

Hormonal control of carbohydrate metabolism

1. **Insulin:** Insulin is produced by B-cells of the islets of Langerhans in response to hyperglycemia (elevated blood glucose level). Some amino acids, free fatty acids, ketone bodies, drugs such as tolbutamide also cause the secretion of insulin. Insulin is basically a hypoglycemic hormone that lowers in blood glucose level through various means. It is an anti-diabetogenic hormone.
2. **Glucagon:** Glucagon is synthesized by alpha-cells of the islets of Langerhans of the pancreas. Hypoglycemia (low blood glucose level) stimulates its production. Glucagon is basically involved in elevating blood glucose concentration. It enhances gluconeogenesis and glycogenolysis.
3. **Epinephrine:** This hormone is secreted by adrenal medulla. It acts both on muscle and liver to bring about glycogenolysis by increasing phosphorylase activity. The end product is glucose in liver and lactate in muscle. The net outcome is that epinephrine increases blood glucose level.
4. **Thyroxine:** It is a hormone of thyroid gland. It elevates blood glucose level by stimulating hepatic glycogenolysis and gluconeogenesis.
5. **Glucocorticoids:** These hormones are produced by adrenal cortex. Glucocorticoids stimulate protein metabolism and increase gluconeogenesis (increase the activities of enzymes-glucose 6-phosphatase and fructose 1,6-bisphosphatase). The glucose utilization by extrahepatic tissues is inhibited by glucocorticoids. The overall effect of glucocorticoids is to elevate blood glucose concentration.
6. **Growth hormone and adrenocorticotrophic hormone (ACTH):** The anterior pituitary gland secretes growth hormone and ACTH. The uptake of glucose by certain tissues (muscle, adipose tissue etc.) is decreased by growth hormone. ACTH decreases glucose utilization. The net effect of both these hormones is hyperglycemic.

Regulation of blood sugar and Clinical Significance of Blood glucose

- **Conditions in which hyperglycemia may occur:**
 1. **Diabetes mellitus in the dog, cat, cow and sheep. This may arise due to:**
 - a. Pituitary neoplasms.
 - b. Adrenal hyperplasia.
 - c. Pregnancy toxaemia.
 - d. Acute pancreatic necrosis.
 2. **Convulsions as in:**
 - a. Eclampsia.
 - b. Intracranial trauma.
 - c. Epilepsy.
 - d. Tetany.
 3. **Transient conditions:**
 - a. Exposure to cold.
 - b. Following general anaesthesia.
 - c. Administration of morphine.
 - d. Injection of epinephrine.
 - e. Intravenous glucose injection.
 - f. Feeding large quantities of carbohydrates.
 - g. Excitement.
 4. **Hyperthyroidism:** There is increased glucose production by the liver in excess of utilization.
 5. **Chronic nephritis.**
- **Conditions in which hypoglycemia may occur:**
 1. Starvation.
 2. Hypopituitarism.
 3. Hypothyroidism.
 4. Hyper insulinism - a) Tumour of pancreas, b) Excess of insulin in therapy.
 5. Adrenal cortical insufficiency.
 6. Severe excretion- Glucose utilization is increased and liver glycogen is depleted.
 7. Ketosis in cattle and sheep.
 8. Hypoglycemia of baby pig (manifested by convulsions, weakness, coma and death). Blood glucose level is 40 mg%.