

AN OVERVIEW ON DIABETES

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Abstract

Diabetes mellitus is a multifactorial disease that requires long-term care since it involves major changes in both physical and psychosocial dimension of each patient. Diabetes education is a critical element of care that improves patient outcomes. Aim: the aim of the present study was to review the literature about the education in diabetes mellitus management. Method: the method of this study included bibliographic research of the literature from reviews and researches, mainly in the pubmed data base, which referred to education in diabetes mellitus management. Pubmed was searched using the following key search terms: “diabetes mellitus”, “self-management”, “education” while the research covered the period 1999-2012. Results: according to the literature, education should not be a mere transmission of information, but a dynamic, holistic, planned care based on individual’s needs (patient-centred approach). Furthermore, education promotes self-management and health-related behaviour modification. Moreover, education should be consistent with individual’s learning skills and psychosocial state. Diabetes education should be reinforced after its' completion and enhance in depth understanding of the significance of check-up and follow-up. Last but not least effective education requires good communication among diabetic patients and health professionals. Conclusions: the overall goal of diabetes education is to help individuals and their families gain the necessary knowledge, life skills, resources and support needed to achieve optimal health. The chronic metabolic disorder diabetes mellitus is a fast-growing global problem with huge social, health, and economic consequences. It is estimated that in 2010 there were globally 285 million people (approximately 6.4% of the adult population) suffering from this disease. This number is estimated to increase to 430 million in the absence of better control or cure. An ageing population and obesity are two main reasons for the increase. Furthermore it has been shown that almost 50% of the putative diabetics are not diagnosed until 10 years after onset of the disease, hence the real prevalence of global diabetes must be astronomically high. This chapter introduces the types of diabetes and diabetic complications such as impairment of immune system, periodontal disease, retinopathy, nephropathy, somatic and autonomic neuropathy, cardiovascular diseases and diabetic foot. Also included are the current management and treatments, and emerging therapies.

Introduction

Diabetes introduction:

Diabetes is one of the global emerging epidemic disease. It is representing its major effects causing morbidity and mortality world wide. Hyperglycemia is one of the common characteristics of both type1 diabetes mellitus(t1dm)and type2 diabetes mellitus(t2dm).it has the potential to cause serious complications due to its insidious and chronic nature.[1].

Medicinal plant introduction:

Recently, we are observing an exponential growth in fields of herbal medicine and their drugs are gaining popularity in both developing and developed countries. Herbal medicines have natural origin and less side effects. Many medications are obtained from medicinal plants, organic matter(stem, leaf and root contents)and from mineral also. Large number of medicinal plants are used as traditional for over thousand of years. It was named as “rasayana” was present in herbal preparations by indian traditional health care systems.

Most of the researches and practitioners discover and dispense their own recipes in Indian systems of medicine. Around the world, they use 21,000 plants for medicinal purposes. It was noticed by the World Health Organization (WHO).

Review focuses on herbal drug preparations and plants which are used in the treatment of diabetes mellitus. Diabetes is the major dangerous disease now a days. We are all observing this all over the globe, it leads to huge economic loss.

Significance:

Now a days, diabetes is considered as a chronic disorder. It occurs due to the carbohydrate, protein, fat metabolism changes i.e., increased fasting and post prandial blood sugar level (after meal consumption). The world prevalence of diabetes is estimated to increase from 4% in 1995 to 5.4% by the year 2025. Diabetes mellitus is a complex metabolic disorder resulting from either insulin deficiency or insulin dysfunction.

There are 2 types of diabetes:

Type 1 diabetes mellitus (insulin dependent): it is caused due to lack of proper functioning of beta cells of pancreas. It leads to deficiency of insulin. The patient depends on exogenous source of insulin. [1],[2],[3].

Type 2 diabetes mellitus (insulin independent): it is unable to respond to insulin, so these are treated with some medicaments and dietary changes.

This type of diabetes is common and it is constituting about 90% of diabetic population.

