

# UNIT 7 - ENDOCRINE SYSTEM

## ACTIVITY - Reading On Diabetes Mellitus

Name \_\_\_\_\_ Period \_\_\_\_\_

### QUESTIONS FOR THE ARTICLE ON DIABETES MELLITUS AND HYPOGLYCEMIA

1. Why did Von Mering and Minkowksi remove the pancreases of dogs?

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2. Scientists often discover things that they had not set out to find. Such discoveries can be said to happen by chance. What observation led to more research in diabetes? Why can this observation be called a chance observations.

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3. What observation led researchers to infer that two functionally different tissue types were present in the pancreas?

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4. Suggest a reason why dogs that showed the symptoms of diabetes did not improve after being fed bits of pancreatic tissue.

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5. Differentiate between the Type I and the Type II diabetes. Be sure to Include the forms, the causes and the treatments.

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6. Suggest ways that a diabetic could prevent or decrease his risk of the following:

a. Burning himself on the stove

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b. Kidney damage

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c. Amputation of a toe, foot or leg

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d. Blindness

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e. hypoglycemic reaction

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**ACTIVITY - Reading On Diabetes Mellitus – KEY**

1. as a control to test the function of the pancreas.
2. more research was necessary for the substances released by the islet cells.
3. tying off the pancreas ducts did not stop the symptoms of diabetes.
4. the insulin cannot work this way because it can be destroyed by the stomach.
5. Type I - usually childhood onset requires insulin  
Type II – usually adult onset does not require insulin.
6.
  - a. pay attention to what they are doing when cooking. Take care of diabetes to prevent nerve damage.
  - b. control blood sugar levels to help reduce capillary damage in the kidneys leading to kidney failure.
  - c. control blood sugar/infection, keep shoes on, meticulous foot care.
  - d. control blood sugar/annual check ups
  - e. watch insulin dosage.

## **HISTORY - DIABETES MELLITUS AND HYPOGLYCEMIA**

**INTRODUCTION:** Diabetes mellitus is a disorder caused by the low levels of or the absence of the hormone insulin which is necessary to take glucose into the cells where they can be converted into energy or stored as glycogen for later use. The use of glucose in the body to provide energy is important as the Central Nervous System, the brain and spinal cord require glucose in order to make their energy or ATP. Hypoglycemia is the overproduction of or the hypersensitivity to the insulin produced. Insulin is produced in the pancreas. Without insulin, the body cannot maintain proper blood sugar levels.

**DISCOVERY OF THE FUNCTION OF THE PANCREAS:** In the late 1800's, two German biologists, Joseph Von Mering and Oskar Minkowski, were studying the role of the pancreas in digestion. They surgically removed the pancreas from a number of dogs. The dogs showed an increase in urine output and died within a period of 10 to 30 days. The researchers noticed that ants were attracted to the urine these dogs produced before they died. A Urine analysis showed that there was a high level of sugar in the urine. Increased urine output and high levels of sugar in the urine were known to be symptoms of diabetes mellitus in human beings. To make sure that the dogs' symptoms were not due to the operation alone, the scientist operated on other dogs but did not remove their pancreases. None of the dogs developed diabetes. They concluded that the diabetic symptoms were due to the removal of the pancreas.

Study of the pancreas showed that it is made of two different tissue types. One type of tissue produces digestive enzymes. The other type of tissue is called the islet of Langerhans. Researchers tried to find out which of the two tissue types produced a substance that prevented diabetes. In one experiment, the pancreatic ducts of experimental dogs were tied off. Tying off these ducts caused the enzyme-producing tissue in the pancreas to atrophy; that is the tissue stopped functioning and began to disintegrate. These dogs did not develop the symptoms of diabetes. Researchers hypothesized that damage or removal of the islets of Langerhans caused the symptoms of diabetes.

Researchers had difficulty finding the substance produced by the islets. They thought that the substance might be found in pancreatic tissue. Researchers fed bits of pancreatic tissue to dogs whose pancreases had been removed, but the symptoms of diabetes did not disappear.

The substance was finally isolated in 1922 by two Canadians, Frederick Banting and Charles Best. They tied off the pancreatic ducts of many dogs. After the enzyme-producing tissue had atrophied, they removed the pancreas. They then froze the tissue, ground it into a solution and injected the solution into diabetic dogs. The dogs showed immediate improvement.

Banting and Best received the Nobel Prize in 1923 for their important work. The substance they discovered was the hormone insulin. Research in the 1950's by Frederick Sanger showed that insulin is a protein.

## **FACT SHEET - DIABETES MELLITUS**

**FORMS OF DIABETES MELLITUS:** There are two forms of the disorder diabetes mellitus. They are Type I, or insulin dependent diabetes mellitus, (which was formerly known as the juvenile onset diabetes), and Type II, or non-insulin dependent diabetes mellitus, (which was formerly known as the mature or adult onset diabetes). Type I usually occurs before the age of 30 and requires regular insulin injections in order to regulate the blood sugar. Type II usually occurs in obese adults after the age of 40 and is often treated with diet, exercise and occasional pills to lower the blood sugar.

**CAUSES.:** Diabetes mellitus is caused by obesity, prolonged periods of mental, emotional or physical stress, pregnancy, or various disease processes as well as known causes. Stress affects the blood sugar as it helps to release hormones that in turn aid in the production and release of glucose to provide the body with sufficient energy to meet its increased needs.

