Psychosocial Factors as Modulators of Human Immune Function: An Appraisal

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ABSTRACT

Immune system is the most complex and important system of the body. The knowledge and understanding of immunomodulatory factors is of vital importance as it may help the individual in making efforts to improve and strengthen it. This article deals with the appraisal of the role of psychosocial factors in the modulation of human immune functions.

Key Words: Stress, Emotion, Optimism, Social Support, Self-efficacy, Life style.

The immune system is one of the most complex system of the body. It constitutes the white blood cells that develop in the bone marrow and in the thymus gland. Some of the cells roam through the blood or the lymphatic system, others reside permanently in one place. (Prokop et al., 1991) The function of the immune system is to recognise and eliminate foreign microorganisms and their toxins that enter the body. This function is partly mediated by central nervous system (CNS) and endocrine system as the immune system can act as the recipient of afferent signals from these two systems. Thus, the three systems are tightly integrated in their functions to preserve homeostasis. Immunity is of two kinds i.e. innate and acquired. Innate immunity is born and formed during early development which is always present and available to protect the individual from challenges by “foreign” invaders. It also involves substances released from leucocytes, phagocytic cells, macrophagic and microglial cells of CNS. Acquired immunity is more specific and comes later. It includes immune organs and cells involved in cell-mediated and humoral immunity. The lymphocyte involved in cell-mediated immunity is called T cells

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because they mature in the thymus gland. It further divides into three categories i.e. T-cytotoxic cells, T-helper cells, T-suppressor cells. T-cytotoxic cells directly destroy invading cells. T-helper cells help B-cells to produce antibodies by releasing cytokines. T-suppressor cells inhibit the development of B-cells and the activity of helper T-cells. The lymphocyte involved in humoral immunity are called B cells. The function of these cells is to recognise foreign cells and to release antibodies from their surfaces. Both systems work together in order to protect the body from infection and illness (Prokop et al., 1991).

Over the years researches have identified several factors, which influence our immune system. The six major factors which affect our immune systems in the order of least to greatest significance are: Overuse and misuse of antibiotic, pollution and environmental toxins, stress and emotional state, genetic makeup, lifestyle and nutritional status. It means that nutritional status and lifestyle override your genetic makeup. This has been accepted by the medical community, but, not much is known about nutrition and lifestyle. A growing number of evidence indicates that psychological factors may significantly affect immune system. (Sher, 1999; Sher, 1998 and Kiecolt-Glaser, Glaser, 1991). Herbert and Cohen, (1993); Kiecolt-Glaser and Glaser, (1988); O. Leary, (1990) have reported that psychosocial factors modulate the immune system in ways that can influence susceptibility to illness. In this paper an attempt has been made to present a brief review of role of various psychosocial factors in the modulation of immune functions.

**Stress:** Stress refers to a real or perceived imbalance between environmental demands required for survival and an individual’s capacity to adapt to these requirements (Lazarus and Folkman, 1984; Chrousos and Gold, 1992). There are two main categories of stress: acute and chronic. Acute stressors include unpleasant films, understimulation/work underload, overstimulation/work overload, unexpected or uncontrollable noise, prestige or status loss, electric shock, uncontrollable situations, physical illness, surgery, threats to self-esteem, and traumatic experiences. Chronic stressors include sleep deprivation, daily hassles, work overload or underload, role strains, or social isolation. Chronic stress not only makes people more vulnerable to catching illnesses but can also impair their immune system’s ability to respond to its own anti-inflammatory signals that are triggered by certain hormones, possibly altering the course of an inflammatory disease. Psychological stress has also been shown to increase susceptibility to viral infection. Subjects exposed to stress showed increases in infection rates from 74% to 90% and clinical colds rose from 27% to 47%. In medical students taking exams,
psychological stress produced a shift in the cytokine balance toward a Th2 profile. The data showed decreased synthesis of Th1 cytokines, including interferon-g (IFN-g), and increased production of Th2 cytokines, including IL-10. Data from our laboratory are consistent with these results (Glaser et al., 2001). Glaser et al., (2001) conducted a study on medical students, and among other things, they found that the students’ immunity went down every year under the simple stress of the three-day exam period. Test takers had fewer natural killer cells, which fight tumors and viral infections. They almost stopped producing immunity-boosting gamma interferon and infection-fighting T-cells responded only weakly to test-tube stimulation. In a recent meta-analytic study in 2004, Segerstrom and Miller meta-analysed nearly 300 studies on stress and health. Their meta-analysis discerned intriguing patterns. Laboratory studies that stressed people for a few minutes found a burst of one type of “first responder” activity mixed with other signs of weakening. For stress of any significant duration—from a few days to a few months or years, as happens in real life—all aspects of immunity went downhill. Thus, long-term or chronic stress, through too much wear and tear, can ravage the immune system.

