



Diabetes Diagnosis

Marcy Hotchkiss
Lansdowne High School
Baltimore, MD

Research Host:

Barbara Caleen Hansen, Ph.D.
University of Maryland, Baltimore

1999

Grade Level:

High School

Diabetes Diagnosis

Purpose:

Students will explain how hormones work in the body by learning about diabetes mellitus and exploring techniques for diagnosing and monitoring the disease.

Objectives:

Students will be able to:

- investigate the characteristics of the disorder presented in a case study.
- research the patient's symptoms to make a possible diagnosis.
- design and conduct experiments to determine the disorder.
- develop a treatment plan for the patient.

Materials:

Activity #1

- planning guide
- one case study per group of two to three students
- library materials or Internet access
- laboratory test list
-

Activity #2 (per group of two to three students)

- solutions prepared according to "Artificial Plasma for Activity #2" (each group should receive a 2-ml sample)
- 10 test tubes, 10 small beakers for patient samples, ten pipets, test tube holder, paper towels, gloves (**must** be worn by each person), empty 200 ml beaker for sample waste collection
- hand-held glucose meters with test strips (at least 10 strips per group)
 - recommend Bayer's 'DEX' glucose meter
- poster board (to present experiment results)

Activity #3

- "Doctor's Prescription" sheet

Before You Begin:

1. Gather materials and prepare artificial plasma as directed.
2. Read through safety procedures for using the glucose meters and test strips.
3. Schedule time in the library or computer center for students to complete their research.
4. As a class, students could construct a list of diseases that can affect the body before beginning Activity #1.

Suggestions for Activities:

Activity #1

1. Explain to students that they are to assume the role of medical students. Divide students into groups of two to three and give each group a case study.

2. Students should take notes on what details they feel are important. They should hypothesize what diseases could or could not be affecting this person.
3. Groups should investigate the disease(s) they selected using the Internet, textbooks, etc.
4. Using the Laboratory Test List, students select a maximum of three tests in which to test the patient. A written proposal (1/2-page maximum) with justification of test selection should be composed and presented to the class. Discussion of why certain tests are performed can be addressed here.

Activity #2

1. Assist students in designing an experiment, if necessary. Be sure to explain the materials available and how to use them properly. Students should present their plan to you before conducting their experiment.
2. Results can be written in report form or placed on poster board and displayed in the room.

Activity #3

1. Groups should prepare a written explanation of the treatment/course of action that they would present to the patient. This should be presented to the class to make comparisons/contrasts to other groups.

Safety Procedures:

- Activity #2 uses artificial plasma to avoid contact with human body fluids in the classroom.
- Students should wear gloves and goggles when performing the experiments.
- Only pipets are to be used in measuring and dispensing the plasma samples.
- Spills should be cleaned up immediately.
- Students should wash hands thoroughly if anything is spilled on them. Hands should also be washed upon completion of the lab.

Questions to Ask:

1. What is your prediction for the level of glucose found in plasma samples of a normal person and a borderline diabetic?
2. What other disorders can affect a person with diabetes? How are they treated?
3. Why does the body not use the glucose, instead of the glucose “spilling” into the urine?

Where to go from here:

1. Invite a physician, physiologist, or diabetes educator to the classroom to discuss how the disease is diagnosed and treated and how it affects the body.
2. Students could interview a person with diabetes to learn how he/she manages diabetes, including nutrition, medications, lifestyle changes, etc. Presentations or a class discussion could be held to learn about the disease from the patient’s perspective.
3. Invite a patient to the classroom to discuss how he discovered his disease, what he does to take care of himself, and how he does this.

Resources:

1. Matyas, Marsha Lakes, Ph.D., and Ann E. Haley-Oliphant, Ed.D., *Women Life Scientists: Past, Present, and Future*. 1997. The American Physiological Society. Bethesda, MD.
2. Dr. Barbara Hansen and Dr. Heidi Ortmeyer, Obesity and Diabetes Research Center, School of Medicine, University of Maryland Baltimore, Baltimore, MD.
3. Bayer Pharmaceutical Company

Procedure for Making “Artificial Plasma”

- You may have to duplicate this procedure in order to make enough solutions for all groups in your class.
- Distilled water should be used.

