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BRIEF DESCRIPTION ABOUT DIABETES MELLITUS (DM)

Udit Saikia Perm state medical University,Perm,Russia

ABSTRACT Diabetes mellitus, commonly known as diabetes, is a metabolic disease that causes high blood sugar. The hormone insulin moves sugar from the blood into your cells to be stored or used for energy. With diabetes, your body either doesn't make enough insulin or can't effectively use the insulin it does make.

KEY WORDS : Diabetes, Increase blood sugar, Diabetic ketoacidosis (abbreviated to DKA) , Insulin, Types, Prediabetes.

I.INTRODUCTION

Diabetes mellitus is a term for several conditions involving how our body turns food into energy. When we eat a carbohydrate, our body turns it into a sugar called glucose and sends that to our bloodstream. our pancreas releases insulin, a hormone that helps move glucose from our blood into your cells, which use it for energy. When we have diabetes and don't get treatment, our body doesn't use insulin like it should. Too much glucose stays in our blood, a condition usually called high blood sugar. This can cause health problems that may be serious or even life-threatening. There's no cure for diabetes. But with treatment and lifestyle changes, we can live a long, healthy life. Diabetes comes in different forms, depending on the cause.

Diabetes is a chronic (long-lasting) health condition that affects how your body turns food into energy.

Impaired fasting glucose" or IFG,(prediabetes) Prediabetes means our blood glucose (also called blood sugar) levels are higher than normal. When our blood glucose levels reach a certain level, we have diabetes. This is a disease that occurs when our body doesn't make or use the hormone insulin properly. It causes too much glucose to build up in the blood. Too much glucose in our blood can be harmful to our body over time.

Prediabetes is when our blood glucose levels are too high, but not high enough to be called diabetes. People who develop type 2 diabetes usually have prediabetes first. If we have prediabetes, we are at much higher risk of developing type 2 diabetes. we are also at risk of developing other health conditions, including heart disease or stroke.The good news is that, if we have prediabetes, we can prevent or delay the onset of full-blown type 2 diabetes by making lifestyle changes. These include eating a healthy diet, reaching and maintaining a healthy weight, and exercising regularly.

II.SIGN & SYMPTOMS

Diabetes symptoms are caused by rising blood sugar.
General symptoms

The general symptoms of diabetes include:

- increased hunger
- increased thirst
- weight loss
- frequent urination
- blurry vision
- extreme fatigue

Symptoms in men

In addition to the general symptoms of diabetes, men with diabetes may have a decreased sex drive, erectile dysfunction (ED), and poor muscle strength.

Symptoms in women

Women with diabetes can also have symptoms such as urinary tract infections, yeast infections, and dry, itchy skin.

III. Complication

High blood sugar damages organs and tissues throughout your body. The higher your blood sugar is and the longer you live with it, the greater your risk for complications.

Complications associated with diabetes include:

- heart disease, heart attack, and stroke
- neuropathy
- nephropathy
- retinopathy and vision loss
- hearing loss
- foot damage such as infections and sores that don't heal
- skin conditions such as bacterial and fungal infections
- depression
- dementia

TYPES OF DIABETES

There are three main types of diabetes: type 1, type 2, and gestational diabetes (diabetes while pregnant).

Type 1 diabetes is thought to be caused by an autoimmune reaction (the body attacks itself by mistake) that stops your body from making insulin. About 5% of the people who have diabetes have type 1. Symptoms of type 1 diabetes often develop quickly. It's usually diagnosed in children, teens, and young adults. If you have type 1 diabetes, you'll need to take insulin every day to survive. Currently, no one knows how to prevent type 1 diabetes.

Type 2 diabetes, our body doesn't use insulin well and can't keep blood sugar at normal levels. About 90% of people with diabetes have type 2. It develops over many years and is usually diagnosed in adults (but more and more in children, teens, and young adults). we may not notice any symptoms, so it's important to get your blood sugar tested if you're at risk. Type 2 diabetes can be prevented or delayed with healthy lifestyle changes, such as losing weight, eating healthy food, and being active.

