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Stress and Health Sciences

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Editorial

A stimulus to a living body is called a stressor, and a nonspecific reaction of a living body caused by the stimulus is called a stress. Stress is always occurring because many routine factors such as temperature change, human relations, work and so on are stressors. In other words, it is no exaggeration to call living itself a stress. You should not think this in a bad way. It can be said that life is fun because there is stress. Working towards dreams and loving a person may be a stressor, but also the significance of living. Whatever the stressor, the responses occurring in vivo are common, which is mainly the excitement of both the sympathetic nervous function and the hypothalamus-pituitary-adrenal axis. Stress responses are essentially a state prepared for fighting and it was necessary to survive in the history of mankind. Because brains and muscles are important to fight, living organisms raise blood pressure and blood glucose to send nutrition and oxygen to them. On the other hand, the blood flow to the internal organs is reduced.

People cannot live without stress, but if stress continues or is too great, it may affect health. Blood pressure and blood glucose may remain high. Myocardial infarction may occur because coronary vessels around the heart contract while the heart is loaded. Gastric ulcer may be caused by reduced mucosal defense due to decreased blood flow. Although such relationships between stress and diseases are well known, stress has come to be thought to affect health more widely. In particular, proinflammatory cytokines are thought to play an important role. In the stress state, the secretion of cortisol increases, and as a result, the immune function is suppressed. However, this is merely a short-term event, and if the stress lasts long, for example, the glucocorticoid receptor of macrophage causes desensitization. It means that it will stop responding because there are too many opponents to join. As a result, there is a possibility that the immune reaction and the inflammatory response may increase with sustaining stress. In this way there is a possibility that stress is related to many diseases as a cause.

As an example, there is a hypothesis that immune function is elevated in depression. There is frequently an increase in cortisol secretion in depression. Desensitization to the glucocorticoid receptor of macrophages occurs, resulting in a vicious circle in which proinflammatory cytokines increase and proinflammatory cytokines further stimulate cortisol secretion. Increased proinflammatory cytokines enter the brain through weak regions of the blood brain barrier and proinflammatory cytokines are also produced more in the brain. Recently, much interest has been turned to the metabolic pathway from tryptophan to kynurenine in the brain [1]. Tryptophan has two metabolic pathways, one of which is intended to synthesize serotonin, and the other is to synthesize kynurenine and kynurenic acid. In the latter pathway, indoleamine 2,3-dioxygenase (IDO) is a key enzyme, which activates by proinflammatory cytokines. Excess proinflammatory cytokines may activate IDO in depression, resulting in reduced production of serotonin. Following the formation of kynurenine, there are two further metabolic pathways of tryptophan. By kynurenine hydroxylase, kynurenine is first metabolized to 3-hydroxykynurenine and further to quinolinic acid. Quinolinic acid and 3-hydroxykynurenine have the neurodegenerative effects. Conversely, kynurenine can be metabolized by kynurenine aminotransferase to produce kynurenic acid which has the neuroprotective effects. In patients with depression, neurodegeneration may be dominant and might be involved in atrophy of several brain regions. There is a hypothesis that systemic low grade inflammation may result in various diseases such as depression and cardiovascular disease in which proinflammatory cytokines play a core role [2].

To maintain or improve health, it is necessary to turn off the stress response. Proinflammatory cytokines are not the only factor that stress affects health. It is also important to study how to properly switch on and off. As a psychiatrist, I realize that it is difficult to turn off even if patients understand the significance. This is the nature of human beings. For those who have difficulty turning off the stress reaction on their own, it is may be beneficial to provide auxiliary means such as fragrance and walking in the forest [3,4].

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