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The Effect of Nutritional Elements on the Immune System

Kursat Karacabey* and Nurfer Ozdemir

Physical Education and Sports, Gaziantep University, Gaziantep, Turkey

Abstract

Background: This study has been done to analyze the effect of nutritional elements on human immune system. Human body possesses many elements in order to protect itself. In the simplest term, the outer creatine layer on the skin is one of them. Human immune system, along with the cells in peripheries circulation, hormones and solvable immuno modulators is fairly sophisticated and had yet not been resolved completely. Immune system, in human organism detects the molecules which are unfamiliar to its own structure and responds to them in convenient terms. In the event of pathogen factor entrance into human body, immune system steps in to action and creates immune response.

There are many factors that affect immune system functions, one of those is nutrition. There is a significant correlation between immune system and nutrition, furthermore malnutrition shouldn't be considered as energy and a protein deficiency alone. Due to these reasons, the main aim of nourishment is not merely to gain energy and protein, but to enhance resistance against ailments with some specific nutriment and to turn the inflammatory response in someone's best interests. The nutriments which show beneficial effects on immune system are called. Immune nutriments and nourishment on these nutriments is called immune diet. The main fields of application of immune diet is patient undergoing surgery, traumatized, cancer patients, patients who need intensive care and patients with serious infections such as sepsis.

Conclusions: In conclusion, in order to strengthen our immune system, to reduce the risks of ailments and to stay healthy the body defence system in our body should be strengthened. To do so, particular costly medicines can be used; however, regular exercises and having an immune diet will be more economical and natural preference.

Keywords: Nourishment; Immune system; Nutritional elements; Immunological nourishment

Introduction

Human beings are in close relation with the microorganisms that were common in nature. Immune system is a means of protection against the damaging effects of noxas, which cause infection in our bodies. Immune system is a form of protection consisting of, thymus, spleen, lymph nodes and some specific immunity cells [1].

Immunity, on resistance against microorganisms acts both naturally and acquired in a complex mechanism, but they are mostly in collaboration. One of the factors that affect natural resistance is nutrition. Malnutrition breaks down the immune functions by suppressing the immune system [1].

The dietary factors that cause harm to immunity functions are either deficient intake of macro-nutrient elements (fat, carbohydrate, protein) or deficiency in some specific micronutrient elements (vitamin, mineral, water). Balanced nutrition, especially in terms of adequate vitamin, mineral and protein intake, enhances the resistance against infections. Research's show that balanced nutrition subsidizes the immune system and Cary out vital importance on the system [2].

Nutrition has an impact on body resistance and microbes. Excessive strain, Traumas, Ambustions, etc., could cause protein destruction consequently body resistance decreases. Malnutrition, especially in childhood play vital role in catching illness and mortality. Malnutrition paves the way for infections and their complications. This composed infection distorts the nutrition and abates the immunity [2,3].

The effects of nutritional elements on immune system has been a study case for many research's because there is significant influence on supporting immune system and in deficiency it causes malfunction in immune system [2,3].

Immune system

Immune system is a common name for structures within our bodies that protects living organisms against harmful substances. Human body possesses many elements in self defence. One of the simplest of those is outer creatine layer on the skin. Another element is biochemical body units [4].

The substance that stimulates the immune system is generally known as nonspecific substance like macrophage and neutrophils that enhance the defence capability of phagocytes. The many of those substances ad here the surfaces of phagocytes and lymphocyte cells and also stimulates the production of interferon, interleukin and sophisticated compositions, consequently activates the immune system [4].

Immune system has a structure that consists of similar neurologic system. One of the most significant traits of immune system is, having the ability of recognizing the millions of different threats and distinguishes them. Thanks to this trait, the functionary cells in immune system, detect the unfamiliar object, memorise it and recognise it when coming across later.

These structures are; thymus spleen, lymph nodes and specific immunity cells. Immune system gets down to work as soon as pathogenic factors entering the body. This defence carried out by immune system against pathogenic called "immune response" [1,5,6].

***Corresponding author:** Dr. Kursat Karacabey, Associate Professor, Physical Education and Sports Gaziantep University, Gaziantep, Turkey, Tel: +90,3423601616 ext1400; Fax: +90,3423600751; E-mail: kkaracabey@hotmail.com, kkaracabey@gmail.com

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Immune system is a moliminous mechanism in fighting against diseases and sanitation. The possible response of immune system against body cells is called autoimmune reactions and consequently autoimmune disorders occur [7-13] (Figures 1 and 2).

