



# Cortisol Test

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## 1 Your individual Result Report

Patient	Max Mustermann	Sample number	test145 / P18188
Date of Birth	08/08/90	Sample received	10/14/15
Weight	66 kg	Report date	-

Dear Max Mustermann,

As requested, we have measured your cortisol level. In order to do that we have measured the level of the stress hormone cortisol in your saliva in the form of a day profile. A day profile is created by performing several measurements throughout the day and shows the chronological sequence of your cortisol level. This leads to a higher significance of the test results compared to single measurements. The reason for this is that the cortisol level undergoes physiological fluctuations throughout the day.

**! An increased cortisol secretion is a reaction of your body to permanent stress. !**

Due to the professional and personal stress from our current lifestyle, cortisol levels are often no longer in the normal range. Furthermore, different illnesses and medications may lead to a deviation of the cortisol level.

Most of the cortisol that is present in blood can be found in a bound form. Approximately 1-3% occur in unbound form. Cortisol is only active in the unbound form. The unbound and active form of cortisol in saliva can be measured.

As cortisol levels in saliva change due to stress, the collection of saliva samples is a simple and patient friendly method for measurement of cortisol levels.

The following laboratory findings and information are only points of references for you, because we do not know your individual situation. Please do not begin or end any therapy based on these results. Instead, please consult your physician or your healthcare care practitioner.

Your Greenamics-Team

## 2 Your Results

Your daily profile looks as follows:

Time	Cortisol in Saliva	Reference Values	Evaluation
First sample	1,8 ng/ml	1,8 - 14,5 ng/ml	inside target value
after 2 hours	14 ng/ml	1,3 - 10,3 ng/ml	above target value
after 5 hours	0,7 ng/ml	0,7 - 5,7 ng/ml	inside target value
after 8 hours	0,6 ng/ml	0,6 - 4,7 ng/ml	inside target value
after 12 hours	0,3 ng/ml	0,3 - 3,3 ng/ml	inside target value

If your values lie outside the reference values, you should contact a physician and discuss further steps with him/her.

### **3 Why does your Body need Cortisol?**

The fact that a failure of cortisol release is life threatening suggests that cortisol is very important.

Cortisol is formed in the adrenal cortex and has a broad range of effects. Cortisol level has influence on carbohydrate balance, fat metabolism and protein metabolism. Furthermore, it is anti-inflammatory and immunosuppressant (reduction of immune response).

#### **Influence on Carbohydrate Balance**

The influence on the carbohydrate balance is caused by the influence of cortisol on the stimulation of glucose (sugar) synthesis in the liver, which leads to raised sugar levels in the blood. Cortisol, therefore, is part of the complex mechanism to regulate blood sugar levels and is part of the so-called glucocorticoids. The increased cortisol secretion during high levels of stress explains the connection between stress, cortisol and diabetes. The pancreas hormone insulin regulates the blood sugar levels in the body. If the pancreas has to constantly fight against raised blood sugar levels and has to secrete insulin, this may lead to the development of diabetes in the long term. The receptors that process the insulin lose their ability to react to insulin when there is a regular surplus. In such a situation it is considered that insulin resistance has developed, which in turn is the symptom of diabetes mellitus type II; the acquired diabetes.

#### **Influence on Fat Metabolism**

There is a special enzyme which is part of the fat metabolism and which is activated by stress and by an increased cortisol level. When activated, it supports the conversion of inactive cortisol to the active form. Higher levels of cortisol lead to an increased secretion of this enzyme and this, in turn, leads to a secretion of active cortisol. This circuit is the basis for excess weight.

#### **Influence on Protein Metabolism**

Cortisol also leads to a more restrictive use of amino acids which are part of the protein synthesis.

#### **Influence on Bone Metabolism**

Cortisol inhibits bone regeneration. This is the reason why a therapy with corticoids (cortisone – the biologically active form of cortisol) leads to porous bones = osteoporosis. Osteoporosis occurs when there is an imbalance of the bone forming osteoblasts and the osteoclasts that are responsible for bone breakdown. A cortisone therapy causes a disturbance of the bone forming cells.

