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Review article

The global burden of Type 2 diabetes: A review

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ABSTRACT

Prosperous food choices and sedentary life style synergize together for the occurrence of overweight and obesity among high risk groups of the population. Obesity is one of the major etiological risk factors for non communicable diseases including type 2 diabetes which is characterized by chronic hyperglycemia and impaired metabolism of carbohydrates, protein and fats. Type 2 diabetes is a multifactorial disease having genetics and environmental components contributing to its development. This review aims to highlight the association between type 2 diabetes, sedentary life style, dietary intake and depression.

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1. Introduction

1.1. Type 2 diabetes is a global health problem

Diabetes mellitus is considered as the number one killer among all chronic diseases. It is now ranks as the fourth most common cause of mortality with coronary artery disease.

Diabetes mellitus is a disease which takes epidemic form and its prevalence increase in scary rate. During the last fifteen years the prevalence of type 2 diabetes has increased by five folds worldwide [1]. There are about 200 million people around the world who are suffering from type 2 diabetes and the number is expected to reach 300 million cases by the year 2025. The main reason for this global increase in type 2 diabetes incidence is particularly associated with overweight and obesity [2]. The international diabetes federation (IDF) reported that the prevalence of diabetes mellitus has reached epidemic levels globally. The estimation of seven regions of IDF indicate 285 million adult have diabetes in 2010 which is compared to 2007 prevalence has increased by 39 million people and the expectation for 2030 is 439 million [3]. In the United States 17 million Americans have diabetes mellitus, 8% of the adult population and 19% of the population over the age of 65 years. Non-communicable diseases have emerged as major health problems in South Asia. The million death study in India reported that non-communicable diseases caused 41.3% of all deaths in the years

2001 to 2003; the remaining deaths were attributed to communicable, maternal, prenatal and nutritional diseases (33.4%), injuries (9.2%) and ill defined conditions (16.1%). Non-communicable disease and injuries caused 63.8% of the deaths in urban areas and 47.7% of deaths in the rural areas [4]. In the Middle East, the sultanate of Oman has a very high prevalence of type 2 diabetes mellitus which is around 10% of total population [5].

A recent study reported the global estimates of the prevalence of diabetes for 2010 and 2030, and in this study, all the Gulf countries have high prevalence of diabetes and Oman ranks 8 in the list of the 10 top countries for diabetes prevalence in 2010 and 2030. Whereas India has number one rank in the list of the 10 top countries for numbers of people aged 20 -79 years with diabetes in 2010 and 2030 [6].

2. Etiology of type 2 diabetes

Diabetes mellitus is a heterogeneous metabolic disease in which hyperglycemia is a central feature. The associated abnormalities in protein, carbohydrate, and fat metabolism are the result of insufficient insulin action on peripheral target tissues due to insufficient insulin secretion (type 1), diminished tissue response to insulin (type 2), or some combination of both. The requisite cell loss for type 1 diabetes, which develops in most individuals by age 20, apparently stems from a combination of genetic susceptibility and an autoimmune reaction presumably stimulated by an environmental insult [7].

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Type 2 diabetes mellitus is one of the most common chronic diseases and is associated with comorbidities, such as obesity, hypertension, hyperlipidemia (increased VLDL triglycerides and decreased HDL cholesterol), and cardiovascular disease, which taken together, comprise the 'Metabolic Syndrome' [8].

Type 2 diabetes mellitus is characterized by fasting and postprandial hyperglycemia and relative insulin insufficiency. If left untreated, then hyperglycemia may cause long term microvascular and macrovascular complications, such as nephropathy, neuropathy, retinopathy, and atherosclerosis [8].

3. Diagnosis of type 2 diabetes

The criteria for the diagnosis of diabetes mellitus have been changed on a number of occasions over recent years. In 1985, the World Health Organization (WHO) published diagnostic cut-points based on the 75 g oral glucose tolerance test (OGTT), which became the "gold standard" over subsequent years. The cut point of fasting plasma glucose (FPG) 7.8 mmol/l was used to separate people with and without diabetes. In 1997, the American Diabetes Association (ADA), followed by WHO in 1998, lowered this value to 7 mmol/l. The change was based on data that showed an increase in the incidence of diabetic retinopathy at this point and beyond, as well as the desire to reduce discrepancy in the number of cases detected by FPG and 2-h post-glucose load. However, some epidemiological studies have shown that lower levels of FPG than previously acknowledged (4.4 mmol/l) were associated with excess risk of cardiovascular mortality, illustrating that the current glucose values that were chosen as diagnostic cut-points are to certain extent arbitrary [9,10].

