

Pancreas

HORMONE: Insulin:

PRODUCTION: Beta cell

TARGETS: Metabolism of glucose on a cellular level

ACTION: Insulin converts glucose into glycogen through glycogenesis; decreases the breakdown of glycogen, converts glucose into fatty acids and stimulates protein synthesis

TARGETS: Metabolism of glucose on a cellular level in insulin-dependent tissues

HORMONE: Glucagon: Produced by Alpha cells

ACTION: Glucagon accelerates the conversion of glycogen store in liver into glucose via glycogenolysis and the through the process of gluconeogenesis converts protein or fats into glucose

STATES OF BLOOD SUGAR LEVELS

The following are conditions of blood sugar levels. They are used to describe when these levels rise or fall. These terms are not diseases in and of themselves but may be used to describe symptoms of diseases.

Hypoglycemia a drop the blood sugar levels due to hypersecretion of insulin, lack of food, or excessive exercise

Characteristics: Sweating, tremors, tachycardia, palpation, Slow depression of CNS -headaches, confusion, lightheadedness, coma

Hyperglycemia absence or inadequate amount of insulin in the blood stream causing an increase in blood sugar levels. Also can be caused by an increase in the secretion of glucagon. Even diet can temporary mimic this condition

Characteristics: polyuria, polyphagia, dehydration, polydipsia, headaches, muscle aches,

DIABETES MELLITUS:

Results from a break down in the body's ability to produce or utilize insulin,

Type I - juvenile onset diabetes

Approximately 10% of cases

Type I- Juvenile onset

Linked to genetic predisposition with an environmental trigger

Autoimmune response leading to the destruction of the Beta Cells

Environmental Factors which contribute:

Drugs / chemicals: Alloxan, Pentamidine

Nutrition: Bovine Milk, Nitrosamines (nitrates from cured or smoked meats)

Viruses: Mumps, Rubella (congenital)

Ketonuria Kussmaul respirations → blow off CO₂ Decreased pCO₂

Insulin Shock – too much insulin / too little food → Hypoglycemia

Characteristics: SNS stimulation → sweating, tachycardia / palpitations, pallor
 Hunger Tremors
 Depression of CNS → headache, fatigue,
 blurred vision / double vision,
 confusion / lightheadedness,
 coma

Treatment:

First give juice, glucose tablets, or hard candy for immediate glucose
Then give protein & carbs (eg: peanut butter on crackers with milk)
If unconscious, glucagon injection

Chronic Complications

Diabetic Neuropathies

As the metabolic processes of the Schwann cells are disturbed segmental loss of the myelin occurs leading to demyelination of the nerves. Affects the both the somatic and the autonomic nerves. Generally affects the sensory input greater than the motor response. Manifests in paresthesias / numbness & the loss of motor functions such as wrist and foot drop. Also seen in autonomic responds like delayed gastric emptying and diarrhea.

Microvascular Disorders

Walls of the capillaries become thick leading to a decrease in rates of exchange. Main effects of this are seen in the eye and the kidney.

Eye: Vessels in the eye may form aneurysm-causing hemorrhage. The retina may detach. Decrease of blood to eye may lead to dehydration of the lens, aqueous and vitreous humor reduction, and cataract formation.

Kidney: Diabetes leads to an increase in pressure in the glomerulus → decrease the rate of filtration → backing up fluids and waste in the body. Manifested in fluid overload, acidosis, nausea, and hypertension. Death from renal failure is more common in Type I

Macrovascular disorders

Lesions form in arterial walls due to increase of circulating lipids cholesterol and triglycerides. Coronary artery disease, Stroke and Peripheral Vascular Disease increase with diabetes and often lead to death in Type II.

Increased risk of infection

The senses: Decreased vision and touch may not detect breaks in the skin. Decreased blood supply leads to increased infection as O₂ cannot get to the cells. Also the inflammation response is decreased as is the activity of the WBCs.

Increase in bacterial growth due to the increase of glucose in the blood

Hormones in the Metabolic Process

Just ate a candy bar → Hyperglycemia

→ Need to get glucose out of blood into cells to lower blood sugar

1. Carbohydrates are broken down to monosaccharides → absorbed in the small intestine

Glucose → Cell use in the production of ATP via glycolysis, Krebs cycle & electron transport chain

2. Glycogenesis – formation of glycogen

Glucose → Glycogen store in the liver and muscles

3. Lipogenesis – formation of neutral fats

Glucose → Adipose Tissue for storage

Hormone which controls the above processes is Insulin

Human Growth Hormone will also stimulate Lipogenesis

Fasting / starving → Hypoglycemia

→ Need to get glucose out of storage in cells & into blood to increase blood sugar levels

1 Glycogenolysis – break down glycogen to release glucose

Glycogen out of liver & muscle → Glucose into blood

2. Lipolysis

Adipose Tissue → Fatty acids & glycerol into blood

3. Gluconeogenesis

Protein & Lipids out of liver & muscle → Glucose into blood

Hormones of: Glycogenolysis = Glucagon & Epinephrine

Lipolysis = Epinephrine, NE, Cortisol, hGH, T3&T4

Gluconeogenesis = Cortisol & Glucagon