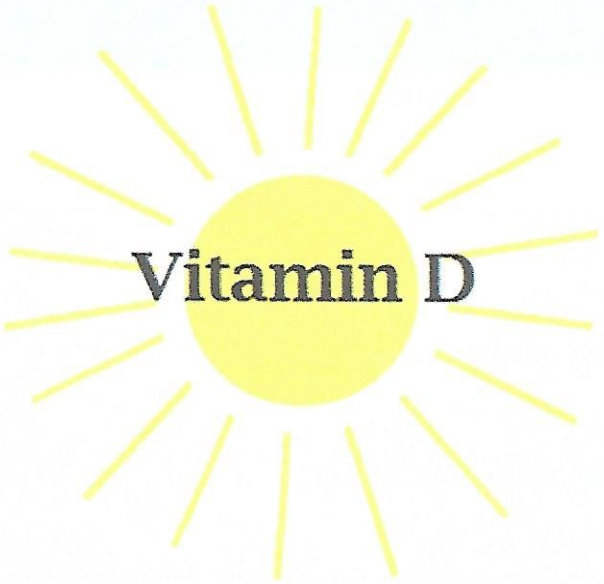
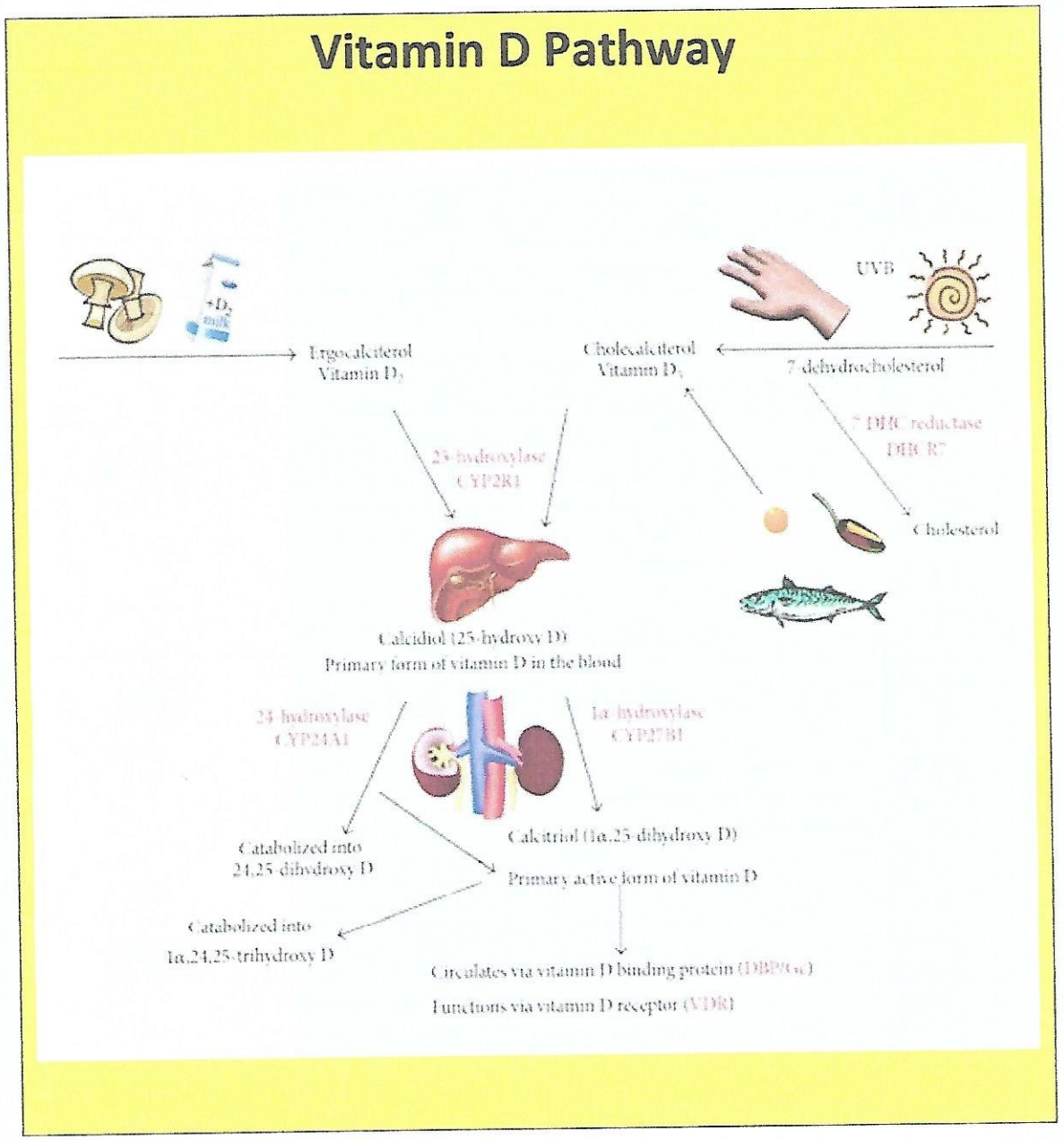


Your Personalised DNA - Based Report My Vitamin D Pathway Report 1014	
Prepared for:	Verne Maree
Date prepared:	11 April 2018
Practitioner Details	
Practitioner:	Sharon Palmer
Clinic:	iDNA Health
Email:	spalmer@optusnet.com.au

Table of Content

The Vitamin D Pathway

The Vitamin D Pathway is complicated and there are many enzymes that control each step. How each of these enzymes function is determined genetically. Your report will cover each of these key enzymes and indicate the mutations you have in these genes, the implications of these mutations, and what you can do to compensate for and decrease the risk of these mutations.



Summary of Your Vitamin D Pathway

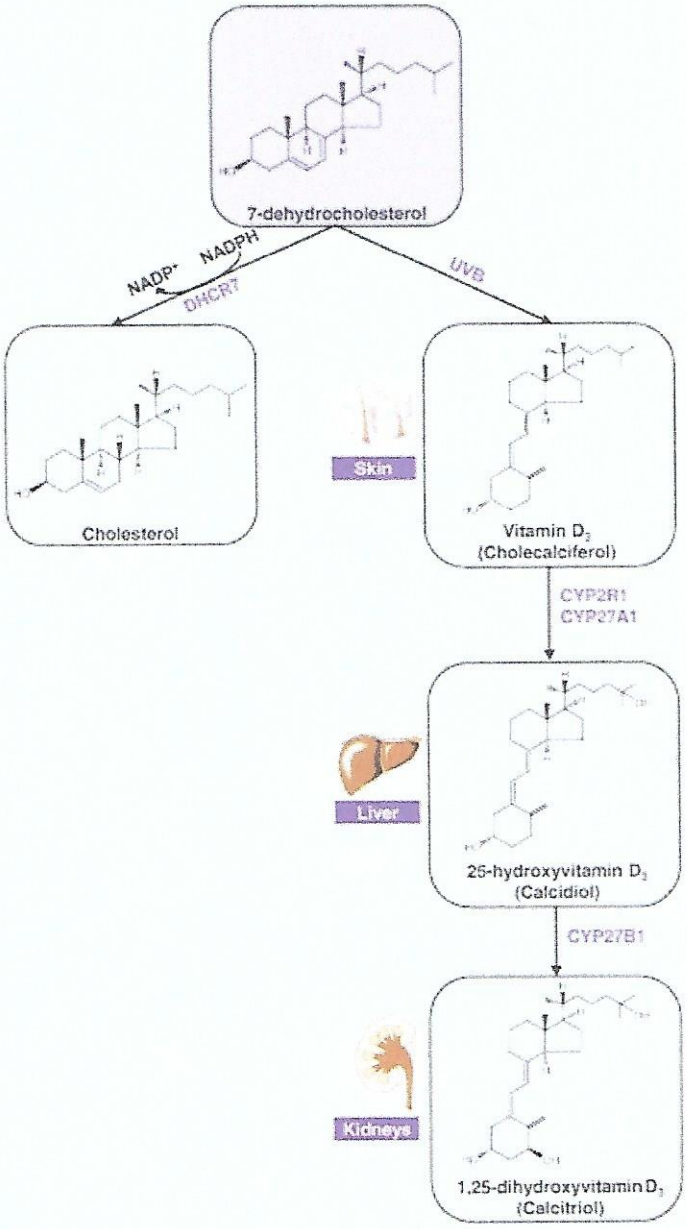
This is a summary of your mutations in each of the steps that make up your Vitamin D Pathway. The higher your percentage the more mutations you have. A high number of mutations in a pathway will lead to decreased function of the pathway.

