



Stress Hormone Test

RESULT REPORT

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1 Your individual result report

Patient		Sample number	test145 / P018188
Born on	08.08.1990	Receipt	14.10.2015
Weight	146 lb	Issue	

Dear Max Mustermann,

As per your request, we measured your cortisol level. For this purpose, we checked the concentration of the stress hormone cortisol in your saliva in the form of a so-called day profile. A day profile takes into account several saliva samples collected in the course of one day to illustrate how your cortisol level changes during this period. This is much more accurate than taking a single sample. The reason for this is that the body's cortisol level is subject to significant physiological fluctuations throughout the day.

! An increased cortisol release is an indicator for permanent stress !

Most of the cortisol in the blood is bound to proteins and only 1-3 % are unbound. Only the non-bound (free) cortisol is the biologically active form. It is released into the saliva where it can be measured.

As the cortisol level changes under stress, taking saliva samples at home is the least stressful way of checking your cortisol level.

The below-mentioned test results and assessment serves as an orientation without knowing anything further about your individual situation. Please do neither stop nor start a therapy on your own; instead, please consult a physician.

This document has been created digitally and is valid without a signature.

If you wish a personal consultation by our nutritionists concerning your test result or if you have general questions, please contact us via mail to questions@cerascreen.co.uk.

Your Cerascreen Team

2 Your test result

Your day profile shows the following results:

Time	Your saliva - cortisol	Reference value	Assessment
morning value	9,0 ng/ml	1,8 - 14,5 ng/ml	Normal value
after 2 hours	10,0 ng/ml	1,3 - 10,3 ng/ml	Normal value
after 5 hours	0,7 ng/ml	0,7 - 5,7 ng/ml	Normal value
after 8 hours	0,6 ng/ml	0,6 - 4,7 ng/ml	Normal value
after 12 hours	0,3 ng/ml	0,3 - 3,3 ng/ml	Normal value

If these values are not within the normal range, you should see a physician to discuss the further procedure.

Please note that the reference values are valid for adults only.

Why did I take / send you 7 samples and can see only 5 results in above result report?

As the cortisol values vary during the morning hours, we calculated the mean value from the 3 samples and mentioned it as "morning value".

On the following pages, you will find interesting information around the topic "cortisol" as well as practical recommendations.

3 What is cortisol needed for?

Cortisol is particularly important to the body as is emphasized by the fact that failure of the cortisol release is life-threatening. Cortisol is produced by the adrenal glands, has a wide spectrum of functions. It aids in the metabolism of carbohydrates (increases sugar), fat and protein. Furthermore, it inhibits inflammations and weakens the activity of the immune system (immunosuppressant).

Influence on Carbohydrate Balance

Cortisol stimulates the formation of glucose (sugar) in the liver, which leads to increased blood sugar levels. This means that it is a part of the complex blood sugar regulation mechanisms and belongs to the class of glucocorticoids. It is released in response to stress which explains the correlation between stress, cortisol and diabetes (diabetes). The pancreatic hormone insulin governs the reduction of increased blood sugar levels. If the pancreas permanently has to counteract raised blood sugar levels and thus constantly has to release insulin, this can lead to diabetes in the long run. The receptors which process insulin react less and less sensitive due to the frequent oversupply of insulin. Thus, insulin resistance has developed and this is a symptom of diabetes type II, acquired diabetes.

Influence on fat metabolism

During fat metabolism, an enzyme that is released in response to stress and raised cortisol levels becomes activated, thus promoting the conversion of inactive to active cortisol. More cortisol leads to more of this enzyme being released and, as a consequence, to further release of cortisol. This cycle creates the basis for obesity.

Influence on protein synthesis

Cortisol also ensures the efficient use of amino acids (proteins).

Influence on bone metabolism

Cortisol inhibits bone regeneration. A treatment involving corticoid-containing preparations (cortisone - the biochemical inactive form of cortisol) can lead to porous bones, known as osteoporosis. This occurs when there is an imbalance between bone constructing cells (osteoblasts) and bone degrading cells (osteoclasts). During cortisone therapy, this can lead to a disruption of the bone constructing cells.

Role in immunological processes

Another central role of cortisol is its participation in immunological processes. Amongst others, it influences the formation and migration of blood cells. This leads to a changed defense reaction of the body. The hormone has immunosuppressive properties and is, for that reason, often used in medicine to reduce inflammatory reactions in the body and counteract transplant rejections. It also has inflammation-reducing effects. In addition, it has an anti-inflammatory effect.