Effects of nutrition on immune system

It is known that each year in the world 6 million children die because of infections caused by malnutrition due to breakdown in immune system. Therefore we must make sure we consume adequate protein, especially milk dairy products, eggs which are biologically valuable proteins in order to keep our immune system strong [3].

In addition; we must also regularly consume foods which are thought to be our first defence line against free radicals such as Vitamin C, E and foods consisting of beta-carotene. Despite the fact that infamous reputation of free radicals, they are highly needed in our lives and they only become dangerous when they are excessive.

Micronutrients called antioxidants can provide protection against free radicals. Antioxidant is a substance that prevents foods especially fats from oxidation and spoilage. As the name suggests, it prevent chain reactions by counteracting combination of oxygen with other substances, so those substances want be oxidized [14].

Malnutrition breaks down the immunity functions by repressing immune system. Repressive immune systems cases have been increasing recently [13]. The dietary factors that cause malfunction in immune system could be insufficient intake of energy and macronutrients (CHO, protein, fats) or deficiency of specific micronutrients [8].

The nutriments which support and stimulate the immune system are called "Immuno nutritional elements" and some effective vitamins are included in this group [15] (Figure 3).

Effective nutritional elements on immune system

The nutriment which benefits our body physiologically or reduce the risks of getting illnesses rather than nutritious features, are called functional nutriments.

The functional nutriments term indicate the correlation between nutriments and health. The functional nutriments maybe the nutriments that are consumed naturally in daily feeding habits or, those genetically modified, or enriched nutriments (eggs containing omega-3, phytosterol added margarines) For instance, canola oil with improved fatty acid, cranberry juice for urinogenital cases, we can also exemplify omega-3-fatty acid derived from fish and flaxseed, Iso - flavones derived from soy beans caratenoids (beta-carotene and lycopene) derived from carrots, tomatoes and other citrus fruits,

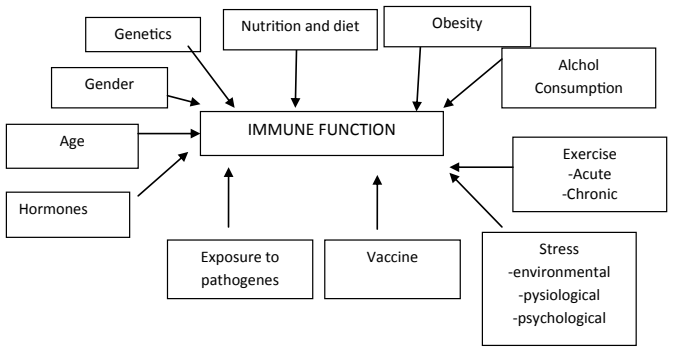

Figure 1: Factors effecting immune function [8].

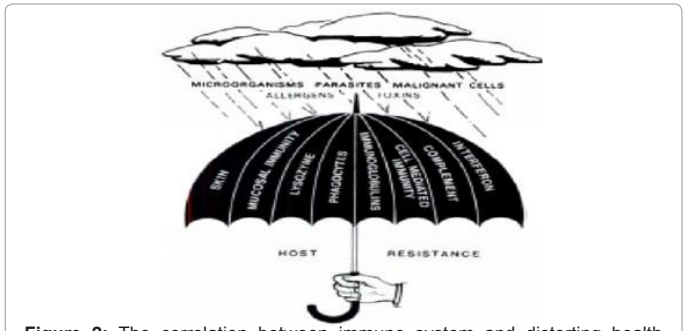

Figure 2: The correlation between immune system and distorting health elements [2].

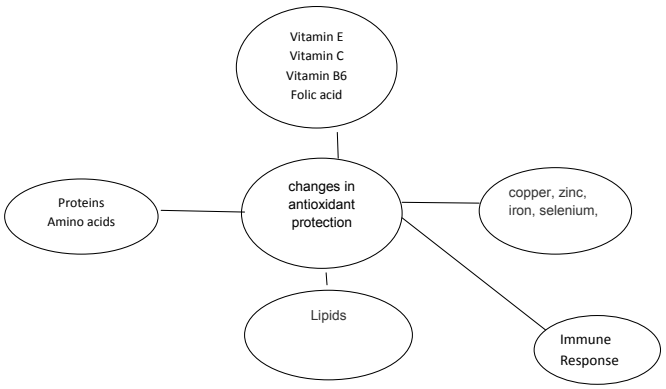

Figure 3: Nutritional elements and immunity response relation [5].

sulforafan derived from broccoli polyphenols from tea and wine, solvable fiber delivered from barley and oat in those group of foods [11].

