



The role of food science in understanding host defense functions among humans during the SARS-CoV-2 pandemic

Time: 08:00-09:30*ET (Toronto), 16th March 2022

Registration: https://us06web.zoom.us/webinar/register/WN_mlijk2ObPQNaUOckOERafug

**Note that some time zones change on the second Sunday of March to Daylight Savings Time. Please check your local time on 16 March against Toronto time (EDT).*

Overview:

Coronavirus Disease 2019 (COVID-19) is pandemic and is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The rising number of cases of this highly transmissible infection has prompted an urgent need to identify and develop effective antiviral interventions that may reduce the health risks associated with this disease. The life cycle of SARS-CoV-2 includes a viral entry, viral replication, viral assembly and release. The symptoms associated with viral infection often lead to fatal outcomes with pneumonia, myocarditis, acute respiratory distress syndrome, hypercoagulability, and/or multi-organ failure.

Recent studies have reported that plant-derived substances, such as quercetin, emodin, epigallocatechin gallate, and berberine may, albeit modestly, inhibit different stages of SARS-CoV-2 life cycle in the host. For example, these substances in some *in vitro* and *in vivo* model systems appear to disrupt viral infection and replication by blocking viral-surface spike protein binding to entry receptor angiotensin-converting enzyme (ACE2), inhibiting viral membrane fusion with host cells, inhibiting main proteinase (Mpro) and RNA-dependent RNA polymerase involved in viral replication, and/or pathological host-responses *in vitro*.

Various functional foods/nutraceuticals, even though not defined by the US government, and dietary supplements may modulate host defense function(s) and overall health status, and thus possibly lower the risk of COVID-19 infection. However, these data are inconsistent and need further clinical evaluation.

Some studies suggest that a balanced diet rich in various nutrients especially specific micronutrients may have a significant role in reducing risks associated with COVID-19 and during the recovery phase. Obesity, type 2 diabetes, and cardiovascular disease are among the non-communicable diseases associated with increased inflammation. A decrease in obesity, which is multifactorial in etiology, may reduce the risk of severe COVID-19 inflammatory responses. This response may be due to fewer ACE2 receptors (depending on tissue type), changes in their binding affinity or alterations in associated proteases and an array of genetic factors.

An increased awareness in food science and dietary components may represent important and critical roles in reducing the risk of SARS-CoV-2 viral infection, growth, and disease progression as well as provide a perspective on the potential use of these plant-derived substances in the development of novel interventions against SARS-CoV-2.

Programme:

Co-Chairs: Dr. Aman Wirakartakusumah (Academy President) and Dr. Charles Aworh (Academy President-Elect)

1. 08:05~08:25

Narain Naidu (President/CEO Nterminus, Yorba Linda, CA, USA): **Understanding the complexities of COVID-19 pathogenesis and the role of dietary components in reducing associated pathologies**

2. 08:25~08:40

Chin-Kun Wang (Chung Shan Medical University, Taiwan): **Impact of dietary nutrients (functional foods/nutraceuticals) and micronutrients on COVID-19 pathologies**

3. 08:40~08:55

Fereidoon Shahidi (Memorial University of Newfoundland, Canada): **Role of phenolics on immune for reducing risks associated with COVID-19 inflammation**

4. 08.55 ~09:10

Kenji Sato (University of Kyoto, Japan): **Role of food protein and hydrolyzed peptides on the modulation of immune functions among humans**

09:10~09:30

Discussion and Summary

Roger Clemens (IAFoST Past President), Roundtable summary and presentation of action items for the scientific/medical community

Speakers:



Understanding the complexities of COVID-19 pathogenesis and the role of dietary components in reducing associated pathologies