Psychological stress could influence the onset and/or progression of conditions that involve excessive inflammation, like allergic, autoimmune, cardiovascular, infectious and rheumatologic illnesses (Miller, Cohen, & Ritchey, 2002). Myocardial infarction (MI or Heart attack) is the best known example of an acute health problem that is usually precipitated by both acute and chronic physical or psychological stress. Stress increases catecholamine, and the increase of plasma catecholamine enhances platelet aggregation, lowers the threshold to cardiac arrhythmia, induces narrowing of the blood vessels and suppresses insulin secretion (McEwen and Stellar, 1993). Diabetes mellitus, the most common form of diabetes, is also significantly affected by stress. Children who had stressful life events stemming from actual or threatened losses within the family, occurring between ages 5 and 9 had a significantly higher risk of Type I diabetes (McEwen and Stellar, 1993). Gastrointestinal diseases such as peptic ulcers and ulcerative colitis are known to be greatly influenced by stress. Studies on ulcer patients have also shown that anger and hostility increase stomach acidity, while depression and withdrawal decrease it. In a large study involving parents of both children with cancer and parents with children who were relatively healthy, Miller, Cohen, & Ritchey, (2002) found that chronic psychological stress reduce the immune system’s reactions to hormonal secretions that were normally used to fight the inflammatory response.

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How one deals with the stress *i.e.* how one copes with the stress may also have strong relationship with one’s immune system, if one uses appropriate and effective coping strategy it will help him to reducing or effectively deal with stress and burden his immune systemless. Jones, (2003) on the basis of his study reported that the ability to proactively handle the stressful situation can alleviate the constant activation of the endocrine system, which in turn increases the effectiveness of the immune system.

**Emotion:** Human ability to experience negative and positive emotions has an evolutionary goal and the presence of feelings designed to influence behaviour should thus be reflected in physiological and immune interactions (Barak, 2006). Recent studies suggest that the tendency to report positive, as opposed to negative, emotions may be associated with greater resistance to objectively verified colds. These laboratory studies are supported by longitudinal studies pointing to associations between psychological or emotional traits and the incidence of respiratory infections (Smith and Nicholson, 2001). Futterman, Kemeny, Shapiro and Fahey (1994) reported that positive emotions boost immunity. A growing body of evidence suggests that pessimism, depression and stress from major and minor events are related to impaired immune function. Normal ‘homeostasis’, the optimal balance of hormones, immunity, and nervous system functioning, protects us from the many threats to our health. Disrupted emotional responses, feeling ‘out of control’, leads to disturbed homeostasis. Physiological processes then get out of control. Different parts of the brain are associated with specific emotions, and they are also associated with specific hormone patterns (Hafen et al., 1996). The release of certain hormones is associated with different emotional responses. These hormones affect health e.g. emotionally induced shifts in hormones can lead to chronic diseases, such as high blood pressure. Some researchers in the field, believe that as many as half of all the patients who visit physicians have physical symptoms that are directly caused by emotions; others believe that the figure is as high as 90 to 95 per cent. It does not mean that the symptoms are imaginary; it is just to say that their root is primarily mental than physical. (Hafen et al., 1996). According to comprehensive research, the most common feature of sudden cardiac death is “marked emotional perturbation,” a flood of strong emotion. Extreme emotional stress in people with otherwise structurally normal hearts can lead to primary arrhythmias (disturbance in heart rhythm that causes it to beat unusually fast or slow). Many studies conducted by researchers throughout the world have shown that cancer-prone persons may tend to avoid expression of negative affect (Kune et al., 1991). Bottling up negative emotions seems to tie up resources of the immune system. Individuals
who disclosed a tragic event seemed to have an elevated immune response and generally were healthier than those who inhibited expression of these emotions. There is considerable evidence that talking about problems and using mental health services, decreases the number of sick days, and lowers health costs for these individuals (O’Leary, 1990).

