

Role of Vitamin-C and Vitamin-D as an Immunomodulatory Dietary Source in Prevention of Infectious Disease Such as Covid-19

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ABSTRACT

BACKGROUND

It is necessary to take adequate and nutritious substances in the diet to fulfill the daily requirement. Carbohydrates, fats, proteins, minerals, vitamins are few of the integrants in the daily diet. Immunity is the multi gem and trailblazing connecting various cellular chains from organ to tissue and so on.

SUMMARY

This chain has explored to serve the antigens from the series of microorganisms like parasites, fungi, viruses, bacteria or carcinogenic cells. Components of WBC (White Blood Cell) like neutrophils and monocytes play vital role in enhancing immunity through wound healing. The above article kingpin the role of vitamin C nutritional function and its relation with immunity as an enhancing factor which can be utilized as a supplement and dietary component to fight against the preventive mode for pandemic diseases like Covid-19 in a systematic way. Antioxidant activity in function of cell cycle and internal health. Sapodilla, guava, orange, lime, mango, strawberry, broccoli and kiwi have an antioxidant property which gist the immunity. Vitamin C is potent immunity cell booster by preventing systemic infections and treating respiratory infections. The role of vitamin C and D per day to up heave the immunity as a preventive measure against various infections. The combine effect of both vitamin C and D can be best

preventive modality in order to maintain health hygiene and immunity and to stay disease free.

CONCLUSION

The above study is suggestive of the role of both vitamin C and D independently or combined as a dietary source to reduce the acute respiratory tract infection like COVID 19.

KEYWORDS: Immunity, vitamin C, Vitamin D, respiratory infections.

INTRODUCTION

Balanced diet is the exuberant factor of livelihood. The basic requirements of the body are obtained through healthy nutritious diet. Moreover few nutritional components are synthesized in body and others are absorbed through food. So it is necessary to take adequate and nutritious substances in the diet to fulfill the daily requirement. Carbohydrates, fats, proteins, minerals, vitamins are few of the integrants in the daily diet. Not only the palliative receptors yearning for sensations but there are many different systems in body ought to function with the help of these components some as an enzyme, some as cofactors and others as coenzymes etc. vitamins are also the component among these nutrients to be the most requisite for several systems. They cannot be formed in body. The external administration of vitamins is paramount for body. Excessive or insufficiency both causes a several pathology leading to diseases. Likewise vitamin C is the prime factor. In the ruling pandemic vitamin C supplements are vigorously given due to its respiratory symptoms and its efficiency to relieve from it. Dietary uptake can also be a boon to succor as a preventive aspect these days. Vitamin C acts as both curative and preventive role. Many studies are suggestive of the vitamin C and its role in boosting immunity.

Immunity is the multi gem and trailblazing connecting various cellular chains from organ to tissue and so on. This chain has explored to serve the antigens from the series of microorganisms like parasites, fungi, viruses, bacteria or carcinogenic cells. [1] Further classification of immunity involves cellular and epithelial obstacle of both specific and nonspecific types [1]. Multiple lofty nexus way these components are connected. Vitamin C plays an efficient role in numerous facets enhancing immunity specially triggering function of immune cells [2,3]. A tough barrier is created fraternizing the cells and the system.

Human body cannot produce Vitamin C among itself it is artificially synthesized or taken orally [4,5]. It also causes life-threatening disease like scurvy [6]. Scurvy diseased person is vulnerable to several infections related to pulmonary disorders and other fatal diseases [7,8]. Bleeding gums, bruising and healing The daily dose of vitamin c varies from age groups and slightly as per gender. Adult male needs 90 mg while female needs 75mg, in pregnancy the dose is 85mg, and lactation has 120mg. smoking alter these values as there is conjoint relation between smoking and respiratory disorders. Respiratory disorders have special reference to vitamin C and a chain ends up with relation of vitamin C and immunity. It increases the plasma concentration and reduces the risk of chronicity [9, 10]. Vitamin c requirement cannot be fulfilled many a times due to lack of healthy diet, poor dietary habits like smoking, alcohol, drug abuse, various diseases, pollutants or poverty [11, 12]. Vitamin C as an immune enhancer is convicted due to its antioxidant property by serving essential bio-components like carbohydrates, lipids, proteins, nucleic acid and prevents the cell synthesis due to exposure of pollutants and toxins [13]. **Increases Amidated peptides** helps in GnRH and as yet undiscovered cofactor function? [14]. Many current research have indicated the role of Vitamin C as a cofactor. [15]

Vitamin C also increases production of collagen and its stability. Wound healing through antioxidant constituents is the notable work of Vitamin C which boosts the early closure of injured wound. [16,17]

Components of White blood Cells (WBC) like neutrophils and monocytes play vital role in enhancing immunity through wound healing.[18]. The dietary foods as an immunomodulator suggest the role of vegetable nutritional value and function in fighting against various infectious diseases such as COVID 19.[19] the most susceptible group among society is newborn, pregnant and elderly aged people vulnerable to respiratory disorders as the immunity enhancer.