Symptoms for both diabetic conditions are:

- Elevated levels of blood sugar level.
- Frequently thirstiness and urination.
- Loss of weight and blurred eye vision.
- Extreme hunger, nausea and vomiting.
- Easily tired and leads to weakness.
- Mood changes and irritability. [4],[5].

Medications for diabetes

➤ Alpha-glucosidase inhibitors:

The drugs that are used for diabetes help in the lowering of our blood sugar levels by the break down of starchy foods and table sugar.

For its effectiveness, some drugs should be taken before meals. Such drugs include:

- Acarbose (Precose) and miglitol (Glyset)

➤ Biguanides :

It helps in the decreasing of sugar levels that our liver makes.

It also helps in the absorption of sugars by our intestine. It makes our body more sensitive to insulin and makes our muscles absorb glucose.

Metformin is the most common biguanide. Metformin is used with the combination of other drugs to treat type 2 diabetes.

Metformin can also be combined with other drugs for type 2 diabetes. It is an ingredient in the following medications:

- Metformin-a logliptin (Kazano)
- Metformin-cangliflozin (Invokamet)
- Metformin-dapagliflozin (Xigduo XR)
- Metformin-empagliflozin (Synjardy)

➤ Dipeptidyl peptidase-4 (DPP-4) inhibitors:

These inhibitors help our body continue to make insulin.

These drugs can also help the pancreas make more insulin. These drugs include:

- Alogliptin (Nesina)
- Alogliptin-metformin (Kazano)
- Alogliptin-pioglitazone (Oseni)

➤ **Glucagon-like peptide-1 receptor agonists (glp-1 receptor agonists):**

These drugs help in increasing the b-cell growth and it can determine how much insulin our body uses. These drugs can decrease our appetite and can determine the glucagon levels used by our body. They can slow stomach emptying.

These drugs include :

- Albiglutide (tanzeum)
- Dulaglutide (trulicity)
- Exenatide (byetta)

➤ **Meglitinides:**

These medications help your body release insulin. However, in some cases, they may lower your blood sugar too much.

These drugs aren't for everyone. They include :

- Nateglinide (starlix)
- Repaglinide (prandin)
- Repaglinide-metformin (prandimet)

➤ **Sodium - glucose transporter (sglt) 2 inhibitor:**

Sodium - glucose transporter (sglt) 2 inhibitors work by preventing the kidneys from holding onto glucose. Instead, your body gets rid of the glucose through your urine.

These drugs are used, in cases where atherosclerotic cardiovascular disease, heart failure, or chronic kidney diseases predominate, the ADA recommends sglt2 inhibitors as a possible treatment option.

- Dapagliflozin (farxiga)
- Dapagliflozin-metformin (xigduo xr)
- Canagliflozin (invokana)

➤ **Sulfonylureas:**

These drugs are used from olden days today.

These drugs act by stimulating the pancreas with the help of b-cells, which causes our body to make more insulin.

These drugs include:

- Glimepiride (amaryl)
- Glimepiride-pioglitazone (duetact)
- Flimepiride-rosiglitazone (avandaryl)

➤ **Thiazolidinediones:**

These drugs work by decreasing the glucose levels in the liver of diabetic patients. These drugs also help our fat cells to use insulin better. These drugs are used to the diabetic patients who are suffering with an increased risk of heart disease.

Options include:

- Rosiglitazone-glimepiride (avanderyl)
- Rosiglitazone-metformin (amaryl m)
- Pioglitazone (actos)

Medicinal plants used for diabetes:

For diabetes and diabetic complications there are more herbal remedies which are often suggested.

In these herbal remedies medicinal plants form the main ingredients of these formulations.

A list of Indian medicinal plants with anti-diabetic and related beneficial are as follows:

1. **Acacia arabica (babhul):**

It is a wild habitat and it is found all over India.

This plant extract acts as secretagogue, which helps in the release of insulin, which acts as an anti-diabetic agent. It plays its active role in inducing its hypoglycemia level control in rats but it cannot induce in alloxanized animals. *Acacia arabica* is also administered as powdered seeds which helps in inducing in hypoglycemia levels this is induced by initiating the release of insulin from pancreatic cells (6).

