Dietary Recommendations During the COVID-19 Pandemic: an Extract

Christianne de Faria Coelho-Ravagnani^a Flavia Campos Corgosinho^b
Fabiane La Flor Ziegler Sanches^c Carla Marques Maia Prado^d Alessandro Laviano^e
João Felipe Mota^f

^aGraduate Program in Movement Sciences, Federal University of Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil; ^bGraduate Program in Nutrition and Health, Federal University of Goiás, Goiânia, Goiás, Brazil; ^cGraduate Program in Biotechnology, Faculty of Pharmaceutical Sciences, Food and Nutrition, Federal University of Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil; ^dDepartment of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB, Canada; ^eDepartment of Translational and Precision Medicine, Sapienza University of Rome, Rome, Italy; ^fClinical and Sports Nutrition Research Laboratory (Labince), School of Nutrition, Federal University of Goiás, Goiânia, Goiás, Brazil

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Abstract

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). This review summarizes nutritional guidelines to support dietary counseling provided by dietitians and health-related professionals. 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. Dietary supplementation has not been linked to COVID-19 prevention. However, supplementation with vitamins C and D, as well as with zinc and selenium, was highlighted as potentially beneficial for individuals with, or at risk of,

respiratory viral infections or for those in whom nutrient deficiency is detected. There was no convincing evidence that food or food packaging is associated with the transmission of COVID-19, but good hygiene practices for handling and preparing foods were recommended. No changes to breastfeeding recommendations have been made, even in women diagnosed with COVID-19.

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Introduction

In January 2020, the world faced an outbreak of coronavirus disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Evidence of high human-to-human transmissibility of SARS-CoV-2 has made social isolation the best preventive measure to avoid the spread of COVID-19 [1]. This pandemic is substantially affecting lifestyles, healthcare systems, and national and global economies. Social isolation is often an unpleasant experience that may have negative effects on

mental health [2]. It has been suggested that, until quarantine ends, self-isolation is likely to cause psychological and emotional symptoms [3], changes in mood and altered sleep or eating patterns [4], worsening of chronic health conditions, weight gain, and increased use of alcohol, tobacco, or illegal drugs.

Optimal nutrition is one of the main determinants of health that can improve well-being and mitigate the harmful health consequences associated with social distancing by helping to prevent or control most chronic diseases (eg, diabetes, hypertension, and excess body weight/obesity); aid in the regulation of sleep and mood;

and prevent fatigue [5, 6], Nutritional modulation of the immune system is also important across the age spectrum. During early childhood, breastfeeding can provide protection against infections and respiratory diseases, as breast milk contains antibodies, enzymes, and hormones that can offer health benefits [7]. In older adults, the group at most risk for COVID-19, changes in dietary habits lead to significant alterations in immunity and inflammation, termed immunosenescence and inflammaging [8]. Some nutrients, such as omega-3 polyunsaturated fatty acids and probiotics, have been linked to anti-inflammatory responses and enhanced resistance to upper respiratory tract infection [8].

In individuals infected with SARS-CoV-2, nutritional status is a crucial factor for optimal prognosis and can determine the clinical severity of COVID-19 [9]. Dietary supplementation with selected vitamins (eg, A, B, C, and D), minerals (eg, selenium, zinc, and iron), and omega-3 fatty acids was suggested by Zhang and Liu [10] as a treatment option for COVID-19 patients and as preventive therapy against lung infection. However, the use of micro-nutrient supplements to prevent infections remains questionable. Since to date there is no vaccine or evidence-based treatment for COVID-19, the optimization of nutrient intake through well-balanced meals and the use of good hygiene practices in food selection, preparation, and conservation is probably the most effective approach for managing the continuous risk of viral infection. To this end, dissemination of healthy eating guidelines for healthcare professionals and the general public is a crucial strategy. Despite intense efforts by international nutrition organizations and other health-related societies to produce guidelines and advice related to the COVID-19 pandemic, literature is still scarce. Meanwhile, the general public has been bombarded with a vast array of nutritional information from governmental authorities, the dietary supplement industry, nutrition enthusiasts, healthcare professionals, and others on how to prevent COVID-19. This information, however, may be conflicting or non-evidence based. Therefore, a systematic search of guidelines and official documents related to nutrition and COVID-19 was conducted. The search included information obtained from several countries affected by the pandemic as well as manuscripts identified in scientific databases. The goal was to address one main question: What nutritional advice is being offered for individuals in quarantine during the COVID-19 pandemic? The aim of this review was to summarize nutritional guidance related to the novel coronavirus (SARS-CoV-2) in order to support dietary counseling provided by dietitians and healthcare professionals during this pandemic.

