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Review Article

Diabetes mellitus (DM): A widespread update

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ABSTRACT

Diabetes mellitus (DM) or simply diabetes is a group of metabolic diseases in which a person has elevated blood sugar, either because the body does not produce sufficient insulin, or because cells do not respond to the insulin that is produced. Diabetes mellitus is a rising health problem in the world that causes severe morbidity and mortality. The prevalence of diabetes was rising day by day. The facts about the diabetes mellitus, its prevalence, morbidity, and mortality were published in many statistical reports. The main aim of the present review is to compile the reports cognate to diabetes mellitus (DM) and their prevalence in India as well as in the world. Sundry herbal drugs have been withal proved efficacious due to their propitious contents in treatment of diabetes. The present review therefore is an attempt to focus on the briefly explain of diabetes, its complications, goals of management, and synthetic and herbal treatment of diabetes. This review will be utilizable for incipient researchers in the field of diabetes.

1. Introduction

Diabetes mellitus (DM) is a metabolic disorder characterized by hyperglycemia resulting due to irregularity in metabolism of carbohydrates, proteins and fats. The disease is the result of defects in insulin production and insulin action, which progressively leads to chronic micro molecular, macromolecular and neuropathic complication. Diabetes mellitus, is also characterized by severe hyperglycemia due to collective consequence of insulin insufficiency and insensitivity to the hormone in the organs/tissues vital to its action, develops into secondary complications - vision loss, peripheral neuropathy, kidney diseases, heart disease and stroke due to prolonged exposure to sustained high levels of glucose in blood. The modern lifestyle, characterized by limited physical activity and changing dietary habits with high caloric intake are probably the only critical predisposing factors for the current epidemic of Type 2 diabetes, worldwide.[1]

The term diabetes was originated by Aretus of Cappadocian. It is derived from the Greek word, *Diabainein*, meaning 'passing through' or 'siphon' a reference to pass large amount of water through excessive urination. It was in 1675 that Thomas Willis added the word "'mellitus"' to the word diabetes. This was because of the sweet taste of the urine. This sweet taste had also been noticed in urine by the ancient Indians, Greeks, Chinese, and Egyptians. In 1776, Matthew Dabson confirmed that the sweet taste to urine was due to presence of excess sugar in blood from diabetic people.[2–4]

The report provides estimates of the global prevalence of diabetes in the year 2000 (as used in the World Health Organization [WHO] Global Burden of Disease Study) and projections for 2030, indicate that there are 171 million people in the world with diabetes and this is projected to increase to 366 million by 2030.[5,6]

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An enormous deal of human health is overstated by utilization of high-calorie diet and comfortable life style. Sundry surveys conclude that prevalent health quandaries of modern society viz. diabetes mellitus, extravagant corpulence and cardiovascular diseases are associated with intake of energy affluent pabulum cumulated with decremented level of physical activity.[7] The occurrence of diabetes mellitus in majority increases with age and obesity. In 1995, 4 % of adults (20 years or older) had diabetes and the percentage has been predicted to rise up to 5.4 % by the year 2030. The disorder prevails much in obese people. More than 1 billion people are reportedly overweight and over 300 million people can be classified as obese.[8,9]

It is quite unfortunate that no single drug is able to achieve blood-glucose control, nor it can be stated that combination of drugs can sever hyperglycemia.[10] Accordingly, progress of secondary complications and subsequent cell apoptosis (including pancreatic β-cells) cannot be foiled. Prolonged use of a particular drug challenges further safety and efficacy of that drug; this stage invariably commences in the treatment of diabetic patients.[11]

Newer drugs in the therapeutic category are required to be developed, as most drugs introduced in the category, during last two decades are reportedly withdrawn citing toxicity concerns/tissue malfunctions those ensued during their clinical usage. Metformin drug being the safer anti-diabetic drug of them in use today.[12,13]