Carbohydrates (CHO): Carbohydrate is an important fuel cell for immune system. That anaerobic glycolysis showing an increase on lymphocytes, stimulated in mitogens, indicates the increase of glucose as a fuel. However during the lymphocyte proliferation, usage of carbohydrates for energy decreases. In this case, glycol tic mid products are directed to purine and pyrimidine nucleotide synthesis for cell growth [2,3,8].

Carbohydrates are nutriments largely found in vegetative foods containing carbon, hydrogen and oxygen molecules [8,16]. They are classified as simplistic (sugar) and complicated (starch) Glue ides are found in sugar , fruits and fruit juice. On the other hand complicated starch is found in vegetables, legumes and cereals. Carbohydrates are situated in human body as glycogen in a small amount. Glycogen is mostly in liver. In other organs and muscles a little amount of glycogen exists.

That being present in blood in the form of glucose in certain amount, is very important in respect for provision of continuous energy for tissues [8,17]. It is emphasised that on high CHO diet, consignation of raw CHO sources affection of immune system negatively. The key point that makes CHO an important figure in immune system is that, it is the most important fuel and its ability of prevention the decrease of number of cells conjoint to apoptosis [18].

Fats: Fats are among the most important nutrition sources for our lives. Fats take an active pole in some biological functions such as; absorption of vitamins A, D, E and K needed for human and animal

nutrition, being a source of omega 3 and omega 6 oil acid, being functional at neuritis functions, provision of permeability and stability for cell membranes [18].

Fats are important energy sources 1 gram fat provides twice the energy as protein and carbohydrate does [16]. Fat acids are powerful modulators of immune response. Studies on animals verify that conjugated linoleic acid available in meat and dairy products stimulates the immune system and prevent breast cancer.

Linoleic acid also decreases allergic sensitization. Diets, containing high amount of fats can also decrease cellular inflammatory activity and immune response [19]. It is a well known fact that omega 3 fat acids lower blood pressure and plasma aggregation and inflammative response [18]. It also features in controlling cellular immune response [11].

Proteins: Proteins make up frame work for cells. They are also framework of body defence systems, enzymes that control body functions, and some hormones [17].

Proteins are nutriments that contain nitrogen, carbon, hydrogen and oxygen in their chemical structures. Many immune mechanisms rely on production of active protein compounds or cell replication. In protein deficiency, functions of immune system decrease. It is thought that the negative effect of protein deficiency on immunity is connected with the effect of immune system regulator for some amino acids. Deficiency in essential amino acid can also cause repression on immune system. Too much consumption of some amino acids can cause diverse effect on immune system functions [19]. The latest studies show that protein metabolism play an important role in formation of natural and acquired immunity against infections.

Arginine: Arginine is an amino acid mainly used for hospitalized patience's [20]. It is among the amino acids containing most nitrogen in the course of growth, illness or metabolic stress, endogenous syntheses remain incapable and it is regarded as conditional essential amino acid. It enhances lymphocytic progress and phagocytosis, and speeds up the wound healing. It enables normalization of T-cell response after serious surgical procedures and traumas. On arginine deficiency, NEK risk arises. It has also antitumor activity. It stimulates anabolic hormone cycle and enhances nitrogen balance [20]. It is required to have a look at studies, done with arginine to determine its location in immune nutrition.

Glutamine: It is the most freely amino acid in blood. Besides it is an important nutrient for prolific cells (blood cells, intestinal cells, cancer cells, etc). It ranks among the antioxidants, glutathione pyrimidine nucleotides, gamma amino butyric acid syntheses. In some cases, such as cancer treatment and intestinal injury, it has curative effects for digestive system. By this way, it can prevent micro be contamination to blood from intestines.

It also takes part in regularization of acid-base balance. It is precursor of glutathione. In serious illness, it can be given either through vascular access or orally; however presentation orally to those babies with low birth weight can lower the risks of fatality rate. It is also important for nitrogen transport between organs.

Patients that are given glutamine, after bone marrow transplant, the number of lymphocyte, T-lymphocyte, $CD4^+$ and $CD8^+$ is upwards [6,20]. Because it is not crucial for an amino acid, which absence in healthy bodies may not be a fail. Therefore, there is no need for daily intake [21].