VITAMIN D

Vitamin D is an element with special immune boosting effect. Vitamin D is a hormone produced externally from the sunrays emitting ultraviolet rays or dietary supplements known as steroid hormone. Huge amount of population of variant ages grossly affect due to its inadequacy. Many studies have proved the relation between deficient vitamin D and its relation with infections [20, 21, 22]. Several studies have been performed to correlate the respiratory viruses and immune function performed by vitamin D [23]. Vitamin D slogan inborn or specific type of immunity it eject a peptide in order to create mucosal defense against viruses of respiratory tract. The risk of infection doubles with the abrupt deterioration of vitamin D. It was been noted that the patients with pneumonia gets severe and mortality and morbidity increases. Viruses duplicate and break the anti-inflammatory barriers and immune system. Vitamin D balances the rennin-angiotensin system leading to reduced cytokine. These cytokine effect on on interferon γ and tumor necrosis factor α [24]. Special hinder in vitamin D is been found in immune homeostasis. Fatty substances oily fish such as salmon, sardines and mackerel, red meat, liver, egg yolks, cheese, butter, cereals are good source of vitamin D. along with diet vitamin D can be obtained through direct exposure to sun. the pores inhibit helper T cells.

VITAMINS AND DIETARY COMPONENTS

Present review was done by encapsulating quintessence of date back studies and begins invigorating facts relatable to vitamin C and D, its role in body and function in boosting the immunity. The above article kingpin the role of vitamin C and D nutritional function and its relation with immunity as an enhancing factor which can be utilized as a supplement and dietary component to fight against the preventive mode for pandemic diseases like COVID-19 in a systematic way. The study excludes current status of pandemic, its pathogenesis related to self maintenance. There are many fruits like oranges, grapes, tangerines having adequate amount of ascorbic acid or Vitamin C. Sapodilla is the richest source of vitamin c 427g. The vitamin C and its role in boosting immunity and its function enhancing whole immune system. [25]. Antioxidant and anti-inflammatory function of sapodilla helps to increase the immunity and hence to fight against various respiratory disorders like COVID- 19.

Guava is another component having 380 mg of vitamin C with antioxidant property. The arched study of concentration of vitamin c to tissue and by mouth dose. Single orange consumption can met a need for one day. As orange is powerful antioxidant acting as a scavenger it helps to prevent from certain dreadful disorders by neutralizing harmful elements. Anti-carcinogenic property is also worth notable. It helps the absorption of iron. Lime has 48mg vitamin C, which the least amount amongst all citrus fruits. To meet the daily dietary need two to 3 limes are required and so is least preferred. Mango the most common fruit has 60 mg of vitamin C with

both anti-oxidant and anti-inflammatory property. Strawberry has 85mg, kiwi has 93 mg vitamin C, broccoli has 51 mg of vitamin C. All the dietary components has antioxidant property.

Table1. Nutritional function of components, amount of Vitamin C

| Sr.no | Name of Component | Vitamin C | Nutritional function |
|-------|-------------------|-----------|--------------------------------|
| 1. | Sapodilla | 424 mg | Antioxidant, Anti-inflammatory |
| 2. | Guava | 380 mg | Antioxidant |
| 3. | Orange | 88 mg | Antioxidant, Anti-inflammatory |
| 4. | Lime | 48 mg | Antioxidant |
| 5. | Mango | 60 mg | Antioxidant, Anti-inflammatory |
| 6. | Strawberry | 85 mg | Antioxidant |
| 7. | Broccoli | 51 mg | Antioxidant, anti-carcinogenic |
| 8. | Kiwi | 93 mg | Antioxidant |

Antioxidant role of vitamin C is explained beautifully in an article. [25] Hence forth immunity has special course with vitamin C supplementation as a dietary mode in preventing dreadful scenario of the several decades. Vitamin D is has egg yolk, oyster, fatty fish, cod liver oil, milk, cereals, salmon

