The Risk Factors for Immune System Impairment and the Need for Lifestyle Changes

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Abstract

Healthy immune system helps in enhancing the quality of life and reduces the risk of infectious disease. Chronic disease increases the risk of immune system impairment. The article reviews the evidence on risk factors causing immune system imbalance and articulates the complex nature of the relationships between immune system risk factors, chronic disease, and infectious disease to highlight the importance of lifestyle choices. Finally, some evidence is presented on mind–body interventions and lifestyle choices for enhancing the immune system function.

Keywords
- chronic disease
- immune system risk factors
- infectious disease
- lifestyle choices

Introduction

Recent developments of COVID-19 pandemic highlight the importance of the immune system in quality of well-being and preventive health management. The scientific evidence indicates that individuals with immune system impairment or those on medications that suppress the immune system are considered to be at much greater risk of any respiratory infections.[1] It is also well-known that the number of individuals exposed to infection is much higher than those presenting with the disease, confirming that most individuals can destroy the microorganisms and prevent the infection or slow down the progression. Unfortunately, impaired immune system increases the susceptibility to any infections, and a presence of any chronic disease (e.g., Type 2 diabetes) further increases the risk of impairment in the immune system.[2,3] Finally, the immunological studies over several years have confirmed that in many infectious diseases, the main pathological aspects are not related to the direct action of an aggressor agent, but an abnormal immune response.[4] Together, the evidence points to understanding the risk factors for immune system impairment. The article reviews these risk factors, the linkage with chronic and infectious disease, the extent of choice the individual or the society has to influence the risk factors, and the implications for the individual and the clinician.

Key Immune System Risk Factors and Linkage with Disease and Quality of Life

►**Table 1** (risk factors for immune system impairment) highlights the evidence of key risk factors impacting the immune system often through the pathway that includes increased (chronic) inflammation. Many of these factors are also the risk factors for chronic disease and as discussed earlier, the impaired immune system increases the risk of infectious disease.[5,6]

The evidence above confirms that the risk factors for chronic disease also have an adverse impact on the immune system, resulting in increased risk for the infectious disease.

Lack of Quantitative Evidence between Specific Risk Factors and the Immune System Impairment

Scientific studies have not yet been able to establish a quantitative relationship between altered immune response and frequency or severity of disease in humans due to genetic dissimilarity and heterogeneous form of environmental exposure and finally lifestyle choices.[25] This is further confounded by the impact of life stage, gender, use of certain medications, drug/alcohol usage, tobacco history, stress, lifestyle, occupation, and nutritional status.[26] This indicates that despite the evidence of the risk factors impairing the immune system, it

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Table 1 Risk factors for immune system impairment

