
Perspective

COVID-19, an Incentive to Tackle Sugar in Hospitals and at Home

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Obesity and metabolic disease are thwarting our efforts to recover from COVID-19. Chronic inflammation is a key feature of both COVID-19 and the metabolic syndrome. Sugar consumption in particular has been shown to affect COVID-19 mortality by contributing to the chronic inflammatory state. Restriction of free sugar intake has a measurable effect on disease-predicting physiological parameters in as little as 9 days. The rapid reduction in inflammation following fructose restriction is key in the context of the COVID-19 pandemic, as COVID-19 exacerbates the same inflammatory pathways as those driven by the metabolic syndrome. Healthcare providers have a duty to implement international recommendations of reduced free sugar intake. By doing so, they could reduce the chronic inflammatory burden contributing to COVID-19 patients' demise. Further, it would set a precedent for reducing the risk of severe disease in the uninfected, by maximizing their potential metabolic health in the context of an infection predicated on its disruption.

Key Words: COVID-19, obesity, sugar, metabolic diseases, coronavirus, free sugar, sugars, metabolic syndrome

Obesity has almost tripled since 1975 worldwide. It is a well-known major risk factor for cardiovascular disease, diabetes mellitus, and cancer. The recent coronavirus disease 2019 (COVID-19) pandemic has highlighted obesity and the associated metabolic syndrome as a public health priority.

More than 600 million adults and 100 million children worldwide are obese. In Europe, the worst figures are seen in England, where 63% of adults and 28% of children are overweight or obese. Rising overweight and obesity have previously been of concern because the inflammatory state they provoke predisposes to other metabolic syndrome-associated conditions including Type 2 Diabetes Mellitus,

hypertension, and cardiovascular disease. According to the Global Burden of Disease study, worldwide diabetes prevalence more than doubled between 1990 and 2017 (211 million to 476 million). Several additional preventable comorbidities arise directly from overweight and obesity, including orthopaedic problems, sleep apnoea, gallstones, and depression. Inflammation arising from obesity and the metabolic syndrome puts sufferers at increased risk of cancer, and of particular current concern, severe COVID-19.

The chronic inflammatory state present in COVID-19 is mediated by pro-inflammatory cytokines including the acute phase reactants interleukin 6 and tumor necrosis factor α [1]. These same molecules are released by adipose

tissue following consumption of fructose, and so are found at increased levels in those with metabolic disease, in whom they trigger hyperinflammation, links which have been demonstrated at both a molecular and an organ-system level [1,2]. In addition to this inflammatory priming, fructose alters the metabolism of immune cells directly, to potentiate the cytokine response following infection [3]. Targeting this systemic inflammatory dysregulation is the mainstay of hospital management of COVID-19 patients, and is achieved with systemic corticosteroids such as dexamethasone, and immunomodulators directly targeting pro-inflammatory cytokines, such as the monoclonal antibodies tocilizumab and sarilumab.

This propensity of both COVID-19 and the metabolic syndrome to stimulate chronic inflammation means those with metabolic disease suffer from significantly worse outcomes following COVID-19. A meta-analysis of 400 000 COVID-19 cases across 4 continents showed that obese individuals suffered from increased rates of hospitalization, ICU admission, intubation and ventilation, and mortality [4]. Examination of data spanning 8 years from the US National Health and Nutrition Examination Survey (NHANES) shows that 88% of adults in the United States suffer from metabolic dysfunction, putting them at risk of such consequences. Although obesity and metabolic syndrome have previously been targets of public health campaigns across the world, prevailing metabolic disease continues to impede the global response to COVID-19.

In 2015 the World Health Organization (WHO) recommended that free sugar intake be restricted to less than 5% of daily intake. In its guideline, WHO defines free sugars as those including monosaccharides and disaccharides added to foods and beverages by the manufacturer, cook or consumer, and sugars naturally present in honey, syrups, fruit juices, and fruit juice concentrates. Consumption of free sugars leads directly to visceral adiposity, increased fasting triglycerides and glucose, and reduced insulin sensitivity [5]. As shown by the NHANES and its linked prospective cohort, there is a significant relationship between added sugar consumption and increased risk of CVD mortality. In addition to consumption of sugary drinks, the NutriNet-Santé prospective cohort of 100 000 French inhabitants confirms that fruit juice consumption in particular is strongly associated with an increased risk of overall cancer. Finally, recent analysis of food supply data in 188 countries shows that the effect of consuming sugar products from all sources on COVID-19 mortality is considerable [6].

Conversely, isocaloric reduction of fructose intake is particularly effective in combatting both overweight and obesity, and development of associated metabolic diseases and mortality. It impacts disease-predicting physiological and metabolic parameters including blood pressure,

lipoprotein profiles, glycaemic control, insulin sensitivity, and inflammatory markers within as few as 9 days following fructose restriction [7]. The rapid reduction in inflammation following fructose restriction is key in the context of the COVID-19 pandemic, as COVID-19 exacerbates the same inflammatory pathways as those driven by the metabolic syndrome. Poor glycaemic control (a key feature of the metabolic syndrome) in patients with COVID-19 is independently associated with an increased risk of multiple organ dysfunction, renal failure, ICU admission, and mortality, even in a non-diabetic range. Importantly, mortality improves with proper glycaemic control [2].