2. *Aegle marmelos*:

Aegle marmelos is commonly / locally known as bengal quince, below bilva.

It is administered as an aqueous extract of leaves of *aegle marmelos* which helps in improving, digestion and it reduces the blood sugar and urea, serum cholesterol levels in alloxanized rats as compared to control. This plant along with its hypoglycemic activity it acts in preventing the rise also of blood sugar levels for about 1 hour which is identified in oral glucose tolerance test (7)

3. *Allium cepa*:

It is locally/commonly called as onion. It is one of the most commonly used vegetable in our daily lives.

The dried onion powder contains various other soluble fractions and also insoluble fractions, which shows its anti-hyperglycemic activity is diabetic.

This plant is known to have anti-oxidant and hyperlipidemic activity. (8),(9),(10).

4. *Allium sativum* :

It is commonly known as garlic. It is a perennial herb cultivated throughout india. A sulfur containing compound known as allicin is responsible for its pungent odour which shows its effect on significant hypoglycemic activity(11). *Allium sativum* acts on our body to give its adverse effects by increasing hepatic metabolism , and it also increases the insulin release from the beta cells of pancreatic cells(12).

S-allyl cysteine sulfoxide (sacs) , it is a sulfur containing amino acid, which is the precursor of allicin and garlic oil, and it helps in controlling the lipid peroxidation better than glibenclamide and insulin. *Allium sativum* also plays its important role in exhibiting antimicrobial, anticancer and cardio protective activities.(13),(14).

5. *Aloe vera* and *aloe barbadensis*:

Aloe vera is commonly present in every home and it is said to be a house plant. This plant has a long history and it is used as a multi purpose plant of folk remedy. This plant can be separated into two basic products namely gel and latex .the gel of *aloe vera* is the leaf pulp or mucilage and it has multipurpose and the latex of *aloe vera* plant is commonly known as *aloe juice* and it is a bitter yellow exudate from the pericyclic tubules just beneath the outer skin of the leaves. The extract of *aloe vera* gum usually increases the effectiveness of the glucose tolerance in both normal and diabetic rats(15).the *aloe vera* plants has an important action in the stimulation of release and synthesis of insulin from the beta cells of pancreas.(16).*aloe vera* plant also has an anti-inflammatory activity.(17).

6. *Azadirachta indica*:

It is commonly known as neem. The hydroalcoholic extracts of this plant are used for the hyperglycemic activity of streptozotocin treated for rats and this is effective because of the increase in glucose uptake and glycogen deposition in isolated rat hemidiaphragm(18,19).

This plant not only acts as anti diabetic activity but it also acts as anti bacterial, antimalarial,antifertility,hepatoprotective and antioxidant effects(20).

7. *Caesalpinia bonducella*:

It is ethnically used by the tribal people of india and it is widely distributed throughout the coastal region of india . It is mainly used for controlling the sugar levels .the ethanolic and aqueous extracts of this plant shows its potent effects on hypoglycemic activity in chronic type ii diabetic models. These extracts also increases the glucogenesis therebyit increases the liver glycogen content (21). The seeds of *caesalpinia bonducella* shows its effects on hyperglycemic and hypoglycemic activities in streptozotocin (stz)-

diabetic rats(22). It causes the blockage of glucose absorption. This drug has the potential to act as antidiabetic and also as anti hyper lipidemic (23).

8. *Coccinia indica*:

The extracts of this plants in there dried form are administered to the diabetic patients for 6 weeks ,it is administered at about 500 mg/kg body weight . These extracts helps restored the activities of enzyme lipoprotein lipase(lpl) which was reduced and the glucose-6-phosphate and lactate dehydrogenase , these enzymatic levels were increased in diabetes.