Table 2. Name of component containing vitamin D per 100gm and its nutritional function

| Sr.no | Name of Component | Vitamin D | Nutritional function |
|-------|-------------------|-----------|--------------------------------|
| 1. | Egg yolk | 42IU | Antioxidant, Anti-inflammatory |
| 2. | Salmon | 447 IU | Antioxidant, anti-viral |
| 3. | Mushroom | 1022 IU | Antioxidant, Anti-inflammatory |
| 4. | Fortified milk | 124 IU | Antioxidant |
| 5. | Orange juice | 137 IU | Antioxidant, Anti-inflammatory |
| 6. | Cereals | 40 IU | Antioxidant |

Mushroom is the richest source of vitamin D having 1022 IU /100grams. Naturally obtaining mushrooms is available easily and can be used in the multiple forms for consumption. Mushrooms are treated with UV light providing much amount of nutrients. Salmon is the fish having 447 IU/100 grams, salmon are available in the large water source. The higher the light exposed to salmon greater is the accumulation of vitamin D therein. The combine effect of mushroom and salmon can be the best solution for fostering the vitamin D as a dietary supplement. Egg yolk contains zinc and selenium. Egg is richest source of protein but other than this the vitamin D contain in 100grams is 42IU. Antioxidant and anti-inflammatory role of these substances render a mesmerizing role in enhancing immunity. Orange is citrus fruit with both vitamin C and D. orange juice is also considered as the source of vitamin D. fortified milk of soya and almond provide similar amount of vitamin D. they are considered as a plant based milk.

Along with vitamin D calcium is another source which speeds up the innate cells.

.VITAMINS AND PATHOPHYSIOLOGY

Biological fluids including blood, plasma, lymph, Cerebro spinal fluid (CSF), Synovial fluid etc has vitamin C as water soluble antioxidants. Hunting the oxygen and nitrogen preferably prevent the oxidative damage. All living beings are copiously attacked by antigens. Due to micro size of these antigens, they settle in the amount of millions on a single head of cell. Vitamin c also acts as co antioxidant. The more the organisms found complex greater is the immunity activated. Most commonly consumed diet has enough nutrition along with essential components to be consumed externally to maintain healthy health and immunity. Antioxidant defense system is the other supernatural mechanism working in human body amongst other systems of body. Antioxidant activity in function of cell cycle and internal health. Sapodilla, guava, orange, lime, mango, strawberry, broccoli and kiwi have an antioxidant property which gist the immunity. Also anti-inflammatory property aid to induce the neutrophils which are the root source in enhancing immunity against damaged tissues by evoking the process of phagocytosis (killing of cells). The reduced vitamin c values in plasma may increase the chances of respiratory infections [26]. The fatality of respiratory diseases can be minimized by intake of vitamin c in patients [27]. Few study have shown the clear findings in x-ray due to intravenous administration of vitamin c in acute lung infection [28,29]. Supplementary dose of vitamin C 200mg in reducing the fatality and duration in symptoms of influenza and bodily tension [30]. The common symptoms of COVID 19 involve common cold and it has crucially proved the intake of vitamin c in depressing the cold and recovery. It reduces the risk of prolonged hospital stay. A study also has denoted the abundant decrease in ESR that is erythrocyte sedimentation rate by oral vitamin c intake [31]. Vitamin C depletion is amply fall during frightful disease. [32]. Ascorbic acid is pin point media for normal metabolism of body. Fresh fruit, citrus fruits and vegetables contain plenty of it. The alveolar fluid clearing and increasing the obstacle between bronchus and alveoli and enervate segregation of lymphocytes (neutrophils) as stated in animal study wherein animals having infection due to lung injury [33] vitamin c enumerate the normal functioning of lungs. There are connecting links in between cells and their receptors to the immune-modulating system and several metabolic disorders [34]. Smoking and tobacco chewing permit the growth of various bacterial and viral infections [35,36]. Other functions of vitamin C are **reducing Hypoxia- inducible factor** [37] is the transcription factor that reacts to reduced oxygen content in environment. **Reduce DNA and histone methylation**[38] inculcate the epigenetic mechanisms. **Increases carnitine** due to huge intake of dairy and non-vegetarian foods. **Increase catecholamine** is the basic work of vitamin c by adequately taking citrus fruits. **Increase collagens** which improve the skin relieves joint pins, prevent the bone density improve the muscle mass and promote the healthy heart functioning [39,40,41]. Wound healing is imposed with the help of vitamin c along with external injuries it heals the internal flora of gastro-intestinal tract that may damaged due to engulfing endotoxins and antibiotics. It protect the cell membranes and allow the oxidation and enlighten the cellular movements [42]. Animal study has indicated the amount of vitamin C in diet by executing the leucocytes [43]. In-vivo detoxification of immune cells by hitting the histamine concentration was seen by vitamin C supplementation [44]. Vitamin D deficient children found to asthmatic in the cord blood plasma. It was found due to deficient vitamin D diet by the conceiving ladies resulting RSV LRTI [45]. The fitness of strong antigens related with the amount of UV light with respect to season and site. So the infections worsen day to day due to changing season and dietary regimen [46]. Migration and sudden climatic changes affect the production vitamin D so the external

