

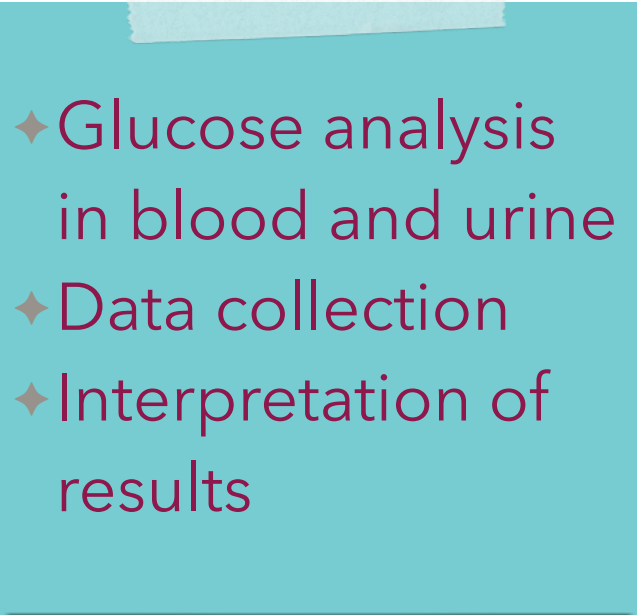
Clinical Biochemistry Unit
Department of Pathology
College of Medicine
King Saud University



Measurement of Glucose in Blood and Urine



Practical Biochemistry
Endocrine System Block Year 2
Tutors All Biochemistry academic staff
Time 2 Hours
Place Males: Biochemistry Teaching Lab, College of Medicine
Females: College of Medicine Girls Campus

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- ◆ Glucose analysis in blood and urine
 - ◆ Data collection
 - ◆ Interpretation of results



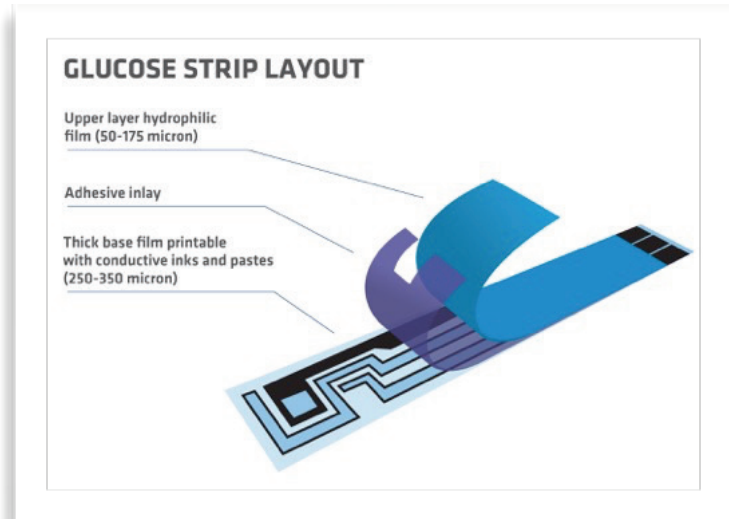
Objectives

By the end of this hands-on practical session, the Second Year Medical students will be able to:

1. Perform the measurement of glucose in blood and urine using glucometer and strip methods respectively.
2. Understand the principle of the tests.
3. Record and calculate the results obtained from the experiments.
4. Interpret and diagnose hyperglycemia and diabetes mellitus using the American Diabetes Association (ADA) guidelines.

Principle

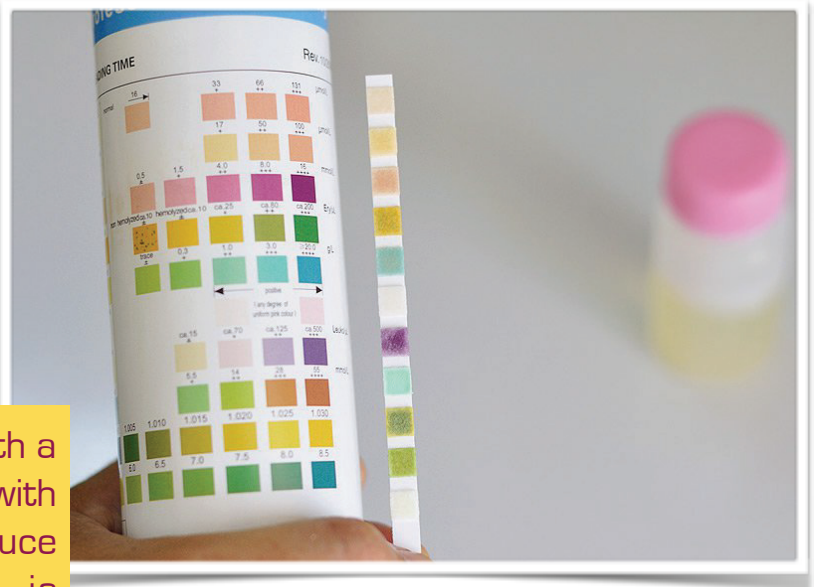
Glucometer



1. The glucometer strip contains **glucose oxidase** enzyme that reacts with blood glucose converting it to **gluconic acid**.
2. **Gluconic acid** then reacts with **ferricyanide** on the strip to produce **ferrocyanide**.
3. The glucometer detects **ferrocyanide** and displays the number on the screen.
4. The amount of **ferrocyanide** is equivalent to that of **glucose** in blood.