Step	Function	Your % of Mutations
Step 1	**Producing Vitamin D from the Sun** This pathway is working at half capacity. You have significantly decreased ability to make Vitamin D3 from the sun. You will need to support your Vitamin D3 levels through supplementation and diet.	50%
Step 2	**Converting Vitamin D3 into 25OH Vitamin D** You are very capable of converting Vitamin D3 into 25OH (the form measured in a blood test) as you have very few mutations in this pathway.	17%
Step 3	**Activating Vitamin D** You have a significant issue with this step and a decreased ability to convert your 25OH into the biologically active form of Vitamin D. You cannot obtain any benefit from your Vitamin D until it is activated. Overcoming your mutations in this step is a priority.	50%
Step 4	**Clearance of Vitamin D** You have normal function of the enzyme that is responsible for maintaining levels of Vitamin D in your tissue. You do not remove your Vitamin D too quickly from the tissues meaning it can exert its effect. It also means you can prevent Vitamin D accumulating in your tissue leading to toxicity.	0%
Step 5	**Transporting Vitamin D** You have very few mutations in this step and therefore a good capacity for transporting Vitamin D to the tissues and organs of the body and to the Vitamin D Receptor.	20%
Step 6	**Vitamin D Receptor Function** Your activated Vitamin D can only exert its effect when it acts via your Vitamin D Receptor. You have significantly decreased activity of your Vitamin D Receptor. You need to increase the activity (expression) of your Vitamin D Receptor on a daily basis. This is a priority.	100%

Step 1 Producing Vitamin D from the Sun

When your skin is exposed to sunlight it manufacturers Vitamin D. The sun's ultraviolet UVB rays interact with a protein in the skin called 7-DHCR, converting it into Vitamin D3 (cholecalciferol).

Mutations in 7-DHCR genes have a major influence on Vitamin D levels. iDNA Health has assessed numerous 7-DHCR genes identified by Genome-Wide Association Studies (GWAS) to assess your ability to produce Vitamin D3 from sun exposure.



Step 1 Producing Vitamin D from the Sun

% of Genetic Mutations in your 7-DHCR Pathway

50%

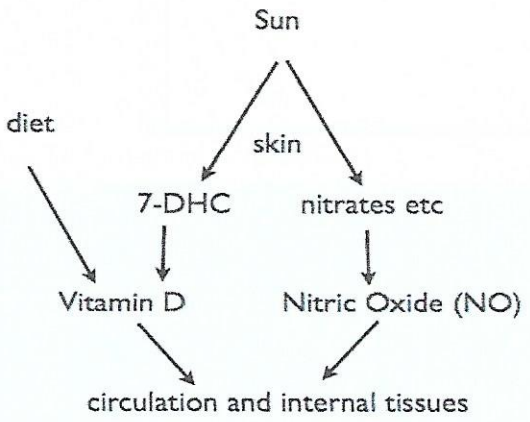
The higher your % of mutations,
the greater your risk of having low Vitamin D levels.

Mutations in this pathway result in low levels of the protein 7-DHCR that is converted into Vitamin D3 upon sun exposure.

The higher your percentage the lower your levels of 7-DHC protein. Low levels of this protein decrease your capacity of making Vitamin D from sun exposure.

Researchers have shown that individuals with your mutations are:

21% more likely to have 25OH Vit D <50nmol/L
21% more likely to have 25OH Vit D <75nmol/L

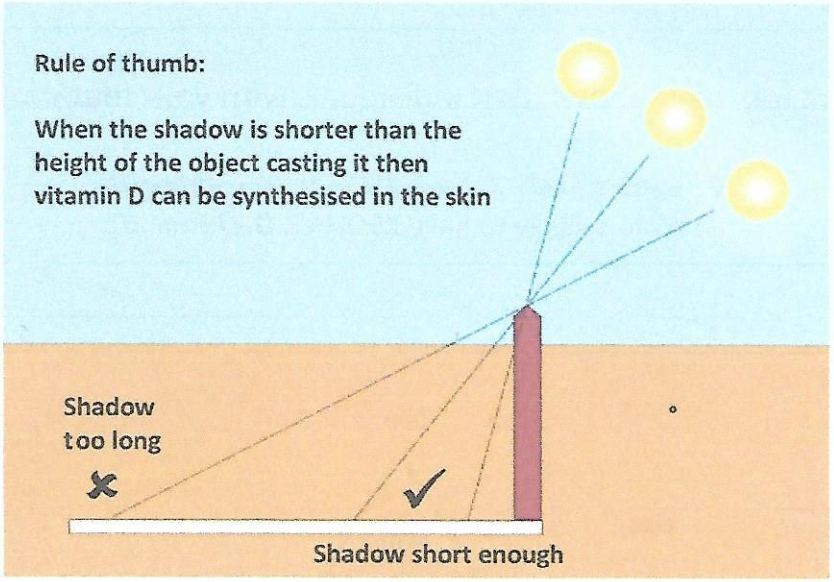


Step 1 Producing Vitamin D from the Sun | Clinical Interventions

1. Decreased Vitamin D Production from Sunlight

Mutations in this pathway will mean that even when you have sunlight exposure (without sunscreen) you may still be at risk of low Vitamin D3 levels. You must also consider the darkness of your skin. The darker your skin the less Vitamin D3 you will make from sun exposure. Melanin (the pigment that makes the skin dark) blocks UVB from reaching 7-DHC. Those with dark skin make less Vitamin D3 from the sun. Having dark skin and mutations in this pathway will result in very little Vitamin D production from the sun.

UVB rays which trigger Vitamin D production vary in intensity with season and latitude. The further away from the equator you live the less intense the UVB and the less Vitamin D3 you will produce. Summer is the month with the highest UVB intensity. Thus in winter months you will be at greater risk of lower Vitamin D3. Sunscreen with a SPF15 reduces Vitamin D production by 99%.



