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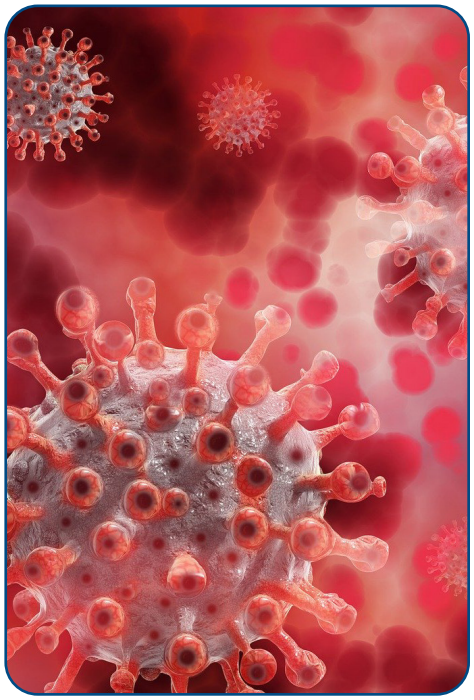
University of California, Davis, Department of Nutrition and the Center for Nutrition in Schools

Selenium Status May Be Related to COVID-19 Cure Rate

Selenium is an important nutrient for immune function and research has demonstrated that poor selenium status is associated with increased mortality from several viruses (1). However, the impact of selenium status on the SARS-CoV-2 virus, which causes coronavirus disease 2019 (COVID-19), is currently unknown.



In a recent letter to the editor published in the *American Journal of Clinical Nutrition*, the authors examined whether there was an association between COVID-19 infection outcomes and selenium status in regions of China (1). Selenium status was primarily assessed with hair selenium concentrations from previously conducted studies, with most of these data from 2011 or earlier. Outcomes for COVID-19 cases were defined as number of cases, number cured, and number of deaths from COVID-19 infections. The researchers then determined if there were associations between these data using linear regression models.

Due to significant differences between cure and death rates in Hubei Province (of which the city of Wuhan is the capital) and the 17 other provinces in China that were included in the study, the researchers analyzed Hubei Province separately. Within Hubei, the cure rate was 13.2 percent and the death rate was

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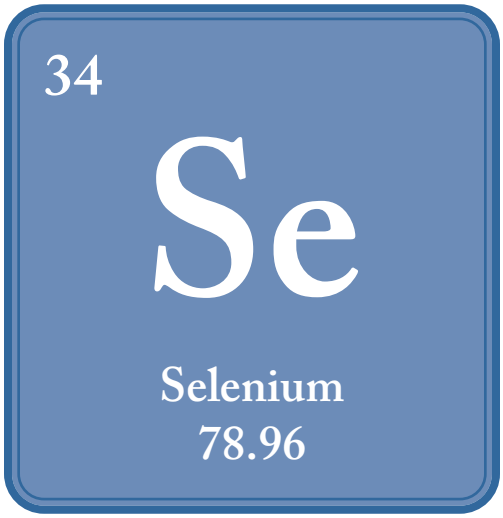
3.0 percent, while these rates were 40.6 and 0.6 percent respectively in the other 17 provinces examined. Within Hubei Province, the city of Enshi had a significantly higher cure rate, 36.4 percent, compared to the rest of the province. Based on previous data, this city also tended to have higher selenium status, with 3.13 mg/kg in women and 2.21 mg/kg in men, compared to the rest of the Hubei, in which the average hair selenium was 0.55 mg/kg.

When looking outside of Hubei, selenium status was significantly associated with cure rate, such that cities with higher hair selenium concentrations had higher COVID-19 cure rates, while lower selenium status was associated with lower cure rates. A notable example was Heilongjiang Province, in which the city of Keshan is located. Keshan is known for historically low selenium status; in fact, Keshan disease, a form of cardiomyopathy related to low selenium intake and specific viral infections, is named for this area. In this region, the death rate was significantly higher, at 2.4 percent, and hair selenium concentrations averaged 0.26 mg/kg.



Selenium is an essential mineral and can be found in foods such as seafood, beef and pork, and nuts and seeds.