A.S. 'Narain' Naidu, PhD (Medicine),

FLS, FACN, FISSVD

N-terminus Research Laboratory, Yorba Linda, California, USA

Abstract: Severe imbalance in iron metabolism among SARS-CoV-2 infected patients is prominent during all three symptomatic (mild, moderate to severe) clinical phases of COVID-19. The Phase-I Hypoxia correlates with reduced O₂ transport by erythrocytes, overexpression of HIF-1 α , altered mitochondrial bioenergetics with host metabolic reprogramming (HMR). The Phase-II Hyperferritinemia results from an increased iron overload, which triggers a fulminant proinflammatory response – the acute cytokine release syndrome (CRS). Elevated cytokine levels (i.e., IL6, TNF α and CRP) strongly correlate with altered ferritin/TF ratios in COVID-19 patients. Phase-III – Thromboembolism is consequential to erythrocyte dysfunction with heme release, increased prothrombin time and elevated D-dimers, cumulatively linked to severe coagulopathies with life-threatening outcomes such as ARDS, and multi-organ failure. Taken together, Fe-R-H dysregulation is implicated in every symptomatic phase of COVID-19. Fe-R-H regulators such as lactoferrin (LF), hemoxygenase-1 (HO-1), erythropoietin (EPO) and hepcidin modulators are innate bio-replenishments that sequester iron, neutralize iron-mediated free radicals, reduce oxidative stress, and improve host defense by optimizing iron metabolism. Due to its pivotal role in 'cytokine storm', ferroptosis is a potential intervention target. Ferroptosis inhibitors such as ferrostatin-1, liproxstatin-1, quercetin, and melatonin could reduce the risk of mitochondrial lipid peroxidation, up-regulate antioxidant/GSH levels and abrogate iron overload induced apoptosis through activation of Nrf2 and HO-1 signaling pathways. Iron chelators such as heparin, deferoxamine, caffeic acid, curcumin, α -lipoic acid, and phytic acid could protect against ferroptosis and restore mitochondrial membrane integrity, iron-redox potential, and rebalance Fe-R-H status. Therefore, Fe-R-H restoration is a host biomarker-driven potential combat strategy for an effective clinical and post-recovery management of COVID-19.

Biography: Professor A Satyanarayan Naidu, PhD, FACN, FLS, FISSVD, is the Director of N-terminus Research Laboratory in California, USA. After receiving PhD in Medical Microbiology (1985) from the Osmania University in India, Dr. Naidu served the Directorate of Public Health Services (DPHS), the Government of A.P., India and the World Health Organization (WHO) Surveillance program. He performed post- doctoral research at the Medical University of Pécs, Hungary and the Biomedical Center-Uppsala, Sweden. Dr. Naidu joined the faculty at the Lund University; Sweden

(1988-1992), the University of North Carolina at Chapel Hill, USA (1993-1997). He was appointed as the Director at the Center for Antimicrobial Research, California State University-Pomona, USA (1998-2000). Dr. Naidu's discoveries on Staphylococcal toxic shock syndrome (TSS) and *E. coli* hemolytic uremic syndrome (HUS) have garnered international recognition. He was principal investigator for several NIH grants, published more than 100 peer-reviewed research publications, written over 30 book chapters, and authored 4 reference volumes in the field of medical sciences. He holds 24 core patents, and his technology transfers in biomedical technology reach worldwide. Dr. Naidu is an elected fellow of the Royal Society for Medicine, the Linnean Society of London, the American College of Nutrition, and the International Society for the Study of Vulvovaginal Disease.



Impact of dietary nutrients (functional foods/nutraceuticals) and micronutrients on COVID-19 pathologies

Chin-Kun Wang

Chung Shan Medical University, Taiwan

Abstract: Coronavirus disease (COVID-19) in 2019 has caused global destruction and significant loss of life. Many researchers have shown great interest in various functional foods/nutraceuticals and dietary supplements to improve immune function and overall health, thereby reducing the risk of COVID-19 infection. A balanced diet rich in various nutrients, especially micronutrients, restoring and reducing the risk of COVID-19-related health problems. Such as vitamin C, vitamin D, omega 3 polyunsaturated fatty acids, probiotics and zinc, all of which are currently undergoing clinical research. A healthy lifestyle and balanced nutrition play an important role in the immune system. The potential and effective food bioactive substances, which may be used as support or complementary intervention to reduce the risks and comorbidities associated with COVID-19.

