

URINE ANALYSIS

URINE ANALYSIS

Composition :

Water → 1-2 L/day.

Total solids: (50 g/day)

Inorganic component (15 g/day) : e.g. NaCl

Organic component (35 g/day) : e.g. urea , uric acid.

Physical characters of urine

1- Volume:

- | | |
|-------------------------|--------------|
| 1- Normal urine output: | 1-2 L / day. |
| 2- Volume > 2L: | polyuria. |
| 3- Volume < 1L: | oligouria. |
| 4- No urine output: | anuria. |

Factors affecting urinary output:

1- Diet :

High protein diet : increases urea and so increase urine output

2- Temperature:

i- Summer: increase perspiration: oliguria.

ii- Winter: decrease perspiration: polyuria.

3- High fluid intake: polyuria.

4- Pathological cases:

Diabetes mellitus: polyuria.

5- Drugs:

Diuretics (xanthine alkaloids): polyuria

2- Color:

➤ **a- Normal urine color** straw yellow due to presence of 3 pigments:

1- Urobilin. 2- Urochrome. 3- Uroerythrin.

➤ **b- Abnormal colors:**

1- Faint yellow or colorless: as in diabetes mellitus since polyuria causes dilution of urine pigments.

2- **Tinge red:** due to:

a- presence of blood as in case of Bilharziasis.

b- Excretion of certain drugs as Rifampicin (used in treatment of TB).

3- **Yellowish green color** : as in case of jaundice.

4- **Orange color:** due to presence of carrots in diet or utilization of phenazopyridine drug (urinary tract antiseptic).

5-**Black color:** as in case of alkaptonuria; which is a disorder in tyrosine metabolism.



3- Odor:

➤ **a- Normal urine odor:** faint aromatic odor due to presence of volatile organic acids.

➤ **b- Odor changes:**

1- Ripe apple like odor (fruity odor): due to presence of acetone in diabetes mellitus.

2- Ammonia like odor: due to release of ammonia as a result of the bacterial action on urea in contaminated and long standing exposed urine samples.

4- Aspect:

- Normal: clear.
- If turbid: may be due to presence of **albumin or bile**.

5- Sediment and deposition:

- Fresh normal urine contains no sediment.
- Sediment present in case of presence of albumin or bile.

6- PH:

- Fresh normal urine: 5.7 – 6.8 (slightly acidic).
- After time : PH becomes alkaline due to production of ammonia by bacterial action.

7- Specific gravity:

➤ **Normal urine specific gravity:** 1.015 – 1.025

Measured by urinometer.

➤ **Accurate reading** = rough reading + $\frac{t-20}{3 * 1000}$

where **t** is room temperature

***Pathological constituents in
urine***

1- Albumin:

Albuminuria	It is the presence of detectable amount of albumin in urine.
Test for albumin in urine.	Heat coagulation test. (procedures)

Heat coagulation test: in a test tube, put 5 ml urine sample + 2 dps dil. Acetic acid. Incline the test tube and heat the surface. The formation of a coagulum indicates the presence of albumin.

2- Glucose:

Glucosuria	It is the presence of detectable amounts of glucose in urine.
Causes	<p>1- Diabetes mellitus.</p> <p>2- Renal diabetes (renal threshold of glucose is lower than 180 mg%).</p> <p>N.B: Renal threshold: maximum capacity of renal tubules to reabsorb certain substance</p>
Tests	<p>1- For glucose in urine : Benedict's test (Fehling can not be used).</p> <p>2- In case of pregnant & lactating women : osazone test.</p>

Benedict test:

- 1 ml of urine sample +1 ml of benedict reagent , shake then heat on direct flame.
- The formation of red precipitate indicate the presence of reducing sugars.

3- Blood:

Hematuria	Presence of detectable amounts of blood in urine.
Causes	Diseases such as Bilharziasis.
Tests:	<p data-bbox="904 391 1251 445">Benzidine test:</p> <p data-bbox="479 482 1676 722"><u>Procedure:</u> 1ml urine sample + 1dp H₂O₂ → shake well → + few drops of benzidine reagent → intense blue color.</p> <p data-bbox="962 759 1244 813"><u>Mechanism:</u></p> <p data-bbox="486 851 1669 1185">The wall of RBCs contain catalase enzyme which converts hydrogen peroxide reagent into water and nascent oxygen which oxidizes benzidine into benzidine blue:</p> $\text{H}_2\text{O}_2 \quad \text{H}_2\text{O} + [\text{O}]$

4- Ketone bodies:

- Ketone bodies include acetone, acetoacetic acid and B-hydroxybutyric acid.

Ketoneuria	It is the presence of detectable amounts of ketone bodies in urine.
Causes	<ul style="list-style-type: none">1- Low CHO diet2- Diabetes mellitus.3- Excessive fat in diet.4- Starvation.
Tests	<p>1) Rothera test: (general test for all ketone bodies) Procedure: 2ml urine sample → saturate with ammonium sulfate crystals → add 2 drops of Na nitro prusside reagent + 1 drops of conc. ammonia → wait for 10 min → magenta red color.</p> <p>2) Gerhard test: (specific for acetoacetic acid) Procedure: 3ml urine sample + 1.5ml FeCl₃ reagent → reddish brown color.</p> <p>(A blank test should be carried out)</p>

5- Bile:

Bile is normal secretion of gall bladder.

Composition:

a- Bile salts: Na^+ and K^+ salts of bile acids (glycocholic and taurocholic acids).

b- Bile pigments: (bilirubin & biliverdin).

Tests for bile in urine:

a- Test for bile salts: Hay's sulfur test:

Procedure:

3 ml urine sample, sprinkle sulfur powder on the surface of the urine, wait for 5 minutes without shaking.

a- If bile salts are present: sulfur will settle to the bottom of the tube.

b- If bile salts are absent: sulfur will remain on the surface of urine sample.

Mechanism :

Sulfur is water repellent, but in the presence of bile salts they act as emulsifier or surfactant which decrease surface tension between sulfur and urine and increases wettability of sulfur which settles to the bottom of the test tube.

b- Test for bile pigments: modified Gmelin's test:

Observation if bile pigments are present: Concentric color rings (green, blue, red).

6- Indican:

- It is potassium salt of indoxyl sulfate.
- Causes of indican appearance in urine:
 - 1- Severe constipation.
 - 2- Gastric cancer.
 - 3- Gastritis.
 - 4- Gastric obstruction.

Test : Jaff's test: If indican is present: blue color in organic layer.

THANK YOU