

Nutrition and Health: A Review

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Abstract:- This review has been done to break down the impact of healthful components on human immune system. Human body has numerous components to secure itself. There are many components that influence immune system functions, one of those is nourishment. There is a critical connection between immune system and sustenance, besides malnutrition shouldn't be considered as energy and a protein lack alone. Because of these reasons, the principle point of sustenance isn't just to acquire energy and protein, yet to improve obstruction against sicknesses with some particular nutriment and to turn the incendiary reaction to somebody's greatest advantage. The nutrients which show gainful consequences for immune system are called Immune nutrients and sustenance on these nutrients is called immune diet. The transition from traditional to modern diets, which are high in energy density and low in nutrient diversity, is linked to the development of acquired metabolic disorders.

Key words: Immune system, Nourishment, Immune nutrients

INTRODUCTION

An ever-evolving field for the ingenuity is food preparation and processing. Consumer demands inevitably lead to changes in the way food is manufactured, and the food business is always doing market research to try to predict what consumers want. As a result of these forecasts, people are looking for tasty, convenient, and, if possible, low-calorie foods at a reasonable price. Foreseeing the future and the requirements of a populace is a risky pursuit, which was shown by the forecasts over thirty years prior by a gathering of American business, government, and scholastic pioneers (Harris, 1980).

Human beings are in close relation with the microorganisms that were common in nature. Immunity, or resistance to germs, works in a complex system that is both innate and acquired, although they mainly work together. Nutrition is one of the variables that influences natural resistance. Malnutrition weakens the immune system by suppressing its functioning. Dietary factors that affect metabolic health include inadequate consumption of macronutrients (fat, carbohydrate, and protein) or a deficiency of certain micronutrients (vitamin, mineral, water). Nutrition that is well-balanced, especially in terms of proper vitamin, mineral, and protein intake, improves infection resistance. According to studies, a well-balanced diet benefits the immune system and is of critical relevance to the system (Kursat Karacabey, Nurfer Ozdemir, 2012). The impacts of nourishing components on immune system has been a concentrate on case for some examinations on the grounds that there is huge effect on supporting immune system and in lack it causes breakdown in safe framework.

ROLE OF FOOD SCIENCE ON HUMAN HEALTH

According to national institute of health research-Proper Diet, adequate amount of nutrients and physical activity plays a vital role on human health and immunity along with treatment toward disease. Healthy growth and development during early life is the effect of good nutrition, which in itself determines the future resilience of the individual to everyday stresses and susceptibility to disease. Nutritional factors set the vulnerability to risk of chronic disease during adulthood. Under-nutrition and obesity increase vulnerability to ill-health and the capacity to cope with any stress. These problems cost lives, cost dignity and increasingly place an unsustainable economic burden on the individual and society as a whole.

However recent reports collected from Food and Agriculture Organisation of the United Nations (FAO), the International Fund for Agricultural Development (IFAD), the United Nations Children's Fund (UNICEF), the UN World Food Programme (WFP) and the World Health Organization (WHO), cited research showing a decrease in the prevalence of stunting in children under the age of five in India, from 47.8% in 2012 to 34.7% in 2019, or from 62 million in 2012 to 40.3 million in 2019.

DIET AND ITS IMPACT:

From the past few decades there have been a tremendous change undergone in dietary habits, and now there is an increased belief that it has an impact on our immune system, health and disease (Tomasz and Niki, 2017). An increased consumption of energy-dense, fatty and processed foods has been observed, often called the "Western diet." This diet is generally high in animal protein, digestible sugars, starch, and fat and low in dietary fibres and healthy nutrients. This change in diet had led to rise in prevalence of inflammatory (including asthma and allergy) and autoimmune diseases (Cordain, Eaton, Sebastian, Mann, Lindeberg, Watkins & O'Keefe, 2005) consuming large amount of westernized food is the result of obesity and type 2 diabetes. Obesity is the aftereffect of an unevenness between energy admission and energy consumption (Hotamisligil, 2006). Excessive fat intake decreases the immune system's capacity to combat infectious diseases. Consuming a high-fat diet, even for a brief period of time, was found to significantly alter the composition of the microbiota and immune system as well as the number of goblet cells in the stomach, which *Listeria* prefers to infect. Moreover, the high-fat diet increased vulnerability to infections outside of the stomach (Vanessa, Adam, Feargal & Raul, 2019).

