

Urinalysis



Biochemistry
Team



Teams

Objectives :

- Understand the scientific basis of urine examination (both physical and chemical properties) using dipsticks .
- Discuss the scientific principles behind the urine being one of the important body fluids .
- Recognize the value of urinalysis as a test for metabolic and kidney disorder and for urinary tract infection (UTIs) .
- Interpret the results of urinalysis and correlate it with the patient clinical findings .

هذا كلام الدكتور عمرو مصطفى والدكتورة ريم عن كل ما يخص البايو العملي ، أتمنى قراءته
بتمعن !

The OSPE will focus on the characteristic physical and chemical findings in urinalysis of diseases. No definitions. No experimental details. No case scenario.

The sources, as we mentioned, **both the practical class and the lecture entitled "chemical examination of the urine"**

May ALLAH help you all to be happy and successful.

Best wishes,
Amr S. Moustafa, M.D., PhD

And Dr.Reem said that , they will ask us about **the abnormal findings** in the physical and chemical examination of urine (for certain diseases or conditions)

تنبيه !!

سلايد ٤ و ٥
مهمين جدا

Urine is a fluid excreted by most of mammals including humans.

- It is formed in the kidneys (renal glomeruli).
- The fluid undergoes chemical changes before it is excreted as urine.
- Normal urine excretion by a healthy person is about 1.5 L per day.

Physical Properties of urine

PARAMETER	NORMAL	ABNORMAL	POSSIBLE CAUSES
Volume	0.4-2.0 L/day	Polyuria	Diabetes, chronic renal failure
		Oligouria	Dehydration, Acute renal failure
Appearance	Clear	Cloudy	Presence of pus cells, bacteria, salt or epithelial cells
Colour	Pale Yellow	Colorless	Excessive fluid intake, uncontrolled DM, DI, chronic renal failure
		Orange	Dehydration, carotenoid ingestion
		Yellow-Green	Jaundice
		Red	Blood, drugs etc
		Dark brown-black	Methemoglobin, alkaptonuria, melanoma, black water fever
		smoky	glomerulonephritis
Odor	Urineferous	Fruity	Diabetic ketoacidosis
		Ammoniacal	Contaminated and long standing exposed urine
		Mousy	Phenylketonuria
		Burnt sugar	Maple syrup urine disease
Deposits	None	Crystals, salts or cells	Blood clots, necrotic tissues and urinary stones
Reaction (pH)	4.6 - 7.0	Acidic	ketosis (diabetes mellitus & starvation), severe diarrhea, metabolic and respiratory acidosis, excessive ingestion of meat and certain fruits
		Alkaline	Respiratory and metabolic alkalosis, Urinary tract infection, Vegetarians

Chemical Properties of urine

PARAMETER	NORMAL	ABNORMAL	POSSIBLE CAUSES
Protein	< 200mg/day	Proteinuria	Nephrotic syndrome, glomerulonephritis,, multiple myeloma, lower UTI, tumors or stones
Glucose	None	Glucosuria	Uncontrolled DM, gestational diabetes, Fanconi's syndrome
Ketones	None	Ketonuria	Diabetic ketoacidosis, Glycogen storage disease, starvation, Prolonged vomiting, Unbalanced diet: high fat & Low CHO diet
Nitrite	None	Detected	UTI
Bilirubin	None	Detected	Hepatic and post-hepatic jaundice
Urobilinogen	<i>Normal Trace (1mg/dl)</i>	> 2 mg/dl	Jaundice
Blood	None	Hematuria	Acute & chronic glomerulonephritis, <i>Trauma , cystitis , renal calculi and tumors</i> , Bleeding disorders (<i>Hemophilia</i>).
		Hemoglobinuria	Hemoglobinopathies, Malaria, Transfusion reaction (<i>Blood Incompatibility</i>)

Proteins

Normally less than **200 mg protein** is excreted in the urine daily; more than this level leads to a condition called "Proteinuria".

➤ Glomerular proteinuria:

It is due to ↑ glomerular permeability → filtration of high molecular weight proteins (e.g. glomerulonephritis).

➤ Tubular proteinuria:

It occurs as a result of ↓ tubular reabsorption with normal glomerular permeability → excretion of low molecular weight proteins (e.g. chronic nephritis)

We took it in the theory,

Nephrotic syndrome:

- Large amounts of protein are lost in the urine and **hypoproteinaemia** develops.
- Increase protein excretion in urine can be one of the following two types:

A: High molecular weight protein excretion:

Glomerular proteinuria due to **increase glomerular permeability** leading to filtration of high molecular weight proteins

B: low molecular weight protein excretion:

Tubular proteinuria due to **decrease reabsorption** with normal glomerular permeability

Urinalysis (using dipstick):

الفهم

Principle:

- ❖ **Dipsticks** are plastic strips impregnated with chemical reagents which react with specific substances in the urine to produce **color-coded** visual results.
- ❖ They provide quick determination of **pH, protein, glucose, ketones, urobilinogen, bilirubin, blood, hemoglobin, nitrite, and specific gravity**.
The depth of color produced relates to the concentration of the substance in urine.
- ❖ Color controls are provided against which the actual color produced by the urine sample can be compared. The reaction times of the impregnated chemicals are standardized.

