glucose solution. In a person without diabetes, the glucose levels rise and then fall quickly. In someone with diabetes, glucose levels rise higher than normal and fail to come back down as fast.

People with glucose levels between normal and diabetic have impaired glucose tolerance (IGT) or insulin resistance. People with impaired glucose tolerance do not have diabetes, but are at high risk for progressing to diabetes. Each year, 1% to 5% of people whose test results show impaired glucose tolerance actually eventually develop diabetes. Weight loss and exercise may help people with impaired glucose tolerance return their glucose levels to normal. In addition, some physicians advocate the use of medications, such as metformin (Glucophage), to help prevent/delay the onset of overt diabetes.

Research has shown that impaired glucose tolerance itself may be a risk factor for the development of heart disease. In the medical community, most physicians are now understanding that impaired glucose tolerance is nor simply a precursor of diabetes, but is its own clinical disease entity that requires treatment and monitoring.

Evaluating the results of the oral glucose tolerance test

Glucose tolerance tests may lead to one of the following diagnoses:

- **Normal response:** A person is said to have a normal response when the 2-hour glucose level is less than 140 mg/dl, and all values between 0 and 2 hours are less than 200 mg/dl.
- **Impaired glucose tolerance (prediabetes):** A person is said to have impaired glucose tolerance when the fasting plasma glucose is less than 126 mg/dl and the 2-hour glucose level is between 140 and 199 mg/dl.
- **Diabetes:** A person has diabetes when two diagnostic tests done on different days show that the blood glucose level is high.
- **Gestational diabetes:** A pregnant woman has gestational diabetes when she has any two of the following: a fasting plasma glucose of 92 mg/dl or more, a 1-hour glucose level of 180 mg/dl or more, or a 2-hour glucose level of 153 mg/dl, or more.

1.1.10 Why is blood sugar checked at home?

Home blood sugar (glucose) testing is an important part of controlling blood sugar. One important goal of diabetes treatment is to keep the blood glucose levels near the normal range of 70 to 120 mg/dl before meals and under 140 mg/dl at two hours after eating. Blood glucose levels are usually tested before and after meals, and at bedtime. The blood sugar level is typically determined by pricking a fingertip with a lancing device and applying the blood to a glucose meter, which reads the value. There are many meters on the market, for example, Accu-Check Advantage, One Touch Ultra, Sure Step and Freestyle. Each meter has its own advantages and disadvantages (some use less blood, some have a larger digital readout, some take a shorter time to give you results, etc). The test results are then used to help patients make adjustments in medications, diets, and physical activities.

There are some interesting developments in blood glucose monitoring including continuous glucose sensors. The new continuous glucose sensor systems involve an implantable cannula placed just under the skin in the abdomen or in the arm. This cannula allows for frequent sampling of blood glucose levels. Attached to this is a transmitter that sends the data to a pager-like device. This device has a visual screen that allows the wearer to see, not only the current glucose reading,

but also the graphic trends. In some devices, the rate of change of blood sugar is also shown. There are alarms for low and high sugar levels. Certain models will alarm if the rate of change indicates the wearer is at risk for dropping or rising blood glucose too rapidly. One version is specifically designed to interface with their insulin pumps. In most cases the patient still must manually approve any insulin dose (the pump cannot blindly respond to the glucose information it receives, it can only give a calculated suggestion as to whether the wearer should give insulin, and if so, how much). However, in 2013 the US FDA approved the first artificial pancreas type device, meaning an implanted sensor and pump combination that stops insulin delivery when glucose levels reach a certain low point. All of these devices need to be correlated to finger sticks for a few hours before they can function independently. The devices can then provide readings for 3 to 5 days.

Diabetes experts feel that these blood glucose monitoring devices give patients a significant amount of independence to manage their disease process; and they are a great tool for education as well. It is also important to remember that these devices can be used intermittently with finger stick measurements. For example, a well-controlled patient with diabetes can rely on finger stick glucose checks a few times a day and do well. If they become ill, if they decide to embark on a new exercise regimen, if they change their diet and so on, they can use the sensor to supplement their finger stick regimen, providing more information on how they are responding to new lifestyle changes or stressors. This kind of system takes us one step closer to closing the loop, and to the development of an artificial pancreas that senses insulin requirements based on glucose levels and the body's needs and releases insulin accordingly - the ultimate goal.

1.1.11 Hemoglobin A1C (HBA1c)

To explain what hemoglobin A1C is, think in simple terms. Sugar sticks, and when it's around for a long time, it's harder to get it off. In the body, sugar sticks too, particularly to proteins. The red blood cells that circulate in the body live for about three months before they die off. When sugar sticks to these cells, it gives us an idea of how much sugar is present in the bloodstream for the preceding three months. In most labs, the normal range is 4%-5.9 %. In poorly controlled diabetes, its 8.0% or above, and in well controlled patients it's less than 7.0% (optimal is <6.5%). The benefits of measuring A1c is that is gives a more reasonable and stable view of what's happening

over the course of time (three months), and the value does not vary as much as finger stick blood sugar measurements. There is a direct correlation between A1C levels and average blood sugar levels as follows.

While there are no guidelines to use A1C as a screening tool, it gives a physician a good idea that someone is diabetic if the value is elevated. Right now, it is used as a standard tool to determine blood sugar control in patients known to have diabetes.

Table 1: Hemoglobin Levels

HBA1c (%)	Mean blood sugar (mg/dl)
6	135
7	170
8	205
9	240
10	275
11	310
12	345

What are the acute complications of diabetes?

1. Severely elevated blood sugar levels due to an actual lack of insulin or a relative deficiency of insulin.

2. Abnormally low blood sugar levels due to too much insulin or other glucose-lowering medications.

Acute complications of type 2 diabetes

In patients with type 2 diabetes, stress, infection, and medications (such as corticosteroids) can also lead to severely elevated blood sugar levels. Accompanied by dehydration, severe blood sugar elevation in patients with type 2 diabetes can lead to an increase in blood osmolality (hyperosmolar state). This condition can worsen and lead to coma (hyperosmolar coma). A hyperosmolar coma usually occurs in elderly patients with type 2 diabetes. Like diabetic ketoacidosis, a hyperosmolar coma is a medical emergency. Immediate treatment with intravenous fluid and insulin is important in reversing the hyperosmolar state. Unlike patients with type 1 diabetes, patients with type 2 diabetes do not generally develop ketoacidosis solely on the basis of their diabetes. Since in general, type 2 diabetes occurs in an older population, concomitant medical conditions are more likely to be present, and these patients may actually be sicker overall. The complication and death rates from hyperosmolar coma is thus higher than in diabetic ketoacidosis.

Hypoglycemia means abnormally low blood sugar (glucose). In patients with diabetes, the most common cause of low blood sugar is excessive use of insulin or other glucose-lowering medications, to lower the blood sugar level in diabetic patients in the presence of a delayed or absent meal. When low blood sugar levels occur because of too much insulin, it is called an insulin reaction. Sometimes, low blood sugar can be the result of an insufficient caloric intake or sudden excessive physical exertion.

Blood glucose is essential for the proper functioning of brain cells. Therefore, low blood sugar can lead to central nervous system symptoms such as:

- dizziness,
- confusion,
- weakness, and
- Tremors.

The actual level of blood sugar at which these symptoms occur varies with each person, but usually it occurs when blood sugars are less than 50 mg/dl. Untreated, severely low blood sugar levels can lead to coma, seizures, and, in the worst case scenario, irreversible brain death.

The treatment of low blood sugar consists of administering a quickly absorbed glucose source. These include glucose containing drinks, such as orange juice, soft drinks (not sugar-free), or glucose tablets in doses of 15-20 grams at a time (for example, the equivalent of half a glass of juice). Even cake frosting applied inside the cheeks can work in a pinch if patient cooperation is difficult. If the individual becomes unconscious, glucagon can be given by intramuscular injection.

Glucagon is a hormone that causes the release of glucose from the liver (for example, it promotes gluconeogenesis). Glucagon can be lifesaving and every patient with diabetes who has a history of hypoglycemia (particularly those on insulin) should have a glucagon kit. Families and friends of those with diabetes need to be taught how to administer glucagon, since obviously the patients will not be able to do it themselves in an emergency situation. Another lifesaving device that should be mentioned is very simple; a medic-alert bracelet should be worn by all patients with diabetes.

1.1.12 Acute complications of type 1 diabetes

Insulin is vital to patients with type 1 diabetes - they cannot live without a source of exogenous insulin. Without insulin, patients with type 1 diabetes develop severely elevated blood sugar levels. This leads to increased urine glucose, which in turn leads to excessive loss of fluid and electrolytes in the urine. Lack of insulin also causes the inability to store fat and protein along with breakdown of existing fat and protein stores. This deregulation, results in the process of ketosis and the release of Ketones into the blood. Ketones turn the blood acidic, a condition called diabetic ketoacidosis (DKA). Symptoms of diabetic ketoacidosis include nausea, vomiting, and abdominal pain. Without prompt medical treatment, patients with diabetic ketoacidosis can rapidly go into shock, coma, and even death may result.

Diabetic ketoacidosis can be caused by infections, stress, or trauma, all of which may increase insulin requirements. In addition, missing doses of insulin is also an obvious risk factor for

developing diabetic ketoacidosis. Urgent treatment of diabetic ketoacidosis involves the intravenous administration of fluid, electrolytes, and insulin, usually in a hospital intensive care unit. Dehydration can be very severe, and it is not unusual to need to replace 6-7 liters of fluid when a person presents in diabetic ketoacidosis. Antibiotics are given for infections. With treatment, abnormal blood sugar levels, ketone production, acidosis, and dehydration can be reversed rapidly, and patients can recover remarkably well.

1.1.13 What are the chronic complications of diabetes?

These diabetes complications are related to blood vessel diseases and are generally classified into small vessel disease, such as those involving the eyes, kidneys and nerves (micro vascular disease), and large vessel disease involving the heart and blood vessels (macro vascular disease). Diabetes accelerates hardening of the arteries (atherosclerosis) of the larger blood vessels, leading to coronary heart disease (angina or heart attack), strokes, and pain in the lower extremities because of lack of blood supply (claudication).

Eye Complications

The major eye complication of diabetes is called diabetic retinopathy. Diabetic retinopathy occurs in patients who have had diabetes for at least five years. Diseased small blood vessels in the back of the eye cause the leakage of protein and blood in the retina. Disease in these blood vessels also causes the formation of small aneurysms (micro aneurysms), and new but brittle blood vessels (neovascularization). Spontaneous bleeding from the new and brittle blood vessels can lead to retinal scarring and retinal detachment, thus impairing vision.

To treat diabetic retinopathy a laser is used to destroy and prevent the recurrence of the development of these small aneurysms and brittle blood vessels. Approximately 50% of patients with diabetes will develop some degree of diabetic retinopathy after 10 years of diabetes, and 80% of diabetics have retinopathy after 15 years of the disease. Poor control of blood sugar and blood pressure further aggravates eye disease in diabetes.

Cataracts and glaucoma are also more common among diabetics. It is also important to note that since the lens of the eye lets water through, if blood sugar concentrations vary a lot, the lens of the

eye will shrink and swell with fluid accordingly. As a result, blurry vision is very common in poorly controlled diabetes. Patients are usually discouraged from getting a new eyeglass prescription until their blood sugar is controlled. This allows for a more accurate assessment of what kind of glasses prescription is required.

1.1.14 Kidney damage

Kidney damage from diabetes is called diabetic nephropathy. The onset of kidney disease and its progression is extremely variable. Initially, diseased small blood vessels in the kidneys cause the leakage of protein in the urine. Later on, the kidneys lose their ability to cleanse and filter blood. The accumulation of toxic waste products in the blood leads to the need for dialysis. Dialysis involves using a machine that serves the function of the kidney by filtering and cleaning the blood. In patients who do not want to undergo chronic dialysis, kidney transplantation can be considered.

The progression of nephropathy in patients can be significantly slowed by controlling high blood pressure, and by aggressively treating high blood sugar levels. Angiotensin converting enzyme inhibitors (ACE inhibitors) or Angiotensin receptor blockers (ARBs) used in treating high blood pressure may also benefit kidney disease in patients with diabetes.

1.1.15 Nerve damage

Nerve damage from diabetes is called diabetic neuropathy and is also caused by disease of small blood vessels. In essence, the blood flow to the nerves is limited, leaving the nerves without blood flow, and they get damaged or die as a result (a term known as ischemia). Symptoms of diabetic nerve damage include numbness, burning, and aching of the feet and lower extremities. When the nerve disease causes a complete loss of sensation in the feet, patients may not be aware of injuries to the feet, and fail to properly protect them. Shoes or other protection should be worn as much as possible. Seemingly minor skin injuries should be attended to promptly to avoid serious infections. Because of poor blood circulation, diabetic foot injuries may not heal. Sometimes, minor foot injuries can lead to serious infection, ulcers, and even gangrene, necessitating surgical amputation of toes, feet, and other infected parts.

