Chapter 1
Diabetes Mellitus: A Concise Review

Ruksar Salim Damji
UAE University, UAE

Shamiha Chowdhury
Manipal Academy of Higher Education, UAE

Zaib-Un-Nisa Munawar Hussain
Manipal Academy of Higher Education, UAE

ABSTRACT

Diabetes mellitus is a chronic metabolic disorder which is at present rapidly growing to an alarming epidemic level. Various pathogenic processes are involved in the development of diabetes mellitus. This spectrums from autoimmune destruction of pancreatic beta cells with consequent deficiency of insulin to abnormalities that lead to resistance to the action of insulin. In the 21st century, the astounding rise in obesity, poor diet, and inactive lifestyles have increased the prevalence dramatically. Although several therapies are in use, Western medications are associated with adverse drug reactions and high cost of treatment. Therefore, there is currently a growing interest in herbal medicines to replace or supplement the Western medications. Extensive research is essential to enhance diagnoses, treatment, and to lessen healthcare expenditures. This chapter provides an overview of the classification, diagnosis, symptoms, complications, and economic burden of diabetes mellitus. Additionally, the authors discuss the current and upcoming therapies to treat this metabolic disorder.

INTRODUCTION

Diabetes Mellitus (DM), is a chronic metabolic disorder characterized by hyperglycemia due to insulin resistance or insufficient insulin secretion (Blair, 2016). Diabetes is escalating at an alarming rate, reaching pandemic dimensions with massive economic, health and social consequences (Kaul, Tarr, Ahmad, Kohner & Chibber, 2012). Based on the (International Diabetes Federation, 2017) Atlas guideline reports,

DOI: 10.4018/978-1-7998-4808-0.ch001

in the year 2017, it was estimated that 425 million individuals were diagnosed with DM and this value is expected to increase to 629 million by the year 2045 (Salman, AlSayyad & Ludwig, 2019). One of the maximal prevalence of diabetes in the world is the United Arab Emirates (U.A.E), but in children, it has been considered as a rarity until recently (Pinhas-Hamiel & Zeitler, 2005).

Currently, the incidence of DM is increasing dramatically due to sedentary lifestyles, unhealthy diet, and a rise in obesity levels, imposing an immediate need for novel therapies to treat this condition. Besides, due to the progressive nature of this disorder, continual assessment of glucose via A1C test and individualized, tailored alterations of therapeutic regimens can improve the clinical outcome. Although they are currently several approaches to lessen the ill effects of DM and its associated complications, it is necessary to search for further efficacious agents with minimal side effects, to halt the rational usage of western drugs (Ekor, 2014). Herbal formulated medicines have a long history of usage to treat several diseases; and today, they are gaining attention to be used in treating DM. This chapter enumerates the pathophysiology, classification, symptoms, diagnosis, treatment, complications, prevention and economic burden associated with DM.

PATHOPHYSIOLOGY

Type 1 Diabetes Mellitus (T1DM) develops when the body's own immune system attacks and destroys the insulin producing β-cells of the pancreas. As β-cell mass declines, insulin secretion decreases up until the insulin available is insufficient to maintain normal blood glucose levels (absolute insulin deficiency). In the absence of insulin, sugar is accumulated in the bloodstream instead of entering the cells. As a result, the body is unable to utilize this glucose for energy (Figure 1 and Figure 2). Once 80-90% of β-cells are destroyed, hyperglycemia initiates to develop and diabetes may be diagnosed (Harvard, 2018).

Type 2 Diabetes Mellitus (T2DM) is commonly associated with certain environmental factors, genetic elements, lifestyle choices and the dynamic between these varied aspects. It involves the dysfunction of insulin producing pancreatic β-cells, insulin hormone resistance in body cells or a combination of both. This condition initiates with resistance to insulin that gradually worsens over time. The resistance and the inadequate production of insulin by β-cells ultimately lead to β-cell failure. Once the β-cells fail, endogenous insulin can no longer be secreted. The inability of cells to utilize the hormone insulin, which inhibits the cell's ability to absorb and utilize glucose in metabolic processes is known as insulin resistance. This is of primary matter in cells that are generally high in metabolic function such as: the liver, muscles and adipose tissues (Sun, 2014).

Majority of the type 2 diabetic patients, have abundant abdominal fat which can cause lipotoxicity. The abdominal fat is resistant to the antilipolytic effect of insulin thereby resulting in elevated levels of free fatty acids (FFAs). Raised free fatty acids exacerbates insulin resistance in the liver and muscle cells and thus increases the formation of glucose and impairs beta cell secretion. Excess fat tissues lead to enormous secretion of cytokines (adipokines and adipocytokines) associated with inflammation, endothelial dysfunction and thrombosis. Atherosclerosis due to insulin resistance is as a result of hypercoagulability, debilitated fibrinolysis and the combination of endothelial damage, oxidative stress and hyperglycemia. The pathophysiology of insulin dependent DM (type 1) and non-insulin dependent DM (type 2) is further portrayed in Figure 3 and Figure 4, respectively.