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Physical fitness and health diet pre, intra and post Covid-19

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Abstract

The SARS-CoV-2-caused COVID-19 pandemic has resulted in a devastating threat to human society in terms of health, economy, and lifestyle. Although the virus usually first invades and infects the lung and respiratory track tissue, in extreme cases, almost all major organs in the body are now known to be negatively impacted often leading to severe systemic failure in some people. Unfortunately, there is currently no effective treatment for this disease. Pre-existing pathological conditions or comorbidities such as age are a major reason for premature death and increased morbidity and mortality. The immobilization due to hospitalization and bed rest and the physical inactivity due to sustained quarantine and social distancing can down regulate the ability of organs systems to resisttoviral infection and increase the risk of damage to the immune respiratory, cardiovascular, musculo-skeletal systems and the brain. The cellular mechanisms and danger of this"second wave"effect of COVID-19 to the human body, along with the effects of aging, proper nutrition, and regular physical activity, are reviewed in this article. The paper also intended to explore the ways in which alternate exercises and fitness activities at home helped them deal with psychological issues and physical health consequences. The regular fitness workout at home during the lockdown greatly helped them to overcome psychological issues and fitness concerns.

Keywords

Cardio metabolic risk; coronavirus disease 2019; diabetes; enteral nutrition; knowledge gap; metabolic syndrome; nutrition; nutrition research; nutrition support therapy; obesity; parenteral nutrition; social determinants of health, COVID-19; exercise; gym workout; lockdown; physical fitness,PA-physical activity

Introduction

Coronavirus disease (COVID-19) is an infectious disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which was first detected in December 2019 in the city of Wuhan,China. Currently, this pandemic has infected more than 15million people in nearly 210 countries around the world resulting in nearly 600,000 deaths. A pandemic of this scale has never been seen since the Spanish Influenza during WWI, and has already created dramatic challenges allover the world in terms of economy, social interactions, and individual lifestyles. Coronaviruses are one of the largest (27–34 kilobase) positive-stranded non-segmented RNA viruses,named after the~120nm diameter envelop(resembles of solar corona) around the nucleic acid-protein complex. The foremost damage of the virus is on human health, including direct injury to the respiratory system, compromise of the immune system, exacerbation of the underlying medical conditions, and eventually systematic failure and death. Due to the COVID-19 attack, tens of thousands of patients have been hospitalized, with additional thousands of millions of people forced to stay in limited space. Conceivably, this dramatic change in lifestyle, resulting from immobilization (hospitalization and bed rest), quarantine, and physical inactivity can cause a second-wave attack on the health and well being of the infected as well as general population. As a major journal of sport medicine and health in the world, the Editor-in-Chief sand the Editorial Board share a strong sense of obligation to provide an overview on the impact of COVID-19 and related physical inactivity on human health, and to offer some physical activity guidelines to individuals suffering from the adverse outcomes during the pandemic and those recovering froman infection.Thus, the goal of this review article is three-fold: 1) to highlight the COVID-19 threats and damages to the various human physiological systems;2) to address the harm of physical inactivity associated with the virus outbreak to the body; and 3) to recommend some practical strategies to mitigate the potential damage. Specifically, we will first give a brief overview on the pathology of COVID-19 and its impact on the immune system. We will then review the impacts of the COVID-19 outbreak and physical inactivity on the respiratory, cardiovascular, and musculoskeletal systems. Special sections will be devoted to how the virus may specifically devastate the aged population and compromise the psychological and mental wellbeing. Finally, we will provide some practical suggestions as to how good nutrition and exercise training can protect against and help recovery from the virus attack. Ultimately, the harm and suffering that the coronavirus can cause to an individual is determined by not only the endowed factors such as age, sex, race, medical conditions, but also the lifestyle of the individual during the pandemic.

