Adiposity contributes to poor glycemic control in people with diabetes mellitus, a randomized case study, in South Kashmir, India

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ABSTRACT

Background: Diabetes mellitus (DM) is a significant health burden and recent reports suggest that the incidence of diabetes is increasing. Poor knowledge, fear of use of new drugs, and lack of awareness of the importance of the control of the disease are common among primary care physicians caring for diabetes patients. Many diabetes patients continue to be underdiagnosed, undertreated, increased use of expensive acute health-care services, and reduced quality of life. Aims and Objectives: The aim was to study the poor control of DM and the associated risk factors associated with Type 2 DM, to spread awareness about DM, to assess the prevalence, treatment, and control of diabetes, to examine the relationship of obesity with raised blood glucose, and finally, to evaluate the effect of the educational level on glycemic control. Study Material: This study was conducted to evaluate the control of diabetes in South Kashmir, India. It was done among patients in the Outpatient Department of Medicine, MMAB Memorial Hospital (GMC Associated Hospital) Anantnag, Kashmir. A random sampling procedure was adopted for the study, and a total of 300 patients were studied over a period of 5 months, which included 155 men and 145 women. During a period of study, within the age group of 36-50 years with adiposity were assessed for glycemic control. Methodology: All patients underwent anthropometric assessment and blood pressure measurements. Fasting blood sample was obtained for plasma glucose and lipids. Patients were assessed for weight and body mass index. Results: The prevalence of uncontrolled glycemia was more frequent in women as compared to men because of adiposity.

Keywords: Coronary artery disease, diabetes mellitus, dyslipidemia, obesity

Introduction

Diabetes is fast gaining the status of a potential epidemic in India with more than 62 million diabetic individuals currently diagnosed with the disease. In 2000, India (31.7 million) topped the world with the highest number of people with diabetes mellitus (DM), followed by China (20.8 million) with the United States (17.7 million) in second and third places, respectively. According to Wild et al., the prevalence of diabetes is predicted to double globally from 171 million in 2000 to 366 million in 2030 with a maximum increase in India. It is predicted that by 2030, DM may afflict up to 79.4 million individuals in India. The incidence of diabetes rises as the population ages and as the prevalence of obesity increases. The etiology of diabetes in India is multifactorial and includes genetic factors coupled with environmental influences such as obesity associated with rising living standards, steady urban migration, and lifestyle changes.¹²

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Diabetes is a common chronic disorder characterized by chronic hyperglycemia with disturbances of carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion, insulin action, or both. Its impact is manifested in patients, their families, and the community as a whole in terms of lost work, poor quality of life, frequent emergency department visits, hospitalizations, and death cases. Therefore, international guidelines have been developed to help the physicians to manage diabetes in a better way and deal with different presentations and situations using the best available evidence methods. Obesity and overweight affect more than 75% of the adult population. India is already being popularized “diabetes capital” of the world and so not far behind in crippling the manpower reservoir of the country. They are known to predispose to many health problems, including diabetes, hypertension (HTN), coronary artery diseases, and some other diseases. Obesity is recognized as a major health problem in both developed and developing countries. In India, obesity is emerging as an important health problem, paradoxically coexisting with significant undernutrition prevailing in different sections of the population. According to Rao-Mohan et al., despite having lower overweight and obesity rates, India has a higher prevalence of diabetes compared to western countries suggesting that diabetes may occur at a much lower body mass index (BMI) in Indians compared with Europeans. Therefore, relatively lean Indian adults with a lower BMI may be at equal risk as those who are obese. The steady migration of people from rural to urban areas, the economic boom, and the corresponding change in lifestyle are all affecting the level of diabetes. The level of morbidity and mortality due to diabetes and its potential complications are enormous and pose significant health-care burdens on both families and society.

**Diabetes mellitus**

“Diabetes means you have too much sugar in your blood. High blood sugar problems start when your body no longer makes enough of a chemical, or hormone, called insulin.” Literal meaning – “sweet urine.” Normal urine contains no sugar. There is sugar (or more correctly glucose) in the urine because the amount of glucose in the blood has built up so much that it spills out into the urine. The amount of glucose builds up in the blood because the body is not able to use the glucose properly. Thus, diabetes is a disorder in which the body cannot make proper use of glucose. The term DM describes a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion, insulin action, or both. Diabetes is a chronic disease. Diabetes affects many body parts; it can cause damage to nerves and blood vessels in the eyes, kidneys, heart, and lower legs if it is not controlled.

Diabetes complications are health problems that can occur when blood glucose remains high over a long period of time. Mouth problems, such as gum disease or problems with teeth. Eye disease (diabetic retinopathy): decreased vision and in some cases, blindness. Heart and blood vessel diseases (cardiovascular diseases [CVD]), such as heart attack, stroke, and peripheral artery disease (poor blood flow in the feet and legs) Kidney disease (diabetic nephropathy): the kidneys may not work as well or may stop working.

