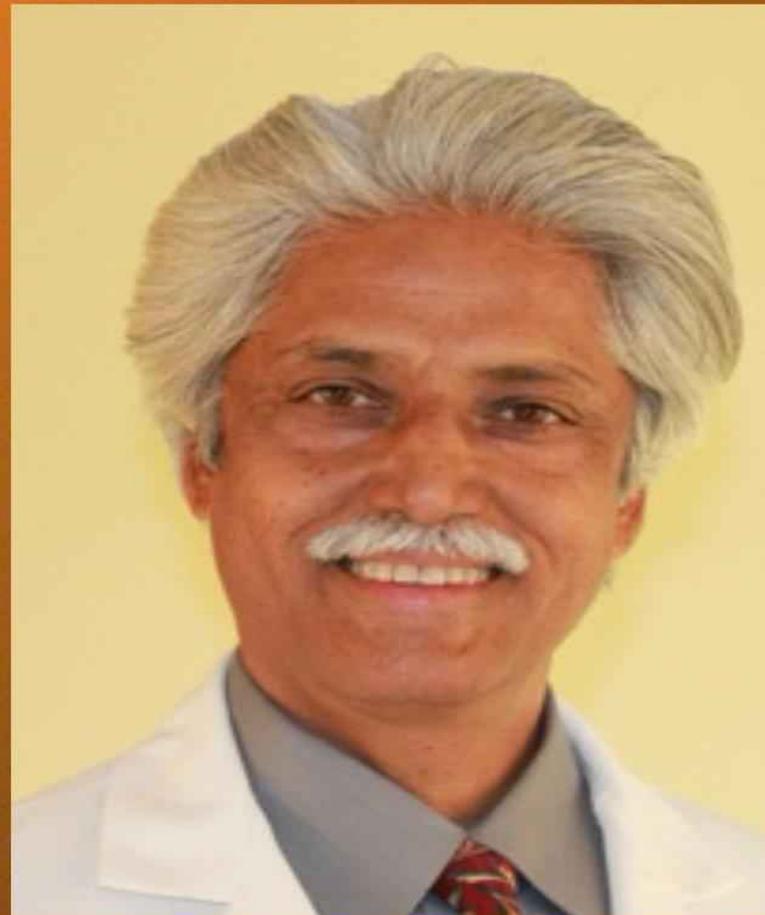


# POWER OF VITAMIN D

The Most  
Scientific,  
Useful  
and  
Practical  
Information  
About  
Vitamin D -  
Hormone D



Sarfraz Zaidi, MD

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# Preface

Since its first publication in 2010, “Power Of Vitamin D” has reached out to more than 100,000 people around the world. At the time of this writing, the book has earned 149 reviews by the readers at Amazon.com, out of which 139 (93%) are excellent reviews (4 and 5 stars). It has been translated into Polish and Romanian languages.

Nothing can be more rewarding for me than to see thousands of people getting in-depth, scientific yet practical knowledge about vitamin D or rather Hormone D, and taking charge of their Hormone D needs. Through the power of knowledge, we can turn around the seemingly insurmountable tide of the pandemic of Hormone D Deficiency - HDD.

In my own clinical practice at the Jamila Diabetes and Endocrine Medical Center in California, patients continue to reap the health benefits of vitamin/hormone D. Every day I hear comments like: “Doc, I don’t get colds and the flu any more like I used to.” Or “I don’t have body aches and pains any more.” Or “I have so much energy now.” I see an improvement in their clinical parameters as well. From diabetes to Hashimoto’s thyroiditis, from asthma to osteoporosis, and so many other diseases, I see a clear-cut clinical improvement.

Researchers from every corner of the world continue to provide compelling scientific evidence about the incredible health benefits as well as safety of vitamin/hormone D. Their findings are in line with my own clinical experience.

In the 3<sup>rd</sup> edition of “Power Of Vitamin D,” I have included more of these excellent scientific studies in addition to sharing my own clinical observations. I have also added three new chapters:

Chapter 27: Vitamin D Supplementation In Special Situations (especially Kidney Stones)

Chapter 29: Vitamin D, Calcium and Magnesium

Chapter 30: Vitamin D and Vitamin K2

I am truly excited to present to you the 3<sup>rd</sup> edition of “Power Of Vitamin D.”

Sarfraz Zaidi, MD

# Introduction

For years, Evelyn suffered from body aches and pains as well as lack of energy. She consulted several physicians. One specialist gave her the diagnosis of Fibromyalgia. Another physician told her she had Chronic Fatigue Syndrome. Someone else told her, "It's all in your head." She was told to just live with it.

This advice didn't satisfy Evelyn. "There has to be a better answer," she said to one of her coworkers, who happened to be my patient and had been on the same dreadful road herself until she consulted me. She told Evelyn that her body aches, pains and chronic fatigue had vanished after she finally got the right diagnosis and treatment. Evelyn immediately made an appointment to see me.

"You're my last hope, Doc," Evelyn said during her visit. I could sense utter frustration in her voice. I tested her vitamin D level which turned out to be very low. With proper treatment of vitamin D deficiency, Evelyn was relieved of her symptoms in just three months.

I see patients like Evelyn every day in my practice. What amazes me is that physicians run numerous expensive and complicated tests, but don't think to order the one simple test that could clinch the diagnosis. Sad!

Here's the plain truth. Most physicians don't have adequate knowledge about vitamin D deficiency and its serious consequences. What little they do know about vitamin D deficiency is based on outdated and inaccurate data.

My own journey to "enlightenment about vitamin D" started about ten years ago. I vividly remember the day at a medical conference in the Boston area when an old professor gave an amazing talk about vitamin D deficiency. Not only are humans affected, he brilliantly explained, but even animals can develop vitamin D deficiency and its awful complications. For example, in nature, iguanas spend most of the day sun bathing. In captivity however, they can develop severe deficiency of vitamin D and consequently, their back bones melt away.

This lecture definitely left a mark on me. Like most other doctors, I was taught that vitamin D deficiency occurs primarily in older folks, people living in cold, northern areas and patients on kidney dialysis. However, the professor made it very clear that it is quite prevalent in young active people, as well.

On my flight home, I kept thinking about it. I wondered, “What about people living in warm, sunny places like my hometown in southern California? Are they low in vitamin D?” I was taught that people living in sunny places like California and Florida don’t develop vitamin D deficiency. Like a true scientist, I wanted to figure it out myself.

