EFFECTS OF CORTISOL ON PHYSICAL AND PSYCHOLOGICAL ASPECTS OF THE BODY AND EFFECTIVE WAYS BY WHICH ONE CAN REDUCE STRESS

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Over the past years, reports of increased stress levels in millennials have been on the rise; Stress in America, a study, from the American Psychological Association found "half of all millennials are so stressed out that they can't sleep at night, and 39 percent of millennials have stress levels that have increased in the past year" (Yandoli, 2013) and "On a 10-point scale, Americans ages 18-33 reported an average stress level of 5.4 compared to the national average of 4.9" (Kingkade, 2013). Consequently, there are a plethora of suggestions regarding ways to reduce stress – common tips include keeping a positive attitude, exercising and eating healthy (WebMD). A popular website also indicates that eating berries help combat stress since "Blueberries are naturally rich in vitamin C, which helps fight increased levels of cortisol, a stress hormone"[1] (Oz, 2010). Unfortunately, for most people, it is difficult to evaluate whether such tips are effective stress reducers. The aim of this article is to explain why stress exists. The cortisol hormone, i.e. "stress hormone" that's secreted by the Hypothalamic-Pituitary-Adrenal (HPA) affects our body in both physical and mental ways that can be detrimental to our overall health. Some of the effects of stress can be due to our genes, while some effects can be due to external environmental factors. However, there do exist effective ways by which one can reduce cortisol levels.

In order to understand why we feel stressed, it is important to understand the mechanism of the Hypothalamic-Pituitary-Adrenal (HPA) axis, an axis along our brain that secretes cortisol. The hormones produced by the hypothalamus results in a cascade of events down the HPA axis which ultimately leads to the secretion of cortisol from the adrenal gland ("Hypothalamic–pituitary–adrenal axis"). In the first step of the process, the hypothalamus contains neuroendocrine neurons that synthesize proteins, which act as hormones when released. While some hormones target distant tissues, some hormones – including vasopressin and corticotropin releasing hormone (CRH) – are released in the blood circulation of the axis for delivery to the pituitary gland. The CRH is received by the anterior pituitary gland, which in turn secretes Adrenocorticotropic Hormone (ACTH) within the blood circulation of the axis. ACTH further acts on the two of the three zones of the adrenal gland – zona fasciculate and the zona reticularis – this action leads to the secretion of glucocorticoids (which mainly consists of cortisol in humans) among other hormones (Mitrovic). Also, 90% of the cortisol is eventually bound by proteins, whereas 10% of the free cortisol is unbound, and therefore biologically active – this free cortisol creates a negative feedback loop whereby it binds to hypothalamus and the pituitary gland to inhibit secretion of CRH and ACTH (Mitrovic).

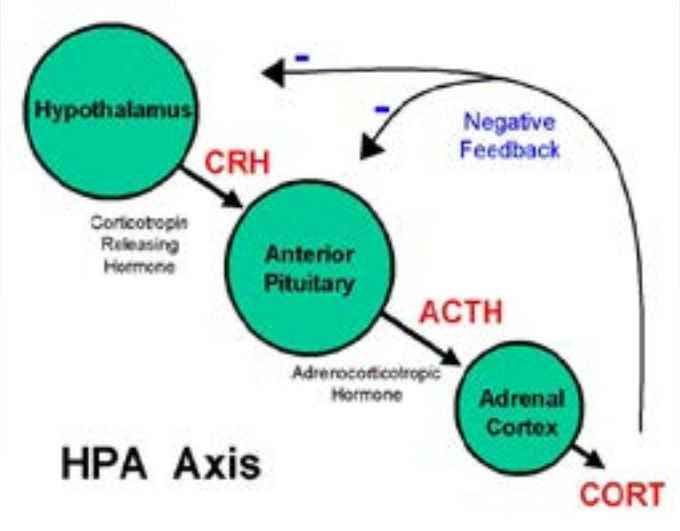


Fig 1. HPA Mechanism

"Some ailments caused by increased levels in cortisol include a suppressed immune system, insomnia, severe mood swings, depression and severe hypotension"

[1] Scientific experiments done to determine correlation between Vitamin E and C levels, and cortisol levels actually suggest that cortisol production did not change with different concentrations of Vitamin E and C. In other words, blueberries do not fight increased levels of cortisol. (Montalvo, Diaz, Galdames, Andres & Larrain, 2011)

Cortisol affects various parts of our body, both psychologically and physically. Some ailments caused by increased cortisol levels include a suppressed immune system, insomnia, severe mood swings, depression and severe hypotension. Glucocorticoids inhibit inflammatory response; specifically, cortisol suppresses the synthesis and secretion of arachnidonic acid, a key precursor for a number of mediators of inflammation. However, heightened levels of glucocorticoid hormones can lead to suppression of the body's immune response due to stabilization of lysosomes, decrease in number of circulating T4 lymphocytes and a decrease in production of key mediators in immune response (Mitrovic). A decrease in immune response reduces the body's ability to recognize and defend itself from foreign entities such as bacteria and viruses (David C. Dugdale).

Cortisol also acts on the central nervous system by directly changing the electrical activity in the limbic system and the hippocampus; this modulation can decrease REM sleep and increase slow-wave sleep and time spent awake. Increased levels of cortisol can cause insomnia and also severe mood swings (Mitrovic).

