Miss Foley

HSci20: DT1 Diagnostics **Urinalysis Lab**

**Urinalysis Lab - PERSONAL**

**Background Information:**

Tests on urine can provide clues to many diseases and information about your overall health. A routine urine screening test may be done to help find the cause for many types of symptoms. The kidneys remove waste material, minerals, fluids, and other substances from the blood for elimination in the urine. Therefore, urine can contain hundreds of different bodily waste products. Many factors (such as diet, fluid intake, exercise, and kidney function) affect what is in urine.

A urine test may be done as part of a routine physical examination to screen for a disease or infection of the urinary tract. Symptoms that may lead to a urine test include discolored or foul-smelling urine, pain during urination, difficulty urinating, flank pain, or fever. Urine tests are also performed to monitor the treatment of certain conditions such as diabetes, kidney stones, a urinary tract infection, hypertension, or some types of kidney or liver disease.

**Macroscopic** examination requires only that the observer has a sense of sight. The most cost-effective device used to screen urine chemistry is a plastic dipstick. This **microchemistry** system has been available for many years and allows qualitative and semi-quantitative analysis within a few minutes by simple but careful observation. The color change occurring on each segment of the strip is compared to an established color chart (on the dipstick container) to obtain results. For an example, see the image below:



Dipstick

**Pre-Lab:**

Complete some external research to determine the normal range for pH, glucose, ketones and protein in urine. In addition, determine what normal urine should look like in terms of color and turbidity. Use this information to fill in the normal range column of Table 1 and Table 2 in the observations section.

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**Purpose:**

The purpose of this activity is to perform two types of analysis (macro analysis and microchemistry) on a variety of urine samples to understand the procedure and purpose of urine testing in the healthcare world.

**Materials:**

* Multipurpose urine testing strips (1 per urine sample per person)
* Urine samples (2 per person) PRE and 3 days later POST
* Small test tubes or cups (1 per urine sample)
* Test tube rack, if using test tubes
* Stop watch
* Latex gloves and safety glasses

**Test Procedure:**

1. Read through the whole procedure before starting the lab.
2. Obtain the materials necessary to complete the lab activity and put on safety equipment.
3. Label your test tube or cup sample. Obtain 5mL of each urine sample and place into the appropriate test tube OR leave urine sample in cup.
4. Complete the **macroscopic analysis** of your urine sample. You will only need your eyes for this step. Write down your observations for color and turbidity in the measured results column in Table 1 for each sample. If your measured result doesn’t match your normal range, indicate this by writing ‘Y’ in the last column. If they do match, indicate this with ‘N’ in the last column.
5. Complete the **microscopic test strip analysis** of your urine samples. Be very careful that you follow the procedure below; if not, this could affect your results.
	1. Swirl your urine sample
	2. Remove lid of reagent container.
	3. Lift 1 strip out of the container without contaminating it. This means do not touch any of the reagent pads with your fingers.
	4. Close reagent container.
	5. Dip strip into urine; covering all reagent bars without touching the rim of the urine container.
	6. Remove strip after 1-2 seconds. Tap against side of container to remove excess urine.
	7. Start stop watch immediately.
	8. Read regent strip at correct time and record results in the measured results of Table 2:
		1. Glucose, Ketones and Protein: 1 minute
		2. pH: 10 seconds
	9. Take a picture to document your strip results in comparison to results color chart.
	10. Discard strip and urine immediately.
	11. Repeat this process for as many urine samples as you have.
6. Clean work area with disinfectant. Wash and put away all materials as directed by your instructor. Remove safety goggles and gloves, and then wash hands.
7. Drink 2+ liters of water/day for the next three (3) days. Repeat procedure for POST urine sample

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_

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**Observations:**

**Table 1: Macroscopic Analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Urine Sample | Characteristic | Normal Range | Measured Results | Abnormal results? (y or n) |
| **PRE** | color |  |  |  |
| turbidity |  |  |  |
| **POST** | color |  |  |  |
| turbidity |  |  |  |
| turbidity |  |  |  |

**Table 2: Chemical Analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Urine Sample | Characteristic | Normal Range | Measured Results | Abnormal results? (y or n) |
| **PRE** | pH |  |  |  |
| Protein |  |  |  |
| Glucose |  |  |  |
| Ketones |  |  |  |
| **POST** | pH |  |  |  |
| Protein |  |  |  |
| Glucose |  |  |  |
| Ketones |  |  |  |

 **PRE Sample Comparison Pic POST Sample Comparison Pic**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_

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**Discussion Questions:**

1. How can water intake be judged by the color of urine?
2. What is the normal value for glucose in urine?
3. Is it ever “normal” to find protein in urine? Why or why not?
4. a) Did you drink 2+ liters of water/day for the last 3 days?

b) What affect did hydration or “de” hydration have on the macroscopic analysis of your POST urine sample?

1. The presence of ketones is often high in the urine of both diabetics and peoples who suffer from anorexia. What characteristics would these two groups have in common that would cause this to happen?

**Conclusion:**

Write a paragraph that summarizes your results and relates back to your purpose. This is where you should summarize your data and have a chance to analyze the results you observed in the lab. For example, if a sample 2 had a positive protein and ketone result…what does that mean?