Diabetic nerve damage can affect the nerves that are important for penile erection, causing erectile dysfunction (ED, impotence). Erectile dysfunction can also be caused by poor blood flow to the penis from diabetic blood vessel disease.

Diabetic neuropathy can also affect nerves to the stomach and intestines, causing nausea, weight loss, diarrhea, and other symptoms of gastro paresis (delayed emptying of food contents from the stomach into the intestines, due to ineffective contraction of the stomach muscles).

1.2 INTRODUCTION TO THE TERM ALLOPATHY

Allopathic medicine is an expression commonly used by homeopaths and proponents of other forms of alternative medicine to refer to mainstream medical use of pharmacologically active agents to suppress symptoms or pathophysiologic processes of diseases or conditions.

1.2.1 History

The practice of medicine in both Europe and North America during the early 19th century is sometimes referred to as heroic medicine because of the extreme measures (such as bloodletting) sometimes employed in an effort to treat diseases. The term allopath was used by Hahnemann and other early homeopaths to highlight the difference they perceived between homeopathy and the medicine of that time.

With the term allopathy (meaning "other than the disease"), Hahnemann intended to point out how physicians with conventional training employed therapeutic approaches that, in his view, merely treated symptoms and failed to address the disharmony produced by the underlying disease. Homeopaths saw such symptomatic treatments as "opposites treating opposites" and believed these conventional methods were harmful to patients.

Practitioners of alternative medicine have used the term "allopathic medicine" to refer to the practice of conventional medicine in both Europe and the United States since the 19th century. The term allopathic was used throughout the 19th century as a derogatory term for the practitioners of heroic medicine, a precursor to modern medicine that did not rely on evidence.

James Whorton discusses this historical pejorative usage:

One form of verbal warfare used in retaliation by irregulars was the word "allopathy." ..."Allopathy" and "allopathic" were liberally employed as pejoratives by all irregular physicians of the nineteenth century, and the terms were considered highly offensive by those at whom they were directed. The generally uncomplaining acceptance of [the term] "allopathic medicine" by today's physicians is an indication of both a lack of awareness of the term's historical use and the recent thawing of relations between irregulars and allopath.

The controversy surrounding the term can be traced to its original usage during a heated 19th-century debate between practitioners of homeopathy and those they derisively referred to as "allopath."

Hahnemann used "allopathy" to refer to what he saw as a system of medicine that combats disease by using remedies that produce effects in a healthy subject that are different (hence Greek root allo- "different") from the effects produced by the disease to be treated. The distinction comes from the use in homeopathy of substances that are meant to cause similar effects as the symptoms of a disease to treat patients (homeo - meaning similar).

As used by homeopaths, the term allopathy has always referred to the principle of curing disease by administering substances that produce other symptoms (when given to a healthy human) than the symptoms produced by a disease. For example, part of an allopathic treatment for fever may include the use of a drug which reduces the fever, while also including a drug (such as an antibiotic) that attacks the cause of the fever (such as a bacterial infection). A homeopathic treatment for fever, by contrast, is one that uses a diluted and succussed dosage of a substance, usually containing no actual particles of that substance that in an undiluted and unsuccussed form would induce fever in a healthy person. Hahnemann used this term to distinguish medicine as practiced in his time from his use of infinitesimally small (or nonexistent) doses of substances to treat the spiritual causes of illness.

The Companion Encyclopedia of the History of Medicine states that "Hahnemann gave an all-embracing name to regular practice, calling it 'allopathy'. This term, however imprecise, was employed by his followers or other unorthodox movements to identify the prevailing methods as constituting nothing more than a competing 'school' of medicine, however dominant in terms of

number of practitioner proponents and patients." In the nineteenth century, some pharmacies labeled their products with the terms allopathic or homeopathic.

Contrary to the present usage, Hahnemann reserved the term "allopathic medicine" to the practice of treating diseases by means of drugs inducing symptoms unrelated (i.e., neither similar nor opposite) to those of the disease. He called the practice of treating diseases by means of drugs producing symptoms opposite to those of the patient "enantiopathic" or "antipathy medicine". After Hahnemann's death, the term "enantiopathy" fell into disuse and the two concepts of allopathy and enantiopathy have been more or less unified. Both, however, indicate what Hahnemann thought about contemporary conventional medicine, rather than the current ideas of his colleagues. Conventional physicians had never assumed that the therapeutic effects of drugs were necessarily related to the symptoms they caused in the healthy: e.g., James Lind in 1747 systematically tested several common substances and foods for their effect on scurvy and discovered that lemon juice was specifically active; he clearly did not select lemon juice because it caused symptoms in the healthy man, either similar or opposite to those of scurvy.

1.3 GENERIC TRADE NAMES OF THE ALLOPATHIC DRUGS

Generic and Trade Names of Drugs for Treatment of Diabetes

1.3.1 Atorvastatin

Atorvastatin is an HMG-CoA reductase inhibitor, also known as "statin", prescribed for hyperglycemia.

Trade Names

Aarpik (20mg) | AB Vas (10mg) | Acrostatin (10mg) | Acrostatin (20mg) | Alip (10mg) | Alip - AM | Alnavas (10mg) | Alnavas -A | Alvastatin (10mg) (Altius) | Alvastatin (10mg) (Ultra Drugs) | Alvastatin (20mg) (Altius) | Alvastatin (20mg) (Ultra Drugs) | Amat | Amdepin Duo FC | Amditor | Amlochol |

1.3.2 Canagliflozin

Canagliflozin is an antidiabetic (sodium glucose co-transporter 2 (SGLT2) inhibitor), prescribed for type 2 diabetes mellitus along with diet and exercise.

1.3.3 Chlorpropamide

Chlorpropamide is a sulfonylurea antidiabetic drug, prescribed for type 2 diabetes. This medication helps to keep blood sugar levels under control.

Trade Names

Chlorformin | Copamide | Copamide | Diabinese | Diabinese |

1.3.4 Desmopressin

Desmopressin is an antidiuretic synthetic hormone, prescribed for primary nocturnal enuresis (nighttime bedwetting). It is also used for coagulation disorders and diabetes.

Trade Names

D -Void | Minirin | Minirin (10 mcg) |

1.3.5 Exenatide

Exenatide is a incretin mimetic, prescribed for type 2 diabetes with diet and exercise, either alone or with other medications.

Trade Names

Byetta (250 mcg) | Byetta (5 mg) |

1.3.6 Glibenclamide and Metformin

Glibenclamide and Metformin contains sulfonylurea and biguanide antidiabetic combination, prescribed for type 2 diabetes.

1.3.7 Gliclazide

Gliclazide is an oral hypoglycemic (anti-diabetic drug), prescribed for type 2 diabetes.

Trade Names

Aliza (80 mg) | Aliza -M | Ancalzide -M | Apdeb (80 mg) | Aviglic (80 mg) | Aviglic -MF | Azukon (80 mg) | Azukon MR (30 mg) | Best M | Betazide (80 mg) | Bezide

(80+500) | Bioformin | Bizid (80 mg) | Bizid -M | Cgcron (30 mg) | Cgcron (60 mg) | Cgcron (80 mg) | Claz -M | Claz -M OD (30+500) | Claz OD (30 mg) |

1.3.8 Glimepiride

Glimepiride is a sulfonylurea antidiabetic agent, prescribed for type 2 diabetes.

Trade Names

Adride | Adride (2 mg) | Adride (4 mg) | Adride M | Adride P | Amarglim | Amaryl | Amaryl (2 mg) | Amaryl (3 mg) | Amaryl -M (1+500) | Amaryl -M (2+500) | Amaryl M Forte (1+1000) | Amaryl M Forte (2+1000) | Amaryl P (1+15) | Amaryl P (2+15) | Aroglim - M2 | Asoride | Asoride (2 mg) | Asoride (3 mg) | Asoride (4 mg) |

Glipizide is a sulfonylurea antidiabetic agent, prescribed for type 2 diabetes (condition in which the body does not use insulin normally and therefore cannot control the amount of sugar in the blood), particularly in people whose diabetes cannot be controlled by diet alone.

Trade Names

Actizide-M | Bimode -M | Bimode -M (5mg) | Bimode SR (10 mg) | Bimode SR (5 mg) | D Glip (2.5 mg) | D Glip (5 mg) | Diabizide -M | Diacon (5 mg) | Diacon M | Diaglip (5 mg) | Diaglip - M | Dibimet Plus | Dibizide - M | Dibizide (10 mg) | Dibizide (2.5 mg) | Dibizide (5 mg) | Efgy - M | Efgy (5 mg) | Egfy M |

1.3.10 Glyburide

Glyburide is an antidiabetic compound, prescribed for type 2 diabetes.

1.3.11 Insulin

Insulin is a hormone produced in the pancreas, prescribed for type 1 diabetes. It is also used for type 2 diabetes.

Trade Names

Actrapid 100iu | Actrapid 100iu | Actrapid 40 iu | Actrapid 40 iu | Actrapid HM | Actrapid HM | B D Micro Fine | B D Micro Fine | B D Micro Fine | B D Micro Fine | B D Micro Fine | B D Micro Fine | Human Actrapid | Human Actrapid 40iu | Human Actrapid 40iu | Human Fastact | Human Fastact | Human Insulatard | Human Insulatard | Human Insulatard 100iu |

1.3.12 Insulin Aspart

Insulin Aspart is a fast-acting form of the hormone insulin, prescribed for diabetes mellitus. It is used with other medium- or long-acting insulin products injected just below the skin to control high blood sugar. It helps sugar (glucose) get into the cells.

Trade Names

FlexPen | Novomix-30 | Novomix-30 Penfill | Novorapid Flexpen | Novorapid Flexpen Vial |

1.3.13 Insulin Detemir

Insulin Detemir is a long-acting form of the hormone insulin, prescribed for diabetes in patients with need of insulin to control their diabetes. It is a long-acting insulin. It helps to control the levels of glucose (sugar) in the blood. It works by helping move sugar from the blood into other

Trade Names

Levemir flexpen® [FlexPen] |

1.3.14 Insulin glargine

Insulin glargine is a long-acting form of the insulin hormone, prescribed for diabetes along with proper diet and exercise program.

Trade Names

Basalog(100iu) | Basalog(100iu) | Humalog (100 iu) | Humalog (3 ml) | Lantus |

1.3.15 Insulin Glulisine

Insulin Glulisine is a fast-acting form of the hormone insulin, prescribed for diabetes mellitus.

1.3.16 Insulin Lispro

Insulin Lispro is a fast acting insulin analogue, prescribed for type 1 diabetes.

Trade Names

Basalog (100 iu) (10ml) | Basalog (100 iu) (3ml) | Flexpen (100 iu) | Humalog (10ml) | Humalog (3ml) | Lantus (100 iu) | Novorapid Flexpen (100 iu) | Novorapid Flexpen (100 iu) (10ml) | Novorapid Penfill (100 iu) |

1.3.17 Linagliptin

Linagliptin is a dipeptidyl peptidase-4 (DPP-4) inhibitor, prescribed for type 2 diabetes.

1.3.18 Metformin

Metformin is an oral antidiabetic agent, prescribed for type 2 diabetes. It helps control blood sugar levels.

Trade Names

Asoformin | Asoformin SR | Avimet (500 mg) | B Form | Baymet | Bemet | Benforce M | Bigesens | Bigesens (500mg) | Bigesens XR | Bigesens XR (1 gm) | Bigomet | Bigomet (500 mg) | Bigomet (500 mg) | Bigomet (850 mg) | Bigomet (850 mg) | Bigomet SR | Bigomet SR (250 mg) | Bigsens -XR (500mg) | Cetapin |

1.3.19 Miglitol

Miglitol is an oral anti-diabetic drug (alpha-glucosidase inhibitor), prescribed for type 2 diabetes either alone or with other medications.

Trade Names

Diamig | Diamig | Diamig (50 mg) | Diamig (50 mg) | Elitox | Elitox | Euglitol | Euglitol | Euglitol (50mg) | Euglitol (50mg) | Glock | Glock (50 mg) | Miglit | Miglit (50 mg) | Mignar | Mignar | Mignar (50 mg) | Mignar (50 mg) | Migset | Migset (50 mg) |

1.3.20 Nateglinide

Nateglinide is an antidiabetic agent, prescribed for type 2 diabetes. It lowers blood sugar level by speeding up the release of insulin from the pancreas. It is used along with diet and exercise.