Methods

This narrative review was carried out from December 2019 to April 2020, during the COVID-19 pandemic. Guidelines and official documents from governmental and nongovernmental health agencies or institutions worldwide, all providing recommendations on food and nutrition during the COVID-19 pandemic, were eligible for inclusion. Literature related to specific nutritional or

pharmacological treatment of patients already infected was excluded. The descriptors «coronavirus», «COVID-19», «COVID» AND «nutrition» OR «diet» were used to search for guidelines, position papers, and official documents in the PubMed, SciELO, Cochrane, and Google databases. The Boolean operators «AND» and «OR» were used to combine the terms used in the literature search. Publications in the following languages were searched: Italian, English, Spanish, and Portuguese. Two authors (J.F.M. and F.C.C.) conducted the search and screened all references independently in a 2-step process. All selected documents were retrieved, and duplicates were excluded. Titles and abstracts were then screened to identify studies that potentially met the eligibility criteria.

Results

Of the 48 documents retrieved, 13 were included in this narrative review. Of these, 8 dietary recommendations were issued from nutrition societies and associations and 6 from national governments (Australia, Brazil, Canada, Italy, Spain, United States). Five guidelines from health organizations (Food and Agriculture Organization of the United Nations, World Health Organization, United Nations Children's Fund, Center for Disease Control and Prevention, and European Food Information Council) were included. [...] Four major nutrition-related topics – overall dietary recommendations, dietary supplements, breastfeeding, and food hygiene – were identified.

Dietary Recommendations

Nearly 70% of the documents retrieved encouraged the consumption of fruits, vegetables, and whole grain foods. Two nutrition societies, from Italy and Spain [12, 22] recommended at least 5 servings of fruits and vegetables per day. Diets rich in fruits and vegetables contain high amounts of vitamins and minerals, including vitamins A, C, D, E, and B complex, as well as zinc and selenium, which are important modulators of the immune system [26]. In addition, fruit and vegetables are good sources of water, antioxidants, and fiber, all of which play a role in the control of hypertension diabetes, and weight gain, some of the most important risk factors for COVID-19 complications [27]. Micronutrients contribute to immune function through a variety of pathways in both innate and adaptive immune responses. Vitamins A, C, D, E, B6, and B12 and zinc are important for the maintenance of structural and functional integrity of physical barriers (eg, skin, gastrointestinal lining, respiratory tract, and others) as well as for the differentiation, proliferation, function, and migration of innate immune cells [28].

Meanwhile, vitamins C and E, along with zinc and selenium, protect against free radical damage during increased oxidative stress. Vitamins A, C, D, E, B6, and B12 and zinc and selenium support the adaptive immune response by influencing the differentiation, proliferation, and normal function of T and B cells. These nutrients also affect antibody production and function [28], contribute to cell-mediated immunity, and support the recognition and

destruction of pathogens. Lastly, they have antimicrobial activity and regulate the inflammatory response [28].

Approximately one-third of the identified guidelines mentioned at least one of these nutrients as being important for optimizing the immune system, placing special emphasis on zinc and vitamins C, A, and D [11, 19, 22]. Adequate intakes of these micronutrients may be attained through a daily diet that includes meat, fish, lentils and beans, dairy foods, nuts, seeds, eggs, citrus fruits (eg, orange, lemon, grapefruit), kiwi, strawberries, and vegetables such as broccoli, cauliflower, pumpkin, spinach, sweet potato, and carrots. [...]

Almost, one-third of the organizations and societies recommended avoiding the intake of salt, fat, and sugar and encouraged reductions in sugary drinks, other sugar-rich products, meat portions, and other foods of animal origin to lower the intake of saturated fat [12–14]. In addition, they suggested that low-fat dairy foods and healthy fats (eg, olive oil and fish oil) be included in the diet [12, 23] and recommended sauces, spices, and herbs as salt substitutes [17].

[...] Drinking water or maintaining adequate hydration was suggested in 3 documents [12, 20, 24], but no guidance on water requirements (eg, cups or milliliters per day) was provided. The evidence in favor of a direct association between hydration status and health has been previously confirmed. Water is essential for cellular homeostasis, kidney function, body temperature control, mood regulation, cognitive function, gastrointestinal and heart function, and headache prevention [37]. [...] Therefore, advice on the importance of drinking water, tea, and milk and consuming other water-containing foods should be delivered by dietitians and healthcare professionals during the COVID-19 pandemic. Since the daily water requirement is influenced by age, sex, level of physical activity, diet, body composition, pregnancy, environmental conditions, and the presence of disease, the recommended intake of water varies widely and can reach 3.7 L/d for older adults (including all water contained in food, beverages, and drinking water) [39]. According to the Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate [39], adults with moderate levels of physical activity who consume approximately 2200 kcal/d can meet water recommendations by drinking 12 cups of water and beverages daily, while children require 4 to 5 cups per day, adolescents (9 to 18 years) 7 to 11 cups per day, and older adults 9 to 13 cups per day.

