Practical Biochemistry

Measurement of Glucose in Blood and Urine

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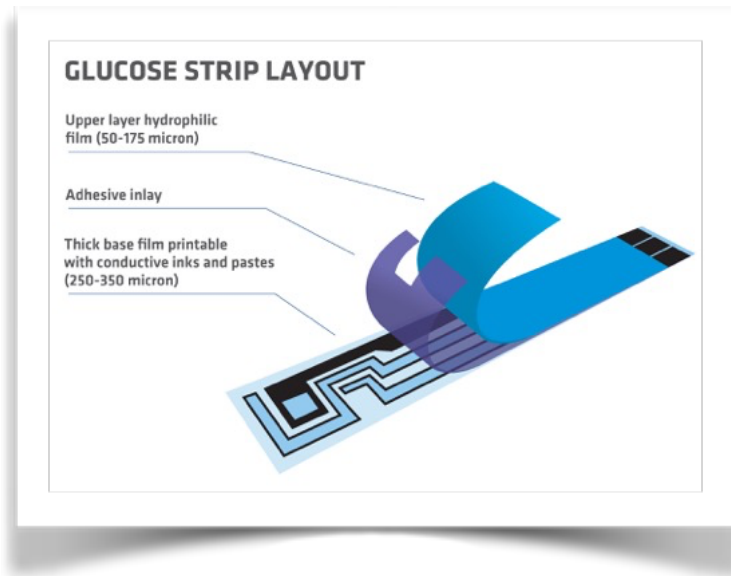
Tutors   All Biochemistry academic staff
Time   2 Hours
Place   Males: Biochemistry Teaching Lab,
                      College of Medicine
          Females: College of Medicine, Girls Campus

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 a glucometer and urine strips, respectively.

2. Describe the principle of the tests.

3. Record and calculate the results obtained from the experiments.

4. Interpret the results using the American Diabetes Association (ADA) guidelines.

Principle
Glucometer

GLUCOSE STRIP LAYOUT

Upper layer hydrophilic film (50-175 micron)

Adhesive inlay

Thick base film printable with conductive inks and pastes (250-350 micron)

1. The glucometer strip contains glucose oxidase enzyme that reacts with blood glucose converting it to gluconic acid.

2. The Gluconic acid then reacts with ferricyanide on the strip to produce ferrocyanide.

3. The glucometer detects ferrocyanide and displays the numbers on the screen.

4. The amount of ferrocyanide is equivalent to that of glucose in blood.

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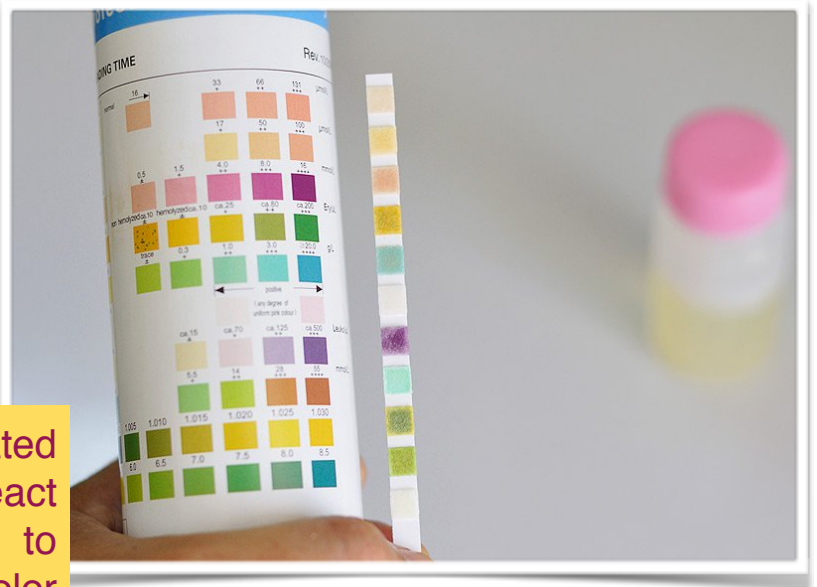
The urine strips are impregnated with a variety of reagents that react with substances in the urine to produce color. The intensity of color is proportional to concentration of the substance being detected.

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.

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

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.
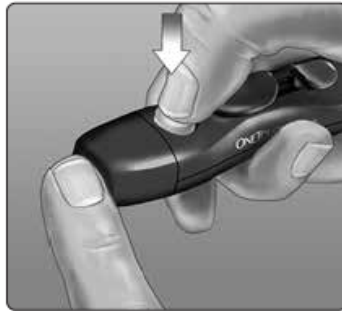
Procedure
Glucometer
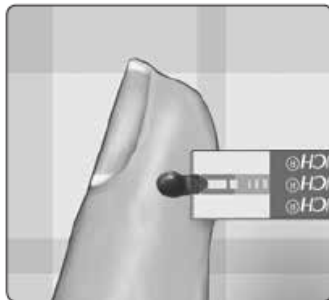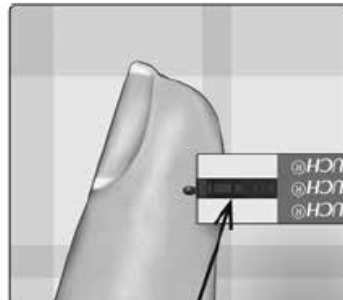
Contact bars

1 Test strip port

2

3

4

Confirmation window full

5

Instructions:

1. Insert the test strip in the glucometer as shown. This will turn on the meter.

2. Disinfect your fingertip using an alcohol swab. Let it dry. Prick the finger using the lancing device.

CAUTION ! The lancet in the lancing device is for single use only. Discard it after each use.

