PERSPECTIVES
DOI: 10.12957/demetra.2021.56051

DEMETRA
Alimentação, Nutrição & Saúde

Julio Acosta-Navarro [1]
Luiza Antoniazzi[1]
Silvia Cárdenas-Prado[2]

[1] Universidade de São Paulo, Faculdade de Medicina, Instituto do Coração. São Paulo, SP, Brasil.

[2] Universidade de São Paulo, Faculdade de Medicina, Instituto de Psiquiatria. São Paulo, SP, Brasil.

Correspondence
Julio Acosta-Navarro
jnavarro_2@hotmail.com

Can humankind prevent the next pandemics through the vegetarian nutrition?

The pandemics we are facing may be an apparently new problem for many, but several other public health disasters have already occurred in different parts of the world. Most emerging infectious diseases (60.3%) are caused by zoonotic pathogens through the cross-transmission of species. In the beginning of the zoonotic transmission chain, transmission occurs between different animal species; in the second stage, transmission occurs between animals and humans, until the last stage of the transmission process takes place among humans, leading to worldwide pandemics.[1] Surprisingly, taking this fact into account, Benatar et al. recognized, in 2007, that mankind did not consider that changing the way humans treat animals, either by not eating them or at least by radically limiting their consumption could be the best way to prevent an unknown future pandemics.[2]

The ongoing COVID-19 pandemics has imposed a serious threat to global health that in just over a year infected 166.624.742 people and resulted in 3.460.618 deaths.[3] These data are underestimated, because 500 to 730 millions of people (6.4% to 9.3% of world population) indeed were infected in the world. Deaths are being undercounted, too.[4] It also led to historic breakdown in the world economy. The causative agent is a novel coronavirus known as SARS-CoV-2 that has an RNA genome, which is 74.5% to 99% identical to that of SARS-CoV (severe acute respiratory syndrome coronavirus), CoV-pangolin, and the coronavirus from horseshoe bat. Recent reports have suggested that SARS-CoV-2 is a modified coronavirus of bat origin, which came to humans because of zoonotic transmission in which the infected pangolin is the intermediary host.[5] The consumption of infected animal is the major cause of animal to human transmission of the virus and due to close contact with an infected person; the virus is further transmitted to healthy individuals.[6]

We hypothesize that in view of several health and environmental benefits, the vegetarian dietary pattern could be considered a great potential for preventing zoonosis that would result in new pandemics and be the best option for the planet and the future of humankind.

SARS-CoV was a virus that caused the first major pandemic of the new millennium in 2003, killing 800 people. Aware that coronaviruses are well known to undergo genetic recombination, which could lead to new genotypes and outbreaks, Cheng et al. predicted dramatically the COVID-19 pandemics twelve years ago. They literally wrote "*the presence of a large reservoir of SARS-CoV-like viruses in horseshoe bats, together with the culture of eating exotic mammals in southern China, is a time bomb*".[7] Apart from this, further fatal pandemics are also considered as zoonotic. In April 2009, a new H1N1 virus was detected in cases of influenza-like illness in California. The association of the origin with the Mexican region of porcine livestock raised suspicions that porcine influenza was involved, showing that there was indeed a triple mutation of this virus.[8] Recently it was identified a reassortant G4 genotype that have all the essential hallmarks of a candidate pandemic virus.[9] The human immunodeficiency virus, etiological agents of AIDS (Acquired Immune Deficiency Syndrome) that cause more than one million annual deaths, have been linked to cross-species transmission of simian immunodeficiency virus. Humans might have been infected either by non-human primates hunting and wild meat consumption.[10]

The 1918 influenza pandemic was the deadliest in known human history and recent estimates put the death toll at 50 million or even higher. In spite of the fact that zoonotic sources for the 1918 influenza virus could remain ambiguous, it is believed that considering the frequent interspecies transmission of influenza viruses between swine and humans, it is most likely that such reassortment events occurred in swine before the pandemic emergence. In this sense, the first well-documented outbreak occurred at Camp Funston, Kansas, where the same railroad that brought soldiers to the camp passed through Kansas City, home to the largest livestock farming in the state of hogs.[11]

Moreover, the potential threat to human health resulting from inappropriate antibiotic use in cattle raising is significant, as pathogenic-resistant organisms disseminated in these livestock are poised to enter the food supply and could be widely propagated in food products. Commensal bacteria found in livestock are frequently present in fresh meat and meat by-products and may serve as reservoirs for resistant genes that could potentially be transferred to pathogenic organisms in humans.[12] Thus, a switch to a predominantly vegetarian nutrition could save risks of such future pandemics.

