Innovat International Journal of Medical & Pharmaceutical Sciences, 2022; (3)

Innovat Publisher

www.innovatpublisher.com

ISSN - 2456-8694
Review Article

AN ANTHOLOGY OF ACUTE STRESS DISORDER

VANDANA SHYAM*, SHIVAM SHARMA, SHWETA AGGARWAL, PRIYANKA SEN, ANIL KUMAR

Department of pharmacy L.R Institute of Pharmacy Jabli Kyar, Oachghat Solan - 173223 (H.P), India. *Email:Vandana1998.shyam@gmail.com*

Received 2022.02.02-Accepted 2022.03.05

ABSTRACT

Acute stress disorder can start for as little as two days and last for weeks to months. It leads to the emergence of various psychiatric diseases, such as post-traumatic stress disorder, depression, anxiety, suicidal ideation, and so on, after one month. It is the first trauma reaction that occurs after being exposed to trauma and stressors. The "fight-or-flight" response is linked to the stress response. By providing better therapy at the early stages of stress, such as acute stress disorder, we can prevent or reduce the likelihood of depression..

Key words*:* Acute stress disorder, neuroactive compounds, stressor.

INTRODUCTION

Acute stress disorder is a CNS disorder that emerges as a result of witnessing, experiencing, fabricating, or being involved in threatening fatalities, injuries, or other stressful situations. A person's reaction to acute psychological trauma is one of fear and despair. It's a condition characterized by a variety of changes in thought, behavior, and emotions. Acute stress disorder can start for as little as two days and last for weeks to months. It leads to the emergence of various psychiatric diseases, such as post-traumatic stress disorder, depression, anxiety, suicidal ideation, and so on, after one month. It is a first-time trauma reaction that occurs after being exposed to trauma and stressors. Acute stress disorder (ASD) is adisorder that has a negative impact on both our mental and physical well-being[1][2].

Healthy brain vs stressed brain

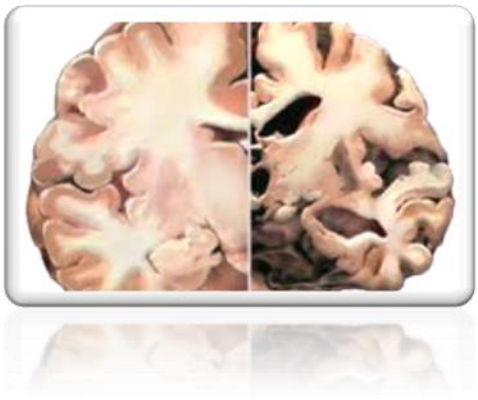
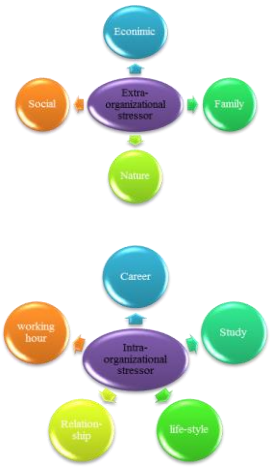


Fig: 1.2

It is the first trauma reaction that occurs after being exposed to trauma and stressors. Stressors are the events and reactions that produce stress. Emotional reactions are more common in the early stages after a trauma. The "fight-or-flight" response is linked to the stress response. The fight or flight response is an important survival response that demonstrates normal human behaviour and response following any trauma or stressor exposure. However, if done frequently over a short period of time, it can be very detrimental, and long-term exposure to stressful situations can lead to anxiety and despair [4].As a result, by providing better therapy at the early stages of stress, such as acute stress disorder, we can prevent or reduce the likelihood of depression[3].

Causes for stress :[15]16][18]



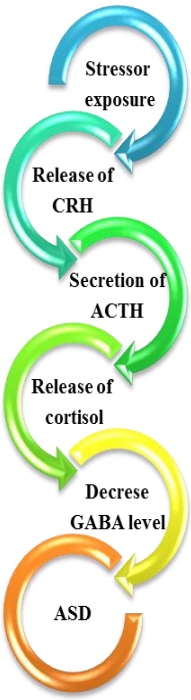
Symptoms of ASD

- Hypervigilance,Palpitation,
- Sleep disturbance,Lack of concentration,
- Chest and stomach pain [17]
- Irritable mood,
- Nausea sweating,
- Restlessness,Flashback [18]
- Depression,
- Reduced awareness of surrounding,Derealization,
- Episodes of aggressions,
- Increased arusal,Recurrent images and thoughts.
- Nightmare [19]

Development of ASD

Stress-related steroid hormones can be processed to produce neuroactive derivatives. The function of the GABA A receptor can be altered by these

neuroactive compounds. Changes in GABA A receptor subunit expression alter the steroid hormone level like stress as well as different exogenous steroid hormone administrationThe activity of stress-derived steroidal hormone on GABA A receptors, on the other hand, may modulate stress hormone synthesis. Corticotropin releasing hormone (CRH) regulates stress response activity, which is regulated through the hypothalamic-pituitary-adrenal axis. It causes the secretion of ACTH from pituitary gland. Which initiate the release of stresshormone (cortisol) from adrenal gland [20].