Gestational diabetes develops in pregnant women who have never had diabetes. If we have gestational diabetes, your baby could be at higher risk for health problems. Gestational diabetes usually goes away after your baby is born but increases your risk for type 2 diabetes later in life. Your baby is more likely to have obesity as a child or teen, and more likely to develop type 2 diabetes later in life too.

IV. GETTING TESTED

We'll need to get your blood sugar tested to find out for sure if you have prediabetes or type 1, type 2, or gestational diabetes. Testing is simple, and results are usually available quickly.

***Corresponding Author** Udit Saikia
Perm state medical University,Perm,Russia

Type 1 Diabetes, Type 2 Diabetes, and Prediabetes

Your doctor will have you take one or more of the following blood tests to confirm the diagnosis:

A1C Test

This measures your average blood sugar level over the past 2 or 3 months. An A1C below 5.7% is normal, between 5.7 and 6.4% indicates you have prediabetes, and 6.5% or higher indicates you have diabetes.

Fasting Blood Sugar Test

This measures your blood sugar after an overnight fast (not eating). A fasting blood sugar level of 99 mg/dL or lower is normal, 100 to 125 mg/dL indicates you have prediabetes, and 126 mg/dL or higher indicates you have diabetes.

Glucose Tolerance Test

This measures your blood sugar before and after you drink a liquid that contains glucose. You'll fast (not eat) overnight before the test and have your blood drawn to determine your fasting blood sugar level. Then you'll drink the liquid and have your blood sugar level checked 1 hour, 2 hours, and possibly 3 hours afterward. At 2 hours, a blood sugar level of 140 mg/dL or lower is considered normal, 140 to 199 mg/dL indicates you have prediabetes, and 200 mg/dL or higher indicates you have diabetes.

Random Blood Sugar Test

This measures your blood sugar at the time you're tested. You can take this test at any time and don't need to fast (not eat) first. A blood sugar level of 200 mg/dL or higher indicates you have diabetes.

Result*	A1C Test	Fasting Blood Sugar Test	Glucose Tolerance Test	Random Blood Sugar Test
Diabetes	6.5% or above	126 mg/dL or above	200 mg/dL or above	200 mg/dL or above
Prediabetes	5.7 – 6.4%	100 – 125 mg/dL	140 – 199 mg/dL	N/A
Normal	Below 5.7%	99 mg/dL or below	140 mg/dL or below	N/A

*Results for gestational diabetes can differ. Ask your health care provider what your results mean if you're being tested for gestational diabetes.

Source: American Diabetes Association

If your doctor thinks you have type 1 diabetes, your blood may also tested for autoantibodies (substances that indicate your body is attacking itself) that are often present in type 1 diabetes but not in type 2 diabetes. You may have your urine tested for ketones (produced when your body burns fat for energy), which also indicate type 1 diabetes instead of type 2 diabetes.

Gestational Diabetes

Gestational diabetes is diagnosed using blood tests. You'll probably be tested between 24 and 28 weeks of pregnancy. If your risk is higher for getting gestational diabetes (due to having more risk factors), your doctor may test you earlier. Blood sugar that's higher than normal early in your pregnancy may indicate you have type 1 or type 2 diabetes rather than gestational diabetes.

Glucose Screening Test

This measures your blood sugar at the time you're tested. You'll drink a liquid that contains glucose, and then 1 hour later your blood will be drawn to check your blood sugar level. A normal result is 140 mg/dL or lower. If your level is higher than 140 mg/dL, you'll need to take a glJucose tolerance test.

Glucose Tolerance Test

This measures your blood sugar before and after you drink a liquid that contains glucose. You'll fast (not eat) overnight before the test and have your blood drawn to determine your fasting blood sugar level. Then you'll drink the liquid and have your blood sugar level checked 1 hour, 2 hours, and possibly 3 hours afterward. Results can differ depending on the size of the glucose drink and how often your blood sugar is tested. Ask your doctor what your test results mean.