It is the position of official entities that appropriately planned vegetarian, including vegan, diets are healthful, nutritionally adequate, and may provide health benefits for the prevention and treatment of certain diseases. These diets are appropriate for all stages of the life cycle.[13-15] In addition, vegetarian people are at reduced risk of chronic diseases of high morbidity and mortality, including ischemic heart disease, type 2 diabetes, hypertension, certain types of cancer, and obesity.[16] The EPIC-Oxford study showed a 32% lower risk of coronary heart disease (CHD) compared with omnivores.[17] Reduced risk for CHD in vegetarians was also confirmed by a 2017 systematic review and meta-analysis of 86 cross-sectional and 10 cohort prospective studies.[18] A large prospective study analyzed data from 25,698 white Seventh-day Adventist adults living in North America, who were followed for 21 years and it was found that the risk of developing type 2 diabetes was roughly half for vegetarians, compared with omnivores.[19] A meta-analysis of seven prospective cohort studies with a total of 124,706 participants showed that vegetarians had an 18% lower cancer incidence compared with omnivores.[20] On the other hand, treatment of developed diseases with vegetarian diet were treated with successes in cardiovascular,[21] immunological[22] and neoplastic diseases.[23]

The idea that a vegetarian dietary pattern could benefit individual biological changes along time was proved in different biologic matters as physiology,[24] biomarkers[25] and genetics.[26] The Western diet, characterized by high levels of saturated fats, sugars, and refined carbohydrates, contributes to increase the prevalence of obesity and type 2 diabetes worldwide and could place these populations at an increased risk for severe COVID-19 pathology and

mortality by activating the innate immune system, thus reducing adaptive immunity, leading to chronic inflammation and impaired host defense against viruses.[27]

With respect to mortality, in a metanalysis of six articles that evaluated the effects of meat and vegetarian diets on mortality, all-cause mortality was higher for increased daily consumption of red meat, especially processed meat.[28] This recent large meta-analyses is consistent with a review of six cohort studies that found a decreased risk (25% to 50%) of all-cause mortality for very low meat intake compared with higher meat intake in five of the studies. They also found a 3.6-year increase in life expectancy when compared long-term (≥17 years) vs. short-term vegetarians.[29] In another longitudinal study, Orlich et al. found that in 96,469 Seventh-day Adventist members, vegetarian dietary patterns were associated with lower all-cause mortality and with some reductions in cause-specific mortality.[30]

However, it is believed that the best diet for humans would be that of our prehistoric ancestors, which seemed to be plant-based, for the following reasons: our digestive system resembles that of herbivores; the diet of our closest evolutionary relatives, the anthropoid apes, is plant based with a high proportion of fruits; our inability to manufacture vitamin C suggests that in prehistoric times our diet was so high in this essential nutrient that internal manufacture was unnecessary.[31] In addition, experimentally it is not possible to produce atherosclerosis in a carnivore animal, no matter how much fat or cholesterol is provided, but feeding humans a diet rich in these nutrients readily produces atherosclerotic plaques, suggesting that humans are essentially herbivores.[32]

At planetary level, other reasons can be considered. Plant-based diets are more environmentally sustainable than diets rich in animal products because they use fewer natural resources and are associated with much less environmental damage.[13] A total of 55% of US-produced corn, 40% of the worldwide grain harvest, and more than 85% of soybeans produced worldwide are destined to animal feed. Much of the land, energy, and water used to grow feed crops for animal farming could be more efficiently used to grow food that would be directly consumed by people.[33] At present, it is recognized that animal agriculture is associated with land degradation, air pollution, loss of biodiversity and global warming and meat production through different processes in the production and distribution chain makes a significant contribution to anthropogenic carbon dioxide emissions and anthropogenic methane and nitrous oxide production.[13] Considering all this, the EAT Lancet Commission of leading nutrition and environmental scientists recently estimated that worldwide adoption of a "Planetary Health Diet" - defined by appropriate consumption of calorie intake, lots of diverse plant-based foods, low amounts of animal-based foods, mainly red meat, unsaturated fats in place of saturated fats, and limited processed foods, refined grains, and added sugars - could prevent approximately 11 million deaths annually and could help to mitigate future environmental crises.[34] Vegetarian nutrition also means the hope for humankind in the space adventure. Space explorers on the Moon, Mars, or even in a space craft might grow plants in a CELSS to remove CO2 and provide O2 and food. It is accepted that selection of crops to be studied should be based on plants that can provide a balanced and attractive, mostly vegetarian diet.[35]

In light of these discoveries, large-scale shifts towards healthy plant-based diets are imperative to ensure future human and environmental health. It is indisputable that present research being conducted around the world, in order to find the most effective form of treatment and vaccine for COVID-19 is essential and urgent. However, one should also consider discussions like the one presented here, on the relationship between the production and consumption of animal products with zoonotic pandemics, so as to avoid future global crises. It seems that by adopting totally or at least partially vegetarian dietary patterns, advantages and benefits of prevention could reach planetary level or enhance the evolution of human species.