Locke of Harvard (1984) has shown that the activity of natural killer cells is decreased during periods of increased life change accompanied by severe emotional disturbances, whereas subjects with similar patterns of life change and less emotional disturbances had more normal levels of natural killer cell activity. Similar findings were confirmed by Michael Irwin in 1987 at V.A. Medical Center in San Diego, noting that natural killer cell activity decreased during depressive reaction to life changes. In 1985, Marvin Stein at Mt. Sinai School of Medicine in New York looked at the effect of conjugal bereavement by studying men whose wives had advanced breast cancer. His work showed that the lymphocyte response pattern in his subjects dropped significantly within one month after the death of their wives. This finding was also confirmed by the research studies of Schleifer (1983) and Bartrop (1977). Arthur Stone (1987) has revealed that salivary immunoglobulin A (our first line defense against the entry of infectious organisms through the respiratory tract) response was lower on days of negative mood and higher on days with positive mood. Thus positive emotions seem to enhance the immune response while negative emotions suppress it.

Optimism: It is the point of view that good things are likely to happen. Optimists tend to experience life’s difficulties with less distress than do pessimists (Scheier, Carver and Bridges, 2001). Optimism has been associated with immune systems (Cohen et al., 1999; Segerstrom et al., 1998). Naturalistic studies have also found optimists to have lower immune parameters than pessimists when stressors persisted over time (Cohen et al., 1999) or participants experienced goal conflict (Segerstrom, 2001). They also tend to have better mental and physical health than pessimists have and they recover more quickly when they become ill (Carver, 1998). Studies have shown that pessimistic people—those who believe they have little control—have poorer health habits, have more illness, and are less likely to take active steps to treat their illness than people with a greater sense of control (Lin and Peterson, 1990). Segerstrom (2001) did a survey on students characterised as more optimistic or pessimistic. The students had a little of their blood drawn: once before starting school, and again at mid-semester. As the semester progressed and the coursework piled higher, pessimists began to lag. By midterm, the optimists had higher numbers than pessimists of cells that protect the immune

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system against disease. Tests were repeated in 1998, on law students and similar results were found. At UK midterm, 67 per cent of pessimists but only 29 per cent of optimists tested ‘clinically inadequate,’ indicating the partial failure of their immune system. This does not mean that 67 per cent of pessimists were actually sick. One can change quite a bit and still be within normal parameters for a healthy person. Segerstrom (2004) concluded that many symptoms of such classic fall—semester bugs as influenza or the common cold are actually caused by the immune system itself, generating heat and sapping energy levels as it fights germs. Whether pessimists can be transformed into optimists, no clear answer was found and it is said that it may be more fruitful to get people to employ certain cognitive strategies, get them to think positively, rather than try to change their personalities. Finally, it is important to remember that the relationship between optimism and lower immunity is variable i.e. when stressors are controllable or responsive to coping efforts, optimists have higher cellular immune parameters than pessimists (Byrnes et al., 1998; Cohen et al., 1999; Segerstrom, 2001; Segerstrom, et al., 1998, Sieber et al., 1992).

**Social Support:** It refers to the perceived comfort, caring, esteem, or help a person receives from other people or groups (Cobb, 1976). Social support system is one of the most effective means of reducing the impact of stress on the immune system. It was found that individuals with three or fewer social ties were four times as likely to develop a cold as individuals who had six or more social ties. Emphasising the role of social network and support system Rabin goes one step further and says that the quality of interaction is much more important. It is also found that individuals with three or fewer social ties are four times as likely to develop a cold as individuals who have six or more ties. Pressman et al. (2005) revealed that feeling lonely clearly impairs the immune systems response following a dose of influenza vaccine. Lack of social support among women suffering from breast cancer predicted poorer natural killer cell activity (Levy et al., 1987). Evidence from other studies also suggest that people who have strong social support have stronger immune system and few immune impairments in response to stress than who have less support (Esterling, Kiecolt-glaser and Glaser, 1996; Kiecolt-Glaser et al., 1991). Kiecolt-Glaser et al. (1984) revealed that medical students who lonely had reduced immune functions. It was also found that women who have higher scores on social interaction scale have better immune function but it is not so in the case of men. The studies cited over here clearly emphasize the role of social networks and ties in health promotion and disease prevention by modulating the immune system. This again provides support to the idea of fourth C (i.e. community matters) besides commitment, control...
and challenge by Kobassa (1973, 1983). Thus, while designing any of the disease prevention and health promotion programs we must give appropriate and adequate attention to social support and related factors.