4 What is the correlation between cortisol and stress?

Apart from noradrenaline, adrenaline and dopamine (= catecholamines) as well as their derivatives, cortisol is the most important stress hormone.

**! An increased cortisol release
is an indicator for long-term stress !**

Under stress, cortisol levels increase considerably. In general, the cortisol system is an inert system, other than the catecholamine system, which reacts immediately and which diminishes soon. The stress response of the catecholamines cause the narrowing of your skin and intestinal vessels as well as a vascular dilation in your muscles. Furthermore, it promotes the redistribution of oxygen-enriched and nutrient-rich blood which is needed for possible muscular effort relating to evolutionary fight or flight responses. These catecholamine effects are only possible with the participation of cortisol.

Stress hormone regulation happens via the so-called endocrine stress axis, the hypothalamic-pituitary-adrenal axis. During this process, the hormone levels are balanced by an antagonist as soon as fluctuations occur. If this reaction mechanism is impaired in one of the organs involved or disturbed by long-term stress, the physiological cortisol levels go out of control.

Below, you will find an example of a day saliva cortisol profile within the normal range. In the event of burnout syndrome, the cortisol level is below the normal range, whereas it is heightened in case of acute and long-term stress, as you can see in figure 2. It illustrates a diurnal cortisol rhythm of cortisol in various stress situations.

