Memory and Attention

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The brain is the foremost central part of our body which is involved in entire functions of the body with help of the spinal cord and sympathetic nervous system. It also controls the production of hormones and chemicals in the body. Memory and memory capacity is linked to stress and stressful conditions. It is observed that stress releases hormones such as glucocorticoids and cortisol that directly affects memory functions (de Quervain, Schwabe, & Roozendaal, 2017). Predominantly, it affects the hippocampus and hypothalamus, the major organs that work in the processing of learning and retrieving the memory. Various studies have shown that memory capacity is directly affected by stress and anxiety. The optimal functioning of the Brain and its related organs depends on the stress-free environment in the body. Cells, tissues, and organs work at optimum under normal circumstances. In conditions of stress and anxiety, body structures, functions, and hormonal level are disturbed. A predominant structure damaged due to stress is the hippocampus, amygdala, and hypothalamus of the brain, involved in learning and memory. Throughout this research paper, different levels of stress and anxiety and how it is linked and connected with memory capacity would be discussed.

The brain is a central part of our nervous system composed of billions of neurons. The brain receives signals from the sympathetic and parasympathetic nervous system (Gagnon & Wagner, 2016). Because of stress, damages, and injuries, long-term, short-term and memory capacity are depreciated. Brain along with spinal cord and neurons controls and regulates body functions. The peripheral nervous system and the sympathetic nervous system also helps in the regulation of body functions (Moran, 2016). The brain has different lobes occipital, temporal, parietal and frontal lobe. For storage of memory, the temporal lobe is a fundamental part of the brain.

The brain is split into different lobes: the frontal, parietal, occipital and temporal lobe. The temporal lobe is most notably associated with the storage of memories of significance & it is the part of the brain involved in chronic and acute stress which are prefrontal cortex, the amygdala, and the hippocampus. The primary brain's memory area is the hippocampus. It is a paired structure situated in the medial part of the temporal area of the brain. It functions in long-term and special memory. It is also involved in transforming short-term memory into long-term memory. Emotional memory is under the regulation of the amygdala (Fillauer et al., 2019). This comprises of fear acclimatizing and memory amalgamation. Finally, the major part prefrontal cortex functions on complex and goal-oriented functions.

Different parts of the brain are troubled by stress and anxiety differently. Long-term memory, short-term memory, and memory capacity are affected differently depending upon the nature of stress, the intensity of stress, the source of stress, time and duration of stress. The part of the brain limbic system functions in stress and anxiety. It is also called an emotional brain because it is so much under the influence of emotions and memory. In the condition of stress, the brain responds through the autonomic nervous system, which activates endocrine glands to control and regulate the metabolic system (de Quervain et al., 2017). Various chemicals are secreted in the body in the circumstances of stress. The steroid hormones such as Glucocorticoids are produced by adrenal glands.

When the body receives a threat, cortisol is released in the bloodstream. In case the body has to send signals from the body, cortisol interrupts the pathway and the ability of the neurotransmitters is reduced to communicate with the body. This, consequently, creates it problematic to recover information. This is evident that stress and anxiety directly affect memory capacity in terms of memory retrieval. Various other chemicals such as corticotrophin and epinephrine are released into the bloodstream in response to stress. Corticotrophin from the hypothalamus and epinephrine from adrenaline are released in stressful conditions. With the release of these hormones, heart rate and breathing rate of the body increases. Therefore, more oxygen is required for the muscles and brain which activates “fight and flight” mode. Memory, however, works better in case of the low or minimum amount of stress.

The Yerkes-Dodson law discloses the association between stress, anxiety, and memory. In the case of a prolonged stress, memory retrieval, long and short-term memory becomes weakened. It depends on stress level and duration that affects long and short term memory (Fillauer et al., 2019). Different physiological changes occur in the case of long and short term stress levels. The body reacts differently in circumstances of long and short term stressful conditions. In the case of short term stress, major functions of the body and brain work appropriately. However, in case of prolonged stressful conditions, the body's major functions are interrupted. Behaviors become enhanced and deteriorated because of stressful conditions, the body's hypothalamus, pituitary, and adrenal glands are activated in response to anxiety. In conditions of stress and anxiety, the body hormonal level is increased. In cases of stress, cortisol is overproduced which interrupts the whole function of the body. It includes the overproduction of cortisol, glucocorticoids, and adrenaline.

