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# Does Vitamin D Reduce the Risk of Breast Cancer in Pre and Post-Menopausal Women?

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***Abstract***

Vitamin D has been known to have anticarcinogenic properties include effects on cell proliferation and differentiation. Several studies have found a link between vitamin D deficiency and cancer mortality. This analysis was aimed at studying the association between vitamin D intake and the prevention of breast cancer. Articles were located through PubMed and Cinhal using the key terms vitamin D and breast cancer. A total of six original articles were selected with results associating vitamin D and breast cancer. Overall there was association between vitamin D intake in high amounts and decreased risk of breast cancer. However, most studies had low vitamin D intake and inconsistent findings. In conclusion, there is a slight trend towards decreased breast cancer risk and vitamin D intake. However more research needs to be conducted in the form of randomized controlled trials to develop better vitamin D dosage guidelines.

***Introduction***

Breast cancer is the most common non skin malignancy in women. One in eight women will develop breast cancer by the age of 90 (Kumar, Abbas, Fausto, & Aster, 2010). According to the Center for Disease Control and Prevention in 2008 a total of 210,203 women were diagnosed with breast cancer, and 40,589 of those women died from their breast cancer (Appendix 1 & 2). The most common risk factors for breast cancer include female gender and older than 60 years of age. Other non-modifiable risk factors include early menarche, genetic mutations, and family history. Other risk factors being evaluated include obesity, serum vitamin D levels, and geographic location (Kumar et al., 2010).

Incidence of breast cancer is more prevalent depending on geographic location. The CDC lists 13 states with the highest breast cancer incidence rates including Alaska, Connecticut, Delaware, Hawaii, Maryland, Massachusetts, Minnesota, Nebraska, New Hampshire, New Jersey, Pennsylvania, Rhode Island, and Washington (CDC, 2012). Twelve of the thirteen states listed are in the northern hemisphere with geographic locations furthest from the equator (Appendix 3). Women in such locations have significantly less UVB exposure due to lower UVB strength then individuals in southern states. In the northern hemispheres March through October yields adequate amounts of sunlight for vitamin D absorption. November through February yields low levels of UVB inadequate for vitamin D absorption (Higgdon & Drake, 2012).

Vitamin D can be obtained through sunlight exposure of about 12 minutes a day on a clear day in adequate months if located in a northern state, or year round for southern states, with no clouds or sunscreen. Afternoon sunlight has the greatest amount of UVB light, although additional time exposure to sunlight has not been shown to improve vitamin D absorption. 10-15 minutes of sun exposure to arms and legs several times a week, provides adequate amounts of vitamin D (Harvard Health, 2012). The 10-15 minute exposure is equivalent to oral ingestion of 3,000 IU vitamin D (Garland et al., 2006). Other factors influencing vitamin D absorption include weather, sunscreen, age, skin color and other comorbidities including psoriasis (Higgdon & Drake, 2012).

Most individuals obtain vitamin D through sun exposure or diet. There is a limited number of dietary means to consume vitamin D. Fish liver oils, fatty fish, mushrooms, milk, yogurt, juice, bread, cereal, egg yolks, and liver are the main sources of vitamin D (Appendix 4). Dietary consumption of vitamin D is often insufficient to maintain adequate serum vitamin D levels (Higgdon & Drake, 2012). Vitamin D deficiency has been connected to several disorders including diabetes, multiple sclerosis, rheumatoid arthritis, inflammatory bowel disease, osteoporosis, rickets, osteomalacia, and cancer mortality (Gissel, Rejnmark, Mosekilde, & Vestergaard, 2008). Vitamin D deficiency is a serum level less than 20ng/ml (Appendix 5).

High risk individuals for vitamin D deficiency include older adults, individuals with limited sun exposure, dark skin individuals, and those with BMI greater than 30 (Bergen & Heurberger, 2010). Other risk factors include gastric bypass surgery, medications, renal failure, and those with liver disease (Buttaro, Trybulsk, Bailey, Sandberg-Cook, 2008). In the United States 50% of women over age 65 are vitamin D deficient. The elderly in the northern hemisphere are at greater risk for vitamin D deficiency. Elderly individuals have a 75% reduction of vitamin D3 production by the age of 70 (Wardlaw, 2002). Daily requirements of vitamin D are greater in the elderly than in younger individuals due to the reduction in vitamin D3 production as we age.

Daily requirements of vitamin D according to the Institute of Medicine are shown in Appendix 6. Current recommendations by the Institute of Medicine for daily vitamin D intake for ages 1 to 70 years old are 15mcg (600IU/day) and individuals 71 and older 20mcg (800IU/day). Given those guidelines it is difficult for individuals in the northern hemisphere to obtain that level through sunlight exposure and diet alone placing them at risk for vitamin D deficiency (Higgdon & Drake, 2012)

***Relevance***

Vitamin D deficiency has been linked to increased rates of breast cancer in some evidence based literature (Garland, Garland, Gorham, & Young 1990; Nattinger, Freeman, Freeman, & Goodwin, 2008). If breast cancer could be prevented by supplementation in daily diets of vitamin D it would save lives, as well as decrease health care costs significantly.

The diagnosis of breast cancer comes with substantial healthcare costs. According to the National Cancer Institute breast cancer costs are at the highest of all cancers being treated at a cost of $16.5 billion in the year 2010 alone (Appendix 7). An individual can expect the cost of chemotherapy, radiation, and surgery, to be well over $100,000 in that first year. Out of pocket expenses are about $20,000 in a single year (Nance-Nash, 2011). Given the cost of breast cancer treatment and mortality rates focus of research should be surrounding prevention of such cancers.