Procedure :

- ❖ Dip the strip in the urine sample provided then remove it immediately.
- ❖ Remove the excess urine and keep the strip in a horizontal position.
- ❖ Read the color produced within 30-60 seconds (*Color changes after more than 2 minutes are of no significance*).
- ❖ Match the color changes to the color scale provided.

Case I (Urine Sample I)

A 12-year-old girl, a known patient with T1DM, presented to Emergency drowsy with short history of vomiting and abdominal pain. On examination:

- Tachycardia
- Tachypnea with a fruity smell of breath.
- BP: 85/50 mmHg (Ref range: 100/66-135/85 mmHg)
- Blood sugar: 26.7 mmol/L (Ref range: 3.9-5.6 mmol/L)
- HbA1C: 9.9% (Ref range: 5.7-6.4%)
- Blood pH: 7.1 (Ref range: 7.35–7.45)
- Circulating Ketone bodies: positive

A mid stream Urine sample was collected for complete urinalysis.

1- Do urinalysis using dipsticks and give a full report regarding:

A- Physical examination.

B- Chemical examination.

2- What is the most likely diagnosis?

Case 1
Diabetic with ketonuria
(diabetic ketoacidosis)

Usually under 25 years patient with **type I diabetes** When there is no enough Insulin, the patient can not use the glucose as a fuel so the body breaks down fat instead, lead to acid (ketones) build up

- **Physical Properties of Urine :**

(Polyuria , Fruity Odor, Acidic PH, colorless)

-**Chemical Properties of urine :**

(Ketonuria , Glucosuria)

Case II (Urine Sample II)

- ⌘ A 49-old woman came to hospital with fever, weakness and dysuria (pain during urination) for the last three days.
- ⌘ The results of her laboratory tests were as follows:

Test	Result	Reference range
Fasting blood glucose	5.0	3.9-5.8 mmol/L
Creatinine	75	55-120 mmol/L
Urea	3.7	2.5-6.4 mmol/L
Sodium	140	135-145 mmol/L
Potassium	3.9	3.5-5.1 mmol/L

A mid stream Urine sample was collected for complete urinalysis.

- ⌘ Microscopic examination of urine showed:-
 - ⊠ WBCs: over 100/HPF (Ref range: 2-3/HPF)
 - ⊠ RBCs: 10/ HPF (Ref range: 0-2/HPF)

1- Do urinalysis using dipsticks and give a full report regarding:

- A- Physical examination.
- B- Chemical examination.

2- What is the most likely diagnosis?

Case 2 UTI

In UTI, the patient usually have :

1-Pain or a burning feeling during urination .

2- a feeling of urgency.

3- feeling the need to urinate frequently , 4-an altered appearance of the urine, either bloody (red) or cloudy containing pus.

5- pain or pressure in the rectum.

- **Physical Properties of Urine :**

(alkaline , cloudy)

-**Chemical Properties of urine :**

(**Proteinuria, Hematuria, Nitrate detected)**

Case III (Urine Sample III)

A 6-year-old boy, developed marked **edema** over a period of few days.

His mother had noted **puffiness around the eyes**, characteristically in the morning. She also noted that his **urine had become frothy**.

His general practitioner ordered the following investigations:

Test	Result	Reference range
Creatinine	58	55-120 mmol/L
Urea	3.4	2.5-6.4 mmol/L
Sodium	136	135-145 mmol/L
Potassium	4.0	3.5-5.1 mmol/L
Total protein	34	60-80 g/L
Albumin	14	35-50 gmL
Cholesterol	11	3.2-5.2 mmol/L
Triglycerides	1.5	0.5-2.27 mmol/L

A mid stream Urine sample was collected for complete urinalysis.

1- Do urinalysis using dipsticks and give a full report regarding:

A- Physical examination.

B- Chemical examination.

2- What is the most likely diagnosis?

Case 3 Nephrotic syndrome

Nephrotic syndrome is a **kidney disease** with (proteinuria- hypoalbuminemia -edema -Hyperlipidemia -hypercholesterolemia).

-Symptoms : **edema , puffiness around the eyes , frothy urine .**

- **Physical Properties of Urine : frothy**

- **Chemical Properties of urine :Proteinuria**

Task I. Physical Examination :

Appearance

Color

Odor

Deposits

Specific gravity(density)

Reaction (pH)

Task II. Chemical Examination:

<u>Item</u>	<u>Observation</u>	<u>Comment</u>
<u>Protein</u>		
<u>Glucose</u>		
<u>Ketones</u>		
<u>Nitrite</u>		
<u>Bilirubin</u>		
<u>Urobilinogen</u>		
<u>Blood</u>		

Urinalysis Report

Group	Test 1	Test 2	Test 3
Session#			
Protein			
Glucose			
ketones			
Nitrite			
Bilirubin			
Urobilinogen			
Blood			
Diagnosis			

