Vitamin D and older adults: More than just a bone problem?

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WHAT WERE THE STUDIES AND WHAT DID THEY SHOW? This issue of *Neurology*® features 3 studies on the possible link between vitamin D and *cognition* (or thinking) in older adults. The first study looked at the possible link between vitamin D levels and cognition in older women. Dr. Annweiler and coauthors[1] studied 752 women aged 75 years and older who lived in France. Levels of 25(OH)D, the form of vitamin D found in the blood, were measured. Patients took a cognitive test called Pfeiffer's Short Portable Mental State Questionnaire (SPMSQ). In this study, low levels (or deficiency) of vitamin D were defined as a 25(OH)D blood level less than 10 (ng/mL). Cognitive impairment was defined as a score of less than 8 (out of 10 points) on the SPMSQ. Seventeen percent had vitamin D deficiency. Women with vitamin D deficiency had lower scores on the SPMSQ and were more likely to have cognitive impairment than those without vitamin D deficiency. The authors found that vitamin D deficiency was associated with cognitive impairment in older women.

The second study looked for links between vitamin D levels, cognition, and strokes in older men and women. Dr. Buell and coauthors[2] studied 318 men and women between 65 and 99 years old in the Boston area. These patients had low income levels, lower functional status, and need for food or personal care. The researchers checked 25(OH)D blood levels and did cognitive testing. Patients had pictures taken of the brain using magnetic resonance imaging (MRI). Vitamin D "deficient" was defined as 25(OH)D blood levels less than 10 ng/mL, and vitamin D "insufficient" was defined as 25(OH)D blood levels between 10 and 20 ng/mL. MRI changes in the large or small vessels in the brain were used to show if there were strokes or cerebrovascular disease. Approximately 15% of the patients were vitamin D deficient, and 44% were vitamin D insufficient. About 24% had dementia. Lower vitamin D levels were linked to dementia and MRI changes in the large and small vessels in the brain. The authors found that those with lower vitamin D levels were more likely to have dementia, strokes, and disease in the blood vessels to the brain.

The final study looked at vitamin D levels and cognition in elderly men. Dr. Slinin and coauthors[3] studied 1,604 men aged 65 years and older in 6 cities. 25(OH)D blood levels were measured, and patients took 2 cognitive tests: the Modified Mini-Mental State Examination (3MS) and a timed test called Trail Making Test Part B (TMTB). The patients were divided into 4 groups, based on 25(OH)D levels. After considering race and education, there was no link between lower vitamin D levels, lower scores on the 3MS, or longer time to complete the TMTB. The authors found that there was not a link between lower vitamin D levels and cognitive impairment in older men.

WHY ARE THESE STUDIES IMPORTANT? It is well known that vitamin D deficiency can affect bone health. However, other research shows a possible link

Table Summary of methods used in studies

First author	Location(s) of study	Description of participants	Definitions of vitamin D status based on 25-hydroxyvitamin D blood levels (ng/mL)	Method of cognitive evaluation	Were changes in cognition seen?
Annweiler	France	752 women aged 75 years and older	Vitamin D deficiency: <10	Pfeiffer's Short Portable Mental State Questionnaire (SPMSQ)	Yes
Buell	Boston	318 men and women between 65 and 99 years old who were receiving home care	Vitamin D deficient: <10	Presence or absence of dementia	Yes
			Vitamin D insufficient: 10–20	Magnetic resonance imaging (MRI) of the brain	
Slinin	Centers from 6 cities	1,604 men aged 65 years and older	Group 1: ≤19.9	Modified Mini-Mental State Exam (3MS)	No
			Group 2: 20–25.09	Trail Making Test Part B (TMTB)	
			Group 3: 25.1–29.79		
			Group 4: ≥29.8		

between vitamin D deficiency and other disorders. These can include heart disease and diabetes.[4] Two out of 3 studies in this issue found that vitamin D deficiency may be linked to cognitive impairment.

WHAT CONCLUSIONS CAN BE MADE? The table shows that the authors studied different groups of people, used different definitions of vitamin D status, and had different tests for cognitive function. As a result, we cannot be certain about the link between vitamin D deficiency and cognitive changes.