REFERENCES

1. Wolfe ND, Dunavan CP, Diamond J. Origins of major human infectious diseases. Nature2007;447(7142):279–83. Doi: 10.1038/nature05775.
2. Benatar D. The Chickens Come Home to Roost. Am J Public Health 2007;97(9):1545–6.Doi: 10.2105/AJPH.2006.090431.
3. COVID-19 Coronavirus Pandemic. Available at: https://www.worldometers.info/coronavirus/. Acessed in October 22nd, 2020.
4. The Economist. *The world marks 1m deaths from covid-19.* September, 29th, 2020. Available at: https://www.economist.com/graphic-detail/2020/09/29/the-world-marks-1m-deaths-from-covid-19. Acessed in October 22nd, 2020.
5. Lam TT, Jia N, Zhang Y, Shum MH, Jiang J, Zhu H et al. Identifying SARS-CoV-2-related coronaviruses in Malayan pangolins. Nature 2020;583:282–5. Doi: 10.1038/s41586-020-2169-0.
6. Shereenab MA, Khana S, Kazmic A, Bashira N, Siddiquea R. COVID-19 infection: Origin, transmission, and characteristics of human coronaviruses. J Adv Res 2020;24:91-8. Doi: 10.1016/j.jare.2020.03.005.
7. Cheng VCC, Lau SKP, Woo PCY, Yuen KY. Severe Acute Respiratory Syndrome Coronavirus as an Agent of Emerging and Reemerging Infection. Clin Microbiol Rev 2007;20(4):660–94. Doi: 10.1128/CMR.00023-07.
8. Schnitzler SU, Schnitzler P.An update on swine-origin influenza virus A/H1N1: a review. Virus Genes 2009;39(3):279–92. Doi: 10.1007/s11262-009-0404-8.
9. Sun H, Xiao Y, Liu J, Wang D, Li F, Wang Cet al. Prevalent Eurasian avian-like H1N1 swine influenza virus with 2009 pandemic viral genes facilitating human infection. [published online ahead of print, 2020 Jun 29]. Proc Natl Acad Sci USA.
10. Devaux CA, Mediannikov O, MedkourH,RaoultD.Infectious Disease Risk Across the Growing Human-Non Human Primate Interface: A Review of the Evidence. Front Public Health2019;7:305. Doi: 10.3389/fpubh.2019.00305.
11. Humphreys M. The influenza of 1918. Evolutionary perspectives in a historical context. Evol Med Public Health2018(1);2018:219–29. Doi: 10.1093/emph/eoy024.
12. Landers TF, Cohen B, Wittum TE, Larson EL. A Review of Antibiotic Use in Food Animals: Perspective, Policy, and Potential. Public Health Rep 2012;127(1):4–22. Doi: 10.1177/003335491212700103.
13. Melina V, Craig W, Levin S. Position of the Academy of Nutrition and Dietetics: Vegetarian Diets. J AcadNutr Diet 2016;116(12):1970–80. Doi: 10.1016/j.jand.2016.09.025.
14. Agnoli C, Baroni L, Berini I, Ciappellano S, Fabbri A, Papa M et al. Position paper on vegetarian diets from the working group of the Italian Society of Human Nutrition. Nutr. Metab. Cardiovasc. Dis. 2017;27(12):1037–52. Doi: 10.1016/j.numecd.2017.10.020.
15. Amit M. Vegetarian diets in children and adolescents. Paediatr. Child Health. 2010;15(5):303–14.
16. Acosta-Navarro J. Vegetarianismo e Ciencia, Editora Alaude, São Paulo, 2010. 252 pp.
17. Crowe FL, Appleby PN, Travis RC, Key TJ. Risk of hospitalization or death from ischemic heart disease among British vegetarians and nonvegetarians: results from the EPIC-Oxford cohort study. Am J Clin Nutr2013;97(3):597–603. Doi: 10.3945/ajcn.112.044073.
18. Dinu M, Abbate R, GensiniGF,Casini A, Sofi F. Vegetarian, vegan diets and multiple health outcomes: a systematic review with meta-analysis of observational studies. Crit Rev Food Sci Nutr2017;57(17):3640–9. Doi: 10.1080/10408398.2016.1138447.
19. Snowdon DA, Phillips RL.Does a vegetarian diet reduce the occurrence of diabetes? Am J Public Health 1985;75(5):507–12. Doi: 10.2105/ajph.75.5.507.
20. Huang T, Yang B, Zheng J, Li G, Wahlqvist ML, Li D. Cardiovascular disease mortality and cancer incidence in vegetarians: a meta-analysis and systematic review. Ann NutrMetab2012;60(4):233–40. Doi: 10.1159/000337301.
21. Gupta SK, Sawhney RC, Rai L,Chavan VD, Dani S, Arora RC et al. Regression of coronary atherosclerosis through healthy lifestyle in coronary artery disease patients. Mount Abu open heart trial. Indian Heart J 2011;63(5):461–9.