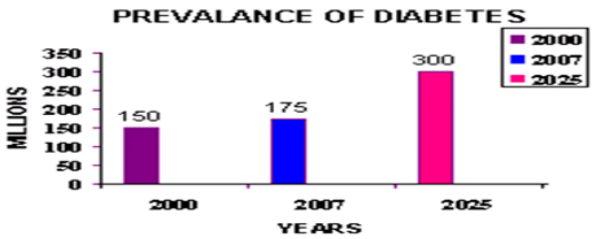

Fig. 1: Prevalence of diabetes

2. Etiological Classification[14–18]

2.1. Type I or insulin dependent diabetes mellitus (IDDM)

It occurs most often in children and adolescents. It is related with complete destruction of β-cells of the pancreas by the body's own antibody, because pancreas can no longer produce insulin. Which manufacture the insulin hormone. The symptos of type-1 diabetes mellitus includes polydipsia, polyurea, polyphagia, weight loss and diabetic ketoacidosis. Type I diabetes is immune mediated and idiopathic.

2.2. Type 2 or non-insulin dependent diabetes mellitus (NIDDM)

It contain about 90-95% of adult cases of diabetes. Usually sets in after 40 years of age and primarily associated with varying degrees of insulin resistance and β-cells dysfunction. The insulin resistance is found in other metabolic compilations including hypertension and obesity. Insulin resistance is the state where tissue does not utilize insulin properly. In addition, type-2 diabetes is usually associated with race, lack of physical activity and a family history of the disease.

2.3. Other specific types

1. Maturity onset diabetes of the youth (MODY)
2. Maternally inherited diabetes and deafness (MIDD)
3. Secondary to pancreatic diseases
4. Secondary to endocrinopathies
5. Secondary to immune suppression
6. Due to infections:- Congenital rubella and Cytomegalo virus
7. Other genetic disorders sometimes associated with diabetes:-
8. Down syndrome, Turner's syndrome, Klinfelter's syndrome.

2.4. Gestational diabetes mellitus (GDM)

It is usually diagnosed during pregnancy. It occurs more often in women who are obese and have a family history of diabetes. Therefore, it is important to regulate the blood glucose levels in order to control the hyperglycemia and to avoid complication to the infants.The presence of glucose level in blood indicate the severity of diabetes, the following table shows the glucose concentration in plasma and diagnosis criteria for diabetes mellitus.

Table 1: Diagnostic criteria of diabetes mellitus.[19,20]

State of the Disorder	Glucose concentration in plasma (mmol/L)
Normal	Fasting < 6.1, and 2 h post-glucose load < 7.8
Diabetes mellitus	Fasting ≥ 7.0, or 2 h post-glucose load ≥ 11
Impaired glucose tolerance	Fasting < 7.0, and 2 h post-glucose load ≥ 7.8 and > 11.1
Impaired fasting glucose	Fasting ≥ 6.1, and < 7.0 and 2h post-glucose load < 7.8

3. Management of Diabetes Mellitus (DM)

Diabetes mellitus is a progressive and complex disorder and for the treatment an extensive range of oral anti-diabetic drugs are available with their advantages & disadvantages stated as follows.[21–24]

Table 2: Classificationof anti-diabetic drugs and their advantages and disadvantages

