

Vitamin D: From Sunshine to Supplements

Sandy Procter, Human Nutrition Specialist and Registered Dietitian

Objectives

After completing this lesson, participants will:

- recognize key functions of vitamin D,
- be able to list three or more diseases associated with low vitamin D levels or deficiency,
- identify strategies to improve one's vitamin D level.

Intended Audiences

- Adult audiences
- Family and Community Education (FCE) groups

Before the lesson, consider these suggestions:

Read the *Vitamin D: From Sunshine to Supplements* Leader's Guide and Fact Sheet. Familiarize yourself with terms used in them.

If you desire, consult http://ods.od.nih.gov/factsheets/VitaminD_pf.asp for more background information.

Collect Nutrition Facts labels from food products with vitamin D fortification — such as breakfast cereals, fortified orange juice, and yogurt — as well as some labels from similar products without fortification for comparison.

Make a copy of the pre-survey and post-survey for each adult audience member. Staple survey sets together, and pre-number both sheets. As the audience arrives, give each attendee a set.

Greet attendees as they arrive and have them complete the pre-survey. Supply pens or pencils as needed. Collect the completed pre-surveys from each attendee before starting the lesson. Ask them to keep the post-survey to complete after the lesson.

After the lesson:

Ask attendees to complete the numbered post-survey and return it.

Thank the audience and remind them of the resources available through the local county or district K-State Research and Extension office.

Return both sets of completed surveys to:
Sandy Procter, Ph.D.
KSU Department of Human Nutrition
204 Justin Hall
Manhattan, KS 66506

Introduction

Vitamin D, the “sunshine vitamin,” has long been understood as necessary for strong bones. Now it returns to the forefront of health and wellness research. Current research has shown that **more than three out of every four Americans** have less than healthy vitamin D levels. Over the past two decades, vitamin D levels have decreased markedly in the American population.

Vitamin D is unique because it is made in the human body when skin is exposed to ultraviolet light in the sun's rays. In supplements

and fortified foods, vitamin D is available in two similar but distinct forms: D₂ — ergocalciferol — which comes

from irradiation of the yeast and plant sterol ergosterol, and D₃ — cholecalciferol — which is obtained from oily fish and made by human skin. Vitamin D deficiency can be treated with oral vitamin D₂, while the naturally occurring form, D₃, is the potent, preferred form for vitamin D supplementation.

History

Vitamin D, or at least its deficiency, has been recognized for centuries. In the mid-1600s, scientific reports described rickets, a failure to mineralize bone in infants that results in bowed legs and arms. Around 1920, studies established that rickets was caused by a

Pronunciation

ergocalciferol
êr'gô-kâl-sîf'ə-rôl'

cholecalciferol
kô'lî-kâl-sîf'ə-rôl'

deficiency. Once the role of vitamin D in rickets was discovered, vitamin D-rich cod liver oil became a common — if not tasty — remedy. In 1923, researchers showed that when a substance in human skin (a pre-vitamin form of vitamin D) came in contact with sunlight or ultraviolet light, a substance identical to vitamin D was produced. When the United States began to fortify milk with vitamin D in the 1930s, rickets was nearly eradicated.

Function

Vitamin D is classified as a fat-soluble vitamin, which means it is stored in the body (in the liver) and is not lost from food into water during cooking. Although the name “vitamin” remains, early research established that vitamin D is chemically a steroid — a hormone — in its function, rather than a true vitamin. This “hidden identity” as a hormone has real significance with the resurging investigation of vitamin D as a key player in chronic health conditions being researched today. Researchers studying vitamin D report approximately 2,000 genes in the human body are affected by the active form of the vitamin.

The sun’s role

Five to 30 minutes of direct summer sun exposure to the arms, legs and back of a light-skinned person twice a week is equal to taking 20,000 international units (IU) of vitamin D. Humans typically obtain 90 percent of vitamin D from sunlight. Over time, however, many things have changed human ability to produce enough vitamin D.

Factors affecting Vitamin D levels: *See Fact Sheet for expanded details on each factor.*

- indoor lifestyle
- sunscreen
- season and latitude
- overweight/obesity
- age
- skin color
- breastfeeding in infants

Resurgence in nutritional rickets, especially in African American infants and children, led to the American Academy of Pediatrics’

2008 recommendation that **all infants and children, including adolescents, need 400 IU of vitamin D each day, beginning at birth.** This represents a *doubling* of previous recommended intake levels for infants, children, and adolescents.

Role in bone health

Vitamin D is an essential component in skeletal development and bone health maintenance. It helps the body use calcium, a primary ingredient for strong, healthy bones. When the body becomes deficient in vitamin D, the blood level of calcium is decreased. This triggers a series of responses that ultimately signal for a breakdown of bone to release calcium for reabsorption by the kidney. Without sufficient vitamin D, bones can become thin, brittle, or misshapen. This may result in rickets in children or osteomalacia in adults. Calcium and vitamin D together protect older adults from osteoporosis.

Recent research suggests that supplemental levels of vitamin D between 700 and 1,000 IU **reduce the risk of falls in older adults.** Other vitamin D research is examining many possible functions in human health.

Current directions in research

Although a number of studies are investigating vitamin D and its role in health and disease, the science is not yet conclusive. Evidence supporting vitamin D’s role in health grows stronger as new studies produce results.

Immune system

Vitamin D plays an important role in keeping the body’s immune system healthy. Much research with vitamin D shows it is key in human **innate immunity** — the nonspecific frontline defense system that allows our bodies to identify and eliminate foreign substances. Vitamin D is also believed to inhibit the development of **autoimmunity** — the abnormal immune response that results in the body attacking its own cells and tissues. Research focusing on the role of vitamin D deficiency in several autoimmune diseases, including rheumatoid arthritis and multiple sclerosis, is shedding new light on these conditions.

