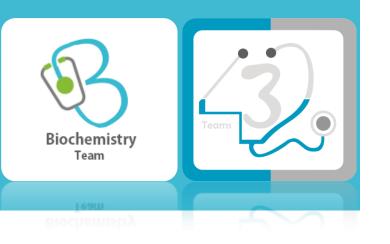
Practical Biochemistry

Urinalysis



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 .

Med432 Biochemistry Team /



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)



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	
	0.4-2.0 L/uay	Oligouria	Dehydration, Acute renal failure	
Appearance	Clear	Cloudy	Presence of pus cells, bacteria, salt or epithelial cells	
		Colorless	Excessive fluid intake, uncontrolled DM, DI, chronic renal failure	
		Orange	Dehydration, carotenoid ingestion	
Colour	Pale Yellow	Yellow-Green	Jaundice	
Colour	Fale fellow	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		s 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	Normal Trace (1mg/dl)	> 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 (Blood Incompatibility)

Proteins

Nephrotic syndrome:

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 \uparrow glomerular permeability \rightarrow filtration of high molecular weight proteins (e.g. glomerulonephritis).

Tubular proteinuria:

We took it in the theory?

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

- 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):

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?



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.

- ℜ 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?



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.

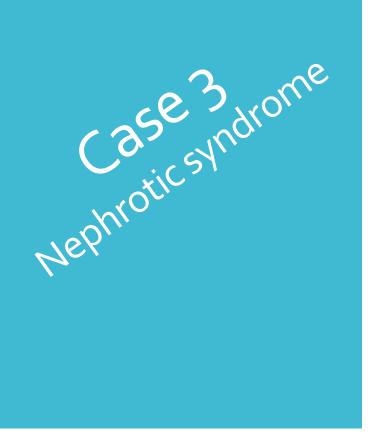
His mother had noted puffiness around the eyes, characteristically in the morning. She also noted that his urine had become frothy.

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?



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 :

Appearar	nce
Color	
Odor	
Deposits	
Specific g	ravity(density)
Reaction	(pH)

• •

Task II. Chemical Examination:

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

Urinalysis Report

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



If you find any mistake, please contact us:) Biochemistryteam@gmail.com Best of luck In the exam <3

أخيررررررررراً ، حاولنا على مدار السنة أن يظهر عمل تيم البآيو بأفضل حلة فـ إن نكن أصابنا فهذا والله ما أردنا وإن تكن الاخرى فحسبنا أن ذلك وسعنا وجل قدرتنا ، سبحانك اللهم وبحمدك ، نشـهد أن لا إله أنت ، نسـتغفرك ونتوب إليك ، تــــــم ابحمدالله ~

