Cortisol is a corticosteroid hormone produced by the Zona fasciculata of the adrenal cortex (in the adrenal gland). It is a vital hormone that is often referred to as the "stress hormone" as it is involved in the response to stress. It increases blood pressure, blood sugar levels and has an immunosuppressive action. In pharmacology, the synthetic form of cortisol is referred to as hydrocortisone, and is used as an antagonist in the treatment of allergies and inflammation as well as substitute supplementation in cortisol production deficiencies. When first introduced as a treatment for rheumatoid arthritis, it was referred to as Compound E.

Physiology

The amount of cortisol present in the blood undergoes diurnal variation, with the highest levels present in the early morning, and the lowest levels present around midnight, 3-5 hours after the onset of sleep. Information about the light/dark cycle is transmitted from the retina to the paired suprachiasmatic nuclei in the hypothalamus. The pattern is not present at birth (estimates of when it starts vary from two weeks to 9 months).

Changed patterns of serum cortisol levels have been observed in connection with abnormal ACTH levels, clinical depression, psychological stress, and such physiological stressors as hypoglycemia, illness, fever, trauma, surgery, fear, pain, physical exertion or extremes of temperature.

There is also significant individual variation, although a given person tends to have consistent rhythms.

Effects

In normal release, cortisol (like other glucocorticoid agents) has widespread actions which help restore homeostasis after stress. (These normal endogenous functions are the basis for the
physiological consequences of chronic stress - prolonged cortisol secretion.). It has been proposed that its primary function is to inversely mobilize the immune system to fight potassium losing diarrhea diseases. Its odd attributes all support this.

Insulin

It counteracts insulin by increasing glycogenolysis (breaking down glycogen) and promotes breakdown of lipids (lipolysis), and proteins, and mobilization of extrahepatic amino acids and ketone bodies. This leads to increased circulating glucose concentrations (in the blood) by increasing gluconeogenesis. There is an increased glycogen breakdown in the liver.¹ Prolonged cortisol secretion causes hyperglycemia. Cortisol has no effect on insulin. The reason why in vivo experiments seem to deny this is that cortisone greatly inhibits insulin. So the cortisone-cortisol equilibrium may explain why in vivo experiments contradict the cortisol effect. Cortisol does cause serum glucose to rise, but this is probably an indirect effect caused by stimulation of amino acid degradation, especially that derived from collagen in the skin. Loss of collagen from skin by cortisol is ten times greater than from all other tissue in the rat.

Amino acids

Cortisol raises the free amino acids in the serum. It does this by inhibiting collagen formation, decreasing amino acid uptake by muscle, and inhibiting protein synthesis. Cortisol (as opticortinol) probably inversely inhibits IgA precursor cells in the intestines of calves. Cortisol also inhibits IgA in serum, as it does IgM, but not IgE.

Gastric secretion

Cortisol stimulates gastric acid secretion. Gastric acid secretion would increase loss of potassium into the stomach during diarrhea as well as acid loss. Cortisol's only direct effect on the hydrogen ion excretion of the kidneys is to stimulate excretion of ammonium ion by inactivation of renal glutaminase enzyme.
Net chloride secretion in the intestines is inversely decreased by cortisol in vitro (methylprednisolone).

Sodium
Cortisol inhibits loss of sodium from small intestines of mammals. However sodium depletion does not affect cortisol, so cortisol is not used to regulate serum sodium. Cortisol’s purpose may originally have been centered around moving sodium because cortisol is used to stimulate sodium inward for fresh water fish and outward for salt-water fish.

Potassium
Sodium loads augments the intense potassium excretion by cortisol, and corticosterone is comparable to cortisol in this case. In order for potassium to move out of the cell, cortisol moves in an equal number of sodium ions. It can be seen that this should make pH regulation much easier, unlike the normal potassium deficiency situation in which about 2 sodium ions move in for each 3 potassium ions that move out, which is closer to the deoxycorticosterone effect. Nevertheless, cortisol consistently causes alkalosis of the serum, while in a deficiency pH does not change. Perhaps this may be for the purpose of bringing serum pH to a value most optimum for some of the immune enzymes during infection in those times when cortisol declines. Potassium is also blocked from loss in the kidneys directly somewhat by decline of cortisol (9 alpha fluorohydrocortisone).

Water
Cortisol also acts as a water diuretic hormone. Half the intestinal diuresis is so controlled. Kidney diuresis is also controlled by cortisol in dogs. The decline in water excretion upon decline of cortisol (dexamethasone) in dogs is probably due to inverse stimulation of antidiuretic hormone (ADH or arginine vasopressin), the inverse stimulation of which is not overridden by water loading. Humans also use this mechanism
and other different animal mechanisms operate in the same direction.

Copper
It is probable that increasing copper availability for immune purposes is the reason why many copper enzymes are stimulated to an extent which is often 50% of their total potential by cortisol. This includes lysyl oxidase, an enzyme which is used to cross link collagen and elastin. Particularly valuable for immunity is the stimulation of superoxide dismutase by cortisol since this copper enzyme is almost certainly used by the body to permit superoxide to poison bacteria. Cortisol causes an inverse four or five fold decrease of metallothionein, a copper storage protein, in mice (however rodents do not synthesize cortisol themselves). This may be to furnish more copper for ceruloplasmin synthesis or release of free copper. Cortisol has an opposite effect on alpha aminoisobuteric acid than on the other amino acids. If alpha aminoisobuteric acid is used to transport copper through the cell wall, this anomaly would possibly be explained.

Immune system
Cortisol can weaken the activity of the immune system. Cortisol prevents proliferation of T-cells by rendering the interleukin-2 producer T-cells unresponsive to interleukin-1 (IL-1), and unable to produce the T-cell growth factor. Cortisol has a negative feedback effect on interleukin-1 which must be especially useful in combating diseases, such as the endotoxin bacteria, that gain an advantage by forcing the hypothalamus to secrete a hormone called CRH. The suppressor cells are not affected by GRMF, so that the effective set point for the immune cells may be even higher than the set point for physiological processes. It reflects leukocyte redistribution to lymph nodes, bone marrow, and skin. Acute administration of corticosterone (the endogenous Type I and Type II receptor agonist), or RU28362 (a specific Type II receptor agonist), to
adrenalectomized animals induced changes in leukocyte distribution. Natural killer cells are not affected by cortisol.

Bone metabolism
It lowers bone formation thus favoring development of osteoporosis in the long term. Cortisol moves potassium out of cells in exchange for an equal number of sodium ions as mentioned above. This can cause a major problem with the hyperkalemia of metabolic shock from surgery.