While this study is interesting, there are a number of weaknesses. The first is that the researchers did not use hair selenium data from patients with COVID-19, rather the selenium status was from city population studies conducted, in some cases, a decade or more earlier. There were also unable to take into account variables that may have had an impact on selenium status or COVID-19 outcomes, such as age or presence of chronic diseases such as cardiovascular disease. They also lacked data on medical facilities and therapies for those with COVID-19. As a result, it's impossible to determine how much, if any, selenium status really impacted COVID-19 cure rate. However, despite these concerns, the study raises interesting questions about selenium and COVID19 outcomes that should be examined in rigorous future studies.

Reference:

1. Zhang J, Taylor EW, Bennett K, Saad R, Rayman MP. Association between regional selenium status and reported outcome of COVID-19 cases in China. Am J Clin Nutr. 2020;111(6):1297-1299. doi:10.1093/ajcn/nqaa095

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Potential Impacts of COVID-19 on Food Insecurity

Prior to the coronavirus disease 2019 (COVID-19) pandemic, food insecurity impacted 14 percent of families with children in the U.S. The economic impacts of the pandemic have only caused this number to rise. A recent article published in the Journal of Urban Health summarized how responses to the pandemic may impact those experiencing food insecurity as well as those currently receiving Supplement Nutrition Assistance Program (SNAP) benefits.

Many low-income families use a variety of techniques to stretch their food dollars that become less tenable during the pandemic. This includes visiting multiple food stores to obtain the most cost-effective products or group shopping trips to stores in which there is a membership fee (such as Costco). These practices become much riskier during the pandemic, particularly for families that rely on public transportation or ride-sharing in order to accomplish this. Relying on social networks, congregate meal sites (such as soup kitchens) or meals with friends and family become much more difficult when there is a need to maintain social distancing.

Early in the pandemic, empty grocery store shelves were a common sight.

Food hoarding, which was commonly reported early in the pandemic, negatively impacts families unable to buy in bulk. On average, most families receiving SNAP spend more than 75 percent of their benefits within two weeks of receiving them, as a result many SNAP recipients run out of benefits before the end of the cycle. This necessitates larger shopping trips when the benefits are received, which may be hampered by empty store shelves due to pandemic-related food hoarding. This is further compounded by those using SNAP benefits needed to limit their shopping to stores that accept those benefits. On social media, many have been advocating for those not using SNAP benefits to avoid grocery shopping on the first few days of the months, however the study authors point out that benefit distribution cycles vary by state; as a result, this response may not be helpful for those using SNAP benefits.

Many state and local governments have been implementing different methods of providing food to those in need, including delivering food along regular school bus routes using school buses as delivery vehicles, or instituting sites where families can pick up 5 days of food at a time. Despite these methods, the study authors note, it is very likely that COVID-19 will not only increase food insecurity and financial difficulties for many, but also widen health disparities, with impacts that may be felt for an extended period of time.

Reference:

1. Kinsey EW, Kinsey D, Rundle AG. COVID-19 and Food Insecurity: an Uneven Patchwork of Responses. J Urban Health. 2020 Jun;97(3):332-335. doi: 10.1007/s11524-020-00455-5. PMID: 32504251; PMCID: PMC7274516.

By Anna M. Jones, Department of Nutrition, University of California, Davis.

Spices May Reduce Inflammation Caused by a High-fat, High-carb Meal

Many spices, such as turmeric and connamon, contain compounds that have anti-inflammatory effects.

Recent research published in the *Journal of Nutrition* suggests that spices not only add flavor to meals—they may also reduce inflammatory responses to a high-fat, high-carbohydrate meal (1).

Twelve men with overweight or obesity, large waist circumference, and one risk factor for cardiovascular disease (including high blood cholesterol or triglycerides, elevated fasting blood glucose, or high blood pressure) were recruited to participate in the study, in which they consumed a meal consisting of coconut curry, a corn muffin, and a cinnamon biscuit, that was designed to result in an inflammatory response. Participants in the study consumed three different versions of the meal (made with no spices, 2 grams of spices, and 6 grams of spices), with at least three days in between each meal. The order in which they consumed the meals were randomly assigned. Blood samples were taken before the meal was consumed, and then every 60 minutes for four hours after the meal. Blood samples were then measured for several different markers of inflammation.

