Innovative Journal of Medical and Health Science
Received 11 Dec 022| Revised 02 Jan 2023 | Accepted 22 Jan 2023 | Published Online 30 Jan 2023

DOI: https://doi.org/10.52845/IJMHS/2023/13-01-1
Inno J of Med Health Sci 13(01), 2041-2044 (2023)

RESEARCH PAPER

ISSN (P) 2589-9341 | (O) 2277-4939 IF: 1.6

The Human Immune System and Psychological Stress: A Conceptual Research Review

[1]Manas Kakkar

[1]MBBS Student
School of Medical Science & Research
Sharda University, Gr Noida, India
E mail – the manaskakkar@gmail.com

Psychological stress can have a negative impact on the human immune system. Stress activates the body's "fight or flight" response, which releases hormones such as cortisol and adrenaline. These hormones can suppress the immune system, making a person more susceptible to infections and illnesses. Chronic stress can also lead to inflammation in the body, which has been linked to a variety of health problems including heart disease, diabetes, and certain types of cancer. Additionally, stress can lead to unhealthy coping mechanisms such as overeating, smoking, and alcohol consumption, which can further compromise the immune system.

1 | CONCEPTUALIZING STRESS

Stress is a physical, mental and emotional response to a perceived threat or challenge. It is the body's way of preparing to defend itself. Stress can be beneficial in short-term situations, such as helping a person to avoid danger or to meet a deadline. However, prolonged or chronic stress can have negative effects on a person's physical and mental health, as well as on their relationships and overall well-being. Stress can manifest in a variety of ways, including anxiety, fatigue, irritability, depression, and physical symptoms such as headaches and muscle tension. Stress management techniques, such as exercise, relaxation techniques, and counseling, can help a person to cope with stress and reduce its negative effects.

2 | OVERVIEW OF THE IMMUNE SYSTEM

The immune system is a complex network of cells, tissues, and organs that work together to defend the body against foreign invaders, such as bacteria, viruses, and other pathogens. The main components of the immune system include white blood cells, also known as leukocytes, and antibodies, which are specialized proteins. The immune system also includes the thymus, spleen, lymph nodes, and bone marrow, which all play a role in the production and function of white blood cells. The immune system works by identifying and neutralizing foreign invaders, and also by remembering past invaders so that it can quickly respond to future infections.

There are two main branches of the immune system: the innate immune system and the adaptive immune system. The innate immune system is the body's first line of defense and includes physical and chemical barriers, such as skin and mucus, as well as cells that can quickly respond to and eliminate foreign invaders. The adaptive immune system, also called the acquired immune system, is a more specific response that targets specific invaders. This branch includes T and B cells, which are white blood cells that can recognize and bind to specific pathogens. Overall, the immune system is an incredibly complex and sophisticated system that plays a vital role in protecting our body from harmful pathogens.

3 | COMPONENTS OF THE IMMUNE SYSTEM

1. White blood cells (leukocytes): These cells play a key role in the immune response and can be divided into two main types: granulocytes and agranulocytes. Granulocytes include neutrophils, eosinophils and basophils, while agranulocytes include lymphocytes (T and B cells) and monocytes.

2. Antibodies: These are specialized proteins that are produced by B cells and help to neutralize and eliminate foreign invaders.

3. Lymphoid organs: These organs play a crucial role in the production and function of white blood cells. They include;

• Thymus: where T cells mature

• Spleen: filter blood and remove dead cells and pathogens

• Lymph nodes: filter lymph and produce and store white blood cells

• Bone marrow: where all blood cells, including white blood cells, are produced.

4. The complement system: This is a group of proteins that work together to enhance the immune response. They can help to mark pathogens for destruction and also help to recruit white blood cells to the site of infection.

5. The innate immune system: This is the body's first line of defense and includes physical and chemical barriers, such as skin and mucus, as well as cells that can quickly respond to and eliminate foreign invaders.

6. The adaptive immune system: This branch includes T and B cells, which are white blood cells that can recognize and bind to specific pathogens, this system is also called the acquired immune system. Overall, all these different components of the immune system work together to protect the body from harmful pathogens and disease.

4 | IMMUNE ASSAYS

Immune assays are laboratory tests that are used to measure the presence, activity, or function of various components of the immune system. These assays can be used to diagnose and monitor a wide range of immune-related conditions, such as allergies, infections, autoimmune diseases, and cancers. Some common types of immune assays include:

corresponding author: ManasKakkar
MBBS Student, School of Medical Science & Research Sharda University, Gr Noida, India
E mail – the manaskakkar@gmail.com

1. Enzyme-linked Immunosorbent Assay (ELISA): This assay is used to detect the presence of specific antibodies or antigens in a sample, such as blood or saliva. It is commonly used for diagnostic testing for infectious diseases, such as HIV and hepatitis, as well as for measuring levels of allergens in the blood.

2. Western Blot: This assay is used to detect specific proteins, such as antibodies or antigens, in a sample. It is often used in combination with ELISA to confirm a positive test result.

