

Stimulating and Boosting the Immune System by Increasing the Number of White Blood Cells (Leukocytes) to Prevent and Treat some Viral Infections

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Abstract

Objective: The study was aimed to boost the immune system by increasing leukocytes number (in vivo) to avoid and treat some viral infections.

Methods: The samples were separated into three main groups. All the groups have vitamin C and D deficiency. The first group was devoted to a vitamin C test, and the second group includes the samples that were treated with vitamin D (in vivo) and also to the third group that consists of samples that were treated with both vitamins C and D. Also for each group, two tests (pre and post-treatment) have been performed. These tests were performed on a sample of thirty participants (which includes males and females), and their ages were 39±13.7 years. Blood elements were detected by using the auto-analyzer system. Here, the Enzyme-linked Immune Sorbent Assay (ELISA) technique was used to measure the concentration of vitamin C and D.

Results: There was a variation in the number of white blood cells, the proportion of lymphocytes and the number of platelets for all volunteers that shared in this study. Significantly, the values were increased after treating with vitamin C, vitamin D and together C and D vitamins. The results showed the total number of leukocytes, lymphocyte, and thrombocytes were significantly increased ($P<0.05$).

Conclusions: The increase in the number of white blood cells, especially lymphocytes, has a major impact on increasing the natural mechanisms within the human body to fight viruses and other pathogens, which include nonspecific responses (Natural killer cell (NKC), cytokines (interferon)) and specific immune responses (humoral and cell-mediated) antigen-antibody complexes and T cells (cytotoxic and helper).

Keywords: Vitamin D; Vitamin C; Immune system; Leukocytes; Viral Infection

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Introduction

Influenza viruses can impact on the functions of the respiratory system by a viral infection and by damage to immune system responses. Most of the patients with cases of acute pneumonia are likely to be less than 5 years old, >65 years old, who have chronic lung or heart disease and a history of smoking, are immune compromised [1]. Regarding vitamin C, there is a study done by Linus Pauling who reported that vitamin C can be used as a treatment for every disease (a panacea) so; he noted that the high amount of vitamin C could combat a group of diseases that affect the host, involving cancer. He also revealed that vitamin C is important to heal flu and disappear it fully. Animal viruses (coronaviruses), such as severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome coronavirus (MERS-CoV) can cause severe respiratory tract infections with high mortality [2]. Other studies indicate that raising the level of vitamin

25(OH) D concentrations through vitamin D supplementation in winter would reduce the risk of developing influenza. On the other hand, the role of vitamin D and influenza was published in 2018 [3]. On the positive side, vitamin D-related native and acquired immune responses to viral infections exist. A study was conducted on school children in Japan to show the effect of Vitamin D on influenza types and it reported significantly reduced incidence of influenza type A but not B for children in the treatment arm taking 1200 IU/d of vitamin D [4]. Although most other trials did not support a beneficial effect of vitamin D supplementation in reducing the risk of influenza infection, another recent RCT did [5]. Vitamin D also enhances cellular natural immunity in part by reducing the cytokine storm induced by the innate immune system. The innate immune system generates both pro-inflammatory and anti-inflammatory cytokines in response to viral and bacterial infections, as observed in COVID-19 patients [6].



