Cortisol, also known as hydrocortisone, is a steroid hormone produced by the adrenal cortex in the adrenal gland of mammals. The zona fasciculata is the tissue that produces this glucocorticoid in response to stimulation by Adrenocorticotropic Hormone (ACTH). Cortisol is classified as a glucocorticoid, which aids in metabolism of fats, proteins, and carbohydrates. Cortisol is commonly referred to as the stress hormone because it is involved in the body’s natural response to stress. Most cells in the body contain receptors for cortisol, allowing it to have many functions within the body.

In normal cortisol release, its actions restore homeostasis after stress. Cortisol is responsible for controlling the body’s blood sugar levels, regulating metabolism. It acts as an anti-inflammatory and can promote the breakdown of glycogen, lipids, and proteins which reduces protein levels in most body cells. Cortisol influences memory acts as an anti-inflammatory and can promote the breakdown of glycogen, lipids, and proteins which reduces protein levels in most body cells. Cortisol influences memory, controls salt and water balance, and helps development of the fetus [1].

Cortisol is responsible for triggering processes during parturition in many species. Cortisol production is controlled by specific enzymes known as the P450 enzymes, which are located on chromosome 10 region CYP17. 11-beta HSD1 and 11-beta HSD2 are the enzymes associated with the metabolism of cortisol [8].

The over or underproduction of cortisol can produce diseases within the body. Primary Hypercortisolism occurs when excessive levels of cortisol are present in the blood resulting in Cushing’s syndrome. Hypocortisolism or adrenal insufficiency results when the adrenal glands do not produce enough cortisol for the body. Addison’s disease refers to primary adrenal insufficiency, where the adrenal glands malfunction [1].

Cortisol’s effect on metabolism is essential, illustrated by how it influences other pathways including ion transport or the immune response [2]. Cortisol stimulates gluconeogenesis, the process that synthesizes glucose from oxaloacetate, to increase blood sugar, counteracting the effects of insulin. However, to counteract the increase in blood glucose, cortisol stimulates the synthesis of glycogen within the liver, carefully regulating the amount of glucose traveling throughout the body.

Cortisol’s effect on metabolism is essential, illustrated by how it maintains a steady supply of glucose during a state of the body fasting. When the body goes through a fasting period, the blood glucose is greatly decreased, but that is regulated by cortisol stimulating the process of gluconeogenesis. In addition, cortisol is key in the regulation of certain ions, including sodium and potassium, which helps the body to regulate physiologic pH after a stress-inducing event. Sodium is prevented from leaving the cell, while potassium is readily excreted, otherwise known as the regulation of the sodium-potassium pump. Because of this regulation, it has been theorized that cortisol may have evolved as a sodium pump inhibitor [7].

Cortisol restores homeostatic mechanisms after the body is exposed to stress. Cortisol’s primary targets are metabolic, but it also influences other pathways including ion transport or even the immune response [2].

Cushing’s syndrome is caused by prolonged exposure to high levels of cortisol within the body. Cushing’s syndrome may be caused by excess glucocorticoids or overproduction of cortisol. Exogenous glucocorticoids are steroid hormones that are created to be chemically similar to natural cortisol. People take exogenous glucocorticoids, like prednisone, for asthma, lupus, rheumatoid arthritis and other inflammatory diseases. Glucocorticoids may also be used to suppress the immune system after transplant surgery in order for the body to not reject the new organ. Overproduction of cortisol in the body is a result of a pituitary ACTH-producing tumor, or a primary adrenal tumor. Women may often exhibit excess hair growth on the face, neck, chest, abdomen, and thighs. Their menstrual cycle may become irregular or eventually stop. Men may exhibit decreased fertility, decreased sex drive, and impotence [3].

Cushing’s Syndrome

Round, red, full face
Acne or skin infections
Thin skin, easily bruised
Increase in adipose tissue
Upper body obesity with thin limbs

Type II Diabetes
“Buffalo back”
High blood pressure
Weak muscles
Bone pain or tenderness
Thinning of bones: spine and rib fractures

Current Treatments:
Treatments for Cushing’s syndrome vary depending on the cause. If a glандular tumor is present, the tumor must be surgically removed. Sometimes the pituitary or adrenal glands are removed entirely so the hormone is no longer produced. If surgery is unsuccessful or not feasible, pharmacological therapy is used in which drugs inhibit the hormone itself. Many of the FDA-approved medications to treat Cushing’s syndrome work by the processes of competitive and non-competitive inhibition.

A common drug used to treat Cushing’s syndrome is known as Ketoconazole. It chemically similar to natural cortisol. People take exogenous glucocorticoids, like prednisone, for asthma, lupus, rheumatoid arthritis and other inflammatory diseases. Glucocorticoids may also be used to suppress the immune system after transplant surgery in order for the body to not reject the new organ. Overproduction of cortisol in the body is a result of a pituitary ACTH-producing tumor, or a primary adrenal tumor. Women may often exhibit excess hair growth on the face, neck, chest, abdomen, and thighs. Their menstrual cycle may become irregular or eventually stop. Men may exhibit decreased fertility, decreased sex drive, and impotence [3].

A selective inhibitor of glucocorticoid synthesis by inhibiting the 11-beta hydroxylase, which is the final step in the glucocorticoid pathway [4].

Normal Physiologic Effects of Cortisol

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