Fighting COVID-19 with proper nutrition

Nutrition is an important factor for human health, including maintaining a strong immune system. However, research up to date in-dicates that no single nutrient or dietary supplement can prevent or treat COVID-19. On the contrary, inappropriate intake, especially overdoses of dietary supplements might be more harmful than beneficial. Clinical data demonstrate that patients dying from COVID-19 are mostly elder people with complication from other diseases and malnutrition problem due to aging. Also, development of COVID-19 from mild to serious symptomsis closely related to the nutritional status.Therefore, assessing nutrition status is necessary and important during COVID-19 infection. SARS-CoV-2 virus, like other coronaviruses, causes rapidly generation of free radicals and the release of cytokines (cytokine storm), leading to oXidative stress which promotes cell death and ultimately results in organ failure.Patients with COVID-19 have increased pro-inflammatory cytokines,high-sensitivity C-reactive protein(hsCRP)and increased risk for sepsis and ARDS. EXperiences from treating SARS, MERS, andother virus infectious diseases and from clinical trials in COVID-19 patients show the beneficial effects of nutritional support against COVID-19. Through reducing oXidative stress and enhancing immunity, nutritional support helps people to lower the risk of virus infection or to alleviate the symptoms of COVID-19.

In plasma from COVID19 patients,hs CRP, a marker of inflammation and oxidative stress,is markedly elevated.Therefore,increasing anti-oxidant status and reducing pro-inflammatory cytokine release alongwith regular treatments is likely an effective strategy for lowering ARDS and COVID-19 risk. Vitamin C is a commonly used antioxidant to scavenge ROS and to protect cells from oxidative stress. Intravenous(i.v.) or oral administration of high-dose vitamin C has been reported to be safe and protects against viral infection without major adverse events.Inaddition, high-dose vitamin C supplementation by i.v. administration shortened the intensive care unit (ICU) stay by 7.8% and significantly reduced mortality rate. Several registered clinical trials are presently being performed to investigate the effects of vitamin C in treatment ofCOVID-19 in several countries such as NCT04264533, NCT04357782andNCT04335084.

Enhancing immunity is an important means for preventing and managing viral infections. Nutritional status affects immune homeostasis while malnutrition will impair immune response to pathogens.Vitamins and trace elements are crucial to maintain the function of immune system.Therefore, supplementation of proper amounts of vitamins and trace elements may enhance immunity against COVID-19.

Vitamin D is a group of steroids responsible for absorption of calcium.Vitamin D not only play the vital role in maintaining proper bone structure but also a modulates immune response. Several studies claimed that vitaminD induces antimicrobial peptides to kill the invading pathogens, including bacteria, virus, and fungi.VitaminD can reduce the cytokine storm by inhibiting expression of pro-inflammatory cytokines, such as TNFα and interferonγ (IFNγ)while stimulating anti-inflammatory cytokines expression by macrophages. Inaddition, vitamin D supplementation may reduce hsCRP in diabetic patients inwhom vitamin D deficiency increases the risk of ARDS.Therefore, vitamin D supplementation is highly recommended to reduce the risk of COVID-19. Currently, several clinical trials are underway to investigate the potential protective effects of vitamin D supplementation at different doses and durations against COVID-19 such as NCT04344041 and NCT04326725.

Vitamin A is a group of retinoids including retinol, retinal and retinoic acid, and is one of the most important factors in maintaining immunesystem function. Vitamin A supplementation has been shown to reduce morbidity and mortality of measles, pneumonia, diarrhea, malaria, and HIV infection.Vitamin A supplementation also enhances immune response after vaccination forme as influenza.

Vitamin B is a group of water soluble vitamins having different functions in the human body.VitaminB2 could decrease the titer of MERS virus inhuman plasma. During lung injury induced by the ventilator, vitamin B3 treatment significantly inhibited the infiltration of neutrophils into the lungs and elicited a strong anti-inflammatory effect. In addition, vitamin B6 deficiency is known to weaken host immuneresponse.

Vitamin E is an antioxidant and its deficiency impairs humoral and cellular immunity. Vitamin E supplementation is particularly effective in improving age-related immunity. Protective effects of vitamin E supplementation on hepatic B virus infection and bacterial pneumonia infection have been reported, however, vitaminE supplementation apparently has no protective effects on acute respiratory tract infections. In view of the protective effect of these vitamins on viral infection, supplementation with multiple vitamins is recommended to reduce COVID-19risk.

Other nutrients involved in strengthening immunity are trace elements such as selenium and zinc. Selenium status is correlated with thecure rate and death rate of COVID-19 patients. High hair selenium level has been shown to correlate positively with treatment outcomes of COVID-19 patients. The mechanism forthe protective effect of seleniumis likely related to the selenium-dependent enzyme glutathione peroxidases, which is an important antioxidant enzyme to reduce ROS and oxidative stress.