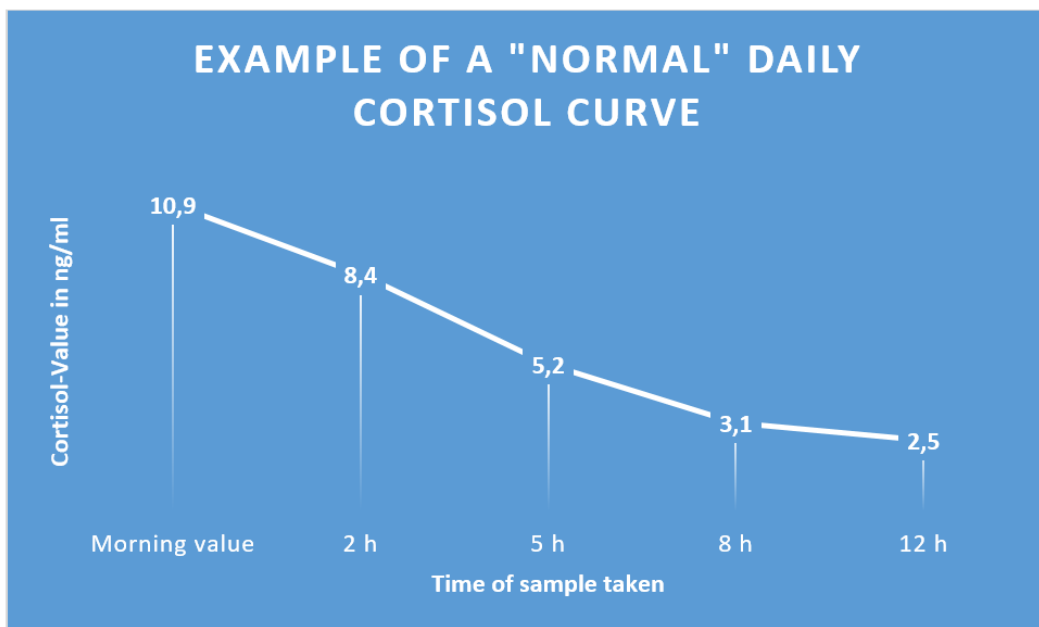


Figure 1: Example of a "normal" diurnal cortisol curve

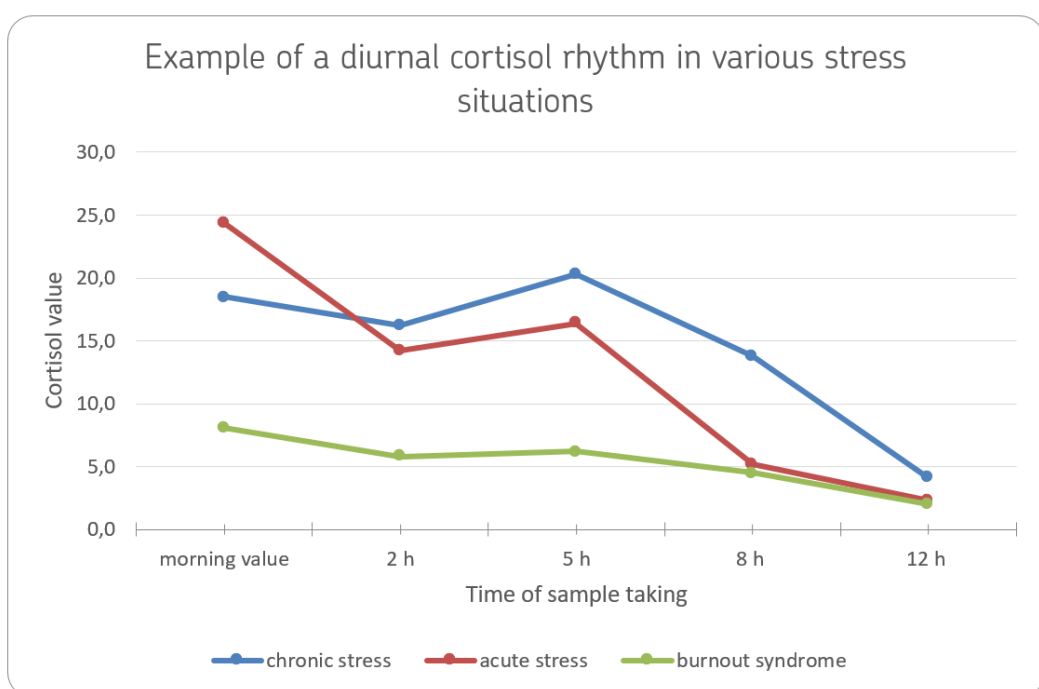


Figure 2: Example of a diurnal cortisol rhythm in various stress situations

Acute Stress

During acute stress, the daily curve of cortisol shows several peak values during stress situations. Counter regulation then brings this value back to the normal range.

Chronic Stress

Chronic stress leads to long-term activity of the stress axis. This leads to an increased nocturnal and early-morning cortisol release, whereas the daily rhythm initially remains largely intact. If stress prevails, the diurnal rhythm changes with partially unstructured curves. Over time, the initially heightened cortisol level reduces but stays above the normal value. The morning-evening gradient remains, in contrast to Cushing's disease (see chapter 5).

Burnout Syndrome

There are various explanations for the decreased cortisol level in case of burnout syndrome. The (patho)biological mechanisms, however, have not fully been clarified. Symptoms are, amongst others, lack of drive, concentration problems, fatigue, digestion problems, insomnia, lack of motivation, cynicism and reduced resilience. Apart from the impacts of the symptoms on the patient's private and professional life, depression can also be a consequence. For both these reasons, it is important to take action in case of an abnormal cortisol level and to consult a physician.

Low Cortisol Level

So-called adrenal insufficiency or adrenal fatigue must also be taken into account as a reason for a low cortisol level. It is assumed that a stress-related overload leads to fatigue of the adrenal cortex and, as a consequence, to lower cortisol secretion. This is supposed to lead to the corresponding symptoms. As the evidence for this is still pending, it is advisable not to simply assume to be suffering from adrenal fatigue. It must be checked whether there are any underlying diseases.

5 What are symptoms of a high cortisol level?

A high cortisol level can not only be identified via a changed cortisol curve in comparison to the physiological diurnal rhythm described above (see figures 1 and 2), but also via individual heightened values.

There is an illness called Cushing's disease, a disorder caused by an overload of glucocorticoids. In life circumstances such as pregnancy and alcoholism, it is called pseudo-Cushing's disease. Higher values are recorded but they are not directly organically induced.

Cortisol levels may also be high in case of obesity, infections, anorexia, acute psychosis, administration of contraceptives containing oestrogen or in case of burns. The signs and symptoms of Cushing syndrome can vary depending on the levels of excess cortisol.

Common signs and symptoms (source: Kluthe):

- Moon face
- Buffalo hump
- Weight gain with truncal obesity (abdomen, neck, face)
- Muscle weakness
- Thin extremities due to muscle atrophy
- Pink or purple stretch marks (striae) on the skin of the abdomen, thighs, breasts and arms / shoulders
- Thinning, fragile skin that bruises easily
- Easy bruising, hair loss, thrombosis
- Increase in blood pressure
- Disturbances of the carbohydrate metabolism (impaired glucose tolerance / diabetes mellitus)
- Osteoporosis due to reduced calcium absorption and reduced bone renewal
- Mental disorders (psychological instability, depression, paranoia)

Women

- Irregular or absent menstrual periods
- thicker or more visible body and facial hair (hirsutism)

Men

- Impotence
- loss of libido and fertility

6 What causes a low cortisol level?

A lack of free (active) cortisol in the body can have many causes. In case of adrenal insufficiency, the cortisol level is low as the adrenal glands cannot produce enough cortisol. This is called Addison's disease.