Vitamins, minerals and other supporters: Another effective nutritional element on immune system is vitamin. Vitamins are sub-branch of nutritional elements which play important role on growth and development, carrying out neurologic and digestion functions, using nutrimental elements effectively, supporting immune system and keeping sanitary [21-23].

Besides the important functions on metabolism, they are on duty for keeping normal cellular function in order [9,11]. In the course of inadequate intake, a break down occurs in growth and body functions. Most vitamins are not synthesized in human body, therefore they should be taken with the diet [10]. Vitamins distinguish as fat-soluble (A,D,E,K) and water-soluble (B,C) [14,22] and the effects of these vitamins on immune system, have been study case for many research [9,23,24].

Ailments, related to vitamin deficiency occur, as a result of vitamin deficiency. Vitamin deficiency causes repression in production of immune cells and cause malfunction [12,23].

It has been established that, vitamins that are considerably important in general metabolism, are very functional at resistance and immune mechanism and vitamin A, vitamin C, pyridoxine, pantothenic acid and thiamine are very effective against infections. In vitamin A and C deficiency, repression in studies stating that [20,23].

Using vitamins A, E, C beta, carotene, and folic acid along with B_{12} as a supplement is very effective on cardiac vascular complaints and cancer mortality and morbidity. However some prospective trials suggest that β carotene supplements have little positive effect. Nevertheless it has been reported that vitamin C have positive effect on atherosclerosis. Vitamin C supplementation for cancer patients enhances the life quality and life time [21,25,26].

Water soluble vitamins:

- **Vitamin B:** It is a water soluble vitamin. B-complex vitamins are thiamine, riboflavin, niacin, vitamin B6, pantothenic acid and biotin [13]. Apart from these, folic acid and B_{12} are among the group B vitamins [22,23,25].

It is thought that, riboflavin, vitamins B_6, B_{12} and folic acid are effective on immune system [14,26]. Vitamin B_6, is the most needed one for immune system among other group B vitamins [21,22].

B_{12} and folic acid, play important role on protein, DNA and RNA synthesize. For this reason they are closely related to immune system. In vitamins B_6 deficiency, production of immune body and lymphocyte decreases. Same deficiencies emerge in folic acid deficiency [21,23].

Vitamin B_{12} also in close relation with folic acid and deficiency of it effects protein and nucleic acid synthesis negatively [22,23].

- **Vitamin C:** The effects of vitamin C on immune system have been argued for many years however many people have been consuming it in order to avoid flu and catarrh. It has been seen from the studies that supplementation of vitamin C, enhances the production of white blood cell, and immune body and helps their proceedings.

However the studies of the effects of Vitamin C on catarrh and upper respiratory infections show that it doesn't reduce the infection rate however it reduces the time and stress of incidents [12].

It is claimed that vitamin C protects the body against infections and bacterial toxins. During the infections, the amount of vitamin C in the

body decreases [12]. Vitamin C also contributes to iron absorption; it is also known as anticancer element.

The functions of group B vitamins are so multifarious. For instance, thiamine take charge in carbohydrate metabolism riboflavin in protein and fat metabolism lastly niacin takes charge in all metabolic functions [12,22,23,27].

- **Vitamin A:** Vitamin A is a fat soluble vitamin. Vitamin A that is needed for body is supplied from retinol and caratenoids [23,28]. It is mostly available in yolk, liver and milk fat.

Especially in children, pneumonia and diarrhoea progress slowly. If there is any vitamin A deficiency then course of illness having vitamin A makes the disturbance gentler. In vitamin A deficiency production of immune body decreases, if vitamin support is made immune body production increases.

It is thought that vitamin A may have anti inflammatory effect. There are many cases indicate that vitamin A support decreases the inflammatory response in acne bronchopulmonary dysplasia and same cancer cells [29,30].

A fat soluble vitamin A, take charge in formation the epithelial tissues, which spreads over the body, visual function and provide continuity in immunity functions [30].

- **Vitamin D:** Vitamin D which is derived from fish and fishy oil and synthesized endogenously by isolation has [14,23] many responsibilities in providing the usual calcium and phosphorus level in blood absorbing calcium to the bones [31], muscle contraction, nerve conduction and other cellular functions [32-34].

After determination of vitamin D receptor in cells, it has been understood that it has many other functions apart from already known classical functions [23,32].

It has been concluded in consequence of the studies conducted that vitamin D might have immunomodulatory affects [7,13].

It is thought that, in adequate in take (50 mcg is recommended) of it, it can be effective in carrying out optimal immune functions, reduction in autoimmune disease incident and enhancing the clinical picture [7,33,35]. In the same time, it is a powerful immune system regulator [7,33].

