ECRONICON OPEN ACCESS

EC NUTRITION
Editorial

The Nutritional Status of Individuals as an Indicator of Resilience against Destabilization in the Covid-19 Pandemic Crisis: A New Era for Developing Sustainable and Leading-Edge Food Systems

Maria Luigia Pallotta*

Department Medicine and Health Sciences, "Vincenzo Tiberio", University of Molise, Campobasso, Italy

***Corresponding Author**: Maria Luigia Pallotta, Department Medicine and Health Sciences, "Vincenzo Tiberio", University of Molise, Campobasso, Italy.

Received: July 15, 2020; **Published:** August 14, 2020

Keywords: *SARS-CoV-2 and COVID-19 Global Pandemic; Nutritional Status; Immune System; Mitochondria; Vitamins; Amino Acids; Industry 4.0 and Sustainable and Modern Food Systems*

On 7th January 2020, subsequently a collection of specimen with pneumonia of unexplained cause in Wuhan, Hubei Province, China, researchers screened an original coronavirus, suddenly denominated Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) [1] and COVID- 19, the inferred disease. SARS-CoV-2 speedly spread worldwide, considering its contagiousness/virulence earmark and boosted by globalization, it was transported everywhere faster than a virus had ever done previously. On March 11th, 2020 the World Health Organization declared COVID-19 a global pandemic [2]. Within the old European continent, my country-Italy-was early and severely involved, with a critical spread of the contamination and an uncontestable number of deceased [3], up to this date, unfortunately, more than 35.000 victims. The SARS-CoV-2-caused COVID-19 pandemic has culminated in an annihilating behave towards to human society in terms of well-being, economy, and style of living [3]. The Italian Government introduced progressive mitigation measurements on March 9 [4-6] and March 11 [7], 2020, to drastically restrict social interactions and prevent virus diffusion. All European countries learned from the Italian lesson and to immediately adopt very restrictive rules to limit viral diffusion, ensure appropriate health-system feedback, and reduce mortality [5]. Supposing the virus commonly first attacks and encroaches the lung and respiratory system tissue, in extremis, main part major organs in the body are, at the present moment, established to be negatively impacted frequently leading to severe systemic failure in part of elderly population [8]. Pre-existing pathological circumstances or comorbidities, for instance, geriatrics are a primary conjecture for untimely death and elevated morbidity and mortality [3]. The immobilization due to hospitalization and bed rest and the physical inactivity due to sustained quarantine and social distancing can downregulate the competence of different organs to resist to viral infection and expand the risk of injury to the immune, respiratory, cardiovascular, musculoskeletal systems and, last but not least, the possibility of seriously damaging the brain [8]. 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 by Woods and colleagues, see reference [3]. While much remains to be known about the COVID-19, the influence of this pandemic on nutrition and dietary intake has already gone beyond the individual and the community to reach national and global levels. The main goal of these recommendations is to maintain the physical and mental health of individuals, resilience of communities and national and global food security [8]. Intriguing clues display that dietary habits are affected by conditions of stress, distress, and emotional disturbance, whereby elevated distress levels are associated with unhealthy dietary patterns and indigent and underprivileged standard of the nutritional therapy [9,10]. The typical denominator that drives most of the dietetics and dietary guidelines and endorsement to combat viral infections, as well as COVID-19, is situated

