Experiment HK-1: Kidney Overview

Preparation

1. Do not drink anything but water during the 3 hour period before lab. You may drink as much water as you wish.
2. Urinate one hour before coming to lab. Do not urinate again until the first collection at the beginning of laboratory.
3. If you have circulatory problems, poor kidney function or have any medical problems, **DO NOT** volunteer as a subject for this experiment.

Equipment Required

Drinking cups

Urine collecting cups

Urine hydrometer

Water for drinking

Cola

Caffeine-free Cola

Diet Caffeine-free Cola

Gatorade or other sports drink

Note: This lab does not use the LabScribe Software for recording data. All data is collected using the hydrometer. The use of pH strips may be added to the protocol.

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Exercise 1: Measuring Urinary Output

Aim: To drink a particular solution and measure the amount of urine produced over time.

Approximate Time: 2.5 hours

Procedure

1. At the start of laboratory, obtain a couple of graduated urine specimen cups and collect the entire contents of your bladder.
2. Note the time when this collection was made, the time of your last urination before lab, and the volume of urine collected.
3. Calculate the control rate of urine production (ml/min) by dividing the urine volume (mls) collected by the number of minutes since your last urination.
4. You will be assigned to drink one of the following solutions. These assignments will be made at random. If you have any medical condition which prohibits you from consuming one of these solutions, inform the lab instructor. You can pick another solution or be excused from being a subject.

Table HC-4-1: Solutions used in Kidney Experiment

Solution	Dosage
Drinking water	When thirsty (Record time between drinks)
Drinking water	16 ml per kg of body weight
Drinking water	7.5 ml per kg of body weight
Cola	7.5 ml per kg of body weight
Gatorade	7.5 ml per kg of body weight
Caffeine-free Cola	7.5 ml per kg of body weight
Diet Caffeine-free Cola	7.5 ml per kg of body weight

5. If you are drinking any solution at the rates of 7.5ml/kg or 16ml/kg of body weight, consume the total volume of the solution as quickly as possible (in under 10 minutes if possible).
6. Collect urine samples at 30, 60, 90, and 120 minutes after drinking the solution. If you need to urinate more frequently, keep a record of the total volume of urine collected during each 60 minute interval.

Data Collection and Measurements

Urine Production Rate (ml/min)

1. Use a graduated specimen cup to measure the volume of urine collected at the 0 (control), 30, 60, 90, and 120 minute sampling times.
2. Calculate the urine production rate in milliliters per minute for each of the four sampling times.

Urinary Specific Gravity

1. For each time point (0, 30, 60, 90, 120 minutes) retain enough of your urine sample to fill 80% of the hydrometer cylinder.
2. Place the urinometer in the chamber and gently spin the device so that it rotates freely for at least two turns.
3. Read the specific gravity of the urine sample by matching the meniscus of the sample with scale on the stem of the urinometer. The scale ranges from 1.000 at the top to 1.060 at the bottom.
    - If the specific gravity of a urine sample is too high (>1.060) or there is an insufficient volume of urine collected, measure a given volume of urine and dilute that volume by adding one or two times more distilled water.
    - Account for the dilution when the specific gravity of the urine is recorded. For example, if one volume of water was added to one volume of urine and the urinometer read 1.02, specific gravity would be calculated by:

        a) Subtracting 1.000 (specific gravity of water) from 1.020 = 0.02;

        b) Multiplying the difference (0.02) x 2 (for the 2 volumes) = 0.04; and

        c) Adding 0.04 to 1.000 = 1.04, the specific gravity of sample.

Optional Measurements: pH, Urinary Glucose

- pH: Use assorted pH papers to determine urine pH of the samples taken at the 0, 30, 60, 90, and 120 minute sampling times.
- Urinary Glucose: Use Diastix$^{(tm)}$ to check for the presence or absence of urinary glucose. Follow the directions for the use of Diastix indicator strips as listed on the container.

Data Analysis

1. Pool the calculated data from all the subjects in the class. Add your urine production rate and specific gravity data for each time point to a large class table. The data from subjects who consumed the same solution should be grouped in the same area of the table.
2. Calculate the average urine production rate and average specific gravity for each time point for all subjects in the group who drank the same experimental solution. Discard any obviously erroneous results.

3. Make line graphs of your urine production rate and specific gravity as a function of time.
4. Examine the results and graphs from other subjects who drank different solutions.

Questions

1. Compare the different groups who drank 7.5 ml of fluid for each kg of body weight. Which group had the highest average urine production rate? Why?
2. Compare the different groups who drank 7.5 ml of fluid for each kg of body weight. Which group had the highest average specific gravity? Why?
3. Compare the groups who drank 7.5 ml and 16 ml of water for each kg of body weight, and water at will. Which group had the highest average specific gravity? Which group had the highest average urine production rate? Why?
4. During the experiment, which group probably had the highest concentration of ADH in their bodies?