**Etiological classification**

Type 1: (Insulin-dependent diabetes/beta-cell destruction, usually leading to absolute insulin deficiency)

- Autoimmune
- Idiopathic
  - A. The pancreas produces very little insulin, if any
  - B. More common in children and young adults, but can occur at any age
  - C. Requires balance of insulin injections (sometimes with oral medications too), activity, meal planning, and lifestyle changes.

**Symptoms**

Frequent urination, abnormal thirst, unusual hunger, rapid weight loss, fatigue and weakness, nausea, and irritability are the symptoms.

Type 2: (May range from predominantly insulin resistance with relative insulin deficiency to predominantly secretory defect with or without insulin resistance). The pancreas produces some insulin, but it may not be enough to keep blood glucose at a normal level or the cells may be resistant to the insulin produced. Most common in persons over 40 years of age, but increasing in teenagers and young children.

**Symptoms**

Drowsiness, dry, itchy skin, weight gain or weight loss (unintentional), blurred vision, tingling, numbness, pain in lower legs, easy fatigue, slow healing of cuts or scratches, frequent infections (e.g., vaginal infections), requires balance of food, activity, lifestyle management, and in some cases oral medications or insulin.

**Other specific types**

Genetic defects of beta-cell function, genetic defects in insulin action, diseases of the exocrine pancreas, endocrinopathies, drug- or chemical-induced, infections, uncommon forms of immune-mediated diabetes, other genetic syndromes sometimes associated with diabetes, and gestational diabetes.

**Diabetes risk factors**

The etiology of diabetes in India is multifactorial and includes genetic factors coupled with environmental influences such as obesity associated with rising living standards and steady urban migration.

1. Physical inactivity
2. First-degree relative with diabetes/high-risk race/ethnicity
3. Women who delivered a baby >9 lb or were diagnosed with gestational DM
4. High-density lipoprotein-cholesterol <35 mg/dl ± triglycerides >250 mg/dl
5. HTN (≥140/90 mmHg or on therapy)
6. Glycated hemoglobin (HbA1C) ≥5.7%, impaired glucose tolerance, or impaired fasting glucose on previous testing
7. Conditions associated with insulin resistance: severe obesity, acanthosis nigricans, polycystic ovarian syndrome, and CVD history.

Diagnostic criteria

The clinical diagnosis of diabetes is often prompted by symptoms such as increased thirst and urine volume, recurrent infections, unexplained weight loss, and in severe cases, drowsiness and coma; high levels of glycosuria are usually present. A single blood glucose estimation in excess of the diagnostic values indicated in figure establishes the diagnosis in such cases. It also defines levels of blood glucose below which a diagnosis of diabetes is unlikely in nonpregnant individuals.

1. Unless the clinical diagnosis is clear, the same test to be repeated using a new blood sample for confirmation
2. Type 2 diabetes testing should be done in all adults who are overweight or obese (BMI ≥25)
3. Testing should be done at age 45, especially if the individuals overweight or obese. If normal results: repeat testing in ≥3-year intervals.

Frequency of HbA1C testing: at least two times each year in patients who are meeting treatment targets and have stable glycemic control (quarterly in patients whose therapy has changed or who are not meeting glycemic control).

Individual diagnosis

The requirements for individual diagnosis differ from those of population studies. The diagnosis should not be based on a single glucose determination but requires confirmatory symptoms or blood/plasma determination. The diagnosis requires the identification of people at risk for the development of complications in whom early preventive strategies are indicated. Ideally, therefore, both the 2-h and the fasting value should be used.

These recommendations contrast with those of the American Diabetes Association Expert Committee which gives primacy to the fasting plasma glucose. The reason for this is that most of the population does not understand the nature of the disease and its consequences. Poor diabetic control leads to many complications that require hospitalization and sometimes severe and drastic measures to help keep the patient alive. Some do not understand that this is preventable and possible to deal with once diagnosed. Obesity and a sedentary lifestyle are precursors to Type 2 diabetes. As professionals, we know that diabetes is harmful and that it leads to serious medical complications. Diabetes is critical; it must be respected and taken seriously by all. It is crucial that we make a change. This change will come about when we the professionals can educate the diabetic population about their disease and help them overcome their misconceptions about its treatment. Educating the patient and his/her family on diet, exercise, and foot care, for example, can form the best and most effective method to treat diabetes and prevent the potential long-term complications. In an effort to achieve these recommended changes, we must as a society encourage the medical people to promote better understanding of such a disease. Age is always a key factor because the risk of DM increases steeply with age.\[4-6\]

Aims and objectives

1. To study the poor control of DM
2. To study risk factors associated with Type 2 DM
3. To assess the prevalence, treatment, and control of diabetes
4. To examine the relationship of obesity with raised blood glucose
5. To evaluate the effect of the educational level on glycemic control.