within the connection between nutrition and immunity [9,11]. Literally, recent clinical data, highlight that nutrition has a wide and deep impact on people's immune system and disease susceptibility. It has recently been reported that precise nutrients or nutrient blend may influence the immune system through the stimulation of cells, alteration in the production of signaling molecules, and gene expression [9,12]. Additionally, food characteristics are significant determinants of gut microbial balance and consequently can shape the nature of immune responses in the individual [9,11]. Nutritional decline in energy, specific protein, and peculiar micronutrients are linked with depressed immune function and increased susceptibility to infection [9,13]. A suitable intake of vitamins, both hydrophobic i.e. A [14], D [15], E [16] and hydrophilic C [17], B_2 or Riboflavin [18-26], B_3 or Niacin [27-31], B_6, and B_{12} is predominantly vital for the maintenance of immune function [9] together with an appropriate absorption of Fe++, Zn++ [32]. Accordingly, the solution for maintaining an adequate immune system is to avoid deficiencies of the healthy food that play a crucial role in immune cell triggering, synergy, differentiation, or functional and convenient expression. The nutritional status of humans being has for long been contemplated as a gauge of resilience against destabilization [9]. The condition of lockdown and confinement could also lead to erratic eating patterns and recurrent snacking, both of them are associated with greater caloric intake and expanded peril of obesity [3]. In this contest, patients with autoimmune diseases are at high risk of infections, due to endogenous (dysfunctional immune system) and external factors (i.e. immunosuppressants) [33,34]. Autoimmune convalescents under immunosuppressive pharmaceuticals could be prone to SARS-CoV-2 affliction; per contra, suspension of the ongoing conventional and biological therapy is contraindicated to avoid disease flares and the consequent increase in the infection risk [9,33]. By means of decreasing oxidative stress and enhancing immunity, nutritional support helps people to lower the risk of virus infection or to alleviate the symptom of COVID-19 [13,33,34]. An emerging concept in immunology is that remodelling of macrophage activities is pivotal in order to control and to direct their metabolism. Thus, rewiring of the Krebs cycle in macrophages sustains the gathering of bioactive metabolites that can promote proinflammatory or anti-inflammatory activities, but the underlying mechanisms are not fully understood. Recently, a study in *Nature* reports that the metabolite itaconate regulates the key anti- inflammatory transcription factor nuclear factor erythroid 2-related factor 2 (NRF2) in macrophages [35,36]. Macrophages that are the primary innate immune cells of the body, regulate wound healing by switching between M1 and M2 phenotypes in order to kill bacteria, clear apoptotic cell debris, stimulate angiogenesis, and deposit functional extracellular matrix. Though, a set of pathologies are characterized by macrophages that are stalled in a M1 state, and there is a need for different compounds (i.e. inhibitors) that can decrease M1 macrophage action. Previous research found that application of unsaturated fatty acids, glycolysis inhibitors, and L-glutamate anabolism/catabolism inhibitors decrease inflammatory gene and protein expression [37]. Also, it has been shown that M1 macrophages primarily rely on glycolysis for energy (ATP production via phosphorylation at the substrate level), while M2 macrophages rely on oxidative phosphorylation [35-38]. However, cells of macrophage lineage have to "pay the price" for making itaconate, and they lose the ability to perform mitochondrial substrate-level phosphorylation [38] Amino acids are fundamental building blocks supporting life. Their role in protein synthesis is well defined, but they contribute to be a host of other intracellular metabolic pathways, including ATP generation, nucleotide synthesis, and redox balance, to support cellular and organismal function. Immune cells critically depend on such pathways to acquire energy and biomass and to reprogram their metabolism upon activation to support growth, proliferation, and effector functions. Amino acid metabolism plays a key role in this metabolic rewiring, and it supports various immune cell functions beyond increased protein synthesis. Thus, amino acid metabolism promotes immune cell function, and improve immunity in pathological conditions [39]. The COVID-19 pandemic crisis has created a new era [40] while we are still trying to examine the contrecoup for humankind, financial system, and, afterwards, food formulation. Thus, both academic analysts and food sector experts will have to face many significant claiming i.e. ensuring food safety and food security, introducing Industry 4.0 tools to reduce losses and waste of food, inclusive of identifying alternative and safe protein sources that meet the nutritional expectations of customers [40-42]. At the same time, they should introduce innovations fast enough with the imminent economic crisis in the era of the COVID-19 pandemic, offering acceptable and economically competitive products and developing functional foods fortified with bioactive compounds and antioxidants that promote healthy microbiota [43-49] and support consumers' immune system [40-49]. There is undoubtedly a need to avoid "business as usual" practices, to think out of the box and accelerate efforts to develop sustainable and modern food systems [43-48,50]. Moreover, researchers have a little power but huge

responsibilities. Thus, novel challenges of COVID-19 pandemic will be addressed in twenty-first century to those visionaries within the pioneering community of Nutritional Biochemists: researchers good will' at work, it is (y)our time! Because even those who go too fast are left behind if the rules of the game are rigged and the common good is not pursued. We are not "only a pawn in their game" but "We're gonna change the world" (Bob Dylan *ipse dixits* in his lyrics). Europe together with all culturally developed and innovative countries has a duty to show the way out of this trap. The gift of suffering will be a new vision of our planet where equanimity and sustainability will finally walk side by side.

All spirits are enslaved which serve things evil (Percy Bysshe Shelley).