Memory
It cooperates with epinephrine (adrenaline) to create memories of short-term emotional events; this is the proposed mechanism for storage of flash bulb memories, and may originate as a means to remember what to avoid in the future. However, long-term exposure to cortisol results in damage to cells in the hippocampus. This damage results in impaired learning. The desirability of inhibiting activity during infection is no doubt the reason why cortisol is responsible for creating euphoria. The desirability of not disturbing tissues weakened by infection or of not cutting off their blood supply could explain the inhibition of pain widely observed for cortisol.

Additional effects

- It increases blood pressure by increasing the sensitivity of the vasculature to epinephrine and norepinephrine. In the absence of cortisol, widespread vasodilation occurs.

- It inhibits the secretion of corticotropin-releasing hormone (CRH), resulting in feedback inhibition of ACTH secretion. Some researchers believe that this normal feedback system may break down when animals are exposed to chronic stress.

- It increases the effectiveness of catecholamines.

- It allows for the kidneys to produce hypotonic urine.
• It has anti-inflammatory effects by reducing histamine secretion and stabilizing lysosomal membranes. The stabilization of lysosomal membranes prevents their rupture, thereby preventing damage to healthy tissues.

• It stimulates hepatic detoxification by inducing tryptophan oxygenase (to reduce serotonin levels in the brain), glutamine synthase (reduce glutamate and ammonia levels in the brain), cytochrome P-450 hemoprotein (mobilizes arachidonic acid), and metallothionein (reduces heavy metals in the body).

In addition to the effects caused by cortisol binding to the glucocorticoid receptor, because of its molecular similarity to aldosterone, it also binds to the mineralocorticoid receptor. Aldosterone and cortisol have similar affinity for the mineralocorticoid receptor however, glucocorticoids circulate at roughly 100 times the level of mineralocorticoids. An enzyme exists in mineralocorticoid target tissues to prevent overstimulation by glucocorticoids and allow selective mineralocorticoid action. This enzyme, 11-beta hydroxysteroid dehydrogenase type II (Protein:HSD11B2), catalyzes the deactivation of glucocorticoids to 11-dehydro metabolites.

**Binding**

Most serum cortisol, all but about 4%, is bound to proteins including corticosteroid binding globulin (CBG), and serum albumin. Only free cortisol is available to most receptors.

**Regulation**

The primary control of cortisol is the pituitary gland peptide, adrenocorticotropic hormone (ACTH). ACTH probably controls cortisol by controlling movement of calcium into the cortisol secreting target cells. ACTH is in turn controlled by the hypothalamic peptide, corticotropin releasing hormone (CRH), which is under
nervous control. CRH acts synergistically with arginine vasopressin, angiotensin II, and epinephrine. When activated macrophages start to secrete interleukin-1 (IL-1), which synergistically with CRH increases ACTH, T-cells also secrete glucocorticoid response modifying factor (GRMF or GAF) as well as IL-1, both of which increase the amount of cortisol required to inhibit almost all the immune cells. Thus immune cells take over their own regulation, but at a higher cortisol set point. Even so, the rise of cortisol in diarrheic calves is minimal over healthy calves and drops below with time. The cells do not lose all of the fight or flight override because of interleukin-1's synergism with CRH. Cortisol even has a negative feedback effect on interleukin-1 which must be especially useful against those diseases which gain an advantage by forcing the hypothalamus to secrete too much CRH, such as the endotoxin bacteria. The suppressor immune cells are not affected by GRMF, so that the effective set point for the immune cells may be even higher than the set point for physiological processes. GRMF (called GAF in this reference) primarily affects the liver rather than the kidneys for some physiological processes.

A high potassium media, which stimulates aldosterone secretion in vitro, also stimulates cortisol secretion from the fasciculata zone of dog adrenals unlike corticosterone, upon which potassium has no affect. Potassium loading increases ACTH and cortisol in people also. This is no doubt the reason why a potassium deficiency causes cortisol to decline (as just mentioned) and why a potassium deficiency causes a decrease in conversion of 11deoxycortisol to cortisol. This probably contributes to the pain in rheumatoid arthritis since cell potassium is always low in that disease.

Diseases and disorders

- **Hypercortisolism**: Excessive levels of cortisol in the blood result in Cushing's syndrome.
• **Hypocortisolism, or adrenal insufficiency**: If on the other hand the adrenal glands do not produce sufficient amounts of cortisol, Addison's disease is the consequence.

The relationship between cortisol and ACTH is as follows:

### THE DISORDERS OF CORTISOL SECRETION

<table>
<thead>
<tr>
<th></th>
<th>Plasma Cortisol</th>
<th>Plasma ACTH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Hypercortisolism</strong> (Cushing's syndrome)</td>
<td>↑</td>
<td>↓</td>
</tr>
<tr>
<td><strong>Secondary Hypercortisolism</strong> (pituitary, Cushing's disease)</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td><strong>Primary Hypocortisolism</strong> (Addison's disease)</td>
<td>↓</td>
<td>↑</td>
</tr>
<tr>
<td><strong>Secondary Hypocortisolism</strong> (pituitary)</td>
<td>↓</td>
<td>↓</td>
</tr>
</tbody>
</table>

### Pharmacology

Hydrocortisone is the chemical form of cortisol used for oral administration or intravenous injection. It is used as an immunosuppressive drug, given by injection in the treatment of severe allergic reactions such as anaphylaxis and angioedema, in place of prednisolone in patients who need steroid treatment but cannot take oral medication, and peri-operatively in patients on long-term steroid treatment to prevent an Addisonian crisis.

It may be used topically for allergic rashes, eczema, psoriasis and certain other inflammatory skin conditions. It may also be injected into inflamed joints resulting from diseases such as gout.

Compared to prednisolone, hydrocortisone is about 1/4 the strength for the anti-inflammatory effect, while Dexamethasone is about 40 times as strong as hydrocortisone. For side effects, see corticosteroid and prednisolone.
Hydrocortisone creams and ointments are available without prescription in strengths ranging from 0.5% to 2.5%, depending on local regulations, with stronger forms available with prescriptions only.

**Cortisol test**

A cortisol test is done to measure the level of the hormone cortisol in the blood. The cortisol level may show problems with the adrenal glands or pituitary gland. Cortisol is made by the adrenal glands. Cortisol levels go up when the pituitary gland releases another hormone called adrenocorticotropic hormone (ACTH).

Cortisol has many functions. It helps the body break down food for energy (metabolism), and it helps the body manage stress. Cortisol levels can be affected by many conditions, such as physical or emotional stress, strenuous activity, infection, or injury. Normally, cortisol levels rise during the early morning hours and are highest about 7 a.m. They drop very low in the evening and during the early phase of sleep. However, if you sleep during the day and are up at night, this pattern may be reversed. If you do not have this daily change (diurnal rhythm) in cortisol levels, you may have overactive adrenal glands. This condition is called Cushing's syndrome.