The researchers found that the high fat, high carbohydrate meal caused an increase in inflammatory markers, however, this increase was statistically smaller after consumption of the meal containing 6 grams of spices. These results suggest that the spices included in the meal may have reduced the level of inflammation caused by the meal. While these results were observed with the meal containing 6 grams of spices, similar results were not observed following the meals containing 2 grams of spices.

The spices, which included turmeric, ginger, cinnamon, among others, were chosen based on whether other research has suggested a cardiovascular impact, and if they were commonly consumed in the U.S. These three spices have been shown to have anti-inflammatory effects in animal (2) and human studies (3, 4), although previous research has not examined the spices in combination. The authors noted that because the spices impact the inflammatory response in different ways, they may have a greater impact

The increase in inflammatory markers was lowest after the consumption of the meal that included 6 grams of spices compared to 2 grams or none.

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combined than if similar amounts were consumed of each spice on its own.

However, this study has several limitations that warrant caution when evaluating the results. The first of these is the small sample size that included only men; as a result, it is not known if similar responses would occur in women. The participants also were aware of which meal they were consuming, although the study authors note that this is unlikely to impact the physiological response to the meal.

References:

1. Oh ES, Petersen KS, Kris-Etherton PM, Rogers CJ. Spices in a High-Saturated-Fat, High-Carbohydrate Meal Reduce Postprandial Proinflammatory Cytokine Secretion in Men with Overweight or Obesity: A 3-Period, Crossover, Randomized Controlled Trial. J Nutr. 2020 Jun 1;150(6):1600-1609. doi: 10.1093/jn/nxaa063.
2. Ranasinghe P, Pigera S, Premakumara GA, Galappaththy P, Constantine GR, Katulanda P. Medicinal properties of 'true' cinnamon (Cinnamomum zeylanicum): a systematic review. BMC Complement Altern Med. 2013 Oct 22;13:275. doi: 10.1186/1472-6882-13-275.
3. Panahi Y, Hosseini MS, Khalili N, Naimi E, Simental-Mendía LE, Majeed M, Sahebkar A. Effects of curcumin on serum cytokine concentrations in subjects with metabolic syndrome: A post-hoc analysis of a randomized controlled trial. Biomed Pharmacother. 2016 Aug;82:578-82. doi: 10.1016/j.biopha.2016.05.037. Epub 2016 Jun 6.
4. Arablou T, Aryaeian N, Valizadeh M, Sharifi F, Hosseini A, Djalali M. The effect of ginger consumption on glycemic status, lipid profile and some inflammatory markers in patients with type 2 diabetes mellitus. Int J Food Sci Nutr. 2014 Jun;65(4):515-20. doi: 10.3109/09637486.2014.880671. Epub 2014 Feb 4.

By Anna M Jones, Department of Nutrition, University of California, Davis.

Using Modeling to Estimate Impacts of Different Taxes on Sugar-Sweetened Beverages

Taxes on sugar-sweetened beverages are becoming increasing common, but the impact may depend on how the tax is implmented.

Across the United States and around the world, cities and countries are implementing taxes on sugar-sweetened beverages as a method to combat the obesity epidemic. In a study recently published in the journal Circulation, researchers examined how different methods of taxing sugar-sweetened beverages may impact health outcomes, health care costs, and policy implementation costs in different ways (1).

Using data from several datasets, the researchers modeled how three different methods of taxing sugar-sweetened beverages would impact cardiovascular disease (CVD) events such as heart attacks, development of type 2 diabetes, as well as potential healthcare savings and costs of manufacturers reformulating their products.

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The model included the sociodemographic, dietary, and health data of 1,000,000 individuals between the ages of 35 and 80 who participated in the National Health and Nutrition Examination Survey (NHANES).