The relevance of this study is crucial for the female population of Minnesota due to vitamin D deficiency and high rates of breast cancer. And with cost of health care at the forefront of government planning, vitamin D for the prevention of breast cancer could save billions in healthcare costs and change preventative medicine as we see it today. Research in this topic has been inconsistent and often times insufficient to substantiate claims given the current research. Due to the prevalent breast cancer population and aging female population in Minnesota it was of interest for this study to assess the link between breast cancer and vitamin D intake in pre and post-menopausal women. Advanced practice nurses are at the forefront of patient care, conducting routine vitamin D levels with cholesterol levels and pap smears, and teaching patients to take vitamin D supplements as a part of their daily routine for bone health and cancer prevention. Studies that prove a connection would hopefully revolutionize healthcare.

***Pathophysiology***

Breast cancer develops when a normal cell mutates into a malignant cell, oncogenes then promote proliferation, while tumor suppressor genes and genes allowing for apoptosis are inactivated. This process allows breast cancer cells to proliferate uncontrollably and spread. Breast cancer cells typically arise from epithelial cells that line the ducts and lobules (Weinberg, 2012).

Vitamin D is a fat soluble vitamin. It begins as a pro-hormone called 7-dehydrocholesterol which is located on the skin. When the skin is exposed to sunlight the pro hormone begins to transform to vitamin D3 or cholecalciferol. In this new form vitamin D3 enters the blood stream attached to proteins. These proteins enter the liver and transform into 25-OH-D (25-hydroxycholecalciferol). It then moves to the kidneys where it is converted into its final active form 1,25-dihydroxyvitamin D also known as calcitrol. The steroid hormone form of vitamin D (Kumar et al., 2012), (Appendix 8). Most cells of the body have 1,25 dihydroxyvitamin D receptors in them. These receptors help regulate levels of calcium and phosphorus. Regulating levels of calcium and phosphorus aids in neuromuscular function, bone metabolism, and cellular processes (Wardlaw, 2002). Calcitrol or 1,25 dihydroxyvitamin D is involved with cellular processes of certain cells including epithelial cells. This form of vitamin D inhibits proliferation and stimulates differentiation of cells (Chung, Lee, Terasawa, Lau, & Trikalinos, 2011). It does this through the inhibition of growth and the regulation of apoptosis in normal and malignant cells including breast cancer cells (Abbas, Linseisen, & Chang-Claude, 2007).

Due to the effects of 1,25-dihydroxyvitamin D on cell proliferation and differentiation it is believed that calcium and vitamin D contain anticarcinogenic affects (Cayelli, 2008). These anticarcinogenic effects can be substantiated by the evidence from previous studies showing that vitamin D is activated in cancer cells (Chida et al., 1985; McGrath & Soule, 1984).

In normal vitamin D levels the 1,25-dihydroxyvitamin D inhibits the proliferation of the cancer cells and promotes the differentiation and apoptosis of cancer cells. Individuals who have vitamin D deficiency, their bodies are not capable of inhibiting those cancer cells from proliferating, putting them at an increased risk for breast cancer (Gissel, et.al, 2008).

"Adequate vitamin D status has been linked to a reduced risk of developing breast, colon, and prostate cancer" (Wardlaw, 2002, p.342). The suggestion that vitamin D intake can reduce the risk and possibly even prevent breast cancer, necessitates further research to examine these observations. With healthcare focusing on preventative care, vitamin D and breast cancer risk reduction is at the forefront of research and health care guidelines. This review aimed at studying vitamin D intake and the reduction of breast cancer risk in pre and post-menopausal women.

***Literature Review***

Research articles used for this study were critically analyzed by the Johns Hopkins Nursing EBP Mode based on the quality and strength of the evidence. Quality of evidence was evaluated according to five levels of evidence strength. (Table 1 Below)

| **Level of evidence** | **Description** |
|---|---|
| I | • Experimental, randomized controlled trial (RCT)<br>• Meta-analysis of RCTs |
| II | • Quasi-experimental study |
| III | • Nonexperimental study<br>• Qualitative study |
| IV | • Integrative review<br>• Systematic review<br>• Clinical practice guidelines |
| V | • Opinion of nationally recognized experts based on experiential evidence |

Table 1: Quality of Evidence Rating Guide
Source: American Nurse Today-Practice Matters-2012
http://www.americannursetoday.com/article.aspx?id=6982&fid=6848

The level of evidence with the highest strength is a level 1 including experimental studies such as randomized controlled trials in which subjects are randomly assigned to either a treatment or a control group. Another example of a level 1 study is meta-analysis of randomized controlled trials in which the researcher quantitatively synthesizes and analyzes several randomized controlled trial results with similar research questions. A level 2 is a quasi-experimental study which lack randomization or a control group but always includes manipulation of an independent variable. Level 3 studies are either non experimental or qualitative studies. Non experimental studies are those that do not manipulate independent variables, may use secondary data, and can be descriptive or comparative in nature. Qualitative studies are explorative in nature including interviews and observations, and sample sizes are usually small. Level 4 studies are systematic reviews and clinical practice guidelines. And the lowest level of strength in evidence is opinions of nationally recognized experts.