CNS Pathways of Splenic Autonomic Output after Stress

The cerebral cortex, limbic system, basal ganglia, hypothalamus, thalamus, and medulla are all involved in central control of the autonomic nervous system, which involves very complicated reciprocal connections. Focusing on the splenic innervation pathway, retrograde pseudorabies virus labelling and c-Fos immunohistochemistry can provide a more complete description of the central sympathetic circuits involved for splenic innervation. Because it is retrogradely carried from nerve terminals to cell bodies, the Pseudorabies virus can be utilised to monitor brain circuits. This virus has an advantage over other retrograde tracers in that it may cross synapses, allowing multi-synaptic circuits to be traced. The immediate early gene cfos is activated, resulting in the production of C-Fos .

Enhanced expression of the c-Fos protein indicates increased brain activation or metabolism.There are numerous particular brain regions that are active under stress (c-Fos+) and that innervate the spleen (pseudorabies virus+) using these techniques.After splenic peripheral injection, some brain areas are typically among the first to contain virus . The A5 cell group, ventromedial medulla, rostral ventrolateral medulla, and caudal raphe magnus are among the medial parvicellular subdivisions of the paraventricular hypothalamic nucleus (medial parvicellular subdivisions of the paraventricular hypothalamic nucleus autonomic subnuclei). Additionally, pseudorabies virus was found to be rapidly contained following splenic injection in Barrington's nucleus and the locus ceruleus, locations not typically assumed to be directly engaged in peripheral sympathetic nervous system modulation.

The "central sympathetic circuit" is made up of brain nuclei with intimate synaptic connections to peripheral sympathetically innervated targets. Importantly, manipulation of nuclei within this circuit has been shown to impact splenic nerve activity and immune function, implying that the central sympathetic circuit plays a functional and regulatory role in splenic sympathetic and immunological modulation. The paraventricular nucleus's dorsal parvicellular cap, ventral pontine reticular nucleus, alpha region of the gigantocellular reticular nucleus, perifacial zone, raphe pallidus, and lateral paragigantocellular nucleus are among these locations. [51]

Risk-factors

Many psychobiological illnesses stem from acute stress disorder. A growing body of research suggests that stressful situations, as well as how an organism assesses them, can evoke quantitatively different physiological and emotional reactions. Threat and negative social evaluation, like uncontrollability assessments, have been found to elicit distinct psychological and bodily responses. Acute stress disorder affects the entire body system and is characterised by a distinct set of symptoms. It is a risk factor for the development of a variety of disorders, including:

Post-traumatic stress disorder

Cause :-

Trauma exposure

Symptoms :-

Depressed mood, hyper alertness or exaggerated startle response, Guilt, memory impairment, lack of concentrating, avoidance of activities that arouse recollection of the traumatic event, intensification of symptoms by exposure to events that symbolize or resemble the traumatic event, palpitation, Initial, middle, or terminal sleep disturbance; [26]

Treatment :-

Cognitive behaviour therapy, SSRIs, tricyclic antidepressants, monoamine oxidase inhibitors, Buspirone, mood stabilizers, antipsychotic agents or neuroleptics (“major tranquilizers”), adrenergic agents, opiate antagonists.[27]

Anxiety

Causes :-

Stress

Symptoms :-

excessive worry, intrusive thoughts, sweating , increase heart rate, hyperventilation.[28]

Treatment :-

Counselling, anti-anxiety, anti-depressants, SSRIs, sedatives.[29]

Depression

Cause :-

Stress, genetics, medication.[28]

Symptoms :-

Restlessness, loss of intrust

Treatment :-

Anti-depressants, anxiolytics, SSRIs.[30]

Personality disorder

Causes :-

Childhood stress, genetic.