Zinc is another important trace element for developing and maintaining immune system function. Previous research on the SARS coronavirus (SARS-CoV) pandemic in 2003 reported that combination of low concentrations of zinc and pyrithione inhibited coronavirus replica-tion.Since the SARS-CoV-2 virus belongs to the same family of corona virusas SARS-CoV, zinc supplementation has high potential for prevention of COVID-19. Considering the potential effect of zine against COVID-19, adding zinc along with chloroquine and hydroxychloroquine may improve the treatment outcome of patients with COVID-19. Clinical trials are presently being conducted to estimate the synergisticaction of zinc and chloroquine as therapy for COVID-19 (NCT04326725,). Insummary, although definite proof for the potential effectiveness of various nutrients in alleviating harmful effects of COVID 19 is still forth coming, supplementation of sufficient vitamins and proper trace elements is recommended to help prevent lung infection and alleviate COVID-19 symptom.Importantly, all nutritional supplements only reduce the possibility of infection and are only adjuvant therapies,whereas the only strategies for COVID-19 prevention and treatment are in the development of vaccine and drugs.

PA and Exercise programming during a pandemic

Infectious and non-communicable diseases have always be set humans, but the recent appearance of COVID-19 has refocused public health perspectives to infectious disease. In the early part of the 20th century, advances in the prevention and treatment of infectious disease was primary, but deaths caused by non communicable disease continued to rise.During the last part of the 20th century, higher global death rates shifted this focus from infectious to non communicable diseases and the scientific community sought to better understand prevention andtreatment of these diseases. The impact of PA and exercise on non communicable disease are well-documented and also impact the immune system and thus affects the bodies antiviral defenses.

Unfortunately, modern lifestyle behaviors promote physical inactivity and sedentariness. These poor lifestyle behaviors are intensified by social distancing and self-imposed or government mandated quarantine measures intended to reduce COVID-19 spread.These circumstances pose significant challenges for remaining physically active. During periods of isolation, all socioeconomic groups, ethnicities, and ages should maintain good health by following the WHO PA recommendations of 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity PA per week, or a combination of both.Muscle-strengthening activities involving major muscle groups are recommended on two or more days a week.In children/adolescents the recommendations include atleast 60minutes per day of vigorous or moderate intensity PA.

To exercise or not to exercise when flu or COVID-19 symptoms are observed

Common COVID-19 symptoms are fever, cough, shortness of breath, and breathing difficulties. In severe cases, infection causes pneumonia, ARDS, organ failure, and even death. Symptoms usually appear within two to 14days and are difficult for the non-health professional to differentiate between flu or COVID-19. Ineither case, the PA or exercising individual should seek medical diagnosis and discontinue PA and exercise immediately.Present data suggest the median time from on set to clinical recovery form Mild COVID-19 cases is approximately two weeks and is three to six weeks or longer for patients with severe or critical disease. When body aches, fatigue, fever or symptoms such as a stomach ache or a hacking cough are present, bed rest is recommended until symptoms subside. Even at this point, taking a break from PA or exercise for a few days is sensible for the body to regain full function. Using the body as aguide to determine when to resume PA or exercise is always useful but becareful not to over-exert. If one is not sure whether or when to exercise, talking with your doctor is vital. When becoming PA or starting exerciseafter an illness, reduce PA and exercise intensity and duration for several days or even weeks. Complete recovery depends on the severity and thelength of time of illness. Each individual responds and recovers differently to illnesses. Attempting PA or exercise at regular exercise intensity and duration before completely recovered,increases risk for more-serious injury or illness.