The researchers modeled three different methods of taxing sugar-sweetened beverages. The first was a volume tax, which was modeled as a tax of 1 cent per fluid ounce on sugar-sweetened beverages. The second was a tiered tax, in which beverages were taxed based on established tiers of sugar content. In this model, beverages with less than 5 grams of sugar per 8 ounces were not taxed, a 1 cent per ounce tax was applied to beverages with 5 to 20 grams of sugar per 8 ounces, and 2 cents per ounce for beverages with more than 20 grams of sugar per 8 ounces. The third was an absolute sugar content tax, which taxed based on the amount of added sugar; this was modeled as 1 cent per teaspoon of added sugar.

The researchers modeled three different methods of taxing sugar-sweetened beverages: a volume tax; a tiered tax, and an absolute sugar content tax.

In addition to including changes to consumer behaviors as a result of the taxes, the researchers also included industry responses in the model. Based on results of taxes on sugar-sweetened beverage in other countries, the model factored in industry reformulations of products to reduce sugar, and therefore taxes, in both the tiered and absolute sugar content tax scenarios.

While all taxes were predicted to prevent CVD deaths and cases of diabetes, the tiered tax was found to be most impactful.

Over 10 years, all three tax scenarios were predicted to prevent several hundred thousand CVD events and cases of diabetes as a result of decreased consumption of added sugar. The tiered tax was modeled to be the most effective, reducing CVD events by 460,000 and diabetes cases by 218,000, compared to 238,000 CVD events and 111,000 diabetes cases with the volume tax, and 369,000 CVD events and 163,000 cases of diabetes with the absolute sugar tax. Both the tiered and absolute sugar content taxes were predicted to save over $100 billion in health care costs over a lifetime, while the volume tax was predicted to save over $50 billion. Costs of industry reformulations were estimated to be $430 million for the tiered tax and $1.15 billion with the absolute sugar content tax.

Overall, the model suggests that a tiered tax on sugar-sweetened beverages may be the most impactful, preventing a greater number of CVD events and cases of diabetes, with lower

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industry reformulation costs, and health care costs savings equal to that of the absolute sugar tax. However, it is important to note that computer modeling itself cannot include all variables that may be involved in a scenario as complex as the one in this study. One of the major weaknesses of the study is that they only used data from individuals aged 35 to 80 years, which doesn't account for how those outside of that age range may respond to taxes on sugar-sweetened beverages. Furthermore, the model extrapolates from existing data, which itself may be subject to measurement error or bias. Despite these limitations, the study provides estimates that may be useful for local, state, or national governments considering taxes on sugar-sweetened beverages.

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1. Lee Y, Mozaffarian D, Sy S, Liu J, Wilde PE, Marklund M, Abrahams-Gessel S, Gaziano TA, Micha R. Health Impact and Cost-Effectiveness of Volume, Tiered, and Absolute Sugar Content Sugar-Sweetened Beverage Tax Policies in the United States: A Microsimulation Study. Circulation. 2020 Aug 11;142(6):523-534. doi: 10.1161/CIRCULATIONAHA.119.042956.

Metabolites in Urine May Help in Assessing Responses to Diet

Assessing changes in dietary behaviors can be very difficult because tools used are often subject to memory, as in 24-hour recalls or food frequency questionnaires, or they have the potential to change behavior, as is the case with weighted food records. Research published in the journal Nature Food offers a promising new way to track diet using urine metabolites (1).

The food and beverages that we consume are broken down and metabolized in the body, with by-products of this process excreted in urine. By analyzing these by-products in the urine to create a metabolic profile, it may be possible to assess how healthy an individual's diet is. Researchers in the United Kingdom and Australia sought to determine if this would be possible in a feasibility study that took place in the UK.

Four standardized diets were developed with increasing adherence to the World Health Organization (WHO) healthy eating guidelines, with Diet 1 adhering the most, and Diet 4 adhering the least. These guidelines include increasing fruits, vegetables, and whole grains, while limiting fats, sugars and salt.

Participants (n=19) were recruited from a United Kingdom database of research volunteers. Each participant completed four separate three-day stays at the research facility, one per diet, spaced at least five days apart. The order in which participants consumed the diets was assigned randomly. Twenty-four-hour urine samples were collected each day.