Principle

Urine strips



The urine strip are impregnated with a variety of reagents that react with substances in the urine to produce color. The intensity of color is proportional to concentration of the substance being detected.

1. **Glucose:** Glucose oxidase enzyme on the strip reacts with glucose in urine to produce gluconic acid and hydrogen peroxide that reacts with peroxidase to produce **bluish-green, greenish-brown, dark brown** color.

2. **Protein:** Tetrabromophenol reacts with proteins to produce **yellow-green, green, blue-green** color.

3. **Ketones:** Sodium nitroprusside reacts with ketones to produce **pink, pink-purple** color.

4. **pH:** Bromothymol and methyl red indicators change color due to acidity or alkalinity of urine.

KETONES mmol/l	NEG	1.5	3	7.5	≥15
GLUCOSE mg/dl	NEG	100	300	1000	3000
PROTEIN g/l	NEG	0.3	1.0	3.0	≥10
pH	5	6	7	8	9

Procedure

Glucometer



Outline of how to use

Attach the Test TIP

Prick

Draw up blood

After blood is applied to the Test TIP, glucose in the blood reacts with the reagent on the Test TIP, and colours the reagent pad. The Meter measures this colour concentration, and shows the blood glucose level on the display.

Test TIP

Meter

Lancet

Lancing Device

Meter

Beep

Completes the measurement in **10** seconds

1. Attach the test tip to the glucometer as shown above.
2. The meter will read "OK".
3. Disinfect your fingertip with an alcohol swab. Let it dry.
4. Prick the finger using the lancing device.

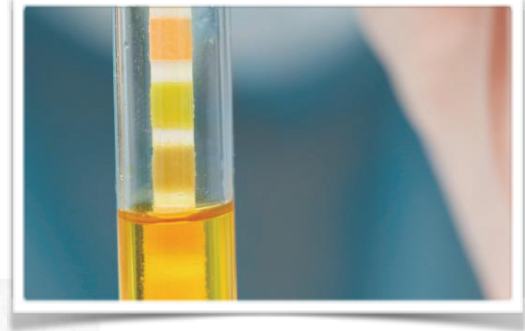


BIOHAZARD! THE LANCET IN THE LANCING DEVICE IS FOR SINGLE USE ONLY. DISCARD IT AFTER USE.

5. Draw up blood until the glucometer beeps.
6. Wait for 10 sec. until results are displayed. Results can be read as mmol/L or mg/dL
7. Interpret your results.

Procedure

Urine strips

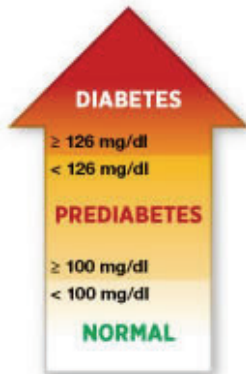


1. Dip the urine strip into the test tube containing the urine sample.
2. Remove immediately.
3. Wipe off excess urine.
4. Read the color within 30-60 sec. by matching with the reference chart as shown above.
5. Interpret your results.



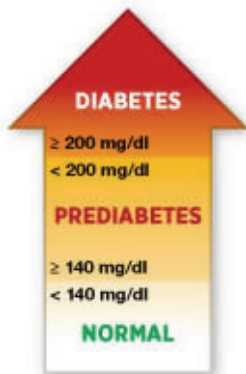
Do not read the strip after 60 sec. Color changes after 60 sec. are of no significance.

ADA Criteria for the Diagnosis of Diabetes



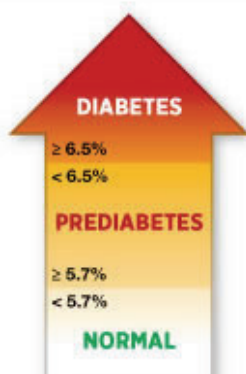
FPG

Result	Fasting Plasma Glucose (FPG)
Normal	less than 100 mg/dl
Prediabetes	100 mg/dl to 125 mg/dl
Diabetes	126 mg/dl or higher



OGTT

Result	Oral Glucose Tolerance Test (OGTT)
Normal	less than 140 mg/dl
Prediabetes	140 mg/dl to 199 mg/dl
Diabetes	200 mg/dl or higher



A1C

Result	Glycated Hemoglobin A1C (Also called HbA1C)
Normal	less than 5.7%
Prediabetes	5.7% to 6.4%
Diabetes	6.5% or higher

www.diabetes.org/diabetes-basics/diagnosis/
 American Diabetes Association (ADA) 2018.

Test Results and Diagnosis

Record your results and interpretation for each test in the table below.

Test	Results	Interpretation
Blood glucose		
Urine protein		
Urine ketones		
Urine glucose		
Urine pH		



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