1.1 Definition

Diabetes mellitus is a syndrome of multiple etiologies characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. This disorder is often associated with long term complications, involving organs like eyes, kidneys, nerves, heart and blood vessels.

1.2 Epidemiology

In recent decades, India has witnessed a rapidly exploding epidemic of diabetes. Indeed, India today has the second largest number of people with diabetes in the world. The International Diabetes Federation (IDF) estimates that there are 72.9 million people with diabetes in India in 2017, which is projected to rise to 134.3 million by the year 2045. The prevalence of diabetes in urban India, especially in large metropolitan cities has increased from 2% in the 1970s to over 20% at present and the rural areas are also fast catching up.

1.3 Types of diabetes

According to the American Diabetes Association and the World Health Organisation, diabetes can be classified into four main types **(see Box)**.

Classification of Diabetes

- Type 1 diabetes
- Type 2 diabetes
- Gestational diabetes
- Other types of diabetes (Monogenic diabetes, pancreatic diabetes, drug-induced diabetes etc.)

Of these, the two most important forms of diabetes are type 1 and type 2 diabetes. Type 1 diabetes is primarily due to autoimmune-mediated destruction of pancreatic beta cells, resulting in absolute insulin deficiency and thus requiring insulin for good health and survival. While type 1 diabetes is also on the increase, the actual numbers of people with type 1 diabetes in India is, relatively speaking, still small. Type 2 diabetes, on the other hand, accounts for over 90-95% of all people with diabetes and is characterized by insulin resistance and abnormal insulin secretion, either of which may predominate. The diabetes epidemic relates particularly to type 2 diabetes, and predominantly due to the changing lifestyles, urbanization, demography and increased longevity.

1.4 Differentiating Between Type 1 and Type 2 Diabetes

Table 1.1 below provides a few clinical points to differentiate between type 1 and type 2 diabetes.

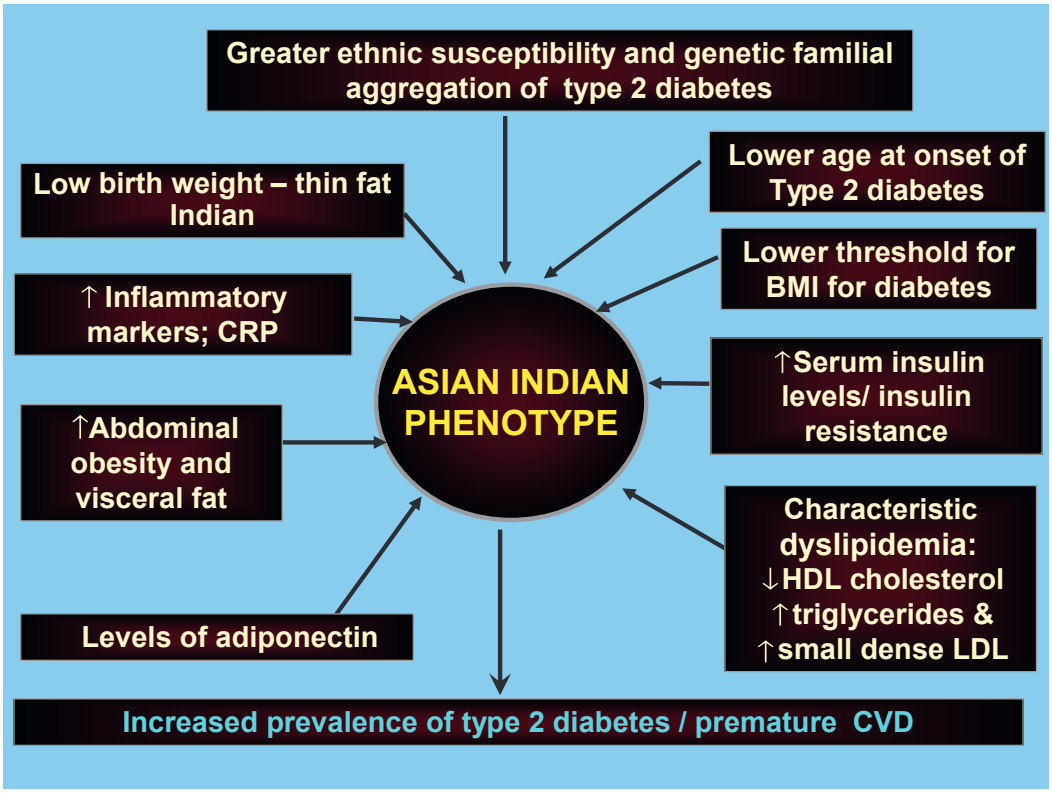
Table 1.1 Points to differentiate between type 1 and type 2 diabetes