I decided to start checking vitamin D levels in my patients. Was I in for a big surprise! Almost 90% of my patients were low in vitamin D. Most of my patients are active people. They are often involved in all sorts of outdoor activities over the weekends. They are proactive in taking care of their health. They take multivitamins, calcium and vitamin D. They are not elderly shut-ins or kidney dialysis patients. And they live in weather charmed, sunny Southern California.

I started to give my vitamin D deficient patients a dose of vitamin D higher than the recommended dose, while closely monitoring them for vitamin D toxicity. I checked their vitamin D level periodically and adjusted the dose of vitamin D accordingly. I was surprised to find that most people required about five to ten times the recommended dose to achieve a good level of vitamin D.

With proper replacement of vitamin D, I started seeing some amazing results in my patients. Body aches and pains simply disappeared. People who were tired all the time and didn’t want to do much made a U-turn. Now they had plenty of energy to participate in their favorite activities. Women with osteoporosis did very well. Their bone density got better and fractures were rare. Diabetics achieved excellent control of their blood sugars. Diabetics are at particularly high risk for heart disease, stroke and cancer, but in my patients, these medical catastrophes were rare occurrences. Patients with thyroid disease felt much better.

I’m not attributing all these great results simply to vitamin D replacement because I have developed my own effective strategies in treating diabetes and thyroid diseases. However, proper vitamin D replacement has been a significant factor in achieving these great results.

In the last few years, many researchers have done excellent work in the field of vitamin D and their findings are in line with my own clinical experience. The relationship of vitamin D deficiency to bone pains, osteoporosis, immune disorders, heart disease, high blood pressure, depression and cancer is well established now. There is also strong evidence to support that vitamin D deficiency may play a significant role in the development of diabetes.

Over the last ten years, my patients have benefited from my strategy of diagnosing and treating vitamin D deficiency. It’s time to spread this important knowledge. That’s why I decided to write this book.

# Chapter 1

## Why Is Vitamin D Important?

In the last 20 years, there has been tremendous research in the field of vitamin D. The findings are astounding! We now know that vitamin D affects almost every organ system in the body.

### ***We now know that:***

1. Vitamin D plays a vital role in the health of *muscles and bones*. It not only helps in the absorption of calcium and phosphorus from the intestines, but it also exerts a direct effect on the muscles and bones. Therefore, vitamin D can prevent as well as treat muscle aches, bone pains, chronic fatigue and osteoporosis.
2. Vitamin D plays a vital role in the normal functioning of the *immune system*. Therefore, vitamin D can prevent as well as treat immune disorders such as asthma, rheumatoid arthritis, Type 1 diabetes, Hashimoto's thyroiditis, Graves' disease, Crohn's disease and Multiple Sclerosis (MS). By boosting the immune system, Vitamin D can prevent as well as treat common colds, flu and other infections.
3. Vitamin D controls the growth of normal as well as *cancerous cells*. Hence, vitamin D can play an important role in the prevention as well as treatment of various cancers especially cancer of the colon, prostate, pancreas and breast.
4. Vitamin D stimulates the production of *insulin* from insulin - producing cells in the pancreas. It also reduces *insulin resistance*. Therefore, vitamin D can help in the prevention as well as treatment of Type 2 diabetes.
5. Vitamin D inhibits the Renin Angiotensin Aldosterone System (RAAS). Renin is a chemical normally produced in the body. It leads to the production of another chemical, called Angiotensin which is responsible for maintaining your blood pressure. Angiotensin also causes release of another chemical called Aldosterone, which is also involved in maintaining your blood pressure. Together, this system of inter-related chemicals is called Renin Angiotensin Aldosterone System (RAAS). If RAAS becomes overactive, it causes high blood pressure (hypertension), kidney disease and heart failure. Now consider

this: *Vitamin D inhibits RAAS*, and therefore, it can prevent *hypertension, kidney disease and heart failure*.

6. Vitamin D can prevent *coronary heart disease* through a number of mechanisms which include inhibition of RAAS, reduction in insulin resistance and reduction of inflammation in the blood vessel wall.
7. Vitamin D affects the normal function of the skin and therefore, can be helpful in the treatment of skin disorders such as *Psoriasis*.
8. Vitamin D affects the health of the teeth and therefore, can play an important role in preventing many dental problems.
9. Vitamin D affects one's mood and therefore, can play an important role in the prevention and treatment of mood disorders such as *depression*.
10. Vitamin D is important for the normal development and functioning of the brain. Therefore, vitamin D may play a role in the prevention as well as treatment of neurologic disorders such as Multiple Sclerosis (M.S.), Alzheimer's disease, Parkinson's disease and Autism.

Isn't it obvious that vitamin D plays a crucial role in maintaining our health?

It's a breakthrough discovery! Now we can truly prevent and treat a number of diseases through proper vitamin D supplementation.

In the following chapters, you'll find detailed information on:

- A. The remarkable benefits of vitamin D
- B. The symptoms and diseases you may have if you are low in vitamin D
- C. How to accurately diagnose vitamin D deficiency
- D. How to properly treat vitamin D deficiency without the risk of its toxicity.

## Chapter 2

### What Is Vitamin D?

Most people, including most doctors, don't really understand what vitamin D truly is. Why do we have such a limited understanding about vitamin D? In order to answer this question, we need to trace the historic background of our understanding of vitamin D.

#### The Long Journey To Understanding Vitamin D

Let me take you back to post-Industrial Revolution Europe in the late nineteenth century, when physicians began to notice a *new* disease among children living in big industrial cities such as London and Warsaw. These children had stunted growth, muscle wasting and deformed legs. Physicians named this new disease *rickets*, but no one understood the cause of this crippling disease.

Now we look back and realize that these children had little exposure to sunshine. They lived in inner cities in over-crowded congested houses with narrow alleys. Prolonged winters as well as pollution from burning coal and wood further decreased sunrays from reaching the surface of Earth. Consequently, severe deficiency of vitamin D developed. Children were particularly affected as their developing bones suffered severely from the consequences of vitamin D deficiency. Moving like a shadow across the land, rickets erupted in the Northeastern U.S. as big industrial cities popped up in this country. By 1900, approximately 80% of children living in Boston suffered from rickets.

By the 1930's, the link between rickets and vitamin D deficiency was well established. This remarkable discovery led to the fortification of milk with vitamin D. In the countries which adopted this practice of vitamin D fortification, rickets was mostly eradicated.

With the elimination of rickets, medical science mostly *forgot* about vitamin D until a few decades ago when it was discovered that vitamin D is really not a vitamin, but a hormone.