Biography: Dr. Chin-Kun Wang is a distinguished professor in Chung Shan Medical University, Council Former President of International Society for Nutraceuticals and Functional Foods (ISNFF), Fellow of International Academy of Food Science & Technology and elected member of the Academy Executive Council, IAFoST; honorary president of Nutrition Society of Taiwan, Chair, Global Incident Alert Network, Global Harmonization Initiative. He got his Ph.D. degree from National Taiwan University and worked at Chung Shan Medical University in 1993. In 1996, he promoted as a full professor, and then took the positions of the Chair, Dean, Vice President and President in Chung Shan Medical University. His research work is focused on human clinical trials and human metabolism of medicine, nutritional supplement, nutraceuticals, herbs, and functional foods. He got the National Award of Biomedicine for his great contribution to the

medical education in 2008. He was also honored as 2012-21 Who's who in the world, Who's who in Asia, and 2009-2010, 2011-21 Who's who in Medicine and Healthcare. He also got the awards of outstanding research from several societies from 2009 to 2021. Dr. Chin-Kun Wang was the former president of Nutrition Society of Taiwan (from 2009 to 2012). For food safety and nutrition, he promoted the legislation for school sanitary law and national nutrition law. During the food safety problem in Taiwan, he joined as a director of ILSI Taiwan and Chair of Global Harmonization Initiative to communicate with the media and press. He believes that scientific evidence is the best support for food safety and world nutrition problem.



Role of phenolic and polyphenolic compounds on immune enhancement and in reducing the risks of COVID-19 infections

Fereidoon Shahidi, Department of Biochemistry,
Memorial University of Newfoundland, St. John's, NL, Canada

Abstract: Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), the virus that causes COVID-19 targets human cells/immune system and is responsible for severe inflammatory pneumonia. Although the lungs are the primary target, damage to other organs including the gastrointestinal tract, kidney, and brain is also frequent. Phenolic and polyphenolic compounds that serve as secondary plant metabolites may exert their effects via direct antioxidant activity and by modulating intracellular signaling. The health benefits of polyphenols are based on phenolic-protein interactions and particularly intracellular enzymes, transcription factors (TFs) and modulating regulations of cell events and signalling pathways. Thus, polyphenols have the potential to strengthen antioxidant defenses, decrease viral entry, inhibit the binding of virus to its angiotensin converting enzyme 2 (ACE2) receptor, upregulate the immune system, and reduce COVID-19 cytokine storm. Dietary compounds/mixtures/extracts that are able to offer this inhibition may serve as ideal interventions targets for COVID-19. Therefore, interaction of polyphenols with viral proteins and/or host cell receptors may interfere with the entry of the virus and its replication in the host cell. In this connection, commodities, or formulations rich in polyphenols or their extracts may be important in providing some level of immunity enhancement and hence a deterrent for SARS-CoV-2 infection and COVID-19.

Biography: Fereidoon Shahidi, Ph.D., FACS, FAGFD-ACS, FAOCS, FCIC, FCIFST, FIAFoST, FIFT, FISNFF, FRSC, is a University Research Professor and Distinguished Scholar in the Department of Biochemistry at Memorial University of Newfoundland. He has authored over 1,000 publications as research papers and book chapters, 78 books, and 10 patents. His research interests are primarily in the areas of nutraceuticals and functional foods with particular attention to lipids, proteins, polyphenols, natural antioxidants and oxidation control. His work has been

cited widely (see Google scholar). He has received numerous awards from different societies, including the American Chemical Society (ACS), American Oil Chemists' Society (AOCS), Institute of Food Technologists (IFT), and the Canadian Institute of Food Science and Technology (CIFST), among others. He has served on and chaired many international committees, evaluating different programs both nationally and globally, such as the nutraceuticals and functional food research at the USDA and as a member of the Washington-based Council of Agricultural Science and Technology on nutraceuticals. He is currently the chair of the Scientific Council of the International Union of Food Science and Technology (IUFoST) and serves as the editor-in-chief (EiC) of the *Journal of Food Bioactives* (JFB) and the journal of *Food Production, Processing and Nutrition* (FPPN). Shahidi is the principal founder of the International Society for Nutraceuticals and Functional Foods (ISNFF), a Disciplinary Interest Group of IUFoST and Founding EiC of the *Journal of Functional Foods* for which he served in that capacity for 10 years. He was a principal founder of the Nutraceutical and Functional Food Division of IFT. He has trained over 150 graduate students, highly qualified personnel, visiting professors, scholars, and PhDs, now his colleagues in over a dozen countries.