Starting an exercise program during a pandemic

When starting a PA or exercise program while in the midst of a pandemic, public health recommendations for social distancing and hygiene practices are paramount considerations when starting a PA or exercise program. Becoming physically active and reducing sedentary behavior is easily accomplished by avoiding sitting for long time periods, taking short movement or activity breaks, utilizing online exercise classes, and using mobile technologies such as telephone applications and wearable sensors to encourage movement. Examples of home exercises not requiring large spaces or equipment while easily practiced at all times of the day include walking, stair climbing, lifting and carrying groceries, chair squats, pushups, sit-ups, rope jumping, yoga, Pilates, and Tai Chi. A beginning exercise program should start at low intensities for short du-rations and progress slowly to more intense PA or exercise periods oflonger durations. Because these activities are easily performed at home, difficulties in finding facilities with proper space and specific equipment is reduced or eliminated. A goal of any beginning PA or exercise program is to progressively work toward completing at least one-half hour of moderate PA every day or at least twenty minutes of vigorous PA every other day of the week. Ideally, strengthening- type activities are included in daily activities at least twice a week. Individuals susceptible to chronic diseases such as cardiovascular or pulmonary disease should seek advice from health careproviders regarding safe exercises. Recommendations for children and youth aged five to 17 years are the accumulation of at least 60 minutes of moderate-to vigorous-intensity daily PA.Inaddition, vigorous-intensity activities that strengthen muscle and bones are recommended at least three times per week.

If engaged in regular PA or exercise and wanting to further enhance cardiovascular and muscle fitness, suddenly beginning an intense aerobic and resistance exercise training program or performing unaccustomed highly intense prolonged exercise is not prudent, because such PA or exercise training can lead to reduced immune function. Thus, if you are already physically active or a regular exerciser but want to become more physically active, adjust exercise programming slowly and progressively to obtain new fitness goals to reduce the likelihood of any negative impact on the immune system.

GOODNUTRITION

Good nutrition is very important before during and after an infection. Infections take a toll on the body especially when these cause fever, the body needs extra energy and nutrients. Therefore, maintaining a healthy diet is very important during the COVID-19 pandemic. While no foods or dietary supplements can prevent COVID-19 infection, maintaining a healthy diet is an important part of supporting a strong immune system. Countries that have implemented strict lockdown and physical distancing regulations, have also put in measures that have protected access to food and have not, thus far, experienced wide spread disruptions in food supplies. The Food and Agriculture Organization of the United Nations (FAO) and other United Nations (UN) agencies are sharing best practices to help governments ensure the food supply continues to be stable.

It is still possible to purchase and consume a healthy diet during these difficult times. Diets vary greatly from place to place based on many factors including eating habits and culture. Yet, when itcomes to food, there is a lot that we know about how to select the right combination of food to attain a healthy diet regardless of where we live.

RECOMMENDATIONS

To maintain healthy diets,FAO encourages everyone to:

Eat a variety of foods within each food group and across all the food groups to ensure adequate intake of important nutrients. For advice on what constitutes a healthy diet in your country, FAO has compiled many countries' Food-based dietary guidelines, you may find your country advice here:

Eat plenty of fruits and vegetables. Fresh fruits and vegetables provide lots of vitamins and minerals as well as fiber that we need for healthy diet. To limit your trips to the market or supermarket, in addition to fresh fruits and vegetables, you can also buy frozen or canned fruits and vegetables. These fruits and vegetables also contain vitamins and minerals. However, in the canning and processing of these products, sometimes other ingredients such as sugar, salt, or preservatives are added. Be sure to read the labels so you can choose the options that are best for you and your family in order to limit intake of these ingredients.

Consume a diet rich in whole grains, nuts, and healthy fats such as in olive, sesame, peanut orother oils rich in unsaturated fatty acids. Such diets may support your immune system and help to reduce inflammation.

Watch your intake of fats, sugar, and salt. Many people in times of high stress, use foodas a comfort, which can lead to over consumption. Furthermore, foods in which we find comfort are oftentimes very palatable because they are high in fat, sugar, salt and calories. Try to avoid eating too much of these ingredients not only as comfort foods but across everything you eat. Again, food labels are helpful here so that consumers can limit the purchasing and eating of these ingredients that should be found only in limited amounts in a healthy diet.

Continue to practice good food hygiene. Because of COVID-19 pandemic, you might be more concerned about food safety; however, COVID-19 is a respiratory virus and is not afood-borne disease. There is no evidence that the disease can be spread through contact with the food purchased. However, it's always good to remember how we can support food safety by practicing the five keys to food safety: (1) keep clean; (2) separate raw and cooked; (3) cook thoroughly; (4) keep food at safe temperatures; and (5) use safe water and raw materials. More detail can be found here:

Drink water regularly. Staying well hydrated, mainly through drinking ample amounts of plain water (6-8 glasses a day for most adults) also helps our immune system. Drinking plain water instead of sugar-sweetened beverages, also helps reduce the risk of consuming too many calories for maintaining a healthy weight.

