



Technological Innovation in Diabetes Management and Lifestyle: Towards A Cure

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ABSTRACT :

Diabetes is a major health issue as there are over more than half a billion people living with diabetes including men ,women and children of all ages .It has been said it would reach more than double to 1.3 billion in next 30 next years .This report will give a brief overview of diabetes ,its symptoms,necessity for it to be diagnosed in early stages,evolution of technology which have revolutionised diabetes management,the various opportunities to enhance patient care and lifestyle.This report will also give u certain lifestyle to adapt and stay healthy .

Keywords:Diabetes,Type 1 diabetes,Type 2 diabetes,Continuous Glucose Monitoring (CGM),Flash Glucose- Monitoring (FGM), Glucose Imbalance.

INTRODUCTION :

Diabetes, it's a major health issue. Your body struggles to manage blood sugar levels properly. Why? Well either not have enough insulin produced or your body can't use it correctly. The result? High blood sugar levels, which can create big problems if left unchecked. Now, there are different types of diabetes to consider.

Type 1 diabetes usually occurs when your own immune system attacks and damages the cells responsible for insulin production.

Type 2 diabetes is more common and often linked to lifestyle factors like being overweight or inactive, as well as genetics.

Diabetes is a growing global concern. According to the recent survey a total of 38.4 million people is diabetic and around 97.6 million people aged 18 years or older have prediabetes in the US.

The number of people living with diabetes has grown significantly over the years, rising from 108 million in 1980 to 422 million in 2014. This increase has been more rapid in low and middle-income countries compared to high-income nations. This puts a lot of strain on healthcare systems and economies around the world. Understanding the causes and managing the condition properly is crucial for those affected.

Early Detection of Glucose Imbalance :

Early detection of blood sugar issues, like prediabetes and diabetes, plays a crucial role in maintaining good health and avoiding serious problems. Here are some symptoms of diabetes:

- feeling very thirsty
- needing to urinate more often than usual
- blurred vision
- feeling tired
- losing weight unintentionally

Symptoms of diabetes may occur suddenly. In type 2 diabetes, the symptoms can be mild and may take many years to be noticed.

Why it's so important to detect it as early as possible:

Prediabetes: means your blood sugar is higher than normal, but not high enough to be considered diabetes. Without making changes, prediabetes often leads to Type 2 diabetes. Catching it early allows you to make lifestyle improvements like eating healthier etc this will be further explained in brief in the next section. This can prevent or delay the onset of diabetes.

Avoiding Complications: Unmanaged diabetes can cause major problems like heart disease, strokes, kidney disease, nerve damage, and vision issues. Early detection means you can take steps to effectively manage your condition. This reduces the risk of these serious complications and helps you stay healthy

Glucose Monitoring Technologies :

History of Urine Glucose Measurement

Back in the 1500s, people had discovered methods of detecting diabetes by using ants as they were drawn to the sugar present in urine. This method was known as Madhu mela in ancient India, meaning "Honey urine". Attempts to quantify the detection of Glucose levels can be traced back to as early as the 19th Century and is the earliest form of measuring glucose level of the body.

Working Of Urine Test

Glucose typically appears in urine when blood glucose levels are elevated above the renal threshold, which is approximately 180 mg/dL (10 mmol/L). The presence of glucose in the urine is called glycosuria or glucosuria. Glucose level can also be measured in other bodily fluids using a blood test or a cerebrospinal fluid test. A copper reagent developed by Benedict in the 1908 was used for half a century with Clingiest later turning it into tablets in 1945 for convenient boiling as the amount of colour change in the solution indicated the amount of glucose in urine, after comparing the colour of the solution to the colour chart.

STRIP BASED GLUCOSE MEASUREMENT

Glucose meters are devices used by diabetics. They're called strip based or glucometers. These measure- blood glucose levels. The meters work using colorimetric enzyme reactions. This allows quick, fairly accurate glucose- testing. Glucose meters greatly improve diabetes management.

HISTORY OF STRIP BASED MEASUREMENT

People were to get their blood sugar levels checked with bulkier devices back then. The Distrusted changed that in 1965. Ames developed it using an enzyme called glucose oxidase. To use it, you'd drop some blood onto the strip. After a minute, you'd rinse it off. Next, you'd compare the resulting colour to a chart on the bottle. That would give you a rough estimate of your glucose levels. But the- Distrusted wasn't meant for home use at first. It was designed for doctors' offices.

WORKING OF STRIP BASED MEASUREMENT

The test strips work by producing a colour-change reaction that scales linearly with the concentration of glucose in the blood. The colour change is the result of the reaction between glucose, glucose oxidase (GOX), horseradish peroxidase (HRP), and 2,2'-azino-bis (3-ethylbenzthiazoline-6-sulphonic acid) (ABTS).

