Editorial

Balanced diet is a major casualty in COVID-19

The World Health Organization (WHO) has announced dietary guidelines during the COVID-19 outbreak stressing the importance of a balanced diet to maintain a strong immune system and to avoid or minimize chronic diseases and infections [1]. Interestingly, the recommendations for servings during COVID-19 period are relatively higher than the usual WHO dietary recommendations [1]. For instance, although most of the dietary guidelines suggest to take five fruits and vegetables per day [2], the WHO has recommended to consume 4 servings of fruits/day and 5 servings of vegetables/day, making a total of 9 servings/day [1]. Furthermore, a combination of whole grain cereals (180g) and a variety of meats and beans (160g) were recommended to optimize the nutritional requirements during this pandemic [1]. In our previous review, we have highlighted the importance of several micronutrients, nutraceuticals and probiotics to enhance the immunity during COVID-19 pandemic [3]. In this review [3], we stated that several micronutrients especially vitamin A, C and D; and trace elements such as Zinc and Selenium are essential for proper function of the immune system [3]. Consequently, a balanced diet is essential to minimize micronutrient deficiencies and prevent viral infections such as COVID-19. Currently, there is limited research on dietary patterns and its effect on incidence or mortality in COVID-19.

Importantly, dietary habits in different population can be a contributory factor for the geographical variation in COVID-19. The entry of SARS-CoV-2 is facilitated by trans-membrane angiotensin-converting enzyme (ACE2) and dietary patterns are associated with ACE levels. In fact, consuming certain foods may be associated with lower mortality [4]. Specifically, almost two times the ACE inhibitory activity of the peptide LVLPGELAK in broccoli protein hydrolysate has been detected, and consequent hypotensive effect has also been shown [5]. Further, other nutrients/dietary patterns have effects on ACE levels high-saturated fat diet increases ACE [6] and other plants foods have an ACE-inhibitory activity [7,8]. It is also interesting to know that blood ACE levels are rapidly sensitive to food intake [9].

Further, malnutrition including protein intake may have a role to play. It is important to note that Indian states with high prevalence of underweight and anaemia have reported the highest number of COVID-19 cases [10]. Therefore undoubtedly, a balanced diet is vital for the prevention of COVID-19 and diet related chronic diseases and may impact mortality due to COVID-19 favourably.

During this COVID-19 pandemic, almost all countries were either on lockdown or maintaining social distancing. This has several implications on food habits both individually and globally. In a recent market survey food consumption pattern was evaluated during the early period of COVID-19 epidemic in Italy, showed an higher consumption of pasta, flour, eggs, long-life and frozen foods and a reduction in fresh fruits and vegetables consumption when compared to the same period in 2019 [11]. In a study among a group of middle-class population in Mumbai, India reduced consumption of fruits/vegetables and increased intake of snacks during the lockdown period was reported [12]. A large (n = 3533) Italian survey showed that 53.9% of participants have changed their lifestyle during the COVID-19 lockdown period, in 2/3rd higher consumption of junk foods and sweets, reduced intake of fruits and vegetables and consumption of leftover foods was reported as compared to the usual intake [13]. Furthermore, nearly half of the individuals in this study reported weight gain [13]. A cross-national survey in China and United States during stay-at-home directives showed at least 5 pound weight gain in 25% and 13% of the study samples, respectively [14]. On the other hand, this survey further reported that's household food insecurity increased by 10 times during the same period [14]. A recent survey on patients with type 2 diabetes mellitus during the lockdown period in India, showed increased levels of snacking, carbohydrate intake and weight gain, which have the potential to de-stabilise glucose control [15]. In another analysis, we have also predicted 7% increase in diabetes risk in apparently among the non-diabetic individuals consequent to weight gain during the lockdown in India [16]. It appears that while we are tackling anxiety due to pandemic, and eagerly looking forward to solutions, basics of diet and lifestyle have been ignored. Consequent rise of obesity and diabetes has potential to increase mortality in many of these individuals.

There are several attributable factors to the food insecurity and inability to achieve balanced diets during this COVID-19 pandemic. Firstly, purchasing power has significantly dropped due to the loss of income during the lockdown period [17]. Additionally, the price of fruits, vegetables and protein rich foods were notably high during the lockdown, especially in China [14]. Secondly, "social isolation" has majorly limited movements to supermarkets and local retailers etc. Thirdly, food wastage of fresh foods such as fruits, vegetables and milk were increased due to restriction of transportations [17]. Finally, importing foods were restricted due to financial and logistics reasons.

Undoubtedly, the COVID-19 epidemic has caused food insecurity all over the globe. Although WHO has recommended a balanced diet to improve overall well-being, unfortunately the balanced diet is the major causality of the COVID-19 pandemic. Overall, fresh fruits and vegetables intake has decreased worldwide, moreover high quality protein rich foods such as meat/fish consumption has reduced in many occasions. Concurrently, consumption of high fat, high sugary foods and snacks have increased, making the diet increasingly imbalanced. These dietary changes may have adversely affected both the immunity and the control of chronic non-communicable diseases (NCDs) due to the lack of micronutrients and increased intake of empty calories. Ironically, the very first COVID-19 infection was transmitted through food (Huanan Seafood Market, China) resulted in a massive global pandemic which has caused a considerable impact on the balanced diet globally.