Step 1 Producing Vitamin D from the Sun | Clinical Interventions

2. Must have Vitamin D Foods

When you have a decreased ability to produce Vitamin D3 from the sun, it is important that you use your diet to provide you with your Vitamin D. Just note that there are foods that provide Vitamin D3 (cholecalciferol) and foods that provide Vitamin D2 (ergocalciferol). *Vitamin D3 (cholecalciferol) is best. Your animal products (fish, fish oil and eggs) provide D3.* Plants/vegetables (such as mushrooms) provide D2. Food manufacturers often fortify food with Vitamin D. They can use D3 or D2 so check. Most foods, with the exception of fatty fish, contain little Vitamin D unless they have been fortified (had Vitamin D added).

Eat 2-3 servings (130 grams per serving) of Fatty Fish per Week

Best Fish Choices

(from highest Vitamin D levels to lowest)

Salmon wild

Sardines

Mackerel

Herring

Tuna

Step 1 Producing Vitamin D from the Sun | Clinical Interventions

The Vitamin D found in mushrooms is the D2 form. Try and buy mushrooms that have been exposed to sunlight (especially if vegetarian or vegan). It greatly increases their Vitamin D content.

Natural Sources of Vitamin D

Food	Serving Size	Vitamin D[a] (IU)
Salmon		
Fresh wild	3.5 oz.	600-1000
Fresh farmed	3.5 oz.	100-250
Sardines, canned	3.5 oz.	300
Tuna, canned	3.5 oz.	236
Mackerel, canned	3.5 oz.	250
Shitake mushroom		
Fresh	3.5 oz.	100
Canned	3.5 oz.	1600
Egg, hard-boiled	3.5 oz.	20

[a]The activity of 40 IU of vitamin D is equivalent to 1 µg.
Source: Golden NH, Abrams SA; Committee on Nutrition. Optimizing bone health in children and adolescents. Pediatrics. 2014 Oct;134(4):e1229-43. doi: 10.1542/peds.2014-2173. Review. PubMed PMID: 25266429.

3.5oz = 100grams

Vitamin D Values of Mushroom Varieties included in the USDA National Nutrient Database	
Mushroom Type	Vitamin D Content (IU)
Mushrooms, brown, Italian or Crimini, raw	3
Mushrooms, chanterelle, raw	179
Mushrooms, enoki, raw	4
Mushrooms, maitake, Raw	349
Mushrooms, morel, raw	179
Mushrooms, oyster, raw	24
Mushrooms, portabella, raw	8
Mushrooms, portabella, exposed to ultraviolet light, grilled	402
Mushrooms, portabella, exposed to ultraviolet light, raw	376
Mushrooms, portabella, grilled	12
Mushrooms, shiitake, raw	13
Mushrooms, shiitake, cooked, with salt	24
Mushrooms, shiitake, cooked, without salt	24
Mushrooms, shiitake, dried	129
Mushrooms, shiitake, stir-fried	18
Mushrooms, white, raw	5
Mushrooms, white, cooked, boiled, drained, with salt	2
Mushrooms, white, cooked, boiled, drained, without salt	2
Mushrooms, white, microwaved	3
Mushrooms, white, stir-fried	7

Step 1 Producing Vitamin D from the Sun | Clinical Interventions

Vegetarian or Vegan

Vegetarians (who do not eat fish) and vegans with mutations in this pathway will be at very high risk of low Vitamin D levels. It will be essential for you to monitor your Vitamin D levels, and if not eating foods high in Vitamin D, to supplement if required.

3. Type of Vitamin D Supplement

When using a Vitamin D supplement it is preferable to use Vitamin D3 and not Vitamin D2. Research demonstrates that the D3 form is more effective at increasing 25OH Vitamin D levels in the blood.

- Vitamin D2 is not converted as effectively to 25OH Vit D
- **If you have mutations in your Step 2 (converting Vitamin D to 25OH Vit D) you are advised to use the D3 form.**

- Vitamin D2 is not as effective as it has a lower affinity for the Vitamin D binding protein so it is cleared more rapidly from the body.
- **If you have mutations in your Step 5 (Transporting Vitamin D) you are advised to use the D3 form.**

For vegans and vegetarians who only want to use the Vit D2 form, note that it must be taken daily. Unless you take Vitamin D2 daily it does not result in as high a blood level of 25OH Vitamin D as comparable amounts of D3.

4. Check your Vitamin D Levels

Your genetic mutations will be with you always. Regularly monitor your 25OH Vitamin D and ensure you maintain ideal levels.

Step 2 Converting Vitamin D into 25OH Vit D

Once you have either made Vitamin D3 in the skin from sun exposure, or eaten food containing Vitamin D3 or D2, it must be converted into 25OH Vitamin D (calcidiol), the main form circulating in the blood, and the form of Vitamin D that is measured in a blood test.

This conversion is done by the CPY2R1 enzyme in the liver. This enzyme is responsible for 75% of 25OH Vitamin D levels in your blood. iDNA Health has assessed numerous CYP2R1 genes identified by Genome-Wide Association Studies (GWAS) to determine your percentage mutation and your ability to convert Vitamin D3 into 25OH Vit D.

% of Genetic Mutations in Your CYP2R1 Pathway

17%

The higher your % of mutations,
the greater your risk of having low Vitamin D levels.

Mutations result in decreased activity of the CYP2R1 enzyme and decreased conversion of Vitamin D3 and especially of Vitamin D2 into 25OH Vitamin D.

Step 2 Converting Vitamin D into 25OH Vit D | Clinical Interventions

If you have mutations in this pathway you are encouraged to be very proactive as this step in your Vitamin D pathway plays such a major role in your 25OH Vit Levels.

1. Support Methylation

Methylation leads to increased production of the enzyme that converts your Vitamin D into 25OH Vit D.

- *You are recommended to order your* DNA-personalised Vitamin B Group Supplementation Report 1007 that reviews all your gene mutations in your methylation pathway and recommends the correct balance of your activated vitamin Bs, which are critical to healthy methylation.