22. McDougall J, Bruce B, Spiller G, Westerdahl J, McDougall M. Effects of a very low-fat, vegan diet in subjects with rheumatoid arthritis. J Altern Complement Med 2002;8(1):71–5.Doi: 10.1089/107555302753507195.

23. Saxe GA, Major JM, Nguyen JY, Freeman KM, Downs TM, Salem CE. Potential attenuation of disease progression in recurrent prostate cancer with plant-based diet and stress reduction. IntegrCancerTher2006;5(3):206–13.Doi: 10.1177/1534735406292042.

24. Acosta-Navarro J, Antoniazzi L, Oki AM, Bonfim MC, Hong V, Acosta-Cardenas P et al. Reduced subclinical carotid vascular disease and arterial stiffness in vegetarian men: The CARVOS Study. Int J Cardiol2017;230:562–6. Doi: 10.1016/j.ijcard.2016.12.058.

25. Navarro JA, Gouveia LA, Rocha-Penha L,Cinegaglia N, Belo V, Castro MM et al. Reduced levels of potential circulating biomarkers of cardiovascular diseases in apparently healthy vegetarian men. ClinChim Acta2016;461:110–3.Doi: 10.1016/j.cca.2016.08.002.

26. Krajcovicová-Kudlácková M, Valachovicová M, Pauková V, Dusinská M. Effects of diet and age on oxidative damage products in healthy subjects. Physiol Res2008;57:647–51.

27. Butler MJ, Barrientos RM. The impact of nutrition on COVID-19 susceptibility and long-term consequences. Brain Behav Immun. 2020;87:53-4.

28. Fields H, Millstine D, Agrwal N, Marks L. Meat Killing Us? J Am Osteopath Assoc 2016;116(5):296–300.Doi: 10.7556/jaoa.2016.059.

29. Singh PN, Sabaté J, Fraser GE. Does low meat consumption increase life expectancy in humans [review]? Am J Clin Nutr2003;78(3 Suppl):526S–32S.Doi: 10.1093/ajcn/78.3.526S.

30. Orlich MJ, Singh PN, Sabaté J, Jaceldo-Siegl K, Fan J, Knutsen S et al. Vegetarian dietary patterns and mortality in Adventist Health Study 2. JAMA Intern Med2013;173(13):1230–8. Doi: 10.1001/jamainternmed.2013.6473.

31. Withnell A. The nature and importance of our prehistoric diet. Nutr. Health 2004;17(4):269–73. Doi: 10.1177/026010600401700401.

32. Roberts WC. Preventing and arresting coronary atherosclerosis. Am Heart J1995;130(3 pt.1):580–600. Doi: 10.1016/0002-8703(95)90369-0.

33. Grant JD. Time for change Benefits of a plant-based diet. Can Fam Physician 2017;63(10):744–6.

34. Willett W, Rockstrom J, Loken B, Springmann M, Lang T, Vermeulen S et al.Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. Lancet 2019;393(10170):447–92. Doi: 10.1016/S0140-6736(18)31788-4.

35. Salisbury FB, Clark MA. Choosing plants to be grown in a Controlled Environment Life Support System (CELSS) based upon attractive vegetarian diets. Life Support Biosph Sci 1996;2:169–79.

Contributors

Acosta-Navarro J: participation in idealization of the study design; data collection, analysis and interpretation; writing the study; and in the final review and approval of the manuscript for submission. Antoniazzi L: participation in data collection, analysis and interpretation; writing the study; and in the final review and approval of the manuscript for submission. Cárdenas-Prado S: participation in analysis and interpretation; writing the study; and in the final review and approval of the manuscript for submission.

Conflict of Interest: The authors declare no conflict of interest.

Received: November 14, 2020
Accepted: April 23, 2021