Symptoms :-

Wide mood swings, difficulty in controlling emotions.[32]
Treatment :-
DBT, Schema-focussed therapy, psychiatric treatment.[31]

Panic attacks

Causes :-
Trauma and stress, family history
Symptoms :-

Palpitation, hot flashes, uncomfortable physical symptoms.
Treatment :-
Anti-anxiety drugs, deep breathing and yoga.[33][34][35]

CVD

Causes :-
Long term stress
Symptoms :-
Chest pain, palpitation, heart attack, high blood pressure [44]
Treatment :-
medication, surgery, pacemaker.[45]

Role of GABA in acute stress disorder

GABA (Gamma aminobutyric acid) is a non-protein amino acid that is widely distributed in the body. It can be found in fungi, mammals, plants, and microbes, among other things. It works as an inhibitory neurotransmitter in the central nervous system of animals, acting through the GABA receptor. Recent research suggests that plants may have GABA A-like receptors that share some characteristics with animal receptors, based on genetic and physiological evidence.

The presence of a suitable concentration of GABA in our bodies aids us in escaping various stresses such as environmental, intellectual, and career-related stress. Pants, like animals, have evolved chemical responses to relieve stress. Other environmental stressors like mild, hot, cold, wind, rain etc increases cellular level calcium ions which stimulates the GABA synthesis and calmodulin-dependent glutamate decarboxylase activity.Exposure of stressor and trauma induce stress responses through the sympathetic-adrenal-medullary (SAM) axis and hypothalamic-pituitary-adrenal (HPA) axis.

The stress-derived steroidal hormones synchronize the function and expression of GABA A receptors (GABA Rs)[21][22][23][24][25].

- Neurotransmission
- Action cascading
- Neurodegenerative diseases
- Circadian rhythm
- Pain perception
- Insomnia
- Epilepsy
- Reproduction

Effect of ASD on brain

Hippocampus

Alteration in neurochemicals, disbalance the level of neurotransmitters, increases neural activity and synaptic plasticity. It may cause Long term damage of hippocampus which cause memory loss.[36]

Amygdala

Stress induce GABAergic inhibition and cause many Neuro-psychiatric diseases.[37]

Medial prefrontal cortex

Loss of spine and dendrites and cause blunted emotional response.[38]

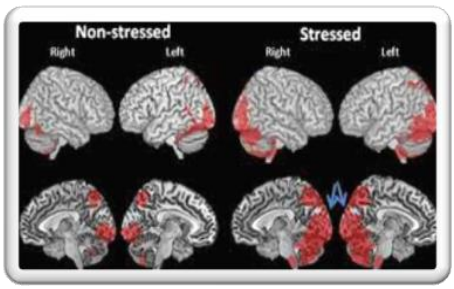


Fig: 1.2

Impact of ASD on physiological functions

Impact on the autonomic nervous system :-

The fight-or-flight response was discovered in 1930s by Walter Cannon's. After this, many researchers investigate the effects of stressful life experience on the sympathetic adrenomedullary system Cannon discovered that exposure to emergency situations results in the release of the hormone epinephrine from the adrenal medulla. Two major components of autonomic nervous system are:

- Parasympathetic nervous system that controls involuntary resting functions.
- Sympathetic nervous function that comes into play in threatening situations and increases involuntary process.

The spleen appears to be the last location of stress-induced immunomodulation, according to evidence.Various researches shows that exposure of different stressors and traumatic events may activates this system, and increase the release of epinephrine and non-epinephrine, it results in the "adrenaline rush". Release of epinephrine is initiated by the discharge of neurotransmitter norepinephrine at various organ sited from sympathetic nervous system.

A hallmark of the acute stress response is SNS stimulation. The activation of the SNS has a number of physiological effects that work together to increase the "fight/flight" response. Th1 cells, B cells, or monocytes/macrophages/dendritic cells, receive intense SNS innervation and express adrenergic receptors (2ADR) in most main and secondary lymphoid tissues (including the spleen). There is evidence that the SNS contributes to the stress-induced inhibition of the KLH Ig response if we focus on the involvement of the SNS in stress-induced immunomodulation (14). The sympathetic nervous system, for example, is stimulated in the central nervous system, suppressing the antibody response to KLH. [51].

Impact on the hypothalamic pituitary-adrenal axis :-

Exposure to a variety of psychological stressor for relatively short durations, can increase the level of hormone cortisol in the blood, saliva, and urine. Cortical is increased due to activation of the hypothalamic-pituitary-adrenal (HPA) axis. There are different neural pathways that links stressful stimulus to an integrated response in the hypothalamus, this stimulus results in the secretion of corticotropin-releasing hormone, this hormone stimulates the pituitary gland which release adrenocorticotropic hormone, it travels through the blood stream and causes the adrenal cortex (the outer layer of the adrenal gland) to release cortisol (in rodents this hormone is called corticosterone).