2. Increased Vitamin D Supplementation

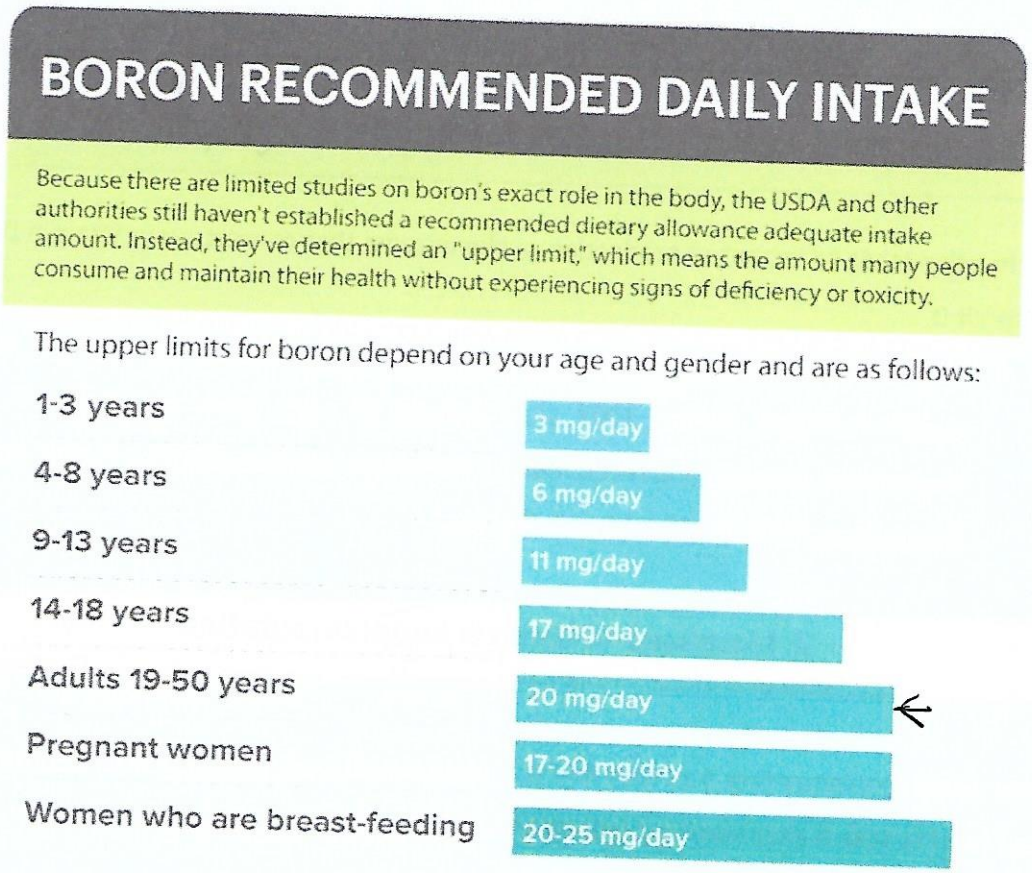
Even when supplementing, you may find it difficult to achieve good 25OH Vit D status. You may need to take higher amounts (above 2,000iu) for a longer period of time (more than 90 days). Check your Vitamin D levels regularly by a blood test.

3. Ensure Adequate Boron

Boron may be a useful supplement for individuals with mutations in this pathway. However, do not take boron without first discussing this with your iDNA Health practitioner, especially if you have had any reproductive cancers. Boron can influence a number of key enzymes in the body and may be contradicted for individuals with certain conditions and diseases.

Those with mutations in this pathway should definitely consume foods high in boron.

Step 2 Converting Vitamin D into 25OH Vit D | Clinical Interventions



Step 2 Converting Vitamin D into 25OH Vit D | Clinical Interventions

Foods High In Boron
Raisins have the highest levels

FOOD	Boron (mg/100g)	FOOD	Boron (mg/100g)
Almond	2.82	Hazel Nuts	2.77
Apple (red)	0.32	Honey	0.50
Apricots (dried)	2.11	Lentils	0.74
Avocado	2.06	Olive	0.35
Banana	0.16	Onion	0.20
Beans (red kidney)	1.40	Orange	0.25
Bran (wheat)	0.32	Peach	0.52
Brazil Nuts	1.72	Peanut Butter	1.92
Broccoli	0.31	Pear	0.32
Carrot	0.30	Potato	0.18
Cashew Nuts (raw)	1.15	Prunes	1.18
Celery	0.50	Raisins	4.51
Chick Peas	0.71	Walnut	1.63
Dates	1.08	Wine (Shiraz Cabernet)	0.86
Grapes (red)	0.50		

Step 3 Activation of Your Vitamin D | Clinical Interventions

If you have mutations in this pathway it is very important for you to control calcium, phosphorus and parathyroid hormone levels. Each of these influences the other and their levels will impact on the activity of your Vitamin D converting enzyme. You must also be cautious with calcium supplementation if you have mutations in this pathway.

1. Control Calcium Levels

Elevated calcium will inhibit this enzyme. If you have mutations in this pathway high calcium will further decrease your ability to activate your Vitamin D. Even if you have none, or very few mutations, high calcium levels will decrease your ability to activate your Vitamin D.

- You need to measure your calcium blood levels (calcium corrected and ionised calcium).
- You need to measure your PTH (see below) as PTH regulates the levels of calcium and phosphorus in your blood.

Calcium Supplementation

If you have mutations in this pathway you should stop all forms of calcium supplementation, and this includes multivitamins, and check your ionized calcium levels. Before you take any form of calcium supplementation you must first understand how your body absorbs calcium. Some people are very high absorbers of calcium and others very poor calcium absorbers. Your genetics in regards to calcium absorption will determine if you should take calcium or not and how you respond to calcium in your diet and to a supplement.

You are recommended to order your DNA-Personalised Calcium Absorption Report 1028.

Step 3 Activation of Your Vitamin D | Clinical Interventions

2. Control Phosphate Levels

Elevated phosphate will inhibit this enzyme. If you have mutations in this pathway high phosphorus will further decrease your ability to activate your Vitamin D. Even if you have none, or very few mutations, high phosphorus levels will decrease your ability to activate your Vitamin D.

- You need to measure your phosphorus blood levels.
- You need to also measure your PTH (see below) as PTH regulates the levels of calcium and phosphorus in your blood.

From a dietary point of view, it is important to balance your calcium intake with your phosphorus intake. The Western diet often contains four times as much phosphorus as calcium.

3. Control PTH (Parathyroid Hormone)

PTH regulates the levels of calcium and phosphorus in your blood. Elevated PTH will result in high levels of calcium which will decrease the activity of your Vitamin D converting enzyme. On the other hand, low PTH (hypoparathyroidism) will inhibit this enzyme.

