Clinical Journal of Diabetes Care and Control
ISSN: 2642-0872

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Review Article *Volume 4 Issue 1*

Diabetes; Prevalence of Type 2 Diabetes and Mitigation

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Received Date: May 05, 2021; **Published Date:** May 27, 2021

Abstract

Diabetes is a chronic disease that arises when the pancreas does not produce enough insulin or when the body is unable to use the insulin effectively it produces. Insulin is a hormone that controls blood sugar. Type 2 diabetes mellitus (T2D) and obesity already represent 2 of the most prominent risk factors for cardiovascular disease, and are destined to increase in importance given the global changes in lifestyle. With rapidly increasing prevalence, diabetes has become one of the major causes of mortality worldwide. According to the latest studies, genetic information makes substantial contributions towards the prediction of diabetes risk and individualized ant diabetic treatment. To date, approximately 70 susceptibility genes have been identified as being associated with type 2 diabetes (T2D) at a genome-wide significant. New agents that better target insulin deficiency and insulin resistance, rapid- and long-acting insulin analogues that provide tight glucose control 24-hours a day, and noninvasive monitoring devices and insulin pumps allow physicians and patients to tailor treatment to each individual's particular needs and concerns.

Keywords: Insulin Resistance; Sugar Glucose; Overweight

Abbreviations: ER: Endoplasmic Reticulum.

Introduction

The occurrence of type 2 diabetes (T2D) is increasing rapidly due to increased economic growth and changes in lifestyle in both developed and developing countries. According to a recent report, the number of diabetics is estimated to reach 439 million by 2030 worldwide [1]. So, policies to prevent and treat diabetes are urgently needed in order to stem this global pandemic. It is well known that T2D is caused by -cell dysfunction and/or insulin resistance, which is promoted by multifactorial genetic or environmental factors [2]. In many reports, it has been suggested that being overweight pressures the insides of individual cells. Specifically, overeating stresses the membranous network inside of cells called endoplasmic reticulum (ER). When the ER has more nutrients to process than it can handle, it sends out an alarm signal telling the cell to dampen down the insulin receptors on the cell surface. This translates to insulin resistance and to persistently high concentrations of the sugar glucose in the blood -- one of the sure signs of diabetes. Obesity is also no longer a condition that just affects older people, although the likelihood does increase with age, and increasing numbers of young people have been diagnosed with obesity.

Links between Obesity and Type 2 Diabetes

While the exact causes of diabetes are still not fully understood, it is known that factors up the risk of developing different types of diabetes mellitus. For type2 diabetes, this includes being overweight or obese (having a body mass index – BMI – of 30 or greater). At least three distinct mechanisms have been proposed to link obesity to insulin resistance and predispose to type 2 diabetes: 1) increased production of adipokines/cytokines, including tumor necrosis factor-α, resistin, and retinol-binding protein 4, that contribute to insulin resistance as well as reduced levels of adiponectin [3]; 2) ectopic fat deposition, particularly in the liver and perhaps

also in skeletal muscle, and the dysmetabolic sequelae [4]; and 3) mitochondrial dysfunction, evident by decreased mitochondrial mass and/or function [5].

Mitochondrial dysfunction could be one of many important underlying defects linking obesity to diabetes, both by decreasing insulin sensitivity and by compromising β-cell function. On a global scale, the prevalence of obesity and type2 diabetes is increasing dramatically, and WHO reports that more than 500 million people are obese [6] and 346 million have diabetes, 90% of whom have been diagnosed with type2 diabetes [7]. Lifestyle and environmental factors are crucially important in the development of obesity and type 2 diabetes. Important risk factors for obesity are physical inactivity, excessive energy intake, depression, sleep disorders and low socioeconomic status, while major risk factors for type 2 diabetes include obesity, especially visceral fat deposition, physical inactivity, smoking, male sex, high age, sleep deprivation, urbanization, low-socioeconomic status and ethnicity [8].

Diabetes

Genetics, age and family history of diabetes can increase the likelihood of becoming diabetic and cannot be changed. But some behaviors that increase risk can:

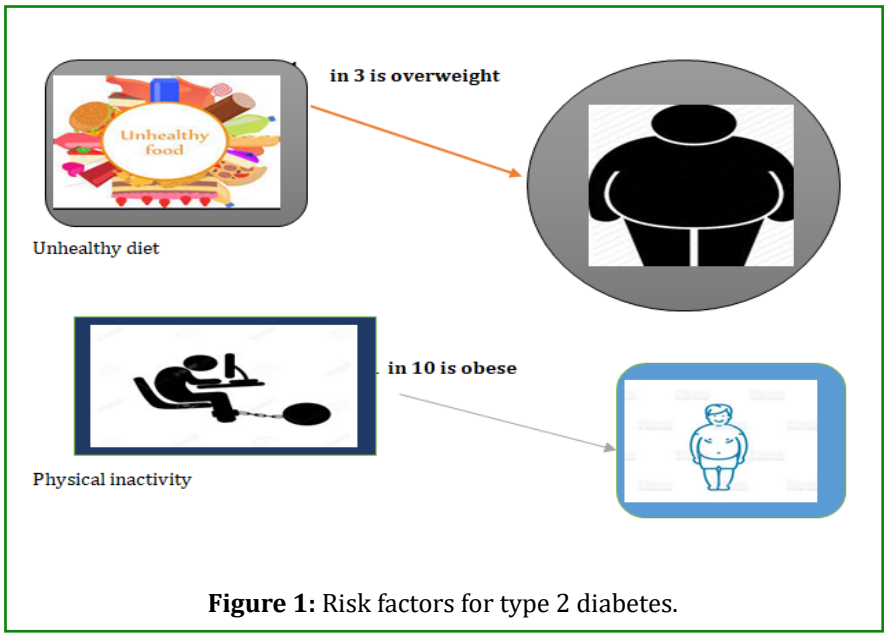

Figure 1: Risk factors for type 2 diabetes.

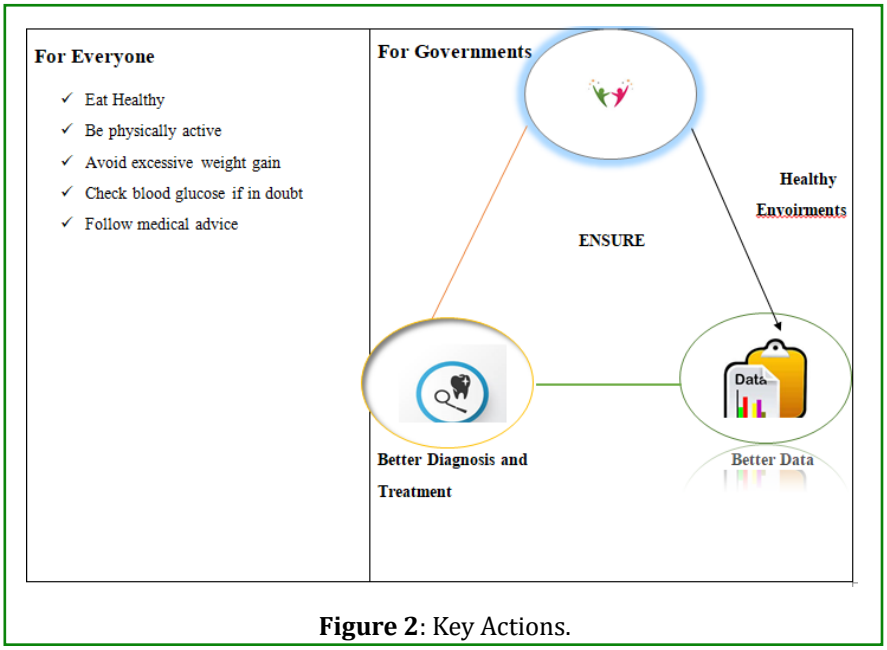

Figure 2: Key Actions.

Genetic Basis of Diabetes

The modern generalization of sedentary life and caloric abundance has created new physiological conditions capable of changing the level of expression of a number of genes involved in fuel metabolism and body weight regulation. It is likely that the genetic variants or alleles of these genes have in the past participated in the adaptation of human physiology to its evolutionary constraints [9]. The nature and prevalence of polymorphisms responsible for the quantitative variation of complex metabolic traits may have been different among human populations, depending on their environment and ancestral genetic background. These polymorphisms could likely explain differences in disease susceptibility and prevalence among groups of humans. From complex traits to potentially complex alleles, understanding the molecular genetic basis underlying quantitative variation will continue to be a growing concern among geneticists dealing with obesity and type2 diabetes, the main fuel disorders of the modern era [10].

Genomics and genetic epidemiology now allow high-level linkage and association studies to be designed. But the pooling of large trans-geographic cohorts may in fact increase the genetic heterogeneity of studied traits and dilute genotype-phenotype associations. Type 2 diabetes is a long-term, potentially crippling, and often fatal medical condition. This disease requires regular monitoring of an individual's blood sugar level and treatment [11]. Type 2 diabetes mellitus (T2D) and obesity already represent 2 of the most prominent risk factors for cardiovascular disease, and are destined to increase in importance given the global changes in lifestyle. Ten years have passed since the first round of genome-wide association studies for T2D and obesity. During this decade, we have witnessed remarkable developments in human genetics [12]. We have graduated from the despair of candidate gene-based studies that generated few consistently replicated genotype-phenotype associations, to the excitement of an exponential harvest of loci robustly associated with medical outcomes through ever larger genome-wide association study meta-analyses.

As well as discovering hundreds of loci, genome-wide association studies have provided transformative insights into the genetic architecture of T2D and other complex traits, highlighting the extent of polygenicity and the tiny effect sizes of many common risk alleles. Type 2 diabetes is a disorder characterized by abnormally high blood sugar levels [13]. In this form of diabetes, the body stops using and making insulin properly. Insulin is a hormone produced in the pancreas that helps regulate blood sugar levels. Specifically, insulin controls how much glucose (a type of sugar) is passed from the blood into cells, where it is used as an energy source [14].