IFN-induced immune dysregulation enforces apoptosis of T cells, which would normally promote virus clearance, resulting in reduced numbers of virus-specific CD8 and CD4 T cells [7-9]. The immune system is a network of specialized cells, tissues, organs chemicals, proteins and enzymes, which includes protecting and saving the host from pathogenic organisms, such as bacteria, viruses, fungi, and parasites, as well as cancer cells [10]. Blood has white cells. These cells are made in the bone marrow. White blood cells (WBC) aid the body to fight infections. In the case of leukopenia, the bodies are more likely to get sick [11]. Vitamin C has an important role in immune defense by stimulating many humoral and cellular activities for natural and acquired immunity. Vitamins C reinforces the capability of epithelial barrier against pathogenic organisms and enhances the activity of oxidant scavenge in the skin. Vitamin C is gathering in most of the immune cells (neutrophils) and can promote cytokines, devouring process (phagocytosis), forming of reactive oxygen species, and finally destroy the pathogens. Vitamin C is necessary for cell programmed death and it eliminates neutrophils consumed from sites of reaction by phagocytosis process, thereby reducing necrosis and possible tissue injury. The action of vitamin C in lymphocytes even now is not clear enough, but vitamin has been given to activate proliferation and differentiation of T-cells and B-cells. The Low amount of vitamin C leads to weakness of immunity and increases susceptibility to happen infections. On the other hand, the infection greatly affects vitamin C levels due to enhanced inflammation and metabolic requirements. Moreover, vitamin C supplementation appears to be able to prevent and treat respiratory infections. Neutrophils and monocytes can store vitamin C than is found in the plasma concentration. These cells accumulate maximal vitamin C concentrations at dietary intakes of ~100 mg/day [12-18]. The results of meta-analyses have been demonstrated that intravenous (IV) large amounts of vitamin C treatment play an important role in the treatment of sepsis and septic shock. Vitamin D deficiency causes the development of the immune-related disease such as autoimmune diseases [20-22]. The role of vitamin D is the modulation of the immune system and it also regulates the production of inflammatory cytokines and immune cells, which play a role in the pathogenesis of many immune-related diseases. This is because Vitamin D has receptors on immune cells [24,25].

Subjects and Methods

Subjects

Thirty participants at 39±13.7 years of age shared in this study. All the volunteers who have been diagnosed by a specialist physician at General Ranya Hospital in Sulymanya governorate, the samples were collected in Ranya city during the period (February 2020). The groups were divided into three parts. The first group involves specimens were tested with vitamin C (in vivo) and the second group includes, samples were treated with vitamin D (in vivo) as well to the third group that consists of samples were treated with both of vitamins(C and D). Also for each group, two tests (pre and post-treatment) have been done.

Methods

Blood from 30 donors was drawn into Acid Citrate Dextrose tubes (ACD-A) (10 ml from each volunteer). ACD-A can be used as an anticoagulant and it has another use in the production of Platelet-Rich Plasma (PRP) [26]. Samples were immediately separated into aliquots and the tests were carried out on three periods, depending on the time of the examination. The first test was done after 30 min of the incubation period, and the second test was conducted after sixty minutes. As for

the third examination, it was examined after ninety minutes from incubation. Before vitamin D3 was given, blood was taken to check the total white blood cells, lymphocytes, and platelets, and then, vitamin D was given to patients at 300,000 IU orally, and after 24 hrs. another test was done for the above-mentioned blood elements. For vitamin C, the same steps as for vitamin D were done, but three doses of 500 mg were given orally daily for 72 hrs. Concerning vitamins(C and D), a dose of 500 mg of vitamin C and 300,000 IU was given, and after that, the examination was carried out 24 hrs. later. Blood elements are measured by using the auto-analyzer system. The concentrations of vitamins (C and D) were estimated by using the ELISA test (Table 1).

Table 1: The treatments and doses that used in the current study.

Treatments	Doses
Vitamin C (<i>in vivo</i>)	500 mg capsule (for 72 hrs.)
Vitamin D (<i>in vivo</i>)	300000 IU
Vitamins C, D (<i>in vivo</i>)	500 mg capsule and 300000 IU

Statistical analysis

Statistical analysis was done by using a Paired-Sample T Test. For all analyses, a value of (P<0.05) was considered significant. All statistical analyses were performed statistical Package for Social Science (SPSS) V20.

Results

The means of Vitamin (C, D), frequency, age and gender of samples for (in vivo) is given in (Table 2). The changes in blood elements that involved in the present study (white blood cell, lymphocyte, and Platelets) at pre and post-treatment of vitamin C and D are shown in tables (Tables 3-5) respectively. Significantly, the leukocytes, lymphocyte, and Platelets were increased (P<0.05) after using the vitamins the above-mentioned.