Lifestyle choice	Impact on the immune system	Discussions and implications
Poor diet (includes macro- and micronutrient imbalance) impacts both innate and adaptive immune systems.[7]	Undernutrition due to insufficientmacronutrients and/or deficiencies in specific micronutrients impairs the immune system, suppressing immune functions that are fundamental to host protection.[8] Sufficient scientific evidence confirms that nutrient intake above recommended levels may positively impact the immune function and modulate chronic inflammatory and autoimmune condition while decreasing infection risk.[7]	Improving the quality of diet must be incorporated with the help of clinician. There is a role of the individual, family, and the society and the need for collaboration between dietician, clinicians and the individual.
Physical inactivity Lack of physical activity impairs the immune system and extreme physical activity may temporarily affect the immune system.	The evidence confirms physical activity (moderate-to-vigorous intensity, less than 60 minutes) helps in enhancing the immune system. Regular exercise training has an overall anti-inflammatory influence mediated through multiple pathways.[9] The evidence also highlights the negative impact on the immune system of severe exercise.[10]	Watchout: Extreme workload (exercise) could adversely impact the immune system. It is best to pursue WHO guidelines on physical activity.[11]
Obesity Obesity is a disease as well as the risk factor for chronic disease and immune system impairment.	Clinical and epidemiological data support the evidence that the incidence and severity of specific types of infectious illnesses are higher in obese persons as compared with lean individuals.[12] Adipose tissuesand chronic inflammation are linked to suppression of the immune system along with the presence of metabolic syndrome parameters.[13]	Obesity and metabolic syndrome need both lifestyle and clinical interventions.
Chronic Stress “Stress-related disease emerges, predominantly, out of the fact that we so often activate a physiological system that has evolved for responding to acute physical emergencies, but we turn it on for months on end, worrying about mortgages, relationships, and promotions”[14].	There is direct linkage between chronic stress and a broad spectrum of human diseases.[15] Stressors can increase the risk of developing infectious disease, and they can also prolong infectious illness episodes.[16] Chronic stress also increases the risk of immune system impairment through pathways that include chronic inflammation.[17] Psychological stress can deregulate the human immune system. Stress can impact immunity differentially across individuals and contexts.[17]	Lifestyle choices play a very important part for addressing chronic stress. Being able to identify the presence of chronic stress is the first step. Thus, it is important not only for the clinician but also the family member to identify and individual who is stressed and seek appropriate help.
Sleep disruption Sleep disruption has implications affecting the nervous system, endocrine system, energy balance, inflammation (and therefore immune system) and cognitive functions.	Prolonged sleep disruption and increased stress due to it results in increased production of pro-inflammatory cytokines causing low-grade chronic inflammation that results in immune system impairment.[18] The relationship between sleep and immune function is bidirectional and increased sleep disruption increases the risk of infectious disease.[19]	Clinicians must screen for sleep disruption through simple self-reported surveys, especially for individuals at high risk of immunosuppression or chronic disease.
Alcohol consumption	Alcohol consumption decreases immune system function, in general though there is some evidence that moderate amount of alcohol can enhance the immune system (due to anti-inflammatory impact).[20]	Given the serious health risks associated with exceeding two drinks per day, increased alcohol consumption cannot be recommended.[21]
Tobacco consumption (Includes smoking and chewing tobacco)	Ample evidence has shown that both innate immunity and adaptive immunity are susceptible to cigarette smoke, which interrupts immunological homeostasis, causes various diseases, and exerts paradoxical effects on immune and tissue cells.[22,23] Chewing tobacco is also linked to immune system impairment.[24]	Despite the anti-inflammatory benefits of nicotine, smoking in general has an overall negative impact and hence not recommended. Any form of tobacco is likely to impair the immune system.

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is not possible to clearly link one or many risk factors with likely occurrence of immune impairment or disease. In other words, the intervention through lifestyle choice must address all the risk factors.

The Importance of Lifestyle Choices and Self-Regulation

The above evidence makes a strong case for lifestyle choices and self-regulation. When the individual meets one or more risk factors, there is an increased probability of immune system impairment that may increase the risk for infectious and chronic disease. Many of these risk factors are controllable and could be managed if the individual or the society as a whole understands and incorporates changes to reduce the risks. Evidence indicates that adults who have poor self-regulation are more likely to have health challenges (e.g., self-efficacy, coping, adherence, and negative effects on health parameters) that affects the quality of life due to chronic disease.[27] From health professionals' perspective, it is important to find ways to enhance the self-regulatory skills to slow down the disease progression and also enhance the quality of life.[28]

Evidence on Mind–Body Interventions

Mind–body medicine focuses on the relationships between the brain, mind, body, behavior, and their effect on health and disease. According to the National Center for Complementary and Alternative Medicine, it encompasses a large group of therapies such as hypnosis, meditation, yoga, biofeedback, tai chi, and visual imagery. Relaxation training had the strongest scientific evidence of a mind–body medicine affecting immune outcomes.[29] Regular practice of yoga including slow breathing or pranayama, tai chi, and meditation also have a positive impact via reduction of inflammation (C-reactive protein), thereby enhancing the immune function.[30,31] To summarize, practices that reduce stress, enhance relaxation, and help in enhancing sleep can improve the immune system, provided they are incorporated into daily routine or lifestyle.

Conclusion

Many positive lifestyle choices such as quality diet, regular physical activity, maintaining ideal body-weight, good stress management practices, quality sleep and no alcohol or tobacco consumption can help in reducing the chronic inflammation and thereby enhancing the immune system function. This is more relevant for individuals with chronic disease since the presence of chronic disease results in impairment of the immune function.

The evidence also confirms that there is no quantitative relationship to identify the linkage between a risk factor and the impairment of the immune system. Hence, making a healthy lifestyle choice is not a one-time intervention on one risk factor but an overall lifestyle change across multiple risk factors on a going basis.

Making the correct lifestyle intervention, when governed by self-regulation, helps in enhancing the immune system that can help in protection against infectious disease and help in improving Quality of Life for individuals with chronic disease.

Conflict of Interest
None declared.

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