When the body has adrenaline rush situations, high blood pressure and abdominal fat are amplified. The bone density is decreased in the state of prolonged stress. All of these conditions are traumatic and worst for the body. The parasympathetic nervous system helps and assists the body to digest and rest whereas, in stressful conditions, these systems of the bodywork inappropriately. The overexposure to chronic stress and anxiety, the memory capacity does not function at optimum (Gagnon & Wagner, 2016). Cortisol and other related stress hormones affect memory retrieval. The mechanisms and working of the body is worsened in case of overproduction of cortisol. The body tries to work appropriately however, chronic and prolonged stress makes it difficult for the body to work in that condition.

With the help of neuroimaging research, the effects of stress hormones were analyzed on memory. The conclusions were in support of deteriorated memory due to prolonged stress and anxiety. With the incidence of stress and anxiety symbols such as pictures or related threatening tasks, the level of cortisol was higher throughout the body, which ultimately resulted in poor or impaired performance of memory. The major response is noted in the hippocampus and amygdala part of the brain. Further results from various other studies are impaired memory retrieval (Cowan, 2016). Various studies were performed on rats to observe the effects of stress on the body. Rats were inoculated with cortisol and conclusions of the study identified brain death in rats after several weeks. The major and predominant affected zones were the hippocampus. Hippocampus is significantly associated with functions in memory. Areas of the brain responsible for memory were severely damaged due to stress hormones. The density of stress hormones was observed to be high in stressful conditions (Gagnon & Wagner, 2016). All the linked systems such as blood circulation, kidneys, and digestive systems are affected.

Brain cell experiences death due to stress hormones and the level of stress is associated with it. For example, a high level of stress and anxiety and duration of stress is predominantly involved in memory functioning and deterioration. Intensity and duration of stress are directly responsible for the impaired functioning of memory and memory capacity. Prolonged and higher levels of stress and stressful conditions causes permanent loss of memory particularly the hippocampus that is responsible for the memory functions in the body (Gagnon & Wagner, 2016). It is also significant to note that chemicals and hormones responsible for stress have not been associated with negative feedback mechanisms.

The chemicals produced in stress are all not destructively connected. For example, norepinephrine is the primary neurotransmitter that plays its role in the neurotransmission processes is also produced in circumstances of stress (de Quervain et al., 2017). It is associated to produce new memories in the body. Limiting or managing stress is important to control the production of stress hormones is significant that causes deteriorating effects in the body and to evaluate such processes that can work in the production of opposite hormones. Those hormones that are helpful in the management of stress under stressful conditions to control stress deteriorating memory. However, the level of stress can be controlled by various methods or utilizing various helpful drugs. The memory capacity is strongly affected by pressure or anxiety under stressful conditions.

Clinical stress and acute anxiety produced by key life occasions have well-known damaging effects on mental courses, for example, working memory. Though, it is believed that anxiety and stress has a connection with everyday working memory and performance on memory capacity. The effects of anxiety contain interloping with an individual's capability and ability to encrypt memory and the capacity and aptitude to recover evidence or information (Fillauer et al., 2019). During anxiety, stress hormones are released in the bloodstream of the body. Stress is associated to cause long-term changes in the brain, particularly in memory capacity. Stress hormones cause impaired functioning of recalling memory specifically long-term memory. However, stress enhances short-term memory. The short-term memory is associated with the emotions of a body.

Stress affects the hypothalamus and amygdala of the brain. As one category of stress hormones are glucocorticoids which affect long-term memory functions of the brain. The significant ones are cortisol that is also called a biomarker of anxiety and stress (Moran, 2016). In a normal situation, the hippocampus produces cortisol through a process of negative feedback in the body. Hippocampus has various receptors that are sensitive to anxiety and stress hormones. Though, excessive production of cortisol causes the impaired functions of the hippocampus. Recalling memory and encrypting memory is affected in this case. Cortisol also affects the energy system of the hippocampus by diverting energy to surrounding tissues and energy to reach the hippocampus is hindered.

Anxiety and stress are linked with impairment of memory functions as well as cognitive functions of the body. Stress has various levels including intrinsic and extrinsic. Extrinsic level of stress is not stimulated by cognitive functions whereas intrinsic is stimulated by cognitive functions (Moran, 2016). The level of intrinsic stress can be chronic or acute.

The various stress hormones are frequently compared or called as inverted-u. Spatial learning is affected by stress and anxiety. Pavlovian conditioning is also affected by chronic stress levels. In stressful circumstances, as stress hormones are produced in the body, adrenal glands secrete adrenaline which initiates the response. Adrenaline is responsible for a response called fight and flight. Adrenaline works like a catalyst and the response activates the body to respond to the stressor. This response is triggered by the sympathetic nervous system. The response includes increased heart rate, high blood pressure and also increased breathing rate of the body (Fillauer et al., 2019). During this response, the kidney produces glucose to provide the body energy to combat stress. Blood circulation is directed towards the brain and major muscles at that time of stress despite body functions. Three main axes are responsible for the physiological response of stress including, thyroxin, vasopressin, and adrenocorticotropic axis.

