

Project Title: *Nutrition and COVID-19 in North Carolina (NC-NC)*

Background: A wide range of health outcomes have been described after infection with the novel COVID-19 virus, ranging from patients who are asymptomatic, to those with severe respiratory illness and death. The impact of nutrition on health outcomes in individuals infected with COVID-19 virus remains largely unknown. Many nutrients influence immune function and inflammatory status. For example, selenium deficiency in humans has been associated with increased infection rates from viruses including Epstein Barr, Hepatitis C, and influenza.¹ Some animal and human intervention studies have shown faster viral clearing and higher antibody titers after selenium supplementation of virally infected hosts, likely due to the oxidant-defense function of several selenoproteins.^{2,3} A recent analysis of COVID-19 infections in China by regional selenium status reported a positive association between cure rate and regional hair selenium content ($R^2 = 0.72$; $P < 0.0001$), suggesting that selenium status may influence outcomes in COVID-19 infections.⁴ The selenium content of food is largely influenced by the selenium content of the soil where the food is produced. Many counties in North Carolina have low selenium content, which may influence an individual's selenium status and also their potential response to infection with the COVID-19 virus.⁵ Other micronutrients such as zinc, also play important roles in immunity. In fact, it has been shown that zinc may inhibit the replication of different type of RNA viruses including the severe acute respiratory syndrome corona virus (SARS CoV).⁶ The contribution of selenium and zinc to the severity of COVID-19 infection has not been investigated. To date, over 25,000 North Carolinians have been infected with COVID-19, and over 800 have died.⁷

Objective: To examine how dietary patterns and the intake and status of select micronutrients (selenium and zinc) affect the severity of COVID-19 illness in a population of North Carolinians who have been infected with the COVID-19 virus.

Methods: We will conduct a case-control observational study among individuals in North Carolina who have been infected with COVID-19. Our study design uses methods that can be deployed under social distancing conditions. Individuals who are asymptomatic or have mild symptoms will serve as controls to individuals who experienced more severe symptoms, and will be matched based on gender, age, BMI, and other health risks where possible (N= 50 per group; total of 100). Data collection will include: (1) demographic data (age, gender, zip code, height, weight, BMI, income, race, pre-existing health conditions); (2) toenail; (3) dietary assessment; (4) interview regarding COVID-19 progression. We will use purposive sampling to recruit a range of participants through partnering with clinicians at Cone Health and other regional health facilities. Toenail samples will be collected for the measurement of selenium and zinc concentrations. Dietary assessment for the intake of foods rich in selenium and zinc over the past two years will be done using a semi-quantitative food frequency questionnaire. This questionnaire will have a list of foods rich in these micronutrients, and subjects will be required to select from a set of options how often they consumed these foods in the past two years. Typical portion size information will also be collected as part of the dietary assessment. Potential subjects will be required to provide proof of previous COVID-19 infection from test results. Logistic regression will be used to determine the relationship between intake and status of the selected micronutrients and the odds of higher severity of symptoms during COVID-19 infection.

Expected outcome: We anticipate that frequent consumption and adequate status of selenium and zinc will be associated with lower severity of symptoms during COVID-19 infection.

Principal Investigators: Seth Armah, PhD and Maryanne Perrin, PhD, RDN are Assistant Professors in the Department of Nutrition at the University of North Carolina Greensboro. Dr. Armah's prior research has focused on the influence of micronutrient intake and status on biomarkers of inflammation. Dr. Perrin's prior research has focused on the dietary intake of lactating women and the micronutrient and bioactive composition of human milk.

Budget:	Personnel	\$80,885
	Supplies & Services	\$18,500
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	Total	\$99,385

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