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THE IMPORTANCE OF NUTRITION FOR PATIENTS WITH CORONAVIRUS INFECTION

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Abstract: Throughout the pandemic, health data has been increased. Host of people have switched to using vitamins and supplements to fight the virus. Optimal nutrition can improve well-being and might mitigate the risk and morbidity associated with coronavirus disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The majority of documents encouraged the consumption of fruits, vegetables, and whole grain foods. Thirty-one percent of the guidelines highlighted the importance of minerals and vitamins such as zinc and vitamins C, A, and D to maintain a well-functioning immune system. In this article, we analyze clinical analysis for vitamins and supplements in the treatment and prevention of COVID-19 infections.
Keywords. Pandemic, vitamin, supplement, COVID-19, SARS-CoV-2, mineral, infection.

ЗНАЧЕНИЕ ДИЕТОТЕРАПИИ ДЛЯ БОЛЬНЫХ С КОРОНАВИРУСНОЙ ИНФЕКЦИЕЙ

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На протяжении всей пандемии данные о здоровье были увеличены. Многие люди перешли на использование витаминов и добавок для борьбы с вирусом. Оптимальное питание может улучшить самочувствие и снизить риск и заболеваемость, связанные с коронавирусной болезнью 2019 (COVID-19), вызванной коронавирусом тяжелого острого респираторного синдрома 2 (SARS-CoV-2). В большинстве документов поощрялось потребление фруктов, овощей и цельнозерновых продуктов. Тридцать один процент рекомендаций подчеркивает важность минералов и витаминов, таких как цинк и витамины C, A и D, для поддержания хорошо функционирующей иммунной системы. В этой статье мы анализируем клинический анализ витаминов и добавок при лечении и профилактике инфекций COVID-19.
Ключевые слова. Пандемия, витамин, добавка, COVID-19, SARS-CoV-2, минерал, инфекция.

KORONAVIRUS INFEKSIYASIGA CHALINGAN BEMORLAR OVQATLANISHINI AXAMIYATI

Pandemiya davomida sog‘liqni saqlash ma‘lumotlari ko‘paydi. Ko‘pchilik virusga qarshi

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kurashish uchun vitaminlar va qo‘shimchalardan foydalanishga o‘tdi. Optimal ovqatlanish farovonlikni yaxshilashi va og‘ir o‘tkir respiratorli respirator sindrom koronavirus 2 (SARS-CoV-2) tufayli kelib chiqqan 2019 yilgi koronavirus kasalligi (COVID-19) bilan bog‘liq xavf va kasallanishni kamaytirishi mumkin. Hujjatlarning aksariyati meva, sabzavot va to‘liq donli mahsulotlarni iste‘mol qilishni rag‘batlantirdi. Ko‘rsatmalarning 31 foizi yaxshi ishlaydigan immunitet tizimini saqlab qolish uchun rux kabi minerallar va vitaminlar, C, A va D vitaminlari muhimligini ta‘kidladi. Ushbu maqolada biz COVID-19 infektsiyasini davolash va oldini olishda vitaminlar va qo‘shimchalarning klinik tahlillarini tahlil qilamiz.
Kalit so‘zlar. Pandemiya, vitamin, qo‘shimcha, COVID-19, SARS-CoV-2, mineral, infektsiya.

Introduction. With an infection, the body must work intensely to mount an immune response. High fever is the immune system's way of revving up metabolism to "battle the bug." Fever is also associated with excess loss of fluids and increased metabolism which can lead to dehydration and increased nutritional requirements. Even though you may not be thirsty or hungry,

it is important that you continue to eat and drink fluids to support your body's ability to fight the virus and support your body's immune function. The mankind immunity has a pivotal role in nutrition acquisition from the pathogens and damaged body tissue during the SARS-CoV-2 virus infection, which may lead to transient overnutrition in the patients, lead to lipotoxicity and further damage in non-adipose tissues, and cause hyperinflammation and cytokine storm in severe cases of COVID-19. Those of us that have a better nutritional status can fight the disease better than others. If our immune system is working really well, we don’t get infected. In general, nutrition affects our entire body. All body processes require enzymes, and many vitamins and minerals help enzymes work better. A number of micronutrients, including vitamins C and D and zinc, have been shown to play key roles in supporting immune function and in reducing risk of respiratory infection. These nutrients can be obtained from the diet and are available as dietary supplements either alone or as part of multivitamin or multinutrient mixtures.