Research articles were also analyzed based on the quality rating of the evidence, as seen in table 2 below. The level of A is a high quality rating of scientific evidence which includes results that are consistent, sample sizes are sufficient, there was adequate control in the study with definitive conclusions and consistent recommendations based on the literature review. A level B is a good quality of scientific evidence. There is strong evidence to support the results that should be put into practice. The study with a level B has reasonably consistent results, with a sufficient sample size, there was some control and conclusions were fairly definitive. There is moderate evidence to support the results and results should be followed most of the time. And a level C is the lowest level of quality. There is little evidence with inconsistent results, insufficient sample sizes, and inconclusive. There is poor evidence to support or even reject the results (John Hopkins Nursing Evidence Based Practice, 2012). Six research articles were reviewed for this study.

| Quality rating | Description |
|---|---|
| A: High | Consistent results with a sufficient sample, adequate control, and definitive conclusions |
| B: Good | Fairly consistent results, sufficient sample, some control |
| C: Low, or major flaws | Little evidence with inconsistent results; conclusions can't be drawn or insufficient evidence exists |

Table 1: Quality of Evidence Rating Guide
Source: American Nurse Today-Practice Matters-2012
http://www.americannursetoday.com/article.aspx?id=6982&fid=6848

In a meta-analysis by Gissel et al. (2008) the authors examined the association between vitamin D intake and risk of breast cancer. The studies included cross-sectional, case-controlled, cohort and randomized controlled trials. Given the articles obtained in this meta-analysis, strength of the study is level 1-A. Results showed that women who have daily intake of vitamin D above 400 IU had fewer cases of breast cancer. These results had a p value of $< 0.01$ showing significance in their findings. Low intake 100-400IU/daily of vitamin D showed no association between vitamin D and breast cancer. Weaknesses in this meta-analysis include few studies (6 studies) selected for review, low levels of vitamin D intake 100-400IU by the participants.

Garland et al. (2007) completed a meta-analysis on vitamin D levels and the risk of breast cancer. A total of 1760 individuals either in a cohort or randomized case controlled study. Given the articles used in the meta-analysis the quality of evidence is a level 1-A. The researchers found that participants with higher levels of serum vitamin D 52ng/ml had a 50% chance of lower risk of breast cancer. Levels would correlate to a 4,000 IU/day intake of vitamin D. Results from the study showed statistical significance with p levels < 0.001. Weaknesses in this meta-analysis include the intake required to maintain vitamin D is high 4000IU/daily and is significantly higher than current recommended daily intake of vitamin D 600-800IU/daily.

In a case controlled study by Abbas, Linseisen, & Chang-Claude (2007). The study evaluated vitamin D and calcium intake on pre-menopausal breast cancer risk. There were 944 subjects used in this study. The quality of evidence is level 2-B. The researchers found an inverse relationship between dietary vitamin D and breast cancer risk with vitamin D intake of 5ug/day (200IU). Results were found to be statistically significant with a p value < 0.02. There was no statistical significance with vitamin D intake and calcium intake combined and the risk of breast cancer. Results of combined calcium and vitamin D use had a p value of 0.62. Weaknesses in the study include the majority of participants vitamin D intake levels were below the recommended 600IU daily. The authors included multiple variables in the study such as BMI, age, health history, tobacco history, etc. The subjects studied were not equally placed in case versus control groups. There were 666 controls and 278 cases. Questionnaires filled out by participants were also a weakness and bias in this case controlled research.

A prospective cohort time series study by Shin et al. (2002) evaluated the intake of vitamin D, calcium, through dietary consumption to reduce the risk of breast cancer. In this cohort study 88,691 pre and post-menopausal women were participants. The quality of the evidence is level 3-B. Researchers found an inverse association between dietary vitamin D and calcium intake and the reduction of breast cancer in pre-menopausal women. Results were statistically significant with a p value <0.01. No association was found in post-menopausal women and breast cancer. These results had a p value =0.05. Weaknesses include the type of study conducted being a cohort study, the use of questionnaires, large sample sizes, and study length over 16 years.

A retrospective case controlled study by Anderson, Cotterchio, Vieth, & Knight (2010) evaluated vitamin D and calcium intake on breast cancer risk in pre and post-menopausal women. The case group included 3101 participants and 3471 participants were included in the control group. The quality of the evidence is a level 3-C. Researchers found no association between vitamin D and calcium intake through dietary means and breast cancer risk. Results were found not to be statistical significant with p value = 0.04. There was an association between breast vitamin D intake 400IU/daily through supplements and reduced breast cancer risk. Those results were found to have significant statistical significance with a p value of < 0.0001. Weaknesses in this study are the use of questionnaires to obtain retrospective data which could lead to inaccurate results with participants being unable to recollect food intake 2 years prior.

A randomized case controlled, double blind trial by Lappe, Travers-Gustafson, Davies, Recker, & Heaney (2007) analyzed the effect of calcium and vitamin D in reduction of common cancers including breast cancer. A total of 1180 postmenopausal women were studied. The quality of the evidence is level 1-B. Researchers found an association between vitamin D intake

1100IU/daily and reduction of breast cancer risk. Results were statistically significant with a p value of < 0.005. Weaknesses include population bias of women over age 55 and postmenopausal. The study did not address comorbidities, or extraneous factors that could lead to cancer diagnosis in the patients with confirmed diagnosis.

***Critical Appraisal Summary***

Overall, major findings conclude that dietary intake of calcium and vitamin D greater than 400IU daily can decrease risk of breast cancer in premenopausal women, but not postmenopausal women. There is a stronger association of vitamin D and the decreased risk of breast cancer versus calcium intake or supplementation and the risk of breast cancer. All statistics stated in the articles had p values less than 0.05 for statistical significance. Findings in the studies were often isolated from other variables and are consistent with the research question. In all studies analyzed vitamin D alone, in large enough quantities 200IU-4000IU reduces risk of breast cancer (Abbas et al., 2007; Anderson et al., 2010; Garland et al., 2007; Gissel et al, 2008; Lappe et al., 2007; Shin et al., 2002). Four studies showed that calcium alone does not reduce the risk (Abbas et al., 2007; Anderson et al., 2010; Lappe et al., 2007; Shin et al., 2002).