Studies have shown that working memory resulted in decreased reaction time in individuals suffering from stress, however, prolonged stress resulted in false alarms and more mistakes as compared to normal circumstances. This shows that during stressful conditions, the body produces hormones that resulted in false alarming and more mistakes have been done by the body (Buszard, Farrow, Zhu, & Masters, 2016). The improvement of stress resulted in working memory is the short reaction time. Stress and anxiety are associated to produce adverse effects in the body particularly affecting working memory. It affects the central executive and the phonological loop. Studies have shown that stress also affects the visuospatial sketchpad. Phonological lops are responsible for the auditory functioning of short term memory. Visuospatial sketchpad is helpful for spatial and visual functioning of short term memory whereas the central executive regulates and controls all of these functions. All of these components are used in the processing of information. Once disrupted because of stress and anxiety, all of these functions would result in disruptions and hence impaired learning. It means stress and anxiety are linked with the disruption and malfunctioning of the learning processes of the brain.

All of the learning processes of working memory are controlled by neural activity. Therefore, stress and anxiety affect the neural activity of the body which ultimately affects working memory. The stressor, acute stress is an instant apparent threat, dissimilar to prolonged stress, is not continuing and the biological stimulation related to severe stress is not closely as severe. One opinion is that severe stress can damage memory, though others consider that severe stress can essentially improve memory (Moran, 2016). Numerous researches have revealed that anxiety and stress hormones improve memory development though they damage memory recovery. For the improvement of memory by severe stress, certain conditions needs to have happened. First of all, the stress context and the information context being encoded must be the same. Secondly, the areas targeted by stress hormones must be the same as that of regions of the brain involved in the recovery of memory. There are alterations in the body in the kind of evidence being recalled or being disremembered. In many circumstances, neutral spurs incline to be recalled, though expressively exciting spurs incline to be gone. However, opposite effects occurred in the adverse events.

The studies have shown that working memory is directly affected by stress hormones. The functions of the working memory are impaired during stressful conditions. The stress hormones are associated to impair functions of short-term memory, long-term memory and also working memory, predominant impaired functions due to stress and stress hormones are learning, memory retrieval. Memory capacity and working memory. It is also observed that certain impaired functions depend on what is going to be changed under what circumstances (Gagnon & Wagner, 2016). As evident stress is linked with specific circumstances to improve memory, however, it depends on specific conditions to be met to have favorable results. In case of noticeable information to be recalled, the apparent stress needs to be persuaded afore encrypting, and recovery must trail just subsequently. In disparity, for expressively emotional spurs to be gone, the stressful experience must be next to encrypting and recovery must trail afterward with a longer interruption.

Angst is a phase of sensitive caution that is related to an upsurge in general sensual sensitivity in arrears to doubt or fight. A characteristic aspect of stress is incomplete control above disturbing opinions and attentional prejudices, subsidizing to a superior emphasis on undesirable spurs. It has been revealed that stress disturbs cognitive working containing working memory. The association works equally, as cognitive damage can result in amplified anxiety and stress. It means stressful conditions causes the cognitive working to focus more on negative and undesirable thoughts as compared to usual thoughts (Gagnon & Wagner, 2016). Brain and sensations are more active and sensitive to negative thoughts. This results in loss of working memory particularly memory retrieval and recovery. In expressions of sensitive mechanisms and the fundamental neurocircuitry, a noteworthy overlay among pressure and anxiety is observed, however, anxiety includes both nervous and active reactions. In seizure, terror and angst can be evident in the deficiency of the neuroendocrine flow that is connected to an anxiety response. Stress triggers the axis of hypothalamus-pituitary-adrenal that secretes stress hormones, glucocorticoids, the adrenal hormones that affect the memory capacity.

Storage of information for a limited time is the ability of short-term memory of the body. The memory capacity of an average individual is 7+2. It means during an event, recalling series of items, a person can remember 5-9 items. The average capacity can be amplified using rehearsals. Various researches have shown that with the help of long-term memory or rehearsals, short-term memory can be stored too long term memory (Gagnon & Wagner, 2016). Similar to short term memory, working memory stores information for a short period. This temporary storage is because it has to be used to perform complex tasks, for example, reasoning. It is observed that stress and anxiety affect working memory predominantly as compared to long-term memory. Stress is linked to produce improvement as well as impairment of the functioning of working memory and memory capacity.

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