Two blood samples may be taken: one in the morning and another in the afternoon.

**Why It Is Done**

A cortisol test is done to find problems of the pituitary gland or adrenal glands, such as making too much or too little hormones.

**How To Prepare**

Avoid strenuous physical activity the day before a cortisol test. Lie down and relax for 30 minutes before the blood test. Many medicines may change the results of this test. Some medicines, such as steroids, can affect cortisol levels for some time even after you stop taking the medicine. Tell your doctor about all the nonprescription and
prescription medicines you take. Be sure to drink enough fluids during the 24-hour urine test to prevent dehydration.

**How It Feels**
The blood sample is taken from a vein in your arm. An elastic band is wrapped around your upper arm. It may feel tight. You may feel nothing at all from the needle, or you may feel a quick sting or pinch.

**Risks**
There is very little chance of a problem from having blood sample taken from a vein.

- You may get a small bruise at the site. You can lower the chance of bruising by keeping pressure on the site for several minutes.
- In rare cases, the vein may become swollen after the blood sample is taken. This problem is called phlebitis. A warm compress can be used several times a day to treat this.
- Ongoing bleeding can be a problem for people with bleeding disorders. Aspirin, warfarin (Coumadin), and other blood-thinning medicines can make bleeding more likely. If you have bleeding or clotting problems, or if you take blood-thinning medicine, tell your doctor before your blood sample is taken.

**Results**
A cortisol test is done to measure the level of the hormone cortisol in the blood.

**Normal**
Normal results may vary from lab to lab.

<table>
<thead>
<tr>
<th>Cortisol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Morning</td>
</tr>
<tr>
<td>5-23 micrograms per deciliter or 138-635 nanomoles per liter (nmol/L)</td>
</tr>
</tbody>
</table>
Salivary Cortisol Ranges for Women and Men

<table>
<thead>
<tr>
<th></th>
<th>Time</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>Morning</td>
<td>3-21 µg/dL or 83-580 nmol/L</td>
</tr>
<tr>
<td></td>
<td>Afternoon</td>
<td>3-10 µg/dL or 83-276 nmol/L</td>
</tr>
<tr>
<td>Child</td>
<td>Morning</td>
<td>3-13 µg/dL or 83-359 nmol/L</td>
</tr>
<tr>
<td></td>
<td>Afternoon</td>
<td>3-10 µg/dL or 83-276 nmol/L</td>
</tr>
</tbody>
</table>

Normal Results

Normal values at 8 a.m. are 6 to 23 mcg/dl. Normal value ranges may vary slightly among different laboratories.

Note: mcg/dl = micrograms per deciliter

What Abnormal Results Mean

Higher-than-normal levels may indicate:

- Adrenal tumor
- Cushing's syndrome
- Ectopic ACTH-producing tumors

Lower-than-normal levels may indicate:

- Addison's disease
- Hypopituitarism

Additional conditions under which the test may be performed:
• Acute adrenal crisis
• Ectopic Cushing's syndrome
• Pituitary Cushing's (Cushing's disease)

High values

• A high level of cortisol in the blood can mean Cushing's syndrome, a disorder that can be caused by overactive adrenal glands, a pituitary or adrenal gland tumor, some types of cancer, or long-term use of corticosteroids.
• One cause of Cushing's syndrome is Cushing's disease, a condition caused by a noncancerous tumor of the pituitary gland (adenoma). An adenoma causes the pituitary gland to make too much of the hormone adrenocorticotropic hormone (ACTH), which in turn causes the adrenal glands to make too much cortisol.
• A high blood cortisol level can be caused by severe liver or kidney disease, depression, hyperthyroidism, or obesity.
• Conditions such as recent surgery, illness, injury, or whole-body infection (sepsis) can cause high cortisol levels.

Low values

• A low level of cortisol in the blood can mean Addison's disease, which is caused by damage to the adrenal glands. If the pituitary gland is not working well, it can cause low levels of the hormone ACTH, which in turn causes low levels of cortisol. Symptoms of pituitary gland failure are like those of Addison's disease. Conditions that can damage the adrenal glands or pituitary gland include some infections, head injury, and some autoimmune diseases.

A low level of cortisol can be caused by internal bleeding that leads to shock. For example, severe bleeding during childbirth that causes damage to the pituitary gland of the mother (Sheehan's syndrome) can cause a low level of blood cortisol.

What Affects the Test
Reasons you may not be able to have the test or why the results may not be helpful include:

- Having physical or emotional stress.
- Being pregnant. This can cause urine cortisol levels to be high.
- Having low blood sugar (hypoglycemia).
- Eating, drinking, or exercising before the test.
- Taking medicines, such as birth control pills, estrogen, amphetamines or corticosteroids.
- Having a radioactive scan within 1 week of a cortisol test.

**What To Think About**

- A 24-hour urine test is used more often than a cortisol blood test to diagnose Cushing's syndrome. For more information on cortisol in urine, see the medical test Cortisol in Urine.

Other tests that can help determine if the pituitary gland or adrenal glands are functioning properly include the adrenocorticotropic hormone (ACTH) and dexamethasone suppression tests. The ACTH stimulation test may be done when Addison's disease is suspected. For more information, see the medical tests Adrenocorticotropic Hormone and Overnight Dexamethasone Suppression Test.

Blood and urine tests for cortisol are used to help diagnose Cushing's syndrome and Addison's disease, two serious adrenal disorders. Some physicians are using salivary cortisol to diagnose Cushing's syndrome as well as to evaluate possible stress-related disorders, although these uses are not widespread.

Both the urine and saliva tests are most frequently used to evaluate excess cortisol production.

Once an abnormal cortisol concentration has been detected, the doctor will do additional testing to help confirm the excess or deficiency and to help determine its cause.
**Dexamethasone Suppression**

If there is excess cortisol production, the doctor may perform a dexamethasone suppression test to help determine whether the cause of the cortisol is related to excess ACTH production by the pituitary. This test involves giving the patient oral dexamethasone (a synthetic glucocorticoid) and then measuring their blood and urine cortisol levels. Dexamethasone suppresses ACTH production and should decrease cortisol production if the source of the excess is pituitary related. There are a variety of dosing schedules, but the medication is usually given every 6 hours for either 2 or 4 days prior to blood or urine collection. Separate 24-hour urine samples are collected prior to and throughout the testing period and then the blood and urine samples are measured for cortisol and evaluated.

**ACTH Stimulation**

If the findings of the initial blood and/or urine tests indicate insufficient cortisol production, the doctor may order an ACTH stimulation test. This test involves measuring the concentration of cortisol in a patient’s blood before and after an injection of synthetic ACTH. If the adrenal glands are functioning normally, then cortisol levels will rise with the ACTH stimulation. If they are damaged, then the response will be limited. A longer version of this test (1-3 days) may be performed to help distinguish between adrenal and pituitary insufficiency.