Trade Names

Glinate | Glinate 120 | Natelide | Natelide (120 mg) | Natiz (120 mg) | Natiz (60 mg) | Natstar | Natstar 120 | NDS | NDS (120 mg) | Nebicard | Nebicard (5mg) |

1.3.21 Pioglitazone

Pioglitazone is a thiazolidinedione antidiabetic, prescribed for type 2 diabetes in certain patients. It is used along with diet and exercise. It may be used alone or with other antidiabetic medicines. It lowers blood sugar by reducing insulin resistance.

Trade Names

3 D-OHA LS | 3D -OHA | 3D -Oha LS | Adride P | Amaryl MP | Amaryl MP (2+500+15) | Asoformin P | Asoformin P (30+500) | Asoride MP | Asoride MP 2 | Bioglita M-15 | Bioglita M-30 | Cetapin P | Cetapin -P | Daoride-PM | Diaglit | Diaglit | Diaglit -MF |

1.3.22 Pramlintide Acetate Injection

Pramlintide Acetate Injection is an amylin analog, prescribed for diabetes.

1.3.23 Repaglinide

Repaglinide is a meglitinide antidiabetic, prescribed for type 2 (non-insulin-dependent) diabetes.

Trade Names

Eurepa | Eurepa (1 mg) | Eurepa (2 mg) | Novonorm (0.5mg) | Novonorm (1mg) | Novonorm (2mg) | Rapamon (2 mg) | Rapilin | Rapilin (1 mg) | Rapilin (2 mg) | Regan | Regan (1 mg) | Regan (2 mg) | Reglide-Plus (0.5+500) | Reglide-Plus (1+500) | Repamon | Repide (0.5 mg) | Repide (1 mg) |

1.3.24 Saxagliptin

Saxagliptin is a new oral anti-diabetic agent, prescribed for type 2 diabetes with diet and exercise.

1.3.25 Sitagliptin

Sitagliptin is a dipeptidyl peptidase-4 (DPP-4) inhibitor, prescribed for type 2 diabetes (condition in which the body does not use insulin normally and therefore cannot control the amount of sugar in the blood), particularly in people whose diabetes cannot be controlled by diet alone. It is

Trade Names

JANUVIA tab | JANUVIA tab |

1.3.26 Tolazamide

Tolazamide is a sulfonylurea antidiabetic, prescribed for type 2 diabetes either alone or with other medications.

1.3.27 Tolbutamide

Tolbutamide is an antidiabetic agent, prescribed for type 2 diabetes.

Trade Names

Rastinon | Rastinone | Tolbutamide |

1.3.28 Vildagliptin

Vildagliptin is an oral antidiabetic agent, prescribed for type 2 diabetes mellitus along with other medications.

1.3.29 Voglibose

Voglibose is an alpha-glucosidase inhibitor, prescribed for diabetes mellitus.

Trade Names

Advog (0.2mg) | Advog (0.3mg) | Alfabose (0.2mg) | Alfabose (0.3mg) | Asvogli (0.2mg) | Asvogli (0.3mg) | Bose (0.2mg) | Bose (0.3mg) | Nexbose (0.3mg) | Nilcobose (0.2mg) | Nilcobose (0.3mg) | Oglibo MD (0.2mg) | Posmeal MD (0.2mg) | Posmeal MD (0.3mg) | Ppg (0.2mg) | Ppg (0.3mg) | Prandial (0.3mg) | Prandial MD (0.2mg)

Some of the drugs prescribed to treat diabetes are available as generics, including the following:

- Acetohexamide, a little-used first-generation sulfonylurea, is available in generic form only. (First-generation sulfonylureas have a greater risk of drug interactions.)
- Tolazamide (Tolinase), also a first-generation sulfonylurea, is available in generic form.
- Glipizide, which is sold under the brand names Glucotrol and Glucotrol XL, is also available in generic form.
- Glyburide, sold as DiaBeta, Micronase, and Glynase, is also available as a generic.
- Glimepiride (Amaryl) is available in generic form.
- Several generic versions of the drug metformin (previously sold only as Glucophage or Glucophage XR) are now available. The combinations of metformin and glyburide (Glucovance) and metformin and glipizide (Metaglip) are available as generic drugs. The

combinations of metformin and rosiglitazone (Avandamet), metformin and pioglitazone (Actoplus Met), metformin and sitagliptin (Janumet), and metformin and repaglinide (PrandiMet), however, are still sold only as brand-name products.

The diabetes drugs not yet available as generics include the following:

- Neither of the alpha-glucosidase inhibitors (drugs that slow the breakdown of carbohydrate in the small intestine), acarbose (Precose) and miglitol (Glyset), is available in generic form. The patent on Precose runs out in 2007, and the patent on Glyset expires in 2009.
- Neither of the currently available thiazolidinediones (drugs that increase insulin sensitivity), rosiglitazone (Avandia) and pioglitazone (Actos), is available as a generic. The various patents on Avandia run out in 2008, 2015, and 2017, and the patents on Actos expire in 2011 and 2016.
- Neither repaglinide (Prandin) nor nateglinide (Starlix) (both of which spur the pancreas to release more insulin quickly after meals) has a generic form. Prandin's patents expire in 2006 and 2009, and the various patents on Starlix expire in 2006, 2012, 2013, and 2019.
- Neither pramlintide (Symlin) nor exenatide (Byetta), two injectable drugs that were approved by the FDA in 2005 and act like hormones in the body, has a generic form. Patents on Symlin expire between 2009 and 2018, and patents on Byetta expire between 2013 and 2020.
- The new diabetes drug sitagliptin (Januvia), first in a class of drugs called DPP-4 inhibitors (which promote insulin secretion and prevent the release of glucose when blood glucose levels are elevated), is not available as a generic. Various patents on Januvia expire in 2017, 2019, and 2022.

Patent dates hint at when brand-name drugs may become available as generics, but they really represent only ballpark estimates, because patent extensions and patent infringement lawsuits could delay FDA approval of generics by 30 months or more.

1.4 NEED OF TREATING DIABETES

Diabetes is a serious condition. If it is not treated well, over the time it may cause significant organ damage to the heart, blood vessels, kidneys, eyes and nerves.

Diabetes is one of the leading causes of

- Heart disease and stroke by diabetic damage of the blood vessels bringing oxygen to the heart and the brain
- Kidney failure and (at a final stage) necessity for hemodialysis
- Limb amputations by diabetic foot syndrome
- New onset blindness in adults by diabetic damages of the retina

1.5 Why early Intervention is important?

Type 1 diabetes has to be treated as soon as it is diagnosed. Early intervention of type 2 diabetes is an important goal that frequently can be achieved by a healthy diet and physical activity. Once type 2 diabetes has established, therapy focuses on the early intervention of consequences and complications.

CHAPTER 2

OBJECTIVES

The main objective of this project is to acquire knowledge about diabetes mellitus and have a brief data especially about type 2 diabetes mellitus. As we know that abelmoschus esculentus is having antidiabetic activity and is proved in having a cure to diabetes so, we want to have an in vivo observation on how abelmoschus esculentus is having its activity and the mechanism of action of it.

CHAPTER THREE

REVIEW OF LITERATURE

1) Alberti et al. [6] proposed a work on Definition, diagnosis and classification of diabetes mellitus and its complications. The classification of diabetes mellitus and the tests used for its diagnosis were brought into order by the National Diabetes Data Group of the USA and the second World Health Organization Expert Committee on Diabetes Mellitus in 1979 and 1980. Apart from minor modifications by WHO in 1985, little has been changed since that time. There is however considerable new knowledge regarding the aetiology of different forms of diabetes as well as more information on the predictive value of different blood glucose values for the complications of diabetes. A WHO Consultation has therefore taken place in parallel with a report by an American Diabetes Association Expert Committee to re-examine diagnostic criteria and classification. The present document includes the conclusions of the former and is intended for wide distribution and discussion before final proposals are submitted to WHO for approval. The main changes proposed are as follows. The diagnostic fasting plasma (blood) glucose value has been lowered to ≥7.0 mmol l^{-1} (6.1 mmol l^{-1}). Impaired Glucose Tolerance (IGT) is changed to allow for the new fasting level. A new category of Impaired Fasting Glycaemia (IFG) is proposed to encompass values which are above normal but below the diagnostic cut-off for diabetes (plasma ≥6.1 to <7.0 mmol l^{-1}; whole blood ≥5.6 to <6.1 mmol l^{-1}). Gestational Diabetes Mellitus (GDM) now includes gestational impaired glucose tolerance as well as the previous GDM. The classification defines both process and stage of the disease. The processes include Type 1, autoimmune and non-autoimmune, with beta-cell destruction; Type 2 with varying degrees of insulin resistance and insulin hyposecretion; Gestational Diabetes Mellitus; and Other Types where the cause is known (e.g. MODY, endocrinopathies). It is anticipated that this group will expand

as causes of Type 2 become known. Stages range from normoglycaemia to insulin required for survival. It is hoped that the new classification will allow better classification of individuals and lead to fewer therapeutic misjudgments.

2) Ratnakar et al. [7] proposed a work on Diabetes Research in India. This study is but a quick quantitative appraisal on diabetes research and therefore just indicative of the research trends. A more indepth study is required as the limitations of publication in highimpact journals and citation profiles are well known. Some of these include, the kind of research (basic, clinical or epidemiological etc.) being carried out, the journal where the research appears, etc., the citation profile depends upon many factors such as collaboration with scientists (especially from the US and/or Western Europe), networking skills of the developing country collaborator, strength of developed country partner, infrastructure available, number of people working, research funding, etc. Diabetes surely presents an interesting case study as it is a disease afflicting both the North and the South and where even the Indian poor need to buy their regular insulin shots from the market. Global pharma, not surprisingly, has put in lot of money into finding newer products and Indian researchers can make a mark if the current trend on the plant-based approach coupled with skill in chemistry are applied for drug development. The clear message is that more research needs to be done and more support from the public sector not just to know and understand the disease but to find affordable health products for the poor diabetic patients.
3) Silink et al. [8] proposed a work on Prevention and control of diabetes with a focus on low and middle income countries. Diabetes is a complex metabolic disorder that is increasingly affecting the world's population. Its health and economic consequences are considerable. The WHO Global Strategy for the Prevention and Control of No communicable Diseases recognizes diabetes as one of its priority conditions (1). The majority of people with diabetes live in low- and middle-income countries, where the prevalence is increasing dramatically. Several rigorous trials in selected populations have shown that diabetes and its complications can be prevented or delayed. This paper outlines the population and clinical research that can be conducted in low-resource settings and that has the potential to decrease the

burden of diabetes in low- and middle-income countries. The topics include priorities in translating clinical trial results into primary and secondary prevention, diagnostic criteria refinement and improved diagnostic and monitoring methods, assessment and management of comorbidity with infectious diseases, surveillance and economic evaluation of intervention

CHAPTER 4

ALTERNATIVES

4.1 AYURVEDA

Ayurvedic Diabetes (Madhumeha) Cure | Diabetes Cure in Ayurveda :-

Synthetic drugs like Sulphonylureas, biguanidine, acarbose and Insulin are widely used in Allopathic treatment of Diabetes (**Madhumeha**). However Diabetes is termed as SILENT KILLER and recently evidence of cases of "Insulin resistance" and the occurrence of side effects from prolonged administration of conventional drugs have triggered the search for safe and effective alternatives. Ancient science of Ayurveda has discussed diabetes at length thousands of years ago. The knowledge and effectiveness of diagnosis can be understood with the fact that Ayurveda has classified Diabetes (**madhumeha**) into 20 Types. **Diabetes Cure in Ayurveda / Ayurvedic Diabetes Cure** are also discussed in detail.

Before discussing Ayurvedic Diabetes Cure | Diabetes Cure in Ayurveda, we will examine the types of diabetes, its causes and symptoms.

Description of two types of Prameha from management point of view strikingly is the same Krisha Pramehi (Lean Diabetic) and Sthula pramehi (Obese Diabetic) are classified in Ayurveda on very similar grounds as Diabetics are classified in IDDM and NIDDM respectively. On the very similar pattern we find the classification as Sahaj pramehi (Congenital) and Apathaya nimmitaj (Due to overeating and wrong eating habits).

Ayurvedic System of Medicine clearly defines Diabetes. Diabetes Mellitus was known to Indian Civilization since vedic period by the name Asrava *(*Prameha). Diabetes is also known as **Madhumeha**. Diabetes is also called Maharoga (Major Disease) as almost all parts of the body

and every cell of human physiology are effected. It also disturbs 5 sheaths of the body –annamaya kosha {Food sheath*}*, pranamaya kosha *{*Energy sheath}, manomaya kosha{Mind Sheath}, vijnana maya kosha{Intellectual Sheath} and anandamaya kosha{Bliss Sheath}. According to Ayurveda, prameha is divided in 4 major types (and total 21 types)Kapha type (again divided into 10 types)

Pitta type (again divided into 6 types)

Vata type (divided into 4 types)

Juvenile diabetes for children (for unhealthy practices of parents and/or due to the sins of past-birth)

The main cause of *prameha(diabetes)* are lack of exercise and consumption of excess food having *ushna, snigdha and guru*nature. Foods that increase *kapha, medhas and mootra* are the major factors for prameha.