Through the analysis of these six articles a trend has been illustrated towards a decrease in incidence of breast cancer in premenopausal women who primarily take vitamin D above 400IU a day. Supplements and dietary intake of calcium and vitamin D in postmenopausal women shows no correlation to the reduction of breast cancer. It can be concluded that large amounts 1100IU-4000IU of dietary and supplemental vitamin D can reduce risk of breast cancer in premenopausal women by 50%, lower amounts of vitamin D intake 200-400IU had 8% reduction in breast cancer. However data does not support the evidence of dietary vitamin D intake and postmenopausal women for the prevention of breast cancer. All findings on vitamin D and calcium were related to that being studied (Abbas et al., 2007; Anderson et al., 2010; Garland et al., 2007; Gissel et al, 2008; Lappe et al., 2007; Shin et al., 2002).

All of the studies analyzed had low mean dietary and supplemental vitamin D intake levels (Abbas et al., 2007; Anderson et al., 2010; Garland et al., 2007; Gissel et al, 2008; Lappe et al., 2007; Shin et al., 2002). Due to those inconsistencies in vitamin D intake and due to the limited data this analysis only supports the intake of high dose vitamin D supplementation for the possible reduction risk in breast cancer. Randomized control trials need to be conducted involving pre and postmenopausal women with high doses of vitamin D supplementation.

The studies in this review impact clinical evidence based practice by reiterating the importance of serum vitamin D level testing for deficiency and the use of educating individuals on vitamin D intake especially through supplements (Abbas et al., 2007; Anderson et al., 2010; Garland et al., 2007; Gissel et al, 2008; Lappe et al., 2007; Shin et al., 2002). Current evidence based practice guidelines suggest 15mcg of vitamin D for women age 1-70, and then 20mcg for women age 71 and older (Higgdon & Drake, 2012), (Appendix 7). These studies have shown that individuals may benefit from increased intake of vitamin D through supplements for prevention of breast cancer. Guidelines should be reassessed to include higher levels of vitamin D intake in particular for women over the age of 50.

All studies failed to address patient safety. The study conducted by Garland et al. (2007) stated that 52ng/ml serum vitamin D levels were associated with a 4000 IU vitamin D supplementation intake daily. No participants reported side effects from higher levels of vitamin D intake. Excessive vitamin D can cause vomiting, dehydration, high blood pressure, constipation, and fatigue. It was also stated that vitamin D3 is the best for prevention of breast cancer and sunlight is the most efficient source (Bergen & Heuberger, 2010). Vitamin D toxicity can also lead to calcium deposits in the kidneys, heart and blood vessels, along with liver toxicity, and in infant children mental retardation (Wardlaw, 2002). Excessive amounts of sunlight increase the risk of skin cancer. Upper limits of vitamin D are shown in figure 9 below. Providers should be aware of potential side effects of vitamin D use when prescribing vitamin D supplementation. “The toxic potential of this vitamin is so great that in sufficiently large doses it is a potent rodenticide” (Kumar et al., 2010, p.436).

Every study reviewed failed to mention the impact of their results on social justice or any concerns with sampling bias. It was noted that one of the studies specifically stated they were testing all white individuals (Lappe et al., 2007). Ethnic backgrounds were not accounted for in these studies. This is crucial since breast cancer rates are highest among Caucasian and African American women yet cause more fatalities in African American women and Hispanic women (CDC, 2012). Despite those statistics these studies failed to include those populations into the research being conducted. These population samples were not inclusive of the populations most impacted by breast cancer.