A cortisol test may be ordered when a patient has symptoms that suggest Cushing’s syndrome (obesity, muscle wasting, and muscle weakness) or Addison’s disease (weakness, fatigue, increased pigmentation, among others). Suppression or stimulation testing is ordered when initial findings are abnormal. Cortisol testing may be ordered at intervals when patients are being or have been treated for Cushing’s syndrome or Addison’s disease to monitor the effectiveness of treatment.

**Cortisol in Urine**
A cortisol test is done to measure the level of the hormone cortisol in a 24-hour sample of urine. The cortisol level may show problems with the adrenal glands or the pituitary gland. Cortisol is made by the adrenal glands. Cortisol levels get higher when the pituitary gland releases another hormone called adrenocorticotrophic hormone (ACTH).

Cortisol has many functions. It helps the body break down food for energy (metabolism), and it helps the body manage stress. Cortisol levels can be affected by many conditions, such as physical or emotional stress, strenuous activity, infection, or injury.

24 hour urine

- You start collecting your urine in the morning. When you first get up, empty your bladder but do not save this urine. Write down the time that you urinated to mark the beginning of your 24-hour collection period.
- For the next 24 hours, collect all your urine. Your doctor or lab will usually provide you with a large container that holds about 1 gal. The container has a small amount of preservative in it. Urinate into a small, clean container and then pour the urine into the large container. Do not touch the inside of the container with your fingers.
- Keep the large container in the refrigerator for the 24 hours.
- Empty your bladder for the final time at or just before the end of the 24-hour period. Add this urine to the large container and record the time.
- Do not get toilet paper, pubic hair, stool (feces), menstrual blood, or other foreign matter in the urine sample.

Results
A cortisol test is done to measure the level of the hormone cortisol in a 24-hour sample of urine.

Normal
Normal results may vary from lab to lab.

<table>
<thead>
<tr>
<th>Cortisol level in a 24-hour urine sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td>Teen</td>
</tr>
<tr>
<td>Child</td>
</tr>
</tbody>
</table>

**High values**

- One cause of Cushing's syndrome is Cushing's disease, a condition caused by a noncancerous tumor of the pituitary gland (adenoma). An adenoma causes the pituitary gland to make too much of the hormone adrenocorticotropic hormone (ACTH), which in turn causes the adrenal glands to make too much cortisol.
- ACTH can be made by other conditions, such as cancer of the lung. This high ACTH level causes the adrenal glands to make more cortisol.
- The adrenal gland can develop tumors (benign or cancerous) that make cortisol and cause Cushing's syndrome.
- A high blood cortisol level can be caused by severe liver or kidney disease, depression, hyperthyroidism, or obesity.

Conditions such as recent surgery, illness, injury, or whole body infection (sepsis) can cause high cortisol levels.

**What Affects the Test**

Reasons you may not be able to have the test or why the results may not be helpful include:

- Having physical or emotional stress.
- Being pregnant. This can cause urine cortisol levels to be high.
- Having low blood sugar (hypoglycemia).
- Eating, drinking, or exercising before the test.
• Taking medicines, such as birth control pills, estrogen, amphetamines or corticosteroids.
• Not collecting exactly 24 hours of urine.

What To Think About

• A 24-hour urine test is used more often than a cortisol blood test to diagnose Cushing's syndrome. For more information on a cortisol blood test, see the medical test Cortisol in Blood.
• Other tests that can help determine if the pituitary gland or adrenal glands are working well include the adrenocorticotropic hormone (ACTH) and dexamethasone suppression tests. The ACTH stimulation test may be done when Addison's disease is suspected. For more information, see the medical tests Adrenocorticotropic Hormone and Overnight Dexamethasone Suppression Test.

Additional information

The hormone cortisol is produced in the adrenal cortex in response to adrenal cortical stimulating hormone (ACTH) produced in the pituitary gland. Cortisol plays an important role in regulating blood sugar, energy production, inflammation, the immune system, and healing.

If you have too little cortisol, you may suffer from fatigue, chronic fatigue, exhaustion, and a disease of the endocrine system called Addison's disease. If your adrenal glands are producing too much cortisol, you may develop conditions such as weight gain, especially around the abdomen, depressed immune function with all of the consequences, accelerated aging, and stomach ulcers.

Recently, a lot of attention has been directed to the effects of excess cortisol on weight gain and on the difficulty in losing weight. Collectively, the various diet plans being promoted by a long list of diet gurus have a failure rate of approximately 93 to 97 percent. There are several reasons for this. One is clearly the difficulty in achieving behavioral modification in the face of easy availability of
the wrong kind of foods, inherently sedentary lifestyles, and intense media programming. Another reason is that our hormones work against us, in the weight loss perspective. High cortisol levels are one of the culprits.

**Cortisol and Stress**

Cortisol is elevated in response to stress. The adrenal glands are not particular, any kind of stress will do. The stress can be physical, environmental, chemical, or imaginary. The human brain is hard wired with automatic responses to protect the body from harm. The classic work on stress was done by Dr. Hans Selye, M.D. He studied the physiological consequences of stress in rats and transferred that research data into a human model.

(1) In the "Fight or Flight" response, the adrenal glands enlarge and secrete large quantities of adrenal cortical hormones. These hormones suppress inflammatory responses and mobilize the body's energy reserves. This puts the body on RED ALERT and diverts all of the body's biochemical resources to immediate survival. The body's self healing mechanisms are arrested (healing diverts energy and raw materials away from immediate survival), the immune system is suppressed, glycogen stores in the liver and muscle tissue are mobilized to raise the blood sugar level, and digestion and assimilation are inhibited. The stomach lining becomes thin and ulcerated and the thymus gland and lymphatic tissue shrinks. This "Fight or Flight" response works well when dealing with man eating food, but it is not suited for our modern lifestyle. Battling traffic, competing for parking spaces, and watching the evening news produces the same physiological responses as running for your life. And the stimuli don't stop and go away, leaving the body with chronic high cortisol levels.

(2) All forms of stress produce the same physiological consequences. This includes environmental stress (heat, cold and noise, etc.), chemical stress (pollution, drugs, etc.), physical stress
(overexertion, trauma, infection, etc.), psychological stress (worry, fear, etc.), and biochemical stress (nutritional deficiencies, refined sugar consumption, etc.). All of these different sources of stress are additive and cumulative in their effects.

As the body responds to this cumulative stress, it goes through three stages of response.

(1) The first stage is REACTION. The body experiences the symptoms from the trauma, infection, heat, cold, chemical irritation, etc. The endocrine system responds with the release of cortisol and other hormones to compensate for the trauma. The heart beats faster, the blood pressure rises, and the pupils dilate.

