

What brings stress in terms of human health?

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Abstract

Everyone experiences stress and each one deals with it differently. It affects almost every system of our body. Recent researches unfold its effects not only to adult humans but even to developing babies in the womb. Stress can lead to gastrointestinal disorders including obesity, mood changes, and irregular or troublesome menstrual periods leave besides cardiac and brain disorders. It also have influence on gut microbiota which in turn regulate many of our physiological events in the body and systems including immune responses.

Keywords: cancer; immune response; pregnancy; obesity; premature aging

Background

Stress is a natural human response that prompts us to address challenges and threats in our lives. Almost everyone experiences stress once in a while though, depending on situation degree of stress may vary. Every one deals with stress differently. To some one certain event might make feel stressed sometimes, but not every time and it is also true that the same event may not make stressed to others. The American Psychological Association classified stress in three types, viz. acute stress, episodic acute stress, and chronic stress — can all make us feel out of sorts or even ill, but chronic stress is often ignored. The human body's normal response changes according to change in situation. When a person is stressed, there are numerous hormonal changes that occur in the body, which helps the body to cope with the situation. This chemical reaction is known as the fight-and-flight response [1].

Physiology precedes psychology in terms of stress, when a person experiences stress, the body's physiology changes, there are three stages to stress: the alarm stage, the resistance stage and the exhaustion stage the body acts accordingly [2]. The alarm stage is when the central nervous system is awakened, causing the body's defenses to assemble. it releases 3 hormones namely, epinephrine (adrenaline), cortisol, and norepinephrine. These hormones are designed to help to deal with stressful situations by increasing our heart rate, blood pressure, and blood sugar levels. While adrenaline has reasonably predictable effects on most people, the interplay between cortisol and the body varies greatly depending on lifestyle, body chemistry, and genetic makeup of the person under stress. Stress symptoms can affect human body, thoughts and feelings, and in turn behaviour. Stress that's not dealt with can lead to many health problems, such as high blood pressure, heart disease, stroke, obesity and diabetes.

Body respond to stress

Stress causing factors are not something special; they are embedded in our daily routine, environmental and economic conditions. When the body is under stress, it leads to changes in hormones due to this there would be changes in the hormone targeted organs. More commonly, it can lead to stress-induced gastrointestinal (GI) symptoms, mood changes, and irregular or troublesome menstrual periods.

Severe stress can lead to sudden, temporary weakening and dysfunction of the heart which may lead to serious complications such as ischemia to the heart, High blood pressure, anxiety due to this palpitations, chest pressure, insomnia, dry mouth, panic attacks including sudden death.

Cancer

Stress appears to be linked to cancer risk it may not be direct, firstly because weakened immune system to getting viral infections, including SARS-CoV-2, and cancer. [3,4] secondly, people under chronic stress may develop certain unhealthy behaviors, such as smoking, overeating, becoming less active, or drinking alcohol, that are themselves associated with increased risks of some cancers. Therefore, studies conducted to date have had varying results.

One case-control study among Canadian men found an association between workplace stress and the risk of prostate cancer, whereas a similar study did not find such an association. [5, 6] A prospective study among more than 100,000 UK women reported no association between the risk of breast cancer and perceived stress levels or adverse life events in the preceding 5 years. [7]

A 15-year prospective study of Australian women at increased risk of familial breast cancer found no association between acute and chronic stressors, social support, optimism, or other emotional characteristics and the risk of breast cancer. [8]

In a 2008 meta-analysis of 142 prospective studies among people in Asia, Australasia, Europe, and America, stress was associated with a higher incidence of lung cancer. [9]

A 2019 meta-analysis of nine observational studies in Europe and North America also found an association between work stress and risk of lung, colorectal, and esophageal cancers. [10]

Though the understanding of the complex relationship between stress immune cells and cancer is still very nascent, chronic stress increases metastasis in at least in mouse model through a mechanism whereby stress hormones trigger neutrophils to form neutrophil extracellular traps that create a metastasis-friendly environment. “This new finding helps us better understand how stress can impact the spread of cancer and may provide new opportunities or treating and preventing metastasis.” “This discovery sparked our curiosity to understand whether and how chronic stress exposure can impact metastasis.”