Yashcha kinchith vidhiranyepi sleshma medho moothra samjananam sa sarva: nidana vishesha:

Classification of Prameha (Diabetes) :

According to Ayurveda , Prameha (Diabetes) can be classified in two categories :-

1) *Apatharpana uthaja prameha* describing the lean diabetic and
2) *Santharpana uthaja prameha* relating the obese diabetic.

Classification according to Causes of diabetes :-

1) *Sahaja prameha* (congenital)
2) *Apathyanimittaja prameha* (due to over eating and poor habits)

Classification of Diabetes according to Dosha :-

According to Ayurveda, *Prameha(diabetes)* is a tridoshaja vyadhi. However the predominance of any one *dosha* and *dooshya* enables its classification into *Vataja, Pitaja & Kaphaja Pramehas.* They are further sub classified into 20 sub categories according to characteristics of urine, its volume, *dhatu* being excreted through urine.

Normally, Prameha (Diabetes- Madhumeha) is classified by Ayurvedic Practitioners according to *dosha* predominance viz.

1) kapahja,

2) pithaja,

3) vathaja,

4) kapha-pithaja,

5) kapha-vathaja,

6) pitha-vathaja, and

7) vatha-pitha-kaphaja.

sannipatha, kevala vathaja and *kapha-vthaja(to some extent)* and *pitha-vathaja* can be considered as IDDM. And others are considered as NIDDM.

1.	Sweda	Profuced Sweating
2.	Angagandham	Foul Smell of the Body
3.	Anga Shidhilathwam	Looseness of the body
4.	Sayyasna Swapnasukhabhishangithwam	Feeling of lethargy
5.	Hridayopadeham	Feeling of something coated or heaviness of hridaya.
6.	Netropadeham	Feeling of some thing coated on eyes
7.	Jhwopadeham	sensation of a coated tongue.
8.	Shravanopadeham	Feeling of coating on ears

9.	Anga ghanathwam	Heaviness of body parts
10.	Keshathivridhi	Excessive growth of hairs
11.	Nakhathivridhi	Excessive growth of Nails
12.	Sheetha priyathwam	Affinity towards cold
13.	Gala shosham	Dryness of throat
14.	Thalu shosham	Dryness of palate
15.	Asya madhuryam	Sweet taste in mouth

According to Sushruta, Dosha predominance is the primary factor in Diabetes Complication. According to him Malabandha(Constipation) is a complication of this disease as the patient has a concentration of Meda. In such cases laxatives of average doses are not effective. According to Brihathrayees, pidika (diabetic carbuncle) is a major complication of prameha (Madhumeha).

Complications as per Dosha :-

Kaphaja

Avipakam – indigestion
Aruchi – Loss of appetite
Chardi – Vomiting tendency
Athinidra – Excessive sleep
Kasam – Cough
Peenasam – Cold with running nose

Pittaja

Vasthimehanyotoda – Pain in Bladder & urinary path
Mushkavatharanam – Pain in testes
Jwara – Fever
Daham – Burning sensation

Trishna – Thirst
Amlika – Acidity
Moorcha – Giddiness
Vitbhedanam – Loose Motion
Hridayashoola – Pain in heart region
Nidranasam – Loss of sleep

Vathaja

Udavartham -Upward movement of vatha.
Kambam -Tremor
Hridgraham -Gripping pain in chest region
Lolatha -Affinity
Soolam -Pain
Anidratha -Insomnia
Sosha -Wasting
Kasam -Cough
Swasam -Difficulty to breath
Badhapureeshathwa –Constipation

According to *Charaka***.**

There are three types of *prameha*.

Sadhya – curable
Yapya – Palliable
Asadhya – Incurable

Sadhya: Describes patients who have been diagnosed very early in the onset of prameha (Madhumeha). In this category of patients , there can be those who are sthoola[obese] and the origin of their disease is in apathyaja [poor living habbits]

Yapya: Patients under this catagory have Pittaja prameha & certain types of kaphaja prameha.How ever Yapya {palliable} helps control the disease with treatment

Asadhya: Describes the incurable version of prameha (Madhumeha) & inherited diabetes.Sahaja patients suffering from this veriety are Krisha {lean}

Management of Prameha (Madhumeha)

According to Ayurveda the line of treatment of prameha is strictly on individuals constitution.

1) The prakrithi of the patient
2) Dosha predominance of disease
3) Dooshya vitiation

4) Obstruction in srothus
5) Manasika Prakrithi
6) Ahara & Vihara
7) Hereditary factors etc…

In general Diabetes Mellitus {Vathaja prameha}Patients are advised to have Bhrimhana medication & diet which increases dhathus in the body

Herbs useful in treatment of Diabetes :-

Specifications :-

Latin Name : *Pterocarpus marsupium – leguminosae*

Rasa (Taste) : Kashaya (Astrigent), Tikta (Bitter)
Guna (Characteristics) – Lakhu (Light), Ruksha (Rough)
Veerya (Potency) – Sheeta (Cold)
Vipaka (Post digestion effect) – Katu (Pungent)

Actions according to Ayurveda :-

- Rasayana : **Vijaysar** rejuvenates each and every cell of the body.
- Raktasodhana : **Vijaysar** purifies the blood and removes all toxins from it.
- Krimirogahar (Antihelmenthic) : **Vijaysar** is very useful in disease which originate from external causes like infection, worm infestation etc.
- Pramehaghna : **Vijaysar** is useful in all disease which involve discoloration of urine including diabetes (Madhumeha).

Vijaysar is excellent herb for Diabetes.

Madhuvijay Blood Sugar Control Tumbler is made from 100% Pure Indian Kino (Vijaysar) herbal wood. Trusted by thousands since 2 generations. Buy Pure..Get Benefited.

Since thousands of years the ancient physicians of this great nation have been successfully treating Prameha with the Ayurvedic measures and drugs. Many drugs have already been screened for their anti-diabetic property/blood sugar lowering property. The importance of diet and exercise is also stressed in Ayurveda. The Ayurvedic diet regimens and the recipes may serve as a good replacement for the Diabetic patient. Though many of the diabetic drugs that are used today have a good sugar lowering (Hypoglycemic property they essentially act at the basic pathology. This helps in controlling the diabetes and not only the blood sugar. The management modalities can be categorized as:

- Vyaayam (Exercise),
- Pathya (dietary regulation),
- Panchakarma (Bio-purification procedures) and
- The use of therapeutic measures (Medicines).

The herbal drugs used in the management of Prameha are bitter, astringent and pungent in taste. Some of the widely used herb apart from Vijaysar for the management of diabetes is as follows:

1. Eugenia jambolana:(Jamun beej churna) Dry seed powder of Jamun fruits have to be used in a dose of one-teaspoon twice/thrice daily with lukewarm water.

2. Gymnema sylvestre: (Gudmar patra churna) Dry leaves of this plant have to be used one teaspoon daily with lukewarm water. The leaves when chewed render the mouth tasteless to sweet for 45 min to one hour.

3. Pterocarpus marsupium (Vijaysar churna) Bark of this plant is available in the form of powder. Cubes or Vijaysaar glasses are also very popular & Effective. The piece of Vijaysaar is kept in water overnight or water is kept in the glass is consumed early morning on empty stomach. One should discard these cubes or glasses once there is no color change observed in water.

4.Ficus bengalensis (Nyagrodha twaka churna) This is banyan tree bark. A decoction of bark is to be prepared and consumed twice daily in a dose of 40 to 80ml. The decoction is prepared by taking around 25-50gms of bark to which 4 cups of water are to be added. It is heated to make one cup, which has to be consumed.

5. Shilajeet Popularly known as Rock salt, various reputed companies have Granular or powdered form of Shilajeet available. Though not very useful in reducing the blood sugar it is an excellent remedy to for loss of libido in males and in case of generalized weakness.

6. C. Tamal (Tejpatra) This is very commonly used as a spice in preparing food products. A diabetic patient may make a point to add the leaves of this plant in his food. Also the powder of leaves may be consumed.

7. Fenugreek seeds (Methi churna) Seeds of Methi have to be soaked in warm water overnight and chewed early in the morning with warm water. One may take powder of these seeds with warm water twice daily. Methi powder may be added to the wheat flour to prepare chapattis.

8. Momordica chirantia Karvellaka (Karella) Juice of Karela should be taken early in the morning in a quantity of 20 ml. The dried whole fruit powder can also be consumed in the dose of ½ to 1 teaspoon twice daily.

9. Embelica officinalis (Amala) When fresh Amla are available one may take Amla juice 20 ml daily or otherwise powder of Amla fruits may be taken twice daily.

10. Curcuma longa (Haridra) Haldi powder along with Amla juice is a very good combination in patients of Diabetes. It is especially useful in prevention as well as treatment of patients of Diabetic eye disease. Haldi can be put in milk as well.

11. Kirat tikata (Chirayata) A decoction of this plant is to be taken daily early morning. It is a very popular remedy used in all parts of the country for various skin disorders and hence forms a perfect remedy for skin infections in Diabetics.

An ayurvedic physician may advice some good Ayurvedic drugs even in patients who do not respond to the oral hypoglycemic drugs or even insulin. These are then termed as adjuvant ayurvedic drugs. Not only do these help in lowering the blood sugar but also prevent the long-term complications of diabetes. We shall name some of these combinations/preparations:

- **Madhuvijay Capsules** : in a dose of 500 mg twice daily along with aqueous infusion of vijaysar wood. This is specially used in patients having diabetes with high stress levels and weakness.
- **Chandraprabha vati**: In a dose of 500 mg twice or thrice daily. This is specially used in patients having Diabetes with Urinary tract infection or in females having leucorrhoea. This can be used along with **Gorshuradi guggul** in the same dose.
- **Trivang Bhasma**: This is a combination of three bhasmas namely Naga, Vanga and Yashaha Bhasma. It is to be taken in a dose of 125mg twice daily available in the form of powder. It is

very useful in conditions where there is excessive urination, Male sexual problems as well as to treat generalized weakness.

- **Dhatri Nisha**: A combination of Haldi powder and Amla Rasa and has to be taken early morning and is especially useful in Diabetic eye condition.
- **Vasant kusumakar rasa**: A very useful tonic for diabetics especially useful in the stage of complications it has to be consumed in a dose of 125 mg twice daily. Along with having a general tonic effect it also helps in Diabetic eye condition and in preventing various conditions developing due to Nerve weakness.
- Arogyavardhini
- Mamajjaka Ghana vati
- Jambvasava
- Pathyakshadhatryadi kashaya
- Panchanimba churna

Along with regular use of vijaysar, following herbs can also be used depending upon symptoms

1) Diabetes with Arthritis: Yograj guggul, freshly prepared decoction of Dasamoola, Rasna saptak, a paste of sunthi or Dasang lepa may be applied on the affected joint.

2) Diabetes with constipation: Powders like Gandharva haritaki, Isabgool, Panchaskar, Hingvastak can be used to relieve constipation.

3) Diabetes with burning sensation in the soles and palms: this can be well managed with Mangista Ghana vati, chandrakala rasa, Chandraprabha vati, pravaal pisti, Guduchi satva etc

4) Diabetes with cough: Diabetic patient suffering of chronic cough may give powders of Yasti madhu, Kantakari, Vasa, Shati etc. Ayurvedic cough syrups available in the market are not safe to be taken by a diabetic patients

5) Diabetes with excessive thirst: Excessive thirst may be managed with the use of cold infusions (heema) of Dahayanak, usheera, Chandan etc. Praval, Guduchi, may also be used.

6) Diabetes with excessive urination: excessive urination can be treated with the use of Trivang bhasma, jasad bhasma, etc

7) Generalised weakness and fatigue are the usual symptoms that can be treated with the use of herbs like shatavari, Ashvagandha, Bala Yastimadhu. Complications like tapyadi loha, Vasant kusumakar rasa are also very effective

8) Impotency is a very distressing symptom of a diabetic patient. By assessing the age of the patient they may be advised Ashwagandha, Kaucha beeja, musali etc.

