

A Systematic Review on the Role of Several Drugs and Nutrients in Enhancing Immunity in the Pandemic Situation of COVID-19

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Article Information

Article Type: Review Article**Journal Type:** Open Access**Volume:** 1 Issue: 1**Manuscript ID:** JCV-v1-1114**Publisher:** Science World Publishing**Received Date:** 29 December 2020**Accepted Date:** 20 January 2021**Published Date:** 25 January 2021***Corresponding Author:****Swarupananda Mukherjee,**

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Citation:

Mukherjee S (2021). A Systematic Review on the Role of Several Drugs and Nutrients in Enhancing Immunity in the Pandemic Situation of COVID-19. J Corona Virus. 1(1); 1-1

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ABSTRACT

COVID-19 through all the world in extreme tension. Gradually thousands of people are being affected day by day. Some of them are cured and some face death. No medicine is discovered till today. One thing is noticeable that the persons having proper immunity power are the winner of COVID-19. There are so many ways- proper nutrition and diet- to increase and maintain immunity power. Wearing face masks, following physical distance, practicing good hand hygiene are important factors in this situation to prevent the attack of corona virus. Along with these factors good hygiene and diet should be maintained properly. There are several phytonutrients, vitamins, proteinaceous foods and also carbohydrate and fat which are going to help human beings to progress their immunity. I want to focus in this small review paper to summarize the major important types of foods and their role in promoting human health by which they can survive in this pandemic situation.

KEYWORDS: Immunity; Mineral sources; Nutrition; Phytonutrients; Probiotics; Vitamins

INTRODUCTION

Immunity is the power to defend the body from infectious disease, which may be caused by bacteria or viruses. There are mainly two types of immunity namely innate immunity and adaptive immunity. These are also known as non-specific and specific immunity respectively. Innate immunity involves of defensive barriers like first line defense (skin) and second line defense. The lymphoid organs

distributed throughout our body are under the immune system. These are classified as a. primary lymphoid organs (thymus) and b. secondary lymphoid organs (spleen, tonsil, lymph nodes, and appendix). B and T lymphocytes are main part of our immune system (Figure 1). B cells arise in bursa fabricius in birds, and bone marrow in mammals. T cells can be found in thymus. B cells give humoral immunity whereas T cells give cell mediated immunity. T cells can be divided into four different types like a. Inducer T cells, b. Cytotoxic T cells, c. Helper T cells, d. Suppressor T cells. [1-3]

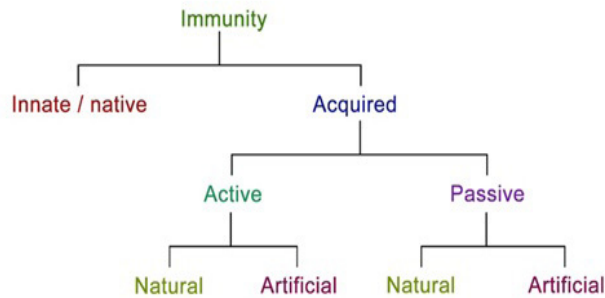


Figure 1: Classification of immunity.

Example of different types of immunity:

1. Innate immunity- skin provides mechanical barrier to prevent entry of microorganism.
2. Natural active acquired immunity- it is obtained from direct contact with disease.
3. Artificial active acquired immunity- it is obtained from killed vaccine, toxoid.
4. Natural passive acquired immunity- it is getting from placenta, mother milk.
5. Artificial passive acquired immunity- it is present in immune serum [4-5]. Concept of antigen and antibody- antigen is a chemical substance (foreign particle), after introducing into the body causes production of specific antibodies production by the body (Figure 2). Antigenic elements are also termed as immunogenic substances. Two important characteristic features of an antigen should be immunogenicity and reactivity. It exists on surface of microorganism or free molecules. Antibody is a chemical substance which acts against antigen to protect our body (Figure 3). It is pretentious in nature. It is mainly present on the surface of plasma cell and in body fluids. Five different types of antibodies are present in human body. These are immunoglobulin G, A, M, D, and E [6].

