Physiological Mechanism of Stress & Coping Strategy

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ABSTRACT
Presently stress is a common factor for every individual and even at a very young age children are facing stress and its related problems, which are really a matter of concern and it needs to be managed from their very initial days. Now, most people are in stressful situations and the reasons vary from individual to individual. If really, we wanted to cope and are also interested to learn the coping mechanism of stress, then it is really required to properly understand and analyze the physiology of stress. There are a number of research studies in the area of psychological stress and its complication and also in the area of its impact on the human body and mind. Still, it is a remarkable challenge to cope with stress and its complicacy, and due to this stress management become very popular and challenging. Apart from medication and other coping mechanisms, the help of simple healthy habits and lifestyles can reduce our stress to a greater extent. The stress responses and their effects are not uniform irrespective of the individual, its severity and casualty depend up on the individual's personal coping attitude and capacity.

KEYWORDS: Stress, Psychological mechanism, Coping mechanism, Health Issues

INTRODUCTION

Life would be simple indeed if our needs were automatically gratified. But, as we know, many obstacles, both personal and environmental, prevent this. Such obstacles place adjustive demands on us and can lead to the experience of stress. The term, stress has typically been used to refer both to the adjustive demands placed on an organism and to the organism's internal biological responses to such demands. Carson, Butcher, and Coleman (1988) referred to adjustive demands as stressors and to the effects they create within an organism as stress.

Definitions of Stress

Lazarus and Folkman (1984) defined stress as an internal state which can be caused by physical demands on the body or by environmental and social situations which are evaluated as potentially harmful, uncontrollable or exceeding our resources for coping.

Zimbardo (1979) defined stress as a nonspecific physiological and psychological response of an individual to any environmental demands or challenges to the integrity of the individual.

According to Back (1977), stress refers to any force which physically and/or psychologically strains the coping mechanisms of an organism.

In the opinion of Hans Selye (1976), a Canadian Physiologist, stress is the nonspecific response of the body to any demand made on it.

Maher (1966) said that stress refers to any of a wide range of factors-physical, physiological, or psychological that place demands upon the organism's capacity to react to a degree that is uncontrollable or threatening.

Types of Stress

All situations positive or negative that require adjustments are stressful. Thus, according to the Canadian Physiologist, Hans Selye (1976), stress is of two types – positive stress or eustress, and negative stress or distress. Both types of stress tax the individual's resources and adjustment, though distress typically has the potential to do more damage.

Stressors and their Types

In the opinion of Zimbardo (1979), anything potentially injurious to the organism, either physically or psychologically, that taxes the adaptive capacity of the organism, is called a stressor.

Holmes (1984) said that changes in one's life are important stressors. Similarly, in the words of Back (1977), a state of stress, composed of the threat, is called a stressor. In other words, any unpleasant, painful, dangerous, embarrassing, or otherwise aversive event that causes or induces stress in the organism is called a stressor. In short, the stressor is an agent of stress.

Stressors are broadly categorized into the following four types.

(i) Physical Stressors include such stressors as injury, infection, electric shock, fasting, body restraint, immobilization, hypertonic saline, water immersion, predator, inadequate living space, and the like.

(ii) Psychological stressors include such stressors as threats to self-esteem, failure in an intellectual task, interaction with a hostile person, frustrations, conflicts, poor health, poor financial conditions, life crisis, and so on.

(iii) Environmental stressors which include stressors like crowding, loud noise, extreme heat, high temperature, excessive cold, pollution of air, and so on.

(iv) Social Stressors include such stressors as social isolation, cultural deprivation, social disadvantages, poor socioeconomic status, disturbed family, low social status, lower social class and race, malnutrition, undesired social activities, breakdown of social networks, and so on.

Physiology of Stress

Emotional arousal is one of the most frequent causes of stress. The physiological reactions that accompany emotions and stress are regulated by the two parts of the Autonomic Nervous System (ANS) – sympathetic and parasympathetic systems. Activation of the sympathetic nervous system readies the body for vigorous activities, producing such reactions as increases in heart rate, blood pressure, and respiration. In contrast, activation of the parasympathetic nervous system influences activity related to the restoration of the body's resources.