Discussion

The present study was aimed to evaluate the effect of vitamins C and D on the total number of white blood cells, the percentage of lymphocyte as well as to the number of platelets (Thrombocytes). The blood elements and vitamins were measured by blood tests for two different periods. The results show that there is a clear rise in the total number of white blood cells, lymphocyte, and platelets but this increase is within the normal limits for leukocytes (4.00-11.0 x 10⁹/L). For vitamin D, the means values of white blood cells, lymphocyte (%) and platelets (1000/μl) before treating with vitamin D were 5620 cells per liter, 30.5±7%, 214.3 (1000/μl) but it was 7040 per liter, 33.11(%), and 234.2 (1000/μl) respectively, after taking the vitamin D. Table 3 shows that the statistical analysis between values was significant (P<0.05) According to the vitamin C, the means values before using vitamin C were 5340 cells per liter, 28.54%, 197.7 (1000/μl) for white blood cells, lymphocyte and platelets respectively, while the means values after treatment with vitamin C became 6730 cells per liter, 32.35%, 219.8 (1000/μl) for white blood cells, lymphocyte and platelets respectively. In table 4 statistical analysis demonstrated that the differences between values were significant (P<0.05). For both vitamins C and D, the values increased with 7030 cells per liter, 33.6300%, 213.7 (1000/μl) for white blood cells, lymphocyte and platelets, respectively in comparison to pre-treatment where it was 5780 cells per liter, 30.74%, 190.6 (1000/μl) for leukocytes, lymphocytes, and thrombocytes, respectively. As shown in table 5 statistically, the differences were significant at the 0.05 level. Through the results obtained from this study, we confirm that vitamins have an effective role in building strong body immunity in order to



Table 2: The means of Vitamin(C and D), frequency, age mean and gender of samples for (in vivo).

Gender	Frequency (%)	Age Mean	Mean of Vitamin D ng/mL	Mean of Vitamin C mg/dl
Male	19 (63.3)	39.11±14.063	15.5263±5.21076	0.4133±.02309
Female	11 (36.7)	38.82±13.913	16.8182±9.78589	0.3267±.02517
Total	30	39±13.7	16±7.09	0.3700±.05215

Table 3: The means and standard deviation values of blood elements at pre and post-treatment of Vitamin D (in vivo).

Variable	The Mean and Std. Deviation for Pre-Vitamin D treatment	The means and Std. Deviation for Post-vitamin D Treatment	Mean Difference	P-value
White blood cell	5620±942.57331	7040±535.82750	1420.000±825.69836	0.000
Lymphocyte (%)	30.5±7.84092	33.11±7.22749	2.61000±1.74957	0.001
Platelets (1000/μl)	214.3±59.3072	234.2±50.72759	19.90±13.63370	0.001

Table 4: The means and standard deviation values of blood elements at pre and post-treatment of vitamin C (in vivo).

Variable	The Mean and Std. Deviation for Pre-Vitamin C	The means and Std. Deviation for Post-vitamin C	Mean Difference	P-value
White blood cells	5340±1088.52602	6730±394.54615	-1390. ±908.53973	0.001
Lymphocytes (%)	28.54±8.22262	32.35±7.13290	-3.810±3.13243	0.004
Platelets (1000/μl)	197.7±57.72742	219.8±61.40901	-22.10±11.79878	0.000

Where: The differences are significant at the 0.05 level.

Table 5: The means and standard deviation values of blood elements at pre and post-treatment of vitamin C and D (in vivo).

Variable	The means and Std. Deviation for Pre-Vitamin C and D treatment	The means and Std. Deviation for Post-vitamin C and D treatment	Mean Difference	P-value
White blood cells	5780±1341.47514	7030.0±980.98590	-1250.0 ±784.92746	0.001
Lymphocytes (%)	30.74±9.99302	33.63±8.91491	-2.890±2.95802	0.013
Platelets (1000/μl)	190.6±43.15656	213.7±46.99657	-23.1±10.50344	0.000

Where: The differences are significant at the 0.05 level.

fight pathogenic organisms, and this study is agreed with Linus Pauling who noted that vitamin C is a very important vitamin and can be used in treatment for all diseases. He also demonstrated that vitamin C is essential to heal flu cases [2]. Our study also agrees with other studies that support of using vitamin D to cause many immune modifications, such as the production of cytokines, immune cells that play an important role against pathogens [24,25].

Conclusion

This study gives additional support that taking vitamin C and vitamin D contributes to increasing the elements of the immune system, and therefore this increase leads to stimulate and boost the immune system to fight viral infections and also other diseases.

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