### **Involvement in immunological Processes**

Another important effect of cortisol is its involvement in immunological processes. Among other effects, it influences the production and distribution of the blood cells. This results in an altered immune defence situation of an organism. The hormone has immunosuppressive characteristics and is therefore very often used as a medication to reduce inflammatory reactions in the body and to prevent rejection reactions after organ transplantations. Furthermore, it has an anti-inflammatory effect.

## **4 What is the connection of Cortisol with Stress?**

Besides the so-called catecholamines noradrenaline, adrenaline, and dopamine and their derivatives, cortisol is the most important stress hormone for humans.

**! An increased cortisol secretion  
is a reaction of your body  
to permanent stress. !**

Stressful situations lead to a strong increase of the cortisol production. In contrast to the catecholamine system, which reacts immediately and slows down very soon, the cortisol system reacts slowly.

The reaction of catecholamines to stress is expressed by a contraction of skin and intestinal vessels and vascular dilation in the muscles. In addition, there is a redistribution of oxygen- and nutrient-containing blood to facilitate possible muscle exertions. This mechanism is a remnant from evolution to support fights or flights. This catecholamine mechanism only works with the participation of cortisol.

The regulation of the hormones takes place via the so-called endocrine stress axis, the hypothalamus – pituitary – adrenal cortex – axis. The different antagonists ensure that the hormone status is balanced as soon as fluctuations occur. If this mechanism is disrupted in one of the participating organs or by constant stress, the physiological cortisol levels leave their normal range.

In the following page, you will find an example of the cortisol day profile in saliva in the normal range. In case of the burnout syndrome, the cortisol level is below the normal range, while it may be increased in the case of acute or chronic stress. This can be seen in Figure 2, which shows an example of the cortisol fluctuations throughout the day in case of different stress situations.