V. Diabetes Prevention

At present, type 1 diabetes cannot be prevented. The environmental triggers that are thought to generate the process that results in the destruction of the body's insulin-producing cells are still under investigation.

While there are a number of factors that influence the development of type 2 diabetes, it is evident that the most influential are lifestyle behaviours commonly associated with urbanization. These include consumption of unhealthy foods and inactive lifestyles with sedentary behaviour. Studies from different parts of the world have established that lifestyle modification with physical activity and/or healthy diet can delay or prevent the onset of type 2 diabetes.

Modern lifestyles are characterised by physical inactivity and long sedentary periods. Community-based interventions can reach individuals and families through campaigns, education, social marketing and encourage physical activity both inside and outside school and the workplace. IDF recommends physical activity at least between three to five days a week, for a minimum of 30-45 minutes.

Taking a life course perspective is essential for preventing type 2 diabetes and its complications. Early in life, when eating and physical activity habits are established and when the long-term regulation of energy balance may be programmed, there is an especially critical window to prevent the development of overweight and reduce the risk of type 2 diabetes. Healthy lifestyles can improve health outcomes at later stages of life as well.

Population based interventions and policies allow healthy choices through policies in trade, agriculture, transport and urban planning to become more accessible and easy. Healthy choices can be promoted in specific settings (school, workplace and home) and contribute to better health for everyone. They include exercising regularly and eating wisely which will help to maintain normal levels of blood glucose, blood pressure and lipids.

Learn more about cost-effection solutions for the prevention of type 2 diabetes

Type 2 diabetes prevention studies

There is overwhelming evidence from studies in the USA, Finland, China, India and Japan that lifestyle changes (achieving a healthy body weight and moderate physical activity) can help prevent the development of type 2 diabetes in those at high risk

- The *Da Qing Study* examined the effect of a 6-year diet and exercise intervention in Chinese individuals with Impaired Glucose Tolerance (IGT) and an average age of 45. The diet intervention alone was associated with a 31% reduction in the risk of developing type 2 diabetes, while the exercise intervention alone showed a 46% reduction. The combined diet and exercise group had a similar 42% reduction in the risk of developing type 2 diabetes during a 6-year follow-up period.

- The *Finnish Diabetes Prevention Study (DPS)* was the first randomized controlled trial to specifically examine the effect of a lifestyle intervention in preventing type 2 diabetes. This study randomly assigned 522 overweight or obese individuals with IGT to either a lifestyle intervention or a control group and followed them for approximately 3 years. The lifestyle intervention provided individualised counseling focused on achieving and maintaining healthy body weight, reducing fat

intake, increasing fibre intake and increasing physical activity. After two years, the incidence of type 2 diabetes in the intervention group was less than half that observed within the control group.

- The *Diabetes Prevention Program (DPP)*was conducted in 3234 US adults with IGT. Unlike most previous studies, the cohort was diverse and included a large proportion of women (68%) and ethnic minorities (45%), and compared lifestyle intervention versus drug intervention (metformin) and a placebo control group over 2.8 years. The DPP reported that both lifestyle intervention and metformin had positive effects on the prevention of type 2 diabetes and restoring normal glucose tolerance. The lifestyle intervention was more effective in preventing type 2 diabetes, particularly in older adults.

- The *Indian Diabetes Prevention Program (IDPP)* was a prospective community-based study, that examined whether the progression to type 2 diabetes could be influenced by interventions in native Asian Indians with IGT who were younger, leaner and more insulin resistant than in multiethnic American, Finnish and Chinese populations Results showed that progression of IGT to type 2 diabetes is high in native Asian Indians. Both lifestyle modification and metformin significantly reduced the incidence of type 2 diabetes in Asian Indians with IGT.

