

GLUCOMETER

Ghulam Rasool
Lecturer, AHS, SMC



Blood Glucose Monitoring

What is it?

- Blood Glucose Monitoring is a way of checking the concentration of glucose in the blood using a glucometer.

What is the purpose?

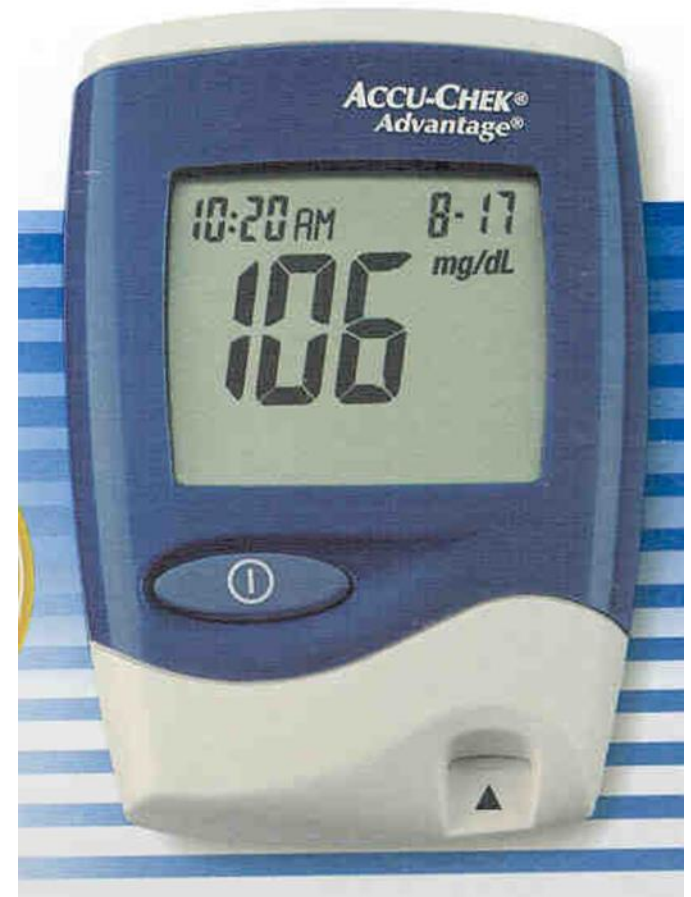
- Provides quick response to tell if the sugar is high or low indicating a change in diet, exercise or insulin.
- Over time, it reveals individual of blood glucose changes.

Why monitor blood glucose?

- Reduces risk of developing complications with diabetes.
- Allows diabetics to see if the insulin and other medications they are taking are working.
- Gives diabetics an idea as to how exercise and food affect their blood sugar.
- May prevent hypoglycemia or hyperglycemia

Glucose Measuring Devices

- Used to Check Blood Sugar Levels
- Many different types and models



Device & Accessories

Glucometer



Test Strips



Lancet

Glucometer

- A **glucose meter** (or **glucometer**) is a medical device for determining the approximate concentration of glucose in the blood. It is a key element of home blood glucose monitoring (HBGM) by people with diabetes mellitus.
- A small drop of blood, obtained by pricking the skin with a lancet, is placed on a disposable test strip that the meter reads and uses to calculate the blood glucose level. The meter then displays the level in units of mg/dl or mmol/l.

Working Principle

- In this method, the electrochemical test strip contains a capillary at one end of the test strip that is used to draw in blood. The test strip also contains an enzyme electrode containing a reagent such as Glucose Oxidase.
- Glucose undergoes a chemical reaction in the presence of enzymes, during chemical reaction electrons are produced. Number of electrons (i.e., the charge passing through the electrode) produced are measured and this is proportional to the concentration of glucose in the Blood.
- An ambient temperature measurement is also made in order to compensate for the effect of temperature on the rate of the reaction

Gluco Meter: components

- **Gluco meter Consists of Following Parts.**
- Power supply section
- Light source
- Test strip
- Optical sensor
- Preamplifier
- Final amplifier
- Analog to digital converter
- Display unit
- Reading unit
- Control panel unit

Power supply section:

- The power supply section of digital Glucometer consists of four or more alkaline manganese button shape batteries.
- This section provide necessary power to other parts.