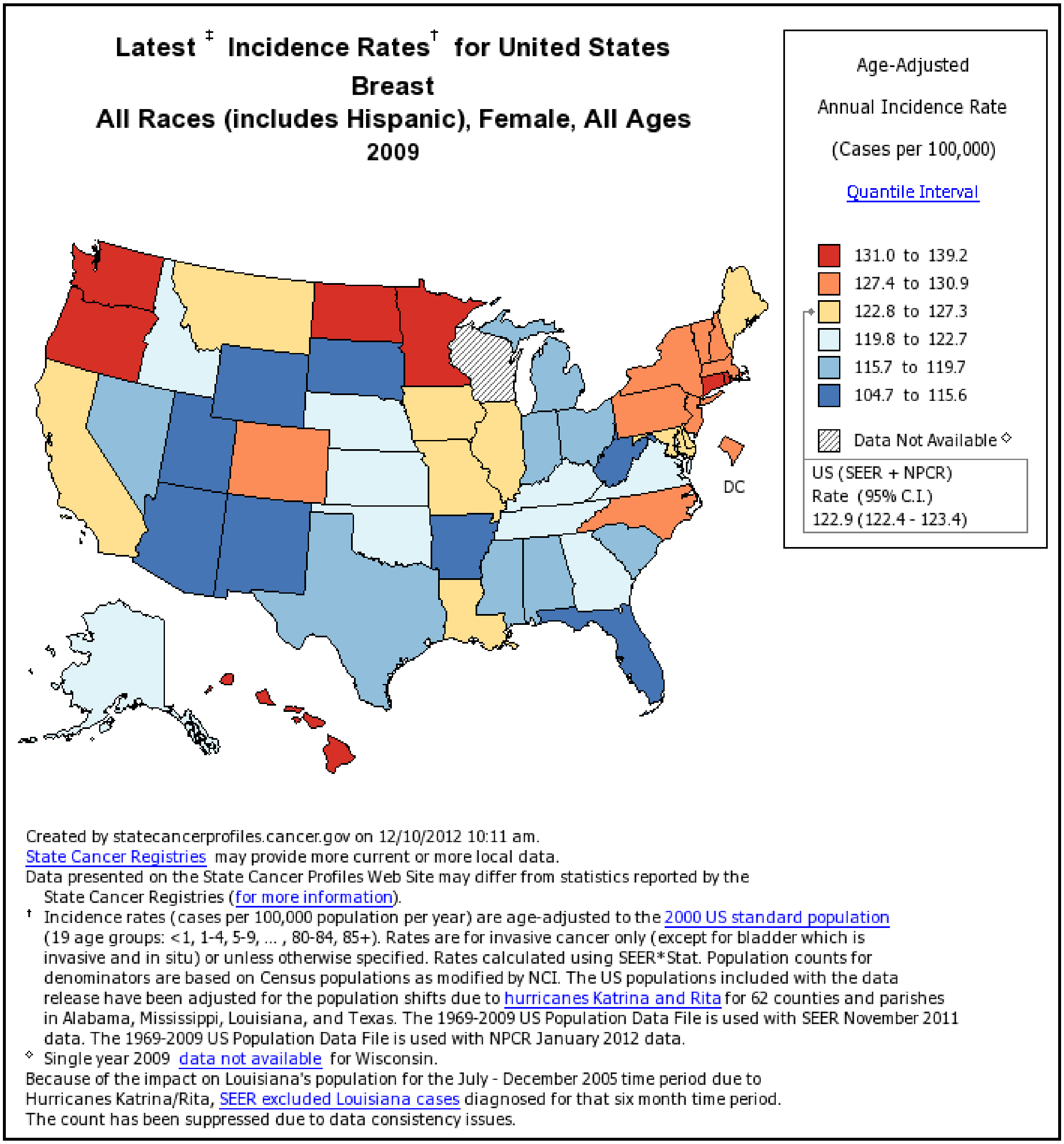
All studies additionally fail to discuss inequality in the access to healthcare to underserved populations. The homeless do not have the means to obtain necessary dairy intake and vitamin supplementation for daily requirements let alone breast cancer prevention. They also lack the access to healthcare to obtain vitamin D testing, mammograms, and breast care. Overall findings from these studies reveal that vitamin D is essential in breast health but dosage is not well defined. Research reviewed in this article primarily consisted of meta-analysis. It would be beneficial for further testing of this topic be conducted as randomized control trials, further examining the effects of vitamin D on prevention of breast cancer and to provide more precise dosage guidelines for reducing the risk of breast cancer.

***Conclusion***

In summary more research needs to be conducted on the side effects of high vitamin D intake for the prevention of breast cancer. Further testing also needs to be conducted with diverse populations to allow the generalization of these results to the public. Future recommendations for research include the use of randomized control trials on vitamin D intake, using serum vitamin D levels as baseline and progress markers in a diverse population sample. Randomized control trials could be used to develop more specific guidelines for vitamin D dosage recommendations for patients for reducing their breast cancer risk.

This information is crucial for Minnesota women. Minnesota women do not get adequate amounts of sunlight to maintain vitamin D levels. Most women are unaware of their vitamin D deficiency, making them more susceptible to breast cancer. Patient education including a hand out sheet and resources are listed after the appendices. Recommendations for implementation into advance practice nursing care would be to test baseline vitamin D levels to assess the need for supplementation and to allow for adequate dosing. As an advanced practice nurse vitamin D will be a part of yearly lab work for women. Implementation would also include patient education on the importance of vitamin D intake and breast cancer screening based on current guidelines and research. Education for fellow colleagues on this topic would include resource lists for further information, current vitamin D intake guidelines, vitamin D toxicity awareness, breast cancer screening guidelines, and a short presentation on the findings of this study. Appendix 10 can be used as a quick reference guide for providers on all the important guidelines and recommendations for practice.

