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Nutritional Recommendations for Patients Undergoing Chemotherapy During the COVID-19 Pandemic

Sarina Salemi [1], Moeina Afshari [2,*] and Mohammadreza Afshari [3]

[1] School of Nutritional Sciences and Dietetics, Tehran University of Medical Science, Tehran, Iran
[2] Faculty of Medicine in Hradec Kralove, Charles University, Hradec Kralove, Czech Republic
[3] Faculty of Pharmacy in Hradec Kralove, Charles University, Hradec Kralove, Czech Republic

[*] *Corresponding author*: Faculty of Medicine in Hradec Kralove, Charles University, Hradec Kralove, Czech Republic. Tel: +420-736764872, Email: afsharim@lfhk.cuni.cz

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Abstract

The world is currently in a large-scale outbreak, referred to as a pandemic, for the novel coronavirus disease SARS-CoV-2 and its variants. Patients having cancer have to combat their illness and its complications, but they also have to suffer a list of side effects due to chemotherapy. This article is written to suggest a list of nutritional considerations for chemotherapeutic patients at this stage of the COVID-19 pandemic to enhance their immune system. Nutrition has a decisive role in immune response, specifically in immuno-suppressed patients, such as those undergoing chemotherapy. Due to the complexity of designing a diet for the mentioned patients, we recommend a balanced and varied diet in the COVID-19 pandemic, including zinc, omega-3, vitamin D, whole grains, and skimmed dairy, which were discussed in great detail in the article.

Keywords: COVID-19, Immune System, Cancer Diet, Chemotherapy, Nutritional Support

1. Context

The world is currently in the midst of a large-scale outbreak, also referred to as a pandemic, of the novel coronavirus SARS-CoV-2 (COVID-19). Pandemics lead to clinical and social interruptions (1). From the clinical point of view, several risk groups are recognized. According to CDC, patients with cancer, immunocompromised state after organ transplant, cardiovascular disease, and type two diabetes mellitus are at increased risk of morbidity and mortality due to COVID-19. Patients having cancer have to combat their illness and its complications and must suffer a list of side effects due to the use of chemotherapy. Some of the nutrition-related side effects are as follows: infections, anemia, nausea, vomiting, change in appetite, diarrhea, mouth, tongue, and throat problems, and mucositis (2). These patients are immunocompromised due to chemotherapy-related neutropenia; therefore, they are at greater risk of infection (3). Consequently, they require greater support. This article is written to suggest a list of nutritional considerations for chemotherapeutic patients at this stage of the COVID-19 pandemic to improve their immune system.

2. Evidence Acquisition

Chemotherapy is usually associated with malnutrition. Due to many side effects caused by chemotherapeutic agents, patients will suffer from vomiting, loss of appetite, restrictive food intake, and subsequently protein catabolism (2). It is documented that malnutrition affects a patient's immune system drastically and weakens the immune response in every phase of infection. In this regard, patients undergoing chemotherapy are more susceptible to viral infections, including COVID-19, and the first obstacle, which is needed to be overcome is malnutrition (4).

Chemotherapeutic patients also suffer from loss or reduced appetite. To alleviate this condition, patients are advised to take small calorie-dense portions of meals with increased frequency. As these patients are experiencing food aversion and hypersomnia, they might be extra sensitive to specific odors or tastes; thus, they will be avoiding some foods. In this case, it is advised to prepare their foods far from their residing spot to prevent their exposure to such a smell. These patients also experience an impaired sense of tasting as a side effect of chemotherapeutic agents. It is recommended to use proper additives and

marinate their foods to make them more favorable to increase their food desire and, consequently, their intake (2). Another common side effect experienced by chemotherapeutic patients is different grades of mucositis due to their treatment (5). It should be considered not to use additives that might irritate the oral cavity and gastrointestinal tract, as mucositis might also lead to reduced food intake hence malnutrition. Studies have demonstrated that the general anti-inflammatory action of zinc sulfate supplementation could relieve mucositis (6). On the other hand, studies have documented the effect of zinc on the immune system in reducing inflammation (7). Additionally, the immuno-protective role of zinc has been noticed to be crucial in the COVID-19 pandemic. Zinc improves mucociliary clearance and antiviral and antibacterial immunity and reduces pulmonary inflammation in the upper and lower respiratory tracts (8, 9).