Research findings indicate that different emotions, and thus stress, are associated with different physiological reactions and patterns of brain activity. Positive emotional reactions are associated with greater activation of the left cerebral hemisphere, while negative emotional reactions are associated with greater activation of the right cerebral hemisphere.

In addition, the physiological reactions to stressors involve such structures, named, the hypothalamus, pituitary gland, and adrenal glands.

Hypothalamus is the chief brain center for internal bodily reactions. It is situated just below the thalamus. Hypothalamus is intimately connected with the functioning of the Autonomic Nervous System (ANS). Both the parasympathetic and sympathetic activities of the ANS are controlled by the hypothalamus. Hypothalamus controls emotions, stress reactions, body metabolism, temperature regulation, blood chemistry, sexual activities, and various other needs.

The pituitary gland is located near the bottom of the brain. It is connected to and largely controlled by the hypothalamus. The pituitary gland is known as the body's master gland because its hormones help to regulate the activity of other glands in the endocrine system. Its most important function is regulating the body's reactions to stress and resistance to diseases. The pituitary gland secretes hormones that have other effects on the body, notably in controlling blood pressure, thirst, and body growth. One specific function of the pituitary gland is of particular importance to the newborn infant. When the newborn infant sucks the mother's breast nipples, a neural message is sent to the mother's hypothalamus, which sends a message to the pituitary gland. This message causes the pituitary gland to secrete a hormone, called prolactin, that releases breast milk for the baby.

TSH (thyroid–stimulating hormone), LH (luteinizing hormone), FSH (follicle–stimulating hormone), ACTH (adrenocorticotrophic hormone), and prolactin are secreted by the pituitary gland.

Adrenal glands are a pair of glands that sit atop the two kidneys. They play an important role in emotional arousal and stress, and they secrete a variety of hormones important to body metabolism and sexual arousal. When stimulated either by a hormone from the pituitary gland or by the sympathetic division of the autonomic nervous system, the adrenal glands secrete three important hormones such as epinephrine, norepinephrine, and cortisol. Both epinephrine and norepinephrine increase blood pressure by increasing heart rate and blood flow. Cortisol increases the body's immunity to diseases. These three hormones are stress hormones.

Because threatening situations generally call for vigorous activity, the autonomic and endocrine responses that accompany them are catabolic in nature; that is, they help mobilize the body's energy resources. The sympathetic branch of the ANS is active, and the adrenal glands secrete epinephrine, norepinephrine, and cortisol, which is a steroid stress hormone. Because the effects of sympathetic activity are similar to those of the adrenal hormones, here we give much importance to the hormonal responses.

Epinephrine affects glucose metabolism, causing muscle glycogen to become available to provide energy for strenuous exercise. Along with norepinephrine, this hormone also increases blood flow to the muscles by increasing the output of the heart. In doing so, they also increase blood pressure, which, over the long term, contributes to cardiovascular diseases. The other stress-related hormone secreted by the adrenal glands is cortisol, which is called a glucocorticoid because it has profound effects on glucose metabolism. In addition, glucocorticoids or cortisol help break down protein and convert it to glucose; help make fats available for energy, increase blood flow, and stimulate behavioral responsiveness, presumably by affecting the brain. Thus, the secretion of glucocorticoids does more than help an organism react to a stressful situation – it helps it survive.

When an individual is in a stressful situation, the stressors activate the nerve cells of the hypothalamus to secrete a hormone-like chemical substance called corticotrophin-releasing factor (CRF). This CRF flows from the hypothalamus to the pituitary gland through a specialized system of blood vessels. Being stimulated by the CRF, certain cells in the anterior pituitary gland increase the secretion of adrenocorticotropic hormone (ACTH) into the bloodstream. The rate of ACTH secretion is in part, controlled by the CRF. Then the ACTH stimulates the cells of the adrenal glands so that epinephrine, norepinephrine, and cortisol are secreted into the bloodstream. It is the inner tissue of the adrenal glands that are activated as part of the emergency response to give us an activating "shot of adrenalin". Cortisol and other similar hormones, like epinephrine and norepinephrine, have many actions which allow the body to deal adaptively with stressors for long periods of time.

