

RAMSADAY COLLEGE, AMTA



AVIRUP CHAKROBORTY

ADRENOCORTICAL HORMONES

The Adrenal cortex has three distinct Layers;

1. The Zona Glomerulosa- these cells are only ones in the adrenal gland which can secrete aldosterone, because it has aldosterone synthetase.
2. The Zona Fasciculata- secretes the glucocorticoids cortisol and corticosterone
3. The Zona Reticularis- secretes the adrenal androgen dehydroepiandrosterone (DHEA) and androstenedione and small amounts of estrogen and some Glucocorticoids.

Mineralocorticoids

- Aldosterone (very potent, accounts for about 90% mineralocorticoid activity)
- Deoxycorticosterone (1/30 as potent as aldosterone, but very small quantities secreted)
- Corticosterone (slight mineralocorticoid activity)
- 9α -Fluorocortisol (synthetic, slightly more potent than aldosterone)
- Cortisol (very slight mineralocorticoid activity, but large quantity secreted)

Glucocorticoids

- Cortisol (very potent, accounts for 95 % of all glucocorticoid activity)
- Corticosterone (provides about 4 % of total glucocorticoid activity, but much less potent than cortisol)
- Cortisone (synthetic, almost as potent as cortisol)
- Prednisone (synthetic, four time as potent as cortisol)
- Methylprednisone (synthetic, five times as potent as cortisol)
- Dexamethasone (synthetic, 30 times as potent as cortisol)

Physiological Functions of the Glucocorticoids

1. Effects of of cortisol on Carbohydrate Metabolism

a. Stimulation of Gluconeogenesis

By far the best known metabolic effect of cortisol and other glucocorticoids on metabolism is their ability to stimulate gluconeogenesis (formation of carbohydrate from proteins and some other substances) by the liver, often increasing the rate of gluconeogenesis as much as 6-10 fold. This results mainly from two effects of cortisol

- i. Cortisol increases the enzyme required to convert amino acids into glucose in the liver cells
 - ii. Cortisol causes mobilization of amino acids from the extra hepatic tissues mainly from muscle.as a result, more amino acids become in The plasma to enter into the gluconeogenesis process.
- b. Cortisol also causes a moderate decrease in the rate of glucose utilization by most cells in the body.
- c. Elevated blood glucose concentration- both the increased rate of gluconeogenesis and moderate reduction in the rate of glucose utilization by the cells cause the blood glucose concentration to rise.

2. Effects of cortisol on Protein Metabolism

i.Reduction in Cellular Protein

One of the principal effects of cortisol on the metabolic systems of the body is reduction of the protein stores in essentially all body cells except those of the liver.

ii.Cortisol increases Liver and Plasma Proteins-

Coincidentally with the reduced proteins elsewhere in the body, the liver proteins become enhanced. Furthermore, the plasma proteins (which are produced by the liver and then released into the blood) are also increased.

3. Effects of Cortisol on Fat metabolism

In much the same manner that cortisol promotes amino acids mobilization from the muscle,it promotes mobilization of fatty acids from adipose tissue. This increases the concentration of free fatty acids in the plasma, which also increases their utilization for energy. Cortisol also seems to have a direct effect to enhance the oxidation of fatty acids in the cells.

4. Cortisol and stress.

Almost any type of stress, whether physical or neurogenic, causes an immediate and marked increase in ACTH secretion by the anterior pituitary gland, followed within minutes by greatly increased adrenocortical secretion of cortisol. We are not sure, why this is significant benefit to the animal. One possibility is that the glucocorticoids cause rapid mobilization of amino acids and fats from their cellular

stores, making them immediately available, both for energy and for synthesis of other compounds, including glucose, needed by the different tissue of the body.

5. Cortisol prevents the development of inflammation by stabilizing lysosomes and by other effects.
6. Cortisol causes resolution of inflammation.
7. Cortisol blocks the inflammatory Responses to allergic reactions.

Functions of the Mineralocorticoids-Aldosterone

1. Aldosterone increases renal reabsorption of sodium and secretion of potassium.
2. Increases extracellular fluid volume and thus arterial pressure.
3. Aldosterone stimulates sodium and potassium transport in sweat glands, salivary glands, and intestinal epithelial cells

Reference

1. Text book of Medical Physiology, Guyton & Hall, 11th edition