IDF recommendations for a healthy diet for the general population

1. Choosing water, coffee or tea instead of fruit juice, soda, or other sugar sweetened beverages.

2. Eating at least three servings of vegetable every day, including green leafy vegetables.

3. Eating up to three servings of fresh fruit every day.

4. Choosing nuts, a piece of fresh fruit, or unsweetened yoghurt for a snack.

5. Limiting alcohol intake to a maximum of two standard drinks per day.

6. Choosing lean cuts of white meat, poultry or seafood instead of red or processed meat.

7. Choosing peanut butter instead of chocolate spread or jam.

8. Choosing whole-grain bread, rice, or pasta instead of white bread, rice, or pasta.

9. Choosing unsaturated fats (olive oil, canola oil, corn oil, or sunflower oil) instead of saturated fats (butter, ghee, animal fat, coconut oil or palm oil. A particular threat in terms of the associated risk of developing type 2 diabetes is the consumption of high sugar foods, particularly sugar-sweetened beverages, In 2014, the World Health Organization (WHO) issued new recommendations to limit sugar intake. IDF fully supports these recommendations and in response published the IDF Framework for Action on Sugar

What is the Difference Between Type 1 and Type 2 Diabetes

Type 1 diabetes usually starts in childhood or young adulthood, whereas type 2 diabetes usually starts in adulthood. In patient with type 1 diabetes, the body's immune system attacks and destroys pancreatic cells (Beta cells) that produce insulin. In patient with type 2 diabetes, the pancreas is not attacked and usually produces insulin. However, patient with type 2 diabetes, for numerous reasons, cannot use the available insulin effectively.

Patient with type 2 diabetes can have the same symptoms as patient with type 1 diabetes, but patient with type 1 diabetes usually have symptoms occur more rapidly. Type 1 diabetes cannot be prevented, but type 2 diabetes can be prevented or delayed with a healthy lifestyle.

VI.Treatment of Diabetes Mellitus:

The treatment of diabetes must be based on an understanding of its pathophysiology. Thus, in type 1 diabetes mellitus a severe insulin secretion deficit exists and the only treatment, at present, is the administration of insulin or insulin analog. However, type 2 diabetes mellitus is a much more complex disease, in which insulin resistance predominates in the early stages. In more advanced stages, insulin resistance persists but the deficit in insulin secretion is more evident. Therefore, the therapeutic approach will depend on the stage of the disease and characteristics of the patient**.**

Type 1 diabetes is treated with:

Insulin is the main treatment for type 1 diabetes. It replaces the hormone your body isn't able to produce.

There are four types of insulin that are most commonly used. They're differentiated by how quickly they start to work, and how long their effects last:

- Rapid-acting insulin starts to work within 15 minutes and its effects last for 3 to 4 hours.
- Short-acting insulin starts to work within 30 minutes and lasts 6 to 8 hours.
- Intermediate-acting insulin starts to work within 1 to 2 hours and lasts 12 to 18 hours.
- Long-acting insulin starts to work a few hours after injection and lasts 24 hours or longer**.**

Type 2 diabetes is treated:

First with weight reduction, a type 2 diabetes diet, and exercise,Diabetes medications (oral or injected) are prescribed when these measures fail to control the elevated blood sugars of type 2 diabetes.If other medications become ineffective treatment with insulin may be initiated.Some people with type 2 diabetes also take insulin.

Gestational diabetes

You'll need to monitor your blood sugar level several times a day during pregnancy. If it's high, dietary changes and exercise may or may not be enough to bring it down.According to the Mayo Clinic, about 10 to 20 percent of women with gestational diabetes will need insulin to lower their blood sugar. Insulin is safe for the growing baby.

Medications for type 1 diabetes

***Insulin**

Insulin is the most common type of medication used in type 1 diabetes treatment.

If you have type 1 diabetes, your body can't make its own insulin. The goal of treatment is to replace the insulin that your body can't make.Insulin is also used in type 2 diabetes treatment. It's given by injection and comes in different types. The type of insulin you need depends on how severe your insulin depletion is.