Permitted food for Diabetics according to Ayurveda:

Wholesome diet habit for diabetes:

1. Shigru(drum stick)
2. Haridra(turmeric)
3. Amalaki(goose berry)
4. Shyamaka-Setaria italica (L.) Beau.
5. Kodrava- Paspalum scrobiculatum,Linn.
4. Yava(barley)
5. Godhuma(wheat)
6. Mudga(green gram)
7. Kulattha(horse gram)
8. Patola(snake gourd)
9. Karavellaka(bitter gourd)
10. Maricha(pepper)
11. Lashuna(garlic)
12. Jambu(blue berry)
13. Vyayama(exercise) etc

Prohibited diet for diabetics according to Ayurveda:

1. Kanda- moola (root-rhizome)
2. Ikshu (sugar cane juice)
3. Taila(oil)
4. Ghrita(ghee)
5. Guda(jiggery)
6. Kanjika/shukta(sour beverages)
7. Madya(alcohol)
8. Pishtanna(carbohydrate rich food)
9. Anupa mamsa(flesh of marshy land)
10. Dadhi (curd)

11. Navanna (new grains)

11. Divaswapna (day sleep etc)

4.2 SIDHA

Siddha Medicine (Tamil *Citta-* or *Tamil-maruttuvam*) is a system of traditional medicineoriginating in Tamil Nadu in South India.

Traditionally, it is taught that the siddhars laid the foundation for this system of medication. Siddhars were spiritual adepts who possessed the ashta siddhis, or the eight supernatural powers. Agastya is considered the first siddha and the guru of all siddhars; the siddha system is believed to have been handed over to him by Murugan, son of Shiva and Parvati

Acacia arabica: (Babhul)

It is found all over India mainly in the wild habitat. The plant extract acts as an antidiabetic agent by acting as secretagouge to release insulin. It induces hypoglycemia in control rats but not in alloxanized animals. Powdered seeds of *Acacia arabica* when administered (2,3 and 4 g/kg body weight) to normal rabbits induced hypoglycemic effect by initiating release of insulin from pancreatic beta cells

Aegle marmelos: (Bengal Quince, Bel or Bilva)

Administration of aqueous extract of leaves improves digestion and reduces blood sugar and urea, serum cholesterol in alloxanized rats as compared to control. Along with exhibiting hypoglycemic activity, this extract also prevented peak rise in blood sugar at 1h in oral glucose tolerance test.

Allium cepa: (onion)

Various ether soluble fractions as well as insoluble fractions of dried onion powder show anti-hyperglycemic activity in diabetic rabbits. *Allium cepa* is also known to have antioxidant and hypolipidaemic activity. Administration of a sulfur containing amino acid from *Allium cepa*, S-methyl cysteine sulphoxide (SMCS) (200 mg/kg for 45 days) to alloxan induced diabetic rats

significantly controlled blood glucose as well as lipids in serum and tissues and normalized the activities of liver hexokinase, glucose 6-phosphatase and HMG Co A reductase. When diabetic patients were given single oral dose of 50 g of onion juice, it significantly controlled post-prandial glucose level.

Allium sativum: (garlic)

This is a perennial herb cultivated throughout India. Allicin, a sulfur-containing compound is responsible for its pungent odour and it has been shown to have significant hypoglycemic activity. This effect is thought to be due to increased hepatic metabolism, increased insulin release from pancreatic beta cells and/or insulin sparing effect. Aqueous homogenate of garlic (10 ml/kg/day) administered orally to sucrose fed rabbits (10 g/kg/day in water for two months) significantly increased hepatic glycogen and free amino acid content, decreased fasting blood glucose, and triglyceride levels in serum in comparison to sucrose controls.

S-allyl cystein sulfoxide (SACS), the precursor of allicin and garlic oil, is a sulfur containing amino acid, which controlled lipid peroxidation better than glibenclamide and insulin. It also improved diabetic conditions. SACS also stimulated *in vitro* insulin secretion from beta cells isolated from normal rats. Apart from this, *Allium sativum* exhibits antimicrobial, anticancer and cardioprotective activities.

Aloe vera and Aloe barbadensis

Aloe, a popular houseplant, has a long history as a multipurpose folk remedy. The plant can be separated into two basic products: gel and latex. Aloe vera gel is the leaf pulp or mucilage, aloe latex, commonly referred to as “aloe juice,” is a bitter yellow exudate from the pericyclic tubules just beneath the outer skin of the leaves. Extracts of aloe gum effectively increases glucose tolerance in both normal and diabetic rats. Treatment of chronic but not single dose of exudates of *Aloe barbadensis* leaves showed hypoglycemic effect in alloxanized diabetic rats. Single as well as chronic doses of bitter principle of the same plant also showed hypoglycemic effect in diabetic rats. This action of *Aloe vera* and its bitter principle is through stimulation of synthesis and/or release of insulin from pancreatic beta cells. This plant also has an anti-inflammatory activity in a dose dependent manner and improves wound healing in diabetic mice.

Azadirachta indica: (Neem)

Hydroalcoholic extracts of this plant showed anti-hyperglycemic activity in streptozotocin treated rats and this effect is because of increase in glucose uptake and glycogen deposition in isolated rat hemidiaphragm. Apart from having anti-diabetic activity, this plant also has anti-bacterial, antimalarial, antifertility, hepatoprotective and antioxidant effects.

Caesalpinia bonducella

Caesalpinia bonducella is widely distributed throughout the coastal region of India and used ethnically by the tribal people of India for controlling blood sugar. Both the aqueous and ethanolic extracts showed potent hypoglycemic activity in chronic type II diabetic models. These extracts also increased glycogenesis thereby increasing liver glycogen content.Two fractions BM 169 and BM 170 B could increase secretion of insulin from isolated islets. The aqueous and 50% ethanolic extracts of *Caesalpinia bonducella*seeds showed antihyperglycemic and hypolipidemic activities in streptozotocin (STZ)-diabetic rats. The antihyperglycemic action of the seed extracts may be due to the blocking of glucose absorption. The drug has the potential to act as antidiabetic as well as antihyperlipidemic.

Capparis decidua

This is found throughout India, especially in dry areas. Hypoglycemic effect was seen in alloxanized rats when the rats were fed with 30% extracts of *Capparis decidua* (*C. decidua*) fruit powder for 3 weeks. This extract also reduced alloxan induced lipid peroxidation significantly in erythrocytes, kidney and heart. *C. decidua* was also found to alter superoxide dismutase and catalase enzyme levels to reduce oxidative stress. *C. decidua*additionally showed hypolipidaemic activity.

Coccinia indica

Dried extracts of Coccinia indica (*C. indica*) (500 mg/kg body weight) were administered to diabetic patients for 6 weeks. These extracts restored the activities of enzyme lipoprotein lipase (LPL) that was reduced and glucose-6-phosphatase and lactate dehydrogenase, which were raised in untreated diabetics. Oral administration of 500 mg/kg of *C. indica* leaves showed significant

hypoglycemia in alloxanized diabetic dogs and increased glucose tolerance in normal and diabetic dogs.

Eugenia jambolana: (Indian gooseberry, jamun)

In India decoction of kernels of *Eugenia jambolana* is used as household remedy for diabetes. This also forms a major constituent of many herbal formulations for diabetes. Antihyperglycemic effect of aqueous and alcoholic extract as well as lyophilized powder shows reduction in blood glucose level. This varies with different level of diabetes. In mild diabetes (plasma sugar >180 mg/dl) it shows 73.51% reduction, whereas in moderate (plasma sugar >280 mg/dl) and severe diabetes (plasma sugar >400 mg/dl) it is reduced to 55.62% and 17.72% respectively. The extract of jamun pulp showed the hypoglycemic activity in streptozotocin induced diabetic mice within 30 min of administration while the seed of the same fruit required 24 h. The oral administration of the extract resulted in increase in serum insulin levels in diabetic rats. Insulin secretion was found to be stimulated on incubation of plant extract with isolated islets of Langerhans from normal as well as diabetic animals. These extracts also inhibited insulinase activity from liver and kidney.

Mangifera indica*: (Mango)*

The leaves of this plant are used as an antidiabetic agent in Nigerian folk medicine, although when aqueous extract given orally did not alter blood glucose level in either normoglycemic or streptozotocin induced diabetic rats. However, antidiabetic activity was seen when the extract and glucose were administered simultaneously and also when the extract was given to the rats 60 min before the glucose. The results indicate that aqueous extract of*Mangifera indica* possess hypoglycemic activity. This may be due to an intestinal reduction of the absorption of glucose.

Momordica charantia: (bitter gourd)

Momordica charantia is commonly used as an antidiabetic and antihyperglycemic agent in India as well as other Asian countries. Extracts of fruit pulp, seed, leaves and whole plant was shown to have hypoglycemic effect in various animal models. Polypeptide p, isolated from fruit, seeds and tissues of *M. charantia* showed significant hypoglycemic effect when administered subcutaneously to langurs and humans. Ethanolic extracts of *M. charantia*(200 mg/kg) showed an antihyperglycemic and also hypoglycemic effect in normal and STZ diabetic rats. This may be

because of inhibition of glucose-6-phosphatase besides fructose-1, 6-biphosphatase in the liver and stimulation of hepatic glucose-6-phosphate dehydrogenase activities.

Ocimum sanctum: (holy basil)

It is commonly known as Tulsi. Since ancient times, this plant is known for its medicinal properties. The aqueous extract of leaves of *Ocimum sanctum* showed the significant reduction in blood sugar level in both normal and alloxan induced diabetic rats. Significant reduction in fasting blood glucose, uronic acid, total amino acid, total cholesterol, triglyceride and total lipid indicated the hypoglycemic and hypolipidemic effects of tulsi in diabetic rats. Oral administration of plant extract (200 mg/kg) for 30 days led to decrease in the plasma glucose level by approximately 9.06 and 26.4% on 15 and 30 days of the experiment respectively. Renal glycogen content increased 10 fold while skeletal muscle and hepatic glycogen levels decreased by 68 and 75% respectively in diabetic rats as compared to control. This plant also showed antiasthemitic, antistress, antibacterial, antifungal, antiviral, antitumor, gastric antiulcer activity, antioxidant, antimutagenic and immunostimulant activities.

Phyllanthus amarus: (bhuiawala)

It is a herb of height up to 60 cm, from family Euphorbiaceae. It is commonly known as Bhuiamala. It is scattered throughout the hotter parts of India, mainly Deccan, Konkan and south Indian states. Traditionally it is used in diabetes therapeutics. Methanolic extract of *Phyllanthus amarus* was found to have potent antioxidant activity. This extract also reduced the blood sugar in alloxanized diabetic rats. The plant also shows antiinflammatory, antimutagenic, anticarcinogenic, antidiarrhoeal activity.

Pterocarpus marsupium:

It is a deciduous moderate to large tree found in India mainly in hilly region. Pterostilbene, a constituent derived from wood of this plant caused hypoglycemia in dogs showed that the hypoglycemic activity of this extract is because of presence of tannates in the extract. Flavonoid fraction from *Pterocarpus marsupium* has been shown to cause pancreatic beta cell regranulation Marsupin, pterosupin and liquiritigenin obtained from this plant showed antihyperlipidemic activity (−) Epicatechin, its active principle, has been found to be insulinogenic, enhancing insulin

release and conversion of proinsulin to insulin *in vitro*. Like insulin, (−) epicatechin stimulates oxygen uptake in fat cells and tissue slices of various organs, increases glycogen content of rat diaphragm in a dose-dependent manner.

Trigonella foenum graecum: (fenugreek)

It is found all over India and the fenugreek seeds are usually used as one of the major constituents of Indian spices. 4-hydroxyleucine, a novel amino acid from fenugreek seeds increased glucose stimulated insulin release by isolated islet cells in both rats and humans. Oral administration of 2 and 8 g/kg of plant extract produced dose dependent decrease in the blood glucose levels in both normal as well as diabetic rats. Administration of fenugreek seeds also improved glucose metabolism and normalized creatinine kinase activity in heart, skeletal muscle and liver of diabetic rats. It also reduced hepatic and renal glucose-6-phosphatase and fructose −1,6-biphosphatase activity. This plant also shows antioxidant activity.

Tinospora cordifolia: (Guduchi)

It is a large, glabrous, deciduous climbing shrub belonging to the family Menispermaceae. It is widely distributed throughout India and commonly known as Guduchi. Oral administration of the extract of *Tinospora cordifolia* (*T. cordifolia*) roots for 6 weeks resulted in a significant reduction in blood and urine glucose and in lipids in serum and tissues in alloxan diabetic rats. The extract also prevented a decrease in body weight. *T. cordifolia* is widely used in Indian ayurvedic medicine for treating diabetes mellitus. Oral administration of an aqueous *T. cordifolia* root extract to alloxan diabetic rats caused a significant reduction in blood glucose and brain lipids. Though the aqueous extract at a dose of 400 mg/kg could elicit significant anti-hyperglycemic effect in different animal models, its effect was equivalent to only one unit/kg of insulin. It is reported that the daily administration of either alcoholic or aqueous extract of *T. cordifolia* decreases the blood glucose level and increases glucose tolerance in rodents.

Herbal Drug Formulations

Many formulations are in the market and are used regularly by diabetic patients on the advice of the physicians.