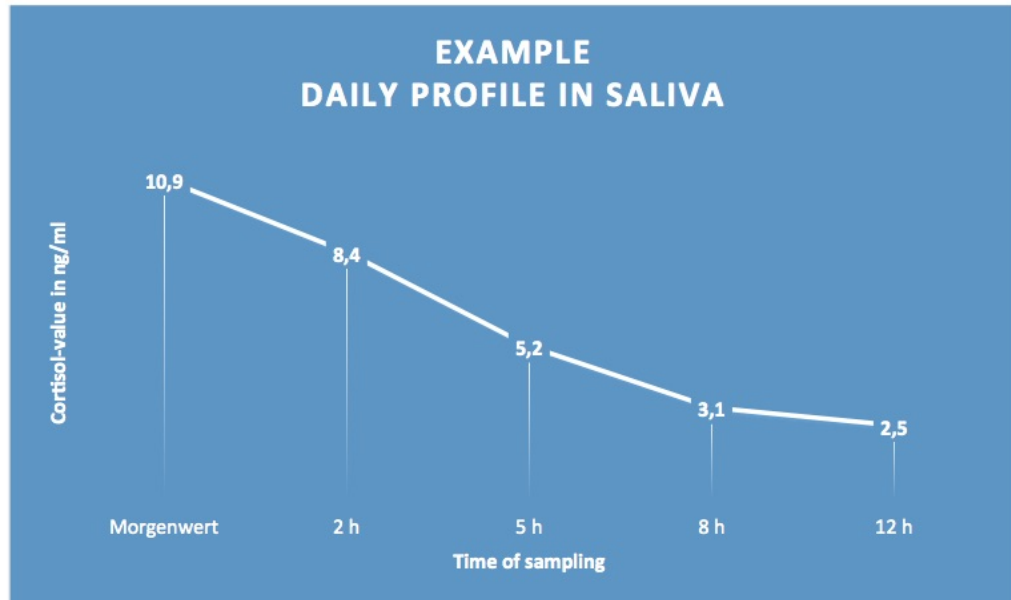


Figure 1: Example for a physiological daily profile of cortisol

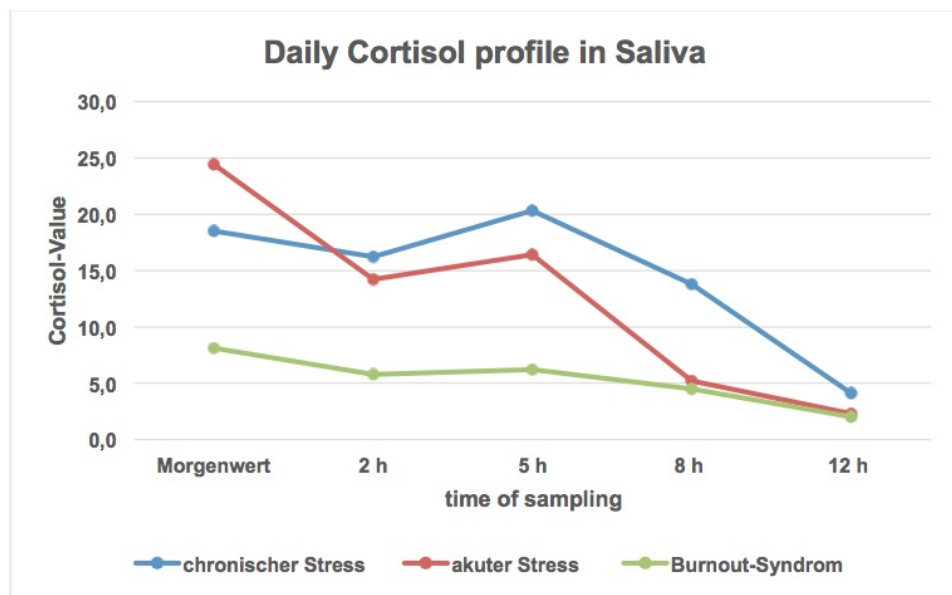


Figure 2: Example for a daily profile of cortisol under different stress situations

### **Acute Stress**

Under acute stress, the daily cortisol curve follows the stress situation with peaks and is then counter-regulated, which means that it goes back to normal ranges.

### **Chronic Stress**

Chronic stress leads to a permanent increased activity of the stress axis. This is seen by increased cortisol levels during the night and in the early morning, while, in the beginning, the levels throughout the day remain in the normal range. Further exposure to stress results in changed fluctuations throughout the day with partly unstructured curves. After some time, the previously increased cortisol levels decrease again – but it still remains above the normal value. The morning-to-night gradient still remains – in contrast to Cushing`s disease (also see section 5).

### **Burnout Syndrome**

There are different explanations regarding the decreased cortisol levels caused by the burnout syndrome; the (patho-)biological relations have not been conclusively explained. Symptoms are among others lack of drive, concentration disorders, fatigue, digestion problems, sleep problems, motivation difficulties, cynicism and reduced physical fitness.

In addition to the negative impact of those symptoms on private and professional life, there is possibility of onset of depression. For both these reasons it is important to take action when the cortisol level is not in the normal range and to contact a therapist.

### **Low Cortisol Level**

One of the reasons for low cortisol levels may be adrenal fatigue. The presumption is that overstrain caused by stress leads to fatigue of the adrenal cortex; thereby causing a reduced secretion of cortisol. This again is supposed to lead to the respective symptoms. As there is no proof for this theory, yet, it is advisable not to rely exclusively on the assumption that you suffer from adrenal fatigue. It has to be investigated whether there are other underlying diseases.

## **5 What are the Manifestations of a raised Cortisol Level?**

A raised cortisol level cannot only be seen by an elimination or a shift of the previously described physiological daily profile (see figures 1 and 2), but also by single increased values. In some cases, the underlying disease may be morbus cushing which is caused by a surplus of glucocorticoids. Some living conditions, such as pregnancy or alcoholism may lead to pseudo-cushing. In this case increased values are measured that are not directly related to organic causes.