	Type 1 diabetes	Type 2 diabetes
Age at diagnosis	Usually childhood and adolescence, but can occur in adults as well	Usually postpubertal; most common in middle to later age groups
Diabetes in 1st degree relative	Unusual	Common
Severe osmotic symptoms/ Ketosis at diagnosis	Can occur	Rare
Markers of insulin resistance	Absent	Present
C-peptide assay	Absence of beta-cell reserve	Preserved beta-cell reserve
Pancreatic autoantibodies	Present	Absent

Type 1 diabetes will not be discussed further in these guidelines and they pertain chiefly to type 2 diabetes.

Type 2 diabetes is a metabolic-cum-vascular syndrome characterized by predominant insulin resistance with varying degrees of insulin secretory defect. It is a progressive disease often associated with central obesity, dyslipidaemia and hypertension. It is more common in overweight and obese individuals of middle to late age but is increasingly being seen in younger age groups and in those with lower body mass index (BMI) as well. The "Asian Indian phenotype" refers to a peculiar constellation of abnormalities in south Asians, whereby for any given level of BMI, they tend to have higher total body fat, visceral fat, insulin resistance and prevalence of diabetes compared to white Caucasians (**Figure 1.1**).

Figure 1.1: The "Asian Indian phenotype"



1.5 Goals for management

- Relief from symptoms of diabetes and improvement in quality of life
- Glycemic control and prevention of acute complications
- Identification and management of comorbid conditions like obesity, hypertension and dyslipidaemia
- Prevention of microvascular complications like retinopathy, neuropathy and nephropathy
- Prevention of macro-vascular complications like cardiovascular, cerebrovascular and peripheral vascular disease
- Prevention of infections

The complete treatment of people with diabetes requires advocating a healthy life style with focus on increased physical activity and a proper balanced diet in addition to prescribing medications.

1.6 Diabetes Education

Diabetes education means empowering people with diabetes with knowledge and providing tools crucial for making them active partners in the diabetes management team. These include:

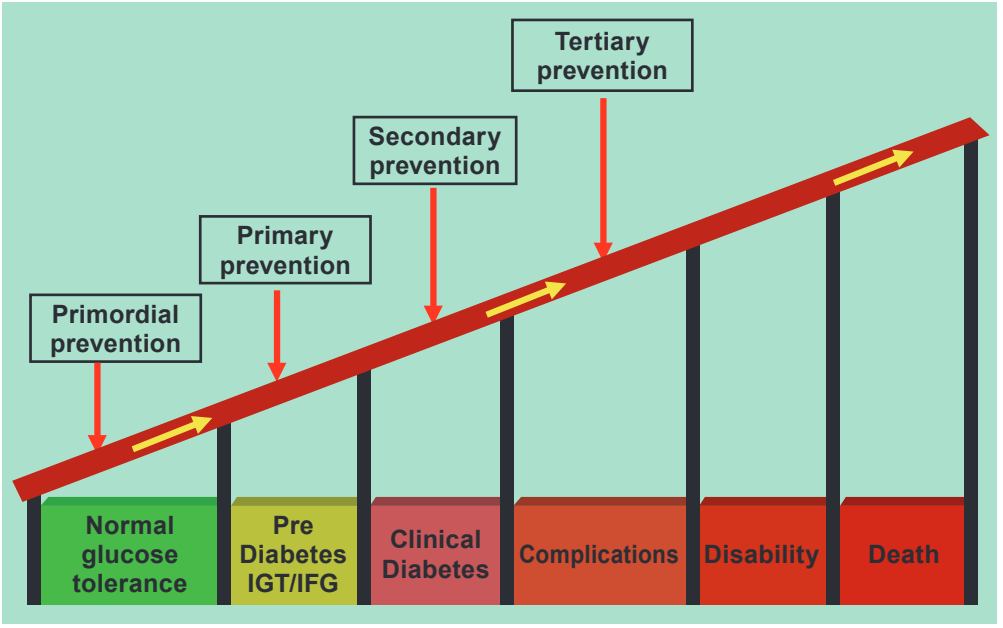
- In-depth information about diabetes, its complications and treatment
- Appropriate self care skills
- Appropriate resources for self care
- A positive attitude
- Self monitoring skills