(2) The second stage is ADAPTATION. After the adrenal glands have enlarged and released large quantities of adrenal cortical hormones, the symptoms disappear and the individual feels good, has energy, and is able to function in the presence of the stresses he/she is under.

(3) The third stage is EXHAUSTION. After an extended period in stage two, the body's reserves of nutritional elements (raw materials) and resilience becomes depleted. The symptoms return and there is now no relief. The individual may collapse physically, suffer a nervous breakdown, become dysfunctional, and/or experience an organ or body system failure (heart attack, stroke, etc.).

(4) An optional fourth stage is DEATH. If the stresses continue after stage three is reached and the body is no longer able to adapt and rest and regeneration and healing do not occur, the consequence is death.

It is important to recognize that an individual, in the cycle short of stage four, can reverse the consequences of stress by removing themselves from the stressful situation and giving themselves the rest, peace of mind, and nutritional support that is necessary to restore the body's reserves.
It is also important to recognize that an individual in stage two has physiologically adapted and they feel asymptomatic, and are usually, therefore, not too concerned about or even conscious of what is happening. One of the consequences of this adaptation is suppression of the immune system. These individuals are more susceptible to infections, colds, and allergies, etc. In the presence of new and dangerous infectious diseases, this can be a very important matter.

The positive effects of massage therapy on biochemistry are reviewed including decreased levels of cortisol and increased levels of serotonin and dopamine. The research reviewed includes studies on depression (including sex abuse and eating disorder studies), pain syndrome studies, research on auto-immune conditions (including asthma and chronic fatigue), immune studies (including HIV and breast cancer), and studies on the reduction of stress on the job, the stress of aging, and pregnancy stress. In studies in which cortisol was assayed either in saliva or in urine, significant decreases were noted in cortisol levels (averaging decreases 31%). In studies in which the activating neurotransmitters (serotonin and dopamine) were assayed in urine, an average increase of 28% was noted for serotonin and an average increase of 31% was noted for dopamine. These studies combined suggest the stress-alleviating effects (decreased cortisol) and the activating effects (increased serotonin and dopamine) of massage therapy on a variety of medical conditions and stressful experiences.

The Consequences of Chronic High Cortisol

To repeat, chronically elevated cortisol levels contribute to the accumulation of abdominal fat and make it very difficult to get rid of it. The immune system is suppressed and the individual becomes more susceptible to infections, both minor and major. Clearly, we would like for our cortisol levels to return to normal.
How to Correct your Cortisol Level

Stress reduction is an essential part of all efforts to normalize cortisol. Stress is the stimuli that caused the cortisol levels to get out of hand to begin with. Each individual should explore and find the stress reduction techniques that work best for themselves. Meditation, physical activities, attitude changes, and etc. are good paths to explore. Without stress reduction, all therapeutic and support measures will eventually fail.

Rest. This may sound obvious but it must be managed and scheduled as a deliberate strategy, choice, and course of action. Otherwise it gets forgotten in the busyness of life.

A low glycemic diet is important. Sugar handling stress increases cortisol levels. Elevated cortisol, in turn, aggravates the sugar handling situation contributing to the development of high insulin levels and ultimately diabetes.

Nutritional supplementation is very valuable in restoring normal cortisol levels. It is important, however, to recognize if your cortisol levels are high or low. Low cortisol levels are the consequence of adrenal exhaustion or the exhaustion phase of the stress response. High cortisol levels are the result of the response to chronic stress and represent the adaptation phase of the stress response.

Determining your Cortisol and DHEA Levels

Both Cortisol and DHEA can be determined by a simple saliva test.

Nutritional Supplements to Support Low or High Cortisol Levels

For basic adrenal support, include:

- A good complete multiple vitamin mineral supplements.
- Mag-C, one capsule three times per day. This is a source of buffered vitamin C and a source of absorbable magnesium.
• Advanced Essential Minerals, two capsules three times per day. Mineral absorption and assimilation can be impaired by stressed adrenal glands. Minerals are essential for energy metabolism.
• B5, one capsule per day
• B6, one capsule per day

One of the best known and most effective ways to lower excess cortisol levels is with the nutrient Phosphatidylinerine (PS). Phosphatidylinerine is believed to facilitate the repair of the cortisol receptors in the hypothalamus. It is believed that the cortisol receptors get damaged by high cortisol levels reducing the ability of the hypothalamus to sense and correct high cortisone levels. Because Phosphatidylinerine helps repair the feedback control apparatus, it is useful in correcting both high and low cortisol levels. Phosphatidylinerine is also useful for preventing short-term memory loss, age-related dementia, and Alzheimer's disease. Typical dosages are one to three 100 mg capsules per day.

Adaptogens are an entire category of herbs that assist the body in coping with stress by restoring hypothalamic cortisol receptor sensitivity. Adaptaphase I from Vitamin Research Products is one such blend of adaptogenic herbs that is based on Russian research. It is a combination of Siberian ginseng, Manchurian Thorn Tree extract, Hawthorn extract, Echinopanax elatum, and Schisandra. Typical dosages are from 1 to 4 ml. per day.

Adaptaphase II is an anti-catabolic blend of herbs that can be used to enhance the effects of Adaptaphase. Adaptaphase II is synergistic blend of ingredients designed to help the body overcome the exhaustion that is experienced by people under such extreme stress. The formula includes soy protein isolate, Rhaponticum carthainoides, Tribulus Terrestris, and Adjuga turkistanica. These ingredients exert profound energizing, anabolic, muscle-building effects. This product is best used in cycles, each cycle lasting 10 days with a break of two to three weeks between each 10 day cycle. Dosage ranges from 4-10 capsules per day depending upon the individual's weight and the
amount of physical or psychological stress that individual is undergoing.

**CortiTrophin** is a combination of **adrenal concentrate** and glycyrrhizinate. **Glycyrrhizinate** is a natural cortisol-mimicking extract from licorice. Taking a small amount of CortiTrophin, 25-100 mgs/day, can be beneficial in treating symptoms of adrenal exhaustion and can provide significant relief from the symptoms of chronic fatigue and fibromyalgia. To best mimic the body's own physiology, CortiTrophin should be taken on an empty stomach, first thing in the morning. If a second dose is required, it should be taken before lunch. Since CortiTrophin mimics the action of cortisol, one should be very judicious in using it. It should only be used intermittently and if any adverse effects occur, such as water retention or elevated blood pressure, use should be discontinued immediately. Individuals with high blood pressure should be very cautious with this supplement and should consult their doctor. Saliva testing should be seriously considered when using cortisol simulating supplements.