supplements are necessary to rebuild the immunity. Inflammatory process gets shut down due to suppression of extra skeletal effects [47]. A parathyroid hormone depends on CVD and reduced lung function [48]. Heart failure and ARDS and pneumonia totally depends upon rennin angiotensin factor. Medical condition relates to poorer respiratory function with pro-inflammatory cytokine. Along with vitamin C and D, vitamin B12 deteriorate the effect of vitamin D. Magnesium vitamin B12 and vitamin D combined use as safe and effective mode to reduce COVID-19 symptoms [49]. Serum 25- hydroxyvitamin D concentration can be increased through these components by adding vitamin C and oral supplements of vitamin D3. The metabolism of vitamin D implies the basic role of Mg (magnesium) in the renal and hepatic reaction by enzymes as a cofactor [50]. Daily supplement up to 100- 250 microgram/day has increased the concentration of Serum 25- hydroxyvitamin D. the increase dose of 100 micrograms/day can be safely given to adults. Antimicrobial activity of vitamin C aid the increased production of glutathione helps in treatment and prevention of COVID-19 [51]. Daily dose of 10mg of vitamin C provides the collagen synthesis and prevent scurvy and are susceptible to several infections by successively decreasing the immune response. The processed food with added doses of vitamins does not shuffle the body mechanism. The vitamins are water soluble so can be excreted out to reduce intoxication by itself [52,53]. Antioxidants in the body are triggered by vitamin C and D to act wisely against several antigens and to activate both specific and nonspecific type of immunity[54,55].

Conclusion:

Inclusively it has been noted the role of vitamin in boosting both innate and adaptive type of immunity. Vitamin C is a formidable antioxidant protecting the human body against external and internal oxidative ultimatum in fostering the immunity. Increase in phagocytic and formation of oxidant at the site of infection bracing the amount of vitamin C. apoptosis of few neutrophils by vivifying macrophagial activity by preventing the damage of host tissues. Vitamin C is potent immunity cell booster by preventing systemic infections and treating respiratory infections. Sapodilla is the best dietary component having antioxidant activity aid in consumption of vitamin C. Broccoli is the vegetable containing abundant vitamin c and other nutrients can be utilized in the form of salad in order to increase the bodily requirement of vitamins and the fruits can be used in the form of juices. Kiwi is the fruit used for increasing the thrombocytes (platelets) in several diseases like dengue, thrombocytopenia etc. Multiple decades have expressed the consequences of vitamin C through diet incorporating the immunity. Antioxidant and anti-inflammatory activity of the above components increases the aversion to infectious diseases. So these components and the others containing vitamin c should be avail in preventing the COVID 19 pandemic and the other infectious diseases. Rapid absorption is fostered by vitamin C or ascorbic acid so it is given as a supplement with several antibiotics. So absorption is another important factor that can be utilized as a pre-dietary element in food for daily consumption. Production of interferons facilitates the defense mechanism to work as a whole. Vitamin C is found 80times in plasma of immune system. Antioxidant activity suppresses the inflammation as in shout up the immunity. It shortens the duration of the symptoms and severity of disease and making up the respiratory function. The above research has summarized the role of vitamin C per day to up heave the immunity. Vitamin D resides very close to respiratory flora thus activating the dendric cells (DCs). Dendric cells engulf the viruses by phagocytic and micropinocytosis activity boosting the immune system rapidly. It activates the PRRs. As in vitamin C cytokine activated , vitamin d produce chemokines (CXCL8, CXCL9, CXCL10 AND IL-15). The role of neutrophils is much clear as it forms an envelope around to protect the respiratory cells from

hosts. The further spread of the disease is prevented by dietary supplement by minimizing the further growth of viruses. Mushroom is found to be the best source of vitamin D. salmon is the fish to be utilized with fatty oily stuffs with ample of vitamin D and antiviral property helps to boost the immunity. The combination of these components ,may help to render the markers and fulfill the daily requirement. Egg yolk is the product to be used which help to gear the interleukin 6 elevation and breakdown the sequel of growing viruses. The spikes of glycoprotein shed down with consumption of vitamin D. The combine effect of both vitamin C and D can be best preventive modality in order to maintain health hygiene and immunity and to stay disease free. The above study is suggestive of the role of both vitamin C and D independently or combined as a dietary source to reduce the acute respiratory tract infection like COVID 19.

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