Bibliography

1. Zhu N., *et al.* "A novel coronavirus from patients with pneumonia in China, 2019". *The New England Journal of Medicine* 382 (2019): 727-733.
2. WHO Virtual press conference on COVID-19-11 (2020).
3. Woods J., *et al.* "The COVID-19 Pandemic and Physical Activity, Sports Medicine and Health Science" (2020).
4. Remuzzi A and Remuzzi G. "COVID-19 and Italy: what next?" *Lancet* (2020).
5. Saglietto A., *et al.* "COVID-19 in Europe: the Italian lesson" (2020).
6. Government of Italy Decree of the president of the Council of Ministers 9 March 2020 (2020).
7. Government of Italy Decree of the president of the Council of Ministers 11 March 2020 (2020).
8. Biondi-Zoccai G., *et al.* "SARS- CoV-2 and COVID-19: facing the pandemic together as citizens and cardiovascular practitioners". *Minerva Cardioangiologica* (2020).
9. Naja F and Hamadeh R. "Nutrition amid the COVID-19 pandemic: a multi-level framework for action". *European Journal of Clinical Nutrition* (2020).
10. Laviano A., *et al.* "Nutrition support in the time of SARS-CoV-2 (COVID-19)". *Nutrition* 74.6 (2020): 110834.
11. Jayawardena R., *et al.* "Enhancing immunity in viral infections, with special emphasis on COVID-19: A review". *Diabetology and Metabolic Syndrome* 14.4 (2020): 367-382.
12. Neurath MF. "COVID-19 and immunomodulation in IBD". *Gut* 69.7 (2020): 1335-1342.
13. Fauci AS. "Infectious diseases: considerations for the 21st century". *Clinical Infectious Diseases* 32.5 (2001): 675-685.
14. Huang Z., *et al.* "Role of Vitamin A in the Immune System". *Journal Clinical Medicine* 7.9 (2018): 258.
15. Grant WB., *et al.* "Evidence that Vitamin D Supplementation Could Reduce Risk of Influenza and COVID-19 Infections and Deaths". *Nutrients* 12.4 (2020): 988.
16. Lewis ED., *et al.* "Regulatory role of vitamin E in the immune system and inflammation". *IUBMB Life* 71.4 (2019): 487-494.
17. Carr AC. "A new clinical trial to test high-dose vitamin C in patients with COVID-19. Version 2". *Critical Care* 24.1 (2020): 133.

18. Pallotta ML., *et al.* "Processi di trasporto (i.e. Flavin Metabolism) in mitochondria *Saccharomyces cerevisiae".* GIBB-SIB Meeting Riccia, Campobasso Italy (1997).

19. Pallotta ML., *et al.* "*Saccharomyces cerevisae* mitochondria can synthesise FMN and FAD from externally added riboflavin and export 428.3 (1998): 245-249.

20. Pallotta ML. "Flavin adenine dinucleotide (FAD) and flavin mononucleotide (FMN) metabolism in *Saccharomyces cerevisiae* mitochondria". Gene Transcription in Yeast: Euro Conference (European Science Foundation) (2004).

21. Pallotta ML. "*Saccharomyces cerevisiae* as a model system for studying mitochondria natural flavin catabolism". 16th International Symposium on Flavins and Flavoproteins (2008).

22. Pallotta ML. "*Saccharomyces cerevisiae* mitochondria contain enzymes capable of hydrolyzing FMN and FAD to riboflavin: probably function in flavoprotein deflavination and reconstitution in cell grown under glucose limitation. 35th FEBS Congress, Gothenburg, Sweden 2010". *FEBS Journal* 277 (2010): 221-221.

23. Pallotta ML. "Evidence for the presence of a FAD pyrophosphatase and a FMN phosphohydrolase in yeast mitochondria: a possible role in flavin homeostasis". *Yeast* 28.10 (2011): 693-705.

24. Pallotta ML. "68 genes for Yeast Flavoproteoma: updates of Flavin Biosynthesis, Transport and Catabolism in *Saccharomyces cerevisiae* mitochondria". 3rd International Conference on Integrative Biology (2015).

25. Pallotta ML. "Riboflavin/Vitamin B2 and Lactic Acid Bacteria". *EC Microbiology* ECO.02 (2019): 03-06.

26. Pallotta ML. "Flavin Cofactors FMN and FAD, the Biologically Active Forms of Riboflavin and Healthy Life". *EC Nutrition* 14.8 (2019): 614-615.

27. Pallotta ML and Di Martino C. "Existence of intramitochondrial nicotinamide mononucleotide adenylyl-transferase activity, which allows for NAD+ synthesis from NMN and endogenous ATP in aged-dehydrated slices tubers of Helianthus tuberosus". 3rd Cell Stress Society International Congress on Stress responses in Biology and Medicine and 2nd Word Conference of Stress, Budapest (Hungary) Cell Stress and Chaperones 12.2 (2007).