Diabecon manufactured by 'Himalaya' is reported to increase peripheral utilization of glucose, increase hepatic and muscle glucagon contents, promote B cells repair and regeneration and increase c peptide level. It has antioxidant properties and protects B cells from oxidative stress. It exerts an insulin like action by reducing the glycated haemoglobin levels, normalizing the microalbuminurea and modulating the lipid profile. It minimizes long term diabetic complications.

Epinsulin marketed by Swastik formulations, contains epicatechin, a benzopyran, as an active principle. Epicatechin increases the cAMP content of the islet, which is associated with increased insulin release. It plays a role in the conversion of proinsulin to insulin by increasing cathepsin activity. Additionally it has an insulin-mimetic effect on osmotic fragility of human erythrocytes and it inhibits Na/K ATPase activity from patient's erythrocytes. It corrects the neuropathy, retinopathy and disturbed metabolism of glucose and lipids. It maintains the integrity of all organ systems affected by the disease. It is reported to be a curative for diabetes, Non Insulin Dependant Diabetes Mellitus (NIDDM) and a good adjuvant for Insulin Dependant Diabetes Mellitus (IDDM), in order to reduce the amount of needed insulin. It is advised along with existing oral hypoglycemic drugs. And is known to prevent diabetic complication. It has gentle hypoglycemic activity and hence induces no risk of being hypoglycemic.

Pancreatic Tonic (ayurvedic herbal supplement): Pancreas Tonic is a botanical mixture of traditional Indian Ayurvedic herbs currently available as a dietary supplement.

Bitter gourd powder marketed by Garry and Sun. It lowers blood & urine sugar levels. It increases body's resistance against infections and purifies blood. Bitter Gourd has excellent medicinal virtues. It is antidotal, antipyretic tonic, appetizing, stomachic, antibilious and laxative. The bitter Gourd is also used in native medicines of Asia and Africa. The Bitter gourd is specifically used as a folk medicine for diabetes. It contains compounds like bitter glycosides, saponins, alkaloids, reducing sugars, phenolics, oils, free acids, polypeptides, sterols, 17-amino acids including methionine and a crystalline product named p-insulin. It is reported to have hypoglycemic activity in addition to being antihaemorrhoidal, astringent, stomachic, emmenagogue, hepatic stimulant, and anthelmintic and blood purifier.

Dia-Care manufactured by Admark Herbals Ltd. is claimed to be effective for both Type 1, Type 2 diabetes within 90 days of treatment and cures within 18 months. Persons taking insulin will eventually be liberated from the dependence on it. The whole treatment completes in 6 phases,

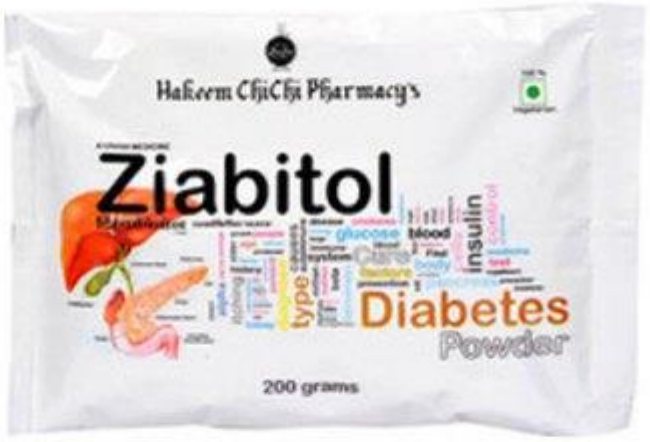
each phase being of 90 days. Approx. 5 grams (1 tea spoon) powder is mixed with 1/2 glass of water, stirred properly and kept overnight. Only the water and not the sediment must be taken in the morning on empty stomach. To the remaining medicine fresh water is added and kept for the whole day and is consumed half an hour before dinner. The taste of the drug is very bitter. It is a pure herbal formula without any side effects.

Diabetes-Daily Care manufactured by Nature's Health Supply is a Unique, Natural Formula, which effectively and safely Improves Sugar Metabolism. Diabetes Daily Care^{TM} was formulated for type 2 diabetics and contains all natural ingredients in the proportion optimal for the body's use.

Gurmar powder manufactured by Garry and Sun is an anti-diabetic drug, which suppresses the intestinal absorption of sacharides, which prevents blood sugar fluctuations. It also correlates the metabolic activities of liver, kidney and muscles. Gurmar stimulates insulin secretion and has blood sugar reducing properties. It blocks sweet taste receptors when applied to tongue in diabetes to remove glycosuria. It deadens taste of sweets and bitter things like quinine (effects lasts for 1 to 2 hours). Besides having these properties, it is a cardiac stimulant and diuretic and corrects metabolic activities of liver, kidney and mus

4.3 UNANI

1. TREATMENT OF DIABETES AS PER UNANI



In Arabic, diabetes is called Ziabetes or Dolab or Zalaqul Kulya and Zalaqul Majari.

In Arabic, diabetes is called Ziabetes or Dolab or Zalaqul Kulya and Zalaqul Majari. According to Unani Medicine, Ziabetes Shakri is a disease in which the consumed water is passed out through the kidney immediately after intake by the patient.

In this disease the mizaj (temperament) of kidneys becomes haar (hot) because of which they absorb water from blood circulation and send it to the urinary bladder immediately.

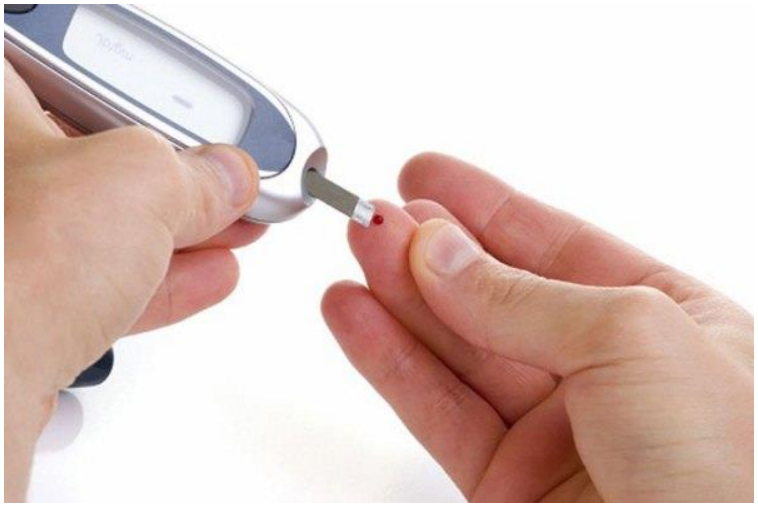
According to Unani, there are two kind of diabetes. One is Ziabetes Haar in which acute symptoms of diabetes (with abrupt onset) occur, such as excessive thirst, increase in urination. Another is Ziabetes Barid in which the thirst and frequency of urination is comparatively less.

There is also a classification, according to presence and absence of sugar in urine. Ziabetes Sada is characterised by excessive thirst and increased urination but there is no sugar in the urine. Ziabetes Shakri is characterised by excessive thirst and urination and presence of sugar in urine.

As per Unani, Diabetes occur due to stress, anxiety, strain and tension (Infaalat-e-Nafsania), over-eating, Excessive use of Alcohol or Sedentary Lifestyle

Unani Drugs (Single drugs recommended for diabetes): Magze tukhme jamun, Karela Bark, Magze tukhme neem, Fenugreek seeds, Bail Leaves, Kalonji, Gurmar booti, Tabasheer, Sarphooka or Gilo).

2. CONTROLLING DIABETES AS PER HOMEOPATHY



CONTROLLING DIABETES AS PER HOMEOPATHY

Diabetes is a long term disease. Homeopaths resorts to different approach towards Diabetes. When the blood sugar level is very high, the priority is to control it. There are Homeopathic remedies that could reduce the sugar. Another approach is to understand the patient's profile through a patho- physiological profiling and resort to treatment of his illness. There is yet another approach to understand the patient in depth through a detailed case taking, crate a profile at his physical, mental, social and spiritual level (holistic approach) and then select a constitutional remedy. Each of these approach has its own scope and limitations. The physician has to take a decision as to what approach is needed on a patient depending on his general health, progress of disease, complications, the organs affected etc.

1) Management of Blood sugar

The commonly used remedies are Uranium Nitricum, Phosphoric Acid, Syzygium Jambolanum, Cephalandra Indica etc. These are classical Homeopathic remedies. These are used in physiologically active doses such as Mother tincture, 3x etc. depending up on the level of the blood sugar and the requirement of the patient.

Several pharmaceutical companies have also brought in propriety medicines with a combination of the few Homeopathic medicines. Biochemic remedies which is a part of Homeopathy advocates Biocombination No 7 as a specific for Diabetes. Another Biochemic medicine Natrum Phos 3x is widely used with a reasonable success in controlling the blood sugar. Scientific studies on the impact of homeopathic medicines in bringing down blood sugar are limited, but many of the above remedies have some positive effects either as a stand-alone remedy or as an adjunct along with other medications.

3. MANAGEMENT OF DIABETES THE YOGA WAY

Yoga for Diabetes

The yogic practices are found to be useful in the management of Diabetes Mellitus through various research studies. The aim of the Yogic treatment is the management of Diabetes in two fold:

1) To stimulate the pancreatic cells to produce adequate amount of insulin.

2) To reduce the insulin resistance.

The practices prescribed for the Diabetic patients are as under

1) Kriyas: Kunjal, Vastradhouti, Kapalbhati, Agnisar and Nauli.

2) Asanas: Tadasanas, Katichakrasana, Pavanmuktasana, Sarvangasana, Matsyasana, Halasana, Ushtrasana, Gomukhasana, Ardhamatsyendrasana, Mandukasana, Paschimottasana, Bhujangasana, Shalabhasana, Dhanurasana, Shavasana

3) Pranayama: Nadisodhana, Suryabhedana, Bhastrika and Bhramari

4) Bandhas: Uddiayana Bandha

5) Meditation: Breath awareness, Om chanting and Om meditation

4.4 YOGA

Exercise — the key to stay healthy

Diabetes is caused when your blood cells do not respond to insulin produced in the body. When you follow a regular exercise regimen, your body starts responding to insulin, helping

to reduce your blood glucose. Exercise also helps improve blood circulation in your body, particularly in the arms and legs, where diabetic patients most commonly encounter problems. It is an excellent way to fight stress, both at the body and mind level, which in turn helps keep one's glucose levels down. Here are top 8 reasons why you should start exercising today.

How yoga helps to fight diabetes

Regular yoga practice can help reduce the level of sugar in the blood, along with lowering blood pressure, keeping your weight in check, reducing the severity of the symptoms and slowing the rate of progression of the disease. It also lessens the possibility of further complications.Stress is one of the major reasons for diabetes. It increases the secretion of glucagon (a hormone responsible for increasing blood glucose levels) in the body. The consistent practice of yoga *aasanas, pranayam* and a few minutes of meditation can help reduce stress in the mind and protect the body from its adverse effects. This, in turn, reducing the amount of glucagon and improve the action of insulin.The practice of yoga is also a proven to lose weight and slow the process of fat accumulation. *Surya namaskar* and *kapal bhati pranayama* are some of the most effective yoga poses that aid weight loss. Since obesity is a major contributing factor for diabetes, doing yoga to keep your weight in check is the key.

Here's how to practise Surya Namaskar the right way.

#1 Pranayam

Breathing in deeply and breathing out helps oxygenate your blood, and improves circulation. It also calms the mind and gives your rattled nerves some much needed rest. Here are few more health benefits of pranayama you should be aware of.

Steps to do this pose:

- Sit on a yoga mat on the floor. Fold your legs in either *padmasana* or sit cross legged.
- Now straighten your back, keep your chin parallel to the floor, place your hands on your knees with your palms facing upwards and close your eyes.
- Breathe in deep and hold your breath for five counts. Exhale slowly. Repeat this process at least ten times.
- Once you are done, rub your palms together till they are warm, and place them on your eyes. Now slowly open them and smile.

#2 Setubandhasana

This pose not only helps keep one's blood pressure in control it also helps to relax the mind, improves digestion, relieves the symptoms of menopause in women and stretches the neck and spine.

Steps to do this pose:

- Lie flat on your yoga mat, with your feet flat on the floor.

- Now exhale and push up, and off the floor with your feet.
- Raise your body up such that your neck and head are flat on the mat and the rest of your body is in the air.
- You can use your hands to push down for added support.
- If you are flexible you can even clasp your fingers just below your raised back for that added stretch.
- The key here is to not overexert or hurt yourself while doing this pose.

Tip: Avoid doing this pose if you have a neck or back injury.

#3 Balasana

Known quite aptly as the child's pose this is a great stress buster. It gently stretches the hips, thighs and ankles, calms the mind and helps relieve stress and fatigue. It is also a great remedy for that lower back pain you might have from long hours of sitting.