- **Vitamin E:** Vitamin E shows inhibitory activity to formation of immunomodulator and platelet [22] on the grounds that it is a fat soluble antioxidant, it enhances the immune response. Having taking vitamin E, stimulates the enhancement of white blood cell, helps them to destroy foreign cells, helps destruction of microbes by special cells and enhance resistance against infectious agents. It also enhances immune body productivity. Even though different results have been obtained, it has been seen that it lessened multiple infections while it has no effect on respiratory tract infections in elderly.

Vitamin E is effective in strengthening immune system. It enhances the body resistance against catarrh and other infections and prevents vitamin A getting oxidized. It has important to consume good sources of vitamin E such as vegetables, hazelnut, walnut and legumes adequately [36,37]. Its antioxidant functions make vitamin E primarily effective against infections [22].

- **Vitamin K:** Vitamin K, which is a crucial vitamin for normal coagulation and modification of protein that are dependent to it, is thought to be in relation with some immune cells [38]. Protein S one of a dependent protein to vitamin K [14], is thought to be related to C4B binding protein (C4BP) and this relation indicates us positive results in favour of B cells [39].

Antioxidants: In the course of metabolic functioning a large number of oxidant substances develop. These are so reactive free radicals and they should be neutralized by antioxidants for not to be harmful to cells.

However free radicals develop on normal body conditions, it can also develop by radiation smoking, pollution, foods and medicines. Free radicals are use full to body, for they are used for killing microbes. However, surplus and needless ones should be neutralized at once. In the course of neutralization of free radicals, Se, Zn, Cu and Mn needed for enzymes to function.

Vitamin E, vitamin C, vitamin D, alfa tokoferol, beta-carotene, uric acid, transferrin, seruloplazmin, flavonoids, lycopene (tomato) are elemental antioxidant substances. There is no need to take extra antioxidants for a person who has health food regularly. The more refined food consumption in daily consumption the fewer intakes of antioxidants [23,28].

Vitamin A, C, E and enzymes such as beta carotene zinc, selenium, copper, glutathione superoxide dismutase and glutathione peroxidise have this anti oxidant functions [11]. Vitamin A, C, E, zinc and selenium are called “war quintette” because of their power full antioxidant traits [23].

Minerals: Minerals are colourless substances found in nutrients and are vital for cellular functions [16] minerals are substances that can’t be self created by body.

Minerals generally collaborate with vitamins and provide vitamins transportation to the most needed areas. At the same time, they play important role in blood pressure cardiac rhythm, muscular functions, keeping the fluid balance, fertility and many more functions.

The scientific studies show that mineral loss and deficiency affect our health directly [17]. There are identified at least 13 vitamins as well as improperly distributed in tissues they all are available in fish [40]. Fish, as well as being a good source of poly unsaturated fatty acids (omega3) calcium, phosphor, selenium and iodine minerals for the development of brain functions, it also helps strengthen the immune system [36].

Aquatic products are magnificent calcium and phosphor course, containing between 15 to 200 mg calcium in every 100 g and 100 to 400 mg in every 100 g in some species. Fish is recommended to those who need sodium died with the containable 60 mg sodium in 100 g muscle.

Potassium which functions as a catalyser in carbohydrate and protein metabolism, eurhythmy, nerve transmission, muscle contraction is found in fish meat in the ratio of between 250-500 mg in every 100 g. Again fish meat is a good source of magnesium which functions as a catalyser in enzyme systems [40].

Trace elements:

- **Selenium (Se):** It is a crucial element which is needed for the progression of both natural and acquired immune system. In serious diseases, deficiency in selenium increases the fatality rate considerably.

Glutathione peroxidise which formed during daily metabolism and which is catalyzing hydrogen peroxide and organic peroxidises is determined to selenium. It ensures the integrity of cell membrane and prevents DNA damage. It reduces the fatality rate in sepsis treatment, infections rate in ambitions; consequently it reduces the antibiotic usage. In default of it, antibody formation decreases, transportation of white blood cells slows down and injuriousness of some viruses' increases, Selenium support enhances the antibody level in blood.

There are far more traits to be discovered about selenium [19]. Selenium possesses important immunity functions in protection of cells against oxidative damage. Selenium is mostly found in aquatic products, kidney, heart and liver and also in whole wheat [41-43].