The world has faced the most challenging pandemic of the modern era, that of severe acute respiratory syndrome coronavirus 2 infection, causing coronavirus disease and affecting over 35 million people globally. The wide range of clinical manifestations associated with this viral disease is thought to be related to the overexpression of inflammatory markers. Due to a dysregulated host response, the most severe form involves multi-organ failure and thromboembolic complications. Immunomodulatory therapies may help prevent its progression and anticoagulation has been shown to reduce the risk of thrombotic complications. As this is a new entity for the medical world, there are no known therapeutic options nor has the prevention of complications been established [1]. A biologically plausible role exists for certain vitamins and minerals in immune pathways. For example, vitamin D has been suggested to reduce SARS-CoV-2 transmission by enhancing antiviral immunity and to reduce mortality by mitigating the cytokine storm linked with severe COVID-19. Moreover, zinc also supports the function of the immune system9 and may have specific antiviral effects. However, robust evidence to support a role for vitamins and minerals in preventing infection with SARS-CoV-2 is not available. Any such evidence would need to take into account factors such as socioeconomic status, ethnicity and occupational exposure to the virus as well as the requirement of a large sample size and a clear

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confirmation of infection [2].As far as role of vitamins C and D are concerned, Vitamin C has gained interest in the management of COVID-19 due to its inherent anti-oxidative properties. There are ongoing clinical trials in various centres to evaluate the outcomes of early vitamin C treatment in patients with various clinical manifestations, but, currently, insufficient data establishing the use of vitamin C is available. Prior studies have shown the potential benefits of vitamin C supplementation in the management of acute respiratory distress syndrome and septic shock due to other viral illnesses [3]. It is prudent to follow-up on the outcomes of current ongoing trials to guide therapy in particular for COVID-19 infection [4]. There is growing interest to suggest that vitamin D deficiency is related to the risk of infection. This vitamin acts as an immune system modulator by providing an effective physical barrier and strengthening both adaptive and innate immunity. A meta-analysis of 25 randomized clinical trials in the past suggests that regular supplementation with vitamin D2/D3 (up to 2000 IU/d) is protective against acute respiratory infections [5]. Therefore, the prophylactic use of vitamin D in patients with COVID-19 is proposed. There is a lack of clinical data to support this treatment modality, and further clinical studies are needed to establish vitamin D supplementation as part of therapy [6].

With regards to some group scientists [7] that we are thoroughly hooked in the articles by Lidoriki et al. and Recinella et al. [8] in which the authors shared that nutrition status plays an important role in the progression of COVID-19. Based on their work, we would like to hypothesize that human immunity has a pivotal role in nutrition acquisition from the pathogens and damaged body tissues during the SARS-CoV-2 virus infection, which may lead to transient overnutrition, lipotoxicity and further tissue damage in overweight patients or patients with metabolic syndromes. Those patients are thus predisposed to escalated inflammation and susceptible to cytokine storm in

severe cases of COVID-19. The interactions between nutrition, microorganism infection and immunity are very complex. On the one hand, adequate nutrition and a symbiotic microbiome ensure proper function of the immune system during infection; on the other hand, the human immune system also plays an important role in acquiring essential nutrients from living microbial cells during the elimination of the symbiotic microbiome and infectious pathogens. Throughout an infection, xenophagy as the specific type of autophagy mediating intracellular pathogen eradication, together with other immunological proteolytic/lipolytic processes, degrades symbiotic microbiome, pathogens, and damaged human body tissues, and turn them into nutrients. This nutrition acquisition pathway may cause transient overnutrition, lead to lipotoxicity, tissue damage, hyperinflammation and cytokine storm. Inflammation is the physiological response of the immune system to tissue damage [9]. It is a protective reaction by the organism to remove the injurious stimuli, and remove the damaged tissue as well as initiate the healing process for the tissue [10].Yet, during acute infection, nutrition excess will prevent the tissue healing process from happening. This is because, if the nutrition from the degradation of pathogens and the damaged body tissues exceeds the nutrition needs for tissue repair, the excessive nutrition will be mostly turned into lipid intermediates and deposited in new non-adipose tissue, causing lipotoxicity in healthy non-adipose tissues and inducing further tissue damage. The breakdown of newly damaged non-adipose tissues and the formation of lipid intermediates result in a vicious cycle. therefore, the overnutrition situation is worsened by the loss of lean body mass, coupled

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with escalation of inflammation, and eventually lead to cytokine storm in the severe cases of COVID-19. Clinically, early parenteral nutrition (PN) alone or PN in combination with enteral feedings are strongly discouraged in critically ill patients, and only initiative early enteral nutrition (EEN) is recommended for patients who can be fed enterally.

EEN can be beneficial due to its trophic effect on gut mucosa to avoid gut mucosa atrophy and bacteria translocation, while aggressive nutritional support may be detrimental due to the transient over-nutrition discussed above. In the future, high-quality clinical trials on restrictive eating in which only very small amount of enteral nutrition will be provided to support the gut mucosa, and maintain serum fasting to dissipate the transient over-nutrition during SARS-CoV-2 viral infection should be designed to research the possible benefits of restrictive eating to COVID- 19 recovery [11].