This entire system takes a very short time for activation i.e. 20 to 40 minutes from the onset of acute stressors. The HPA axis and inflammatory response patterns to acute stress are linked, as is basal HPA axis activity. Better habituation and stronger responsiveness to acute stressors are connected to patterns of basal cortisol activity that have been linked to beneficial health outcomes. This is a crucial step toward comprehending the long-term health consequences of acute stress reactivity. Longitudinal designs should be used in future studies to better establish the direction of these connections. To explore the specifics of the dynamic system, mechanistic research of the HPA axis should be done, taking into account the interplay of different levels of this system. [41]

Impact on the immune system

Stressful life experiences like job loss, exam etc can diminish the numerous immune. These experiences reduce the levels of classes of immunological cells called lymphocytes and cause the inhibition of various functions of lymphocytes. Some major functions of lymphocytes are produce immune response such as wound healing. Stress exposure can also initiate immune processes as well as it increases the circulating levels of cytokines that promote inflammation. However, inflammation is a response to exposure to a pathogen that produce systemic and local changes.

This physiological system is interlinked with each other and one system is affected by another. For example the lymphatic cell products act on brain causing alteration in mood and potentially contributing to depression and anxiety. Similarly, the hormonal secretions also affect our brain mostly the

secretion of neurotransmitters. These neurotransmitters are responsible for signal transmission throughout our body. So, any disbalance in the level of neurotransmitters may cause different psychological disorders. Now a days acute stress disorder becomes very common. [42][43]

Anti- inflammatory cytokines are responsible to maintain homoeostasis and cytokines such as IL-2, IL-4 or IL-10 counter the effects of pro-inflammatory cytokines. The release of pro-inflammatory cytokines such as IL-6, macrophage inhibitory factor (MIF), interleukin-1 (IL-1), and tumour necrosis factor (TNF) is part of the systemic inflammatory response to trauma (TNF). Some signal transcription factors of pro- and anti-inflammatory signals plays a major role in the expression and synthesis of cytokines. Pro-inflammatory signal transcription factors affected by protein-beta (c/EBP-beta) binding, protein binding can be enhanced by signal transducer and activator or transcription (STAT-3 and -5) and CCCAT enhancer.

Anti-inflammatory effect was exerted by the suppression of signal transcription factors which cause the suppression of cytokine singling (SOCS-1, SOCS-2, SOCS-3). Expression and secretion of T-cell (RANTES) belongs to the group of signal transcription factors that shows anti-inflammatory effect by:- Supressing pro-inflammatory cytokine expression e.g. SOCS-3 and Regulating T-cell function e.g. RANTES[53].

Substantive Domain Response to Chronic and Acute Stress

It was found that women are more vulnerable to acute stress than men. The typical severe chronic stress is more strongly related to depression than the typical severe acute stress, but this does not employ that the chronic stress is more important than acute stress. The emotional consequences of acute stress such as rape, are undoubtedly more severe than the effect of many chronic stress**es.** Chronic stress is a better predictor than acute stress for both men and women [54].

Effect of stress on different body system

Cardio vascular system

Stress may cause long-term problems for heart and blood vessels e.g. Increase in heart rate and blood pressure.

Digestive system

Stress involves in increasing risk of developing type 2 diabetes, upset digestive system, it cause heartburn or acid reflux and stomach pain. [46]

Respiratory system

In stress, rate of breathing becomes faster in an effort to quickly distribute oxygen-rich blood to your body.[47]

Central nervous system

Stress can shrink the prefrontal cortex, and increase the size of the amygdala, which makes the brain more receptive to stress.[48]

ANS

Stress increases the levels of pro-inflammatory cytokines.[49]

Reproductive system

Stress reduce male and female fertility and also affect the process of reproduction. [50]

Nervous system

Exposure of any trauma release flood of cortisol and adrenaline which cause muscle tighten, rise in heart rate and blood pressure. [49]

Endocrine system

Stress cause the in the serum level of many hormones like glucocorticoids, catecholamines, growth hormone and prolactin etc which alter different physiological function of body.[52]

Acute stress and plants

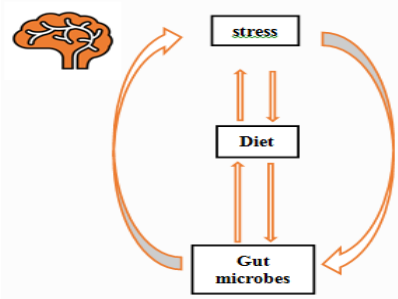
Heavy metals, drought, salt, low temperature, and other abiotic stressors are all key factors that affect crop productivity and yield. These stressors are linked to the development of harmful chemical entities known as reactive oxygen species (ROS), such as hydrogen peroxide (H2O2), superoxide radical (O2), and hydroxyl radical (OH), among others. ROS can cause cellular damage by degrading proteins, inactivating enzymes, altering gene expression, and interfering with a variety of metabolic pathways. With breakthroughs in plant molecular biology, where the basic understanding of ROS chemical activity is better understood, our understanding of ROS in response to abiotic stress has been revolutionised.