4. Type 2 Diabetes and Sedentary Lifestyle

Type 2 diabetes mellitus is linked with behavioural, environmental, and societal factors such as overweight, physical activity, sedentary behaviour, and unhealthy dietary habits. Obesity, sedentary lifestyles and diets that are rich in fats are known risk factors for diabetes. Both central obesity and high fat diets induce insulin resistance, which leads to hyperinsulinemia, the compensatory response to insulin resistance. Certain ethnic groups such as those of African, Hispanic, Native American and Asian descent are particularly vulnerable to diabetes and its complications. Hyperinsulinemia is often associated with further weight gain, which exacerbates hyperglycemia and leads to chronic over-production of insulin [8].

Physical activity, low intake of dietary fat (especially saturated fat) and adequate intake of complex carbohydrate and fiber can improve insulin action and secretion and hence enhance glucose disposal. Exercise is one of the main therapeutic measures to deal with high blood glucose levels in diabetic patients. It is believed to control hyperglycemia through the improvement of peripheral insulin sensitivity particularly in skeletal muscle. In addition, many studies have also described exercise as a countermeasure against many abnormalities observed in diabetic patients, such as hyperlipidemia, hypertension, and a tendency for hypercoagulation, which are considered to increase the risk of macro- and microvascular complications. These and many other chronic complications of diabetes mellitus seem to be attenuated by the regular practice of physical exercise [11].

Lifestyle factors, such as diet, physical activity and obesity, have a major influence on the development and progression of the conditions that precede the onset of type 2 diabetes and subsequent complications. The prevalence of unhealthy lifestyle

factors, such as inactivity and obesity, and their negative health consequences are rapidly increasing in the world. Physical inactivity, unhealthy diet and obesity have been estimated to account for about 14% of all deaths in the United States. According to conservative estimates, physical inactivity accounts for about 4% and obesity for about 7% of direct health care costs in the United States, figures that are comparable to those related to smoking. Modification of lifestyle factors is an important strategy for reducing the incidence of type 2 diabetes and subsequent complications [12].

Key actions for type 2 diabetes controls and prevention of complications are lifestyle modifications, primarily through diet and physical activity. However, more comprehensive care models face challenges from lack of human and physical infrastructure, to health personnel qualification. Social actors (primarily family members) represent a major support for such disease control and prevention specifically; population sociocultural environment is closely linked to a particular lifestyle, thus becoming a difficult to change process. Knowledge is a key tool for diabetic patients and family members to understand this disease. However, some particular barriers limit behavioural changes. Research on socially and culturally sensitive methods, focusing on environmental as much as on personal factors, is necessary for alternative interventions [13].

5. Association of Depression and Type 2 Diabetes

According to many studies type 2 diabetes has association with depression. In an earlier study from the European Depression in Diabetes Research Consortium, we have found that diabetes-specific emotional problems, such as feelings of guilt or anxiety when the patient gets off track with the diabetes management (2656%), concerns about food (2641%), fear of hypoglycaemia (2162%) or worries about complications (29 74%) were particularly common in patients with high levels of depression symptoms. Moreover, 79% Croatian, 47% Dutch and 41% English of the patients with a severe depression score reported to have four or more serious diabetes-specific emotional problems. For patients with low depression scores, these percentages were: 29% Croatian, 11% Dutch and 1% English [14].

Depression is another condition with high prevalence worldwide. Approximately 340 million people worldwide suffer from depression at any given time including 18 million in the United States. According to the World Health Organization (WHO), depression is responsible for the greatest proportion of burden associated with non-fatal health outcomes accounting for approximately 12% total years lived with disability. In 2000, it was estimated that depressive disorders were higher in women (4930 per 100,000) than men (3199 per 100,000) and that globally depressive disorders were the fourth leading cause of disease burden in women and seventh leading cause in men [3,14].

More than 18 million people in the United States have type 2 diabetes today, representing approximately 7% of the population (American Diabetes Association, 2007). Depression occurs in 27% of individuals with type 2 diabetes and is more prevalent in women (28%) than in men (18%). Younger individuals with diabetes have an increased incidence of depression [14].

Surveys and metaanalyses conducted on diabetes mellitus and depression have shown that the existence of diabetes mellitus doubles the probabilities of depression occurrence and that depressive symptoms were significantly more in women, than in men [1,3]. Depression is an important global public-health issue, both because of the relatively high lifetime prevalence ranging

from 2% to 15% and because it is associated with substantial disability [3].

