



Nutritional recommendations for CoVID-19 quarantine

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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 [1]. 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*” [2]. 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 [3]. 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 [4]. Quarantine-related 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 [5]. Further, beyond sleep-inducing properties, milk products such as yogurt could also augmented natural killer cell activity and reduce the risk of respiratory infections [6]. During quarantine the increased intake of macronutrients could also be accompanied by micronutrients deficiency as occurs in obesity [7], 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 [8]. 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

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these micronutrients such as vitamin E, vitamin C, and beta-carotene 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 [9]. 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 [10]. 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 [11]. 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.

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 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.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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References

1. Moynihan AB, van Tilburg WA, Igou ER, Wisman A, Donnelly AE, Mulcaire JB. Eaten up by boredom: consuming food to escape awareness of the bored self. *Front Psychol.* 2015;6:369.
2. Yilmaz C, Gökmen V. Neuroactive compounds in foods: occurrence, mechanism and potential health effects. *Food Res Int.* 2020;128:108744.
3. Rodríguez-Martín BC, Meule A. Food craving: new contributions on its assessment, moderators, and consequences. *Front Psychol.* 2015;6:21.
4. Wu C, Chen X, Cai Y, Xia J, Zhou X, Xu S, et al. Risk factors associated with acute respiratory distress syndrome and death in patients with coronavirus disease 2019 pneumonia in Wuhan, China. *JAMA Intern Med.* 2020. <https://doi.org/10.1001/jamainternmed.2020.0994>.
5. Peuhkuri K, Sihvola N, Korpeila R. Diet promotes sleep duration and quality. *Nutr Res.* 2012;32:309–19.
6. Makino S, Ikegami S, Kume A, Horiuchi H, Sasaki H, Orii N. Reducing the risk of infection in the elderly by dietary intake of yoghurt fermented with *Lactobacillus delbrueckii* ssp. *bulgaricus* OLL1073R-1. *Br J Nutr.* 2010;104:998–1006.
7. Garcia OP, Long KZ, Rosado JL. Impact of micronutrient deficiencies on obesity. *Nutr Rev.* 2009;67:559–72.
8. Thurnham DI. Micronutrients and immune function: some recent developments. *J Clin Pathol.* 1997;50:887–91.
9. Chandra RK. Effect of vitamin and trace-element supplementation on immune responses and infection in elderly subjects. *Lancet.* 1992;340:1124–7.
10. Muscogiuri G, Altieri B, Annweiler C, Balercia G, Pal HB, Boucher BJ, et al. Vitamin D and chronic diseases: the current state of the art. *Arch Toxicol.* 2017;91:97–107.
11. te Velthuis AJ, van den Worm SH, Sims AC, Baric RS, Snijder EJ, van Hemert MJ. Zn(2+) inhibits coronavirus and arterivirus RNA polymerase activity in vitro and zinc ionophores block the replication of these viruses in cell culture. *PLoS Pathog.* 2010;6: e1001176.