Furthermore, overweight, infections, anorexia, acute psychoses, taking an estrogen-containing birth control pill or burns can lead to an increase of the cortisol level



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Possible symptoms are (source: Kluthe):

- moon face
- buffalo hump
- obesity of the trunk (stomach, neck, face)
- slight hypertension
- disorders of the carbohydrate metabolism (disturbed glucose tolerance / diabetes mellitus)
- osteoporosis, caused by a decreased calcium resorption and reduced bone generation
- weakness of the muscles
- thin limbs, caused by muscle degeneration
- for women: irregularity of the menstruation cycle, increased body hair
- impotence and loss of libido
- broad red stripe in the area of the shoulder girdle, stomach and thighs
- parchment-like skin
- proneness to bruising, loss of hair, thrombosis
- psychic disorders (instability, depression, paranoia)

## 6 What causes a low Cortisol Level?

A shortage of cortisol in the body may have several reasons. In case of an insufficiency of the adrenal cortex (decreased activity), the cortisol level is reduced, because not enough cortisol is synthesized. This condition is called morbus Addison. The so-called adrenogenitale syndrome also leads to a decreased cortisol level. A therapy that contains cortisone may also change cortisol levels.

Lack of cortisol can lead to the following symptoms (source: Mayo Clinic):

- loss of weight, loss of appetite
- low blood pressure
- dizziness
- fatigue
- vomiting
- nausea
- stomach ache
- craving for salt
- hyperpigmentation (dark skin spots)
- weakness of muscles or pain
- irritability and depression
- for women: loss of hair and libido problems

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## 7 How can the Cortisol Level be normalized?

Besides a successful therapy or the remedy of underlying illnesses so that the stress regulation is back to a physiological status, there are other possibilities to bring the cortisol level back to normal.

This can be done by different approaches:

- Give your body the chance to regenerate! Sufficient sleep of good quality helps to reduce stress.

- Work out!

A work-out helps to reduce stress and can bring the cortisol level back to normal values.

- Take time to relax!

Use methods to cope with stress or use the signal of a raised cortisol level to develop personal techniques.

- Take time for togetherness and social contacts!

This is how you activate your cuddle hormone oxytocin. This is secreted after physical contacts and social support and it leads to a decrease of the cortisol level.

### **Eat the right food! Our suggestions are:**

#### **Resist your sugar craving!**

This leads to sugar peaks which additionally stress the pancreas. It is better to eat whole grain products, fruit and vegetable. These help to keep the blood sugar level on a constant level and to prevent blood sugar peaks.

#### **Supplement with B-vitamins!**

Vitamin-B complex, especially B6 and folic acid lead to lower personal stress such as work-related stress and to reduced levels of depression. The following foods contain high levels of these vitamins: legumes, fish, walnuts, yeast, soy.

#### **Reduce your coffee consumption!**

Coffee raises the cortisol level.

#### **Drink black tea!**

Black tea is also able to decrease the cortisol level. Please only do this if there are no compelling health reasons that should prevent you to do that.

**Eat dark chocolate!**

Dark chocolate not only contains antioxidants, but also decreases the cortisol level.

**Eat fish!**

Fish contains plenty of omega 3 fatty acids, which reduce the secretion of cortisol. You should prefer mackerel, herring or salmon. There are also some plant oils where you can find larger amounts of omega 3, such as rapeseed oil or soy oil.

**Zinc helps!**

It reduces the cortisol secretion. It is possible to get higher amounts of zinc by eating oysters. Edam cheese, Swiss cheese or eggs are also suitable.

**Vitamin C helps!**

Sweet peppers, citrus fruits and berries contain high amounts of vitamin C. This vitamin is able to normalize cortisol levels. As vitamin C is not stable and is destroyed by cooking or by light, it is preferable to eat everything fresh.

In case of low cortisol levels that are not caused by the burnout syndrome, grapefruit may help to raise the cortisol level again.

You can also raise your cortisol level with liquorice and the glycyrrhizic acid that is contained in it. But this is not recommended for pregnant women as there could be an uptake by the unborn child. Furthermore, patients who take anticoagulants, should not eat liquorice or eat only a little amount due to the fact that it contains vitamin K.

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