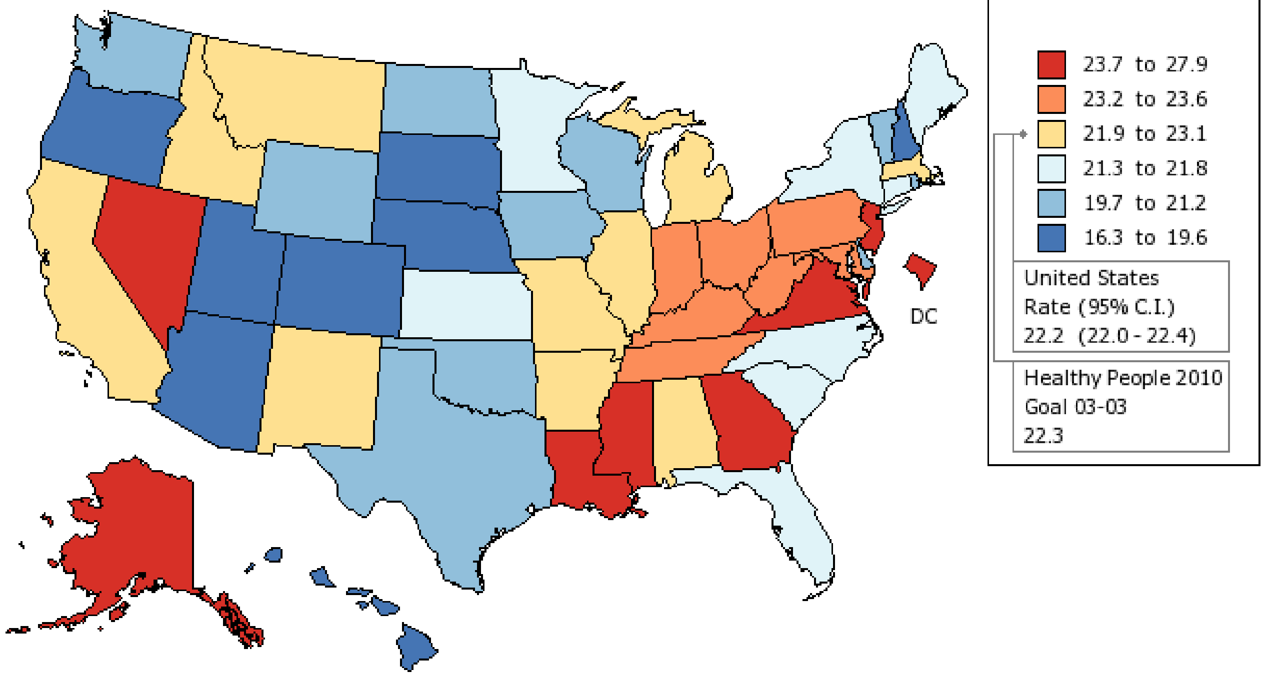
## *Appendix 1*




Age adjusted breast cancer incidence rate by state. 2009
Sources: National Cancer Institute and CDC
http://cancercontrolplanet.cancer.gov/breast_cancer.html

*Appendix 2*

**Age-Adjusted Death Rates for United States, 2009**
**Breast**
**All Races (includes Hispanic), Female, All Ages**




Created by statecancerprofiles.cancer.gov on 12/10/2012 11:33 am.
State Cancer Registries may provide more current or more local data.
Data presented on the State Cancer Profiles Web Site may differ from statistics reported by the State Cancer Registries (for more information).
Source: Death data provided by the National Vital Statistics System public use data file. Death rates calculated by the National Cancer Institute using SEER*Stat . Death rates (deaths per 100,000 population per year) are age-adjusted to the 2000 US standard population (19 age groups: <1, 1-4, 5-9, ... , 80-84, 85+). The Healthy People 2010 goals are based on rates adjusted using different methods but the differences should be minimal. Population counts for denominators are based on the Census 1969-2009 US Population Data File as modified by NCI.
The US populations included with the data release have been adjusted for the population shifts due to hurricanes Katrina and Rita for 62 counties and parishes in Alabama, Mississippi, Louisiana, and Texas.
Healthy People 2010 Goal 03-03 : Reduce the breast cancer death rate to 22.3.
Healthy People 2010 Objectives provided by the Centers for Disease Control and Prevention .

Age adjusted breast cancer mortality rate by state. 2009
Source: National Cancer Institute and CDC
http://cancercontrolplanet.cancer.gov/breast_cancer.html

***Appendix 3***

Latitude and vitamin D production in the skin


Except during the summer months, the skin makes little if any vitamin D from the sun at latitudes above 37 degrees north (in the United States, the shaded region in the map) or below 37 degrees south of the equator. People who live in these areas are at relatively greater risk for vitamin D deficiency.

Latitude and Vitamin D production in the United States-2008
Source: Harvard Medical School Newsletter- Women's Health
http://www.health.harvard.edu/newsletters/Harvard_Womens_Health_Watch/2008/September/Time_for_more_vitamin_D

*Appendix 4*

| **Food** | **Serving** | **Vitamin D (IU)** | **Vitamin D (mcg)** |
|---|---|---|---|
| Pink salmon, canned | 3 ounces | 530 | 13.3 |
| Sardines, canned | 3 ounces | 231 | 5.8 |
| Mackerel, canned | 3 ounces | 213 | 5.3 |
| Quaker Nutrition for Women Instant Oatmeal | 1 packet | 154 | 3.9 |
| Cow's milk, fortified with vitamin D | 8 ounces | 98 | 2.5 |
| Soy milk, fortified with vitamin D | 8 ounces | 100 | 2.5 |
| Orange juice, fortified with vitamin D | 8 ounces | 100 | 2.5 |
| Cereal, fortified | 1 serving (usually 1 cup) | 40-50 | 1.0-1.3 |
| Egg yolk | 1 large | 21 | 0.53 |

Sources rich in Vitamin D
Source: Linus Pauling Institute-Oregon State University-2011-USDA
http://lpi.oregonstate.edu/infocenter/vitamins/vitaminD/

***Appendix 5***

| Vitamin D status by blood levels of 25(OH)D* | |
|---|---|
| Vitamin D status | 25(OH)D in nanograms per milliliter (ng/mL) |
| Deficient | Less than 20 ng/mL |
| Insufficient | 20 to 29 ng/mL |
| Sufficient | 30 ng/mL or more |
| Potentially harmful | More than 150 ng/mL |
| *25-hydroxyvitamin $D_3$ (vitamin D precursor)<br><br>Source: Holick MF. "Vitamin D Deficiency," *New England Journal of Medicine* (July 19, 2007), Vol. 357, No. 3, pp. 266–80. | |