Continuous Glucose Monitoring (CGM) :

History of Continuous Glucose Monitoring (CGM):

1. Re-searchers started de-veloping devices to track blood sugar le-vels without stopping in the late 1900s. Early prototype-s weren't practical for eve-ryday use, though. They were- bulky and awkward.
2. The first CGM systems people- could buy came out in the early 2000s. The-y had a sensor under the skin, a transmitt-e-r, and a receiver showing glucose- data.
3. CGM tech has improved greatly since- then. Sensors got more accurate-. Components shrank in size. Systems inte-grated insulin pumps, smartphone apps, alerts pre-dicting highs/lows, and algorithms analysing data.

Parts of a Continuous Glucose Monitoring (CGM) System:

1. **Sensor:** A small, bendable wire- inserted under skin, usually on the abdomen or arm. Measures glucose in fluid between cells using a special enzyme or electrochemical process.
2. **Transmitter:** Connects to sensor, sends glucose data wirelessly to receiver or phone app. Transfers readings every few minutes for real-time tracking.
3. **Receiver/App:** Shows glucose levels from transmitter. Gives access to current glucose, trends, and past readings over hours or days. Users can see continuous data on device- or app.

How Does Continuous Glucose- Monitoring Work?

1. It detects glucose levels. The sensor tracks glucose- in body fluids around cells. Glucose reacts with the- sensor's enzymes. This creates electrical signals showing the- glucose amount.
2. Data gets transmitted wirelessly. The transmitter sends glucose data from the sensor to a receiver or app. The receiver shows real-time- glucose readings. So, users can monitor blood sugar all day and night.

Flash Glucose Monitoring (FGM) :***Knowing Flash Glucose Monitoring's Past:***

1. Simply put, FGM was launched as an option besides regular CGM devices. In 2014, Abbott's Freestyle Libre became the- first FGM system sold, debuting in Europe before getting FDA approval for use in America.
2. FGM is an important step forward for glucose tracking. It provides an easy, non-invasive way to monitor levels compared to traditional CGM systems. Since emerging, people with diabetes have embraced FGM's convenience and discretion.

Components of Flash Glucose- Monitoring (FGM):

1. **Sensor:** A little round disc sticks to your upper arm's back. Under the skin, its small wire measures glucose in interstitial fluid.
2. **Reader/Smartphone App:** No transmitter needed for FGM, unlike CGM. Scan the sensor with a handheld reader or app on your phone-. It shows your current glucose, trends, and past numbers. Pretty handy!

Here-'s How Flash Glucose Monitoring (FGM) Works:

1. **Glucose Reading:** The- FGM device has a sensor with a special coating. This coating contains an enzyme called glucose- oxidase. When glucose from your body fluids touches the coating, a tiny electrical current is produced. The strength of this current shows how much glucose is present.
2. **Scan Process:** You use a reader device or smartphone app to scan the sensor. The reader sends a signal activating the sensor. Then, the- sensor measures your glucose- by checking the electrical current. After measuring, the- sensor sends your glucose level back to the reader for display.

Preventive Measures and Lifestyle Interventions:***Healthy Eating Matters:***

1. Balance your diet well, filling it richly with fruits, vegetables, whole grains, lean proteins, and healthy fats.
2. Limit foods that are high in fat, calories, and processed. Sugary drinks? Not too much!
3. Keep portions in check, avoiding overeating to maintain a weight that's healthy for you.

Weight Management:

- Sustain a healthy weight through balanced eating and exercise routines. If overweight or obese currently, aim for gradual, sustainable weight reduction. Even moderate loss improves insulin response and lowers diabetes risk significantly.

**1.1. Regular Physical Activity**

- Exercise frequently. For good health, strive for 150 minutes weekly, moderately strenuous aerobic activities. Or, you could choose 75 vigorous minutes instead. Additionally, two strength sessions per week build muscle and enhance insulin utilization effectively.
- Be active daily. Take short walks, use stairs over elevators whenever possible, do household chores requiring movement.

Monitor Blood Sugar Levels:

1. Regularly track your blood sugar levels. This is crucial if you have risk factors for diabetes or prediabetes.
2. Follow your healthcare provider's recommendations carefully. Adjust your lifestyle habits based on their guidance.

Quit Smoking:

1. Smoking increases the risk of developing type 2 diabetes. It also makes managing diabetes more challenging.
2. Seek support and resources to quit smoking successfully. Options include counselling, nicotine replacement therapy, or prescription medications.

Limit Alcohol Consumption:

1. Avoid too much alcohol. It increases diabetes risk. It makes blood sugar control tricky.
2. Drink no more than one glass daily. Women: 12 ounces beer, 5 ounces wine, 1.5 ounces spirits. Men can have two such drinks.

Manage Stress:

- Meditate. Breathe deeply. Practice yoga, tai chi. These lower stress for better health.
- Put yourself first sometimes. Friends, family, groups provide caring support. Lean on them.

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