More research needs to be performed in both men and women living in the community. A standard definition of vitamin D deficiency is needed. Patients with vitamin D deficiency should be given more cognitive testing to see which aspects of their thinking are affected. Once the link between vitamin D deficiency and cognitive impairment is understood, other studies using tests like MRI may help find causes for cognitive problems. Researchers can then find out if vitamin D supplements can prevent or treat cognitive changes that may be linked to vitamin D deficiency.

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About vitamin D deficiency

WHAT IS VITAMIN D AND HOW DO HUMANS GET IT? Vitamin D is a fat-soluble hormone. Humans get vitamin D in 3 ways: sunlight, diet, and dietary supplements. Sunlight makes vitamin D in the skin. Foods that have vitamin D include oily fish like salmon and sardines. Foods with vitamin D added to it include milk products, orange juice, and cereals. Vitamin D in pill form is also available.

WHAT DOES VITAMIN D DO? A main role of vitamin D is to bring calcium and phosphorus from the gut into the blood circulation. Calcium and phosphorus are minerals needed to keep the bones strong. Vitamin D also can work in other parts of the body, including the brain. In the brain, vitamin D may have an important role in cognition (the process of thinking).

HOW IS VITAMIN D MEASURED IN THE BODY? 25(OH)D is the form that circulates in the blood, and this is the level that is measured when blood is drawn.

WHAT IS VITAMIN D DEFICIENCY? What are considered good levels of vitamin D depends on age, and definitions of vitamin D deficiency vary. According to the National Institutes of Health, a 25(OH)D blood level less than 15 ng/mL is too low.

WHAT CAUSES VITAMIN D DEFICIENCY AND WHO IS AT RISK FOR DEVELOPING IT? Vitamin D deficiency has many causes. It can occur in people who cannot get vitamin D, such those who do not get enough sunlight. Older adults are at risk for developing vitamin D deficiency because they are not able to make enough of the vitamin in the skin. Those with liver and kidney disease may develop vitamin D deficiency because they are not able to process the hormone. Other causes include medications (for example, antiseizure medications and steroids) and obesity. Vitamin D deficiency may also run in families.

WHAT CAN HAPPEN IF SOMEONE HAS VITAMIN D DEFICIENCY? Vitamin D deficiency can cause weakening of the bones, which is called "rickets" in children and "osteomalacia" in adults. It may be linked to chronic medical illnesses, such as heart disease and diabetes. In the brain, vitamin D deficiency may be linked to cognitive impairment.

WHAT IS COGNITIVE IMPAIRMENT? Cognitive impairment occurs when a person is having difficulty with the process of thinking. Some of these changes involve memory, such as forgetting conversations or repeating oneself. Other examples include problems with making decisions, trouble doing many tasks at the same time, or difficulty finding one's way around a familiar place, among many others. When being tested for cognitive impairment, patients are usually asked to complete specific tests that measure their ability to think.

DOES VITAMIN D DEFICIENCY CAUSE DEMENTIA? Dementia occurs when cognitive changes result in an inability to function in daily life. More research is needed to determine the strength of the link between vitamin D deficiency and dementia.

CAN VITAMIN D DEFICIENCY BE PREVENTED? There are no clear guidelines to prevent vitamin D deficiency. It is thought that 200–600 international units of vitamin D a day may be enough to maintain adequate vitamin D levels in most children and adults. Higher doses of vitamin D may be needed for people with other conditions such as liver and kidney disease. Sunlight is also important in keeping a good vitamin D level, but the amount needed is unclear. Patients should also know there is a risk of skin cancer with too much sunlight exposure.

CAN SUNLIGHT EXPOSURE AND VITAMIN D SUPPLEMENTS PREVENT OR TREAT COGNITIVE CHANGES AND DEMENTIA? More research is needed to determine whether sunlight and vitamin D supplements can prevent or treat cognitive changes and dementia.

FOR MORE INFORMATION

NIH Office of Dietary Supplements
http://dietary-supplements.info.nih.gov/factsheets/vitamind.asp