9. *Capparis decidua*:

This plant is found throughout the india, mainly in dry areas. It has hypoglycemic effect which was seen in alloxanized rats , it is observed when the rats were fed with 30% extracts of this plant fruit powder for 3 weeks . This plants extract was used in reducing as alloxan induces lipid peroxidation significantly in erythrocytes , kidney and heart. This plant also shows its effect in the hypolipidaemic activity.

10. *Coccinia indica*:

The extracts of *coccinia indica* were administered to diabetic patients for 6 weeks. The extracts of this plant are restored the activities of enzyme lipoprotein lipase(lpl) that was reduced and glucose-6-phosphatase and lactate dehydrogenase, which were raised in untreated diabetes. Administration through orally is of 500mg/kg of c. The leaves of the *indica* showed significant hypoglycemia in alloxanized diabetic dogs and increased glucose tolerance in normal and diabetic dogs.

11. *Eugenia jambolana*:(indian gooseberry, jamun)

In india decoction of kernels of *eugenia jambolana* is used as household remedy for diabetes. This can 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 also varies with different level of diabetes. In case of the mild diabetes(plasma sugar>180mg/dl)it shows 73.51% reduction, where as in moderate (plasma sugar>280mg/dl) and severe diabetes (plasma sugar >400 mg/dl) it is reduced to 55.62% and 17.72% respectively. The extraction of this jamun pulp showed the hypoglycemic activity in streptozotocin included diabetic mice within 30min of administration while the seed of the same fruit required 24hr..

12. *Mangifera indica*:(mango)

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

13. *Momordica charantia*:(bitter gourd)

This *momordica charantia* is commonly called as an antidiabetic and antihypoglycemic 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.. Ethanolic extracts of *m .charantia*(200mg/dl) 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.

14. *Ocimum sanctum*:(holy basil)

Ocimum sanctum is commonly called as tulsi. Since ancient times, this plant is known for its medicinal properties. The obtained aqueous extract of leaves of *ocimum sanctum* showed the significant reduction in blood sugar level in both normal and alloxaninduced diabetic rats. Administration through oral of plant extract(200mg/dl) 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. The content of renal glycogen increased 10 fold while skeletal muscle and hepatic glycogen levels

decreased by 68 and 75% respectively in diabetic rats compared to control. This plant also showed antiasthmatic, antistress, antibacterial, antifungal, antiviral, antitumor, gastric antiulcer activity, antioxidant, antimutagenic and immunostimulant activities.

15. *Phyllanthus amarus*:(bhuiawala)

This plant is a herb up to 60cm, from family euphorbiaceae. This plant is commonly known as bhuiamala. It is scattered throughout the hotter parts of india, mainly deccan, konkan and south indian states. Traditionally this plant 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. This plant also shows anti-inflammatory, antimutagenic, anticarcinogenic, antidiarrhoeal activity.

16. *Pterocarpus marsupium*:

This plant 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 because of presence of tannates in the extract. Flavonoid fraction from *pterocarpus marsupium* has been shown to cause pancreatic beta cell regranulation. Marsupin, pterosouin 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.

17. *Trigonella foenum graecum*:(fenugreek)

This plant 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. Administration through oral is 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 is also reduced hepatic and renal glucose-6-phosphatase and fructose-1,6-bisphosphatase activity. This plant also shows antioxidant activity.

18. *Tinospora cordifolia*:(guduchi)

This plant is a large, glabrous, deciduous climbing shrub belonging to the family menispermaceae. It is widely distributed throughout india and commonly known as guduchi. Administration through oral 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 obtained extract is also prevented a decrease in body weight. T. *Cordifolia* is widely used in indian ayurvedic medicine for treating diabetes mellitus. Administration through oral of an aqueous t. *Cordifolia* root extract to alloxan diabetic rats caused a significant reduction in blood glucose and brain lipids.

Herbal drug formulations:

There are many formulations which are commonly available in the market and these formulations are used regularly by diabetic patients on the advice of physicians.