Stress Effects on Health

We generally speak of two types of health – good health and bad health. Good health refers to the total "physical, mental, social, and spiritual well-being". Bad health, on the other hand, usually refers to the health that is suffering from varieties of illnesses or sicknesses.

Long-term stress definitely can be hazardous or harmful to one's health, and can even result in brain damage. A pioneer in the study of stress, Hans Selye (1976) suggested that most of the harmful effects of stress were produced by the prolonged secretion of glucocorticoids. Although the short-term effects of glucocorticoids are essential, the long-term effects are

damaging. These damaging effects include increased blood pressure, damage to muscle tissue, steroid diabetes, infertility, inhibition of growth, inhibition of the inflammatory responses, and suppression of the immune system. High blood pressure can lead to heart attacks or stroke. Inhibition of growth in children subjected to prolonged stress prevents them from attending their full height. Inhibition of the inflammatory responses makes it more difficult for the body to heal itself after an injury, and suppression of the immune system makes an individual vulnerable to infections and, perhaps, cancer. Thus, the most important cause of the harmful effects of stress is elevated levels of glucocorticoids, but the high blood pressure caused by epinephrine and norepinephrine also plays a contributing role.

Let us discuss how can stress impair the functions of the immune system.

The Immune System

Stress has been labeled as the "*silent killer*", because it can quietly chip away at our immune system, thereby weakening our body's ability to prevent or fight off illness and diseases.

The immune system is one of the most complex systems of the body. Its function is to protect us from infections caused by the attack of foreign viruses, microbes, fungi, bacteria, and other types of parasites.

The immune system derives from white blood cells that develop in the bone marrow and in the thymus gland (i.e., situated on the chest). The thymus gland secretes a hormone called thymosin which supports immune responses of the body. Some of the white blood cells roam through the blood or lymphatic system; others reside permanently in one place.

The immune reaction occurs when the body is invaded by foreign organisms, including bacteria, fungi, and viruses. Two types of reactions, such as, nonspecific and specific, occur. One nonspecific reaction called an inflammatory reaction, occurs early, in response to tissue damage produced by an invading organism. The damaged tissue secretes substances that increase the local blood circulation and make capillaries leak fluids, which causes the region to become inflamed. The secretions also attract phagocytic white blood cells that destroy both the invading cells and the debris produced by the breakdown of the body's own cells.

Another nonspecific reaction occurs when a virus infects a cell. The infection causes the cell to release a peptide called interferon, which suppresses the ability of viruses to reproduce. In addition, natural killer cells continuously prowl through tissue; when they encounter a cell that has been infected by a virus or that has become transformed into a cancer cell, they engulf and destroy it. Thus, natural killer cells constitute our first defense against the development of malignant tumors.

Two types of specific immune reactions occur which are known as chemically mediated and cell-mediated. The chemically mediated immune reaction involves antibodies. All bacteria have unique proteins on their surfaces, which are called as antigens. These proteins serve as the invader's calling cards, identifying them to the immune system. Through exposure to bacteria, the immune system learns to recognize these proteins. The result of this learning is the development of special lines of cells that produce specific antibodies. These antibodies are nothing but proteins that recognize antigens and help kill the invading microorganism. One type of antibody is released into the blood circulation by B-lymphocytes, which develop in the bone marrow. These antibodies are called immunoglobulins, which are nothing but chains of

proteins. The immunoglobulin binds with antigen on bacterium; kills it directly or attracts other white blood cells which then destroy them.

The other type of defense by the immune system is known as the cell-mediated immune reactions, which are produced by T-lymphocytes, which originally developed in the thymus gland. These cells also produce antibodies that remain attached to the outside of their membrane. T-lymphocytes primarily defend the body against fungi, viruses, and multicellular parasites. When antigens bind with their surface antibodies, the cells either directly kill the invaders or signal other white blood cells to come and kill them.