Social support may buffer the adverse effects of stress on immune responses. In a study researchers examined the direct relationships between peripheral lymphocyte sub-populations and several aspects of social support. Partial correlation coefficient controlled by age and smoking between social support and immune cells was calculated. A weak but significant correlation between perceived social support and the numbers of CD3-/CD16+ and CD3-/CD56+ NK cells was found. A positive correlation of perceived social support with NK cell numbers was also observed which suggests that perceived social support has a direct effect on NK cells and that increased social support might be accompanied by high natural immunity (Miyazaki et al., 2003). Social support may affect the immune system in a way that can influence susceptibility to diseases. This hypothesis was supported by Cohen who reported that psychological and social factors play an important role in determining our resistance to upper respiratory illness. He (Cohen) emphasised that people having less social ties/network were more susceptible to develop cold than those with more ties. Not only were they less susceptible to develop colds, they produced more mucus, were less effective in mucocilliary clearance of the nasal passage, and shed more virus. The association between social network diversity and colds occurred in both types of subjects i.e. those who entered the study with and without antibody to the experimental viruses (2).

Self-Efficacy: A sense of efficacy can also affect the human immune system. Epidemiological and correlational studies show that lack of behavioural or perceived control over environmental demands increases susceptibility to various infections (e.g. bacterial and viral infection), accelerate the progression of diseases and in this way contribute in the development of physical disorders (Schneiderman, McCabe, and Baum, 1992; Peterson and Stunkard, 1989). The inability to control the stressors can impair the immune system. A line of evidence indicates that exposure to stressors without the ability to control them activates neuroendocrine, catecholamine, opioid systems and suppresses the immune system (Bandura, 1991; Maier, Laudenslager, and Ryan, 1985; Shavit and Martin, 1987). Three major pathways through which perceived self-efficacy affects the immune system are mediating through stress, depression and expectancy learning. Shavit and Martin (1987) reported that inability to control stressors leads to some immunosuppressive affects such as reduced natural killer cell cytoxicity mediated by the release of endogenous opioids. This finding suggests that uncontrollable stressors impair the activity of different

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facets of immune function. Depression has also been shown to reduce immune function. Studies (Ader and Cohen, 1993; Herbert and Cohen, 1993a) suggested that more severe the depression, the greater the reduction in immunity. O’Leary et al., (1988) highlighted the interactive role of self-efficacy and reported that increase in depression due to perceived self-efficacy mediates the immunity. Central expectancy also modulates immunologic reactivity. Animal studies have shown that immune function can similarly be influenced by expectancy learning as other two pathways. There is some evidence which indicates that lower functioning of immune system is mediated by affective processes rather than by behavioural changes in activity level or eating and sleeping patterns. Although the way in which depression affects immune function has not been fully explored (Bandura, 2003), in a study Kuno, Yazawa, Ohira, (2003) examined the interaction effects of generalised self-efficacy and controllability of acute stress on salivary secretory immunoglobulin A (s-IgA), task performance, and psychological stress responses in a typical learned helplessness paradigm. The interaction of self-efficacy and controllability was observed only on the s-IgA variable; increase of secretion of s-IgA secretion under stressor uncontrollability was more prominent in the low self-efficacy group than in the high. These results suggest that generalised self-efficacy is a moderator of the stressor controllability effect on secretory immunity.

