International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Uncontrolled Diabetes Mellitus Type II Prevalence Among Young, Middle, and Old-Aged Adults in Perambalur District Population of Tamil Nadu, India

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Abstract

This study is aimed to approximate the prevalence of uncontrolled diabetes mellitus among Perambalur District population of South TamilNadu. Diabetes mellitus (DM) is a chronic metabolic disorder due to insulin deficiency or resistance which can affect multiple organs of the body such as heart, kidneys and eyes. Uncontrolled diabetes mellitus (DM), refers to having high blood sugar levels (hyperglycemia). Uncontrolled diabetes is at a greater risk of diabetic complications and a significant health concern in Perambalur District of Tamil Nadu, Southern India, India. A study conducted in Dhanalakshmi Srinivasan Institute of Medical Sciences & Hospital, Perambalur district of Tamil Nadu, Southern India, India. The study included 454 uncontrolled diabetes mellitus subjects of which 60.35% uncontrolled diabetes mellitus in female population and 39.65% uncontrolled diabetes mellitus in male population. The study included 274 female subjects was further divided into three age groups, age group I (25 to 44 years) of 23.38% uncontrolled diabetes mellitus population, age group II (45 to 60 years) of 47.46% uncontrolled diabetes mellitus population, and age group III (61 to 85 years) of 29.20% uncontrolled diabetes mellitus population. The 180 uncontrolled diabetes mellitus male subjects was further divided into three age groups: age group I (25 to 44 years) of 32.22% uncontrolled diabetes mellitus population, age group II (45 to 60 years) of 42.22% uncontrolled diabetes mellitus population, and age group III (61 to 85years) of 25.56% uncontrolled diabetes population. This uncontrolled diabetes mellitus was confirmed by estimating glycated hemoglobin (HbA_{1C}) in these diabetes mellitus population. Our study confirmed that there may be a significant burden of diabetes mellitus related both micro vascular and macro vascular complications in this Perambalur district region of Tamil Nadu, Southern India, India.

Introduction

Diabetes mellitus is a chronic medical condition of carbohydrate metabolism characterized by impaired ability of the body to produce (1) or respond to insulin (2). In both cases, the levels of glucose in the blood increase, causing hyperglycemia (high blood sugar) (3). As glucose accumulates in the blood, excess levels of this sugar are excreted in the urine. Because of greater amounts of glucose in the urine,

more water is excreted with it, causing an increase in urinary volume (4) and frequency of urination as well as thirst. (The name *diabetes mellitus* refers to these symptoms: *diabetes*, from the Greek *diabainein*, meaning "to pass through," describes the copious urination, and *mellitus*, from the Latin meaning "sweetened with honey," refers to sugar in the urine.) (5) Other symptoms of diabetes include itching, hunger, weight loss, and weakness. and thereby maintain proper levels of sugar (glucose) in the blood by insulin. There are two major forms of the disease. Type 1 diabetes, formerly referred to as insulin-dependent diabetes mellitus (IDDM) (6) or juvenile-onset diabetes, usually arises in childhood, accounts for about 5 to 10 percent of cases of diabetes and 20% of new patients are adults. Type 2 diabetes, formerly called non- insulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes, usually occurs after age 40 and becomes more common with increasing age. Type 2 diabetes is far more common than type 1 diabetes, accounting for about 90 percent of all cases. The frequency of type 2 diabetes varies greatly within and between countries and is increasing throughout the world. Most patients with type 2 diabetes are adults, often older adults, but it can also occur in children and adolescents (7). Diabetes mellitus also may develop as a secondary condition linked to another disease, such as pancreatic disease (8); a genetic syndrome, such as myotonic dystrophy; or drugs, such as glucocorticoids (9). Gestational Diabetes is a temporary condition associated with pregnancy (10). In this situation, blood glucose levels increase during pregnancy but usually return to normal after delivery(11). However, gestational diabetes is recognized as a risk for type 2 diabetes later in life. Uncontrolled diabetes can lead to several serious health complications, including increased risk of heart disease, stroke, and hypertension, and even death. High blood sugar causes around 20 percent of cardiovascular death (12) s, as per the World Health Organization (13). It can also lead to kidney failure, and eye damage (14). Thus, the present study is aimed to approximate the prevalence of uncontrolled diabetes mellitus among Perambalur District population of South TamilNadu.