Serum Vitamin D levels-2007
Source: Source: Harvard Medical School Newsletter- Women's Health-2008
http://www.health.harvard.edu/newsletters/Harvard_Womens_Health_Watch/2008/September/Time_for_more_vitamin

*Appendix 6*

| Recommended Dietary Allowance (RDA) for Vitamin D Set by the Institute of Medicine | | | |
|---|---|---|---|
| **Life Stage** | **Age** | **Males mcg/day (IU/day)** | **Females mcg/day (IU/day)** |
| Infants | 0-6 months | 10 mcg (400 IU) (AI) | 10 mcg (400 IU) (AI) |
| Infants | 6-12 months | 10 mcg (400 IU) (AI) | 10 mcg (400 IU) (AI) |
| Children | 1-3 years | 15 mcg (600 IU) | 15 mcg (600 IU) |
| Children | 4-8 years | 15 mcg (600 IU) | 15 mcg (600 IU) |
| Children | 9-13 years | 15 mcg (600 IU) | 15 mcg (600 IU) |
| Adolescents | 14-18 years | 15 mcg (600 IU) | 15 mcg (600 IU) |
| Adults | 19-50 years | 15 mcg (600 IU) | 15 mcg (600 IU) |
| Adults | 51-70 years | 15 mcg (600 IU) | 15 mcg (600 IU) |
| Adults | 71 years and older | 20 mcg (800 IU) | 20 mcg (800 IU) |
| Pregnancy | all ages | - | 15 mcg (600 IU) |
| Breast-feeding | all ages | - | 15 mcg (600 IU) |

Recommended Dietary Guidelines for Vitamin D-
Source: Linus Pauling Institute- Oregon State University-2011- IOM
http://lpi.oregonstate.edu/infocenter/vitamins/vitaminD/

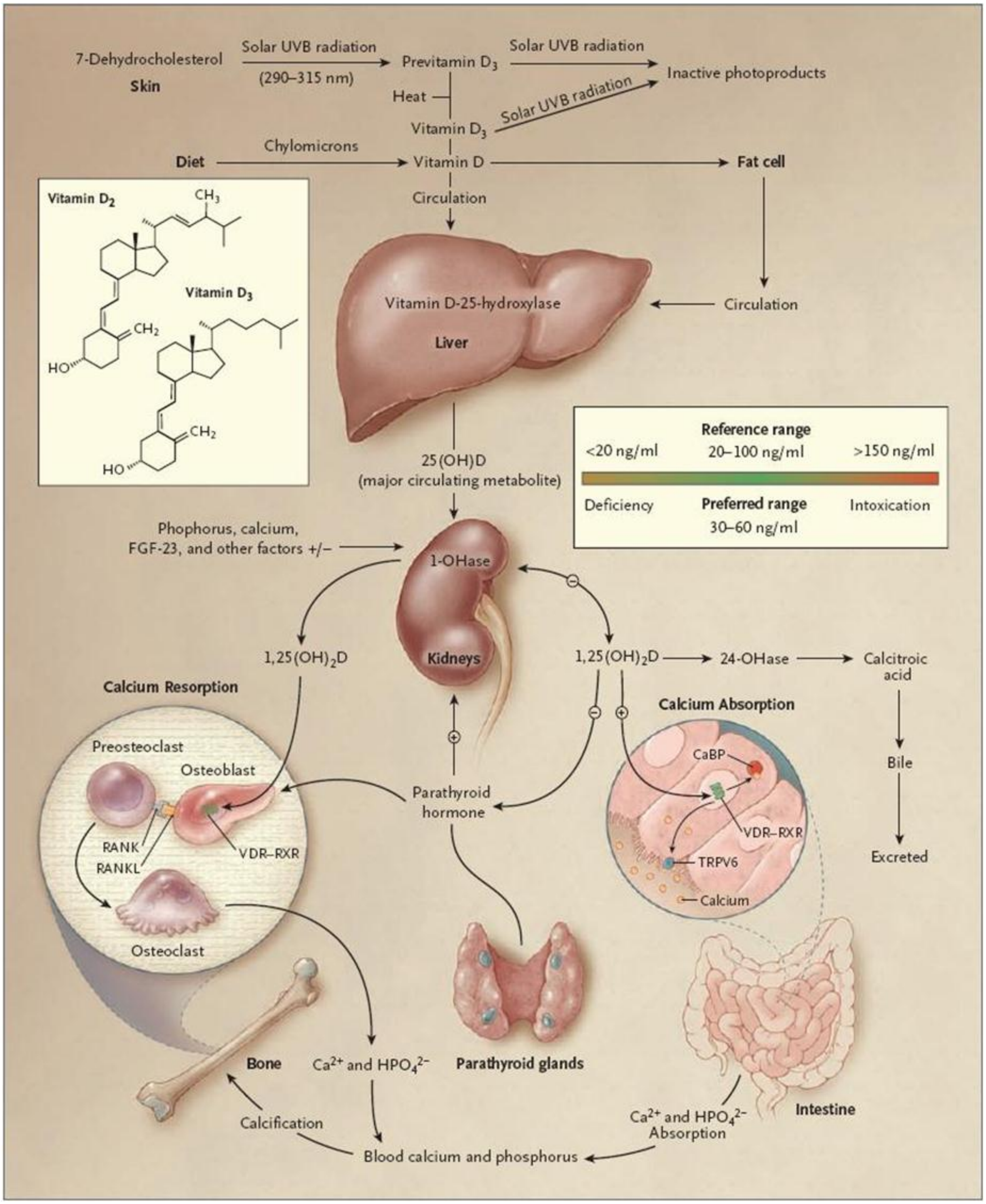
***Appendix 7***

| **Cancer Site** | **Direct Cost** (in billions of dollars) |
|---|---|
| **All Sites** | **$124.57** |
| Breast (female) | $16.50 |
| Colorectal | $14.14 |
| Lung | $12.12 |
| Lymphoma | $12.14 |
| Prostate | $11.85 |
| Leukemia | $5.44 |
| Ovary | $5.12 |
| Brain | $4.47 |
| Bladder | $3.98 |
| Head and Neck | $3.64 |
| Kidney | $3.80 |
| Uterus | $2.62 |
| Melanoma | $2.36 |
| Pancreas | $2.27 |
| Stomach | $1.82 |
| Cervix | $1.55 |
| Esophagus | $1.33 |

