

Student Guidelines: Endocrine Physiology Lab

CAUTION: Procedures in this exercise involve the use of human blood which puts you at risk of contamination and development of certain life-threatening communicable diseases including, but not limited to, AIDS and Hepatitis.

NOTE: No student will be required to draw his/her own blood.

I. Checklist:

- A. Glucose measurements and tolerance test.
- B. Complete lab report sheet.

II. Glucose Measurements and Tolerance Test

****NOTE:** This lab is not intended to provide diagnoses of any kind. The results are for instructional use only. All results will remain anonymous. If you are concerned about any results you may find, please consult your physician.

OBJECTIVES

- To measure blood glucose (sugar) levels.
- To gain an understanding of pancreatic function and homeostatic mechanisms in the endocrine system.

MATERIALS (provided)

Glucose meter and test strips
Alcohol pads
Lancet

For those undergoing full glucose tolerance tests:

- 4 lancets
- 4 alcohol pads
- 4 test strips
- Timer
- Glucose containing drink (Kool-Aid, prepared according to the package instructions)

***NOTE:** If you know you are diabetic, please refrain from volunteering for the full glucose tolerance test as this is not a clinic and your health and well-being are very important.

BACKGROUND

The endocrine portion of the pancreas functions primarily in the regulation of glucose homeostasis. The cells in the endocrine portion of the pancreas are located in the Islets of Langerhans, so named as they form islands of endocrine cells in a sea of exocrine glands. The beta and alpha cells located in the Islets produce the counterregulatory hormones insulin and glucagon, respectively. The primary function of insulin is to lower blood glucose whereas glucagon acts to increase blood glucose levels. Together these hormones help maintain glucose homeostasis in the body. The goal of this lab is to perform glucose measurements following an overnight fast (morning labs), right

after lunch, or in the afternoon. At least 5 students from each laboratory section will be chosen from volunteers to undergo a full mock glucose tolerance test.

GENERAL PROTOCOL

A. Initial Blood Draw:

1. Go to the designated finger pricking area of the lab.
2. Clean the lab area thoroughly using 10% bleach or other anti-microbial spray.
3. Sit down prior to pricking your finger.
4. Clean the area to be pricked with an alcohol pad and dry completely.
5. Prick the fingertip with a lancet.
6. Hold the finger until a small drop of blood appears. You may need to apply a little pressure by squeezing the fingertip. Collect the blood drop with the test strip.
7. Follow the instructions for inserting the test strip and using the meter.
8. **IMPORTANT: Be sure to write down this value on your Worksheet.**
9. Dispose of lancets in the red biohazard sharps container.
10. Dispose of alcohol pads, gauze pads and bandaids in the designated biohazard disposal container.
11. Clean lab bench thoroughly with 10% bleach or other anti-microbial spray after use.

B. Mock Glucose Tolerance Test:

1. After the initial blood draw, drink 1 cup of Kool-Aid prepared by your laboratory instructor. Be sure to drink it all at once.
2. Repeat the blood draw and glucose testing every 30 minutes following the glucose drink for a total 3 more tests over the course of 90 minutes.

IMPORTANT: Be sure to write down these values on your Worksheet

Worksheet: Results of Glucose Testing

Lab Section: _____ Time: _____

I. Full glucose tolerance test

Initial Glucose Reading (mg/dl): _____

Glucose at 30 mins (mg/dl): _____

Glucose at 60 mins (mg/dl): _____

Glucose at 90 mins (mg/dl): _____

Have you had any caffeine prior to this test? YES NO

If so, at what time? _____

What type of caffeine? _____

Did you have anything to eat prior to this lab? YES NO

If yes, at what time was your last meal? _____AM/PM

II. Single blood glucose measurement

Initial Glucose Reading (mg/dl): _____

Have you had any caffeine prior to this test? YES NO

If so, at what time? _____

What type of caffeine? _____

Did you have anything to eat prior to this lab? YES NO

If yes, at what time was your last meal? _____AM/PM

Instructor Guidelines: Endocrine Physiology Laboratory

- Check with your institution's Institutional Review Board (IRB) to determine whether a human subjects protocol needs to be submitted prior to using this laboratory exercise.
- Since students will be testing their own blood and possibly be exposed to other student's blood, it is highly recommended that they sign a consent form prior to the start of the lab. This form should contain information on whether they are voluntarily consenting to participate in the lab, potential hazards, clean-up instructions for their own blood, how many students can be at the finger pricking station at a time, to notify the instructor if they feel faint, etc.
- The glucose measurements collected can be either single measurements (good for after lunch or afternoon labs) or a full mock glucose tolerance test (good for any time of day, but the mornings are best since students can come in fasted (i.e. no food or drinks other than water after midnight)).
- Be sure to collect the data from the student's worksheets.
 - For the single measurement tests, values can be compared to other laboratory sessions at other times of the day as well as the time 0 values from students who underwent the full mock glucose tolerance test.
 - For the full mock glucose tolerance test, plot their blood glucose levels at 0, 30, 60, and 90 minutes following the ingestion of the glucose drink (x-axis: time, y-axis: glucose levels). In my experience, blood sugar levels do return to baseline within 90-minutes following the ingestion of Kool-Aid.
 - I typically present these graphs in the next classroom session where we discuss what the results mean but they can also be discussed in each laboratory session.
- **Items to Discuss:**
 - What the results of a normal glucose tolerance test should look like. What insulin and glucagon levels would be like on the graph if they had been measured along with glucose.
 - What the results of an abnormal glucose tolerance test would look like:
 - *Type I Diabetes Mellitus*: insufficient insulin; levels of glucose stay high; insulin would not increase with glucose and would remain low or not present.
 - *Type II Diabetes Mellitus*: insulin resistance; levels of glucose would stay high; insulin levels may be high in the initial stages of the disease since this disorder is characterized by diminished glucose disposal from the blood.
 - *Diabetes Insipidus*: Would look normal since this is not a disorder involving insulin or glucose.
 - *How caffeine would affect the results*: caffeine increases glucose disposal from the blood as it increases metabolism and activates glucose uptake

pathways in tissues that are separate from the insulin signaling pathways. So blood glucose levels may start off lower and return to baseline faster in students that have recently ingested caffeine.

- *How food may affect the results:* Food may help to slow down the absorption of glucose from the Kool-Aid (depending on the type of food ingested) and may therefore result in lower initial glucose levels in students and a lower spike in glucose during the tolerance test.