Commentry

Food Processing and Technology to Combat the 3-Pronged Threat of COVID-19, Diabetes, and Obesity

Rwik Sen[1*], Shreya Sarkar[2]

[1]Active Motif, USA; [2]Cardiovascular Research New Brunswick, Saint John Regional Hospital, Canada

COMMENTARY

Diabetes Mellitus (DM) is a major health concern with 8.5% global prevalence and an alarming rising rate [1]. After cancer and cardiovascular diseases, DM leads global mortality, with over 70% of deaths worldwide [2]. Two major types of DM are type 1, usually predominant in children, and type 2, more common in adults, tend to have different risk factors [3].

The coronavirus disease 2019 (COVID-19) pandemic caused by SARS-CoV-2 renews our focus on the population affected by DM. Majority of the patients requiring hospitalization (60-90)% present with co-morbidities, with a significant population having diabetes (17-34)%, not limited to but exacerbated with old age [4]. These patients tend to be more susceptible to respiratory failure, have a high risk to Intensive Care Unit admission and hence showed a poor prognosis [5,6]. Case Fatality Rates (CFR) of COVID-19 is significantly higher with DM as comorbidity, e.g. 35.5% in Italy [7]. An important risk factor in type 2 DM is obesity [8], and both are closely associated with rampant systemic inflammation which is prevalent in COVID-19 [9,10]. Since DM and obesity result from genetic, epigenetic, environmental, lifestyle, and nutritional conditions, the Journal of Food Processing and Technology serves as an excellent resource for nutritional intervention to combat the 3-pronged problem of DM, obesity, and COVID-19.

Hence, we need to understand the molecular connection between the above 3 conditions. DM results from a destruction of the β-cells of the pancreas (type 1), or due to insulin resistance/relative insulin deficiency (type 2) [11]. DM is critically regulated by AngII (Angiotensin II), a major effector of Renin Angiotensin System (RAS) of hormones. Angiotensin-Converting Enzyme 2 (ACE2), the host cell receptor for SARS-CoV-2, cleaves AngII into biologically active peptides. Inhibition of ACE2 and AngII receptor show clinical benefits against complications during diabetic cardiovascular progressions [12]. ACE2-mediated downstream reaction cascades can be targeted as compensatory pathways in type 2 diabetes development [13]. Regarding obesity, angiotensin inhibition rescues obesity-associated hypertension, and Single Nucleotide Polymorphisms (SNPs) in ACE2 correlate with dislipidemia, obesity, and cardiac dysfunction in DM patients [14]. ACE2 is largely expressed in visceral adipose tissue [15], which likely serves as a huge accumulation of viral load during COVID-19 [16].

Pharmaceutical inhibitors against AngII receptor and ACE2 ameliorate health issues associated with obesity [17], diabetes, blood clotting, and inflammation response leading to multi-organ failure, all of which exacerbate the prognosis of COVID-19. Food processing and technology have an important role to play here because natural inhibitors of AngII receptor and ACE2 need to be preserved in the nutrition that is being provided to patients of DM, obesity, and COVID-19. For example, antioxidants, anti-inflammatory, blood thinning properties are properties of some natural food which need to be made accessible to consumers of fresh food, as well as, packaged preserved food with extended shelf life. This process will also benefit combination therapy involving natural nutrition and medications. Although no natural food has been established as cure or prevention of COVID-19, but some of their properties interfere with ACE2 and AngII to ameliorate hostile physiological conditions that otherwise exacerbate the health of COVID-19 patients.

Authors contributed equally, declare no conflicts of interest

REFERENCES

1. Mirzaei M, Rahmaninan M, Mirzaei M, Nadjarzadeh A. Epidemiology of diabetes mellitus, pre-diabetes, undiagnosed and uncontrolled diabetes in Central Iran: results from Yazd health study. BMC Public Health. 2020;20:166.
2. Blüher M. Obesity: Global epidemiology and pathogenesis. Nat Rev Endocrinol. 2019;15:288-298.
3. Tan SY, Wong JL, Sim YJ, Wong SS, Elhassan SA, Tan SH, et al. Type 1 and 2 diabetes mellitus: a review on current treatment approach and gene therapy as potential intervention. Diabetes Metab Syndr: Clinical Res Rev. 2019;13:364-372.
4. Wiersinga WJ, Rhodes A, Cheng AC, Peacock SJ, Prescott HC. Pathophysiology, transmission, diagnosis, and treatment of coronavirus disease 2019 (COVID-19): A Review. JAMA. 2020.

5. Dhama K, Khan S, Tiwari R, Sircar S, Bhat S, Malik YS, et al. Coronavirus Disease 2019-COVID-19. Clin Microbiol Rev. 2020:33.

6. Ceriello A, Standl E, Catrinoiu D, Itzhak B, Lalic NM, Rahelic D, et al. Issues for the management of people with diabetes and COVID-19 in ICU. Cardiovasc Diabetol. 2020;19:1-7.

7. Onder G, Rezza G, Brusaferro S. Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy. JAMA. 2020;323:1775-1776.

8. Tsalamandris S, Antonopoulos AS, Oikonomou E, Papamikroulis GA, Vogiatzi G, Papaioannou S, et al. The role of inflammation in diabetes: current concepts and future perspectives. Eur Cardiol Rev. 2019;14:50.

9. Wellen KE, Hotamisligil GS. Inflammation, stress, and diabetes. J Clin Investig. 2005;115:1111-1119.

10. Reilly SM, Saltiel AR. Adapting to obesity with adipose tissue inflammation. Nat Rev Endocrinol. 2017;13:633-643.

11. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2010;33:S62-S69.

12. Patel VB, Parajuli N, Oudit GY. Role of angiotensin-converting enzyme 2 (ACE2) in diabetic cardiovascular complications. Clin Sci. 2014;126:471-482.

13. Bindom SM, Hans CP, Xia H, Boulares AH, Lazartigues E. Angiotensin I-converting enzyme type 2 (ACE2) gene therapy improves glycemic control in diabetic mice. Diabetes. 2010;59:2540-2548.

14. Liu C, Li Y, Guan T, Lai Y, Shen Y, Zeyaweiding A, et al. ACE2 polymorphisms associated with cardiovascular risk in Uygurs with type 2 diabetes mellitus. Cardiovasc Diabetol. 2018;17:127.

15. Zhang Y, Somers KR, Becari C, Polonis K, Pfeifer MA, Allen AM, et al. Comparative expression of renin-angiotensin pathway proteins in visceral versus subcutaneous fat. Front Physiol. 2018;9:1370.

16. Iannelli A, Favre G, Frey S, Esnault V, Gugenheim J, Bouam S, et al. Obesity and COVID-19: ACE 2, the Missing Tile. Obes Surg. 2020:1.

17. Gupte M, Thatcher SE, Kari CM, Shoemaker R, Yiannikouris F, Zhang X, et al. Angiotensin converting enzyme 2 contributes to sex differences in the development of obesity hypertension in C57BL/6 mice. Arterioscler Thromb Vasc Biol. 2012;32:1392-1399.