

Investigation 13.B: Analyzing Endocrine Disorders

Question: Using the information chart provided and some simulated blood and urine samples, how can you diagnose hormonal imbalances?

Safety Precautions



- Do not drink any of the solutions used in the laboratory.
- Wash up any spills and your hands after each trial.
- Benedict's solution is toxic and an irritant. If you get it on your skin or in your eyes, immediately inform your teacher and flush your skin or eyes with clean water.
- Be extremely careful around open flames.

Materials

- simulated samples of blood (5)
- simulated samples of urine (5)
- digital blood glucose monitor (if available)
- blood and urine test strips (if using a monitor)
- cotton swabs
- Benedict's solution (if not using a monitor)
- medicine dropper
- 10 mL test tubes (10)
- test-tube rack
- 10 mL graduated cylinder
- Bunsen burner or small propane torch
- 400 mL beaker
- hot plate
- test-tube clamp
- beaker tongs

Symptoms of Various Endocrine Imbalances

Patient's condition	Substances identified	Blood concentrations (mmol/L)	Present or absent in the urine	Additional information
healthy	glucose	5.0	absent	person experiences no additional symptoms
	sodium	140	absent	
diabetes mellitus	glucose	25	present	person reports being thirsty and must urinate frequently
	sodium	138	absent	
diabetes insipidus	glucose	4.5	absent	person is producing large volumes of dilute, pale urine
	sodium	150	absent	
Addison's disease	glucose	4.0	absent	person is under stress; urine output is high; there is sodium in the urine
	sodium	130	present	
pituitary gland and adrenal gland disorder (reduced cortisol, epinephrine, and hGH)	glucose	3.5	absent	this is an older person whose glucagon-producing cells have deteriorated
	sodium	142	absent	

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Procedure

Record your data in the following table.

Patient	Blood glucose concentration	Glucose present or absent in urine	Sodium present or absent in urine	Name of disorder
A				
B				
C				
D				
E				

Part A: Testing for Glucose Concentrations in the Blood and Urine

1. If your school has a glucose monitor, place a drop of the first sample of simulated blood or urine on a clean test strip. Plug the strip into the monitor and take a glucose reading. Record the value that you obtain in your data table. Repeat the procedure for the other samples.
2. If a glucose monitor is not available, you can use the Benedict's test to determine the concentration of glucose in each of the blood samples, and to detect the presence or absence of glucose in the urine. Benedict's solution identifies simple sugars, such as glucose, by causing a colour change. As the concentration of glucose changes, so will the colour of the sample mixed with Benedict's solution, according to the following table.

Benedict's Test Colour Equivalence Table

Colour of solution	Glucose concentration (percent)	Glucose concentration (mmol/L)
blue	0.0	0
light green	0.1–0.5	5.56–27.8
olive green	0.5–1.0	27.8–55.6
yellow	1.0–1.5	55.6–83.3
orange	1.5–2.0	83.3–111
red-brown	2.0+	111+

- a) Test the 5 blood samples first. Label 5 test tubes A through E. Use the 10 mL graduated cylinder to measure 5 mL of Benedict's solution into each test tube.
- b) With a medicine dropper, add 5 drops of simulated blood from each of the patient's samples to the appropriately labelled test tube. Rinse out the medicine dropper with clean water between samples.
- c) Fill a 400 mL beaker about two-thirds full with water. Place the beaker on a hot plate and turn it on. When the water has had time to warm up, use the test-tube clamps to place the test tubes with the samples and Benedict's solution into the beaker. Leave the test tubes in the beaker until there is a colour change or a maximum of 5 min.

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- d) Use the test-tube clamps to remove the test tubes from the water bath. Record the results in your data table.
- e) Next, test the 5 urine samples. Use the procedural steps (a) through (d).

Part B: Testing for Sodium in the Urine (Teacher Demonstration)

- 3. Have your teacher ignite a Bunsen burner or propane torch. Your teacher will dip a cotton swab in one of the urine samples, then immediately place the wet end of the swab in the flame. If sodium is present in the urine, the flame should flare bright orange. If not, the flame should stay blue. Record your observations in your data table. Your teacher will repeat this step for the remaining urine samples, using a new cotton swab for each sample.

Analysis

- 1. Which patient in this investigation acted as a control?
- 2. Why were simulated blood and urine samples used in this investigation, instead of real samples?

Conclusions

- 3. Use the table listing the symptoms of different endocrine imbalances to diagnose the condition of each of the patients (A through E).

