EDITORIAL

Vitamin D Associations and Sleep Physiology—Promising Rays of Information

Commentary on Massa et al. Vitamin D and actigraphic sleep outcomes in older community dwelling men: the MrOS Sleep Study. SLEEP 2015;38:251–257.

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The potential role of the steroid hormone vitamin D beyond maintenance of bone health and association of vitamin D insufficiency with chronic and neurologic diseases has received increasing attention in the past decade.[1–5] Remarkably, no studies of vitamin D and sleep architecture and/or sleep quality were published until a 2009 abstract reporting that lower vitamin D levels measured in 2005–2006 National Health and Nutrition Examination Survey (NHANES) were associated with shorter sleep duration.[6] Since then, researchers and clinicians have gradually become aware of and hypothesized a potential role for vitamin D in maintaining or improving sleep.[7]

In this issue of *SLEEP*, Massa and colleagues[8] report the largest study published to date with both objective sleep measures and measured vitamin D concentrations and the first such study in community-dwelling older men. Subjects in this cross-sectional cohort were aged 68 years and older, ambulatory, and had previously enrolled in the Osteoporotic Fractures in Men (MrOS) Study[9]; as part of an ancillary study, subjects underwent phlebotomy for serum 25-hydroxyvitamin D analysis and five consecutive days of actigraphy. Raw actigraphy data and morning logs were used to score mean nightly total sleep, sleep efficiency, and minutes of wake after sleep onset. In this cohort, lower 25-hydroxyvitamin D concentrations were associated with shorter sleep duration, with subjects whose vitamin D concentrations were below 20 ng/mL having double the risk of total sleep time less than five hours compared with those subjects whose vitamin D concentrations were > 40 ng/mL. In addition, the authors detected a trend for worsened sleep efficiency with lower concentrations of 25-hydroxyvitamin D. In the only other large study of vitamin D that included objective sleep measures, Grandner and colleagues also examined total sleep time and sleep efficiency, but reported slightly different measures of sleep architecture—sleep acrophase and sleep out of bed (naps) in post-menopausal women.[10] The authors estimated dietary intakes of vitamin D from rather than measuring vitamin D serum concentrations and noted higher intakes of vitamin D were associated with delayed onset of sleep, a paradoxical finding because those women in this cohort who were exposed to more light and therefore presumably more UVB radiation generally demonstrated earlier sleep onset. Because dietary intake of vitamin D does not appear to be a major determinant of circulating vitamin D stores,[11] the current Massa study provides better concomitant measure of vitamin D status than previous studies.[8] The single larger study did not include objective sleep measures, and it also examined a community-based cohort, the 2007–2008 NHANES dataset.[12] The authors also noted that higher vitamin D concentrations were associated with better maintenance of sleep,[12] and controlled for some potential confounding comorbidities known to affect or be affected by sleep onset, quality, and duration rather than potential confounding comorbidities that are associated with vitamin D status. Thus, potential such confounds as cognitive status, renal insufficiency, hypertension, and diabetes may not have been controlled for in the Grandner study.

Because low vitamin D is associated with multiple disease states, many of which are associated with altered sleep physiology,[3,4,13] the question of causality or reverse causality will continue to arise in any investigation of vitamin D and sleep. Biologically plausible mechanisms by which low vitamin D concentrations may impact sleep quality via increased pain, myopathy, immune dysregulation, and cardiovascular disease were recently reviewed and clearly warrant further investigations.[14] However for most of these conditions, one can also postulate that the disease state or condition itself may lead to less activity by a patient. Latitude, physical activity, and sun exposure, rather than dietary intake, appear to major determinants of vitamin D sufficiency[11]; thus being obese, having diabetes, Parkinson disease, dementia, or depression may cause lower vitamin D concentrations in those affected rather than low vitamin D contributing to the condition. Longitudinal epidemiological and interventional studies that include multiple laboratory assessments of vitamin D status and objective measures of disease presence and severity over time can help address this conundrum of whether low vitamin D contributes to disease emergence or severity or disease states contribute to low vitamin D. However, such studies may also have to account for genetic variations, as emerging evidence suggests genes also interact with vitamin D concentrations and may impact disease.[11,15,16] Currently, the few published studies focusing on sleep and vitamin D tend to focus on disease associations with disease presence or severity, but results of uncontrolled pilot interventions are emerging[7,17] and suggest vitamin D supplementation may improve sleep quality; clearly larger, controlled trials are needed. By demonstrating that lower vitamin D levels are associated with reduced sleep duration and quality in a well-characterized community-dwelling population, the current study by Massa and colleagues helps shine bright ray of enlightenment on current knowledge of the relationship between sleep and vitamin D and will help inform design considerations

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for both interventional studies and additional epidemiological studies.

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