In addition to pharmacological management of hyperinflammation, hospitalized COVID-19 patients should be fed an anti-inflammatory diet. This can be done by minimizing the free sugars in food and drinks as well as in enteral (tube) and parenteral (intravenous) liquid diets. Such measures would maximize these patients' potential glycaemic control and metabolic health in the context of an infection predicated on its disruption. Further, targeting these inflammatory pathways with nutritional enhancement is not something that can benefit only the critically ill and hospitalized—it can be done at home to prevent the uninfected population from developing severe disease. This is particularly important as efficacy of COVID-19 vaccines is thought to be adversely influenced in those with impaired metabolic health [2].

Possible modifications to inpatient and cafeteria meals include replacing desserts with starters, and limiting portions and packaged snacks to a maximum of 5 g free sugar. In terms of drinks available to hospital patients and staff, taking into account the effects of fruit juice, a reasonable step would be to limit drinks available throughout the hospital environment to water, milk, tea, and coffee, excluding pre-prepared and bottled tea and coffee. Liquid diets fed to patients via nasogastric or nasojejunal tubes should not include fructose or its derivatives as ingredients, as this contributes to inflammation—liquid carbohydrates can be obtained from dextrose. The recently published Report of the Independent Review of NHS Hospital Food (UK National Health Service) suggests a number of more specific granular and system-level measures which hospitals across the world can use to improve their food and food environments.

Some hospitals have taken preliminary steps towards reducing sugar during the past decade. The Nationwide Children's Hospital in Columbus, Ohio, published its experience of banning sugar-sweetened beverages (SSBs) entirely, showing in particular no revenue loss at non-vending food locations. The University of California, San Francisco stopped selling SSBs in both the University and associated hospital, and measured a decreased insulin

resistance and waist circumference in its cohort of more than 200 staff. Although there have been attempts by NHS Trusts to limit intake of sugars through reduction of SSB sales, and there are financial incentives for UK hospitals to provide healthier food options to staff in particular, levels of overweight and obesity continue to rise.

Sugar reduction as a preventative measure is not novel—the 2015 sugar limit recommendations of WHO have since been echoed by bodies around the world, including the United Nations in its Decade of Action on Nutrition 2016-2025, the Dietary Guidelines for Americans, which recommended limiting sugars to less than 10% of daily intake, and the Asia Pacific Academic Consortium for Public Health. The European Commission endorses policies that either restrict or eliminate choice, such as bans on sale of high sugar items in schools, those that guide choice through disincentive, such as tax, and those that enable choice through measures including increasing availability and affordability of fresh fruit and vegetables. In the United Kingdom, Public Health England (PHE) specifically advised lowering sugar content of food and drinks served in hospitals, as well as incorporating these recommendations into its Eatwell Guide. The UK's National Diet and Nutrition Survey has since confirmed that the WHO 5% limit is exceeded in every age group and sex. More recently, the Scientific Report of the American Dietary Guidelines Advisory Committee advised again that sugar consumption should be reduced, and that infants and toddlers should consume no SSBs whatsoever.

Reduction of added sugar in meals has however only been implemented sparsely, either at or away from the hospital, and fruit juices, the major sugary drink, continue to be left out of measures. The poor public perception of hospital food reminds us that we have no time to lose: more than 40% of the 77 000 respondents to the 2019 Care Quality Commission (regulatory body for UK healthcare) inpatient survey did not rate their hospital food as good, and 1 in 7 rated it as poor. Whilst it may not be the sugar content of hospital food that is complained about as opposed to its palatability, sugar is a factor that must be considered in addressing this.

National lockdowns to stem the pandemic have only compounded the situation at home. A recent cross-sectional study of 25 000 Norwegian inhabitants demonstrated a high prevalence of psychological stress in relation to the pandemic, and showed that this was associated with increased intake of both high sugar foods (candy, cakes, biscuits, or sweet desserts) and SSBs [8]. Whilst institutional sugar bans are still uncommon, taxes on sugar are a growing international convention, as well as restrictions on marketing and sales, including in schools. In December 2020, the UK Government

announced that from 2022, marketing of unhealthy foods in prominent locations, including shop entrances and checkouts, multibuy deals, and free refills of sugary drinks in restaurants, will be banned. Retailers will no longer be able to tempt consumers to buy sugary foods impulsively. The Government will also ban junk food adverts on television before 9 PM. These first steps are positive, although outcomes will not manifest for years.

Hospitals are duty-bound to seize COVID-19 as their opportunity to minimize free sugar served to patients, staff, and visitors. Whilst combatting inflammation is particularly important for the critically ill, it is of significant benefit to all as a preventative measure, and relies upon the example set by those in the healthcare profession. The Report of the Independent Review provides a useful framework which, along with the recommendations of WHO and other bodies, can enable healthcare providers worldwide to exemplify nutrition in a manner that addresses both concerns of obesity and metabolic syndrome and their effect on COVID-19, and public perception of hospital food.

Sugar reduction is a simple modification which leads to measurable health benefits in days. It is an important preventative measure for metabolic disease, which could lead to fewer serious cases of COVID-19 either by alleviating the inflammatory burden, or preventing it from developing. Adopting change now will prove healthcare providers' commitment to our health, and set a precedent for how we should act at home. Waiting yet longer will be detrimental to our health and recovery from COVID-19.

This is both a societal and a medical issue. Hospitals should be paragons of healthy food, not abodes of sugar-bingeing. They must act now to rectify the obesogenic environment they perpetuate.

Additional Information

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