**DHEA** is a hormone which acts as a precursor for many other hormones. DHEA levels decline drastically with age. Many anti-aging physicians and programs advocate DHEA supplementation for individuals over 40 years of age. There is some medical controversy regarding this practice. If you are considering taking DHEA supplements, it would be a good idea to use the tests to both determine the need for it and get the dosage adjusted properly. DHEA can also be used empirically to alleviate the symptoms of excess cortisol or hyperadaptosis. DHEA can improve glucose tolerance, convert excess body fat to lean muscle mass, alleviate depression, increase energy and decrease pain in chronic fatigue and fibromyalgia patients, decrease joint pain and fatigue in inflammatory and autoimmune diseases, improve mental clarity, and enhance overall immune function. Typical doses for DHEA are 10 to 25 mg for women, 25 to 100 mg for men, taken in the morning to mimic the body’s natural rhythm. Note: Dosage should be adjusted based
on test results. It is important for men to take a prostate PSA test before supplementation. DHEA supplementation could potentially complicate prostate cancer, so professional medical advice is necessary if the PSA level should be elevated.

Adrenal exhaustion is more difficult to resolve. Adrenal exhaustion involves a depletion of energy reserves and a loss of resilience. Symptomatic signs of adrenal exhaustion can be as diverse as fatigue, nervousness, anxiety, severe PMS, depression, brain fog, carbohydrate cravings, allergies, muscular pain and tenderness, joint pain, and irritable bowel syndrome. The goal of nutritional therapy in this situation is to restore the natural, diurnal release of normal levels of cortisol. The theory is, if you provide the body with a small amount of a cortisol-like substance, the adrenal glands can take a rest and have an opportunity to regenerate. Then normal cortisol production will be restored.

**High Stress Hormone Levels Impair Memory**

"We tested memory and other cognitive functions before treatment, after one day of treatment and again after four days, in individuals receiving either a high dose of cortisol, a lower dose or an inactive substance," explained lead author John W. Newcomer, M.D., assistant professor of psychiatry and psychology. "We saw memory impairment only in the individuals treated with the higher dose and only after four days of exposure. The good news is it appears that it would take several days of stresses like major surgery or severe psychological trauma in order for cortisol to produce memory impairment. And after a one-week wash-out period, memory performance returned to the untreated levels."

Cortisol is produced in the body during stress. It belongs to a family of stress hormones called glucocorticoids that, among other actions, can interfere with energy supply to certain brain cells involved in memory. Newcomer's previous work showed that treatments with a synthetic glucocorticoid called dexamethasone impaired memory. But
this is the first study to demonstrate that prolonged exposure to high levels of cortisol--the hormone actually produced in the body in response to high stress--has that same negative effect.

"The dexamethasone work came pretty close to telling the story of what actually happens with large amounts of stress and high levels of cortisol," Newcomer said. "But this study more accurately represents the effects of cortisol in the brain when a person is under high levels of stress."

A total of 51 people participated in the study -- 25 men and 26 women between ages 18 and 30. They were assigned to one of three groups. One group of seven men and eight women received a high daily dose of cortisol. A second group of eight men and eight women took a lower dose, and the remaining 10 men and 10 women received an inactive substance. All took their capsules twice daily for four days. The amounts mimicked cortisol levels secreted in response to stressful medical procedures. The high dose corresponds to cortisol secretion after events like abdominal surgery. The lower dose was similar to cortisol secretion during a minor medical procedure such as getting stitches or having a skin growth removed.

The volunteers also were asked to listen to and recall parts of a paragraph so the researchers could assess their verbal declarative memory. This type of memory involves several brain regions, including the hippocampus, a seahorse-shaped brain structure related to memory and learning. The memory test, as well as tests of other cognitive functions, were given before the cortisol treatment, after one day of treatment, after four days of treatment and six days after the subjects stopped taking cortisol.

Newcomer, who also is a staff psychiatrist at Barnes-Jewish Hospital, found that memory performance suffered only in those subjects who received the high dose of cortisol and only after the subjects had received the hormone for several days. Fourteen of the 15 individuals taking the high dose experienced a decrease in memory performance
after four days of treatment. No effects were found on the other cognitive tests.

In addition to explaining the memory problems that could occur during hospitalizations for surgery, the results may be relevant to other situations as well, Newcomer said. Major psychological stresses, which can be different for different individuals, also could produce similar effects on memory. For example, if a student studying for a test has just experienced a major trauma such as a death in the family, he or she might not be as efficient at learning new material.

A few people may experience high cortisol levels in response to less profound events, such as the pressure of upcoming final exams. So cramming for exams is not a good idea. "These high cortisol levels are relevant to the kind of memory that helps us function moment-to-moment," Newcomer said.

The remaining questions involve how much stress must be present before memory suffers. The cortisol levels produced in the study were significantly higher than those that occur during an average bad week. Most people would have to experience a severe medical situation or severe physical or psychological trauma. But Newcomer believes there may be some effects from long-term exposure to slightly lower levels, though those experiments have not yet been done.

The glucocorticoid effects on memory appear to be reversible. Therefore, Newcomer does not believe the memory effects demonstrated in this study are part of any process associated with loss of neurons or permanent damage in the hippocampus or other brain structures.

"The evidence suggests that these kinds of cortisol levels are not neurotoxic themselves," Newcomer said. "Perhaps sustained, high levels make neurons vulnerable to other types of injury, but we don't believe the memory impairments we saw in this study are in any way
associated with an irreversible process. In fact, our evidence shows that this memory impairment is quickly reversible."

**Cortisol Connection: Managing Stress and Weight**

Today there are commercials that tout the effectiveness of supplements like Cortislim ™ and Relacore ™ that propose to help people lose weight and feel less stressed by inhibiting the effects of cortisol. However, these commercials do not fully inform the general public about:

1. What is stress and its significance to overall physiological functioning?
2. The actual pathways involved with the stress response and the one responsible for cortisol release.
3. The function and importance of cortisol for bodily function.
4. The potential link between cortisol and obesity.
5. The potential link between stress, cortisol, and appetite.

The purpose here is to briefly review, discuss and clarify some misconceptions on these topics and to suggest some practical assessment and stress management ideas for the fitness professional and personal trainer to incorporate with students and clients.

What is stress and its significance to physiological functioning?
Hans Selye, a foremost stress physiologist of the 20th century defined stress as “….the nonspecific response of the body to any demand made upon it .” Richard Lazarus, another highly regarded psychologist adds that stress is “…any event in which environmental demands, internal demands, or both tax or exceed the adaptive resources of an individual, social system, or tissue system.”

In many different societies, stress is a common term that is often associated with negative situations and settings. Yet, a stress-free life may also be harmful, because an individual will lose his/her ability to react to the different challenges of life. Every person has an optimal
positive stress level referred to as eustress, while stress that is harmful is noted to be distress.