While some organizations recommend choosing unprocessed foods [12, 13, 22–24], healthy dried, frozen, or canned foods (eg, fish, fruits, soups) are suggested as alternatives when fresh produce is not available [17, 23]. There is a current trend for guidelines to support homemade and fresh meals instead of processed foods. [...]

Although there is some lack of clarity and guidance regarding obesity as a risk factor for COVID-19 [47], substantial preliminary data demonstrate that higher body mass index is a considerable risk factor for hospitalization and development of severe pneumonia [48–51]. In fact, a systematic review and meta-analyses showed that 50% of the adult patients infected with the Middle

East coronavirus presented with hypertension and diabetes, while obesity was present in 16% of the cases [52]. Moreover, a recent study found a significant inverse correlation between body mass index and age: young individuals admitted to hospitals were more likely to have obesity. The study suggested that obesity could shift the incidence of severe COVID-19 disease to younger ages in countries where the prevalence of obesity is high [48]. [...] Thus, healthy weight loss could be a good strategy to reduce the risk of COVID-19 complications. Although none of the institutions mentioned weight loss in their guidelines, 3 of them highlighted the importance of avoiding weight gain. Specific guidelines for obese individuals are nonetheless needed to promote gradual weight loss without compromising the body's lean mass. Considering the difficulty to achieve significant weight loss through physical activity during the pandemic, protein intake of around 30% of energy requirements may be considered for adults under energy-restricted diets. This level of protein intake can prevent or attenuate the loss of lean muscle mass while also promoting greater satiety during weight loss [54]. In their discussion of nutritional recommendations during COVID-19 quarantine, Muscogiuri et al. [4] highlighted the role of tryptophan, an amino acid and a precursor of serotonin, in the regulation of satiety and caloric intake, suggesting protein-rich foods such as milk, yogurt, seeds, and nuts as good sources. It is worth noting that web-based weight-loss approaches are becoming popular and are effective for patients with obesity [55]. Such tools may be useful during the COVID-19 pandemic.

Probiotics were recommended by only one institution [11], which did not provide a specific amount or examples of food sources. Probiotics are defined as live microorganisms that, when administered in adequate amounts, confer a health benefit on the host.» [56]. They can act through diverse mechanisms, including modulation of immune function, production of antimicrobial compounds and organic acids, improvement of gut barrier integrity, formation of enzymes, and interaction with resident microbiota [57]. Studies of probiotic species belonging to the *Lactobacillus* and *Bifidobacterium* genera have shown promising results regarding improved immune function [58]. Fermented dairy products might be a good option to improve the gut microbiota, although further studies are needed to better elucidate the modulatory mechanisms of the microorganisms in these foods. Only one agency provided guidance on alcohol consumption. The Food and Agriculture Organization of the United Nations [20] recommended that alcohol intake be limited, but no specific amounts were provided

Excessive alcohol consumption is associated with reduced host immunity to viral infections and increased susceptibility to tuberculosis and bacterial and viral pneumonia in humans and animals [59]. On the other hand, some benefits of moderate alcohol consumption have been reported, including reduced risk of cardiovascular disease, alleviation of acute stress, improved mood, and increased relaxation [60]. Current guidelines for moderate intake recommend no more than 1 drink per day for women and no more than 2 drinks per day for men [5]. It should be

Fig. 1. Rationale for dietary recommendations during the coronavirus disease 2019 (COVID-19) pandemic. Key nutrients that support the immune system can be obtained through dietary components that include fresh foods (e.g., fruits and vegetables), fish, lean meat, dairy, water and other non-sugary beverages, and healthy fats. A healthy diet can also decrease the risk of, or help control, hypertension, diabetes, obesity, and muscle atrophy, which are all considered risk factors for COVID-19 complications. There are no known supplements that can prevent COVID-19; however, in populations at risk of deficiency, supplements can mitigate the public health risks associated with COVID-19. Breastfeeding benefits an infant's immune system, protecting against viruses and bacterial infections. The use of personal protection, such as masks, along with good hygiene practices, such as frequent handwashing with soap and water or alcohol-based sanitizers, can prevent COVID-19 transmission and immune system impairment. Symbol: (-): inhibitory effect.

noted that individuals who do not drink alcohol should not start drinking.

Finally, generic terms and phrases such as «healthy diet», «variety of foods in each group», «variety of fresh and unprocessed foods», and «varied diet» were observed in the majority of the documents. These messages might not be clear enough to encourage people to make healthy food choices. Specific recommendations, including examples of food and instructions for food preparation, would improve the public health message.