Steps to do the pose:

- Sit on the floor with your weight on your knees. Now flatten your feet onto the floor and sit on your heels.
- Spread your thighs apart a little. Exhale and bend forward from your waist.
- Let your stomach rest on your thighs and extend your back. Now stretch out your arms in front of you to elongate the back.

- You can also rest your forehead on the floor. This may require flexibility, so don't push your body beyond its limit. You will get better with time.
- This is a resting pose so you should ideally breathe at a normal pace. You can stay in this pose for as long as three minutes or as little as five counts

Tip: If you are pregnant, have a knee injury or have diarrhoea do not do this pose.

#4 Vajrasana

This is a simple pose that is great to relax the mind, improve digestion and massages the *kanda*.According to Ayurvedic principles, *kanda* is a spot about 12 inches above the anus that is the point of convergence for over 72,000 nerves.

Steps to do this pose:

- All you need to do is place a yoga mat on the floor.
- Kneel on the mat, and let the top surface of your feet touch the mat, such that your heels are pointing upwards.
- Now gently place your buttocks on your heels. It is important to note that your heels are on either side of your anus.
- Now place both your palms on your knees, facing downwards. Close your eye and breath in deeply at a steady rate.

#5 Sarvangasana

This pose is essentially known for its ability to regulate the working of the thyroid glands. These glands are responsible for the proper functioning of the entire body including the digestive, nervous, reproductive system, regulating metabolism and respiratory system. Apart from that, it nourishes the spine with a good supply of blood and oxygen, helping you beat nervous system disorders, and improving your all round health. Read more about how sarvangasana works.

Steps to do this pose:

- Lie on a yoga mat with your legs extending outwards.
- Now slowly raise your legs either by first folding them at the knees or by lifting them straight.
- Place your palms along your back and hips to support it, and raise your body while pointing your toes to the ceiling.
- All your weight should be on your shoulders. Make sure you breathe slowly and lock your chin into your chest.
- Your elbows should be touching the floor and your back should be supported. Hold this pose for as long as you are comfortable.
- To return to the lying position, slowly lower your body. Do not fall back to the lying position.

Tips: Do not do this pose if you suffer from any neck or spinal injuries. If you do have high blood pressure perform this exercise only under supervision.

#6 Halasana

This pose is great for those who sit for long hours and tend to have bad posture. It stimulates the thyroid glands, parathyroid glands, lungs and abdominal organs, therefore helping the blood rush to your head and face, improves digestion and keeps the hormonal levels in check. Read more about how halasana can beat bad posture and backache.

Step to do this pose:

- Lie flat on the floor with your feet flat stretched out. Place your arms by your side and bend your knees so that your feet are flat on the floor.
- Now, slowly raise your legs from the hips. Place your hands on your hips as you raise them and use your hands as support.
- Now slowly bend your legs at the hips and try to touch the floor behind your head with your toes and straighten your hands so they are flat on the floor.
- Breath out while going up. To return to the lying position gently roll your back onto the floor, breath in while you come down. Do not drop down suddenly.

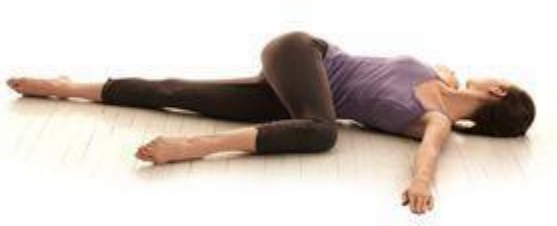
Tip to keep in mind: If you suffer from liver or spleen disorders,hypertension, have diarrhoea are menstruating or have suffered a neck injury, avoid doing this pose.

#7 Dhanurasana This pose is great to strengthen your back and spine, stimulate the reproductive organs,beats stress and fatigue, relieves menstrual pain and constipation.

Steps to do this pose:

- Lie on your stomach with your feet hip-width apart and your arms by the side of your body.
- Fold your knees and hold your ankles. Breathing in, lift your chest off the ground and pull your legs up and back.
- Look straight ahead with a smile on your face. Keep the pose stable while paying attention to your breath.
- Continue to take long deep breaths as you relax in this pose. But don't get carried away!
- Do not overdo the stretch. After 15 -20 seconds, as you exhale, gently bring your legs and chest to the ground. Release the ankles and relax.

Tip: Do not practice this pose if you have high or low blood pressure,hernia, neck injury, pain in the lower back, headache, migraine or a recent abdominal surgery or if you are pregnant.



#8 Chakrasana This pose is great to stretch the spine and relax the muscles of the back. Moreover it helps relax the mind and make it stress free.

Steps to do this pose:

- To do this pose start by lying on your back with your arms horizontally stretched out in line you're your shoulders.
- Bend your knees and bring your feet close to your hips. The soles of your feet should be fully on the ground.
- Swing your knees to the left until the left knee touches the ground (the right knee and thigh should rest on the left knee and thigh).
- Simultaneously, turn your head to the right and look at your right palm. Make sure your shoulder blades touch the ground.
- While the body is twisted, there is a tendency for one of your shoulder blades to lift off the ground. You must work against this tendency for the stretch to be effective.
- Feel the stretch in the thighs, groin, arms, neck, stomach and back as you hold the pose. With each exhalation, relax deeper into the pose.
- After a few minutes, you may slowly turn your head back to the centre, and straighten the torso and legs. Mirror the pose on the other side.

Tip: Avoid this posture if you have any spinal injuries.

#9 Paschimotasana

This is a forward bending pose that helps the blood to flow to the face. Apart from that, it helps the stomach function better, strengthens and relaxes the back and arms.

Steps to do this pose:

- Sit with your legs stretched out on the floor. Next hold the big toe of your feet with your index finger and thumb.
- Now, exhale and slowly bend forward and try to touch your forehead to your knees.
- The key is that your elbows should touch the floor. Do not breath in.

- Stay in this position for five counts and inhale as you rise back to the sitting position.

Tips to keep in mind: If you have any type of back pain or complaints with your spine, do not do this pose. Moreover, be easy on yourself, you might not be able to touch your knees with your forehead. Know that if you keep at it you will regain your flexibility and be able to do the pose properly.

#10 Ardha Matsyendrasana

This asana is specifically designed to increase the capacity of your lungs so it can inhale and hold more oxygen. It also loosens up the spine andrelieves backaches and discomfort in the back.

Steps to do this pose:

- Sit up with your legs stretched out straight in front of you, keeping your feet together and your spine erect.
- Bend your left leg and place the heal of your left foot beside your right hip (optionally, you can keep your left leg straight).
- Now, Take the right leg over your left knee and place your left hand on your right knee and your right hand behind you.
- Twist at the waist, shoulders and neck in this sequence to the right and look over the right shoulder. Hold and continue with gentle long breaths in and out.
- To come back to the starting position, continue breathing out, release the right hand first (the hand behind you), release the waist, then chest,lastly the neck and sit up relaxed yet straight.
- Repeat to the other side. Breathing out, come back to the front and relax.

4.5 POLYHERBAL

Acacia arabica: (Babhul)

It is found all **Aegle marmelos: (Bengal Quince** over India mainly in the wild habitat. The plant extract acts as an antidiabetic agent by acting as secretagouge to release insulin. It induces hypoglycemia in control rats but not in alloxanized animals. Powdered seeds of *Acacia arabica* when administered (2,3 and 4 g/kg body weight) to normal rabbits induced hypoglycemic effect by initiating release of insulin from pancreatic beta cells.

, Bel or Bilva)

Administration of aqueous extract of leaves improves digestion and reduces blood sugar and urea, serum cholesterol in alloxanized rats as compared to control. Along with exhibiting hypoglycemic activity, this extract also prevented peak rise in blood sugar at 1h in oral glucose tolerance test.

Allium cepa: (onion)

Various ether soluble fractions as well as insoluble fractions of dried onion powder show anti-hyperglycemic activity in diabetic rabbits. *Allium cepa* is also known to have antioxidant and hypolipidaemic activity. Administration of a sulfur containing amino acid from *Allium cepa*, S-methyl cysteine sulphoxide (SMCS) (200 mg/kg for 45 days) to alloxan induced diabetic rats significantly controlled blood glucose as well as lipids in serum and tissues and normalized the activities of liver hexokinase, glucose 6-phosphatase and HMG Co A reductase. When diabetic patients were given single oral dose of 50 g of onion juice, it significantly controlled post-prandial glucose levels.

Allium sativum: (garlic)

This is a perennial herb cultivated throughout India. Allicin, a sulfur-containing compound is responsible for its pungent odour and it has been shown to have significant hypoglycemic activity. This effect is thought to be due to increased hepatic metabolism, increased insulin release from pancreatic beta cells and/or insulin sparing effect. Aqueous homogenate of garlic (10 ml/kg/day) administered orally to sucrose fed rabbits (10 g/kg/day in water for two months) significantly

increased hepatic glycogen and free amino acid content, decreased fasting blood glucose, and triglyceride levels in serum in comparison to sucrose controls.

S-allyl cystein sulfoxide (SACS), the precursor of allicin and garlic oil, is a sulfur containing amino acid, which controlled lipid peroxidation better than glibenclamide and insulin. It also improved diabetic conditions. SACS also stimulated *in vitro* insulin secretion from beta cells isolated from normal rats. Apart from this, *Allium sativum* exhibits antimicrobial, anticancer and cardioprotective activities.

Aloe vera and Aloe barbadensis

Aloe, a popular houseplant, has a long history as a multipurpose folk remedy. The plant can be separated into two basic products: gel and latex. Aloe vera gel is the leaf pulp or mucilage, aloe latex, commonly referred to as "aloe juice," is a bitter yellow exudate from the pericyclic tubules just beneath the outer skin of the leaves. Extracts of aloe gum effectively increases glucose tolerance in both normal and diabetic rats. Treatment of chronic but not single dose of exudates of *Aloe barbadensis* leaves showed hypoglycemic effect in alloxanized diabetic rats. Single as well as chronic doses of bitter principle of the same plant also showed hypoglycemic effect in diabetic rats. This action of *Aloe vera* and its bitter principle is through stimulation of synthesis and/or release of insulin from pancreatic beta cells. This plant also has an anti-inflammatory activity in a dose dependent manner and improves wound healing in diabetic mice.

Azadirachta indica: (Neem)

Hydroalcoholic extracts of this plant showed anti-hyperglycemic activity in streptozotocin treated rats and this effect is because of increase in glucose uptake and glycogen deposition in isolated rat hemidiaphragm. Apart from having anti-diabetic activity, this plant also has anti-bacterial, antimalarial, antifertility, hepatoprotective and antioxidant effects.

Caesalpinia bonducella

Caesalpinia bonducella is widely distributed throughout the coastal region of India and used ethnically by the tribal people of India for controlling blood sugar. Both the aqueous and ethanolic extracts showed potent hypoglycemic activity in chronic type II diabetic models. These extracts

also increased glycogenesis thereby increasing liver glycogen content. Two fractions BM 169 and BM 170 B could increase secretion of insulin from isolated islets. The aqueous and 50% ethanolic extracts of *Caesalpinia bonducella*seeds showed antihyperglycemic and hypolipidemic activities in streptozotocin (STZ)-diabetic rats. The antihyperglycemic action of the seed extracts may be due to the blocking of glucose absorption. The drug has the potential to act as antidiabetic as well as antihyperlipidemic.

Capparis decidua

This is found throughout India, especially in dry areas. Hypoglycemic effect was seen in alloxanized rats when the rats were fed with 30% extracts of*Capparis decidua* (*C. decidua*) fruit powder for 3 weeks. This extract also reduced alloxan induced lipid peroxidation significantly in erythrocytes, kidney and heart. *C. decidua* was also found to alter superoxide dismutase and catalase enzyme levels to reduce oxidative stress. *C. decidua*additionally showed hypolipidaemic.

Coccinia indica

Dried extracts of *Coccinia indica* (*C. indica*) (500 mg/kg body weight) were administered to diabetic patients for 6 weeks. These extracts restored the activities of enzyme lipoprotein lipase (LPL) that was reduced and glucose-6-phosphatase and lactate dehydrogenase, which were raised in untreated diabetics. Oral administration of 500 mg/kg of *C. indica* leaves showed significant hypoglycemia in alloxanized diabetic dogs and increased glucose tolerance in normal and diabetic dogs.