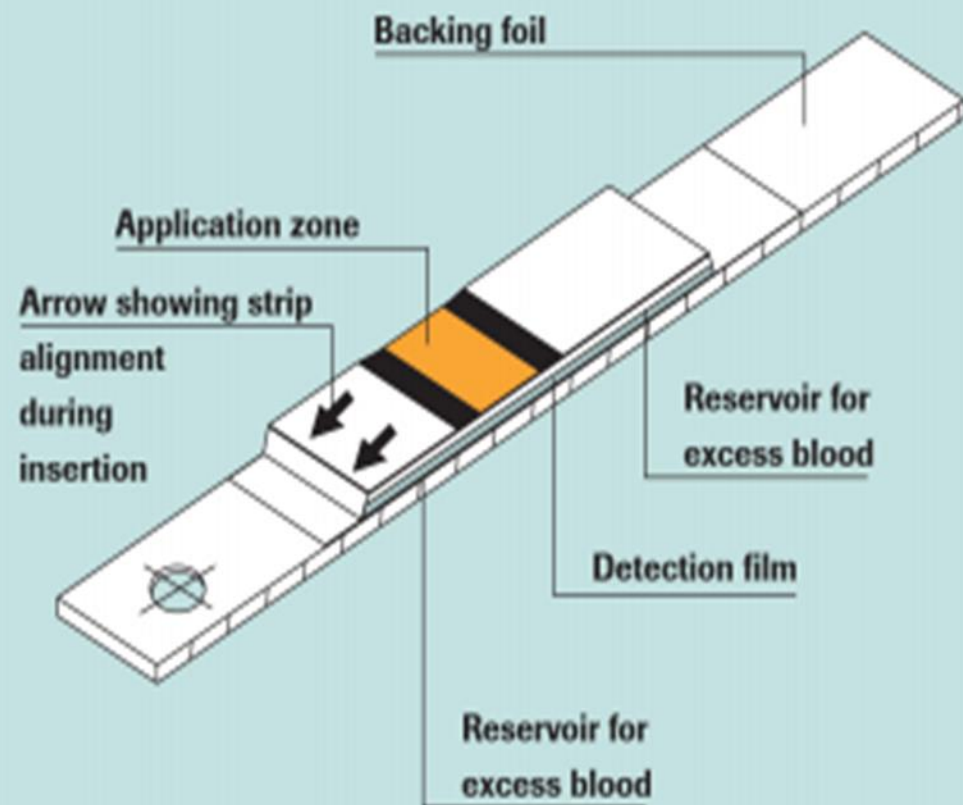
Light source:

- There is a light source, which may be a light-emitting diode (LED) with a lens.
- The light is focused on test strip with the help of lenses.

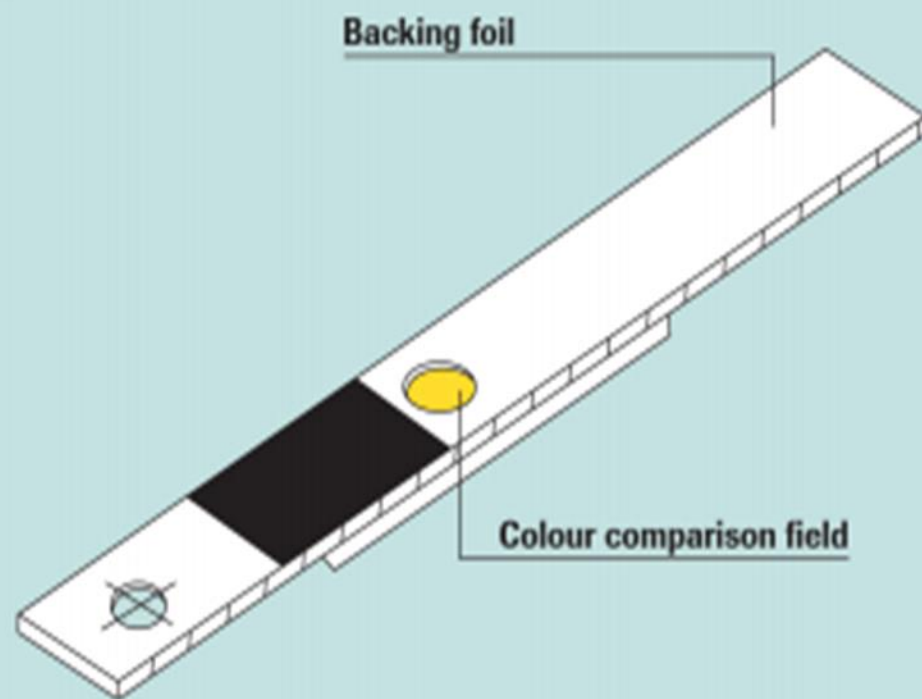
Test strip:

- Every strip has a test pad (filter) on it. This test pad has a certain chemical on it. The test strip is inserted in the test strip guide meter.
- A suspended drop of blood is allowed to form and is applied to the yellow test pad and without spreading the drop and without touching the pad. The test pad should be completely covered.

Front side



Reverse side



Optical sensor

- Differential light is produced when light from the light source is passed through the test pad containing glucose or sugar particles.
- When optical sensor receives this differentiated light, it produces potential according to the counting of glucose or sugar particles in blood.
- The potential (voltage) is a measure of glucose quantity.

Amplifier

- **Preamplifier**

The signal produced by optical sensor is applied to a pre-amplifier, which performs preamplification of the signal.

- **Final amplifier**

The output of preamplifier is applied to the final amplifier, which further amplifies the signal.

- **Analog to digital converter**

The amplified analog signal is applied to an analog to digital converter (ADC), which converts it into digital form.

- **Display unit**

The digital signal is applied to the display unit, which display the reading on screen.

- **Reading unit**

Reading in milligram per deciliter (mg/dl) or mmole /liter.

- **Control panel unit**

There is a control panel unit, which has different buttons for various options i.e. (button for ON & OFF)

Glucose Testing: Coding the Meter

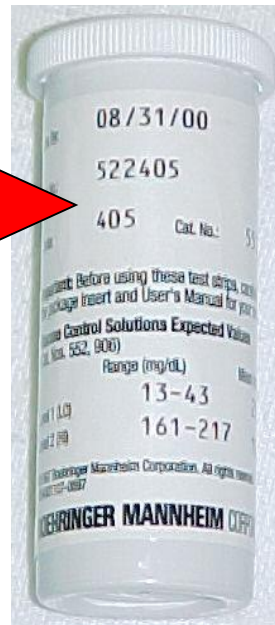
Calibration must be conducted when a new box of test strips is opened, or, if the meter is dropped .

Coding of the meter, will match the meter with the reactivity of the test strip. Each lot of test strips is assigned a function number identified on the code strip.

Reset the code for each new vial of test strips used. The function number appearing on the display must match the number appearing on the code strip, on the front of the code strip package.

Glucose Testing: Coding the Meter

Remove Code Chip from Test Strip Box. Match the number printed on the Code Chip to the number on the Test Strip Vial.



Insert the Code Chip into Meter with the numbers facing up.



Confirm Codes

Calibrate the meter using "Test Quality Control Solutions" or "Electronic Controls"