Limit consumption of alcohol. Another way many people try to cope with stress is through having an alcoholic drink. These drinks have little nutritional value, are often times high in calories, and excess consumption is linked to numerous health problems. If you drink alcohol, do so only immoderate.

Many people are concerned that food might be running out from supermarket shelves. However, in most cases those empty shelves indicate bottle necks in getting some products to consumers, not that the food supply is not available at all. Many retailers in countries around the globe are working to overcome this challenge by hiring extra workers to rapidly restock shelves, reducing store hours to allow more time to restock, and redeploying workers from other tasks to help with restocking shelves.

For more general information on food supply see FAO's FAQs here:

FAO suggests not buying more than your family needs to reduce the risk of unnecessary food waste.FAO also recommends applying the nine simple steps to reduce household-level food waste. 1) Ask for smaller portions, 2) love your leftovers, 3) shop smart, 4) buy "ugly" fruits and vegetables, 5)check your fridge, 6) practice first in, first out (FIFO), 7) understand dates on your food, 8) turn waste into compost, 9)sharing is caring:give to help.

Find morehere:

Because many people are at home with their children, this time together can be used to start children on the road to lifelong habits that support a healthy diet. Fun activities to download for kids at home to learn about healthy diets and nutrition can be found in the Nutrition Challenge Badge found here and don't forget, in addition to a healthy diet, other lifestyle factors are critical part of maintaining well being and a healthy immune system. A healthy lifestyle includes additional strategies such as:

Not smoking;

Exercising regularly;

Getting adequate sleep;and,

Minimizing and coping with stress.

References

1. Cucinotta D, Vanelli M. WHO Declares COVID-19 a Pandemic. *Acta Bio Med*. 2020;91(1):157-60.

2. Mechanick JI, Hurley DL, Garvey WT. Adiposity-based chronic disease as a new diagnostic term: American Association of Clinical Endocrinologists and the American College of Endocrinology position statement. *Endocr Pract*. 2017;23(3):372-378

3. Mechanick JI, Garber AJ, Grunberger G, Handelsman Y, Garvey WT. Dysglycemia-based chronic disease: An American Association of Clinical Endocrinologists position statement. *Endocr Pract*. 2018;24(11):995-1011.

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4. Mechanick JI, Farkouh ME, Newman JD, Garvey WT. Cardiometabolic-based chronic disease – adiposity and dysglycemia drivers. *J Am Coll Cardiol*. 2020;75(5):525-538.

5. Mechanick JI, Farkouh ME, Newman JD, Garvey WT. Cardiometabolic-based chronic disease – addressing knowledge and clinical practice gaps in the preventive care plan. *J Am Coll Cardiol*. 2020;75(5):539-555.

6. Parra-Bracamonte GM, Lopez-Villalobos N, Parra-Bracamonte FE. Clinical characteristics and risk factors for mortality of patients with COVID-19 in a large data set from Mexico. *Ann Epidemiol*. Published online August 14, 2020. doi: 10.1016/j.annepidem.2020.08.005.

7. Killerby ME, Link-Gelles R, Haight SC, et al. Characteristics associated with hospitalization among patients withCOVID-19 –Metropolitan Atlanta, Georgia, March-April, 2020. *MMWR*. 2020;69(25):790-794.

8. Patel AP, Paranjpe MD, Kathiresan NP, et al. Race, socioeconomic deprivation, and hospitalization for COVID-19 in English participants of a national biobank. *Int J Equity Health*. 2020;19(1):114.

9. Batty GD, Deary IJ, Luciano M, et al. Psychosocial factors and

hospitalisations for COVID-19: prostpective cohort study based on a

community sample. *Brain Behav Immun*. 2020; 89:569-578.

10. Li X, Xu S, Yu M, et al. Risk factors for severity and mortality

in adult COVID-19 inpatients in Wuhan. *J Allergy Clin Immunol*.

2020;146(1):110-118.