Identifying the factors involved in ROS formation, as well as their potential involvement during abiotic stress, is critical for identifying ways to control plant growth and metabolism under acute stress circumstances. The key to understanding stress-related toxicity is ROS-mediated oxidative stress, which has been extensively researched in various plants, with the results clearly revealing that oxidative stress is the primary symptom of toxicity. To deal with both enzymic and non-enzymic ROS, plants have their own antioxidant defence systems. These antioxidants' coordinated activities regulate ROS detoxification and minimise oxidative stress in plants.

Though ROS are often thought to have a negative influence on plants, some research suggest that they are helpful in regulating key cellular functions; nonetheless, there are few such reports in plants. New paths for understanding ROS metabolism and signalling have opened up thanks to molecular techniques to understanding its crucial role in abiotic stress. ROS also serves as a secondary messenger, indicating important biological functions such as cell growth, apoptosis, and necrosis.[57]

Acute stress and microorganisms

Stress and depression can revolutionise the gut bacteria's constituents through brain chemicals, inflammation, and autonomic alterations. In turn, the gut microbial discharge metabolites, toxins, and neurohormones that can affect eating behaviour and mood.Stress reactivity and mood are influenced by gut microorganisms. Finally, stresses, mood, and food, in combination with gut bacteria, can affect immune function and health [59].



Microorganisms are significantly more sensitive to heavy metal stress than soil, animals or plants growing on the same soils. In effect, laboratory investigations assess reactions to quick, acute toxicity (disturbance), whereas field experiment monitoring measures responses to long-term chronic toxicity (stress), which builds up over time.[58]

Guidelines for management of ASD

American Psychiatric Association:-

Practice guideline for the treatment of patients with ASD and PTSD.[10]

Australian Center for Post-traumatic Mental Health:-

Australian guidelines for the treatment of adults with ASD and PTSD[11]

National Child Traumatic Stress Network and National Center for PTSD:-

Psychological first aid field operations guide[12]

U.S. Department of Veterans Affair and U.S. Department of Defence:-

Clinical practice guidelines for management of posttraumatic stress. [13][14]

Diagnosis of ASD

Acute stress disorder is defined in DSM-4 as on the one hand depicting an array of relatively common pathological initial response after the exposure

of stressor and trauma. According to DSM-5, after the traumatic event acute stress disorder last from 3 days to 1 month. DSM (diagnostic and statistical manual of mental disorder), classify the mental disorders according to standard criteria.

It is the official manual published by American Psychiatric Association. The diagnosis of acute stress disorder was introduced to describes the initial reactions after the trauma exposure which is known as acute stress reaction (ASR)[5][6][7][8][9].

Treatment

Eye movement desensitization [11].

Cognitive behaviour therapy.

GABA A receptor agonist e.g. diazepam.

GABAA receptor 1-selective agonist e.g. zolpidem[55].

selective serotonin reuptake inhibitors (SSRIs).Antidepressants [56].

CONCLUSION

Witnessing, experiencing, fabricating, being involved in threatened fatalities, harm, and so on can cause acute stress disorder. On the one hand, it is depicting a range of rather common pathological first responses after exposure to stressors and trauma. The systemic inflammatory response to stress causes changes in the structure and function of various important organs such as the muscle, heart, liver, and immune system, resulting in catabolism, hypermetabolism, and protein breakdown. The existence of a sufficient amount of GABA in our bodies aids us in escaping various stresses.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interest.