Materials and Methods:

Specimen used for glucose estimation was plasma smples that is free from hemolysis, as hemolysis can interfere with the accuracy of the test. Sodium fluoride is the preferred anticoagulant for collecting plasma. Its use is crucial because it inhibits glycolysis, thus preventing the breakdown of glucose in the blood sample, which could lead to inaccurately low glucose readings (16). Unless or otherwise specified all the blood samples colledcted from median cubital vein which is the most prominent superficial vein in the body.

Glucose was estimated by GOD (Glucose Oxidase) and POD (Peroxidase) method (17) in fully automated machine ERBA Mannheim EM 200. The Machine was calibrated using glucose standard solution containing 100mg/dl.

The GOD-POD reagent is a critical component. This enzyme reagent mixture contains glucose oxidase (GOD), peroxidase (POD), 4-aminoantipyrine, phenol, and a phosphate buffer with an approximate pH of 7.0. The assays are performed and the reaction mixtures are incubated at 37^{o} C for 10 minutes and. Following incubation, measure the absorbance of the solutions in the Standard (S) and Test (T) tubes at a wavelength of 540nm using a green filter automatically in the Erba Mannheim EM 200 autoanalyzer. This measurement is to be made against the Blank (B) as a reference. The glucose concentration is calculated by the auto-analyzer automatically. This calculated concentration provides a quantitative measure of glucose in the specimen, which is essential for diagnostic and monitoring purposes in various medical conditions, such as diabetes.

HbA1c (glycated hemoglobin) estimation is carried from whole blood collected drawn from from median cubital vein with EDTA and measured by immuno assay method(18) using Mouse-anti human HbA1c monoclonal antibody binds to particle bound HbA1c and Goat anti--mouse IgG polyclonal antibody interacts with the monoclonal mouse anti-human HbA1c antibody at 37º C and agglutination takes place in the buffer system of 3-cycloamino-1-propanesulphonic acid buffer pH 9.0 adjusted with Sodium hydroxide and Boric acid. The measured absorbance at 660nm is proportional to the HbA1c bound to particles, which in turn is proportional to the percentage of HbA1c in the sample automatically in the Erba Mannheim EM 200 autoanalyzer and we used Erba Mannheim XL System Packs reagents in all our experiments performed.

In this present study we collected 454 patient's venous blood samples that include 274 females and 180 males from our Central Clinical Biochemistry Laboratory, Dhanalakshmi Srinivasan Institute of Medical Sciences and Hospital, Thuraiyur Main Road, Tamil Nadu-PIN 621212, India.

Results and Discussion:

In this study we found uncontrolled diabetes mellitus in 454 patients that include 274 female patients and 180 male patients. They are further classified into three age groups based age group I (25 to 44 years) of 23.38% uncontrolled diabetes mellitus population, age group II (45 to 60 years) of 47.46% uncontrolled diabetes mellitus population, and age group III (61 to 85 years) of 29.20% uncontrolled diabetes mellitus population. The 180 uncontrolled diabetes mellitus male subjects was further divided into three age groups: age group I (25 to 44 years) of 32.22% uncontrolled diabetes mellitus population, age group II (45 to 60 years) of 42.22% uncontrolled diabetes mellitus population, and age group III (61 to 85years) of 25.56% uncontrolled diabetes population. This uncontrolled diabetes mellitus was confirmed by estimating glycated hemoglobin (HbA_{1C}) in these diabetes mellitus population. In this study we found that the fasting blood glucose (FBG) in the age group I and II of both males (Table No.1) and females (Table No.2) are more than renal threshold (180 mg/dl), indicates that may be glycosuria, which may be an increased amount of glucose in the urine. This can happen when the glomerurular filtrate has more glucose than the renal tubules can restore or when the plasma glucose is high. This happens in uncontrolled diabetes mellitus Type II population. Both Post Prandial Blood Sugar (PPBS) and Random Blood Sugar (RBS) in all the three age groups of both male (Table No.1) and Female (Table No.2) have extremely very high blood sugar levels. This is supported by high percentage values of Glycated hemoglobin (HbA1c) in all the three age groups I, II, III of both males and females. Glycated Hemoglobin is a form of hemoglobin that is chemically linked to sugar molecule (19) a protein in red blood cells that carries oxygen (20). Sugar molecules, such as glucose, can attach to hemoglobin in the bloodstream through a sponateous (non-enzymatic) process called glycation. The higher the blood sugar level, the more hemoglobin becomes glycated. HbA1C is a marker of long term blood sugar (21) control in people with diabetes mellitus. The hemoglobin A1c (HbA1c) test measures the amount of blood sugar (glucose) attached to the hemoglobin at N-terminal amino acid residue of Valine of beta subunit of hemoglobin (22) and epsilon amino group of lysine residues of both alpha and beta subunits. Hemoglobin (23) is the part of your red blood cells that carries oxygen from your lungs to the rest of your body. Red blood cells are active for 2-3 months. This is something that is made when the glucose (sugar) in your body stick to red blood cells and cannot use it properly (24), resulting raising blood sugar, leads to uncontrolled diabetes mellitus type II.