Vitamin D and diabetes

Considerable research is examining vitamin D's connection to diabetes — both type 1 and type 2. Several studies report increased blood levels of vitamin D appear to lower diabetes risk by improving insulin sensitivity. Adequate intake of vitamin D may prevent or delay the onset of diabetes and reduce complications for those already diagnosed, a 2009 study suggests.

Vitamin D and cancer

Researchers have discovered that vitamin D regulates a number of genes in as many as 17 cancers, including prostate, colon, and breast cancers. Other studies appear to suggest that low levels of the vitamin may affect not only the outcome of a cancer diagnosis, but may even play a role in the *cause* of certain cancers.

How much vitamin D do people need?

This question has no clear, easy answer, and has sparked the most controversy surrounding vitamin D. Humans make and require different amounts of vitamin D, depending on life and reproductive stage, as well as skin pigment and amount of exposure to direct sunlight. Determining individual requirements is challenging, but there is no question that vitamin D is required from before birth through old age.

The American Academy of Pediatrics recommends that infants to age 1 receive 400 IU of vitamin D daily. The Institute of Medicine committee assessing Dietary Reference Intakes (DRIs) released results of their report in November 2010. The following daily amounts, from food and supplement sources, are recommended:

- Children age 1 to 18: 600 IU
- Adults age 19 to 70: 600 IU
- Adults age 71+: 800 IU

Upper levels, at the high end of the safety scale, should not be misunderstood as the amounts people need or should attempt to consume. Adults should stay below 4000 IU of vitamin D per day to avoid the risk of harm. The upper level is lower for children.

Self-help steps to increase vitamin D

What can you do to protect your health and avoid vitamin D deficiency? Here are some tips for self care. *See the Fact Sheet for expanded details of each step.*

- Talk to your doc.
- Let the sun shine!
- Focus on food. (*Pass out food labels and packages here, and discuss vitamin D amounts on labels. Note that the percentage of vitamin D added is percent of 200 IU, the previous recommended amount for adults.*)
- Mind your meds.

By learning more about the body's need for vitamin D, you are able to take meaningful steps to protect and improve your health.

Author

Sandy Procter, Ph.D., RD, LD

Acknowledgements

Special thanks to Denis Medeiros, Ph.D., RD, and Lisa J. Martin, MPH, RD, for reviewing this lesson.

References and Resources

- Office of Dietary Supplements. National Institutes of Health. *Dietary supplement fact sheet: Vitamin D*. Updated 12/11/08. Retrieved October 15, 2009, from http://ods.od.nih.gov/factsheets/VitaminD_pf.asp
- Wagner C.L., Taylor S.N., Hollis, B.W. (2008). "Does vitamin D make the world go 'round'?" *Breastfeeding Medicine* 3 (4), 239-250.
- Wagner C.L., Greer, F.R., Section on Breastfeeding and Committee on Nutrition (2008). "Prevention of rickets and vitamin D deficiency in infants, children, and adolescents." *Pediatrics* 122(5), 1142-1152.
- Linus Pauling Institute, Micronutrient Research for Optimum Health. (2008, January). "Vitamin D." Retrieved Nov, 17, 2009, from <http://lpi.oregonstate.edu/infocenter/vitamins/vitaminD>
- University of California–Riverside (1999). *History of vitamin D*. Retrieved October 13, 2009, from <http://vitamind.ucr.edu/history.html>
- Vitamin D Council. *Understanding vitamin D cholecalciferol*. Retrieved January 13, 2010, from <http://www.vitamindcouncil.org>
- Institute of Medicine of the National Academies (2010). Report brief. *Dietary reference intakes for calcium and vitamin D*. Retrieved November 30, 2010, from <http://www.iom.edu>

(**Leaders:** Make two copies of this survey, circle pre-survey on one and post-survey on the other, staple together, and number as directed on page 1. Distribute sets to participants as they arrive.)

Vitamin D – Sunshine to Supplements

Please fill in the circle next to the best answer, and return after completing. Your answers are completely confidential – the number above helps the author improve future lessons!

1. Vitamin D is needed

- a. to absorb calcium
- b. for a healthy immune system
- c. for good vision at night
- d. both a and b
- e. all of the above

2. Vitamin D is found naturally in many foods.

- True
- False

3. Our body can make vitamin D when our skin is exposed to sunlight.

- True
- False

4. Most Americans have healthy levels of vitamin D.

- True
- False

5. I plan to talk to my doctor about taking a vitamin D supplement.

- Yes
- No

I already have talked to my doctor about taking a vitamin D supplement.

Thank you for your responses! Please return this survey to the leader when you are finished.

Adapted from "Vitamin D and Your Health" by Rosemary Rodibaugh, PhD, RD, LD, University of Arkansas Division of Agriculture. Adapted and used with permission of the author.

Author contact information:

Sandy Procter, Ph.D., RD, LD
204 Justin Hall
Manhattan, KS 66506
procter@ksu.edu



Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned.

Publications from Kansas State University are available on the World Wide Web at: www.ksre.ksu.edu

Publications are reviewed or revised annually by appropriate faculty to reflect current research and practice. Date shown is that of publication or last revision.

Contents of this publication may be freely reproduced for educational purposes. All other rights reserved.

In each case, credit Sandy Procter, *Vitamin D: From Sunshine to Supplements, Leader's Guide*, Kansas State University, December 2010.

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

MF2928 (Rev.)

December 2010