*What is a hormone?* A hormone is a substance that is produced in one part of the body, enters the blood stream and exerts its effects at sites distant from the original site of its production. For example, thyroid hormone is produced in the thyroid gland. It then travels through the blood stream and exerts its actions on the heart, muscle, brain and almost

every other organ in the body.

## Vitamin D: A Hormone

Vitamin D is, in fact a hormone. It is produced in the skin from 7-dehydrocholesterol (pro-vitamin D<sub>3</sub>) which is derived from cholesterol. Here is evidence that cholesterol is not all that bad, contrary to what most people think these days. The fact is that cholesterol is a precursor for most hormones in your body.

Type B Ultraviolet rays (UVB) from the sun act on pro-vitamin D<sub>3</sub> and convert it into pre-vitamin D<sub>3</sub>, which is then converted into vitamin D<sub>3</sub>. Medically speaking, we call it cholecalciferol. Vitamin D<sub>3</sub> then leaves the skin and gets into the blood stream where it is carried on a special protein called a vitamin D-binding protein (VDBP).

Through blood circulation, vitamin D<sub>3</sub> reaches various organs in the body. In the liver, vitamin D<sub>3</sub> undergoes a slight change in its chemical structure, under the influence of an enzyme called 25 hydroxylase. At that point, it is called 25-hydroxy cholecalciferol or 25-(OH)-D<sub>3</sub> (or calcifediol). It is then carried through the blood stream on vitamin D-binding protein (VDBP) to the kidneys where it goes through another change in its chemical structure, under the influence of an enzyme called, 1-alpha hydroxylase. At that point, vitamin D is called 1,25- dihydroxy cholecalciferol or 1,25-(OH)<sub>2</sub>-D<sub>3</sub> (or calcitriol). This is the *active* form of vitamin D. It gets in the blood stream and goes to various parts of the body and exerts its actions.

In addition, 25-hydroxy cholecalciferol can convert into an *inactive* form, called 24,25-dihydroxyvitamin D<sub>3</sub>. This action takes place through the action of an enzyme called 24 hydroxylase, located in the kidneys.

With the discovery that vitamin D is a hormone, scientists found the main effect of vitamin D was on calcium and phosphorus absorption from the intestines.

It was also realized that people with kidney failure cannot convert 25 (OH) vitamin D into 1,25-(OH)<sub>2</sub> - vitamin D. Therefore, people with chronic kidney failure on dialysis were placed on a synthetic supplements of 1,25-(OH)<sub>2</sub>-D which is also called calcitriol. Drug companies saw an opportunity and started manufacturing calcitriol (brand name Rocaltrol). Soon, it became a standard of medical practice to prescribe calcitriol to every patient on chronic kidney dialysis.

In the last 20 years, our understanding about vitamin D has gone through revolutionary changes. For example, now we know that conversion of 25-(OH)-D into 1,25-(OH)<sub>2</sub>-D takes

place *not* only in the kidneys, but also in a number of other tissues such as lymph nodes, skin and lungs. Now we know that vitamin D is *not* only involved in the absorption of calcium and phosphorus from the intestines, but also plays an important role in the normal functioning of *every system* in the body, such as regulation of cell growth, differentiation of cells into specialized cells and eventually cell death, regulation of immune, cardiovascular and musculoskeletal systems, and insulin metabolism.

Like other hormones, vitamin D exerts its biologic effects through a specific chemical structure inside the cell, called Vitamin D receptor (VDR), which has been found in almost every tissue in the body. VDR is present inside the nucleus of a cell. After vitamin D binds to its receptor, it can affect various genes. Breakthrough research (1) from McGill University, Canada has revealed that vitamin D can affect more than 900 genes, directly or indirectly. In this way, vitamin D regulates a vast range of physiological processes inside the cell.

## Hormone D Deficiency or HDD

Scientists also discovered that vitamin D deficiency is much more prevalent than was previously thought. In fact, it has reached pandemic proportions around the world. This may partly explain the pandemics of chronic fatigue, osteoporosis, heart disease, hypertension, diabetes, cancer, asthma and other immunologic diseases. Proper vitamin D supplementation can help to prevent as well as treat most of these medical diseases. Unfortunately most physicians are *not* taking vitamin D seriously. Why? One reason is that it is mistakenly called a vitamin. And physicians are trained not to take vitamins seriously. Calling a hormone a vitamin is a serious medical mistake, which unfortunately continues in this day and age. Amazing!

It's time we correct this biggest *misnomer* in recent medical history. I am calling vitamin D deficiency as **Hormone D Deficiency or HDD**. Please join me in spreading this accurate terminology. In an attempt to educate my fellow physicians, I wrote an article in the July-August 2010 issue of *Endocrine Practice*, official journal of the American Association of Clinical Endocrinologists (2).

### References:

1. Wang TT, Tavera-Mendoza LE, Laperriere D, Libby E, MacLeod NB, Nagai Y, Bourdeau V, Konstorum A, Lallemand B, Zhang R, Mader S, White JH. Large-scale in silico and microarray-based identification of direct 1,25-dihydroxyvitamin D3 target genes. *Mol Endocrinol*. 2005 Nov;19(11):2685-95.

# Chapter 3

## Misconceptions About Vitamin D

There are a lot of misconceptions about vitamin D. Here are some common ones I've heard:

- “I drink milk, so I can't be low in vitamin D.”
- “I take a multivitamin and a calcium supplement every day, so my vitamin D should be okay.”
- “I eat healthy, so my vitamin D should be fine.”
- “I play tennis outdoors twice a week. How can I be low in vitamin D?”
- “I don't want to take vitamin D because I read about vitamin D toxicity. It's quite scary.”
- “I'm outdoors at least 15 minutes a day. My vitamin D should be fine.”
- “I live in a sunny place. How can I be low in Vitamin D?”
- “But a study did not find any benefits of vitamin D.”

When people make these comments, I simply advise them to have their vitamin D level checked. They're often surprised at the results. Most people turn out to be low in Vitamin D.

Contrary to common belief, milk is a poor source of vitamin D. In the USA, one cup of milk contains 100 I.U. of vitamin D. Now imagine trying to drink about 20-40 cups of milk a day to get a good level of vitamin D! The usual cup of milk added to your cereal provides you with just a *miniscule* amount of vitamin D.

People who take multivitamins and calcium supplements are under the impression they get enough vitamin D. Not true! I check vitamin D level in my patients who are on multivitamins and calcium supplements. Almost all of them turn out to be low in vitamin D. Why?