11. Fan J, Wang H, Ye G, et al. Low-density lipoprotein is a potential

predictor of poor prognosis in patients with coronavirus disease 2019.

Metabolism. 2020; 107:154243.

12. Tian J, Yuan X, Xiao J, et al. Clinical characteristics and risk factors associated with COVID-19 disease severity in patients with cancer

in Wuhan, China: a multicenter, retrospective, cohort study. *Lancet*

Oncol. 2020;21(7):893-903

13. NikpouraghdamM, Jalali Farahani A, Alishiri G, et al. Epidemiological

characteristics of coronavirus disease 2019 (COVID-19) patients

in IRAN: a single center study. *J Clin Virol*. 2020;127:104378. https:

//doi.org/10.1016/j.jcv.2020.104378.

14. Huang J, Cheng A, Kumar R, et al. Hypoalbuminemia predicts the

outcome of COVID-19 independent of age and co-morbidity. *J Med*

Virol. Published May 14, 2020. https://doi.org/10.1002/jmv.26003.

15. Yuki K, Fujiogi M, Koutsogiannaki S. COVID-19 pathophysiology: a

review. *Clin Immunol*. 2020;215:108427.

16. Wambier CG, Goren A, Vano-Galvan S, et al. Androgen sensitivity

gateway toCOVID-19 disease severity. *Drug DevRes*. Published online

May 15, 2020. https://doi.org/10.1002/ddr.21688.

17. Rollston R,Galea S. COVID-19 and the social determinants of health.

Am J Health Promotion. 2020;34(6):687-689.

18. Mechanick JI, Rosenson RS, Pinney SP, et al. Coronavirus and

Cardiometabolic Syndrome. *J AmColl Cardiol*. 2020;76(17):2024-2035

19. Liu H, Chen S, Liu M, et al. Comorbid chronic diseases are strongly

correlated with disease severity among COVID-19 patients: a systematic

review and meta-analysis. *Aging Dis*. 2020;11(3):668-678.

20. Wells Mulherin D, Walker R, Holcombe B, et al. ASPEN report on nutrition support practice processes withCOVID-19: the first response. *Nutr Clin Pract*. 2020;35(5):783-791

21. Bornstein SR, Rubino F, Khunti K, et al. Practical recommendations for the management of diabetes in patients with COVID-19. *LancetDiabetes Endocrinol*. 2020;8(6):546-550.

22. Yehya A, Carbone S. Managing type 2 diabetes mellitus during COVID-19 pandemic: the bittersweet. *Diabetes Metab Res Rev*. Published online June 3, 2020. https://doi.org/10.1002/dmrr.3360.

23. Muscogiuri G, Pugliese G, Barrea L, et al. Commentary. Obesity: the "Achilles heel" for COVID-19? *Metabolism*. 2020;108:154251. https: //doi.org/10.1016/j.metabol.2020.154251.

24. Del Rio C, Malani P. Translating science on COVID-19 to improve clinical care and support the public health response. *JAMA*. 2020; 323(24):2464-2465. https://doi.org/10.1001/jama.2020. 9252.

25. Yan CH, Faraji F, Prajapati DP, et al. Association of chemosensory dysfunction and COVID-19 in patients presenting with influenza-like symptoms. *Int Forum Allergy Rhinol*. 2020;10(7):806-813.

26. Price-Haywood EG, Burton J, Fort D, et al. Hospitalization and mortality among black patients and white patients with COVID-19. *N Engl J Med*. 2020;382(26):2534-2543.

27. Dunn CG, Kenney E, Fleischhacker SE, et al. Feeding lowincome children during the COVID-19 pandemic. *N Engl J Med*. 2020;382(18):e40. https://doi.org/10.1056/NEJMp2005638.

28. Wolfson JA, Leung CW. Food insecurity and COVID-19: disparities in early effects for US adults. *Nutrients*. 2020;12(6):1648. https://doi. org/10.3390/nu12061648.