Electronic Controls



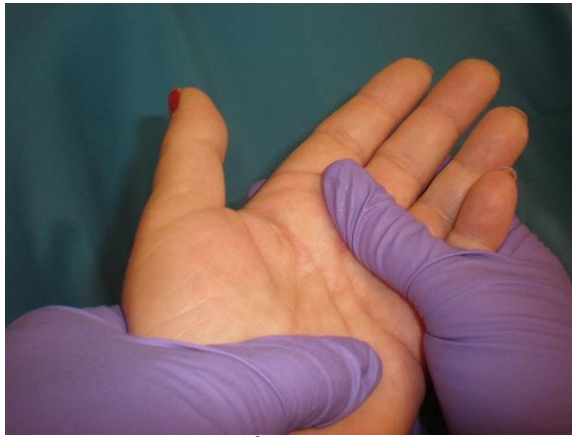
Quality Control Solutions

Glucose testing: General Steps

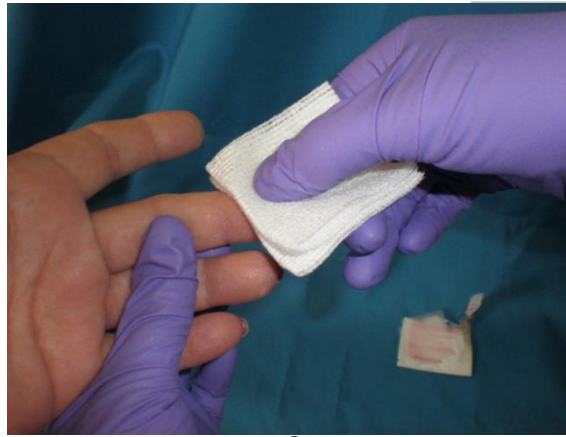
- Identify patient using two patient identifiers (name and DOB)
- Explain procedure to the patient.
- Gather all necessary equipment and supplies prior to start of the procedure.
- Inspect all equipment and supplies for damage, general integrity and expiration date- do not use any damaged or expired materials.
- Perform hand hygiene before and after patient contact.

Glucose Testing: Procedural Steps

- Perform finger stick according to procedure.
- Remove a test strip from vial. Always check expiration date. Be sure the code number (function number) on the display window matches the function number on the code strip and vial.
- Insert the strip fully into the Meter. The meter will turn on when the strip is inserted.
- A "beep" will sound, and the Function Number and previous test result will begin flashing in the display window.
- Touch and hold the Test Strip in the Meter to the drop of blood until the meter beeps (within 5 seconds).



1



2



3



4



5



6



7

Glucose Testing: Procedural Steps

- Blood glucose result will appear in the display window.
- Use a 2 X 2 gauze to apply pressure to stop bleeding of the finger. Apply Band-Aid if necessary.
- Remove the used Test Strip from the Meter. The Meter will turn off automatically.
- Dispose of gauze, cotton balls, test strip etc, in regular trash; unless materials are saturated with blood then dispose of in medical waste regulated trash.
- Remove gloves and dispose.
- Perform hand hygiene.

Record results:



CAUTION

- Immediately and quickly repeat test results that are Lo, Hi, less than 60 or greater than 400.
- If still at this range, immediately verbally report to health care provider with call for stat care.



Errors

- Out of date strips
- Contaminated strips
- Incorrect meter coding
- Incorrect meter
- Hands not clean
- Temperature of equipment

WARNING

Conducting this test exposes the operator to potentially infectious material. Standard precautions, including glove use, are required for this procedure.



Glucose Testing: Limitations

- Hematocrit levels above 55% will cause lowered results.
- If comparing results between TRUEtrack and a lab system, perform a TRUEtrack blood test within 15 minutes of lab test. Results from TRUEtrack are considered accurate if within +/-20% of lab results.
- If patient has recently eaten, finger stick results from TRUEtrack can be up to 70 mg/dL (3.9 mmol/L) higher than venous lab results.

Storage and Stability

Test strips: Store unopened test strips at room temperature (15-30°C), away from direct sunlight

- Unopened test strips are stable until expiration date
- Opened test strips must be discarded after 120 days.
- Store Test Strips in original vial only. Do not transfer old Test Strips to new vial.

Control solution:

- Store solution at room temperature (15-30 °C)
- Unopened bottles are stable until expiration date
- Opened bottles are stable at room temperature for 3 months after first opening.

Glucose concentrations in Blood

Glucose Test	Person without diabetes	Person with diabetes
Fasting Test	70-110mg/dL	≥ 140 mg/dL
2 hours after meal	≤ 110 mg/dL	≥ 200 mg/dL