Research Design and Methods

The study was conducted among the patients in the Outpatient Department (OPD) of Medicine, MMAB Memorial Hospital (GMC Associated Hospital) Anantnag, Kashmir. A total number of 300 patients were studied over a period of 5 months which including 155 men and 145 women. The sample size was calculated for moderate effect size taking the confidence interval as 95%. For the estimation of sample size, the formula used for calculation of the power of the study was (1-β) and the estimated power was 90%; the effective size required for the study was 300. The analysis for data was done using the Chi-square test and Student's t-test at appropriate places and 5% was considered as a level of significance, i.e., value <05. The prevalence of obesity among diabetic patients was high; most of the patients have poor diabetic control, whereas less than one-third of the patients had good diabetic control. All patients underwent anthropometric assessment such as measurement of height, weight, BMI, waist circumference, and blood pressure. The duration of DM, treatment used for DM (diet alone, oral hypoglycemic agents, and insulin or both insulin and oral hypoglycemic agents), frequency of visits for checkup, awareness of diabetic complications, and self-care management behavior. Waist circumference was measured in minimal light clothing. Height and weight were taken with a beam balance with minimal clothing and no footwear. The BMI was obtained by dividing weight in kg by the square of the height in meters. Blood pressure was estimated in the nondominant arm in the sitting position. It was measured 5 min after the patient was comfortable using the correct-sized cuff. After an overnight fast of at least 8 h, a nonheparinized venous blood sample was taken, serum was separated within 2 h of venipuncture, and analysis was done within 24 h. Biochemical parameters were analyzed with commercially available enzymatic reagents.

Results

A total number of 300 patients were studied over a period of 5 months which included 155 men and 145 women. The prevalence of obesity among diabetic patients was high; most of the patients have poor diabetic control, whereas less than one-third of the
patients had good diabetic control. All patients underwent anthropometric assessment such as measurement of height, weight, BMI, waist circumference, and blood pressure [Table 1].

### Discussion

The major health consequences associated with overweight and obesity are Type 2 diabetes, coronary heart diseases, HTN, gallbladder disease, certain types of cancer, dyslipidemia, and insulin resistance. Many Asian races show a tendency for fat deposition in the abdominal area which is known as central adiposity. Hyperinsulinemia and insulin resistance are closely associated with central adiposity. Visceral fat increases the risk of diabetes and hyperlipidemia by favoring insulin resistance. The increased risk posed by intra-abdominal fat for diabetes and other metabolic diseases could be related to higher fat cell number in the abdominal adipose tissue, higher blood flow, increased receptors for cortisol and testosterone, and greater catecholamine-induced lipolysis when compared with the subcutaneous adipose tissue. In addition, there is a marked increase in the flux of nonesterified fatty acids to the liver in abdominally obese patients. There is sufficient evidence to show that abdominal obesity causes insulin resistance, and it is a key component of the metabolic syndrome. [3] Racial susceptibility to insulin resistant and metabolic syndrome has been demonstrated, and Indians are highly susceptible to both. [4,5] Obesity is a modifiable disorder; there is evidence from many prospective studies that weight reduction by lifestyle modifications including dietary changes and regular physical activity reduces the risk of diabetes in high-risk groups. Implementation of preventive measures from early childhood will have far-reaching benefits as even the prevalence of other obesity-related disorders could decline. The current study that included most of the diabetics attending the OPD showed that more than 70% of the patients suffered from overweight and obesity. Previous studies showed that overweight and obesity are common morbidities among diabetics regarding diabetic control, this study found that poor diabetic control.[6,7]

### Conclusion

Obesity is one of the major risk factors for diabetes, yet there has been little research focusing on this risk factor across India. Almost every organ in the body can be adversely affected with the onset of diabetes, but with timely intervention and care, the disease can be kept under check.

### Table 1: Characteristics of patients (n=300)

| Gender | Height (cm) | Weight (kg) | BMI | Waist circumference (inches) | Blood pressure control (%) | Blood sugar control (%) |
|--------|-------------|-------------|-----|------------------------------|---------------------------|------------------------|
| Male   | 165-170     | 65-73       | 24.5-26 | 30-32 | Mild (n=70); Mild (n=99); 45.16 (n=69.67) | 67.58 (n=83.40) |
| Female | 152-158     | 67-77       | 26.5-29 | 32-36 | Moderate Poor (n=98); (n=121) | 69.67 (n=83.40) |

BMI=Body mass index

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### Conflicts of interest

There are no conflicts of interest.

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