Most often we get our vitamin D through the sun, but throughout this time, Palacios said, taking a supplement is a good idea. She added that studies have shown that low levels of vitamin D have been associated with a greater risk of developing respiratory conditions in adults and children. In fact, studies have begun to show that people with vitamin D deficiencies are at a higher risk of getting infected by the COVID-19 virus. Vitamin D is critical for bone and mineral metabolism. Because the vitamin D receptor is expressed on immune cells such as B cells, T cells, and antigen-presenting cells, and because these cells can synthesize the active vitamin D metabolite, vitamin D also has the potential to modulate innate and adaptive immune responses. Multiple observational studies involving nearly 2 million adults suggest vitamin D deficiency/insufficiency increases susceptibility to COVID-19 and severe COVID-19, although with a high risk of bias and heterogeneity. Association with mortality was less robust. Heterogeneity in RCTs precluded their meta-analysis. In summary, vitamin D deficiency/insufficiency increased the odds of developing severe COVID-19.

Patients with severe COVID-19 had lower 25(OH)D concentration. Heterogeneity was significant and may partly be explained by differences in definition of severe disease. Most studies did not report the timing of vitamin D testing in relation to the stage of illness, leading to high or unclear risk of bias in the exposure and outcome assessment domain [12]. Vitamin D deficiency/insufficiency may increase the risk of developing COVID-19 infection and susceptibility to more severe disease. Its association with mortality is less robust. The data arise from a heterogeneous group of studies with substantial risk of bias; hence, the reduced certainty of

evidence and need for cautious interpretation. RCTs investigating the therapeutic role of vitamin D were largely heterogeneous in design, precluding a meta-analysis [12].When it comes to piece of researchs that are related to vitamin C, a water-soluble vitamin, plays various roles, including supporting connective tissues through collagen synthesis, wound healing, and enhancing the immune system through its bactericidal properties and antibody boosting [13]. It has previously been proposed as having a theoretical benefit in immune defence against COVID-19 infection, based on its known properties and hypothetical, inconsistent evidence supporting its role in symptom mitigation in the common cold [14–16]. Additionally, various studies have demonstrated the positive effects of vitamin C against Epstein–Barr virus, enterovirus/rhinovirus-

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induced acute respiratory distress syndrome, and severe sepsis and in mechanically ventilated patients with acute respiratory distress syndrome in the ICU [17-19]. IV vitamin C was investigated based on variable evidence of its use in critically ill patients and showed no mortality benefit but some symptom management benefit [20]. One study involving high-dose vitamin C in the setting of COVID-19 demonstrated a significantly longer hospital stay than the non-vitamin C arm. Additionally, there were no significant differences in mortality or ICU length of stay. Vitamin C, alone and in combination with zinc, showed no significant decreases in COVID- 19-related symptoms compared to no study intervention. This vitamin has been hailed for years as a go-to source for aiding the immune system.

According to another reliable sources, the world is currently experiencing the pandemic of coronavirus (CoV). In late 2019, the CoV infection began in Wuhan, Hubei, China. It had been originally called 2019 nCoV and it has been renamed CoVID-19 by the World Health Organization on February 2020. This epidemic began with animal-to-human infection, and the direct cause of death is generally due to ensuing severe atypical pneumonia. CoVID-19 has now been declared a pandemic by the World Health Organization, and people in all countries are under quarantine in order to reduce the spread of the virus, which then also lessens the impact on medical resources. Since quarantine is associated to the interruption of the work routine, this could be result in boredom. Boredom has been associated with a greater energy intake, as well as the consumption of higher quantities of fats, carbohydrates, and proteins [21]. Further, during quarantine continuously hearing or reading about the pandemic without a break can be stressful. Consequently, the stress pushes people toward overeating, mostly looking for sugary “comfort foods” [22]. This desire to consume a specific kind of food is defined as “food craving”, which is a multidimensional concept including emotional (intense desire to eat), behavioral (seeking food), cognitive (thoughts about food), and physiological (salivation) processes [23]. Of interest, a gender difference has been reported in food craving, with a higher prevalence in women than in men. Carbohydrate craving encourages serotonin production that in turn has a positive effect on mood. In a sense, carbohydrate-rich foods can be a way of self-medicating anti stress.The effect of carbohydrate craving on low mood is proportional to the glycemic index of foods. This unhealthy nutritional habit could increase the risk of developing obesity that beyond being a chronic state of inflammation, it is often complicated by heart disease, diabetes, and lung disease that have been demonstrated to increase the risk for more serious complications of CoVID- 19 [24]. Quarantinerelated stress also results in sleep disturbances that in turn further worsen the stress and increase food intake thus giving rise to a dangerous vicious cycle. Therefore, it is important to consume food containing or promoting the synthesis of serotonin and melatonin at dinner. A considerable variety of plant species including roots, leaves, fruits, and seeds such as almonds, bananas, cherries, and oats contain melatonin and/or serotonin. These foods may also contain tryptophan, which is a precursor of serotonin and melatonin. Protein foods such as milk and milk products are the main sources of the sleep-inducing amino acid tryptophan. Moreover, tryptophan is involved in the regulation of satiety and caloric intake via serotonin that mainly lowers carbohydrate and fat intake, and inhibits neuropeptide Y, the most powerful hypothalamic orexigen peptides [25]. Further, beyond sleep-inducing properties, milk products such as yogurt