The compliance of people with diabetes is essential for effective management of diabetes. Education programmes are intended to help people to understand why these actions are so important and thereby increase their motivation for self-management.

1.7 Prevention of Diabetes

There is an urgent need for strategies to prevent or at least slow down the emerging epidemic of diabetes apart from treating diabetes and associated complications. Several factors are thought to contribute towards the acceleration of the epidemic, the most important being the rapid epidemiological transition due to urbanization and life style changes. Identifying individuals at risk is essential in planning preventive measures. Prevention of diabetes has several windows of opportunities (**Figure 1.2**).

Figure 1.2: Levels of prevention of diabetes



The three stages of prevention are:

1.7.1 Primordial prevention attempts to reduce the risk factors for diabetes, e.g., reducing or preventing obesity to reduce the future risk of diabetes.

1.7.2 Primary prevention targets people who are in the stage of prediabetes to prevent the onset of diabetes. All people with prediabetes should be regularly screened and encouraged at each health care visit to pursue a healthy life-style, including a healthy diet, adequate exercise and weight control in order to prevent diabetes. Several studies including from India have shown that diabetes can be prevented in up to a third of people with prediabetes. When lifestyle alone is not sufficient and especially in those with combined IFG and IGT where progression to type 2 diabetes appear imminent, use of metformin in addition to lifestyle measures may be considered especially in Indians who progress rapidly to diabetes from the prediabetes stage.

1.7.3 Secondary prevention is to prevent the onset of complications in those who are already diagnosed to have diabetes. This can be achieved by meticulous control of diabetes with the help of diet, physical activity, life style modification and antihyperglycaemic drugs as indicated. Control should include holistic care beyond glycemic control i.e. attention to blood pressure, lipids etc.

1.7.4 Tertiary prevention of diabetes is aimed at limiting physical disability and rehabilitation measures in those who have already developed diabetic complications and preventing them from going into end stage complications of diabetes.

Type 2 diabetes occurs a much earlier age (at least a decade earlier) in Indians compared to other major ethnic groups. Screening of asymptomatic individuals allows diagnosis of diabetes and prediabetes to be made at an earlier stage and thus appropriate management can be instituted. In addition, it provides an opportunity for screening of cardiovascular disease (CVD) risk factors and the institution of interventions for their control. Early detection of diabetes has been shown to improve outcomes.

2.1 Whom and when to screen?

Screening should be performed in all individuals >30 years of age. It should be carried out at an earlier age in adults who have one or more of the following risk factors:

- Family history of diabetes
- Overweight/obese (BMI ≥23 kg/m^2) or have increased waist circumference (>90 cm males, >80 cm females)
- History of hypertension (≥130/80 mmHg) or on treatment for hypertension
- History of dyslipidaemia
- Sedentary physical activity
- History of gestational diabetes or macrosomia (birth weight > 3.5 kg)
- History of CVD (ischaemic heart disease, cerebrovascular disease)
- History of polycystic ovarian syndrome and/or acanthosis nigricans

2.2 How to screen?

Screening can be done by fasting plasma glucose, an oral glucose tolerance test (OGTT) using 75 gm glucose or a random plasma glucose. Glycosylated (glycated) haemoglobin (HbA1c) is also recommended for screening; however, in India there are some limitations regarding its use.