Carbohydrates are considered the principal source of energy. According to the Warburg effect, glucose is the main fuel for cancerous cells; thus, the consumption of simple carbohydrates with a high glycemic index should be restricted in these patients' diets. Since simple sugars lead to further weakening of the immune system by the insulin-dependent mechanism, primarily, they must be avoided and replaced by whole grains (10, 11). Another possible intervention could be decreasing the patient's carbohydrate intake by offering a low-carb diet. Studies have demonstrated the benefit of a ketogenic diet on the immune system. Therefore, ketogenic diets can also be recommended as they are commonly used in the treatment of brain cancers. On the other hand, it has been shown that ketogenic diets can boost the immune system against the influenza virus (12, 13). Recently, Kossoff et al. have provided some recommendations based on a ketogenic diet for patients suffering from epilepsy during the COVID-19 pandemic (14).

It is documented that saturated and trans fats lead to the development of inflammatory responses (15). These responses should be avoided during chemotherapy. Consequently, dietitians recommend reduced consumption of these harmful fats in animal products, such as red meat and high-fat dairy products. Splicing factor (SFA) also plays a role in the suppression of the immune system and inevitably increases the vulnerability to various viral infections (16). From this point of view, chemotherapeutic patients are recommended to consume zero percent fat dairy products and lean meat. Essential fatty acids, specifically n-3 PUFA, have been known for their anti-inflammatory effects. Enhancement of the immune system has also been observed; thus, greater ability to defeat viral infections can be achieved (17). This effect is caused by increasing the level of NADPH oxidase, protein kinase C, and some other accompanying mechanisms. The above-mentioned immune components increase the amount of superoxide produced by neutrophils, and thereupon, greater immune capacity is observed in chemotherapeutic patients (18). Additionally, omega-3 supplementation could decrease the reduction of the HLA-DR gene expression in monocytes of chemotherapeutic patients (19). Dietitians should consider the use of omega-3 in chemotherapeutic patients' diets. Salmons and sardines, which are rich in omega-3, should be included in the patient's diet as protein sources instead of red meat and poultry.

Vitamin D is crucial in immune system modulation. In carcinogenesis, vitamin D plays an important role in cell differentiation. Vitamin D boosts the immune system through different mechanisms. This enhancement is affected from the first line of defense in non-specific immunity to the cellular level in specific immunity. Studies have also indicated the effect of vitamin D on lower respiratory tract infections. Since the tissues of the lower respiratory tract are also the target of COVID-19 infection, thusly supplementation of vitamin D is considerable (20). The prevalence of vitamin D deficiency is highly reported in patients undergoing chemotherapy (21). Studies have shown that patients with a lower level of 25-hydroxy-D serum are predisposed to COVID-19 infection and also show increased morbidity and mortality throughout the infection (22). It is recommended to supplement these patients routinely to increase serum levels of 25-hydroxy-D serum from 40 - 60 $ng.mL^{-1}$.

In the pandemic period, the public is recommended to consume a considerable proportion of vegetables and fruits to improve their immune system. Vegetables and fruits contain notable amounts of essential micronutrients, phytochemicals, and fibers (23). Antioxidants and polyphenols might be interfering with the mechanism of some chemotherapeutic agents and hindering their effects (24). Conversely, other studies have shown the positive effect of some of these phytochemicals on specific chemotherapeutic substances (25). When patients undergo chemotherapy, they will suffer from neutropenia (3). As neutropenia causes a great delay in immune response, it is recommended to carefully disinfect and later boil fruits and vegetables consumed. Due to the discrepancies among resources, moderate use of vegetables and fruits is recommended.

3. Conclusions

In conclusion, nutrition has a decisive role in immune response, specifically in immuno-suppressed patients, such as those undergoing chemotherapy. Due to the complexity of designing a diet for the mentioned patients, we recommend a balanced and varied diet in the COVID-19 pandemic, which includes all micronutrients and trace elements plus zinc, omega-3, vitamin D, and foods, such as whole grains and skimmed dairy, which was discussed in detail above.

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Footnotes

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