At the root of the problem is the recommended daily dose of vitamin D, which is old and

outdated. Currently, the recommended daily dose of Vitamin D is 400 - 600 I.U. (International Units). This dose of vitamin D was developed to prevent rickets, a bone disease in children.

In the last decade, scientific studies have shown that vitamin D is not only important for the health of bones, but is also vital for the health of virtually every cell in the body. However, you need a much higher dose of vitamin D than 400 - 600 I.U. a day to achieve these results.

In contrast, multivitamins and calcium supplements continue to follow the recommended daily dose. So when you read the label of a multivitamin or a calcium supplement, which claims that it meets 100% of the daily requirement for vitamin D, you obviously assume you take the right amounts of vitamin D. However, if you have your vitamin D level checked, you'll be in for a big surprise. Your vitamin D level will likely be low.

Sunshine is an excellent source of vitamin D. However, playing tennis or golf a couple of times a week is not enough. Neither is taking a walk 3 times a week or spending some weekends outdoors. I am amazed to see articles on vitamin D deficiency in newspapers and magazines which recommend that outdoor sun exposure for 15 minutes a day is enough to take care of your vitamin D requirement. How inaccurate!

For the last 13 years, I have checked vitamin D levels in all of my patients. Many of these people are active - outdoors about 30 to 60 minutes a day, playing golf or other sports two to three times a week and walking three times a week. They take multivitamins and calcium supplements containing vitamin D and yet they are still quite low in vitamin D. This is reality!

Occasionally, you may read or hear about a study that did not find any benefits of vitamin D. If you look at the study carefully, you will find that the researchers employed the recommended dose of vitamin D -400-600 IU per day- a dose which will prevent rickets and that's all. Whenever you look at a study on vitamin D, make sure that the researchers measured vitamin D levels and these levels were between 50-100 ng/ml, (which is equal to 125-250 nmol/L, units often used outside the USA.)

So why do people have these misconceptions about vitamin D? To answer this question, you have to answer another question. Where do people get their medical information? Usually from newspapers, magazines, TV and the internet. Unfortunately, many articles are written by people who have no real medical experience. Most of these professional writers simply gather information on vitamin D from previously published articles. In this way, inaccurate information in those previous articles simply gets recycled.

# Chapter 4

## Natural Sources Of Vitamin D

Where do we get our vitamin D? A lot of people recognize that we get vitamin D from the sun: Vitamin D is the “sunshine” vitamin. But are we getting enough vitamin D from the sun?

### Sun

*The Sun is the major source of vitamin D.* How much vitamin D you get from the sun varies from person to person. There are a number of factors that determine the amount of vitamin D you can get from the sun.

#### 1. Geographic Location.

Where you live determines how much vitamin D you *can* get from the sun. The farther North you live from the equator, the less is the intensity of sun rays reaching the earth. Therefore, your skin forms less vitamin D if you live in northern climates such as the North Eastern U.S., Canada and northern European countries.

#### 2. Season and time of the day.

Your skin *can* form more vitamin D during summer, but less during winter. This is because fewer sun rays reach the surface of Earth during winter. Similarly, the best time for the synthesis of vitamin D is between 10 am and 3 pm.

#### 3. Sun Screens, Pollution, Shade, Glass Windows, Clothing

Sunscreens, pollution, shade, glass windows and clothing all decrease the amount of UVB rays entering your skin and therefore, reduce the normal production of vitamin D by the skin. A sunscreen with a Sun Protection Factor (SPF) of 8 or more reduces the ability of the skin to form vitamin D by more than 95%. Complete cloud cover, shade and severe pollution reduce solar UVB energy by 50%.

#### 4. Age

Compared to a young person, the skin of an elderly person contains much less 7-dehydrocholesterol. Therefore, the skin of an elderly person typically manufactures only about 25% of vitamin D3 as compared to the skin of a young person.

## 5. Color of skin

The color of your skin comes from a pigment in the skin called *melanin*. The more melanin you have, the darker your skin color. Melanin serves as a natural sun screen and blocks sunrays from getting into deeper layers of skin. Therefore, darker skin is *less* efficient in synthesizing vitamin D from the sun as compared to fair skin. For example, an African American person may need 6-10 fold the time in the sun as compared to a white person in order to produce the same amount of vitamin D. However, people with darker skin are less likely to get skin cancer due to the protective effects of melanin. Nature is such an equalizer!

## DIET

*Diet is not a major source of vitamin D.* Some food items that naturally contain small amounts of vitamin D include oily fish such as salmon, mackerel and blue fish. The amount of vitamin D in fish remains unchanged if it is baked, but decreases about 50% if fish is fried. Also, farm raised salmon has only about 25% of vitamin D compared to wild salmon.

Vitamin D is also present in small quantities in vegetables, meat and egg yolks. Natural milk does *not* contain any vitamin D, but most milk in the USA (and some other countries) is fortified with vitamin D and therefore, contains small amounts of vitamin D. Vitamin D is also added in small amounts in dairy products such as cheese and some yogurts.

Most cereals in the USA are also fortified with small amounts of vitamin D. Orange juice is also fortified with a small amount of vitamin D.

**The following food items are supposed to contain the indicated amount of vitamin D:**

Cod Liver Oil, 1 Tablespoon = 1360, I.U.	Swordfish, cooked, 3 ounces = 566, I.U.	Salmon, cooked (3.5 ounces) = 360, I.U.
Mackerel, cooked (3.5 ounces) = 345, I.U.	Canned Tuna (3.0 ounces) = 200, I.U.	Sardines canned in oil, drained (1.75 ounces) = 250, I.U.
Raw Shiitake	Fortified Milk, one cup (8	Yogurt, from fortified milk,

Mushrooms (10 ounces) = 76, I.U.	ounces or 240 ml) = 100, I.U.	6 ounces = 80, I.U.
Margarine, fortified, 1 Tablespoon = 60, I.U.	Fortified Orange Juice, one cup (8 ounces or 240 ml) = 100, I.U.	Fortified Cereal 40-80 I.U. per serving.
Egg, 1 whole (vitamin D is found in the yolk) 20, I.U.	Liver of beef, cooked (3.5 ounces) = 15, I.U.	Swiss cheese (1 ounce) = 12, I.U.

\* I.U. = International Units

A word of caution! You can't rely on the stated quantities of vitamin D on food labels. In one study (1) researchers from Boston University School of Medicine, USA, found that 62 % of the milk samples they tested, contained less than 80% of the stated amount of vitamin D on the label. In addition, no vitamin D was detected in 3 of the 14 samples of skim milk tested. The vitamin D content of fish is also highly variable.