Options include:

Short-acting insulin

*regular insulin (Humulin and Novolin)

Rapid-acting insulins

*insulin aspart (NovoLog, FlexPen, Fiasp)
*insulin glulisine (Apidra)
*insulin lispro (Humalog)

Intermediate-acting insulin

*insulin isophane (Humulin N, Novolin N)

Long-acting insulins
*insulin degludec (Tresiba)
*insulin detemir (Levemir)
*insulin glargine (Lantus)
*insulin glargine (Toujeo)

Combination insulins
*NovoLog Mix 70/30 (insulin aspart protamine-insulin aspart)
*Humalog Mix 75/25 (insulin lispro protamine-insulin lispro)
*Humalog Mix 50/50 (insulin lispro protamine-insulin lispro)
*Humulin 70/30 (human insulin NPH-human insulin regular)
*Novolin 70/30 (human insulin NPH-human insulin regular)
*Ryzodeg (insulin degludec-insulin aspart)

Amylinomimetic drug
Pramlintide (SymlinPen 120, SymlinPen 60) is an amylinomimetic drug. It's an injectable drug used before meals.
It works by delaying the time your stomach takes to empty itself. It reduces glucagon secretion after meals. This lowers your blood sugar.It also reduces appetite through a central mechanism.

Medications for type 2 diabetes
If you have type 2 diabetes, your body makes insulin but no longer uses it well.Your body can't make enough insulin to keep your blood sugar levels normal. The goal of treatment for you is to help your body use your insulin better or to get rid of extra sugar in your blood.Most medications for type 2 diabetes are oral drugs. However, a few come as injections. Some people with type 2 diabetes may also need to take insulin.

Alpha-glucosidase inhibitors
These medications help your body break down starchy foods and table sugar. This effect lowers your blood sugar levels.For the best results, you should take these drugs before meals. These drugs include:
*acarbose (Precose)
*miglitol (Glyset)

Biguanides
Biguanides decrease how much sugar your liver makes. They decrease how much sugar your intestines absorb, make your body more sensitive to insulin, and help your muscles absorb glucose.

The most common biguanide is metformin (Glucophage, Metformin Hydrochloride ER, Glumetza, Riomet, Fortamet).

Metformin can also be combined with other drugs for type 2 diabetes. It's an ingredient in the following medications:
*metformin-alogliptin (Kazano)
*metformin-canagliflozin (Invokamet)
*metformin-dapagliflozin (Xigduo XR)
*metformin-empagliflozin (Synjardy)
*metformin-glipizide
*metformin-glyburide (Glucovance)
*metformin-linagliptin (Jentadueto)
*metformin-pioglitazone (Actoplus)
*metformin-repaglinide (PrandiMet)
*metformin-rosiglitazone (Avandamet)
*metformin-saxagliptin (Kombiglyze XR)
*metformin-sitagliptin (Janumet)

Dopamine agonist
Bromocriptine (Cycloset) is a dopamine agonist.
It's not known exactly how this drug works to treat type 2 diabetes. It may affect rhythms in your body and prevent insulin resistance.

Dipeptidyl peptidase-4 (DPP-4) inhibitors
DPP-4 inhibitors help the body continue to make insulin. They work by reducing blood sugar without causing hypoglycemia (low blood sugar).

These drugs can also help the pancreas make more insulin. These drugs include:

*alogliptin (Nesina)
*alogliptin-metformin (Kazano)
*alogliptin-pioglitazone (Oseni)
*linagliptin (Tradjenta)
*linagliptin-empagliflozin (Glyxambi)
*linagliptin-metformin (Jentadueto)
*saxagliptin (Onglyza)
*saxagliptin-metformin (Kombiglyze XR)
*sitagliptin (Januvia)
*sitagliptin-metformin (Janumet and Janumet XR)
*sitagliptin and simvastatin (Juvisync)
*Glucagon-like peptide-1 receptor agonists (GLP-1 receptor agonists)

These drugs are similar to the natural hormone called incretin.
They increase B-cell growth and how much insulin your body uses. They decrease your appetite and how much glucagon your body uses. They also slow stomach emptying.