Advantages	Disadvantages
1. Sulfonylurea e.g. Tolbutamide, Glyburide, Glimepiride, Glipizide	
1. Fast onset of action 2. Low cost 3. Convenient dosing 4. No effect on blood pressure	1. Cardiovascular mortality, Weight gain (5 to 10 pounds on average) 2. Glyburide has slightly higher risk of hypoglycemia compared with glimepiride and glipizide.
2. Biguanides e.g. Metformin	
1. Low risk of hypoglycaemia 2. Good effect on LDL cholesterol & triglycerides 3. No ill effect on blood pressure & weight gain 4. Low cost	1. Higher risk of GI side effects (nausea and diarrhoea) 2. Cannot be taken by people with diabetes who have moderate kidney disease or heart failure because of risk of lactic acid build-up 3. Less convenient dosing
3. The alpha-glycosidase inhibitors e.g. Acarbose, Miglitol	
1. Lower risk of hypoglycemia compared to sulfonylureas 2. Not associated with weight gain 3. Decreases triglycerides 4. No adverse effects on cholesterol	1. Less effective than most other diabetes pills in lowering HbA1c 2. Higher risk of GI side effects than other diabetes pills except metformin 3. Inconvenient dosing 4. High cost
4. The thiazolidinediones e.g. Pioglitazone, Rosiglitazon	
1. Low risk of hypoglycaemia 2. Slight increase in "good" (HDL) cholesterol 3. Pioglitazone linked to decreased triglycerides 4. Convenient dosing	1. Higher risk of heart failure 2. Weight gain (5 to 10 pounds) 3. Link to higher risk of edema & anemia 4. Increase in "bad" (LDL) cholesterol 5. Rosiglitazone linked to increased triglycerides and possibly higher risk of heart attack 6. Slower onset of action 7. Rare risk of liver problems; required monitoring & high cost.
5. The meglitinides e.g. Nateglinide, Repaglinide	
1. No bad effect on cholesterol 2. Rapid o nset of action	1. Repaglinide associated with risk of hypoglycemia and weight gain similar to the sulfonylureas 2. Nateglinide has less effect on HbA1c 3. Inconvenient dosing & high cost.
6. Dipetidyl Peptiase–IV inhibitor e.g. Sitagliptin	
1. Lower risk of hypoglycemia 2. Few known side effects (but new drug) 3. neutral effect on weight 4. Convenient dosing	1. Reduces HbA1c less than several other diabetes drugs 2. Preliminary treatment use only if unable to take other diabetes drugs 3. Less data on potential side effects compared to older drugs 4. Relatively expensive.

3.1. Herbal treatment of diabetes[25–28]

Over the last few decenniums environmental, bio-cordial, cost efficacious and comparatively forfended and plant-predicated medicines have peregrinate from the fringe to the main stream with the incremented research in the field of traditional medicine. According to Ayurveda, there are several medicinal plants has been identified to possess antidiabetic potential. Most of the herbal preparations from these medicinal plants are reported to have minimal or no side effects. Since the ancient period, herbal plants are being used to treat diabetes mellitus. Some of the very common and beneficial antidiabetic herbal plants of Indian origin are *Acacia arabica* (Babul), *Aegle marmelose* (Bael), *Agrimonia eupatoria* (Church steeples), *Allium cepa* (Onion), *Allium sativum* (Garlic), *Ghrita kumara* (Aloe vera), *Azadirachta indica* (Neem), *Benincasa hispida* (Ash Gourd), *Caesalpinia bonducella* (Fever Nut), *Citrullus colocynthis* (Bitter Apple) *Coccinia indica* (Ivy Gourd), *Ficus benghalenesis* (Banyan Tree), *Gymnema sylvestre* (Gurmar), *Hibiscus rosa-sinesis* (Gurhal), *Jatropha curcas* (Purging Nut), *Mangifera indica* (Mango), *Momordica charanti*a (karela), *Morus alba* (Mulberry), *Mucuna pruriens* (Kiwach), *Ocimum sanctum* (Tulsi), *Pterocarpus marsupium* (bisasar), *Punica granatum* (Anar), *Syzygium cumini* (Jamun), *Tinospora cordifolia* (Giloy), and *Trigonella foenumgraecum* (Methi). Shreds of evidence showed that the modern allopathic medicines which use currently to treat diabetes mellitus are also developed from the active chemicals of the medicinal plants. WHO has listed 21,000 plants for medicinal purposes around the world. Among these 2500 varieties are in India, out of which 150 species are used commercially on a moderately large scale. India is the largest producer of medicinal herbs and is called the botanical garden of the world.

4. Conclusion

Diabetes mellitus is a metabolic disorder with an increasing global prevalence and incidence. Elevated blood glucose levels are symptomatic of diabetes mellitus as

a consequence of insufficient pancreatic insulin secretion or poor insulin-directed mobilization of glucose by target cells. The main aim to this article was focuses on brief introduction of diabetes, classification and management. Diabetes mellitus is aggravated by and associated with metabolic complications that can consequently lead to premature death. This review explores diabetes mellitus in terms of its historical perspective, biochemical basis, economic burden, management interventions along with the future perspectives. New drugs are developing to treat diabetes and these important roles have a great impact on the prevention and management of this disease which improves patient's quality of life.

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None.

6. Conflict of Interest

None.

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