Dietary Supplementation

All documents reported that there are currently no known supplements to prevent COVID-19. Only 2 documents mentioned that it might be possible to use supplements to meet dietary recommendations [11, 19]. Some vitamins and minerals improve immunity; however, the idea that more is better is a misconception. Megadoses of vitamins and minerals can induce toxic and adverse effects [61, 62] or interact with medications, leading to enhanced or reduced pharmacological effects [63]. On the other hand, it is important to note that Dietary Reference Intakes have been established for healthy individuals and are based on a diet providing 2000 kcal/d [64]. Thus, healthcare professionals should individualize dietary plans by considering factors that can increase nutrient requirements, such as specific diseases/conditions, medications, dietary patterns (eg, vegetarianism), and exercise intensity. For this purpose, the range from the Recommended Dietary Allowance to the Tolerable Upper Intake Level can be used to optimize the dietary plan [65]. [...]

Breastfeeding

Breastfeeding provides a multitude of benefits for both mother and child. Breast milk contains important antibodies that benefit the child's immune system, protecting against viral and bacterial infections [7]. According to the World Health Organization, breastfeeding must be exclusive until 6 months of age (no water, other fluids, or solids) and continued until 2 years of age or beyond [79]. Only 6 of the 13 documents included in this review addressed this topic [15, 18, 19, 21, 23, 25]. All recommended that breastfeeding be maintained during the COVID-19 pandemic, even in women diagnosed with the disease. However, good hygiene practices are recommended, including mask wearing, handwashing before and after touching the infant, and disinfecting frequently used surfaces.

Food Hygiene

Approximately 54% of the documents selected for this review included guidance on food hygiene [14, 16, 18–20, 23]. There is currently no convincing evidence that food or food packaging is associated with the transmission of COVID-19 [18, 20, 23]. The risk of fecal-oral transmission, while low, can persist even after viral clearance from the respiratory tract. This highlights the need for routine stool testing and transmission-based precautions for hospitalized patients [81] and probably for those recovering at home. All documents emphasized the importance of adequate personal hygiene when handling food, highlighting the need for frequent handwashing with soap and water or alcohol-based hand sanitizers. In food and beverage stores, the greatest risk of contamination

tion is through contact with other people and «high touch» surfaces such as food scales, shopping-cart handles, and elevator buttons [19]. Unlike some viruses that can live on food or other surfaces for several days, SARS-CoV-2 can survive on metal or plastic surfaces for 3 days and on cardboard surfaces for 1 day [82]. Infectious disease authorities in several countries are recommending the use of soap or alcohol-based hand sanitizer for handwashing, reinforcing the importance of strict hygiene measures to prevent the spread of contamination [80, 83]. According to the European Food Safety Authority [19], there is no need to disinfect food packaging itself, as long as some precautions are taken: (1) wash hands for 20 seconds with soap and water before and after grocery shopping, unpacking foods, and after receiving delivered food; (2) maintain a safe distance (1 to 2 meters) from other people when shopping; (3) do not go shopping when sick; instead, when possible, order groceries online or have family members or friends help with shopping; (4) avoid touching foods unless you plan to buy them; (5) limit trips to the supermarket by planning meals; (6) cover your mouth and nose with a tissue or your sleeve when coughing or sneezing, and wash hands afterward; and (7) after touching surfaces, avoid touching your face, nose, and mouth until after hands have been washed. [...]

Figure 1 describes the rationale behind the dietary guidance and the personal hygiene practices recommended during the COVID-19 pandemic, along with the potential mechanisms linking diet and the prevention of COVID-19 complications.

Conclusion

This review summarizes recent scientific literature and existing recommendations from national and international nutrition agencies on an optimal diet, vitamin and mineral supplementation, and good hygiene practices for food preparation during the COVID-19 pandemic. The findings can be used to help dietitians and healthcare professionals better address dietary recommenda-

tions during the COVID-19 pandemic. Guidance related to the safe handling of food, from production to consumption, is critical to reduce the risk of viral dissemination. The general recommendation is to consume a diet based predominantly on fresh foods such as fruits, vegetables, whole grains, low-fat dairy sources, and healthy fats (olive oil and fish oil) and to limit intakes of sugary drinks and processed foods high in calories and salt. Dietary supplements (i.e., vitamins C and D, zinc, and selenium) should be administered to individuals with, or at risk of, respiratory viral infections or in whom deficiency is detected. Breast milk is the safest and healthiest food for infants, and breastfeeding should be encouraged, even in women diagnosed with COVID-19.

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Author Contributions

C.d.F.C.-R., F.C.C., F.L.F.Z.S., and J.F.M. designed the review. F.C.C. and J.F.M. performed the literature search. C.d.F.C.-R., F.C.C., F.L.F.Z.S., and J.F.M. drafted the manuscript. C.M.M.P. and A.L. critically reviewed the manuscript. All authors approved the final version of the manuscript.

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Declaration of Interest

The authors have no relevant interests to declare.

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The references are available at <https://academic.oup.com/nutritionreviews/article/79/4/382/5870414>.