Also the so-called adrenogenital syndrome leads to lower cortisol levels. Likewise, treatment with cortisone medication can lead to changed cortisol levels.

In case of cortisol deficiency, the following symptoms can appear (source: Mayo Clinic):

- Weight loss, decreased appetite
- Low blood pressure, dizziness, even fainting
- Fatigue
- Nausea
- Vomiting
- Stomach and abdominal pain
- Salt craving
- Darkening of your skin (hyperpigmentation)

- Muscle weakness or pain
- Irritability
- Depression
- Body hair loss or sexual dysfunction in women

7 How can cortisol levels be normalized?

Successful therapy or healing of the underlying disease can restore a physiological stress regulation.

Apart from these, there are further possibilities to reduce the cortisol levels back to normal:

- Give your body the possibility to regenerate!
Sufficient high-quality sleep helps to reduce stress.
- Do sports!
Sport helps to relieve stress and can normalize the cortisol level.
- Allow time for relaxation!
For example, use stress management techniques or take the signs of a high cortisol level as a chance to discover your personal techniques.
- Ensure to take time for intimacy and social contacts on a regular basis!
You hereby activate the “feel-good” hormone oxytocin. This is released as a result of physical contact and social support and lets your cortisol level recover.
- **Eat smart! Here are some examples:**

Resist your sweet tooth!

This causes blood sugar peaks that put additional stress on the pancreas. Instead eat wholemeal products, fruit and vegetables. This helps to keep your blood sugar level steady and even and to avoid blood sugar peaks.

Take vitamin B!

Vitamin B complex, especially B6 and folic acid, help to reduce work stress and improve your mood. Legumes, fish, walnuts, yeast and soy are rich in these vitamins.

Reduce coffee consumption!

Coffee increases the cortisol level.

Drink black tea!

Black tea decreases the cortisol level. However, please drink tea only if it is not contradicted by serious health reasons.

Eat dark chocolate!

It does not only contain antioxidants, but also reduces your cortisol level.

Eat fish!

It is rich in omega-3 fatty acids which reduce the release of cortisol. Prefer mackerel, herring and salmon. Some vegetable oils like rapeseed oil and soybean oil also contain larger amounts of omega-3 fatty acids.

Zinc helps!

It reduces the cortisol secretion. Oysters contain a lot of zinc. Edam and Emmental cheese as well as chicken eggs are also ideal sources.

Vitamin C helps!

Peppers, citrus fruits and berries are rich in vitamin C. It helps to normalize the cortisol level. Eat them fresh, as vitamin C is unstable and easily destroyed by heating and exposure to sunlight.

In case of too low cortisol levels, that do not originate from a burnout syndrome, grapefruit helps to increase the level.

Liquorice and one of its ingredients, glycyrrhetic acid, can also increase the cortisol level. Pregnant women, however, should refrain from eating liquorice as the embryo cannot counter this influence. People who take anticoagulants should only eat liquorice in smaller quantities or better avoid it as it contains vitamin K. If cortisol levels are especially low, and this is not caused by burnout syndrome, grapefruit helps to bring your level back up.

Liquorice and the glycyrrhetic acid it contains can likewise increase cortisol levels. This should not be done during pregnancy, however, because the unborn child also will be subject to this increase, and it has no tools at its disposal to counter this. In addition, people who take coagulation inhibitors should only eat liquorice in small quantities, as it contains vitamin K.