Researchers analyzed metabolites in the urine to create a metabolic profile for each participant. They found that participant profiles changed systematically with the study diets they

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consumed. Since urinary metabolic profiles are responsive to diet, this allowed the researchers to use statistical modeling to create a dietary metabolite score (DMS). The DMS compares how similar an individual's metabolic profile is to profiles of those who consumed the different diets. DMS increasing depending on the diet, with scores ranging from -1 (most similar to profiles of Diet 4) to +1 (most similar to profiles of Diet 1, the closest to WHO guidelines). These findings suggest that urinary metabolic profiles may be potential method for examining individual responses to diet.

Researchers in the UK and Australia were able to analyze metabolic by-products in the urine to create a Dietary Metabolite Score.

While this feasibility study demonstrates the potential of DMS, the research had some limitations. A major limitation was the lack of diversity in the sample; nearly all the participants were white, with one participant identifying as Asian. As a result, the DMS that were developed may not be applicable in a more diverse population. Furthermore, the diets contained a narrow range of foods, with all participants consuming the same four diets. Outside of a research setting, the broad range of foods consumed combined with variability in metabolic profile may make it more difficult to correlate diets with the WHO guidelines to healthy eating. The researchers also found that there was significant variation between individuals, which may make it difficult to use the DMS at a single time point; it may be better suited to looking at changes over time.

Reference:

1. Garcia-Perez I, Posma JM, Chambers ES, Mathers JC, Draper J, Beckmann M, Nicholson JK, Holmes E, Frost G. Dietary metabotype modelling predicts individual responses to dietary interventions. Nature Food. 2020 Jun;1(6):355-64.

By Anna M. Jones, Department of Nutrition, University of California, Davis.

Does Protein Supplementation Impact Strength or Body Composition?

It is commonly recommended to increase protein intake in combination with strength-building exercise to build or maintain muscle mass; despite this, the research has been mixed on whether protein supplementation can have a positive impact (1).

To investigate this question, researchers at University College Dublin conducted a meta-analysis of research studies that examined the effects of protein supplementation on at least one of three measures: lean body mass; handgrip strength; and leg press strength (1). The meta-analysis also included whether timing of protein supplementation

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Protein supplementation had a positive effect on lean body mass in both adults between the ages of 18 and 55, that those older than 55 years.

(before exercise, before and after, and at other times) may have an impact on body composition or strength. Because there may be differences in effects depending on age, the researchers included studies that focused on adults between the ages of 18 and 55 years and older adults (55 years of age or older) and analyzed these groups separately.

Overall, the authors reviewed 65 studies with nearly 3,000 participants total (n = 2,907), with which they conducted three separate meta-analyses: lean body mass (26 studies); hand grip strength (8 studies); and leg press strength (24 studies). The amount of protein supplemented ranged from 10 to 106 grams per day, with whey being the most common protein supplement.

Protein supplementation had a positive effect on lean body mass in both adults and older adults. However, protein supplementation was found to have no impact on muscle strength compared to control in either hand grip or leg press strength. When examining whether timing of protein supplementation made an impact, the researchers found no statistically significant difference on timing for any of the three outcomes.

The findings regarding improvements in lean body mass in older adults are promising, as muscle mass generally declines in older age. The study authors note that these results support the development of protein supplementation guidelines for older adults to improve or maintain lean body mass. However, the researchers acknowledged several limitations to the systematic and review and meta-analysis. The studies included varied in design and the majority did not report how well participants adhered to the protein supplementation protocol. As a result, more studies are needed to confirm the findings of the meta-analyses.

In addition to examining whether protein suppmentation impacted strength or body composition, the researchers also investigated whether timing of supplementation had an effect.

Reference:

1. Wirth J, Hillesheim E, Brennan L. The Role of Protein Intake and its Timing on Body Composition and Muscle Function in Healthy Adults: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. J Nutr. 2020 Jun 1;150(6):1443-1460. doi: 10.1093/jn/nxaa049. PMID: 32232404.

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