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A pilot cross-sectional study of vitamin D status, demographic factors, and SARS-CoV-2 infection in a diverse south-east London patient population at the start of the COVID-19 pandemic

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Vitamin D deficiency and insufficiency have been associated with increased risk and severity of SARS-CoV-2 infection.[1] These conditions are prevalent among older adults, Asian and Black populations, and in individuals with high body mass index (BMI),[2] all of whom comprised a significant proportion of critically ill patients with SARS-CoV-2 infection in the UK.[3] This study investigated vitamin D status and its relation to BMI, ethnicity, sex, and in a hospital patients.

This study investigated vitamin D status by measuring serum 25-hydroxyvitamin D (25(OH)D) concentrations and its relation to BMI, ethnicity, sex, and laboratory data in a large sample (N = 17,628) from St Thomas' Hospital, London, UK, collected close to the start of the COVID-19 pandemic between January and June 2020. We also identified 485 patients positive for SARSCoV-2 RNA/IgG between March 2020 and January 2021 from those 17,628 patients.

The prevalence of vitamin D deficiency (25(OH)D <25 nmol/L) was 25% in Black, 21% in Asian, and 17% in White patients. Vitamin D insufficiency (25(OH)D 25-50 nmol/L) was observed in 36%, 34%, and 33% of these groups, respectively. The lowest concentrations of 25(OH)D were observed in individuals aged 17-21 years across all ethnicities, with levels increasing with age and stabilising after 60 years. The highest prevalence of vitamin D insufficiency was in overweight (33%, BMI 25.0-29.9) and obese individuals (35%, BMI 30.0-34.9). The deficiency rates were 18.5% for females and 22.4% for males. Notable disparities in BMI and age were observed among Black patients but not in Asian and White groups. Differences in 25(OH)D concentrations were also observed between sexes across different ethnicities, with the exception of South Asian individuals (Bangladeshis, Indians, Sri Lankans). SARS-CoV-2 RNA/IgG screening indicated 485 patients had previously been infected with SARS-CoV-2. Of these patients, the median 25(OH)D concentration was 42 nmol/L (IQR 25-66 nmol/L); 24.1% were vitamin D deficient, and 36.7% were insufficient (total 60.8% deficient/insufficient). Of those with deficiency, 40% were Black and 43% were White. It is well documented that vitamin D negatively regulates pro-inflammatory cytokines such as TNF-α,[4] which are involved in the pathogenesis of SARS-CoV-2 infection.[5] In a subset of the SARS-CoV-2 infected patient cohort (N = 45), we found a significant negative correlation between 25(OH)D concentration and TNF-α levels (Pearson's $r = -0.395$, $P < 0.01$).

In conclusion, this study highlights a high prevalence of vitamin D deficiency among individuals of Black ethnicity, young adults (17-21 years), males, and those with obesity during the early part of the COVID-19 pandemic in south-east London. Vitamin D deficiency may be a preventable risk factor for SARS-CoV-2 infection and linked to hyperinflammation. Because TNF-α is known to be elevated in obesity,[6] further analysis of this pro-inflammatory cytokine and vitamin D in patients with SARS-CoV-2 infection and concomitant obesity is warranted.

References

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