An experiment was done in which particularly C57Bl/6J mice were fed with high fat diet (45% of the total caloric intake from fat), a low-fat diet (10% of the total caloric intake from fat) or regular chow (18% of the total caloric intake from fat). Total time period for feeding was decided to be 2 weeks in order to avoid obesity and metabolism associated with longer-term feeding. However, mice fed with high fat diet (murine) had more body weights when compared to the different groups after providing diets for 2 weeks. After two weeks, it was noticed that mice were infected with *L. monocytogenes* (also called as EGDem) in which the particular internalin InlA protein has been changed to increase interaction with murine E-cad, and hence effectively increase invasive disease in the mice. It is known that wild-type *L. monocytogenes* InlA protein interacts poorly with murine E-cad, most likely to shift passively at Peyer's patches in non-indulgent models and is incapable of significant obtrusive disease in normal mice. Even Short-term consumption of a high-fat diet increases host susceptibility to *Listeria monocytogenes* infection (Vanessa, Adam, Feargal, Raul, 2019) (Ian, Pat, Colin & Cormac, 2010). The experiment carried out eventually suggest that a westernized High Fat diet changes the biology of the host beyond the gut and increases susceptibility to infectious disease.

NUTRITION'S EFFECT ON IMMUNE SYSTEM FUNCTION

Adequate nutrition is cardinal enhances immunity. The immune system is a network of biological processes that fights against an organism from diseases. It analyses the action of large variety of pathogens, from viruses to cancer cells and perceive a difference in them from the organism's own healthy tissue. It has already instituted that several factors influence the function of the immune system which including stress, sleep and nutrition (Breda Gavin & Smith, 2020) (Fall, Fang, Erlendsdóttir, 2019). According to WHO recommendations for food, "excellent nutrition is vital for health, particularly at times when the immune system might need to fight back," especially during the present pandemic. (WHO, 2020). Eating adequate and exclusive possession of diet which is high in vitamins and minerals has a great impact on immune system by providing antioxidants to lowers the damage of cells caused by free radicals. Free radicals and antioxidants should be in balanced proportion in order to enhance a proper physiological function (Lobo, 2010) or may lead to in T-cell production (Cohen, 2017).

THERE ARE TWO TYPES OF IMMUNITY IN HUMANS.: INNATE AND ADAPTIVE.

Using protective barriers, innate immunity serves as our bodies' initial line of defence against infections. Natural defences include skin, which keeps away most infections, pathogen-trapping mucus, pathogen-destroying stomach acid, Enzymes in our tears and sweat that aid in the production of antibacterial substances. The innate immune system incorporates entire features of the host's immune security system defined by the genes in the germ line of the mass. Some of the soluble proteins and bioactive molecules also form an essential component of innate immunity as a complement system that has an importance for both innate and adaptive immune systems which is greater than that of protein in plasma or cell surface (Chaplin, 2010).

A system called adaptive or acquired immunity develops the ability to identify pathogens. It is controlled by the spleen, thymus, bone marrow, and lymph nodes, among other cells and organs in our body. When a foreign substance enters the body, these cells and organs produce antibodies, which trigger the growth of immune cells (including many kinds of white blood cells) that are specifically directed to the dangerous substance and attack and eliminate it. After then, our immune system adjusts by keeping track of the foreign substance so that, if it re-enters, these antibodies and cells will be even more potent and swift to eradicate it.

The total amount of energy required by the entire immune system is in an inactivated state and it increases the demand for energy during periods of infection, with greater basal energy expenditure during fever, cancer, pregnancy for example. Many micronutrients are necessary for every stage of the immunological response in the body. Examples of nutrients that have been found to be essential for the development and operation of immune cells include vitamin C, vitamin D, zinc, selenium, iron, and protein (including the amino acid glutamine). It is not surprising that protein deficiency eventually decreases immune response by increasing susceptibility to infection but the demonstrations that was carried out on animal has showed adverse effect of protein deficiency on immunity and this effect has been confirm in various human settings (Calder, Jackson, 2000). Thus, the immune cell is functioned by the nutrition, which has an active reaction against pathogens and also solves the effect rapidly when there is increase in any underlying chronic inflammation. The source that is required to boost immune system comes from energy and nutrients that can be met from the healthy diet, or from endogenous sources such as body stores (Caroline, Philip and Elizabeth, 2019). Immune system is affected by micronutrients and dietary components throughout the life course or in reducing chronic inflammation. An effective regenerative response within the immune system, for instance, depends on the micronutrients vitamin A and zinc, which govern cell division. Arginine, an amino acid, is also necessary for the production of nitric oxide by macrophages (Calder, Jackson, 2000).