Life Style: Life style refers to the general pattern of living and behaving e.g. diet, exercise, sleep, etc. There are some people who have faulty eating and sleeping habits; they may either not exercise at all or indulge in very heavy exercise. In health psychology two types of life style/behaviours have been mentioned. These are health promoting and health endangering life style/behaviours. Health promoting life style may include, taking a balanced/nutritious diet, doing exercise regularly, having adequate sound sleep, abstaining from smoking and heavy drinking etc. Smoking, heavy drinking, unbalanced diet, lack of exercise, irregular sleeping schedules, etc. on the contrary are health endangering behaviours. There are evidences available, which show that, these health endangering or promoting behaviour modulates our immune system (Kusaka, Kondou and Morimoto, 1992). Our body’s cells need pure water, fresh air, and regular exercise and nutrient rich diet to remain healthy. It is true for immune system cells also. Elaine More outlined that our immune system is healthiest when it gets its regular exercise by working as intended and when it is not overloaded with toxins and stressors. Thus change in one’s life style may cause change in one’s immune status and consequently one’s health and well-being. There are several studies, which have clearly outlined the role of life style related factors in immunomodulation. Kusaka, Kandan and Masinato (1992), on the basis of their study, reported that people who
have healthy life style (e.g. getting enough sleep, eating balanced meal etc.) have a strong immune system than those who do not have healthy life style. Sleep deprivation or irregular patterns of sleep may also result in various kinds of sleep disorders/disturbances (Bootzin et al., 2001). Exercise is one of the key management strategy used by health care professionals to address many of the psychosomatic (e.g. cardiovascular disease, hypertension, asthma) and even chronic diseases like HIV/AIDS. Not only this, positive effects of exercise on one’s health and well being have also been noted (Shyam and Singh, 2007). In one study La Perriere, et al. (1997) found aerobic exercise to be significantly associated with improvement in strength, cardiovascular function, and psychological status in general population. Morgan and Goldstein (1987) have reported that exercise helps to reduce anxiety, depression, and improves self-esteem, well-being, body image and perceived control. Several studies (La Perriere et al., 1991; Lox, McAuley and Tucker, 1996, Macarthur, Levine and Birk, 1993, Terry, Sprinz and Ribeiro, 1999) have reported improvement in muscular strength and flexibility, cardiopulmonary function, decrease in depression, anxiety, anger and increase in CD4 lymphocytes following exercise training. Nixon, O’Brien, Glazier and Tynan, (2003) have reported that simple aerobic exercise is safe and may be beneficial for adults with HIV/AIDS. Thus it is clear that life style may have a significant effect on our immune functioning helping us to remain disease-free and healthy.

**Improving Immune Functioning**

The immune system is the most complex and important system of our body. It works incessantly 24 ours a day, every day of our life. The immune system searches for cells that show signs of infection. Following suggestions can help us in protecting and improving our immune system:

**Nutritious diet:** A balanced diet rich in nutrients is essential for keeping us healthy. A diet rich in fresh vegetables and fruits, which provide a wide range of essential antioxidants and nutrients, makes our immunity strong whereas refined, processed sugary foods are a recipe for lowered immunity. High quality proteins and healthful fats (especially monounsaturated facts, and vitamins boost our immunity).

**Sound sleep:** We must take sound and enough sleep so that our body gets the required rest during which many vital functions known to enhance our immune system are performed. Lack of adequate and sound sleep impairs the activity of natural killer cells and macrophages, it also slows the production of disease fighting white blood cells.

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Avoid chemical toxins: Chemical toxins adversely affect our immune system. Therefore, we must refrain from chemical cleansing agents, recreational drugs, smoking, too much coffee or tea, industrial toxins, air pollution, and unnecessary unprescribed drugs.

Exposure to sunlight: Sunlight is a good source of vitamin D, which is known to help making our immune system strong and thereby preventing vitamin deficiency disorders, autoimmune disorders including multiple sclerosis and thyroid disorder.

Develop a good social network: Social support has been found to help improve our immune system, may be by way of managing our emotions and dealing with stress. A network of good friends and good relations with family member helps in general well-being of body and the mind.

Be positive and optimistic: Positive and optimistic outlook and perspective is known to improve our immune system. Have a positive view about self surrounding and future. Have faith, things will improve.

Believe in yourselves: It has been reported extensively in literature in Health Psychology that those who have internal locus of control have good health and it is easy to change/ modify their behaviours for promotions of health as opposed to those having external locus of control.

Change your way of perceiving things: It is known to us that stress and stressful life events adversely affect our immunity. It is said that stress lies in the eyes of the beholder i.e. how we perceive and interpret the events determines stress and its level. Therefore, change your frame of reference and perspective of viewing and interpreting persons, events etc.

Exercise: It is beyond doubt that exercise helps us to remain healthy by way of improving our immunity. Studies have shown that moderate level (i.e. not too less and not too much) of exercise is good. Therefore, have at least 30-40 minutes walk, aerobics, yogic exercise regularly.

Reduce stress: One of the biggest problems faced by the modern man is stress. Stress can be of several types and because of several reasons. We must try to reduce it by way of adopting a realistic life style and goals, by managing our time etc. True, it is difficult to remain stress free, yet we can reduce and manage it by developing healthy ways of coping with it by changing our perspective, exercising etc.

Treat infections early: Bacterial or viral infections take on our immunity. So, whenever we have infections treat them with the help of qualified and experienced physicians/ medical persons.
To conclude, psychosocial factors have significant impact on our immune functions. Therefore, there is a need to give adequate recognition to these by the physicians/medical persons, while designing any treatment and/or prevention program. Time has come now that a psychologist/more so health psychologist be also included in health professionals’ team in our country.

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