

# Urinalysis Lab

The purpose of this demonstration is to give students an understanding of substances that can be measured by urinalysis dipsticks.

The strips we are using measure:

- |                 |                     |
|-----------------|---------------------|
| 1. Leukocytes   | 6. Blood            |
| 2. Nitrites     | 7. Specific gravity |
| 3. Urobilinogen | 8. Ketones          |
| 4. Protein      | 9. Bilirubin        |
| 5. pH           | 10. Glucose         |

Attention must be paid to time limits set for each reagent pad for accurate results.

Procedure:

1. The urine specimen should be mixed by inverting the sample a couple of times.
2. While these are not real urine specimens the student may want to wear gloves while handling the test strip.
3. Remove one strip from the vial and replace cap.
4. Hold the strip against vial to observe proper reading format.
5. Completely immerse reagent areas of the strip in the urine specimen and remove immediately and reseal the specimen.
6. Start timing and touch or blot the edge of the strip on an absorbent material to remove the excess urine. This prevents the 'run-off' phenomenon which can lead to erroneous or inaccurate results.
7. Hold the strip in a horizontal position to prevent possible mixing of chemicals from adjacent reagent areas and/or contaminating the hands with urine.
8. Compare reagent areas to corresponding Color Chart on the bottle label at the time specified. **HOLD STRIP CLOSE TO COLOR BLOCKS AND MATCH CAREFULLY.**
9. Avoid laying the strip directly on the Color Chart as this will result in the urine soiling the chart.
10. After dipping the strip, check the pH area. If the color on the pad is not uniform, read the pH reagent area immediately, comparing the darkest color to the appropriate Color Chart.
11. Refer to color chart for the permitted reading time.
12. A positive reaction (small or greater) at or less than 2 minutes on the leukocyte test may be regarded as a positive indication of leukocytes in urine. Color changes that occur after 2 minutes are of no diagnostic value.
13. Students can review the information provided to determine possible causes for any abnormal results
14. Discard used reagent strip.

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The following are possible reasons for abnormal dipstick results. This test is not diagnostic, it is used to screen for possible problems that need further investigation.

## **Glucose in urine:**

Glucose is normally filtered by the glomerulus but is then almost completely reabsorbed in the proximal tubule. When the amount of filtered glucose exceeds the kidney's ability to resorb, glucose may appear in the urine.

Abnormal glucose results may indicate

- Diabetes Mellitus
- Renal glycosuria during pregnancy
- After excessive consumption of carbohydrates

### **Ketones in Urine:**

Normally ketones are not found in the urine. Ketones are the product of fat metabolism in the absence of adequate carbohydrates. It is commonly encountered in uncontrolled diabetes. However, some ketones may be present in the urine of individuals on a carbohydrate-free diet (high-protein weight loss diets), and occasionally with starvation or a prolonged fast.

Abnormal ketones values may indicate

- Diabetic ketoacidosis
- Insufficient food intake
- Starvation
- Strict dieting

### **Blood in the Urine:**

The urine dipstick is used to test for the peroxidase activity of erythrocytes, not for the actual presence of the physical RBC. Myoglobin and hemoglobin produce a positive dipstick for hematuria because these substances also will produce this reaction. Microscopy is needed to determine if RBCs are actually present. Normally there should be no reaction to this test.

Abnormal blood/hemoglobin results may indicate

- Hematuria (blood in urine)
  - Kidney and bladder calculi
  - Damage to kidney or urinary tract
- Hemoglobinuria (hemoglobin in urine)
  - Breakdown of red blood cells
  - Poisoning
- Myoglobinuria
  - Myocardial infarct
  - Muscle damage

### **Protein in the Urine:**

Normally the glomerulus has limited permeability to protein so it is not normally found in the urine. Diseased kidneys allow more protein to be filtered so the presence of protein in the urine is a hallmark of a variety of renal diseases.

Abnormal protein results may indicate

- Congestive heart failure
- Dehydration
- Diabetic nephropathy
- Glomerulonephritis
- Nephrotic syndrome
- Nephrotoxic drugs
- Preeclampsia
- Urinary tract infection

### **Urine pH**

The primary and normal function of the kidney is to acidify the urine. Normal serum pH is 7.4, but the normal urinary pH ranges from 4.5 to 8. Abnormally function of the renal tubules can cause changes in urine pH. For example in tubular acidosis, the blood becomes more acidic because the renal tubules cannot acidify the urine, so the urine becomes more alkaline.

The urine pH can be related to diet. Acid urine can be the result of ingestion of fruits that acidify the urine. This is the reason cranberry juice is used for urinary tract problems. Meat eaters tend to have more acidic urine, and vegetarians tend to have alkaline urine.

Abnormally high pH may indicate

- Gastric suction
- Kidney failure
- Kidney tubular acidosis
- Urinary tract infection
- Vomiting

Abnormally low pH may indicate

- Diabetic ketoacidosis
- Diarrhea
- Starvation

### **Specific Gravity of Urine**

The most useful information derived from the specific gravity is insight into the patient's hydration status and the concentrating ability of kidneys. The normal specific gravity ranges from 1.003 to 1.030.

Abnormally low specific gravity may indicate

- Diabetes insipidus
- Certain renal diseases
- Excess fluid intake
- Diabetes mellitus

Abnormally high specific gravity may indicate

- Dehydration
- Adrenal insufficiency
- Nephrosis
- Congestive cardiac-failure
- Liver disease

### **Nitrites in urine**

Nitrates are normally excreted by the kidney, nitrites are not normally found in urine. Bacteria in the urine can reduce urinary nitrates to nitrites. So a positive nitrite test usually means infection. A negative nitrite test does not rule out a urinary tract infection, but a positive one strongly suggests infection.

Abnormal nitrite values may indicate

- Urinary tract infection

### **Bilirubin/Urobilinogen in urine**

Urine does not usually contain bilirubin. Bile duct obstruction or liver disease will cause an elevated urine bilirubin. There can normally be small amounts of urobilinogen in the urine.

**Abnormal increased urobilinogen results may indicate**

- Excessive RBC breakdown
- Restricted liver function
- Liver cirrhosis

### **Leukocytes in urine**

Normally there are no white blood cells in the urine. The presence of leukocytes may indicate that there is a urinary tract infection present.