Thus, the white blood cells (i.e., the natural killer cells) are the primary defense of the body against infections.

Stress Effects on Aging /Old People

Several lines of research suggest that stress is related to aging in at least two ways. First, older organisms, even when they are perfectly healthy, do not tolerate stress as well as younger ones (Shock, 1977). Second, stress may accelerate the aging process (Selye, 1976). Sapolsky and his colleagues (1986), have investigated one rather serious long-term effect of stress, that is, brain damage. They reported that hippocampal formation (the hippocampus is a structure of the limbic system in the brain) plays a crucial role in learning and memory, and evidence suggests that one of the causes of memory loss that occurs with aging is the degeneration of this brain structure. Research with animals has shown that long-term exposure to cortisol or glucocorticoids destroys neurons located in a particular zone of the hippocampal formation. The hormone appears to destroy the neurons by making them more susceptible to potentially harmful events, such as decreased blood flow, which often occurs as a result of the aging process. The primary effect of the hormone is to lower the ability of the neurons in the hippocampus to utilize glucose so that when the blood flow decreases, their metabolism falls and they begin to die. Perhaps, then, the stress to which people are subjected throughout their lives increases the likelihood of memory problems later in life. Uno and his coworkers (1989) found that if stress is intense enough it can even cause brain damage in young primates as well as in humans.

Coping with Stress

Emotions and stresses are the spices of life; they are just like the salt in curry; without this life is not a life. There is no life without stress; and no stress without life. Some amount of stress is essential for life because the achievements of an individual are possible, in part, due to stress. Therefore, an optimal amount of stress in one's life is a blessing in disguise; though chronic stress is harmful.

Almost any change in the environment or life demands some coping. Though the susceptibility to stress effects varies greatly from person to person, there are some events that seem to be stressors for many of us. Chief among these is injuries or infections of the body, annoying or dangerous events in the environment, and major changes or transitions in life, which force us to cope in new ways.

The term, coping process (Lazarus, 1966) has been applied to the various mechanisms a person can use to escape, modify or learn to live with a threat. Many cognitive factors appear to be central to the coping process – particularly, evaluation of the stressful stimuli,

expectations of their effects, and the individual's more or less enduring predispositions/personalities.

Coping strategies: There are several methods of coping with stress. Chief among them is:

(i) Transcendental meditation (TM)
(ii) Relaxation training
(iii) Hypnosis
(iv) Biofeedback
(v) Systematic desensitization

Since the severity of stress effects varies from individual to individual, the coping strategies may also vary from person to person. Depending upon the stress effects, individuals may take any one or more coping strategies to adapt to their stressors. The impact of stressors can sometimes be reduced if a person has control over the stressors (Cohen, 1980).

Human beings are organisms of incredible adaptability. They adapt to what is available sometimes by altering the environment to make it more livable. The capacity to imagine an environment better suited to our needs and the ability to create it are hallmarks of the human species. It is the refined development of our cerebral cortex that enables us to think, plan, and solve problems through the manipulation of abstract symbols. Through cognition and the use of language, we can profit from our past mistakes to transform the present into a more desirable future. Adaptability is given a big boost by our ability to learn much from merely observing the effects of stressors.

It is the brain's Reticular Activating System (RAS) that has the job of "waking up the cortex". It makes the organism vigilant and aware of what is happening in the environment and to it. The RAS is a bundle of nerve fibers running from the Spinal Cord through the medulla into the cortical regions of the brain. These fibers receive inputs from all the senses, thus helping put the total organism in better contact with its environment. They then make the organism alert, aroused, and sensitive to changes in environmental stimuli. This generalized arousal, coupled with appropriate information about bodily needs and environmental demands, plays an important role in determining the ultimate expression of behavior. This complex physiological response marshals the body's full energy resources almost instantly. It does so without conscious preparation. Human beings adapt not only biologically, but also psychologically. The key to human adaptation goes beyond survival at any cost. Therefore, I wish you to think positively, to do positively, and hope for positivity.

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