3. Position the glucometer near your finger as shown.

4. Draw up blood using the strip until the confirmation window is full.

5. Wait for a few seconds until results are displayed. Results can be read as mmol/L or mg/dL.

6. Record and interpret your results.

Procedure
Urine strips
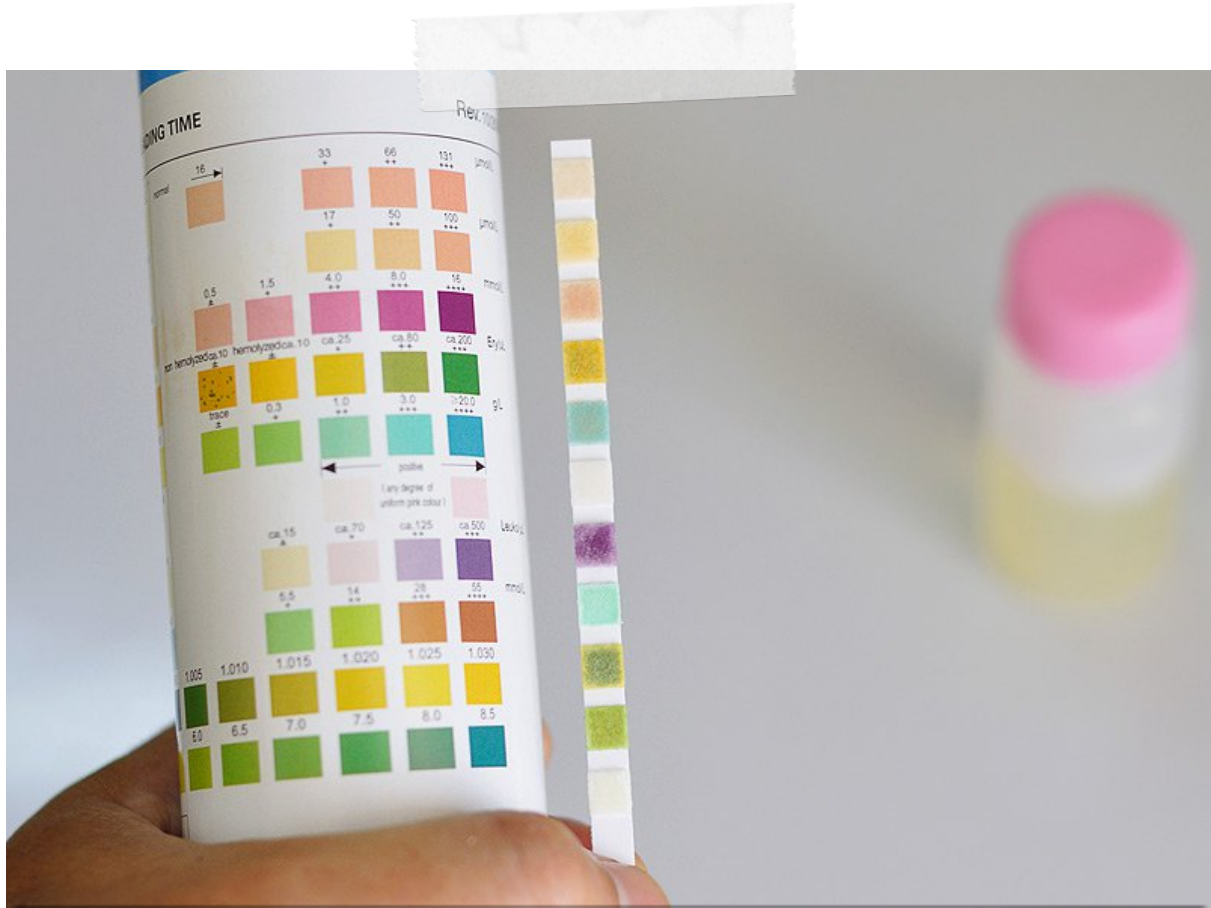
1. Dip the urine strip into the test tube containing the urine sample.

2. Remove immediately.

3. Wipe off excess urine. Invert the strip upside down and align it with the reference chart as shown in the picture above.

4. Read the color within 30-60 sec. by matching with the reference chart as shown above.
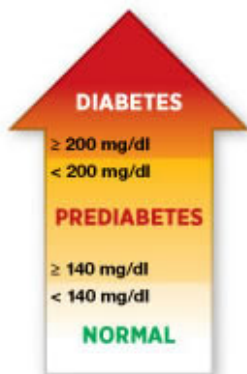
5. Interpret your results.

⚠️ Do not read the strip after 60 sec. Color changes after 60 sec. are of no significance.
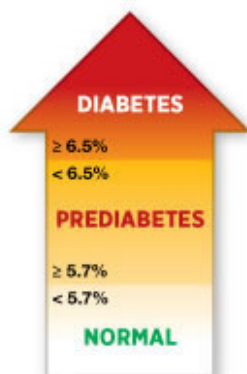
ADA Criteria for the Diagnosis of Diabetes
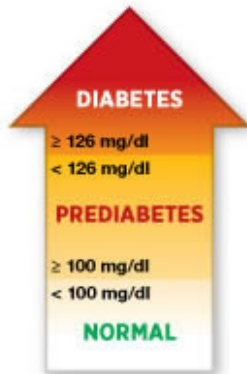
Result	Fasting Plasma Glucose (FPG)
Normal	less than 100 mg/dl
Prediabetes	100 mg/dl to 125 mg/dl
Diabetes	126 mg/dl or higher

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

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 Interpretation

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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