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**Urinalysis Interpretation**

**Smell**

The normal smell of urine can be described as **urinoid**. Other smells of interest include:

* Fecal smell - gastrointestinal-bladder fistula
* Fruity or sweet smell - diabetic ketoacidosis
* Ammonia smell - alkaline fermentation.
* Asparagus smell - eating a lot of asparagus, can often smell it within 20 min of ingestion

**Colour**

Normal urine colour is often described as straw, yellow or amber. This colour may be altered by medications, food sources or disease. Vitamin tablets often result in a bright yellow urine, as does the presence of bilirubin (a bile pigment). Red urine may be due to blood, hemoglobin, or beetroot. Iron supplements may cause a dark brown specimen, as might amounts of prophobilin or urobilin (a chemical produced in the intestines). Normal urine is also transparent. Turbid or cloudy urine may result from infection the presence of blood cells, bacteria or yeast (ex. Candida). Foamy urine may indicate either the presence of glucose or protein.

**Leukocytes**

This test detects white cells in the urine (pyuria) which is associated with urinary tract infection.

**Nitrites**

Nitrites are formed by the breakdown of urinary nitrates. This is usually caused by Gram-negative and some Gram-positive bacteria. So the presence of nitrites suggests bacterial infection such as E. coli, Staphylococcus and Klebsiella. Commonly found during a urinary tract infection.

**Urobilinogen**

Normally present in the urine in small quantity. Less than 1% of urobilinogen is passed by the kidneys the remainder is excreted in the feces or transported back to the liver and converted into bile. Raised levels may be due to:

* Cirrhosis
* Hepatitis
* Hepatic necrosis
* Hemolytic and pernicious anemia
* Malaria

**Protein**

This is measuring the amount of albumin in the urine. Normally there should be no detectable quantities. Elevated protein levels are known as proteinuria. Albumin is one of the smaller proteins, and if the kidneys begin to dysfunction it may show an early sign of kidney disease. Other conditions which may lead to protein in the urine include:

* Injury to the urinary tract, bladder or urethra
* Inflammation, malignancies.
* Multiple myeloma

**Ketones**

* Not normally found in the urine, ketones are produced during fat metabolism. Presence of ketones may indicate:
* diabetes
* alcoholism
* eclampsia
* a state of starvation
* pregnancy

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**pH**

Measures the hydrogen ion concentration of the urine. It is important that a fresh sample be used as urine becomes more alkaline over time as bacteria convert urea to ammonia (which is very alkaline). Urine is normally acidic but its normal pH ranges from 4.5 to 8.

Low pH (acidic):

* Foods such as acidic fruits (cranberries) can lower the pH, as can high a high protein diet.
* As urine generally reflects the blood pH, metabolic or respiratory acidosis can make it more acidic.
* Other causes of acidic urine include diabetes, diarrhea and starvation.

High pH (alkaline):

* Low carb or vegetarian diet
* May be associated with renal calculi.
* Respiratory or metabolic alkalosis
* Urinary tract infection

**Hematuria**

Classified as microscopic or macroscopic. Microscopic means that the blood is not visible with the naked eye. Blood may be present in the urine following trauma, smoking, infection, renal calculi or strenuous exercise. It may also be present with:

* Urinary tract infections.
* Damage to the glomerulus or tumors which erode the urinary tract.
* Acute tubular necrosis.
* Traumatic catheterization.
* Damage caused by the passage of kidney stones.
* Contamination from the vagina during menstruation.
* The presence of myoglobin (myoglobinuria) after muscle injury will also cause the reagent strip to indicate blood.

**Specific Gravity**

The specific gravity (SG) of urine signifies the concentration of dissolved solutes and reflects the effectiveness of the renal tubules to concentrate it ( when the body needs to conserve fluid). If there were no solutes present the urines SG would be 1.000, the same as pure water. The SG of urine is around 1.010 but can vary greatly:

Decreased SG may be due to:

* Excessive fluid intake (oral or IV fluids)
* Renal failure
* Acute golmerulonephritis, pyelonephritis, acute tubular necrosis
* Diabetes insipidus

Increased SG may be due to:

* Dehydration due to poor fluid intake, vomiting or diarrhea
* Heart failure
* Liver failure
* Inappropriate antidiuretic hormone secretion
* It also reflects a high solute concentration which may be from glucose (diabetes or IV glucose) or protein.

**Bilirubin**

Produced as a by-product during the degradation of RBC in the liver and normally excreted in the bile. Once in the intestine it is excreted in the feces (as stercobilin) or by the kidneys (as urobilinogen). Presence of bilirubin in the urine may therefore indicate:

* liver disease
* biliary tract infection
* pancreatic causes of obstructive jaundice

**Glucose**

Glucose is not normally present in the urine. Once the level of glucose in the blood reaches a ˜renal threshold ™ the kidneys begin to excrete it into the urine in an attempt to decrease the blood concentration. So high blood concentrations lead to glycosuria, as does conditions that may reduce this renal threshold.

* Diabetes
* Liver disease
* Medications such as tetracycline, lithium, penicillin, cephalosporin’s
* Pregnancy