28. Pallotta ML. "Plant cells respond to ageing by implementing an emergency survival". Third SMBBM International Congress of Biochemistry, IUBMB Special Meeting on Plant Stress and 6th Congress of FASBMB (2009).

29. Pallotta ML and Di Martino C. "A new mitochondrial three-component pyridine nucleotide pathway, namely a NMN→NAD→NADP route, is functional in plant heterotrophic tissues 35th FEBS Congress, Gothenburg, Sweden". *FEBS Journal* 277 (2010): 221-221.

30. Pallotta ML. "NMN, an intermediate in the salvage pathway, helps to increase the intramitochondrial NAD+ concentration in yeast and influences NAD+/NADH ratio: possible function as metabolic read-out 65". Mosbacher Kolloquium - Molecular Protein Quality Control in Health, Aging and Disease, German Society for Biochemistry and Molecular Biology, Mosbach Germany (2014).

31. Di Martino C and Pallotta ML. "Mitochondria-localized NAD biosynthesis by nicotinamide mononucleotide adenylyltransferase in Jerusalem artichoke (*Helianthus tuberosus* L.) heterotrophic tissues Planta 234.4 (2011): 657-670.

32. Te Velthuis AJW., *et al.* "Zn(2+) inhibits coronavirus and arterivirus RNA polymerase activity *in vitro* and zinc ionophores block the replication of these viruses in cell culture". *PLoS Pathogen* 6.11 (2010): e1001176 1-e100117610.

33. Picchianti-Diamanti A., *et al.* "Infectious Agents and Inflammation: The Role of Microbiota in Autoimmune Arthritis". *Frontiers in Microbiology* (2018): 2696.

34. Picchianti-Diamanti A., *et al.* "Cytokine Release Syndrome in COVID-19 Patients, A New Scenario for an Old Concern: The Fragile Balance between Infections and Autoimmunity". *International Journal of Molecular Sciences* 21.9 (2020): 3330.

35. "Itaconate helps KEAP1's cool". *Nature Reviews Immunology* 18 (2018): 294.

36. Mills E., *et al.* "Itaconate is an anti-inflammatory metabolite that activates Nrf2 via alkylation of KEAP1". *Nature* 556 (2018): 113-117.

37. Bhavani Singh. "Altering Metabolism Repolarizes Pro-Inflammatory Human Macrophages Drexel University, ProQuest Dissertations (2020).

38. Nemeth B., *et al.* "Abolition of mitochondrial substrate-level phosphorylation by itaconic acid produced by LPS- induced Irg1 expression in cells of murine macrophage lineage". *The FASEB Journal* 30.1 (2015): 286-300.

39. Kelly B and Pearce EL. "Amino Assets: How Amino Acids Support Immunity". *Cell Metabolism* (2020).

40. Galanakis CM. "The Food Systems in the Era of the Coronavirus (COVID-19) Pandemic". *Crisis Foods* 9.4 (2020): 523.

41. Galanakis CM. "Food Quality and Shelf Life". Academic Press: London, UK (2019).

42. Galanakis CM. "Food Security and Nutrition". Galanakis C, Edition; Elsevier-Academic Press: London, UK (2019).

43. Rossi F., *et al.* "Traditional Italian dairy products: a flavourful source of naturally occurring bacteria with beneficial effects on health". *The Microbiol Continuity Across Evolving Ecosystems* (2015): 14-18.

44. Rossi F and Pallotta ML. "Bacteriocin Producing Cultures: A Sustainable Way for Food (2016).

45. Rossi F., *et al.* "Candidate probiotic strains, with immunomodulatory and antioxidant effects, isolated from traditional Italian dairy products". *Journal of International Society of Microbiota* 3.1 (2016).

46. Pallotta ML (2019) Cutting edge on phytochemicals uptake and bioenergetics performance: mitochondrion as a cornstone for managing healthy aging 6 International Symposium on Model-it Molfetta, Ba, Italy June 2019.

47. Pallotta ML(2019) Alternative food source in NCDs patients: recent advances in JA tuber as model system in bioenergetics and mitochondrial metabolism studies 6 International Symposium on Model-it Molfetta, Ba, June.

48. Amadoro A., *et al.* "Traditional dairy products can supply beneficial microorganisms able to survive in the gastrointestinal tract LWT". *Food Science and Technology* 93 (2018): 276-283.

49. Gnaiger Erich & MitoEAGLE Task Group (2020) Mitochondrial physiology Bioenerg Commun 2020.1 https://doi:10.26124/bec:2020-0001.v1 www.bioenergeticscommunications.org 1 of 44.

50. Home: Sustainable Development Knowledge Platform.

Volume 15 Issue 9 September 2020