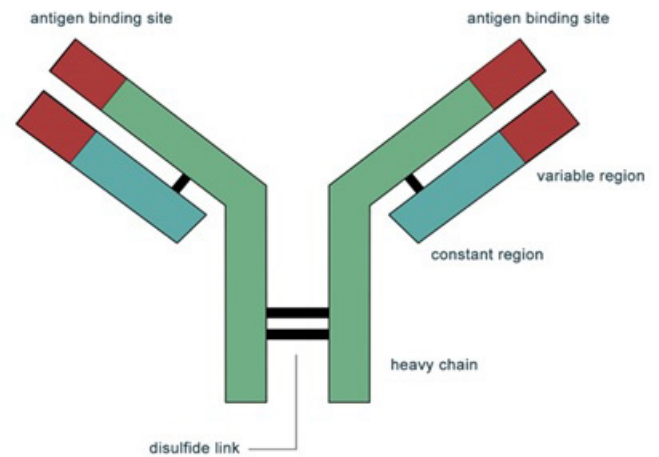


Figure 2: Structure of antibody.

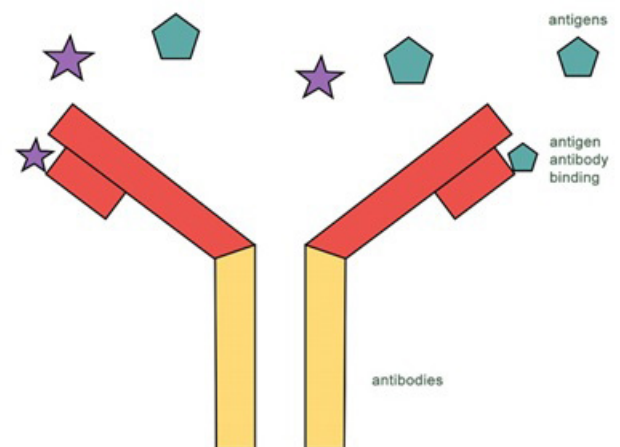


Figure 3: Antigen antibody binding.

IgG is largely present in human body. Lymph, blood, and intestine are full of this antibody. By increasing phagocytosis, it protects our body against bacteria and virus.

IgA is mainly present in tears, saliva, mucus, milk. Mucous membrane is locally protected by it.

IgM has the largest size. It is present in blood, lymph and on B cell surface.

IgD is also present in blood, lymph and on B cell surface. It involves in stimulating antibodies producing cells to produce antibodies.

IgE mainly presents on mast cell and basophil cells. It is liable for allergic reactions.

Immune functions affecting factors- several factors affect our immune system. These are as following- 1. Genetics, 2. Gender, 3. Age, 4. Hormone, 5. Nutrition and diet, 6. Obesity, 7. Alcohol consumption, 8. Exercise -Acute -Chronic, 9. Different stress like -environmental, physiological and psychological, 10. Vaccine.

Different vitamins related to nutrition- vitamins are organic in nature which is required in diet in small amounts to play various biological roles. Vitamin A, D, E, K are regarded as oil soluble whereas vitamin B, C, P are water soluble.

Vitamin A is required for vision, reproduction, epithelial cells maintenance, and adequate growth. Fish, egg yolk, cheese, butter, milk are the richest source of this vitamin. Retinol and retinoic acid are two important form of vitamin A which is necessary for prevention of keratin synthesis which helps to maintain epithelial tissue. Xerophthalmia, keratomalacia are dangerous disease which can be occurred due to lack of vitamin A.

Vitamin D is very essential to regulate plasma level of calcium (Ca²⁺) and phosphate (PO₄³⁻). The biologically active form of vitamin D is calcitriol. It plays important role on bone, kidney. Fatty fish, fish liver oil, are the main source of vitamin D. rickets and osteomalacia are the main deficiency disorder of vitamin D in child and adult respectively. The risk of microbial infection and death is diminished by Vit D by several mechanism. Partly by activating antimicrobial peptides, including human cathelicidin, LL-37, 1,25-dihydroxyvitamin D, and defensins, vitamin D stimulates cellular innate immunity. [7-11]

Vitamin E- tocopherol is natural antioxidant. It is also known as anti- sterility vitamin. It plays several physiological roles like protection of RBC from hemolysis, reproductive functions, cellular respiration, storage of creatine in skeletal muscle etc. Cotton seed oil, wheat germ oil, peanut oils are the major source of this vitamins. Sterility, muscle degenerations are more important deficiency disorder of vitamin E.