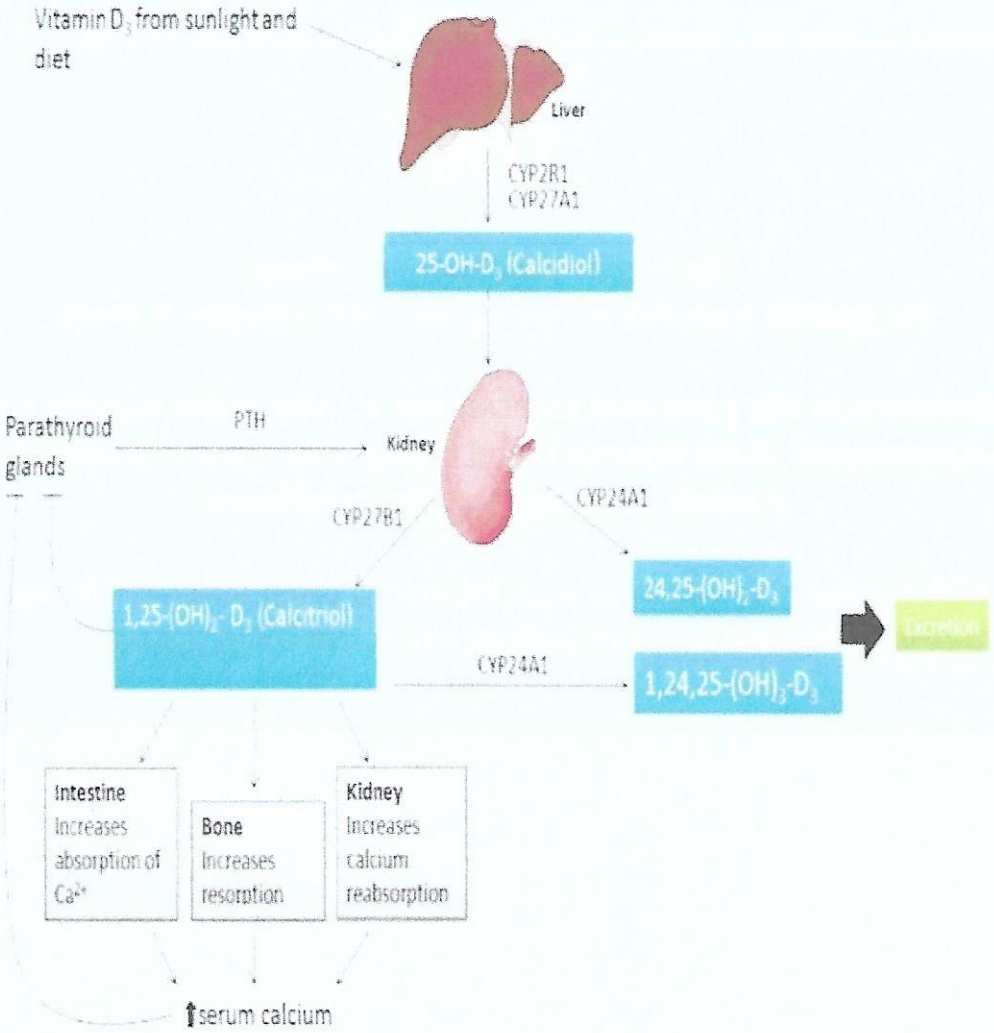
- You need to measure your PTH levels.

4. High Intake of Vitamin D3

You must have a high intake of Vitamin D3, either from the diet or through supplementation. Doses of up to 10,000 or 20,000iu/day maybe necessary to compensate for the mutation. Do not supplement with these doses unless advised. You must first have your calcium, phosphorus and PTH measured and are advised to have a bone density scan.

Step 4 Clearance of Your Vitamin D

Your CYP24A1 enzyme breakdowns and inactivates both your 25OH Vit D and your *biologically active 1,25-dihydroxyvitamin D so that it can be excreted from the body.* The main aim of this enzyme is to control levels of Vitamin D within tissues and prevent toxicity. However, if the enzyme is working too quickly it will result in rapid breakdown and excretion and lead to low levels.



Step 4 Clearance of Your Vitamin D

iDNA Health has assessed numerous CYP24A1 genes to determine your percentage mutation and your clearance of Vitamin D.

% of Genetic Mutations in Your Vitamin D Clearance System

0%

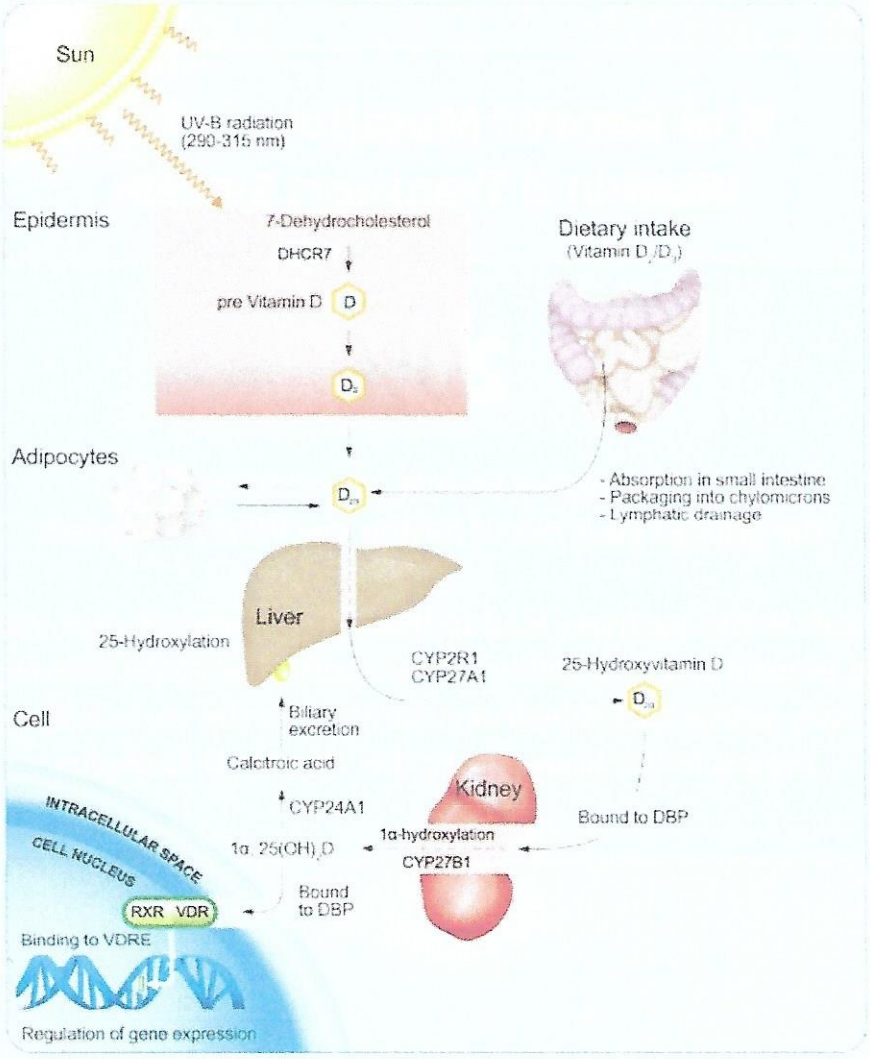
The higher your % of mutations,
the greater your risk of having low 25OH Vitamin D levels.

Mutations in this gene lead to increased activity of the enzyme that inactivates your 25OH Vitamin D and biologically active 1,25-dihydroxy Vitamin D, leading to decreased levels.

A high % means you excrete your Vitamin D too quickly which results in decreased levels of biologically active D3 in the body.

Step 5 Transporting Your Vitamin D

Your 25OH Vitamin D and biologically active 1,25-dihydroxyvitamin D are bound by your *Vitamin D Binding Protein* for transport to target tissues and organs and to the Vitamin D Receptor. Your Vitamin D Binding Protein is manufactured in the liver.



Step 5 Transporting Your Vitamin D

iDNA Health has assessed numerous genes, identified by Genome-Wide Association Studies (GWAS), that produce Vitamin D Binding Protein, to determine your % mutation and assess your ability to transport Vitamin D around the body.