## Vitamin D3 Versus Vitamin D2

Natural vitamin D comes in two forms: vitamin D3 and vitamin D2. The proper chemical name for vitamin D3 is cholecalciferol and vitamin D2 is ergocalciferol. Vitamin D from the sun and fatty fish is vitamin D3 (cholecalciferol) and the one from vegetables is Vitamin D2 (ergocalciferol).

Over the counter vitamin supplements are mostly vitamin D3. A prescription form of vitamin D is vitamin D2 which comes in a large dose of 50,000 I.U. Recently, vitamin D3 has also become available in a high dose of 50,000 I.U.

In an excellent study (2) from Creighton University in Omaha, USA, researchers compared the blood levels of vitamin D level after administering a single dose of 50,000 IU of vitamin D2 or D3 in healthy volunteers. They concluded that vitamin D2 potency is less than one third that of vitamin D3. Certainly vitamin D3 is more physiological, as we humans synthesize Vitamin D3, and not D2, in our skin. For this reason, I primarily use vitamin D3 in my clinical practice.

## References:

1. Holick MF, Shao Q, Liu WW, et al. The vitamin D content of fortified milk and infant

# Chapter 5

## A Pandemic Of Vitamin D Deficiency

Believe it or not, we are facing a *pandemic* of vitamin D deficiency! Fifteen years ago, I started investigating vitamin D levels in my patients. To my surprise, the vast majority turned out to be low in vitamin D. My experience is in line with other researchers. For example, a study (1) from the National Institutes of Health, USA, analyzed the data on vitamin D status in the U.S. adult population from 2000-2004, which showed that 50-78% of Americans were low in vitamin D. What's alarming is that the situation is getting worse. In a study (2) from the University of Colorado, USA, researchers found that vitamin D levels in Americans were lower during the 2000-2004 period compared to the 1988-1994 period. Clearly vitamin D deficiency is rapidly getting worse.

Not only Americans, but people all around the world are suffering from vitamin D deficiency. For example, according to a publication (3) from The Medical Research Council Human Nutrition Research, United Kingdom, 90% of adults in the United Kingdom were found to be low in vitamin D. In a study (4) from Sri Venkateswara Institute of Medical Sciences, India, researchers concluded that 82% of individuals in India had varying degrees of low vitamin D levels. In a study (5) from The Chinese University of Hong Kong, researchers assessed vitamin D levels in women in Beijing and Hong Kong. Over 90% of women in both cities were low in vitamin D. In another study (6), from the University of Tokyo, Japan, investigators found that 82% of Japanese men and women were low in vitamin D. In a study (7) from Qassim University, Saudi Arabia, all participants were low in vitamin D. In a study (8) from the University of São Paulo, Brazil, 100% of men and women were found to be low in vitamin D.

Vitamin D deficiency is the true pandemic of our times. It is perhaps more common than any other medical condition at the present time.

### It Spares No Age

Infants, children, adults and elderly are all low in Vitamin D. In my extensive clinical experience, it's rare to find someone who has a good level of vitamin D. In my practice, the age of patients range from 15 to 95. I find an overwhelming majority of these patients to be low in vitamin D. Several studies have clearly demonstrated that vitamin D deficiency spans across all age groups.

## **It Spares No Geographic Location**

According to an old paradigm, vitamin D deficiency exists only in northern areas with severe prolonged winters such as Canada, the Northeastern U.S., the U.K. and other northern European countries. However, in reality, vitamin D deficiency is highly prevalent even in sunny, warm places such as the Middle East, India, Pakistan, Brazil, Mexico, New Zealand and Australia. In my own extensive clinical experience in southern California, I have found that most of my patients are low in vitamin D. Vitamin D deficiency is a global phenomenon.

If you live in northern climates, you are more prone to vitamin D deficiency because you can't get enough vitamin D during winter months. In places above 42 degrees North latitude (approximately a line drawn between the northern border of California and Boston), there isn't sufficient solar UVB (Ultra Violet B) energy to form vitamin D in the skin during winter time (from November through February). In far northern latitudes, this decrease in solar energy may last up to 6 months.

In areas below 34 degrees North latitude (approximately a line drawn between Los Angeles and Columbia, North Carolina), there's enough solar UVB energy for skin synthesis of vitamin D throughout the year. *But even in these areas, the sun can't give you vitamin D if you avoid it by using clothing, sun screen lotions or by simply staying out of it.* Therefore, you may live in a sunny place south of 34 degrees latitude, but still be low in vitamin D.

Several clinical studies have shown that vitamin D deficiency is extremely common in the sunny Middle East, primarily because the skin doesn't get enough sun exposure. Due to cultural habits, people avoid the sun and cover most of their body with clothes. This is particularly true in the case of women living in these countries.

## **It Spares No Race**

Although fair skin is more efficient in synthesizing vitamin D from sun exposure as compared to dark skin, people with fair skin avoid the sun more than people with dark skin for fear of skin cancer. Even when they go out, they often apply a layer of sunscreen, which prevents vitamin D synthesis. In my extensive clinical experience, I've found people from various racial and ethnic groups to be low in vitamin D.

## **What Are The Causes For The Pandemic Of Vitamin D Deficiency?**

# 1. Modern Life-Style

Let's take a historic look on vitamin D. It appears that humans started their journey on planet Earth in Africa where there was plenty of sunshine. These early humans covered little, if any, parts of their body. With slow migration northwards over thousands of years, the skin gradually adapted to colder northern climates by reducing the content of its natural sun screen (melanin) and consequently, skin became lighter in color. People with light skin were then able to synthesize enough vitamin D in brief exposures to sunshine.

Vitamin D deficiency is a relatively new phenomenon. Scientists first recognized it in the seventeenth century in the U.K. and other Northern European countries. Interestingly, it coincided with the period of the *Industrial Revolution* when people flocked to big industrial cities and lived in multistoried buildings with narrow, dark alleys. Pollution from coal burning factories created a thick layer of smog. These factors significantly reduced the amount of sun rays reaching Earth in these regions which already had marginal sunshine during long winter periods.

The phenomenon of the Industrial Revolution continued in the newly discovered lands of America and Canada. In addition, native Africans were enslaved and transported in ships to America over a period of months. Compare this *rapid* migration to the thousands of years it took for early Africans to migrate to Europe, allowing for their skin to adapt to less sunshine. In contrast, this recent migration was extraordinarily rapid, allowing no time for the skin to adapt to conditions of less sunshine. For this reason, African-Americans as a group are particularly low in vitamin D. In recent years, worldwide migration happens at an even faster pace. In a matter of hours, you can migrate from one region of the world to another. That's why people from various parts of Asia and Africa who migrate to the U.K and North America are particularly low in vitamin D.