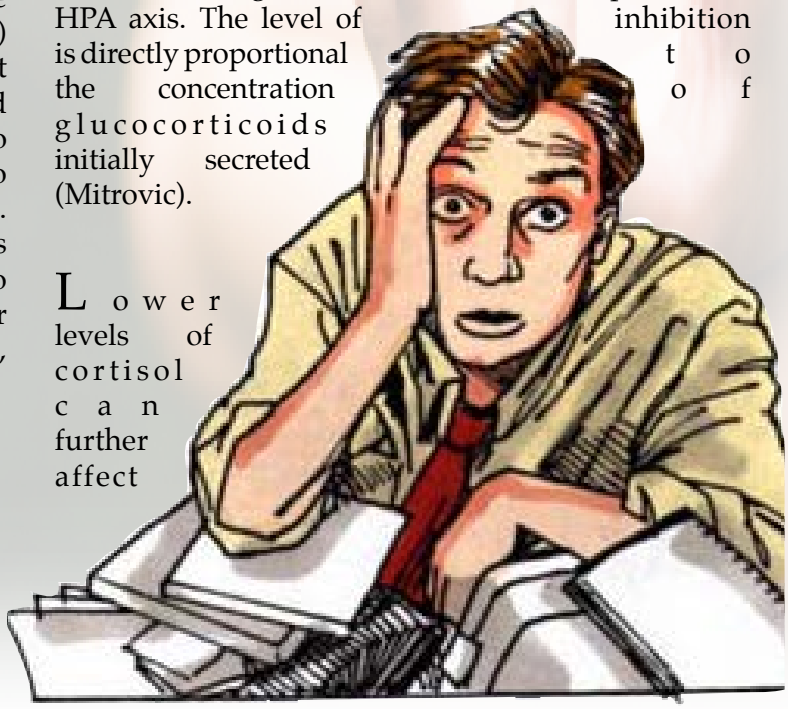
Though one may experience ailments caused by increased levels of cortisol, females are more prone to stress as a result of a specific variation in their genomes. 5-HTTLPR is a repeat polymorphic region that occurs in the promoter, a sequence upstream of the gene that's required for transcription, of the SLC6A4 gene, the gene that encodes serotonin transporter. There are two alleles (variants) that are normally reported; the short (s) allele and the long (l) allele. Evidence from a study of 67 girls reported that girls who were homozygous for the s-allele produced higher and prolonged levels of cortisol in response to the stressful stimuli in comparison to that of girls who were heterozygous, or homozygous for the l allele. Results suggest that females who are homozygous for the s allele may have an increased susceptibility to depression in response to stressful events during her life due to a specific variation in her genome (Gotlib, Joormann, Minor & Hallmayer, 2008).

There exists a scientifically proven way by which one can reduce cortisol levels – Yoga. Results from a study suggested that the levels of cortisol in people with Major Depressive Disorder dropped significantly after three months of practicing yoga, suggesting that yoga has antidepressant effects (Thirthalli, Naveen, Rao, Varambally, Christopher & Gangadhar, 2013).

"WHEN YOU CHANGE YOUR MIND ABOUT STRESS, YOU CAN CHANGE YOUR BODY'S RESPONSE TO STRESS"

There also exist environmental factors that can alter one's cortisol levels. Following the recent major financial crisis in Greece, a comparison in cortisol levels and a questionnaire with different health indicators was administered to 124 Greek youth and 112 Swedish youth, who were much less affected by the economic turmoil. The Greek youth reported significantly higher perceived stress, experience of serious life events, low hope for the future and, significant and widespread symptoms of anxiety and depression compared to their Swedish counterparts. However, it was found that the Greek youth had low cortisol levels (Faresjo, Theodorsson, Chatziarzeni, Sapouna, Claesson, Koppner & Faresjo, 2013). This suggests that a prolonged exposure to highly stressful situations lead to lowered free cortisol levels as a result of the negative feedback loop of the HPA axis. The level of inhibition is directly proportional to the concentration of glucocorticoids initially secreted (Mitrovic).

Lower levels of cortisol can further affect



the body in detrimental ways. For example, cortisol aids in maintaining the responsiveness of vascular smooth muscles to proteins, and therefore participates in blood pressure regulation. However, when exposed to low levels of cortisol, the smooth muscle becomes unresponsive to proteins. This decreased responsiveness can lead to severe low blood pressure, otherwise known as hypotension (Mitrovic).

While some of the popular tips on reducing stress may or may not be true, there exist scientifically proven ways to reduce stress. In addition to yoga, another effective way to reduce stress concerns itself with how you think about stress! On her TED talk titled "How to make stress your friend", Stanford University psychologist, Kelly McGonigal, says that "when you change your mind about stress, you can change your body's response to stress" (McGonigal, 2013). When one feels stressed, the person may interpret it as anxiety or signs that you're not handling the situation very well, however, it's healthier to view stress as something that energizes your body and is preparing you to meet the challenge. Because in a typical stress response, you might be breathing faster, your heart rate might go up – as a result, your blood vessels constrict. However, when you view stress as a positive phenomenon, your blood vessels stay relaxed, making for a healthier cardiovascular profile. The next time you feel stressed, think to yourself, "This is my body helping me rise to this challenge" (McGonigal, 2013).

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