NUTRITIONAL VARIABLES AND THEIR IMPACT

Human body, for example is like an engine that requires energy for working that is utilized by the food which is digested (A. Stewart Truswell). Human sustenance addresses a comprehension of the nature and association of two significant frameworks: one internal and one external. The energy from the food is used by body for the mechanical work performed by the muscles and for segregation and partially for the work necessary to maintain the body's structure and functions. Unlike engines, however in the human body there is continuous breaking down (catabolizing) and building up (anabolizing) of component parts. In order to overcome the energy needed for chemical reaction and for manufacturing new materials foods supply nutrients are essential. Carbohydrate, fat, and protein are, to a large extent, replaceable sources of energy (A. Stewart Truswell).

There are mainly two major factors that affect human nutrition they are extrinsic factor an intrinsic factor. Extraneous factors like food, xenobiotics, climate and intrinsic factors like sex, age, gene variations.

Extrinsic factors utter the efficiency of molecular fate of nutrients and other dietary compounds and health outcomes, including physical nod such as photoperiod and temperature. Just like, the setting of endogenous circadian rhythms by alternating light/dark photoperiod of the day-night cycles, which in turn are delicately linked to the regulation of metabolic activity (Yiheng Chen, Marek Michalak, and Luis, 2018). Harmful environments, that persuade the emancipation of stress hormones, can harm the ability of the body to sense and respond to metabolic challenges. Changes in the epigenome can be brought by extrinsic factors in which nutrient and energy metabolism can be impacted strongly and can also contribute to the development of metabolic disorders in organs like the heart (such as cardiovascular disease) and the memory (such as Alzheimer's disease) (Dallman, 2010) (Jaenisch, Bird A, 2003).

Similarly, intrinsic factors influence the efficiency of nutrient metabolism. The function and particular activities of membrane transporters, receptors, signalling proteins, enzymes, carrier proteins, transcription factors, and other proteins involved in the transport, sensing, and processing of particular nutrients are affected by the variability in gene frequencies, which has an impact on the effectiveness of destructive metabolism. Genetic variants in NPC1L1 have been related with the incidence of cardiovascular events, but it remains obscure if the impact of NPC1L1 on cardiovascular risk is dependent on its role in cholesterol absorption (Yiheng Chen, Marek Michalak, and Luis B, 2018). Biological context is determined by Sex and aging and serve as important modifiers of metabolic efficiency. Both genders have distinct features in terms of metabolic profiles, gene expression programs, and susceptibility to diseases. Aging is associated due to degradation of metabolic efficiency which is caused by deterioration of cellular and genetic components resulting from chemical destruction accrue through life stages. At the primitive level, aging is associated with gradual changes in cellular processes designed to maintain homeostasis (Groenendyk, Agellon, Michalak, 2013). Also, it was shown that both cell-intrinsic and cell-extrinsic components contribute to immunological ageing. Although persistent viral infections may hasten immunological ageing, individual differences in ageing must be taken into account (Michael, Christopher, Shultz, Yvette, Nafees, 2014).

EFFECT OF VITAMINS ON IMMUNITY

Vitamins are necessary nutrients in our diets and have long been known to have an effect on our immunity. (Mora et al., 2008).

Vitamin A : Retinol and carotenoids are known to be the rich source of vitamin A. large amount of vitamin A can be supplied through yolk, liver and milk fat. Vitamin A act through either all-trans retinoic acid, 9-cis retinoic acid or other metabolites and nuclear retinoic acid receptors and plays an obligatory function in the formation of innate and cell-mediated immunity (Villamor & Fawzi, 2005). According to the demonstration done on children, children's with hypovitaminosis A and anemia show a significant increase in supreme CD4 and CD8 T-cell after vitamin A supplementation (De Azevedo Paiva et al., 2010). Although vitamin A may have anti-inflammatory effect, it takes charge in formation the epithelial tissues, which spreads over the body, provide continuity in immunity functions (Kursat K and Nurfer, 2012).