% of Genetic Mutations in Your Vitamin D Transport System

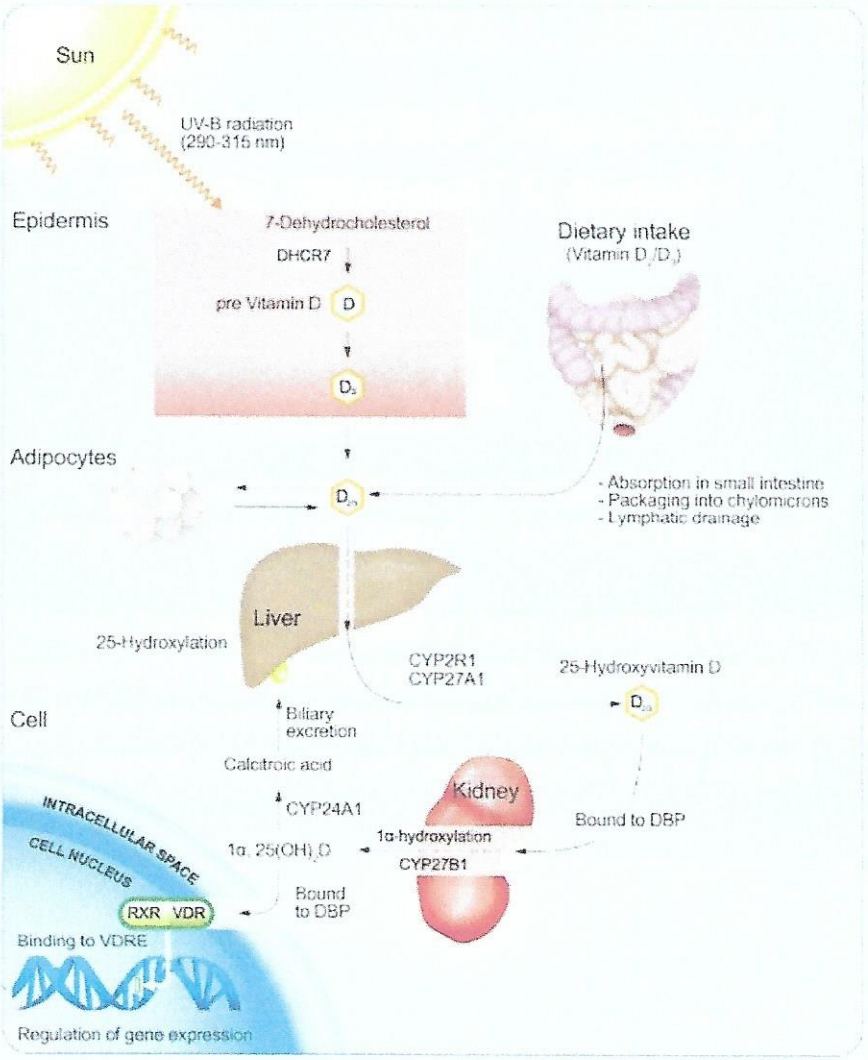
20%

The higher your % of mutations,
the greater your risk of having low Vitamin D levels.

Mutations in this pathway lead to decreased levels of your Vitamin D binding protein and less ability to transport your 25OH Vitamin D and biologically active 1,25-dihydroxyvitamin D to the various tissues and organs in the body and to the Vitamin D Receptor.

Step 5 Transporting Your Vitamin D

Your 25OH Vitamin D and biologically active 1,25-dihydroxyvitamin D are bound by your *Vitamin D Binding Protein* for transport to target tissues and organs and to the Vitamin D Receptor. Your Vitamin D Binding Protein is manufactured in the liver.



Step 5 Transporting Your Vitamin D

iDNA Health has assessed numerous genes, identified by Genome-Wide Association Studies (GWAS), that produce Vitamin D Binding Protein, to determine your % mutation and assess your ability to transport Vitamin D around the body.

% of Genetic Mutations in Your Vitamin D Transport System

20%

The higher your % of mutations,
the greater your risk of having low Vitamin D levels.

Mutations in this pathway lead to decreased levels of your Vitamin D binding protein and less ability to transport your 25OH Vitamin D and biologically active 1,25-dihydroxyvitamin D to the various tissues and organs in the body and to the Vitamin D Receptor.

Step 5 Transporting Your Vitamin D | Clinical Interventions

1. Limit or Avoid Caffeine

Avoid or limit caffeine. It will reduce the activity of your Vitamin D Binding Protein by 70%.

2. Using Statin Drugs for High Cholesterol

Statin drugs used for lowering cholesterol may interfere with the production and function of your Vitamin D Binding Protein.

3. Control Inflammation

Inflammation will decrease production of your Vitamin D Binding Protein. Check your C.Reactive Protein levels. Keep it <1.

4. Avoid Stress

Physiological stress will decrease production of your Vitamin D Binding Protein.

5. Vitamin D Supplementation

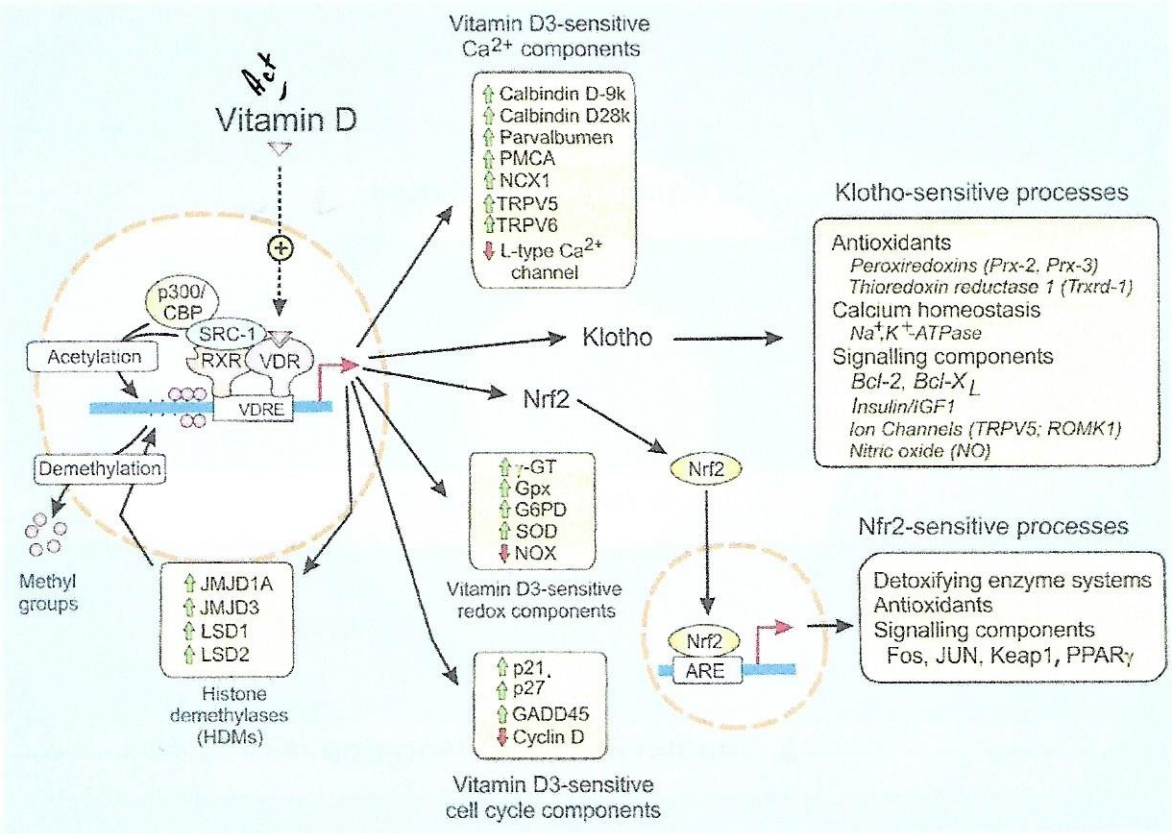
Even when supplementing, you may find it difficult to achieve good 25OH Vit D status. You may need to take higher amounts (above 2,000iu) for a longer period of time (more than 90 days).