Now consider another interesting phenomenon. As a result of the *Industrial Revolution*, people with fair skin were able to rapidly migrate to Southern regions with plenty of sunshine. Their skin didn't have time to adapt to these new sunny environments. Therefore, these fair skinned people started developing skin cancer from excessive sun exposure. This led to the development of sunscreen lotions and the drum beat of "avoid the sun!" Even people with dark skin started applying sunscreen lotions under the impression that "it's a healthy habit."

The main reason we're facing an epidemic of vitamin D deficiency is our modern life-style, which minimizes our exposure to the sun. Our technological revolution has dramatically changed lifestyles around the globe. Most people work indoors. They leave their homes early in the morning and return home around sunset or even after dark (especially during winter time). Even at lunch, most people drive to a restaurant or stay

inside to eat. Many people spend their lunch break in their office. Over the weekend, we watch TV or surf the internet for entertainment. Teenagers usually stay indoors hooked to a computer, smart phone or other electronic gadgets rather than going outdoors and playing real sports. While shopping, people are mostly indoors thanks to huge grocery stores and shopping malls. Many of the elderly live in assisted living facilities or nursing homes and don't get any sun exposure. Just observe yourself. How often do you, your family and friends stay indoors while carrying out usual activities of daily living?

## **2. Sun Phobia**

Over the last 30 years or so, sun avoidance has been successfully drilled into the minds of the general public. People are simply scared of the *so-called* ill-effects of the sun including skin cancer, wrinkles and aging spots. Due to sun phobia, people avoid sun exposure at all costs. When we go outside for even a little while, we make sure to apply sun screen. Parents compulsively apply sunscreen before they allow their children to go outdoors. Many people don't realize that sunscreen also prevents vitamin D synthesis in the skin.

## **3. Obesity**

Vitamin D is fat soluble. Therefore, it gets stored in the fat in your body. In obese individuals, there is excessive storage of vitamin D in fat. Consequently, the circulating level of vitamin D is low in these individuals. Obesity has reached epidemic proportions in the USA and the rest of the world is also catching up in this regard. The epidemic of obesity is contributing to the epidemic of vitamin D deficiency. It's interesting to note that in most cases, obesity is a product of our modern life-style as well.

In a study (9) from City University of New York, USA, researchers looked at the levels of vitamin D in 12,927 adults 18 years and older living in the USA. They found that overweight and obese individuals were 24% and 55%, respectively, less likely to have an adequate level of vitamin D compared with their normal-weight counterparts.

In one study (10) from Columbia University Medical Center, USA, researchers assessed vitamin D status in 56 obese men and women. Vitamin D was low in all individuals. It was inversely associated with BMI (Body Mass Index). In other words, the more obese you are, the lower your vitamin D level.

## **4. Medical Illnesses**

Malabsorption:

Because vitamin D is fat soluble, vitamin D deficiency can develop in medical conditions that cause malabsorption of fat, such as surgical resection of the small intestine and stomach, chronic pancreatitis, pancreatic surgery, celiac sprue, Crohn's colitis and cystic fibrosis.

### Liver and Kidney Diseases:

Vitamin D from the blood is taken up by the liver where it is transformed into 25 (OH) Vitamin D which in the kidneys is further transformed into 1,25 (OH)<sub>2</sub> Vitamin D. Therefore, vitamin D deficiency develops in chronic liver disease such as cirrhosis and in chronic kidney disease.

## **5. Medications**

Some medications can further decrease vitamin D level. These medications include: Phenytoin (brand name Dilantin), Phenobarbital, Rifampin, Orlistat (brand names Xenical and Alli), Cholestyramine (brand names Questran, LoCholest and Prevalite) and Steroids

I often see patients who have been on these drugs for a long time, yet they're completely unaware these drugs can rob them of vitamin D. They react with disbelief when I inform them about the relationship between these medications and vitamin D deficiency. "Why didn't my other doctor tell me about it?" is their usual question. Of course, it's your doctor's responsibility to inform you about the side-effects of medicines. Unfortunately, the reality is that some do and some don't.

So educate yourself and be a partner in taking charge of your health. That's why you're reading this book. Nothing can be more rewarding for me than providing you with the information you need to help take care of your vitamin D needs in collaboration with your health care provider.

## **6. Current Recommendations on Vitamin D Intake are Inadequate**

Many people taking vitamins assume that their vitamin D level is okay because the label on their vitamin bottle says it meets 100% of the daily requirements. This misconception is one of the major reasons for vitamin D deficiency among those people who are proactive in taking care of their health.

Vitamin manufacturers follow government guidelines for the daily recommended amounts of various vitamins and minerals. As of 2015, the recommended daily allowance of vitamin D in the USA is: 400 I.U. (International Units) from birth to age 1, then 600 I.U. from age 1 until age 70, and 800 I.U. if you are older than 70.

In various parts of the world, vitamin D dose is also expressed in microgram (mcg) instead of I.U. Therefore, you need to convert I.U. into micrograms.

**Here is the table to convert from I.U. to mcg.**

400 I.U.	10 mcg.
600 I.U.	15 mcg.
800 I.U.	20 mcg.

Based on my vast clinical experience, most people need a much higher dose of vitamin D to obtain an optimal level of vitamin D. In addition, how much vitamin D a person needs is dependent on a number of factors, as you will learn in this book. Therefore, the optimal dose of vitamin D varies from person to person, and in the same person from summer to winter. Hence, the one-size-fits-all approach is not very scientific.

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## Chapter 6

# **Vitamin D Deficiency and Body Aches, Pains And Chronic Fatigue Syndrome**

Body aches, pains and chronic fatigue are the most common complaints that doctors hear from their patients. While there are many reasons why people develop body aches, pains and fatigue, one *common and easily treatable* cause is vitamin D deficiency. Unfortunately, it often remains undiagnosed and untreated. Consequently, people continue to suffer from chronic pains and fatigue for many years.

## **The Link Between Vitamin D Deficiency And Body Aches, Pains and Chronic Fatigue**

Vitamin D has a close relationship with another hormone known as Parathyroid Hormone (PTH) which is produced by the parathyroid glands, four tiny structures lying low in the neck behind the thyroid gland.