'himalaya' is one of the well - known herbal products marketing company. For diabetes in herbal formulations the drug 'diabecon' is manufactured by the 'himalaya' company. This drug acts to increase the peripheral utilization of glucose, increase of hepatic and muscle glucagon levels. It also helps to promote the beta cells repair and regeneration and it causes to increase the c-peptide levels. This drug has an antioxidant property which helps in the protection of beta cells from oxidative stress. 'diabecon' drug exerts insulin like action by reducing the glycated haemoglobin levels which helps in normalizing the microalbuminuria and also helps in a modulating the lipid profile, which helps in the minimizing of long term diabetic complications.

"swastik formulations" market a diabetic drug by the name "epinsulin" which contains epicatechin, a benzopyran. These two contents(epicatechin and benzopyran) acts as an active principle. Epicatechin plays its active role in increasing the camp content of the islet, which is further associated with the release of insulin. It plays an important role in the conversion of proinsulin to insulin by increasing cathepsin activity. This drug helps to play an active part

in the correct of some diseases and metabolic disturbances like neuropathy, retinopathy and also the distributed metabolism of glucose and lipids.

Garry and sun company marketed a drug for diabetic treatment. Bitter gourd powder is the drug to treat diabetes, in olden days. Bitter gourd is used as a folk medicine of diabetes and it is a native medicine of asia and africa. Bitter gourd powder helps in lowering of blood and urine sugar levels which plays its active role in increasing the body's resistance against infections. This powder is also helps in purifying the blood. Bitter gourd has an excellent medicinal values. It has many uses such as, stomachic, antibilious and also used as a laxative.

Another drug obtained from herbal formulations known as "dia-care" it is manufactured by admark herbal ltd. It is proved to be effective for diabetes mainly for both type 1 & type 2 diabetes. It cures the diabetes with in 90 days of treatment and the diabetes is almost cured with in 18months of its usage. Normally the diabetic patients will dependent on the usage of insulin for a long time. But in this 'dia-care' drug the whole treatment for diabetes cure will be completed in 6 phases in which each phase takes about 90 days. Approximately 5gms i.e., about 1 tea spoon powder of this drug is mixed with a half glass of water, it is stirred properly and it is kept over night. In the early mornings only the water of this drug should be taken with empty stomach and the sediment should not be taken. To this sediment again fresh water is added and it kept for whole day. About ½ an hour before the dinner it should be taken. It has very bitter taste. It has no side effect and it is a pure herbal formula.

One of the formulation of ayurvedic cure known as "diabeta". This drug is used for the diabetic treatment. So it is also known as an antidiabetic drug. It is available in the market as capsule form. It is available in the combination of proven anti-diabetic fortified with potent immune modulators, anti hyperlipidemics and it also acts for anti-stress and it obtained from the hepato protective of plant origin.

Plethico laboratory manufactured a drug for diabetes obtained from the extracts of germinated fenugreek seed and it was named as syndrex. Over 1000 years, this fenugreek is used as an ingredient of traditional formulations.

Drawbacks:

Herbal formulations may give its effectiveness but the major problem of this herbal formulation is that the active ingredients were not well defined. The interaction between the active component and their molecular interaction is very important to know. By knowing the interaction, it may help us to analyse the therapeutic efficacy of the product and also to standardize the product. Hence, it is major drawback of herbal formulations which are used for diabetic treatment & care .

Conclusion:

Diabetes mellitus is a most common endocrine disorder , affecting millions of people world wide .it is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both . The increase in resistance and populations of patients at same risk,in conjunction with the restricted number of commercially available drugs for diabetes that still present have many side effects and also problems like unwanted hypoglycemic effect or the causes of to shift the reasearch towards traditionally available medicine which have no side effect and wide range of bioactivity and do not require laborious pharmaceutical synthesis seems highly attractive.

A wide range of agents are in development for using the tratement of type 1 or type 2 diabetes all of these agents appear to be effective in improving glycemic contro but it is unknown whether they will have an impact on the course of the disease or alter the micro and macro vascular consequences of uncontrolled diabetes one of the dpp – 4 inhibitors is most likely to reach market next, as well as possibly liraglutide or mitiglinide.

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