3. Flow Cytometry: This assay is used to measure the number and function of white blood cells in a sample. It can be used to diagnose and monitor conditions such as leukemia and lymphoma, as well as to evaluate the effectiveness of certain treatments.

4. T cell assays: These assays are used to measure the number and function of T cells in a sample. They can be used to diagnose and monitor conditions such as HIV and cancer, as well as to evaluate the effectiveness of certain treatments.

5. Immunohistochemistry (IHC): This assay is used to detect specific proteins or antigens in tissue samples, such as tumor samples. It is commonly used in pathology to identify cancer cells and to determine the stage of the disease.

These are just a few examples of the many different types of immune assays that are available. The specific assay used will depend on the condition being tested for, and the information that the doctor or researcher wants to obtain.

5 | PATHWAYS BETWEEN STRESS AND THE IMMUNE SYSTEM

Stress can have a significant impact on the immune system, and the relationship between stress and the immune system is complex and multifaceted. Here are a few ways that stress can affect the immune system:

1. Hormonal changes: Stress can activate the hypothalamic-pituitary-adrenal (HPA) axis, which leads to an increase in the release of cortisol and other stress hormones. These hormones can suppress the immune response by decreasing the number and activity of white blood cells, such as T cells and natural killer cells.

2. Inflammation: Chronic stress has been associated with an increase in inflammation, which can contribute to the development of a wide range of diseases, including heart disease, cancer, and autoimmune conditions.

3. Disruption of the gut microbiome: Stress can disrupt the balance of bacteria in the gut, which can lead to an increased risk of infections and other immune-related conditions.

4. Alteration in the immune cells activation and differentiation: Stress can cause alterations in the immune cells activation, differentiation and proliferation, which could affect the ability of the immune system to fight off infection and disease.
5. Impaired wound healing: Stress can also affect wound healing, by altering the immune response to injury, which might lead to chronic inflammation and increased risk of infections.

It's worth mentioning that stress can have different effects depending on the timing, duration, and intensity of the stressor, as well as the individual's baseline immune function, lifestyle and genetics. Therefore, it's important to take into account all these factors to have a comprehensive understanding of the relationship between stress and the immune system.

6 | REVIEW OF RESEARCH ON IMMUNE SYSTEM & STRESS

There are many research papers that have been published on the relationship between the immune system and stress. Some notable examples include: "The Impact of Psychological Stress on the Immune System: A Review of the Literature and Implications for Family Medicine," published in The Journal of the American Board of Family Medicine in 2014. This review paper provides an overview of the relationship between stress and the immune system, including the effects of stress on the production of white blood cells, antibodies, and inflammatory molecules.
"Stress and the Immune System: A Meta-analytic Review of Laboratory Studies," published in Psychological Bulletin in 2000. This meta-analysis reviewed studies on the relationship between stress and the immune system and found that stress is associated with a decrease in the number and function of white blood cells.
"Stress, Inflammation and Cancer," published in Nature Reviews Cancer in 2005. This review paper discusses the relationship between stress, inflammation, and cancer, including the ways in which stress can affect the immune response to cancer cells.
"Stress and the gut-brain axis: regulation by the microbiome," published in Physiology & Behavior in 2019. This review paper discusses the relationship between stress, the gut microbiome, and the immune system, including the ways in which the gut microbiome can affect the immune response to stress.
"Stress, Immunity, and Vaccination: A Review of the Human Research," published in Brain, Behavior, and Immunity in 2016. This review paper provides an overview of the relationship between stress and the immune response to vaccinations, including the ways in which stress can affect the production of antibodies in response to vaccination.

These are some examples of the studies that have been conducted on the relationship between the immune system and stress, and the findings are still under investigation and more research is needed to establish clear links and causality.

7 | CONCLUSION

The immune system and stress have a complex relationship. Stress can both positively and negatively impact the immune system. Acute stress, such as from physical exercise, can improve the immune response by increasing the number of white blood cells and antibodies. However, chronic stress can weaken the immune response by decreasing the number of white blood cells and altering their function. Stress can also increase inflammation in the body, which can contribute to the development of chronic diseases. Studies have also shown that stress can lead to changes in the gut microbiome, which can affect the immune response.

Several studies have also found that stress can affect the immune response to vaccinations. Stress can decrease the effectiveness of the vaccine by decreasing the production of antibodies. Stress can also impact the immune response to infections, with some studies suggesting that stress can increase the likelihood of infections, while others have found that stress can decrease the severity of infections.

There is also evidence that stress can affect the immune response to cancer. Stress can increase the likelihood of cancer by promoting inflammation, altering the gut microbiome, and suppressing the immune response. Stress can also affect the progression of cancer by altering the immune response to the cancer cells.

Overall, research suggests that stress can have a significant impact on the immune system, and that the relationship between stress and the immune system is complex and multifaceted. More research is needed to fully understand the mechanisms underlying this relationship and to develop effective strategies for preventing and treating stress-related immune dysfunction.

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