Under normal conditions, PTH is important in maintaining a normal level of calcium in the blood, which is important for the normal functioning of each and every cell in the body, particularly muscle cells and heart cells. PTH maintains a normal level of calcium in the blood by acting on the kidneys, bones and intestines. By acting on the kidneys, it prevents excessive loss of calcium in the urine. It also helps the kidneys convert 25 (OH) vitamin D into 1,25 (OH)<sub>2</sub> vitamin D, which then acts on the intestines and helps in the absorption of calcium and phosphorus into the blood stream. By acting on the bones, PTH dissolves their calcium and brings that calcium into the blood stream.

In people with vitamin D deficiency, the parathyroid glands start to produce more than the normal amount of PTH. Large amounts of PTH then cause excessive dissolving of calcium from the bones. Consequently, bones become weak. These people then start to experience bone aches and pains, which are diffuse and deep. People often can't describe them precisely, but say things like:

“Doc, my whole body hurts.”

“It hurts all over.”

“My body just aches. I feel like someone pulled the plug.”

But sometimes, patients can describe these pains with precision: “Doc, this pain feels deep, as if my bones are aching.”

As a result of generalized aches and pains, you also feel tired and fatigued. You may feel like taking a nap in the afternoon. Typically, you visit your family physician who puts you on pain medications and runs a bunch of expensive tests, which often turn out to be normal. You are then referred to a number of specialists who order more special diagnostic tests. Results of all these tests are often normal as well. Meanwhile, no one orders a test for vitamin D and PTH and therefore, your true diagnosis remains elusive. Some specialist may give you the diagnosis of Fibromyalgia, Chronic Pain Syndrome or Chronic Fatigue Syndrome. This simply describes your symptoms in fancy medical terminology, but obviously doesn't get to the root of your problem.

You and your physician are perplexed. What's really causing these pains? “It must be in your head.” Your doctor suggests an anti-anxiety/anti-depression medication. You may actually be anxious and/or depressed because of your frustration. After all, you've undergone extensive testing and yet no one really knows what's wrong with you. You start thinking the worst: “Maybe it's some cancer they haven't diagnosed yet.” It's understandable if you're anxious or depressed.

By this time, you're willing to accept any diagnosis. So you buy into any explanation your physician offers. I have heard all kinds of interesting explanations given to patients by their physicians. Here are some examples:

“Your aches and pains are due to anxiety and depression.”

“It's just from getting old!”

“You have fibromyalgia.”

“You have Chronic Fatigue Syndrome”

“You're suffering from frailty.”

So your physician puts you on anti-anxiety/anti-depression medications in addition to the pain killers you're already taking. Each drug may cause some side-effects. Often you

develop new symptoms for which you're given a new medication and then you experience their side-effects. A vicious cycle sets in.

Before you know it, you're on a long list of medications and still having a lot of symptoms, including generalized aches and pains. Because these medications give temporary relief of your symptoms, you get attached to them. You start to think you can't live without them. You go from physician to physician looking for pain and anti-anxiety medications, which sooner or later, they refuse to refill. Eventually, you may be referred to a pain specialist. Now you are in for some heavy duty pain medications and sometimes, your pain specialist recommends complicated procedures aimed at treating your Chronic Pain Syndrome. These pain medications are often narcotics with potential for addiction and many other serious side-effects. Over the years, I have seen many such unfortunate messed up cases.

In medical literature, there are several studies which clearly demonstrate that patients with chronic muscles aches and pains continue to suffer simply because their physicians fail to diagnose vitamin D deficiency as the root cause of their symptoms. In one such study (1), researchers investigated vitamin D level in patients with chronic muscle aches and pains at a university-affiliated clinic in Minneapolis, Minnesota, USA. They were amazed to find out that nearly all of their patients were low in vitamin D. Many had severe deficiency of vitamin D. Some had been seeing doctors for years and vitamin D deficiency was not even considered as a cause of their disabling symptoms.

Perhaps now, you realize how frequently physicians miss the diagnosis of vitamin D deficiency as the root cause of chronic muscle aches and pains. Therefore, you have to be proactive in taking charge of your health. Get your vitamin D level tested and get on the proper dose of Vitamin D! (See Chapters 25 and 26 on Diagnosis and Treatment of Vitamin D Deficiency) I have many patients in my practice whose body aches and pains simply disappeared after proper replacement of vitamin D.

## **Secondary Hyperparathyroidism**

When vitamin D deficiency goes undiagnosed and untreated, PTH level in the blood becomes elevated. In medical terms, we call it *secondary hyperparathyroidism*. Your blood calcium level is normal at this stage of your disease of chronic vitamin D deficiency. Physicians generally don't order a PTH test when your calcium level is normal. That's what they were taught in medical schools! Therefore, secondary hyperparathyroidism often remains undiagnosed.

Unfortunately, this high level of PTH comes with a price. It erodes your bones, causing

them to ache. Medically speaking, we call it *osteomalacia*. In plain language, your bones are weak, they ache and they can also easily fracture.

*Therefore, if you have bone pains, muscle aches, or chronic fatigue, make sure you get a 25 (OH) vitamin D blood test and a PTH blood test, even if your **blood calcium level is normal.***

## Treatment Of Secondary Hyperparathyroidism

Secondary hyperparathyroidism is due to vitamin D deficiency. Obviously, you treat this condition with vitamin D supplementation. Surprisingly, I have seen patients whose parathyroid glands were *inappropriately* surgically removed to treat their secondary hyperparathyroidism.

In a study (2) from Helsinki University Central Hospital, Finland, researchers performed a statistical analysis of 52 published clinical trials, including 72 intervention groups and 6290 patients. They found an *inverse* relationship between vitamin D level and PTH level. In other words, the lower the vitamin D level, the higher the PTH level. They also found that PTH level decreases in a *linear* fashion during vitamin D supplementation. In other words, as vitamin D level goes up, PTH level comes down proportionately.

I have similar experience at the Jamila Diabetes and Endocrine Medical Center. Here is a case study to illustrate these points:

### Case Study

A 61 year old Caucasian female consulted me for Hyperparathyroidism and Osteoporosis. Her primary care physician had put her on Actonel, without ever checking her vitamin D level. She stopped taking Actonel after she read its potential horrendous side-effects.