REFRENCES

1. Bryant RA, Harvey A. Acute stress disorder. Washington; 2000.
2. Harvey AG, Bryant RA. Acute stress disorder: a synthesis and critique. Psychol Bull. 2002 Nov;128(6):886-902. doi: 10.1037/0033-2909.128.6.886, PMID 12405136.
3. Cardeña E, Carlson E. Acute stress disorder revisited. Annu Rev Clin Psychol. 2011 Apr 27;7:245-67. doi: 10.1146/annurev-clinpsy-032210-104502, PMID 21275643.
4. Bryant RA. Acute stress disorder as a predictor of posttraumatic stress disorder: a systematic review. J Clin Psychiatry. 2010 Dec 14;71(2):381.
5. Ning J, Li X, Hicks LM, Xiong L. A Raf-like MAPKKK gene DSM1 mediates drought resistance through reactive oxygen species scavenging in rice. Plant Physiol. 2010 Feb;152(2):876-90. doi: 10.1104/pp.109.149856, PMID 20007444.
6. Du H, Wang N, Cui F, Li X, Xiao J, Xiong L. Characterization of the β-carotene hydroxylase gene DSM2 conferring drought and oxidative stress resistance by increasing xanthophylls and abscisic acid synthesis in rice. Plant Physiol. 2010 Nov;154(3):1304-18. doi: 10.1104/pp.110.163741, PMID 20852032.
7. Frances A. Diagnosing the DSM. New York Times; 2012 May 11. 11.
8. Regier DA, Narrow WE, Kuhl EA, Kupfer DJ. The conceptual development of DSM-V. Am J Psychiatry. 2009 Jun;166(6):645-50. doi: 10.1176/appi.ajp.2009.09020279, PMID 19487400.
9. Petry NM, O'Brien CP. Internet gaming disorder and the DSM-5. Addiction. 2013;108(7):1186-7. doi: 10.1111/add.12162.
10. American Psychiatric Association. American psychiatric association.
11. Forbes D, Creamer M, Phelps A, Bryant R, McFarlane A, Devilly GJ et al. Australian guidelines for the treatment of adults with acute stress disorder and post-traumatic stress disorder. Aust N Z J Psychiatry. 2007 Aug;41(8):637-48. doi: 10.1080/00048670701449161, PMID 17620160.
12. Brymer M, Jacobs A, Layne C, Pynoos R, Ruzek J, Steinberg A, Watson P. National Child Traumatic Stress Network and National Center for PTSD. Psychological first aid: field operations guide. 2006.
13. Brymer M, Jacobs A, Layne C. National Child Traumatic Stress Network and National Center for PTSD Psychological First Aid: Field Operations Guide [online]; 2006 Jul.
14. Seal KH, Bertenthal D, Miner CR, Sen S, Marmar C. Bringing the war back home: mental health disorders among 103 788 US veterans returning from Iraq and Afghanistan seen at Department of Veterans Affairs Facilities. Arch Intern Med. 2007 Mar 12;167(5):476-82. doi: 10.1001/archinte.167.5.476, PMID 17353495.
15. Schwartz AJ, Black ER, Goldstein MG, Jozefowicz RF, Emmings FG. Levels and causes of stress among residents. J Med Educ. 1987 Sep;62(9):744-53. doi: 10.1097/00001888-198709000-00006, PMID 3625739.
16. Bhargava D, Trivedi H. A study of causes of stress and stress management among youth. IRA-International. J Manag Soc Sci. 2018 Jun;11(03):108-17.
17. Harvey AG, Bryant RA. Dissociative symptoms in acute stress disorder. J Trauma Stress. 1999 Oct;12(4):673-80. doi: 10.1023/A:1024773202939, PMID 10646185.
18. Harvey AG, Bryant RA. Acute stress disorder: A synthesis and critique. Psychol Bull. 2002;128(6):886-902. doi: 10.1037/0033-2909.128.6.886, PMID 12405136.
19. Jubinville J, Newburn-Cook C, Hegadoren K, Lacaze-Masmonteil T. Symptoms of acute stress disorder in mothers of premature infants. Adv Neonatal Care. 2012 Aug 1;12(4):246-53. doi: 10.1097/ANC.0b013e31826090ac, PMID 22864005.
20. Tan H, Zhong P, Yan Z. Corticotropin-releasing factor and acute stress prolongs serotonergic regulation of GABA transmission in prefrontal cortical pyramidal neurons. J Neurosci. 2004 May 26;24(21):5000-8. doi: 10.1523/JNEUROSCI.0143-04.2004, PMID 15163692.
21. Hasler G, van der Veen JW, Grillon C, Drevets WC, Shen J. Effect of acute psychological stress on prefrontal GABA concentration determined by proton magnetic resonance spectroscopy. Am J Psychiatry. 2010 Oct;167(10):1226-31. doi: 10.1176/appi.ajp.2010.09070994, PMID 20634372.
22. Houtepen LC, Schür RR, Wijnen JP, Boer VO, Boks MP, Kahn RS et al. Acute stress effects on GABA and glutamate levels in the prefrontal cortex: A 7T 1H magnetic resonance spectroscopy study. NeuroImage Clin. 2017 Jan 1;14:195-200. doi: 10.1016/j.nicl.2017.01.001, PMID 28180078.
23. Kalueff AV, Nutt DJ. Role of GABA in anxiety and depression. Depress Anxiety. 2007;24(7):495-517. doi: 10.1002/da.20262, PMID 17117412.
24. Casida JE. Insecticide action at the GABA-gated chloride channel: recognition, progress, and prospects. Arch Insect Biochem Physiol. 1993;22(1-2):13-23. doi: 10.1002/arch.940220104, PMID 7679302.
25. Gale K. GABA and epilepsy: basic concepts from preclinical research. Epilepsia. 1992 Jan 1;33:S3-12.
26. Horowitz MJ, Wilner N, Kaltreider N, Alvarez W. Signs and symptoms of posttraumatic stress disorder. Arch Gen Psychiatry. 1980 Jan 1;37(1):85-92. doi: 10.1001/archpsyc.1980.01780140087010, PMID 7352843.
27. Albucher RC, Liberzon I. Psychopharmacological treatment in PTSD: a critical review. J Psychiatr Res. 2002 Nov 1;36(6):355-67. doi: 10.1016/s0022-3956(02)00058-4, PMID 12393304.
28. D'Aquila PS, Brain P, Willner P. Effects of chronic mild stress on performance in behavioural tests relevant to anxiety and depression. Physiol Behav. 1994 Nov 1;56(5):861-7. doi: 10.1016/0031-9384(94)90316-6, PMID 7824585.
29. Barlow DH. Anxiety and its disorders: the nature and treatment of anxiety and panic. Guilford press; 2004 Jan 28.
30. Goldman LS, Nielsen NH, Champion HC, Council on Scientific Affairs, American Medical Association. Awareness, diagnosis, and treatment of depression. J Gen Intern Med. 1999 Sep;14(9):569-80. doi: 10.1046/j.1525-1497.1999.03478.x, PMID 10491249.