6. Check your Vitamin D

Check your 25OH Vitamin D blood levels regularly.

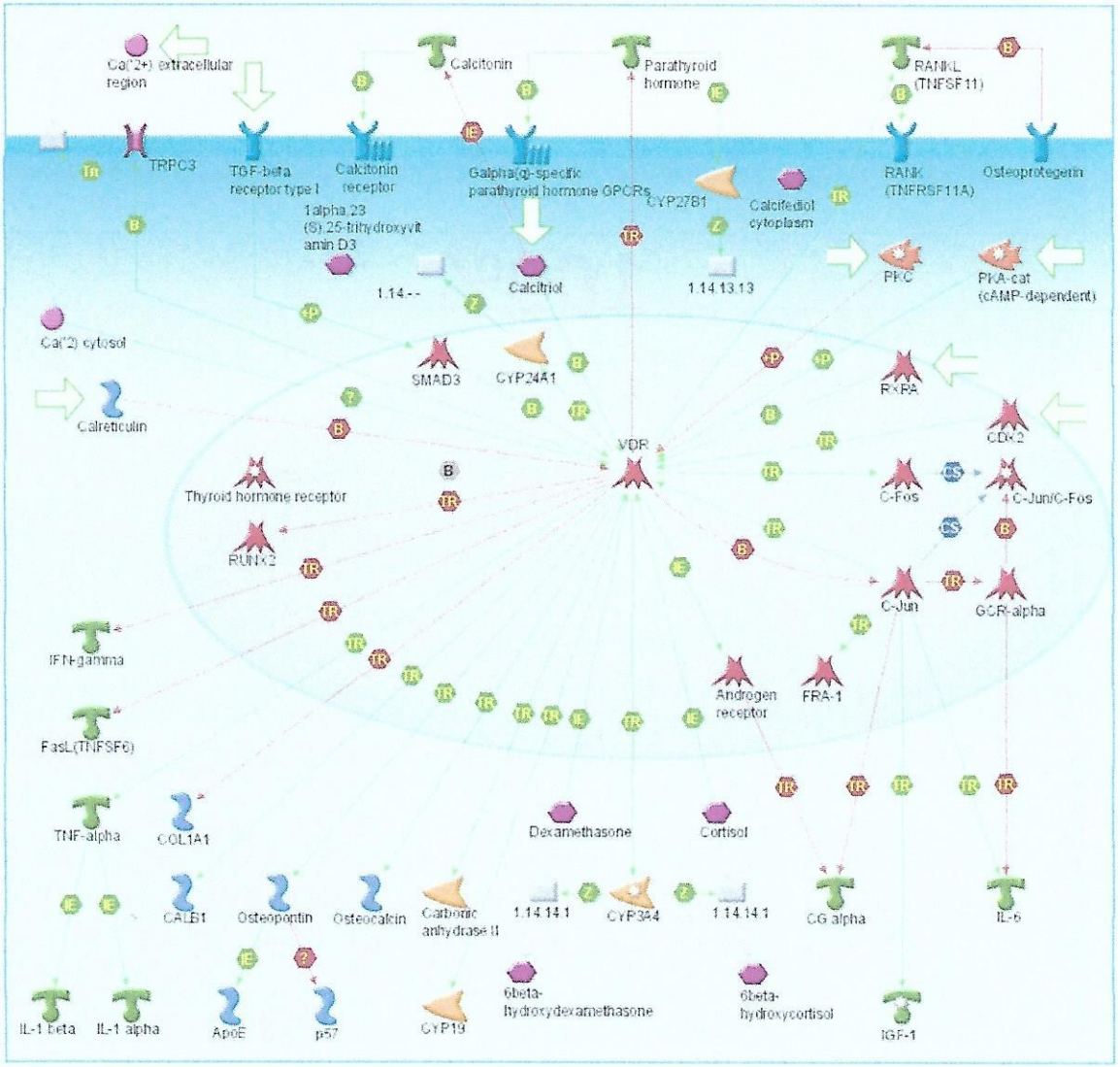
Step 6 Vitamin D Receptor Function

Your Vitamin D Receptor (VDR) is found in nearly every tissue of your body. Vitamin D acting via the Vitamin D Receptor impacts on multiple biological processes. There are also thousands of VDR binding sites throughout the human genome, which means your VDR controls thousands of other genes. All genome actions of your biologically active 1,25-dihydroxy Vitamin D are mediated by the VDR. Mutations in your Vitamin D Receptor will decrease your ability to activate your genome and control critical processes and functions.



Step 6 Vitamin D Receptor Function

The diagram below illustrates how critical the function of your Vitamin D Receptor is. This diagram depicts the Vitamin D Receptor regulation of the genes involved in osteoporosis. This is just one of hundreds of biological process regulated by your Vitamin D Receptor.



Step 6 Vitamin D Receptor Function

iDNA Health has assessed numerous VDR genes to determine your % mutation.

% of Genetic Mutations in Your Vitamin D Receptors

100%

Mutations in this pathway lead to decreased activity and response of your Vitamin D Receptor to 1,25-dihydroxyvitamin D. Mutations in your Vitamin D Receptor will impact on many aspects of your health.

Certain VDR mutations also impact on Vitamin D levels and response to supplementation.

Researchers have shown that individuals with your mutations have :