She had a history of breast cancer, diagnosed 5 years ago, for which she underwent breast surgery and radiation. She had seen several physicians, and none of them mentioned anything about vitamin D. After reading my book, "Power of Vitamin D," she became aware of the benefits of vitamin D and started to take 1000 IU of Vitamin D3 per day. When she consulted me, she was having fatigue, and generalized body aches and pains. I checked her blood levels of vitamin D, PTH and Calcium, which were as follows:

25 OH Vitamin D = 32 ng/ml (Normal range: 30-100)

PTH intact = 101 pg/ml (Normal range: 14-72)

Blood Calcium = 10.3 mg/dl (Normal range: 8.6-10.4)

I diagnosed her with Secondary Hyperparathyroidism due to vitamin D deficiency. Even though vitamin D at a daily dose of 1000 IU had brought her vitamin D level at the low normal range, it was still low for her, which caused an elevation in her PTH level. Secondary Hyperparathyroidism was the main reason for her osteoporosis.

Over the next two years, I gradually increased her dose of Vitamin D to 20,000 IU per day. Her PTH level has come down into the normal range as her vitamin D level rose into high normal range.

Here are her Progress Notes:

	<b>Baseline</b>	<b>1 year</b>	<b>2 year</b>
<b>25 OH Vitamin D</b> Normal range: 30-100 ng/ml	32	48	93
<b>PTH, intact</b> Normal range: 14-72 pg/ml	101	78	50
<b>Calcium</b> Normal range: 8.6-10.4 mg/dl	10.3	10.0	10.3
<b>Daily Dose of Vitamin D3</b>	1000 IU	15,000 IU	20,000 IU

As you can see, her PTH and blood calcium levels have stayed in the normal range on high doses of vitamin D. She feels great. No kidney stones. No aches or pains. No bone fractures.

Her primary care physician, on his own, decided to order a parathyroid scan, which turned out to be normal. There was no tumor of the parathyroid gland.

## **Tertiary Hyperparathyroidism / Primary Hyperparathyroidism**

If vitamin D deficiency and resulting secondary hyperparathyroidism is not properly

treated, eventually, one or more of your parathyroid glands may get enlarged from all the overwork they have to do. At this stage of chronic vitamin D deficiency, your *blood calcium level also becomes elevated*. I call this advanced stage of chronic vitamin D deficiency *tertiary hyperparathyroidism*. Tertiary means that your disease has progressed from secondary hyperparathyroidism to a more advanced stage. However, traditionally, it is called *primary hyperparathyroidism*.

Typically, a physician is trained to order a blood level of PTH in a patient with elevated calcium level in the blood. If PTH turns out to be high, the patient is diagnosed with primary hyperparathyroidism. As a knee jerk reflex, the patient is then sent for parathyroid surgery.

I have a problem with this terminology of primary hyperparathyroidism, because it implies that your PTH level became elevated for some *unknown* reason. With this mind set, physicians, even at this advanced stage of the disease, don't order a vitamin D level. This terminology of primary hyperparathyroidism comes from the era when we did not test our patients for vitamin D deficiency as we do now. Unfortunately, most physicians remain stuck in their old way of thinking.

My belief is that most cases of primary hyperparathyroidism are actually tertiary hyperparathyroidism, the result of years and years of untreated vitamin D deficiency. With early diagnosis and treatment of vitamin D deficiency, we should be able to prevent a large number of these cases of so called primary hyperparathyroidism.

Rarely, blood level of calcium and PTH are elevated despite an optimal level of vitamin D. These are the true cases of primary hyperparathyroidism. What is an optimal level of vitamin D? Please refer to Chapter on Treatment of Vitamin D Deficiency. It's interesting to note that the prevalence of primary hyperparathyroidism has increased tremendously in the last three decades. This precisely coincides with the widespread usage of sunscreen lotions and an epidemic of obesity, both of which have contributed to the epidemic of vitamin D deficiency.

## **Combined Primary Hyperparathyroidism And Secondary Hyperparathyroidism**

Even in these true cases of primary hyperparathyroidism, there is often a component of secondary hyperparathyroidism, which is easily treatable with vitamin D. Consequently, with proper vitamin D supplementation, your PTH level comes down, although it may not get into the normal range.

In general, when you are diagnosed with Primary Hyperparathyroidism, your physician

often does not even bother to investigate your vitamin D level. Hence, your vitamin D deficiency remains undiagnosed with all of its negative consequences. Often, you are even given the advice to *stop* taking vitamin D, as your physician is afraid that vitamin D will further increase the calcium level in your blood. The reality is actually quite opposite.

In a study (3) from Warwickshire Institute for the Study of Diabetes, Endocrinology and Metabolism, University Hospitals in the UK, researchers observed forty consecutive patients with primary hyperparathyroidism and coexistent vitamin D deficiency. They found that those patients who were treated with vitamin D had a significant drop of 21% in their PTH level, compared to those who did not receive vitamin D. They followed these patients up to 54 months and found treatment with vitamin D to be safe, without any increase in the calcium level in the blood or any detrimental effects on the kidneys.

## **When To Consider Parathyroid Surgery**

In the late stage of parathyroid disease (tertiary or primary hyperparathyroidism) due to chronic vitamin D deficiency, if your blood calcium remains elevated above 11 mg/dl even after you have achieved an optimal blood level of vitamin D (discussed in Chapter 26, on Treatment of Vitamin D Deficiency), you should consider parathyroid surgery.

Some people with elevated blood calcium level may also develop kidney stones. These patients should have parathyroid surgery. High calcium in the blood leads to high spillage of calcium in the urine and consequently, increases your risk for calcium stone formation in the kidneys. This high spillage of calcium in the urine can be easily diagnosed with a test ordered by your physician. In this test, called 24 hours urine for calcium, you collect your urine for 24 hours and take it to the laboratory for calcium testing. Contact the laboratory in advance for special instructions as well as a special bottle to collect your urine.

If you have high blood calcium, high PTH level and your 24 hours urine calcium is more than 300 mg, you are at high risk for calcium stone formations in the kidneys. You may consider parathyroid surgery even if you don't yet have kidney stones.

Some patients with tertiary (primary) hyperparathyroidism may develop severe osteoporosis and are at risk for fracture of their bones. They should also consider parathyroid surgery.

## **You Need Vitamin D Replacement Even After Parathyroid Surgery**

Parathyroid surgery does not treat the disease itself: vitamin D deficiency. Symptoms of vitamin D deficiency such as body aches, pains and chronic fatigue are not going to go away just by doing parathyroid surgery. Many physicians are not aware of this fact. Typically, patients undergo parathyroid surgery, but still no one orders vitamin D level. Please remember that even after parathyroid surgery, you will need proper replacement with vitamin D.

Perhaps now, you can understand why an early diagnosis and proper treatment of vitamin D deficiency can save you from a lot of misery. You can prevent body aches, pains, osteoporosis, kidney stones and parathyroid surgery.

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