31. Bateman AW, Gunderson J, Mulder R. Treatment of personality disorder. Lancet. 2015 Feb 21;385(9969):735-43. doi: 10.1016/S0140-6736(14)61394-5, PMID 25706219.
32. Bateman AW, Fonagy P. Effectiveness of psychotherapeutic treatment of personality disorder. Br J Psychiatry. 2000 Aug;177(2):138-43. doi: 10.1192/bjp.177.2.138, PMID 11026953.
33. Rapee R. The psychological treatment of panic attacks: theoretical conceptualization and review of evidence. Clin Psychol Rev. 1987 Jan 1;7(4):427-38. doi: 10.1016/0272-7358(87)90020-1.
34. Salkovskis PM, Clark DM, Hackmann A. Treatment of panic attacks using cognitive therapy without exposure or breathing retraining. Behav Res Ther. 1991 Jan 1;29(2):161-6. doi: 10.1016/0005-7967(91)90044-4, PMID 2021378.
35. Barlow DH, Craske MG, Cerny JA, Klosko JS. Behavioral treatment of panic disorder. Behav Ther. 1989 Mar 1;20(2):261-82. doi: 10.1016/S0005-7894(89)80073-5.
36. Joëls M. Stress, the hippocampus, and epilepsy. Epilepsia. 2009 Apr;50(4):586-97. doi: 10.1111/j.1528-1167.2008.01902.x, PMID 19054412.
37. Roozendaal B, McEwen BS, Chattarji S. Stress, memory and the amygdala. Nat Rev Neurosci. 2009 Jun;10(6):423-33. doi: 10.1038/nrn2651, PMID 19469026.
38. Belleau EL, Treadway MT, Pizzagalli DA. The impact of stress and major depressive disorder on hippocampal and medial prefrontal cortex morphology. Biol Psychiatry. 2019 Mar 15;85(6):443-53. doi: 10.1016/j.biopsych.2018.09.031, PMID 30470559.
39. Alen NV, Deer LK, Karimi M, Feyzieva E, Hastings PD, Hostinar CE. Children's altruism following acute stress: the role of autonomic nervous system activity and social support. Dev Sci. 2021 Sep;24(5):e13099. doi: 10.1111/desc.13099, PMID 33550679.
40. Roos LE, Knight EL, Beauchamp KG, Berkman ET, Faraday K, Hyslop K et al. Acute stress impairs inhibitory control based on individual differences in parasympathetic nervous system activity. Biol Psychol. 2017 Apr 1;125:58-63. doi: 10.1016/j.biopsycho.2017.03.004, PMID 28268165.
41. Chen X, Gianferante D, Hanlin L, Fiksdal A, Breines JG, Thoma MV et al. HPA-axis and inflammatory reactivity to acute stress is related with basal HPA-axis activity. Psychoneuroendocrinology. 2017 Apr 1;78:168-76. doi: 10.1016/j.psyneuen.2017.01.035, PMID 28209543.
42. Dhabhar FS. Effects of stress on immune function: the good, the bad, and the beautiful. Immunol Res. 2014 May;58(2-3):193-210. doi: 10.1007/s12026-014-8517-0, PMID 24798553.
43. Dhabhar FS. Enhancing versus suppressive effects of stress on immune function: implications for immunoprotection and immunopathology. Neuroimmunomodulation. 2009;16(5):300-17. doi: 10.1159/000216188, PMID 19571591.
44. Garfin DR, Thompson RR, Holman EA. Acute stress and subsequent health outcomes: A systematic review. J Psychosom Res. 2018 Sep 1;112:107-13. doi: 10.1016/j.jpsychores.2018.05.017, PMID 30097129.
45. Kearney M. Kearney M. Prevention and treatment of CVD: a new priority for the NHS. Heart. 2019 Dec 1;105(24):1924-. doi: 10.1136/heartjnl-2019-315611, PMID 31399481.