2.3 Where to screen?

Preferably, screening should be done in a health care setting. Alternatively, community screening can also be done.

2.4 Retesting:

Retesting should be done after 3 years in case of normal glucose tolerance. In case of prediabetes, it should be done annually.

2.5 Other aspects:

CVD risk factors such as hypertension, dyslipidemia, tobacco use and case of sedentary lifestyle should be identified and treated.

3.1 Diagnostic Criteria for Diabetes

- Symptoms of diabetes (see Section 3.2) plus casual or random plasma glucose ≥ 200 mg/dl (Casual means without regard to time of last meal)
- Fasting plasma glucose ≥ 126 mg/dl*
- 2 hour post 75 g glucose ≥ 200 mg/dl (as part of OGTT)*
- Glycated Haemoglobin ≥ 6.5%*

*Diabetes diagnosed using any of these criteria should be confirmed with another test subsequently.

3.2 Symptoms of Diabetes

- Osmotic symptoms- polyuria, polydipsia
- Weight loss in spite of polyphagia
- Tiredness, weakness
- Generalised pruritus
- Recurrent urogenital infections
- Delayed healing of wounds

More than half of all patients with diabetes will have no symptoms at all

3.3 Criteria for the Diagnosis of Prediabetes

The term “prediabetes” refers to a situation where the blood glucose levels are higher than normal, but not high enough to warrant a diagnosis of diabetes. Prediabetes consists of two entities viz. impaired fasting glucose (IFG) and impaired gluose tolerance (IGT).

The diagnostic criteria for diabetes and prediabetes are summarized in **Table 3.1**

Table 3.1: Diagnostic criteria for diabetes and prediabetes

Parameter	Normoglycemia(mg/dl)		Prediabetes (mg/dl)		Diabetes (mg/dl)
	WHO	ADA	WHO	ADA	
FPG	< 110	< 100	110-125 (IFG)	100-125 (IFG)	≥ 126
2-h PG	< 140		140-199 (IGT)		≥ 200
HbA1c	< 5.7%		5.7-6.4%		≥ 6.5%
Random plasma glucose*					≥ 200 (with symptoms of diabetes)

* Individuals with random plasma glucose between 140-199mg/dl are recommended to undergo OGTT

WHO - World Health Organisation; ADA-American Diabetes Association; IFG - Impaired Fasting Glucose; IGT - Impaired Glucose tolerance; FPG - Fasting Plasma Glucose; 2-h PG-2 hour post load Glucose test (oral glucose tolerance test) plasma glucose; HbA1c – Glycosylated Haemoglobin

3.4 Oral Glucose Tolerance Test (OGTT)

- Person to be tested should be on a normal diet (with at least 200 g carbohydrate/ day) for at least 3 days before the test
- The test should be done after an overnight fast of 8-10 hours and comprises of two blood samples: fasting and 2 hours after glucose load
- Following the collection of the fasting blood sample for analysis of plasma glucose, the individual should be administered 75 g of glucose (1.75 g/ kg body weight for children to a maximum of 75 g) dissolved in at least 250 ml of water. The glucose load should be drunk within a period of 5 minutes

The second sample should be collected 2 hours after the glucose load is given. The subject should be resting and refrain from smoking and eating in between the two sample collections.

3.5 Testing for Type 2 Diabetes in Children and Adolescents

Children and adolescents aged 18 years and below should be screened for diabetes if they are overweight (weight>120% of ideal body weight) and have any of the following risk factors:

- Family history of type 2 diabetes in first degree relatives
- Signs of insulin resistance (Acanthosis nigricans)
- Hypertension
- Dyslipidaemia
- Polycystic Ovary Syndrome (PCOS)