Role of food protein and hydrolyzed peptides on the modulation of immune functions among humans

Kenji Sato

Division of Applied Biosciences, Graduate School of Kyoto University

Abstract: Some host and viral proteins are involved in the entry of SARS-CoV-2 into cells. Peptides with specific sequences can interact with these proteins and have potential prophylactic and therapeutic activities against COVID-19. However, it is difficult to deliver food-derived peptides to target organs. Some bioactive peptides increase anti-microbial peptides, which can also attack enveloped viruses such as SARS-CoV-2. SARS-CoV-2 increases host inflammatory peptide, angiotensin II, and induces severe inflammation by binding the viral protein to host angiotensin converting enzyme (ACE)-2 not ACE-1. Some bioactive peptides can decrease angiotensin II by oral administration. Under inflammation caused by COVID-19, blood glutathione level has been demonstrated to be low. Oral administered glutathione and its precursor such as N-acetylcysteine could ameliorate hypo-glutathione in COVID-19 patients and severity of symptom, as they can enter into blood stream by oral administration. Thus, bioactive peptides have potential to decrease of risk factors of COVID-19 by oral administration.

IAFoST Co-Chairs and Discussion Leaders:

Dr. Aman Wirakartakusumah, an IAFoST Fellow, is a scientific leader, experienced administrator, a diplomat at the highest levels internationally and is known as a person who is dedicated to service above self who brings people and viewpoints together. He has a strong grasp of IUFoST's issues and is committed, passionate and has unbounded drive in everything he does for the Union. Dr. Wirakartakusumah was Indonesian Ambassador to UNESCO, Rector of two Indonesian universities, and highly regarded chair of IUFoST's Education Committee and the World Bank-initiated Global Food Safety Curricula Initiative. He is a member of the Indonesia Academy of Sciences, has led Indonesia in establishing educational standards and is actively engaged with ASEAN/APEC countries in implementing food safety policies, measures and educational standardisation. He is the President of the International Academy of Food Science and Technology (IAFoST).



Dr. Ogugua Charles Aworh is Lifetime Achievement Award recipient and past Academy Chair of the Nigerian Institute of Food Science and Technology (NIFST). He obtained a B.Sc. (Hons) from the University of Ibadan (UI), Nigeria; MSc and Ph.D. in Food Science and Technology from Cornell University, USA. He is Distinguished Professor and served three-terms as Head, Department of Food Technology, UI. He has been visiting Research Fellow/Professor at University of Leeds, UK; University of British Columbia, Canada; and Alexander von Humboldt Research Fellow, Hamburg University of Technology, Germany. He is pioneer Chairman of UI's Multidisciplinary Central Research Laboratory. His areas of research include post-harvest technology and processing, food safety, biotechnology, and capacity building. He has over 100 scientific publications and has supervised 120 MSc and 17 PhD students. He led WAAFoST's [IUFoST Regional Body] contribution to IAFoST/ IUFoST Global Challenges Report and is mentor for African Women in Agricultural Research and Development and IUFoST young scientists. He is the President Elect of the International Academy of Food Science and Technology (IAFoST).

Dr. Roger Clemens is part-time faculty within the University of Southern California' School of Pharmacy where he enjoys adjunct appointments as Professor of Pharmacology and Pharmaceutical Sciences and Assistant Professor of Regulatory and Quality Sciences. Dr. Clemens is a past president of the Institute of Food Technologists (IFT) and is the immediate past presiding officer (Past President) of the International Academy of Food Science and Technology (IAFoST). He co-founded, established and contributed to a Food, Medicine and Health column published monthly in Food Technology for the past 16 years. He is an elected Fellow in the Institute of Food Technologists, American Society for Nutrition, American College of Nutrition, and International Academy of Food Science and Technology