8 Reference

- Barbadoro, P. (2013). Fish oil supplementation reduces cortisol basal levels and perceived stress: a randomized, placebo-controlled trial in abstinent alcoholics. *Mol Nutr Food Res.* 2013 Jun;57(6):1110-4.
- Brandão-Neto, J.(1990). Zinc acutely and temporarily inhibits adrenal cortisol secretion in humans. A preliminary report. *Biol Trace Elem Res.* 1990 Jan;24(1):83-9.
- Camfield, D.A., Wetherell, M.A., Scholey, A.B. et al. (2013). The Effects of Multivitamin Supplementation on Diurnal Cortisol Secretion and Perceived Stress. In: *Nutrients* 5, 4429-4450.
- Delarue, J. (2003). Fish oil prevents the adrenal activation elicited by mental stress in healthy men. *Diabetes Metab.* 2003 Jun;29(3):289-95.
- Der kleine Souci / Fachmann / Kraut (2011). *Lebensmitteltabelle für die Praxis.* Stuttgart: Wissenschaftliche Verlagsgesellschaft.
- Dienes, K. A., Hazel, N. A. and Hammen, C. L. (2013). Cortisol Secretion in Depressed and At-Risk Adults. In: *Psychoneuroendocrinology.* 2013 Jun; 38(6).
- Ditzen, B. et al. (2007). Effects of different kinds of couple interaction on cortisol and heart rate responses to stress in women. In: *Psychoneuroendocrinology.* 2007 Jun; 32(5), p565-574.
- DocCheck online (2014). Burnout-Syndrom: Modekrankheit oder ernstzunehmende Diagnose? <http://news.doccheck.com/de/blog/post/1752-burnout-syndrom-modekrankheit-oder-ernstzunehmende-diagnose/>. Stand 04.09.2015.
- Elmadfa, I. (2009). *Ernährungslehre.* Stuttgart: Verlag Eugen Ulmer.
- Heinrich, P., Müller, M. und Graeve, L. (2014). *Löffler/Petrides Biochemie und Pathobiochemie.* Berlin / Heidelberg: Springer Medizin Verlag.
- Rehner, G. und Daniel, H. (2010). *Biochemie der Ernährung.* Heidelberg: Spektrum Akademischer Verlag.
- Heinrichs, M. (2003). Social support and oxytocin interact to suppress cortisol and subjective responses to psychosocial stress. *Biol Psychiatry.* 2003 Dec 15;54(12):1389-98.
- Halwachs-Baumann, G. (2011). *Labormedizin. Klinik - Praxis - Fallbeispiele.* Wien: Springer Verlag.
- Kalman, B.A; Grahn, R.E (2004): Measuring salivary cortisol in the behavioral neuroscience laboratory. In *Journal of Undergraduate Neuroscience Education* 2.
- Kirschbaum, C. (2010): Trier Social Stress Test. In: *Encyclopedia of Psychopharmacology.*
- Kleine, B. und Rossmannith, W. (2014). *Hormone und Hormonsystem.* Berlin und Heidelberg: Springer Spektrum Verlag.
- Kluthe, B. Online. <http://www.dr-kluthe.de/endokrinologie/Nebennieren/cushing/> Stand 21.08.2015.
- Lovallo, W.R., et al. (2006). Cortisol responses to mental stress, exercise, and meals following caffeine intake in men and women. In: *Pharmacol Biochem Behav.* 2006

Mar; 83(3): 441–447.

Martin, F-P. J. (2009). Metabolic Effects of Dark Chocolate Consumption on Energy, Gut Microbiota, and Stress-Related Metabolism in Free-Living Subjects. *Journal of Proteome Res.*, 2009, 8 (12), pp 5568–5579

Mayoclinic Online. Addison's disease.

<http://www.mayoclinic.org/diseases-conditions/addisons-disease/basics/symptoms/con-20021340>. Stand 21.08.2015.

Methlie, P. (2011). Grapefruit juice and licorice increase cortisol availability in patients with Addison's disease. *Eur J Endocrinol.* 2011 Nov;165(5):761-9.

Nicolson, N. A. (2008). Measurement of cortisol. In: *Handbook of physiological research methods in health psychology.*

Priewe, J. und Trümmers, D. (2007). *Das Erste - kompakt. Kompendium Vorklinik.* Heidelberg: Springer Medizin Verlag.

Rauch, A., et al. (2010). *Cell Metabolism*, 11(6): 517-531.

Steptoe, A. (2007). The effects of tea on psychophysiological stress responsivity and post-stress recovery: a randomised double-blind trial. *Psychopharmacology (Berl)*. 2007 Jan;190(1):81-9.

Stough, C., Scholey, A., Lloyd et al. (2011). The effect of 90-day administration of a high dose vitamin B-complex on work stress. *Hum. Psychopharmacol. Clin. Exp.*, 26: 470–476.

Stuart Brody, S. (2002). A randomized controlled trial of high dose ascorbic acid for reduction of blood pressure, cortisol, and subjective responses to psychological stress. In: *Psychopharmacology*. January 2002, Volume 159, Issue 3, pp 319–324.

Weber-Hamann B., et al. (2002). Hypercortisolemic depression is associated with increased intraabdominal fat. *Psychosom. Med.* 64, 274-277.