These are all important actions for people with diabetes.
For some people, atherosclerotic cardiovascular disease, heart failure, or chronic kidney disease may predominate over their diabetes. In these cases, the American Diabetes Association (ADA) recommends certain GLP-1 receptor agonists as part of an antihyperglycemic treatment regimen.
These drugs include:

*albiglutide (Tanzeum)
*dulaglutide (Trulicity)
*exenatide (Byetta)
*exenatide extended-release (Bydureon)
*liraglutide (Victoza)
*semaglutide (Ozempic)

Meglitinides
These medications help your body release insulin. However, in some cases, they may lower your blood sugar too much.

These drugs aren't for everyone. They include:
*nateglinide (Starlix)
*repaglinide (Prandin)
*repaglinide-metformin (Prandimet)

Sodium-glucose transporter (SGLT) 2 inhibitors
Sodium-glucose transporter (SGLT) 2 inhibitors work by preventing the kidneys from holding on to glucose. Instead, your body gets rid of the glucose through your urine.In cases where atherosclerotic cardiovascular disease, heart failure, or chronic kidney disease predominate, the ADA recommends SGLT2 inhibitors as a possible treatment option.

*dapagliflozin (Farxiga)
*dapagliflozin-metformin (Xigduo XR)
*canagliflozin (Invokana)
*canagliflozin-metformin (Invokamet)
*empagliflozin (Jardiance)
*empagliflozin-linagliptin (Glyxambi)
*empagliflozin-metformin (Synjardy)
*ertugliflozin (Steglatro)

Sulfonylureas
These are among the oldest diabetes drugs still used today. They

work by stimulating the pancreas with the help of beta cells. This causes your body to make more insulin.

*These drugs include:
*glimepiride (Amaryl)
*glimepiride-pioglitazone (Duetact)
*glimepiride-rosiglitazone (Avandaryl)
*gliclazide
*glipizide (Glucotrol)
*glipizide-metformin (Metaglip)
*glyburide (DiaBeta, Glynase, Micronase)
*glyburide-metformin (Glucovance)
*chlorpropamide (Diabinese)
*tolazamide (Tolinase)
*tolbutamide (Orinase, Tol-Tab)

Thiazolidinediones

Thiazolidinediones work by decreasing glucose in your liver. They also help your fat cells use insulin better.These drugs come with an increased risk of heart disease. If your doctor gives you one of these drugs, they'll watch your heart function during treatment.

Options include:

*rosiglitazone (Avandia)
*rosiglitazone-glimepiride (Avandaryl)
*rosiglitazone-metformin (Amaryl M)
*pioglitazone (Actos)
*pioglitazone-alogliptin (Oseni)
*pioglitazone-glimepiride (Duetact)
*pioglitazone-metformin (Actoplus Met, Actoplus Met XR)

VII. CONCLUSION

Diabetes Mellitus (DM) is considered to be a major health problem that is predicted to turn into a global epidemic. In developing countries, the number of people with diabetic gradually increasing day by day; as well as complication like diabetic retinopathy will continue to rise. Retinopathy is the potential sight threatening condition; it is a significant public health problem all over the world. Adequate treatment of the risk indicators might prevent and reduce the burden of these diseases and improve the quality of health care services.

*Patients with Diabetes may presents with variety of Musculoskeletal complications.
*Most of these conditions point to long standing disease and poor Glycemic control.
*Early diagnosis and Rx improve general outcome.
*Similar musculoskeletal manifestations may occur in other endocrine/metabolic diseases

Discuss potential diabetes risks with your doctor. If you're at risk, have your blood sugar tested and follow your doctor's advice for managing your blood sugar.

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