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could also augmented natural killer cell activity and reduce the risk of respiratory infections [26] During quarantine the increased intake of macronutrients could also be accompanied by micronutrients deficiency as occurs in obesity [27], which is commonly associated with impaired immune responses, particularly cell-mediated immunity, phagocyte function, cytokine production, secretory antibody response, antibody affinity, and the complement system, thus making more susceptible to viral infections [28].

Thus, during this time it is important to take care of nutritional habits, following a healthy and balanced nutritional pattern containing a high amount of minerals, antioxidants, and vitamins. Several studies reported that fruits and vegetables supplying micronutrients can boost immune function. This happens because some of these micronutrients such as vitamin E, vitamin C, and betacarotene are antioxidants. Anti-oxidants increase the number of T-cell subsets, enhance lymphocyte response to mitogen, increased interleukin-2 production, potentiated natural killer cell activity, and increased response to influenza virus vaccine compared with placebo [29]. Beta Carotene is most abundant in sweet potatoes, carrots, and green leafy vegetables while sources of vitamins C include red peppers, oranges, strawberries, broccoli, mangoes, lemons, and other fruits and vegetables. The major dietary sources of vitamin E are vegetable oils (soybean, sunflower, corn, wheat germ, and walnut), nuts, seeds, spinach, and broccoli. In addition, quarantine could be associated to a less time spent outdoor, less sun-exposure, and reduced production of vitamin D as a result of lower levels of 7-dehydrocholesterol in the skin.

Vitamin D deficiency in winter has been reported to be associated to viral epidemics. Indeed, adequate vitamin D status reduces the risk of developing several chronic diseases such as cancers, cardiovascular disease, diabetes mellitus, and hypertension that significantly higher risk of death from respiratory tract infections than otherwise healthy individuals [30]. Further, vitamin D protects respiratory tract preserving tight junctions, killing enveloped viruses through induction of cathelicidin and defensins, and decreasing production of proinflammatory cytokines by the innate immune system, therefore reducing the risk of a cytokine storm leading to pneumonia. Since the time spent outdoor and consequently the sun exposure is limited, it is encouraged to get more vitamin D from diet. Foods containing vitamin D include fish, liver, egg yolk and foods (e.g., milk, yogurt) with added vitamin D. Another essential trace element that is crucial for the maintenance of immune function is zinc. It has been reported that zinc inhibited severe acute respiratory syndrome (SARS) coronavirus RNA-dependent RNA polymerase (RdRp) template binding and elongation in Vero-E6 cells [31].

Although oysters contain the most zinc per serving, the most common food to get zinc are represented from poultry, red meat, nuts, pumpkin seeds, sesame seeds, beans, and lentils. All the above described nutrients are enclosed in Mediterranean Diet pattern that could represent a healthy nutritional pattern to be followed in quarantine. Key ingredients of Mediterranean cuisine include olive oil, fresh fruits and vegetables, protein-rich legumes, fish, and whole grains with moderate amounts of wine and red meat. As far some conclusion that belongs to the scientists [21], In conclusion, due to the quarantine-related situational stress-eating, nutrition becomes a priority at this time. Many people probably have much of what they might need at home, and so there is

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no reason to rush to buy groceries creating mass gatherings that could contribute to the spread of CoVID 19 because during quarantine food stores stay open throughout. Keeping foods that are good sources of immuno-supportive nutrients, planning times to eat, meals, portions and having a cutoff time for eating but mostly having in mind positive attitudes could be helpful to tackle the negative health effects of quarantine.

Conclusion: In conclusion, in this article we have discussed nutritional recommendations for COVID-19 disease, nutrition acquisition by human immunity, transient overnutrition and the cytokine storm in severe cases of COVID-19 and dietary recommendations during the COVID-19 pandemic. We have analyzed the opinions and conclusions of several scientists on this topic. We believe that this article can be an impetus for further in-depth research.

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