29. Huizar MI, Arena R, Laddu DR. The global food syndemic: the impact of food insecurity, malnutrition and obesity on the healthspan amid the COVID-19 pandemic. *Prog Cardiovasc Dis*. Published online July 10, 2020. https://doi.org/10.1016/j.pcad.2020.07.002

30. Paslakis G, Dimitropoulos G, Katzman DK, et al. A call to action to address COVID-19-induced global food insecurity to prevent hunger, malnutrition, and eating pathology. *Nutr Rev*. Published online July 11, 2020. https://doi.org/10.1093/nutrit/nuaa069

31. Belanger MJ, Hill MA, Angelidi AM, et al. COVID-19 and disparities in nutrition and obesity. *N Engl J Med*. 2020;383:11, e6932. Laurencin CT, McClinton A. The COVID-19 pandemic: a call to action to identify and address racial and ethnic disparities. *J Racial Ethn Health Disparities*. 2020;7(3):398-402.

33. Food Security Information Network. Global report on food crises 2019. http://www.fao.org/emergencies/resources/documents/resources-detail/en/c/1187704/ (Accessed on August 24, 2020) .

34. Li T, Zhang Y, Gong C, et al. Prevalence of malnutrition and analysis of related factors in elderly patients with COVID-19 inWuhan, China. *Eur J Clin Nutr*. 2020;74(6):871-875.

35. Calder PC, Carr AC, Gombart AF, et al. Optimal nutritional status for a well-functioning immune system is an important factor to protect against viral infections. *Nutrients*. 2020;12(4):1181.

36. Handu D, Moloney L, Rozga M, et al. Malnutrition care during the COVID-19 pandemic: considerations for Registered Dietitian Nutritionists. *J Acad Nutr Diet*. Published onlineMay 14, 2020. https://doi.org/10.1016/j.jand.2020.05.012

37. Zabetakis I, Lordan R, Norton C, et al. COVID-19: the inflammation link and the role of nutrition in potential mitigation. *Nutrients*. 2020;12(5):1466.

38. Butler MJ, Barrientos RM. The impact of nutrition on COVID-19 susceptibility and long-term consequences. *Brain Behav Immunol*. 2020;87:53-54.

39. Rayman G, Lumb A, Kennon B, et al. Guidance on the management of diabetic ketoacidosis in the exceptional circumstances of the COVID-19 pandemic. *Diab Med*. 2020;37(7):1214-1216.

40. Zhang P, He Z, Yu G, et al. The modified NUTRIC score can be used for nutritional risk assessment as well as prognosis prediction in critically ill COVID-19 patients. *Clin Nutr*. Published on June 5, 2020; https://doi.org/10.1016/j.clnu.2020.05.05

41. Martindale R, Patel JJ, Taylor B, et al. Nutrition therapy in critically ill patients with coronavirus disease 2019. *J Parenter Enteral Nutr*. Published online May 27, 2020; https://doi.org/10.1002/jpen.1930.

42. Petrilli CM, Jones SA, Yang J, et al. Factors associated with hospital admission and critical illness among 5279 people with coronavirus disease 2019 in New York City: prospective cohort study. *BMJ*. 2020;369: m1966.

43.Ammar A., Brach M., Trabelsi K., Chtourou H., Boukhris O., Masmoudi L. (2020a). Effects of COVID-19 Home Confinement on Eating Behaviour and Physical Activity: Results of the ECLB-COVID19 International Online Survey. Nutrients 12:1583. 10.3390/nu12061583 - DOI - PMC - PubMed

44.Ammar A., Chtourou H., Boukhris O., Trabelsi K., Masmoudi L., Brach M., et al. (2020b). COVID-19 Home Confinement Negatively Impacts Social Participation and Life Satisfaction: A Worldwide Multicenter Study. Int. J. Environ. Res. Publ. Health 17:6237. 10.3390/ijerph17176237 - DOI - PMC - PubMed

45.Ammar A., Trabelsi K., Brach M., Chtourou H., Boukhris O., Masmoudi L., et al. (2020c). Effects of home confinement on mental health and lifestyle behaviours during the COVID-19 outbreak: Insight from the "ECLB-COVID19" multi countries survey. medRxiv Preprint

46.Ammar A., Trabelsi K., Brach M., Chtourou H., Boukhris O., Masmoudi L., et al. (2020d). Effects of home confinement on mental health and lifestyle behaviours during the COVID-19 outbreak: Insight from the ECLB-COVID19 multicenter study. Biol. Sport 38 9–21.