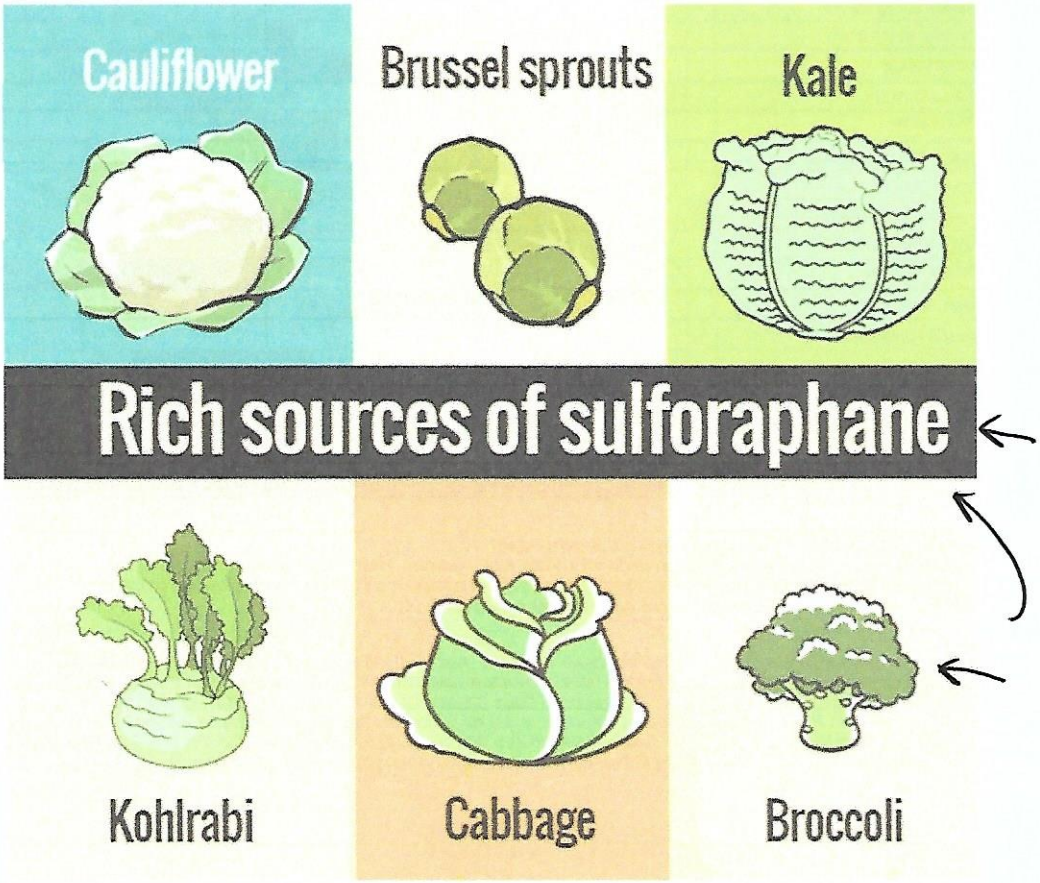
Significantly low Vitamin D levels

A poor response to supplementation even after taking 2,000iu of Vitamin D for 90 days.

Step 6 Vitamin D Receptor Function | Clinical Interventions

1. Enhance Expression of your VDR

A compound called sulforaphane will increase the expression of your Vitamin D Receptor. Sulforaphane is liberated from cruciferous vegetables (broccoli and especially broccoli sprouts). If your have VDR mutations you are recommended to eat cruciferous vegetables daily. Your iDNA Health practitioner will also recommend supplements that will enhance expression of your Vitamin D Receptor.



2. Vitamin D Supplementation

Even when supplementing, you may find it difficult to achieve good 25OH Vit D status. You may need to take higher amounts (above 2,000iu) for a longer period of time (more than 90 days

Ideal Vitamin D Blood Levels

At iDNA health we advise that you aim for blood levels of

25OH Vitamin D of between 100 and 150 nmol/L

Vitamin D – Percentage Reduction of Disease Incidence at Different Blood Serum Levels

This chart presents results of clinical research collated by www.grassrootshealth.org
More information and web-links at www.stargateuk.info/vitamind

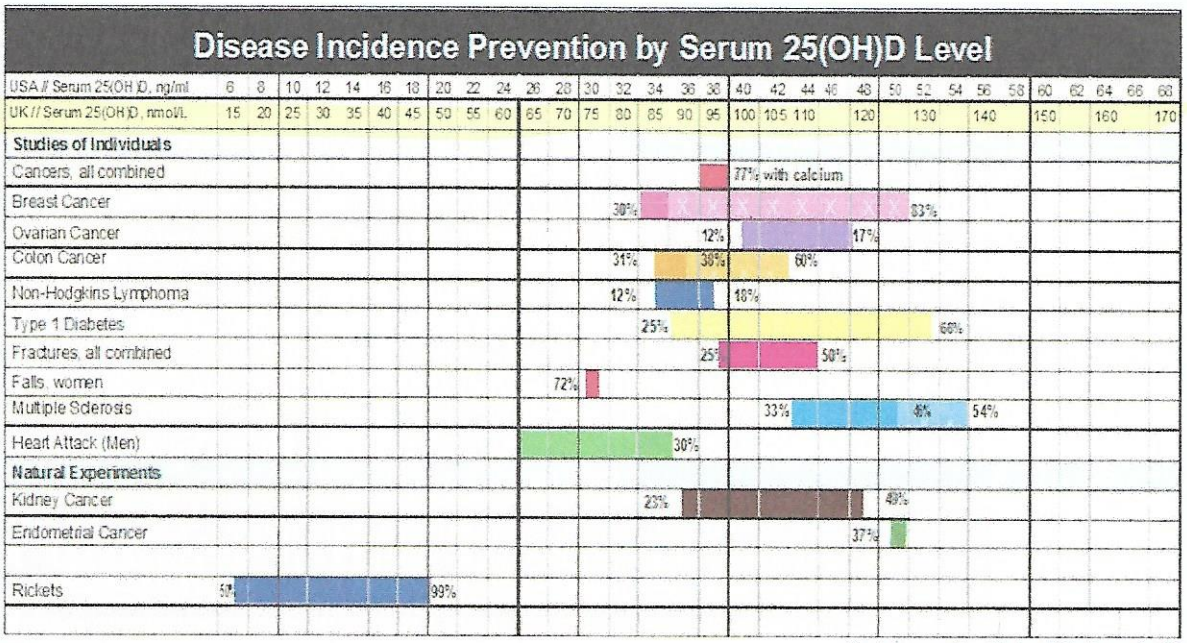


Chart prepared by Garland CF, Baggerly CA

Legend:
All percentages reference a common baseline of 25 ng/ml as shown on the chart
%'s reflect the disease prevention % at the beginning and ending of available data. Example: Breast cancer incidence is reduced by 30% when the serum level is 34 ng/ml vs the baseline of 25 ng/ml. There is an 83% reduction in incidence when the serum level is 50 ng/ml vs the baseline of 25 ng/ml
The x's in the bars indicate 'reasonable extrapolations' from the data but are beyond existing data.

References:
All Cancers: Lappe JM, et al. Am J Clin Nutr. 2007;85:1586-91. Breast: Garland CF, Gorham ED, Mohr SB, Grant WB, Garland FC. Breast cancer risk according to serum 25-Hydroxyvitamin D: Meta-analysis of Dose-Response (abstract). American Association for Cancer Research Annual Meeting, 2008. Reference serum 25(OH)D was 5 ng/ml. Garland, CF, et al. Amer Assoc Cancer Research Annual Mtg, April 2008, Colon: Gorham ED, et al. Am J Prev Med. 2007;32:210-6. Diabetes: Hyppönen E, et al. Lancet 2001;358:1500-3. Endometrium: Mohr SB, et al. Prev Med. 2007;45:323-4. Falls: Broe KE, et al. J Am Geriatr Soc. 2007;55:234-9. Fractures: Bischoff-Ferrari HA, et al. JAMA. 2005;293:2257-64. Heart Attack: Giovannucci et al. Arch Intern Med/Vol 168 (No 11) June 9, 2008. Multiple Sclerosis: Munger KL, et al. JAMA. 2006;296:2832-8. Non-Hodgkin's Lymphoma: Purdue MP, et al. Cancer Causes Control. 2007;18:969-99. Ovary: Tworoger SS, et al. Cancer Epidemiol Biomarkers Prev. 2007;16:783-8. Renal: Mohr SB, et al. Int J Cancer. 2006;119:2705-9. Rickets: Arnaud SB.