What are the stress response pathways?

People can react to a stressor in different ways. For instance, if an individual perceives the stressor as a challenge to his/her control of a situation, norepinephrine, the “fight” hormone is predominantly released. If the stress arousal increases and a possible loss of control is felt by the individual, then epinephrine, another “flight/anxiety” hormone is released.

When the stress is prolonged and seen as hopeless, the individual becomes more distressed and feels defeated. This activates the hypothalamus in the brain. What follows is a cascade of hormonal pathways resulting in the final release of cortisol from the adrenal cortex (of the kidney).

The brain has the ability to selectively activate the fight, flight, or defeat responses. This usually occurs in day to day living when an individual perceives his/her hassles as a challenge to control or a loss of control. Although the stress pathways work together, they each can uniquely affect the function of bodily processes. For instance, the “fight” or “flight” stress responses cause the heart to beat faster and harder as well as release more free fatty acids (disassembled triglycerides) into the blood. The “defeat” response stress pathway can lead to enhanced lipogenesis (fat creation), visceral obesity (deep abdominal obesity), breakdown of tissues, and suppression of the immune system.

Where does cortisol come from and what is its purpose in the body?

Cortisol has become a ‘prime’ hormone of fascination, discussion and confusion within the consumer and fitness industry, due to misleading television commercials and advertisements. It is a steroid (compound based from a steroid nucleus) hormone that is produced
in the cortex of the adrenal glands located on top of each kidney. Fasting, food intake, exercising, awakening, and psychosocial stressors cause the body to release cortisol. Cortisol is released in a highly irregular manner with peak secretion in the early morning, which then tapers out in the late afternoon and evening. Energy regulation and mobilization are two critical functions of cortisol. Cortisol regulates energy by selecting the right type and amount of substrate (carbohydrate, fat or protein) that is needed by the body to meet the physiological demands that is placed upon it. Cortisol mobilizes energy by tapping into the body’s fat stores (in the form of triglycerides) and moving it from one location to another, or delivering it to hungry tissues such as working muscle. Under stressful conditions, cortisol can provide the body with protein for energy production through gluconeogenesis, the process of converting amino acids into useable carbohydrate (glucose) in the liver. Additionally, it can move fat from storage depots and relocate it to fat cell deposits deep in the abdomen. Cortisol also aids adipocytes (baby fat cells) to grow up into mature fat cells. Finally, cortisol may act as an anti-inflammatory agent, suppressing the immune system during times of physical and psychological stress.

The potential link between cortisol and visceral obesity: What is going on at the tissue level?

Cortisol directly effects fat storage and weight gain in stressed individuals. Tissue cortisol concentrations are controlled by a specific enzyme that converts inactive cortisone to active cortisol. This particular enzyme is located in adipose (fat) tissues. Studies with human visceral (fat surrounding the stomach and intestines) and subcutaneous fat tissue have demonstrated that the gene for this enzyme is expressed more by obese conditions. It has also been demonstrated in research that human visceral fat cells have more of these enzymes compared to subcutaneous fat cells. Thus, higher levels of these enzymes in these deep fat cells surrounding the abdomen may lead to obesity due to greater amounts of cortisol being produced at the tissue level. As well, deep abdominal fat has
greater blood flow and four times more cortisol receptors compared to subcutaneous fat. This may also increase cortisol’s fat accumulating and fat cell size enlarging effect.

What is the potential link between stress, cortisol, and appetite?

Animal and human studies have demonstrated that cortisol injections are associated with increased appetite, cravings for sugar, and weight gain. It was demonstrated that premenopausal women who secreted more cortisol during and after novel laboratory stressors chose to consume more foods high in sugar and fat. It has been thought that cortisol directly influences food consumption by binding to receptors in the brain (specifically, the hypothalamus). This can stimulate an individual to eat food that is high in fat and/or sugar. Cortisol also indirectly influences appetite by regulating other chemicals that are released during stress such as CRH (corticotrophin releasing hormone), leptin, and neuropeptide Y (NPY). High levels of NPY and CRH and reduced levels of leptin have been shown to stimulate appetite.

What are the harmful health effects associated with stress-induced obesity?

Chronic stress can contribute to several harmful physiological events. When body tissues are exposed to high levels of cortisol for extended periods of time, some cellular and tissue alterations may occur. High levels of cortisol cause fat stores and excess circulating fat to be relocated and deposited deep in the abdomen, which left unchecked can develop into or enhance obesity. In addition, hypertension (high blood pressure), hyperlipidemia (elevated lipids), and hyperglycemia (elevated glucose) have been linked to elevated cortisol levels. Individuals with a high waist-to-hip ratio (which identifies visceral obesity) are at a greater risk for developing cardiovascular disease, type II diabetes mellitus, and cerebrovascular disease.
Are there any practical assessment tips for the fitness professional to utilize?

To help identify clients with a potential risk for the diseases described above (which are associated to stress-induced obesity) and distinguish any patterns of fat distribution, fitness professionals can utilize a waist-to-hip ratio (WHR) measurement or waist circumference measurement. The WHR is the circumference of the waist divided by the circumference of the hips. The waist measurement is at the narrowest part of the torso between the ribs and iliac crest. The hip measurement is around the buttocks at its maximum posterior extension. Norms are available in some fitness texts, but in general, health risk is very high for men (30-39 yrs) when WHR is >0.96 for men and when it is >0.84 for women (30-39 yrs). With waist circumference, the National Cholesterol Education Program recommends using a waist circumference of >88cm (or >35 inches) for women and >100 (or >39 inches) cm for men, to evaluate obesity as a risk factor to metabolic diseases and coronary heart disease.

What are some useful stress management tips for the fitness professional to incorporate with their students and clients?

Fortunately, fitness professional are already doing many physical activities to help their clients manage stress. Many types of aerobic and anaerobic exercise have been shown to be effective interventions in reducing or managing stress. Some of the popular ‘mindful’ exercise programs such as yoga and Tai Chi (or Tai Chi Chaun) are also recommended for stress management. Meditation, progressive relaxation, deep breathing, and visualization are methods that can be effective in decreasing stress-induced symptoms. Also, eating right and getting enough rest should be incorporated in a stress management plan for life.

Conclusion

Stress will always be a part of daily living and is necessary for
providing the challenge for physiological and psychological
development. However, too much stress over a period of time
combined with poor coping habits may cause physical, chemical, and
hormonal imbalances in the body, thus leading to disease and death if
left unchecked. The pathways of the stress response are complex and
may activate other hormonal pathways, resulting in the release of
cortisol. The chronic release of cortisol combined with altered tissue
production is linked to the development of abdominal obesity in
both men and women. Cortisol is associated to overeating, craving
high caloric fatty and sugary foods, and relocating fat from the
circulation and storage depots to the deep internal abdominal area.
We must continually educate the general public of the value of
exercise and stress management activities as important strategies for
managing stress and lessening the health risks associated with stress-
induced obesity.