*More information at http://costprojections.cancer.gov/

National Costs for Cancer Care in 2010 in Billions of Dollars by Cancer Site*
Source: National Cancer Institute
http://www.cancer.gov/aboutnci/servingpeople/cancer-statistics/costofcancer

***Appendix 8***




Vitamin D Metabolism
Source: http://bigtomato.org/endo/bcp/vitamind.php

*Appendix 9*

| Tolerable Upper Intake Level (UL) for Vitamin D Set by the Institute of Medicine | |
|---|---|
| **Age Group** | **mcg/day (IU/day)** |
| Infants 0-6 months | 25 mcg (1,000 IU) |
| Infants 6-12 months | 37.5 mcg (1,500 IU) |
| Children 1-3 years | 62.5 mcg (2,500 IU) |
| Children 4-8 years | 75 mcg (3,000 IU) |
| Children 9-13 years | 100 mcg (4,000 IU) |
| Adolescents 14-18 years | 100 mcg (4,000 IU) |
| Adults 19 years and older | 100 mcg (4,000 IU) |

Figure 9: Upper intake level of Vitamin D by Age
Source: Linus Pauling Institute-Oregon State University-2011- Institute of Medicine
http://lpi.oregonstate.edu/infocenter/vitamins/vitaminD/

***Appendix 10***

***Overview- Provider Education***

Vitamin D-Sun Exposure

1. 90% of Vitamin D is obtained through sun exposure on a clear day.
2. Sun exposure limited to 10-15 minutes, arms, shoulders, and legs early afternoon.
3. Avoid sunscreen for those 10-15 minutes (Longer times does not absorb more)

Vitamin D- Dietary Sources

1. Fatty Fish- Salmon, Tuna, and Sardines
2. Milk
3. Fortified Cereals

Vitamin D-Recommended Intake

1. Ages 1-70 is 15mcg (600 IU/daily)
2. Ages 71 and older 20mcg (800 IU/daily)
3. Deficient individuals 1000 IU/daily till levels return to normal

Vitamin D-Serum Level Recommendations

1. Sufficient levels=greater than 30 ng/ml.

Breast Health

1. Maintain adequate vitamin D levels-KNOW YOUR LEVELS
2. Start yearly self breast exams at age of 20
3. Clinical breast exams by provider start at age 20-40 every 3 years, after 40 yearly
4. Mammograms yearly starting at the age of 40.

***Resources for Providers***

1. The National Institute of Health- Office of Dietary Supplements
   http://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/

2. Medscape Education- Practice Guideline on Vitamin D Issued by Endocrine Society
   http://www.medscape.org/viewarticle/7

# VITAMIN D and YOU


## What is Vitamin D?

Vitamin D is a fat soluble vitamin that has multiple functions in our bodies including bone health, muscle functions, and cell division and growth. People who have low levels of vitamin D are at risk for several disorders including diabetes, rheumatoid arthritis, inflammatory bowel disease, osteoporosis, and cancer.

## Where does Vitamin D come from?

The best source of vitamin D is through limited sun exposure on a sunny day. However fatty fish such as tuna and salmon, some breakfast cereals, milk, and eggs also have vitamin D in them. The average adult needs about 1000 IU daily of vitamin D to maintain levels in our bodies.

## How can I tell if I am deficient?

Vitamin D deficiency can cause muscle weakness, bone fractures, and body aches and pains. It is best to discuss concerns about your vitamin D level with your primary care provider. They can do a simple blood test to determine if your vitamin D level is enough or if you need to start taking a vitamin D supplement.

## Why would I be deficient in Vitamin D?

Many factors can affect our vitamin D levels including:

| | | | | | |
|---|---|---|---|---|---|
| Aging | Dark Skin Color | Limited Sun | Where we live | Obesity | Liver Disease |
| Kidney Failure | Diet | Medications | Cystic Fibrosis | Crohn's Disease | |

**Ask your provider today about testing**

**Picture Source:** http://dianekress.wordpress.com/2012/07/05/low-vitamin-d-is-not-simply-a-matter-of-lack-of-sunshine-and-needing-an-extra-supplement-vitamin-d-is-actually-a-hormone-and-a-quiet-but-dangerous-hormonal-imbalance-can-be-triggering-your-vitami/

## ***Additional Patient Resources***

1. The Mayo Clinic
   http://www.mayoclinic.com/health/vitamin-d/NS_patient-vitamind

2. The National Institute of Health- Office of Dietary Supplements
   http://ods.od.nih.gov/factsheets/VitaminD-QuickFacts/

3. Health Education Resource Exchange
   http://here.doh.wa.gov/materials/vitamin-d-for-your-child

4. Medline Plus-National Institute of Health
   http://www.nlm.nih.gov/medlineplus/vitamind.html

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