The researchers point out that their study could have implications for the use of synthetic glucocorticoids, such as dexamethasone, which are widely used to overcome the side effects of chemotherapy and to treat symptoms of advanced cancer [11].

Stress during pregnancy

As far type of food is concerned it is true that “You are What your Mother Ate” [12], but how about stress? Most recently, some studies are suggesting that stress in the womb can affect a baby's temperament and neurobehavioral development while pregnant. Mothers who experienced high levels of stress their infants particularly in the first trimester, show signs of more depression and irritability [13]. If throughout pregnancy, cortisol levels are high peak during the third trimester, had unexpected birth complications [14].

Gut Microbes

Out of all types of flora and fauna present in the gut microbiota bacteria are the most studied microbes in relation to human stress, and mood, in addition to other factors such as diet, environment, etc. The basic studies have indicated that gut microbiota can regulate brain function through the gut-brain axis. There are various ways to convey psychological stress to the gut [15] however recently, a new bone marrow mediated pathway was also discovered [16] Stress and anxiety which are common in mental diseases and can affect health through gut bacteria since a variety of physical disorders, and dysbiosis of intestinal microbiota was related to anxiety highlighting the role that immune cells play as messengers that convey. The heightened inflammation that frequently accompanies stress and depression triggers blooms of pathogenic bacteria that encourage dysbiosis and a leaky gut [17]

Immune System

Stress affects potentially our immune system too [18]. But mechanism of action of stress on immune system is still not fully explored. Nevertheless, lately Poller et al. [19] They tried to provide mechanistic insights for this phenomenon. They found that acute stress uses distinct brain circuits to regulate leukocyte dynamics and contribute to differential disease susceptibility in response to either autoimmune challenge or viral infection. Stress can reduce the number of natural killer cells or lymphocytes in the body, which are needed to fight viruses, according to the American Psychological Association. Chronic stress-related increases in glucocorticoids may impair antibody response by decreasing the number of mature B lymphocytes available to become antibody producing cells [20-22].

Obesity

It has long been theorized that an association exists between long-term stress and obesity. Stress can also enhance weight gain and fat deposition through changes in feeding behaviour [23]. Prolonged stress can affect mental as well physical health. It leads to a little extra weight around the

middle, and extra abdominal fat. Chronic stress can lead to “comfort eating,” due to change in the pattern of food intake, dietary preference, and the rewarding properties of foods body's response to increased levels of cortisol, getting a handle on stress is a priority if you want to prevent stress-related weight gain. When insulin and cortisol levels are high very low-density lipoprotein (VLDL) is a fatty acid released from fat cells and on its way, there it damages other tissue within your body as it travels [24].

Premature aging

Stress brings cascade of biological responses in the body because of release of stress hormones such as cortisol and adrenaline; due to this inflammation and damage to DNA and cells take place. “Biological Aging” gets accelerated if stress is prolonged for period of time. Stress can lead to oxidative stress which is responsible for the production of reactive oxygen species (ROS). Oxidative stress can damage cells, proteins, and DNA, leading to premature aging. Stress induces secretion of glucocorticoids, which leads to the generation of ROS through increased mitochondrial activity. ROS preferentially damages telomeres and inhibits telomerase activity, and both contribute to short and dysfunctional telomeres. Rate of telomere shortening may indicate the pace of aging. Many factors affect longevity, and the Yale research indicates that chronic stress can shorten one's lifespan. Stress was already known to exacerbate physical health problems, such as increased risk for heart attack or diabetes [25,26].

Under stress biological age can increase faster. Research has also indicated that stress caused by sleep deprivation increases signs of aging, such as fine lines, reduced elasticity, and uneven pigmentation [25]. The loss of skin elasticity may also contribute to the formation of bags under the eyes which can be reversed when the tension eases, but according to a study published today in *Cell Metabolism*. Researchers used DNA methylation clocks to measure and note changes in biological age as it responds to stress in humans and mice [26]

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