Vitamin K- vitamin K is available in three forms like Vit K1, Vit K2, and Vit K3 which are termed as phyloquinone, menaquinone and menadione respectively. It is the only vitamin which has specific coenzyme function. Vitamin K is required for production of blood clotting factors. Cabbage, cauliflower egg yolk, meat are sources of this vitamin. [12]

Vitamin C- it has several biochemical functions like collagen formation, folic acid metabolism, tyrosine metabolism, peptide hormone synthesis, iron and hemoglobin metabolism. Vitamin C increases antibody synthesis and also helps in increment of phagocytic action of leucocytes. Citrus fruits, guava, are main sources of vitamin C. [13]

Vitamin B complex- vitamin B complexes can be subdivided into two portion- a. energy releasing and b. hematopoietic.

Example of energy releasing vit B complexes are thiamine (vit B1), riboflavin (vit B2), niacin (vit B3), pyridoxine (vit B6), biotin (vit B7), pantothenic acid (vit B5).

Example of hematopoietic vitamins are folic acid, cyanocobalamin.

Coenzymes of thiamine (TPP) plays a significant role in the communication of nerve impulses. Vitamin B6 has one co enzyme named as pyridoxal phosphate. It takes part in several reactions like transamination, decarboxylation, deamination, condensation etc. Biotin is involved in many metabolic reactions like gluconeogenesis, fatty acid synthesis etc. Cobalamin is an essential vitamin for the proper function of the human body, and shortage is fairly widespread with advanced age. [14-15]

Flavonoids related to nutrition- these materials are containing O-glycoside and C-glycoside. Different types of flavonoids uses with examples are given in the Table 1. [16-20]

The therapeutic uses of flavonoids and their sources are explained in the Table 2.

Terpenoids as nutritional foods- these substances contain isoprene unit. These are obtained from plant and animal origin (table 3). [25-29]

Table 1: Flavonoids and example:

Types	Example
Flavones	Quercetin, leutolin
Flavonones	Hesperidin
Isoflavones	Genestein, diadzein
Flavonols	Kaempferol, myrcetin
Anthocyanins	Cyanidin, delphinidin

Table 2: Source and therapeutic action of flavonoids: [21-24]

Name of flavonoid	Source	Therapeutic action
Hesperidin, rutin	Buck wheat	Used in capillary bleeding
Ginkgolide	Ginko	Potent inhibitor of platelet activity factor
Silymarin	silymarin	Hepatoprotective

Table 3: Source and therapeutic use of terpenoids:

Active component	Source	Therapeutic uses
Alpha and beta pinene, histadine, piperine	Black pepper	Condiment, antibacterial
ascaridole	Chenopodium oil	Anthelmintic
Citral	Lemon peel	Carminative
Allin, allicin	Garlic	Anthelmintic, aphrodisiac
Taxol, cephalomannine	Taxus	Anticancer
Chrysanthemine A and B	Feverfew	Migrane, menstrual disorder
Myristicin, amyloextrin	Nutmeg	Rheumatism
Cinnamom aldehyde	Cinnamom	Astringent
Eugenol	Tulsi	Immunomodulator
Limonene	Lemon peel	Carminative

Limonoids- these compounds are triterpenoid in nature. Citrus fruits are rich with this compound. Limonin, nomilin, obacunone etc. are examples of limonoids. By inhibiting Phase I enzymes and tempting Phase II detoxification enzymes in the liver these compounds give anticancer activity.

Carotenoids- The immune response is modulated by beta-carotene and other carotenoids. In addition to breast health, carotenoids, which may not be associated with increased immunity associated with beta carotene supplementation, may also enhance reproductive strength. [30]

Mineral sources as nutritional substances- these are inorganic in nature. These substances play an important role which unquestionably crucial for the very existence of the organism. Minerals can be classified as macro and micro elements. These can be represented by Table 4. [31-32]

Macro minerals- Micro minerals, their major sources & functions are given in the Table 5.

Different naturally occurring substances can be used as nutritional foods which can help us to maintain our immunity level. These are as following (Table 6).

Table 4: Sources and functions of macro elements:

Elements	Major sources	Functions
Calcium	Milk and milk products	Constituent of teeth, bone, muscle contraction
Phosphorus	Milk, cereals, vegetables	Formation of phosphate, nucleic acid
Magnesium	Cereals, vegetables, fruits	Constituent of teeth, bone, and coenzyme of enzymes (kinase)
Sodium	Table salt	Balance of acid base values, osmotic pressure
Potassium	Fruits, nuts	Maintenance of acid base balance, osmotic pressure
Chlorine	Table salt	Preservation of acid base balance, formation of HCL

Table 5: Sources and functions of micro elements: [33]