In conclusion, solutions for this global public health problem are not simple as the root cause which is multifaceted and interlinks to several social, cultural and economic aspects. Diet associated NCDs is a major public health challenge especially in developing countries, accounting for nearly 70% of total mortality. Deterioration of dietary habits during this lockdown period has major impact on the health system of developing countries by worsening NCDs on top of the COVID-19. It is time to strengthen National programs which can decrease diet insecurity and imbalances. Research is of great importance, and modulation of tissue ACE-2 and its effect on incidence and mortality of COVID-19 must be looked at. Finally, at individual levels, we must send repeated simple messages of heightened importance of maintaining correct lifestyle during COVID-19 pandemic; regular exercise and balanced and nutritious foods.

Declaration of competing interest

NO Conflict of Interest.

References

[1] World Health Organization. Nutrition advice for adults during the COVID-19 outbreak. 2020 19/06/2020]; Available from, http://www.emro.who.int/nutrition/nutrition-infocus/nutrition-advice-for-adults-during-the-covid-19-outbreak.html.

[2] Jayawardena R, et al. Food consumption of Sri Lankan adults: an appraisal of serving characteristics. Publ Health Nutr 2012;16(4):653—8.

[3] Jayawardena R, et al. Enhancing immunity in viral infections, with special emphasis on COVID-19: a review. Diabetes, Metab Syndrome: Clin Res Rev 2020;14(4):367—82.

[4] Bousquet J, et al. Is diet partly responsible for differences in COVID-19 death rates between and within countries? Clin Transl Allergy 2020;10:16.

[5] Dang Y, et al. In vitro and in vivo studies on the angiotensin-converting enzyme inhibitory activity peptides isolated from broccoli protein hydrolysate. J Agric Food Chem 2019;67(24):6757—64.

[6] Schuler R, et al. High-saturated-fat diet increases circulating angiotensin-converting enzyme, which is enhanced by the rs4343 polymorphism defining persons at risk of nutrient-dependent increases of blood pressure. J Am Heart Assoc 2017;6(1).

[7] Iwaniak A, Minkiewicz P, Darewicz M. Food-originating ACE inhibitors, including antihypertensive peptides, as preventive food components in blood pressure reduction. Compr Rev Food Sci Food Saf 2014;13(2):114—34.

[8] Fan H, Liao W, Wu J. Molecular interactions, bioavailability, and cellular mechanisms of angiotensin-converting enzyme inhibitory peptides. J Food Biochem 2019;e12572.

[9] Tejpal S, et al. Angiotensin converting enzyme (ACE): a marker for personalized feedback on dieting. Nutrients 2020;12(3).

[10] Das A, Das M, Ghosh S. Impact of nutritional status and anemia on COVID-19-is it a public health concern?. In: Evidence from national family health survey-4 (2015-2016). Public Health; 2020. India.

[11] Bracale R, Vaccaro CM. *Changes in food choice following restrictive measures due to Covid-19.* Nutrition, Metabolism and Cardiovascular Diseases. 2020.

[12] Metha V. The impact of COVID-19 on the dietary habits of middle-class population in mulund. Mumbai, India: AIJR Preprints; 2020.

[13] Di Renzo L, et al. Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey. J Transl Med 2020;18(1):229.

[14] Dou Z, Stefanovski Darko, Galligan David, Lindem Margaret, Paul Rozin, Chen Ting, Ariana M, Chao. The COVID-19 pandemic impacting household food dynamics: a cross-national comparison of China and the. *U.S.* SocArXiv; 2020.

[15] Ghosal S, et al. Estimation of effects of nationwide lockdown for containing coronavirus infection on worsening of glycosylated haemoglobin and increase in diabetes-related complications: a simulation model using multivariate regression analysis. Diabetes, Metab Syndrome 2020;14(4):319—23.

[16] Ghosal S, Arora B, et al. Increase in risk for type 2 diabetes due to lockdown for COVID19 pandemic in apparently non-diabetic individuals in India: a cohort analysis. Diabetes, Metab Syndrome: Clin Res Rev 2020.

[17] Stephens EC, et al. Editorial: impacts of COVID-19 on agricultural and food systems worldwide and on progress to the sustainable development goals. Agric Syst 2020;183:102873.

Ranil Jayawardena[*]
Department of Physiology, Faculty of Medicine, University of Colombo, Colombo, Sri Lanka

Queensland University of Technology (QUT), Institute of Health and Biomedical Innovation, Brisbane, Australia

Anoop Misra
Fortis-C-DOC Centre of Excellence for Diabetes, Metabolic Diseases and Endocrinology, Chirag Enclave, New Delhi, India

National Diabetes, Obesity and Cholesterol Foundation (N-DOC), New Delhi, India

Diabetes Foundation (India), New Delhi, India

[*] Corresponding author. Department of Physiology, Faculty of Medicine, University of Colombo, Sri Lanka.
E-mail address: ranil@physiol.cmb.ac.lk (R. Jayawardena).

30 June 2020