Eugenia jambolana: (Indian gooseberry, jamun)

In India decoction of kernels of *Eugenia jambolana* is used as household remedy for diabetes. This also forms a major constituent of many herbal formulations for diabetes. Antihyperglycemic effect of aqueous and alcoholic extract as well as lyophilized powder shows reduction in blood glucose level. This varies with different level of diabetes. In mild diabetes (plasma sugar >180 mg/dl) it shows 73.51% reduction, whereas in moderate (plasma sugar >280 mg/dl) and severe diabetes (plasma sugar >400 mg/dl) it is reduced to 55.62% and 17.72% respectively. The extract of jamun pulp showed the hypoglycemic activity in streptozotocin induced diabetic mice within 30 min of administration while the seed of the same fruit required 24 h. The oral administration of the extract

resulted in increase in serum insulin levels in diabetic rats. Insulin secretion was found to be stimulated on incubation of plant extract with isolated islets of Langerhans from normal as well as diabetic animals. These extracts also inhibited insulinase activity from liver and kidney.

Mangifera indica*: (Mango)*

The leaves of this plant are used as an antidiabetic agent in Nigerian folk medicine, although when aqueous extract given orally did not alter blood glucose level in either normoglycemic or streptozotocin induced diabetic rats. However, antidiabetic activity was seen when the extract and glucose were administered simultaneously and also when the extract was given to the rats 60 min before the glucose. The results indicate that aqueous extract of*Mangifera indica* possess hypoglycemic activity. This may be due to an intestinal reduction of the absorption of glucose.

Momordica charantia: (bitter gourd)

Momordica charantia is commonly used as an antidiabetic and antihyperglycemic agent in India as well as other Asian countries. Extracts of fruit pulp, seed, leaves and whole plant was shown to have hypoglycemic effect in various animal models. Polypeptide p, isolated from fruit, seeds and tissues of *M. charantia* showed significant hypoglycemic effect when administered subcutaneously to langurs and humans. Ethanolic extracts of *M. charantia* (200 mg/kg) showed an antihyperglycemic and also hypoglycemic effect in normal and STZ diabetic rats. This may be because of inhibition of glucose-6-phosphatase besides fructose-1, 6-biphosphatase in the liver and stimulation of hepatic glucose-6-phosphate dehydrogenase activities.

Ocimum sanctum: (holy basil)

It is commonly known as Tulsi. Since ancient times, this plant is known for its medicinal properties. The aqueous extract of leaves of *Ocimum sanctum*showed the significant reduction in blood sugar level in both normal and alloxan induced diabetic rats. Significant reduction in fasting blood glucose, uronic acid, total amino acid, total cholesterol, triglyceride and total lipid indicated the hypoglycemic and hypolipidemic effects of tulsi in diabetic rats. Oral administration of plant extract (200 mg/kg) for 30 days led to decrease in the plasma glucose level by approximately 9.06 and 26.4% on 15 and 30 days of the experiment respectively. Renal glycogen content increased 10 fold while skeletal muscle and hepatic glycogen levels decreased by 68 and 75% respectively in

diabetic rats as compared to control. This plant also showed antiasthemitic, antistress, antibacterial, antifungal, antiviral, antitumor, gastric antiulcer activity, antioxidant, antimutagenic and immunostimulant activities.

Phyllanthus amarus: (bhuiawala)

It is a herb of height up to 60 cm, from family Euphorbiaceae. It is commonly known as Bhuiamala. It is scattered throughout the hotter parts of India, mainly Deccan, Konkan and south Indian states. Traditionally it is used in diabetes therapeutics. Methanolic extract of *Phyllanthus amarus* was found to have potent antioxidant activity. This extract also reduced the blood sugar in alloxanized diabetic rats. The plant also shows antiinflammatory, antimutagenic, anticarcinogenic, antidiarrhoeal activity.

Pterocarpus marsupium:

It is a deciduous moderate to large tree found in India mainly in hilly region. Pterostilbene, a constituent derived from wood of this plant caused hypoglycemia in dogs. showed that the hypoglycemic activity of this extract is because of presence of tannates in the extract. Flavonoid fraction from *Pterocarpus marsupium* has been shown to cause pancreatic beta cell regranulation Marsupin, pterosupin and liquiritigenin obtained from this plant showed antihyperlipidemic activity. (−) Epicatechin, its active principle, has been found to be insulinogenic, enhancing insulin release and conversion of proinsulin to insulin *in vitro*. Like insulin, (−) epicatechin stimulates oxygen uptake in fat cells and tissue slices of various organs, increases glycogen content of rat diaphragm in a dose-dependent manner.

Trigonella foenum graecum: (fenugreek)

It is found all over India and the fenugreek seeds are usually used as one of the major constituents of Indian spices. 4-hydroxyleucine, a novel amino acid from fenugreek seeds increased glucose stimulated insulin release by isolated islet cells in both rats and humans. Oral administration of 2 and 8 g/kg of plant extract produced dose dependent decrease in the blood glucose levels in both normal as well as diabetic rats. Administration of fenugreek seeds also improved glucose metabolism and normalized creatinine kinase activity in heart, skeletal muscle and liver of diabetic

rats. It also reduced hepatic and renal glucose-6-phosphatase and fructose −1,6-biphosphatase activity. This plant also shows antioxidant activity.

Tinospora cordifolia: (Guduchi)

It is a large, glabrous, deciduous climbing shrub belonging to the family Menispermaceae. It is widely distributed throughout India and commonly known as Guduchi. Oral administration of the extract of *Tinospora cordifolia*(*T. cordifolia*) roots for 6 weeks resulted in a significant reduction in blood and urine glucose and in lipids in serum and tissues in alloxan diabetic rats. The extract also prevented a decrease in body weight. *T. cordifolia* is widely used in Indian ayurvedic medicine for treating diabetes. Oral administration of an aqueous *T. cordifolia* root extract to alloxan diabetic rats caused a significant reduction in blood glucose and brain lipids. Though the aqueous extract at a dose of 400 mg/kg could elicit significant anti-hyperglycemic effect in different animal models, its effect was equivalent to only one unit/kg of insulin. It is reported that the daily administration of either alcoholic or aqueous extract of *T. cordifolia*decreases the blood glucose level and increases glucose tolerance in rodents.

Herbal Drug Formulations

Many formulations are in the market and are used regularly by diabetic patients on the advice of the physicians.

Diabecon manufactured by 'Himalaya' is reported to increase peripheral utilization of glucose, increase hepatic and muscle glucagon contents, promote B cells repair and regeneration and increase c peptide level. It has antioxidant properties and protects B cells from oxidative stress. It exerts an insulin like action by reducing the glycated haemoglobin levels, normalizing the microalbuminurea and modulating the lipid profile. It minimizes long term diabetic complications.

Epinsulin marketed by Swastik formulations, contains epicatechin, a benzopyran, as an active principle. Epicatechin increases the cAMP content of the islet, which is associated with increased insulin release. It plays a role in the conversion of proinsulin to insulin by increasing cathepsin activity. Additionally it has an insulin-mimetic effect on osmotic fragility of human erythrocytes and it inhibits Na/K ATPase activity from patient's erythrocytes. It corrects the neuropathy, retinopathy and disturbed metabolism of glucose and lipids. It maintains the integrity of all organ

systems affected by the disease. It is reported to be a curative for diabetes, Non Insulin Dependant Diabetes Mellitus (NIDDM) and a good adjuvant for Insulin Dependant Diabetes Mellitus (IDDM), in order to reduce the amount of needed insulin. It is advised along with existing oral hypoglycemic drugs. And is known to prevent diabetic complication. It has gentle hypoglycemic activity and hence induces no risk of being hypoglycemic.

Pancreatic Tonic (ayurvedic herbal supplement): Pancreas Tonic is a botanical mixture of traditional Indian Ayurvedic herbs currently available as a dietary supplement.

Bitter gourd powder marketed by Garry and Sun. It lowers blood & urine sugar levels. It increases body's resistance against infections and purifies blood. Bitter Gourd has excellent medicinal virtues. It is antidotal, antipyretic tonic, appetizing, stomachic, antibilious and laxative. The bitter Gourd is also used in native medicines of Asia and Africa. The Bitter gourd is specifically used as a folk medicine for diabetes. It contains compounds like bitter glycosides, saponins, alkaloids, reducing sugars, phenolics, oils, free acids, polypeptides, sterols, 17-amino acids including methionine and a crystalline product named p-insulin. It is reported to have hypoglycemic activity in addition to being antihaemorrhoidal, astringent, stomachic, emmenagogue, hepatic stimulant, anthelmintic and blood purifier.

Dia-Care manufactured by Admark Herbals Ltd. is claimed to be effective for both Type 1, Type 2 diabetes within 90 days of treatment and cures within 18 months. Persons taking insulin will eventually be liberated from the dependence on it. The whole treatment completes in 6 phases, each phase being of 90 days. Approx. 5 grams (1 tea spoon) powder is mixed with 1/2 glass of water, stirred properly and kept overnight. Only the water and not the sediment must be taken in the morning on empty stomach. To the remaining medicine fresh water is added and kept for the whole day and is consumed half an hour before dinner. The taste of the drug is very bitter. It is a pure herbal formula without any side effects.

Diabetes-Daily Care manufactured by Nature's Health Supply is a Unique, Natural Formula, which effectively and safely Improves Sugar Metabolism. Diabetes Daily Care^{TM} was formulated for type 2 diabetics and contains all natural ingredients listed in Table 2 in the proportion optimal for the body's use.

Gurmar powder manufactured by Garry and Sun is an anti-diabetic drug, which suppresses the intestinal absorption of sacharides, which prevents blood sugar fluctuations. It also correlates the metabolic activities of liver, kidney and muscles. Gurmar stimulates insulin secretion and has blood sugar reducing properties. It blocks sweet taste receptors when applied to tongue in diabetes to remove glycosuria. It deadens taste of sweets and bitter things like quinine (effects lasts for 1 to 2 hours). Besides having these properties, it is a cardiac stimulant and diuretic and corrects metabolic activities of liver, kidney and muscles.

DIABETA, a formulation of Ayurvedic Cure, available in the capsule form is an anti-diabetic with combination of proven anti-diabetic fortified with potent immunomodulators, antihyperlipidemics, anti-stress and hepatoprotective of plant origin. The formulation of Diabeta is based on ancient ayurvedic references, further corroborated through modern research and clinical trials. Diabeta acts on different sites in differing ways to effectively control factors and pathways leading to diabetes mellitus. It attacks the various factors, which precipitate the diabetic condition, and corrects the degenerative complications, which result because of diabetes. Diabeta is safe and effective in managing Diabetes Mellitus as a single agent supplement to synthetic anti-diabetic drugs. Diabeta helps overcome resistance to oral hypoglycemic drugs when used as adjuvant to cases of uncontrolled diabetes. Diabeta confers a sense of well -being in patients and promotes symptomatic relief of complaints like weakness giddiness, pain in legs, body ache, polyuria and pruritis.

Syndrex manufactured by Plethico Laboratory contains extracts of germinated fenugreek seed. Fenugreek is used as an ingredient of traditional formulations over 1000 years. We are currently studying the mechanism of this antidiabetic drug using animal model on one hand and cultured islet cells on the other.

Thus many different plants have been used individually or in formulations for treatment of diabetes and its complications. One of the major problems with this herbal formulation is that the active ingredients are not well defined. It is important to know the active component and their molecular interaction, which will help to analyse therapeutic efficacy of the product and also to standardize the product. Efforts are now being made to investigate mechanism of action of some of these plants using model systems.

CHAPTER FIVE

MATERIAL AND METHODS

4.1 Materials

Test Substance: Abelmoschus Esculentus

4.1.1 Chemicals/Reagents required

1.	Abelmoschus Esculentus
2.	Fresh Seeds
3.	Matured Seeds
4.	Methanol
5.	Muslin Cloth

4.1.2 Apparatus/Equipments Required

1.	Macerator
2.	Weighing Balance
3.	Rotary Evaporator
4.	Lyophilizer
5.	Tarson Tubes
6.	Stirrer
7.	Funnels
8.	Magnetic Stirrer

4.2 METHOD

First of all fresh seeds of abelmoschus esculentus were taken out of the fruit and weighed 50 grams. Three macerators were taken and filled with methanol each. First macerator contained mature fruit, second contained fresh seeds and the third one with fresh fruit.

All were kept for 48 hours with occasional shaking. Maceration was completed after 48 hours and all the macerators were checked and the extract was collected from all of them.

Rotary evaporatorion was done with the extract and further followed by lyophilization to complete the process. Water is removed from the extract after it is frozen and placed in a vaccum allowing ice to change directly.

CHAPTER SIX

Discussion and conclusion

We have worked firstly by having a brief description about diabetes mellitus, its symptoms, treatment and various alternatives used as medicines for treating this. We wanted to do the in vivo experiment on how abelmoschus esculentus is having an antidiabetic effect in human body but due to unavailability of animals for testing purpose, we couldn't perform the whole experiment.

At the end of the project we are able to collect the extract of abelmoschus in solid form after various extracting and lyophilization process and converting it into solid form for further testing.

We are able to acquire brief knowledge about diabetes mellitus and plan to perform in vivo experiment on this project in our future.

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