Elements	Major sources	Functions
Iron	Organ meats, vegetables	Constituent of heme
Copper	Organ meats, vegetables, cereals	Constituents of enzymes (tyrosinase, oxidase)
Iodine	Ionized salts, sea foods	Goiter
Manganese	Cereals, vegetables	Cofactor of enzymes (arginase, carboxylase)
Cobalt	Foods of animal origin	Constituent of vit B 12
Fluorine	Drinking water	Proper formation of bone, teeth

Table 6: Sources and functions of different naturally occurring substances:

Naturally occurring substances	Sources	Functions
Dietary fiber	Fruits, vegetables	Lipid control, weight control, glucose control.
Probiotics	Kefir, sauerkraut, pickled cucumbers	Asthma, cancer, allergies
Polyunsaturated fats	Fatty fishes	Diabetes, asthma, mental health
Polyphenols	Tea, dry legumens, berries	Diabetes, cancer, microbial infection.

Carbohydrate as nutritional food- these are polyhydroxy aldehyde or ketones. It can be denoted by an empirical formula $C_m(H_2O)_n$. It is an energy sources in human being. 4 Cal/gm energy can be obtained from carbohydrates. These are the reserve material of plant (starch) and animals (glycogen) to meet the instant energy demands of body. Carbohydrates can also be act as precursors for many organic compounds like protein, fat. Monosaccharide, oligosaccharide, and polysaccharide are main types of carbohydrates. The key factor which makes CHO (carbohydrate) a significant material in immune system is that, it is one of the most fundamental fuels and it has also the ability to avoid the decrease of number of cells conjoint to apoptosis. There are several carbohydrates which can be used as laxative, and also protective peptic ulcer such as sterculia gum, guar gum etc. [34]

Several glycoproteins and their main roles during are given on the Table 7.

Several glycosaminoglycans and their functions are as following (Table 8)-

Fats as nutritional substances- These molecules contain hydrocarbons which form the building blocks of living cells' structure and function. Essential fatty acids are supplied in the diet as these cannot be synthesized in human body. Fats provide more energy than equal amount of protein and carbohydrate. Linoleic acid, linolenic acid and arachidonic acids are these types of fatty acids (Table 9). These have several therapeutics activity like allergic sensitization lowering property, cellular inflammatory decreasing activity and also provide immune response. [35]

Table 7: Glycoproteins and their functions:

Glycoproteins	Functions
Immunoglobulins	Defense against infection
Fibronectin, laminin	Cell- cell recognition
Intrinsic factors	Vit B12 absorption

Table 8: Glycosaminoglycans and their functions:

Glycosaminoglycans	Functions
Dermatan sulfate	Maintain shape of tissues
Keratin sulfate	Makes cornea transparent
Hyaluronic acid	Promotes wound healing

Table 9: Examples of several lipids:

Lipids	Example
Simple lipids	Triglycerides, beeswax etc.
Compound lipids	Phospholipids (lecithin, cephalin etc), glycolipids (nervon, oxynervon etc.)
Derived lipids	Cholesterol, ergosterol, lycopene etc.

Internal organs are protected by lipids, and it can also serve as insulating materials. Steroid hormones and prostaglandins are important as cellular metabolic regulators. One of the most abundant animal sterols is cholesterol. It is present in cell membrane and it helps in synthesis of bile acids, sex hormones, and vitamin D. Blood pressure lowering property and plasma aggregation preventing property and inflammation response are given by omega 3 fatty acids. Rice bran oil which contains oleic acid and palmitic acid is used as an antioxidant.

Proteins and amino acids as nutritional substances– carbon, hydrogen, oxygen, nitrogen, sulfur are the main constituents of proteins. Proteins can act as blood clotting factor, enzyme, hormone, immunoglobulin. They also take part in genetic control, muscle contraction, respiration. 50% of cellular dry weight is shaped by proteins and it also forms essential basis of structure and function of life. Adequate number of proteins and amino acids help to develop immunity, but excessive consumption may lead to various side effects. 10 essential amino acids are there which cannot be synthesized by our body. These should be provided by foods. The essential amino acids are arginine, valine, histidine, isoleucine, leucine, lysine, methionine, phenyl alanine, threonine, tryptophan (Table 10 - 12).

