Proceedings of the Nutrition Society (2022), **81 (OCE1)**, E4 doi:10.1017/S0029665122000040

Winter Conference 2021, 7–8 December 2021, Obesity and the brain

Socio-economic deprivation correlates with lower 25-hydroxyvitamin D concentration: analysis of n 447,766 individuals from the UK Biobank cohort

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Little published data has assessed the association between socio-economic deprivation and 25- hydroxyvitamin D (25(OH)D) concentration. One study found low socio-economic status predicted vitamin D deficiency[1], but another did not[2].

Our objective was to assess the relationship between 25(OH)D and Townsend Deprivation Index (TDI) in a large sample, using data from the UK Biobank Cohort, which has data on 502,000 individuals (baseline 2006–2010, aged 40 years or over). Blood draws, for measurement of serum 25(OH)D by the DiaSorin Liaison XL assay, were spread across the year with each participant sampled once. The UK Biobank holds ethical approval from UK North West Multi-Centre Research Ethics Committee (11/NW/0382).

We had 447,766 participants with data for both 25(OH)D and TDI. Median (interquartile range; IQR) TDI score for quartile 1 (least deprived) was −4.4 (1) and for quartile 4 (most deprived) was 2.8 (3). Median (IQR) for 25(OH)D concentration for quartile 1 vs quartile 4 was as follows: spring (42.0 (27.4) vs 35.1 (26.7) nmol/L, $P < 0.001$); summer (58.8 (24.8) vs 49.9 (28.3) nmol/L, $P < 0.001$); autumn (55.4 (26.8) vs 45.6 (29.9) nmol/L, $P < 0.001$) and winter (40.4 (26.9) vs. 32.7 (25.4) nmol/L, $P < 0.001$).

Therefore, quartile 4 was lower by 7–10 nmol/L depending on season. Results for quartiles 2 and 3 were intermediate to those of 1 and 4. P values were from Kruskal Wallis tests across four quartiles.

Logistic regression assessed whether TDI quartile predicted vitamin D deficiency (<25 nmol/L), including 414,017 participants with sufficient data. All model variables (TDI, gender, ethnicity, age, self-reported health, vegetarianism, season, Body Mass Index (BMI), summer sunlight exposure, vitamin D containing supplement use, oily fish consumption, region) were predictors of 25(OH)D <25 nmol/L ($P < 0.001$). Compared to quartile 1 (OR = 1), quartiles 2 to 4 had increased odds of deficiency as follows: quartile 2 (OR = 1.05; 1.01,1.08); quartile 3 (OR = 1.29: 1.25, 1.33); quartile 4 (OR = 1.77; 1.72, 1.82).

Overall, we found higher deprivation scores were associated with lower 25(OH)D by 7 to 10 nmol/L. After adjustment for confounders, those with the highest deprivation still had 77% increased odds of being <25nmol/L compared with the lowest deprivation. For perspective, 10 nmol/L is the winter 25(OH)D difference between Southern England and Northern Scotland[3]. The most deprived UK sub- populations need targeting with interventions to increase vitamin D concentration. As participants in the Biobank are likely to be less deprived than the UK average, the 25(OH)D differences we report may be an underestimate.

Acknowledgments

This research was conducted using the UK Biobank Resource: application 15168.

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