Stock glucose solution: 100 mg glucose in 10 ml water
(equivalent to 1 g/dl or 1000 mg/dl)

** This will be used as the control patient samples.

To get the concentrations of 125 mg/dl to 250 mg/dl for patients A and B dilute the stock solution as follows:

- 250 mg/dl: 1 ml stock + 3 ml water
- 225 mg/dl: 900 microL stock + 3.1 ml water
- 200 mg/dl: 800 microL stock + 3.2 ml water
- 175 mg/dl: 700 microL stock + 3.3 ml water
- 150 mg/dl: 600 microL stock + 3.4 ml water
- 125 mg/dl: 500 microL stock + 3.5 ml water

** You will need a P-1000 pipet in order to follow this method.

The following chart shows the corresponding samples and times that should be matched to the patient.

Sample	Patient A	Patient B
0 min	150 mg/dl	125 mg/dl
30 min	250 mg/dl	175 mg/dl
60 min	225 mg/dl	200 mg/dl
90 min	200 mg/dl	175 mg/dl
120 min	175 mg/dl	175 mg/dl

Diabetes Diagnosis

Your Chief of Staff recommended that you conduct a blood test for excess glucose to diagnose the patient. Congratulations, if you selected this testing procedure as one of your choices. For the glucose, a glucose tolerance test will be given and plasma samples measured before the test, 30 minutes after, 60 minutes after, 90 minutes after, and 120 minutes after the patient ingests a sugary liquid.

Design and conduct an experiment for this lab test. Based on the information you have gathered you must include the following in a written lab report: question, hypothesis, plan, results (data table, graphs, etc.), and conclusions.

Materials you can use:

- 5 plasma samples from the patient listed in your case study (taken at the times listed above)
- 5 plasma samples from a control patient
- 10 test tubes and test tube holder
- 10 pipets (one used for each sample - be sure not to contaminate samples by mixing them together.)
- hand-held glucose meter (Be sure to read directions or follow your instructors directions before using.)
- 10 test strips
- gloves (**must** be worn at all times)
- paper towels
- empty 200 ml beaker to collect sample waste and used pipets

Patient A

The patient is a 49-year old male who arrived at his doctor's office in the University Medical Center complaining of dizziness and nausea.

History of Illness:

The patient was at the zoo with his children. As they were walking around, he began to feel nauseous and dizzy. After sitting for 15 minutes the symptoms did not go away. He had been in fairly good health up until that day. However, in recent years he had become more easily fatigued. He attributed the fatigue to his weight, which had reached 300 pounds. In the previous year he had gained 50 pounds, but now he was happy to note he seemed to be losing a bit of weight. This morning he felt extremely weak. He said it felt like he had a really bad case of the flu without the fever. His concern was that it would get worse in the coming days.

Patient B

The patient is a 15-year old female who arrived at the University Medical Center Emergency Room complaining of extreme fatigue, nausea, and vomiting.

History of Illness:

The patient was in good health until approximately two weeks ago when he noticed she became very thirsty and had to use the bathroom more frequently. After a few days of this she noticed a progressive weight loss, which reached a total of 10 pounds in two weeks. This weight loss occurred in spite of a good appetite until anorexia developed one week ago. She attributed this to her work, school, and basketball schedule. The patient was also having difficulties focusing, as her vision became blurred. The day of the admission she felt occasionally dizzy when walking from the sofa to the bathroom. She also developed nausea and vomited twice before going to bed. The next morning the patient was found to be profoundly weak and extremely fatigued. An ambulance was called, and the patient was brought to the ER.

Chief of Staff
University Medical Center

Patient _____

Date:

Diagnosis:

Action(s) to be taken:

Signed:

Laboratory Test List

Test	Description	Cost
Graded Exercise Test	“stress test,” done on bicycle	\$400
CAT	Shows a cross-sectional picture of brain, abdomen, and sometimes skeleton	\$2000
Urinalysis	Examines chemical composition of urine (glucose, proteins, ketones, pH, leukocytes, etc.)	\$50-100
X-rays	Examines internal organs for damage	\$100-1000
MRI	Shows visual image of internal organs (can show more detail than CAT)	\$3000-5000
EKG	Measures heart activity	\$300
Blood Test	Examines chemical composition of blood	\$100-200
EEG	Measures brain activity	\$800