Table 10: The sources and physiological functions of these amino acids:

Amino acid	Sources	Functions
Arginine	Fish, grains, wheat, red meat etc.	Wound healing, maintaining immune and hormone function.
Lysine	Beans, soybeans, fish, meat etc.	Important for muscle and collagen, promotes absorption of calcium ion.
Tryptophan	Chicken, beans, cheese etc.	Important for determination of mood, behavior, and also important for serotonin synthesis.
Histidine	Soybeans, eggs, sesame, peanuts etc.	Helps to maintain healthy tissue in body, to maintain normal sexual functioning, natural detoxifier.

Table 11: The nutritional classification of different protein & amino acids uses in improve the immunity and their example are given in the Table 11 & Table 12.

Types of protein	Examples
Complete protein	Egg albumin, milk casein etc.
Partially incomplete protein	Wheat etc.
Incomplete protein	Gelatin, zein etc.

Table 12: Several non-protein amino acids are there several significant physiological functions:

Amino acids	Functions
Ovothiol	Antioxidant
Cycloserine	Antituberculosis drug
S- adenosylmethionine	Methyl donor in biological system

Nutritional effects of bitter glycosides- these compounds have several activities like bitters, stomachic, helps in digestion. Gastric juice secretion can be enhanced by these types of compounds (Table 13). The drugs belonging to this class are as following- [36-37] Several natural drugs are also there which can play their role as immunity enhancers (Table 14).

Table 13: Sources and uses of bitter glycosides:

Drug	Source	Therapeutic uses
Gentian	<i>Gentiana lutea</i>	Appetite stimulant
Picrorrhiza	<i>Picrorrhiza kurroa</i>	Stomachic, laxative, febrifuge
Chirata	<i>Swertia chirata</i>	Bitter tonic, used in dyspepsia
Quassia	<i>Picrasma excelsa</i>	Bitter tonic, thread worm expulsion
Gymnema	<i>Gymnema sylvestre</i>	Antidiabetic, weight lowering property

Table 14: List of natural drugs as immunity booster and their functions [38].

Name of the drug	Family	Physiological role
Garlic	Liliaceae	diaphoretic, expectorant, antispasmodic action.
Ginseng	Araliaceae	Stomachic, thymoleptic action.
Aswagandha	Solanaceae	Tonic in dyspepsia.
Turmeric	Zingiberaceae	Treatment of whooping cough.
Jeevanti	Apocynaceae	Antipyretic, antioxidant.
Giloy	Menispermaceae	Useful in treating jaundice.
Licorice	Leguminosae	Useful in treatment of ulcer.
Bael	Rutaceae	Treatment of diarrhea and dysentery.
Brahmi	Umbelleferae	Act as sedative, blood purifier and diuretic.

Role of probiotics in immunity- The intestinal microbial flora is controlled by probiotic supplements and promises potential as a functional way to enhance gut and immune function. By preserving GI function and health, preventing the immunosuppressive effects of extreme exercise, and susceptibility to illness, probiotics can indirectly aid athletic efficiency. Enteric bacteria also play a role in metabolic progressions, in particular by generating substrates from non-digestible starch fermentation. The interest in using probiotics to recover health is largely focused on their potential capacity to modulate different immune system aspects. To function as effective prophylactic agents against common diseases, probiotics must stimulate innate and acquired elements of the mucosal immune system [39].

The favorable effects of tea on immune system- Quercetin, caffeine are the chemicals present in tea which have activities on acquired and innate immunity. These chemical constituents help us

to protect us from infection of common cold, immune disorder, cancer etc. Oral conditions such as dental caries, periodontal disease, and tooth decay may have major effect on the general health of a person and can be a coronary disease risk factor. Intake of tea has been linked with lower human caries. Tea has several anticholinergic effects. Several mechanisms have been suggested to understand the reported anti-cariogenic effects of tea, including inhibition of plaque bacterial growth and inhibition of glucosyl-transferase and alpha-amylase production, which reduces the cariogenic ability of foods containing starch. Various polyphenolic components of tea have been exposed to have anti-inflammatory properties in animal and in vitro models, particularly during oxidative tension, though some of these belongings have been reported at concentrations which are unlikely to be replicated in vivo [40].

CONCLUSION

During this COVID situation we should keep our immunity power healthy and wealthy. There are several nutritional foods discussed in this small article. Different vitamins have different physiological effects. Minerals are also required for proper nutrition; these compounds help human beings to be energetic. Several flavonoids, phytonutrients, terpenoids, glycosides are also discussed here which can give us a boosting energy by which we can protect ourselves from corona virus. Carbohydrate, protein, fat should be taken at a proper amount. They also help to maintain our body needs. Proper diet and physical exercise are also important to be healthy.

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