Vitamin C: Vitamin C has important functions in the body: it plays a significant role in the immunity and its deficiency causes defects in immune functions. During the process of infection Vitamin C which is present in leukocytes is extensively exploited (Maggini et al., 2007), so its deficiency is caused during this illness and stress. However, the studies of the impacts of Vitamin C on catarrh and upper respiratory contaminations show that it doesn't diminish the disease rate anyway it decreases the time and incidents stress. Vitamin C also contributes to iron absorption; it is also known as anticancer element (Saygin, Karacabey, Ilhan, 2006).

Vitamin D: in its active form 1, 25, dihydroxycholecalciferol [1, 25 (OH) 2 D3] Vitamin D, especially is advantageous for calcium utilization and bone mineralization in the body, together with this important role, it is significantly critical in the regulation of immune system (Griffin, Xing, & Kumar, 2003). Deficiency of vitamin D results in exploitation to infections because of insufficient and impaired responses from innate and antibody specific immunity (Wintergerst, Maggini, & Hornig, 2006). When taken in adequate intake (50 mcg is recommended), optimal immune functions can be carried out along with reduction in autoimmune disease incident.

Vitamin E: Vitamin E is regarded as the primary defence line aligned with peroxidation of lipids in the body tissue which is a fat-soluble antioxidant and is essential for regular utility of the immune cells (Lee C. Y, & Wan F, 2000). For the formation of immunomodulator and platelet on the grounds, vitamin E perform inhibitory activities, it helps in enhancing the immune response. Moreover, vitamin E increases white blood cell levels, aids in the killing of foreign cells, aids in the death of germs by specific cells, and increases resistance to infectious agents. Moreover, it increases the effectiveness of the immune system. It intensifies the body resistance against catarrh and other infections and prevents vitamin A getting oxidized. It consumes good sources of vitamin E such as vegetables, hazelnut, walnut and legumes adequately (Barba, Esteve, Frigola, 2012).

Vitamin K: One of a dependent protein to vitamin K which is Protein S, is believed to be associated to C4B binding protein (C4BP), and this connection suggests favourable outcomes for B cells. For normal coagulation and modification of protein Vitamin K performs a crucial role (Kursat and Nurfer, 2012).

Vitamin B: It is a water-soluble vitamin. B-complex vitamins are thiamine, riboflavin, niacin, vitamin B6, pantothenic acid and biotin (Palmer, 2011). folic acid and B12 are also among the group B vitamins. Vitamin B6 is effective in immune function by acting as coenzyme for more than 100 metabolic reactions and is essential in nucleic acid (Oka, 2001) and protein biosynthesis. Cofactors of several enzymes include vitamin B6. However, vitamin B12 is effective for DNA and RNA synthesis where it is necessary for cell replication. In addition, it also acts as a modulator of human immunity; it functions in facilitating the production of T-lymphocytes recruited in cellular immunity, restoring abnormally increased CD4/CD8 ratio and maintains the count of lymphocyte subgroups in the normal range (Farhan, Muhammad, Rabia, Azmat Ullah, 2015). Vitamin B12 favors both humoral and cellular immunity and is involved in carbon-1 metabolism. B12 and folic acid, assume significant part on protein, DNA and RNA incorporation. They are consequently strongly tied to the immunological system. (Kursat and Nurfer, 2012).

CONCLUSION

Nutritional Supplements have been usually viewed as sustenance, giving natural substances expected to cells development and expansion, and fuel for controlling cell digestion. It has fundamental to have a sufficient and adjusted nourishment for solid development and improvements. Nutrient's part in insusceptible framework capacities can't be disregarded. In other words, healthy our nourishment is, the stronger immune system we possess. A few healthful components, like proteins cancer prevention agents (proteins antioxidants), and zinc have the uncommon advantages on resistance capacities. Arrangement of these dietary components through normal food sources will keep individual from the symptoms of harm.

The processed food varieties that are unmistakable in the Western-style dietary example might be the significant factor answerable for the ascent of procured metabolic disorders as seen in created social orders. The drawn-out utilization of these food sources, which regularly have helpless supplement variety and exorbitant energy content, lead to inadequacies in key supplements.

Every person needs a sufficient amount of vitamins and an adequate, balanced diet to maintain a healthy immune system. A balanced diet is essential for strengthening the immune system and lowering the likelihood of contracting infections.

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