**INCIDENCE:** Diabetes mellitus affects 5% of the population in the United States (approximately 10-12 million persons). It is estimated that only half of those diabetics are actually diagnosed and receiving medical attention. It occurs equally in males and females. The risk increases with age.

**SYMPTOMS:** The observable symptoms are more pronounced with the Type I diabetes over the Type II. These include fatigue, polyuria (increased urine production), polyphagia (increased hunger) and polydipsia (increased thirst). Other symptoms include dehydration, even though they are usually drinking large amounts of fluids and weight loss, even though they have a ravenous appetite. Symptoms in Type II usually include fatigue and increased hunger.

**DIAGNOSIS:** Diagnosis is based on blood sugar levels and the presence of glucose in the urine. The normal values for blood glucose are 70-120 mg per deciliter after a period of fasting. Two consecutive readings of 140 mg or above indicates diabetes. A person may also undergo a glucose tolerance test in which the subject fasts, has a blood sugar level drawn for a baseline, and then will drink a sweet sugar or glucose drink. Every hour thereafter, the blood will be drawn to test the blood sugar. The body, if it was producing sufficient amounts of insulin, should be able to remove the sugar from the blood and the levels should drop. In a patient with diabetes, the blood sugar levels remain higher than normal during the first two hours of so.

Glucose is a compound that is not normally found in the urine as the kidneys are responsible for reabsorbing and conserving the glucose. If glucose is found in the urine it indicates that the levels of glucose are too high for the kidneys to take care of properly, and consequently, some leaks out in the urine. This test is done by the patient producing a urine sample and the medical care given dipping a stick into the urine to see if there is a color change indicating the presence of glucose.

**TREATMENT:** Type I diabetics, as they have a deficiency of insulin, require regular insulin injections at regular intervals. The insulin once came from beef and pork sources, but is now being made with advances in genetic engineering, specifically, recombinant DNA. There are two major types of insulin, the Regular brand which is a rapid, short acting form and NPH, which is an intermediate, longer acting form. The patient will usually be required to test his/her blood sugar at intervals throughout the day, usually before meals and adjust his/her insulin injections accordingly. Insulin injections are given into the subcutaneous layer of the skin.

The Type I diabetic should be on a strict diet to regulate glucose levels. The well-known diet is the American Diabetic Association diet or the ADA diet. The diet is controlled with exchanges of the various food groups and organic compounds of fat, carbohydrates and protein. Simple sugars or monosaccharides, should be avoided and the person should increase his amount of polysaccharides.

The Type II diabetic usually benefits from a diet that is high in polysaccharides, low in monosaccharides, as well as one that is low in calories to facilitate weight reduction. The diet should also be accompanied by an exercise program. The Type II diabetic may also take oral hypoglycemics, medications which stimulate their own insulin production and increase their sensitivity to the insulin present.

**COMPLICATIONS:** Diabetics are prone to many long range complications. Out of all the heart attacks that occur, 50% of them are attributed to complications of diabetes. During a heart attack, blood flow is reduced to an area of the heart which causes tissue death. As a result, the pumping mechanism of the heart is interfered with, and a heart attack, or myocardial infarction, results. One of those complications is atherosclerosis, fatty deposits on the lining of the arteries, which make them narrow. The heart has to pump harder to push the blood through. It also accounts for 50% of all strokes that occur. A stroke is when blood flow is reduced to an area of the brain, resulting in the death of brain tissue. They are susceptible to blindness due to interference with the blood supply in the eye. This is known as diabetic retinopathy. They develop neuropathy, which affects the nerves causing numbness and decreased sensitivity. They have a decreased resistance of infections as the glucose content in the epidermis and urine encourages the growth of bacteria. They are also in line for kidney damage, known as nephropathy. They may require dialysis or a kidney transplant. Dialysis includes the removal of blood from the patient to be filtered by a machine. This would remove excess water and waste products. A transplant involves a person who donates an organ which is implanted into the patient. (You may remember this from the movie 'Steel Magnolias'). However, the risks are considerably decreased when the patient is able to care for himself, maintain his diet and his blood sugar levels. Hypoglycemia is another disorder.

**HYPOGLYCEMIA:** Hypoglycemia is the abnormally low glucose level in the blood stream.

**CAUSES:** The major causes are when the use of glucose exceeds the supply, overproduction of insulin or the excessive injection of insulin such as with a diabetic.

**TYPES:** There are two major forms of hypoglycemia. One is known as reactive, which responds to insulin administration or production. The other is known as fasting, which is due to the lack of food, such as before breakfast.

**SYMPTOMS:** The symptoms are many but usually include such symptoms as fatigue, nervousness, irritability, trembling, hunger, sweats, headache, and rapid heart beat. In extreme cases, such as with a diabetic and excessive insulin injections, a coma may also be seen. Remember that the central nervous system disorders are common as it needs glucose to make its ATP.

**DIAGNOSIS:** Diagnosis is on the basis of a fasting blood sugar test which is usually less than 45 to 60 mg.

**TREATMENT:** Treatment involves the maintenance of a constant, normal blood sugar level. This would include smaller, more frequent feedings throughout the day. The diet should avoid the monosaccharides as it stimulates insulin production, which of course, would drop the blood sugar level. If the patient is a diabetic, hard candy, frosting or jam would be indicated. If the person is in a coma EMS should be contacted immediately.