The comorbidity of depression with chronic physical diseases such as arthritis and diabetes is well recognised in developed countries. Several studies have shown that there is an increased risk of having major depression in people with one or more chronic diseases. The clinical diagnosis of major depression is based on the presence of depressed mood and anhedonia during the same 2-week period and the presence of any five of the following symptoms: (i) depressed mood; (ii) markedly diminished interest or pleasure in activities; (iii) significant weight loss when not dieting or weight gain; (iv) insomnia or hypersomnia; (v) psychomotor agitation or retardation; (vi) fatigue or loss of energy; (vii) feelings of worthlessness or excessive or inappropriate guilt; (viii) diminished ability to think or concentrate; and (ix) recurrent thoughts of death, suicidal ideation, or a suicide attempt.

To meet criteria (i) these symptoms should represent a change from previous functioning and should occur most of the day. Minor depression is similar to major depression in which patients experience depressed mood or anhedonia during the same 2-week period. However, the patient's symptoms are fewer than the five items required to make a diagnosis of major depression. Dysthymia is characterized by depressed mood for most of the day, for more days than not, as indicated either by subjective account or observation by others, for at least 2 years. In addition, at least two of the following symptoms should be present while the patient is depressed (1): (i) poor appetite or overeating; (ii) low self-esteem; (iii) insomnia or hypersomnia; (iv) poor concentration or difficulty making decisions; (v) low energy or fatigue; and (vi) feelings of hopelessness. Patients with dysthymia typically have fewer symptoms (less than 5) than is required to make a diagnosis of major depression [1,3,7].

Diabetes and depression share common pathophysiological mechanisms and there are many theories which explain these mechanisms and how diabetes and depression can lead to the development of each other. Theoretically there is a reciprocal relationship between the dysregulation of the hypothalamic-pituitary axis in depression and in diabetes. Several studies have shown a significant correlation between depression and glycosylated haemoglobin, HbA1C, in individuals with type 1 diabetes.

In another study the increased risk of type 2 diabetes in individuals with depression is believed to result from increased counter regulatory hormone release and action, alterations in glucose transport function, and increased immuno-inflammatory activation. These physiologic alterations are thought to contribute to insulin resistance and beta islet cell dysfunction, which ultimately lead to the development of type 2 diabetes. The second hypothesis is that depression in patients with both type 1 and type 2 diabetes results from chronic psychosocial stressors of having a chronic medical condition [1,3,7].

Recent reports reported that depression was significantly associated with poor glycemic control in individuals with type 1 and type 2 diabetes and was associated with persistently higher HbA1c levels over the time period [15-17].

6. Depression, Diabetes and Obesity

Obesity is known as risk factor of type 2 diabetes and is also associated with depression. Obesity is a major public health concern. Among US adults, prevalence of obesity (defined as a body mass index or BMI of 30 or more) increased from

approximately 23% in 1990 to 31% in 2000 [18].

Obesity is a recognised health hazard in both physical and emotional health in most countries of the world. Numerous clinical as well as epidemiological studies have shown a strong association between obesity, diabetes mellitus, cardiovascular disease and stroke. The cost of treating cardiovascular disease and its complications is rising at an alarming rate in highly industrialised societies [19-21]. Overweight and obesity are risk factors for type 2 diabetes and cardiovascular diseases. On the other hand, diabetes may lead to microvascular (blindness, renal failure, neuropathy) and macrovascular (stroke, myocardial infarction, lower extremity amputations) complications. Obesity and depression are increasingly prevalent and associated with various health complications. Obesity is associated with hypertension, dyslipidemia, diabetes mellitus, coronary heart disease, stroke, as well as increased all cause mortality. Depression is associated with increased risk of coronary heart disease, myocardial infarction, heart failure in patients with systolic hypertension, low bone mineral density, and increased mortality [22].

Numerous epidemiologic studies examined the association between obesity and depression or other psychiatric disorders. Early research in the UK suggested a negative association between obesity and symptoms of depression or anxiety. Subsequent studies had variable results, with some finding no significant association between obesity and depression, some finding a positive association limited to women, some finding stronger associations in women than men and some finding associations limited to severe obesity [23-26].

Tobacco use, poor diet, physical inactivity and alcohol consumption are the leading preventable causes of death in the United States. Notably, evidence suggests that the risk of engaging in these behaviours is higher among people with certain psychiatric conditions, particularly depression and anxiety. For example, recent research indicates that people with major depression or anxiety disorders, particularly panic disorder, have a higher prevalence of regular smoking than those without such conditions [27,28].

7. Conclusion

Type 2 diabetes mellitus is a major health problem globally and it is associated with depression which needs effective intervention programs including health education and counselling for improving the well being of the type 2 diabetic patients.

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