Bottom line

We should familiarize our clients and students with the links between
stress and abdominal obesity. Cortisol is a necessary hormone that is
responsible for fuel regulation and is released while exercising, eating,
awakening, and psychosocial stress. However, if there is too much
cortisol in circulation, abdominal obesity can develop. This type of
central obesity is linked to developing cardiovascular disease, type II
diabetes mellitus, and cerebrovascular disease. An effective and
regular exercise and stress management program may be a key to
reducing and or preventing stress-induced obesity.

Wellness

Interesting how we learn in layers. In my pursuit of understanding as
completely as I can how the body works, first I learned how we can
develop health complaints by eating the wrong foods, exercising too
little or too much, and not getting enough sleep. But the reason our
lifestyle is so fundamental to our health is because everything we do -
every mouthful of food, every bout of exercise or lack thereof, every
thought and emotion we have, as well as how much light or darkness we expose ourselves to has a hormonal consequence in the body. Because an imbalance in one hormone affects the others, poor lifestyle choices have far-reaching impacts on our systems, and cause widespread, seemingly unrelated symptoms. For example, we may get insomnia or feel lethargic a lot, we may put on weight and be unable to lose it no matter how much exercise we do, we may become depressed, we may feel too hot or too cold a lot, if female, we may have difficult periods and the worse our hormone balance is the worse our symptoms at menopause.

If our hormones are off, we crave particular foods (usually the ones that will make us worse), we are not tired at night so we don’t want to go to bed, we feel down so we start thinking thoughts that bring us further down. If we don’t improve our lifestyle in order to bring our hormones back into balance, over time we may get a disease. So, because of how vital hormone balance is to our health, I have become fascinated by the endocrine system.

We have four endocrine glands that spit out hormones as needed - the thyroid, the pancreas, the ovaries/testes, and the adrenals. The thyroid puts out T4, the pancreas is responsible for insulin, the ovaries and testes give us our sex hormones, and the adrenals put out adrenaline otherwise known as epinephrine, aldosterone and cortisol. After a woman has gone through menopause and the ovaries are out of commission, the adrenals also make estrogen and progesterone although in lesser amounts. All of these hormones interact with each other, so if one hormone is out of whack it affects the amounts and functions of all the others. The endocrine glands not only communicate amongst themselves, but they also talk to the nervous system and the immune system as was scientifically proven by Dr. Candace Pert and discussed in her book Molecules Of Emotion: The Science Behind Mind-Body Medicine.

Because in my estimation, problems with cortisol are the most common and underlie so many health complaints, I figure it is the
best place to start. As I have said in many other tips, cortisol is the hormone that gets secreted when we are under physical, emotional and spiritual stress. Physical stress includes acute stressors like a car accident or medical emergency, and chronic stressors like constant pain, poor nutrition or food sensitivities, dehydration, too much or too little exercise, too little sleep. Emotional stress is usually chronic and includes stuff like financial stress, relationship stress, work stress, time stress, and spiritual stress may include things like conflicts between one’s religion and one’s sexuality, one’s choice of life-partner, or one’s occupation. No matter what the source of stress, cortisol is released into the blood stream to help us cope by increasing sympathetic tone (fight and flight response), and to put sugar into the blood stream so our muscles and brain have the fuel needed to react. When we look at that list, it becomes pretty obvious why so many of us may have problems with cortisol! Cortisol should be high in the morning, but should subside by evening when our rest and repair system (parasympathetic system) is supposed to take over.

Cholesterol is the base material from which many of our hormones are made. Cholesterol gets converted into pregnenalone, which then manufactures cortisol, T4 (thyroxine), estrogen, progesterone, DHEA and testosterone. So, when cortisol is needed to help us cope with stress, cortisol gets prioritized at the expense of the other hormones. Your body figures that if you are under stress, reproduction is not important, so progesterone and DHEA (which builds testosterone) are sacrificed to make cortisol, for example. This causes major PMS symptoms in females, as progesterone is needed to balance estrogen.

Adrenal fatigue eventually occurs if one is under prolonged stress. In Stage 1, cortisol and DHEA levels increase, but if the stressors don’t go away and one moves into Stage 2 adrenal fatigue, cortisol levels remain high, but DHEA becomes depleted. Finally in Stage 3, the adrenals give up. They simply cannot sustain the prolonged need for cortisol, so both cortisol and DHEA levels drop. At this point, one can’t handle much. These people often can’t work, and after one
short activity or appointment they are done for the day and have to go home and rest. Frequently the diagnosis of chronic fatigue or fibromyalgia is given.

So can you see that taking sleeping pills to help one sleep, taking medicine to relieve PMS symptoms, taking stimulants like caffeine and sugar to get through the day, Synthroid for low thyroid, or antidepressants to boost mood may really only be addressing symptoms of problems with cortisol, but not the cause? By removing various stressors through improving the lifestyle factors described in these tips, one can help the body return to hormonal balance. Using functional medicine to measure circadian cortisol, DHEA, and sex hormones, interventions can be made to help the body return to homeostasis.

Find yourself lashing out at somebody, stuck in anxiety, or fearful you’ll you’re your job? If so, you likely have stirred up a hormone in your brain that will work against relationships, courage, and well-being. Cortisol is the hormone that appears when we slip into stress, when we feel angry or fearful, or when we respond to an email out of sheer frustration. It will shut down learning ... and can cause depression.

It’s the opposite of serotonin – the hormone of well-being. Cortisol reduces your ability to learn and communicate. It’s what hits your brain along with that angry customer that finds you on a day when you’re tired or behind in your work.

While cortisol holds an important roles in your mind, but is meant to be very short term. It’s useful for treating allergies short term or for spiking your energy to survive a dangerous moment, lower sensitivity to pain, or getting you through a short term project. If you stress too much or grieve too long, however, you can easily maintain cortisol in harmful levels.
Prolonged levels in the bloodstream have negative effects and will:

1. Lower your immune system so you’ll get sick faster than others
2. Slow down your thinking
3. Create blood sugar imbalances
4. Raise your blood pressure
5. Weaken muscle tissue
6. Decrease bone density
7. Increase fat in the stomach areas

To ensure you stay away from dangerous levels of cortisol today… run from stress and flee those triggers that inject negative thinking … and you’ve already headed away from cortisol and toward serotonin… for a better day at work. Now think of one thing you enjoy… look forward to or plan to create… and your brain will rewire itself for a far better workday. It’s just how the hormones work for you rather than against you, and you’ll be pleased at the results