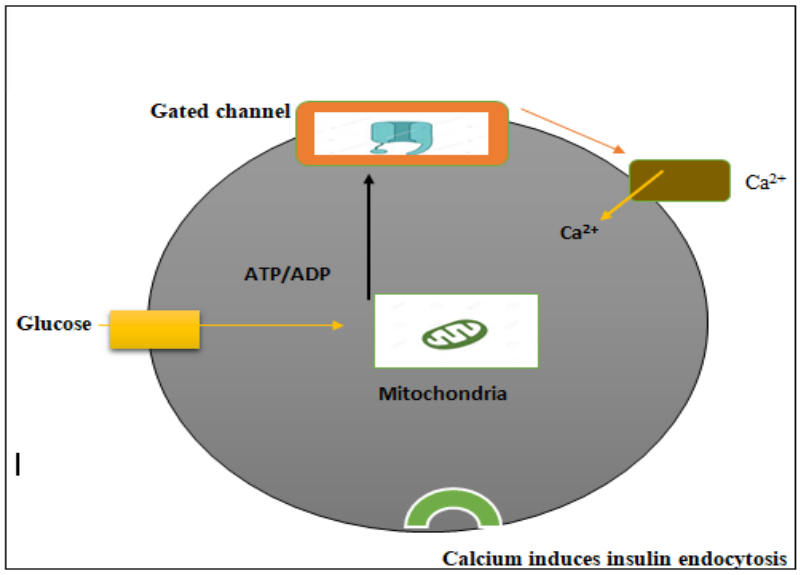

Figure 3: Calcium induces insulin endocytosis.

When blood sugar levels are high (such as after a meal), the pancreas releases insulin to move the excess glucose into cells, which reduces the amount of glucose in the blood. Most people who develop type2 diabetes first have insulin resistance, a condition in which the body's cells use insulin less efficiently than normal. As insulin resistance develops, more and more insulin is needed to keep blood sugar levels in the normal range. To keep up with the increasing need,

insulin-producing cells in the pancreas (called beta cells) make larger amounts of insulin. Over time, the beta cells become less able to respond to blood sugar changes, leading to an insulin shortage that prevents the body from reducing blood sugar levels effectively. Most people have some insulin resistance as they age, but inadequate exercise and excessive weight gain make it worse, greatly increasing the likelihood of developing type2 diabetes.

Type 2 Diabetes more Prevalent

Type 2 diabetes can occur at any age, but it most commonly begins in middle age or later. Signs and symptoms develop slowly over years. They include frequent urination (polyuria), excessive thirst (polydipsia), fatigue, blurred vision, tingling or loss of feeling in the hands and feet (diabetic neuropathy), sores that do not heal well, and weight loss. If blood sugar levels are not controlled through medication or diet, type 2 diabetes can cause long-lasting (chronic) health problems including heart disease and stroke; nerve damage; and damage to the kidneys, eyes, and other parts of the body.

Manifestation

The most common type of diabetes, type2 diabetes, accounting for 90 to 95 percent of all cases. The occurrence of diabetes increases with age, and the disease currently affects more than 20 percent of Americans over age 65. It is the seventh leading cause of death in the world. The risk of diabetes varies by ethnic and geographic background. The prevalence of diabetes is rapidly increasing worldwide. Due to rise in inactive (sedentary) lifestyles, obesity, and other risk factors, the incidence of this disease has more than quadrupled in the past 35 years.

Reasons

The causes of type 2 diabetes are complex. This condition results from a combination of genetic and lifestyle factors, some of which have not been identified. In addition to excess weight, there are many other facts that increase your risk of developing type2 diabetes, such as:

Family History and Genetics

People who have family members with type 2 diabetes are at a greater risk of developing it themselves. People who have a higher rate of diabetes include: Asians Pacific Islanders, American Indians and Alaskans.

Increased Age

As we age, the risk of type 2 diabetes becomes greater. The pancreas ages right along with us and don't pump insulin as accurately as it did when we were younger. As our cells age, they become more resistant to insulin as well.

High Blood Pressure and High Cholesterol

Not only do these two factors do damage to heart vessels, but they are two key components in metabolic syndrome. Having metabolic syndrome increases the risk of heart disease, stroke and type2 diabetes.

Other Names for this Condition

- Adult-onset diabetes
- Diabetes mellitus, non-insulin-dependent
- Diabetes mellitus, type 2
- Diabetes mellitus, type II

Conclusion

As obesity is a developing epidemic of modern societies, the co-incidence with diabetes is also developing. The resulting 'diabesity' raises the question whether weight management and diabetes should be targeted with combined treatment strategies. Type2 diabetes does not have a clear form of inheritance, although many affected persons have at least one close family member, such as a parent or sibling, with the disease. The risk of emerging type 2 diabetes rising with the number of affected family members. The increased risk is likely due to mutual genetic factors, but it is also related to lifestyle effects (such as eating and exercise habits) that are pooled by members of a family. New causes that better target insulin shortage and insulin resistance, rapid- and long-acting insulin analogues that provide tight glucose control 24-hours a day, and noninvasive monitoring devices and insulin pumps allow physicians and patients to tailor treatment to each individual's particular needs and concerns.

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