

# Cortisol

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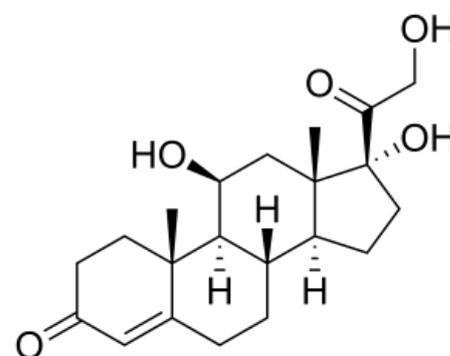
Last update: Sunday, 06 Nov 2022 at 10.06 pm.

Cortisol	
<b>Gland</b>	adrenal glands( zona fasciculata )
<b>Structure</b>	steroid hormone
<b>Effects</b>	regulation of intermediary metabolism, metabolism of lipids, carbohydrates and amino acids

Cortisol belongs to the group of glucocorticoids, hormones produced by the adrenal cortex (its middle layer – *zona fasciculata*). In humans, it is the main hormone from this group. Its production is regulated by adrenocorticotrophic hormone (ACTH) from the adenohypophysis by the principle of negative feedback. The main function of cortisol is the regulation of the metabolism of nutrients - carbohydrates, proteins and fats.

## Synthesis and degradation

The starting substance for the synthesis of steroid hormones, which include glucocorticoids, is cholesterol. Cholesterol is stored in large quantities in the form of esters in the cells of *zona fasciculata*. Its main source for cells is plasma lipoproteins (LDL and HDL), in smaller quantities it is also newly synthesized. The formation of steroid hormones in the cell mainly involves the mitochondria, where the precursor pregnenolone is produced, and also the endoplasmic reticulum, where, due to enzymatic reactions, pregnenolone is gradually transformed into cortisol or another steroid hormone.



Chemical formula of cortisol

## Cortisol level

ACTH secretion pulses during the day, with following rises of secretion of cortisol. We most often observe **morning pulses of cortisol** in humans, approximately 75% of the daily output of cortisol is eliminated between four and ten o'clock in the morning. <sup>[1]</sup> The daily production of the hormone is 10-20 mg. Normal values for the morning cortisol level in the blood are 118-618 nmol/l, the ideal time for sampling is between seven and nine o'clock. Afternoon samples are taken between 4 and 7 p.m., the physiological range is 85-460 nmol/l. <sup>[2]</sup> In the diagnosis, we also use the determination of the concentration of cortisol in the urine, we perform it after a twenty-four-hour urine collection, the reference values are 79-590 nmol/24 h <sup>[2]</sup>.

## Main function

- **Regulation of intermediary metabolism.** Cortisol is often referred to as the stress hormone. Its main goal is to mobilize the organism under stress, which it achieves mainly due to its effects on energy metabolism. It works mainly in the liver, muscles, pancreas and adipose tissue. It has a **catabolic** and **antianabolic**.
- **Carbohydrate metabolism.** The goal of cortisol is to ensure that there is enough glucose for the brain in a stressful situation. It increases the concentration of glucose in the blood, which it achieves by stimulating gluconeogenesis in the liver.
- **Lipid metabolism.** It mobilizes the body's fat reserves and also stimulates lipolysis.
- **Amino acid metabolism.** Cortisol supports the breakdown of proteins (thus causing an increase in urea excretion), the obtained amino acids are used for gluconeogenesis. Its excessive concentration can lead to connective tissue and skin disorders, such as stretch marks, as in Cushing's syndrome.
- **Cardiovascular system.** Positively inotropic, increases cardiac output and blood pressure.
- Increase in erythropoietin production.

- **Anti-inflammatory effect.** Cortisol stimulates the production of anti-inflammatory cytokines and suppresses the production of pro-inflammatory cytokines by preventing the formation of phospholipase A<sub>2</sub>.
- **Suppression of the immune response.** Cortisol reduces the number of T-lymphocytes and causes atrophy of lymphatic tissue.
- Cortisol is the most important **stress hormone**. With its gluconeogenic effect, it ensures a sufficient supply of glucose in the brain, and by stimulating the cardiovascular system, it maintains circulatory functions.

## Links

### related articles

- Adrenal glands

### References

1. GANONG, William F. *Přehled lékařské fyziologie*. 20. edition. Praha : Galén, 2005. 890 pp. pp. 380. ISBN 80-7262-311-7.
2. ZIMA, Tomáš – MRÁZOVÁ, Kateřina. *www.lekarskeslovníky.cz : Biochemické hodnoty* [online]. [cit. 2016-02-12]. <<http://lekarske.slovníky.cz/normalni-hodnoty>>.

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- KITTNAR, Otomar. *Lékařská fyziologie*. 1st edition. Grada, 2011. pp. 518, 519, 520. ISBN 978-80-247-3068-4.
- GANONG, William F. *Přehled lékařské fyziologie*. 20. edition. Praha : Galén, 2005. 890 pp. pp. 375-381. ISBN 80-7262-311-7.