- **Zinc (Zn):** Zinc has features stimulating the immune system. Zink helps prevention of infections in the long term. Beside this, it has been seen that, zinc pastilles speed up the viral diseases and are very effective in relieving the symptoms.

It is needed for many enzyme activation including DNA and RNA synthesis. It has also antioxidant effect. In deficiency, malfunction in cellular immunity, deterioration in acrodermatitis and enteropatica, increase, in fungus, virus, bacterial infections; decrease in thymus gland and lymphocytes and changes in rations, diarrheal, malabsorption and slowdown in growth occurs.

The effects of zinc on immune system functions take place with immunity support. Adequately zinc intake improves the anticancer effect of vitamin A and helps newly developed cancer cells by strengthening defence system. The best zinc sources are giblets like liver, meat aquatic products, eggs, cheese, walnut, hazelnut, whole wheat and whole wheat bread [40-44].

- **Capper (Cu):** Copper plays an important role in immune system development and continuation. Even though, both deficiency and superabundance cause some negative effects on immune system, in take with food is generally sufficient and immunity problems relating to capper deficiency aren't encountered [43,44].

- **Iron (Fe):** Both deficiency and superabundance have an effect on immune system. Virus and bacteria need iron for proliferation. There for during acute infectious diseases, giving iron should be avoided. In iron deficiency, transportation of white blood cells toward infectious areas decreases and destruction of microbes that entered in cells abates.

Fertility of lymphocyte, in charge of defence, is affected negatively in deficiency of iron. However, cells, in charge of production of antibody, what is called humoral immunity aren't affected by iron deficiency. It can be emphasised that, in areas wide spread of malaria; iron support to children can increase the complications [22,23,43].

Prebiotics and probiotics: Probiotic products are beneficiary microorganism added nutrients. Intestines are known as the biggest immune organ in body. Intestines bacteria are always in interactivity with the immune system bacteria in intestines. This interactivity is very important for immune system development. Probiotics are effective on systemic immune response as well as strengthening the immune system is gastrointestinal system. Probiotics can activate the effects mentioned above [10,34,43].

Non-pathogenic microorganisms, which regulate mucosal and systemic immunity when taken with foods, are separately and which regulate the nutritional and microbial balance, are called probiotics [31,34,43]. Probiotic consumption has some immune inflammatory diseases e benefits; immune system stimulation, regulation, protection against enteric infections, and immune inflammatory diseases (inflammatory bowel diseases) mitigation of lactose intolerance symptoms, reduction in blood cholesterol level and prevention of cancer [11,45-47].

It has been stated that, probiotics strengthen the mucosa defence systems and affects on immune stimulation. Probiotic bacteria stimulate the immune system of host, by effecting specific immunity and natural immunity. It has also been stated that, the presence of probiotic bacteria in viable cell's intestines, stimulates and strengthens the immune system [44,46-48].

Conclusion

It has essential to have a adequate and balanced nutrition for healthy growth and developments. Nutriment's role in immune system functions can't be ignored. That is to say, however healthy our nourishment is, the stronger immune system we possess. Some nutritional elements, such as proteins antioxidants, and zinc have the special benefits on immunity functions. Provision of these nutritional elements through natural foods will prevent person from the side effects of overuse. Weight-loss programs, in which less than 1200 kilocalorie foods is consumed effect the immunity functions, for this reason, these extremely unhealthy so-called fast weight-loss diets should be avoided. A healthy immune system lets us fell well look well and lets us use our energy more effectively. Remaining away from the stressful factors, approaching life and events positively, keeping away from smoking and alcohol, adequate and balanced nourishment and regular exercising are among the supports we can give to our immune system. However, sometimes, these supports become insufficient and we may need some strengthening out sourcing for our immune system. This supports should be preferred through natural nutrients rather than medications.

For a proper nourishment program, it is advised to seek professional help from a die titian. It has been proved that, fresh fish, vegetables, mushrooms, medicinal herbs, herbal teas, omega 3 fat acids (plentifully available in salmon and mackerel) complex carbohydrates, yogurt, kefir and seaweed stimulate the T-cells and other immune cells.

Every individual should have an adequate and balanced diet and have sufficient amount of vitamins in order to have a functional immune system. It's vital to have a balanced diet for straightening the immune system and reduce the risks of catching infections.

Consequently in order to strengthen the immune system, reduce the risks of diseases and stay healthy, natural defence system of our organism should be strengthen. To achieve this, particular costly medicines can be used or alternatively regular exercise and having immunological nutrients will be more economical and natural preference.

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