46. Lee SP, Sung IK, Kim JH, Lee SY, Park HS, Shim CS. The effect of emotional stress and depression on the prevalence of digestive diseases. J Neurogastroenterol Motil. 2015 Apr;21(2):273-82. doi: 10.5056/jnm14116, PMID 25779692.
47. Ritz T, Steptoe A, DeWilde S, Costa M. Emotions and stress increase respiratory resistance in asthma. Psychosom Med. 2000 May 1;62(3):401-12. doi: 10.1097/00006842-200005000-00014, PMID 10845354.
48. Radley J, Morilak D, Viau V, Campeau S. Chronic stress and brain plasticity: mechanisms underlying adaptive and maladaptive changes and implications for stress-related CNS disorders. Neurosci Biobehav Rev. 2015 Nov 1;58:79-91. doi: 10.1016/j.neubiorev.2015.06.018, PMID 26116544.
49. Kemeny ME. The psychobiology of stress. Curr Dir Psychol Sci. 2003 Aug;12(4):124-9. doi: 10.1111/1467-8721.01246.
50. Dobson H, Smith RF. What is stress, and how does it affect reproduction? Anim Reprod Sci. 2000 Jul 2;60-61:743-52. doi: 10.1016/s0378-4320(00)00080-4, PMID 10844239.
51. Fleshner M. Physical activity and stress resistance: sympathetic nervous system adaptations prevent stress-induced immunosuppression. Exer Sport Sci Rev. 2005 Jul 1;33(3):120-6. doi: 10.1097/00003677-200507000-00004, PMID 16006819.
52. Charmandari E, Tsigos C, Chrousos G. Endocrinology of the stress response. Annu Rev Physiol. 2005 Mar 17;67:259-84. doi: 10.1146/annurev.physiol.67.040403.120816, PMID 15709959.
53. Schneider CP, Schwacha MG, Chaudry IH. The role of interleukin-10 in the regulation of the systemic inflammatory response following trauma-hemorrhage. Biochim Biophys Acta. 2004 May 24;1689(1):22-32. doi: 10.1016/j.bbadis.2004.01.003, PMID 15158910.
54. McGonagle KA, Kessler RC. Chronic stress, acute stress, and depressive symptoms. Am J Community Psychol. 1990 Oct;18(5):681-706. doi: 10.1007/BF00931237, PMID 2075897.
55. Vinkers CH, Klanker M, Groenink L, Korte SM, Cook JM, Van Linn ML et al. Dissociating anxiolytic and sedative effects of GABAAergic drugs using temperature and locomotor responses to acute stress. Psychopharmacology. 2009 Jun;204(2):299-311. doi: 10.1007/s00213-009-1460-4, PMID 19169673.
56. Ursano RJ, Bell C, Eth S, Friedman M, Norwood A, Pfefferbaum B et al. Practice guideline for the treatment of patients with acute stress disorder and posttraumatic stress disorder. Am J Psychiatry. 2004 Nov 1;161(11);Suppl:3-31. PMID 15617511.
57. Choudhury S, Panda P, Sahoo L, Panda SK. Reactive oxygen species signaling in plants under abiotic stress. Plant Signal Behav. 2013 Apr 1;8(4):e23681. doi: 10.4161/psb.23681, PMID 23425848.
58. Giller KE, Witter E, Mcgrath SP. Toxicity of heavy metals to microorganisms and microbial processes in agricultural soils: a review. Soil Biol Biochem. 1998 Sep 1;30(10-11):1389-414. doi: 10.1016/S0038-0717(97)00270-8.
59. Madison A, Kiecolt-Glaser JK. Stress, depression, diet, and the gut microbiota: human–bacteria interactions at the core of psychoneuroimmunology and nutrition. Curr Opin Behav Sci. 2019 Aug 1;28:105-10. doi: 10.1016/j.cobeha.2019.01.011, PMID 32395568.