Table No: 1 Uncontrolled Diabetes Mellitus Type II among Male Population

Serial No	Parameters	Normal	Age Group I (25-44 years)	Age Group II (45-60 years)	Age Group III (61years- above)
1	Fasting Blood Sugar (FBS) mg/dl	83.8 +/- 8.6	233.5 +/- 79.0	186.2 +/- 64.7	134.0 +/- 22.8
2	Post Prandial Blood Sugar (PPBS) mg/dl	149.5 +/- 8.7	392.3 +/- 130.0	330.7 +/- 83.5	262.7 +/- 95.0
3	Random Blood Sugar (RBS) mg/dl	126.8 +/- 3.6	319.6 +/- 124.0	283.0 +/- 86.7	202.0 +/- 46.6
4	Glycated Hemoglobin (HbA1C) %	3.28 +/- 0.634	9.76 +/- 3.49	10.5 +/- 2.75	8.45 +/- 2.56
5	Number of Sample used	20	58	76	46

It is an important blood test that gives a good indication of how well your diabetes is being managed. an ideal HbA1c level is 48mmol/mol (6.5%) or below. A high HbA1c means high blood sugar level, may develop diabetic complications (25, 26), serious problems with eyes and feet.

Table No: 2 Uncontrolled Diabetes Mellitus Type II among Female Population

Serial No	Parameters	Normal	Age Group I (25-44 years)	Age Group II (45-60 years)	Age Group III (61years-above)
1	Fasting Blood Sugar (FBS) mg/dl	83.8 +/- 8.6	187.3 +/- 39.9	185.9 +/- 60.5	155.6 +/- 51.6
2	Post Prandial Blood Sugar (PPBS) mg/dl	149.5 +/- 8.7	335.2 +/- 97.78	362.5 +/- 84.0	274.7 +/- 66.0
3	Random Blood Sugar (RBS) mg/dl	126.8 +/- 3.6	273.8 +/- 87.1	282.5 +/- 81.6	243.9 +/- 48.1
4	Glycated Hemoglobin (HbA1C) %	3.28 +/- 0.634	9.7 +/- 1.9	9.2 +/- 2.7	8.17 +/- 1.3
5	Number of Sample used	20	64	130	80

Summary:

In summary, Uncontrolled diabetes mellitus is a significant health concern in Perambalur district of South Tamil Nadu, This may lead to various complications that include increased risk of cardiovascular complications, heart and blood vessels issues, nerve damage, blurred vision and serious eye problems, kidney damage, weaked immune system, depression, increased risk for dementia, bone disease, mensural irregularities and fertility issues, digestive problems, foot and skin complications, recurrent infections, fatigue, weakness, unexplained sudden weight loss, increased hunger (polyphagia), excessive thirst (polydipsia),and frequent urination (polyuria). Thus, it is important that managing blood sugar levels is a crucial to prevent or minimize these complications. Regular monitoring, healthy diet, physical activity, and appropriate medications are essential for managing uncontrolled diabetes mellitus among Perambalur district population, in South Tamil Nadu.

Conclusion:

To conclude Uncontrolled Diabetes Mellitus (Uncontrolled hyperglycemia) has a high prevalence among population of Perambalur District in Tamil Nadu is a major public health issue. This uncontrolled diabetes mellitus Type II is unevenly distributed based on geographic location of Perambalur District and urbanization. Prevention, early detection and treatment stratigies and educating the public through hospital campaign should be considering uneven distribution of uncontrolled diabetes.

Acknowledgement:

We acknowledge the support of the Chancellor, the Dean, the Medical Superintendent and the Management, Dhanalakshmi Srinivasan Institute of Medical Sciences and Hospital, given to us dispassionately throughout this study. We also acknowledge all our technicians Central Clinical Biochemistry Laboratory for their valuable assistance. We also acknowledge all the patients of Dhanalakshmi Srinivasan Institute of Medical Sciences Hospital, without their presence, this study could not be possible.

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