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KOFINAS PERINATAL
Providing care to the unborn

UPDATES ON PERINATAL ISSUES AND NEWS ABOUT KOFINAS PERINATAL

The Health Benefits of Vitamin D

Vitamin D is not just a vitamin, it is also a very valuable hormone

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Kofinas Perinatal Baby of the Month

" Justin London was born February 12th 2010. While many said it was not possible to conceive a baby in my forties...we were lovingly lead to our miracle baby.
Justin is 5 weeks now and holds his head up, smiles and is cooing all the time. He is the love of our lives and brings us endless

joy each and every day. Each day his personality is getting more and more special.
We are eternally thankful to all the people who made this journey possible "

Proud Parents
Lorna and Petter

A *vitamin* is an organic compound required as a nutrient in tiny amounts by an organism. The term vitamin was derived from "vitamine", a combination word from *vital* and *amine*, because it was suggested that the organic micronutrient food factors which prevented beriberi and perhaps other similar dietary-deficiency diseases, might be chemical amines. This proved incorrect for the micronutrient class, and the word was shortened to “vitamin”. Today, a chemical compound is called a vitamin when it cannot be synthesized in sufficient quantities by an organism, and must be obtained from the diet. Thus, the term is conditional both on the circumstances and the particular organism. For example, ascorbic acid functions as vitamin C for some animals but not others, and vitamins D, K and biotin are required in the human diet only in certain circumstances. The term *vitamin* does not include other essential nutrients such as dietary minerals, essential fatty acids, or essential amino acids, nor does it encompass the large number of other nutrients that promote health but are otherwise required less often.

Vitamins are classified by their biological and chemical activity, not their structure. Thus, each "vitamin" refers to a number of *vitamer* compounds that all show the biological activity associated with a particular vitamin. Such a set of chemicals are grouped under an alphabetized vitamin "generic descriptor" title, such as "vitamin

A", which includes the compounds retinal, retinol, and four known carotenoids. *Vitamers* by definition are convertible to the active form of the vitamin in the body, and are sometimes inter-convertible to one another, as well.

Vitamins have diverse biochemical functions. Some have hormone-like functions as regulators of mineral metabolism (e.g. vitamin D), or regulators of cell and tissue growth and differentiation (e.g. some forms of vitamin A). Others function as antioxidants (e.g. vitamin E and sometimes vitamin C). The largest number of vitamins (e.g. B complex vitamins) function as precursors for enzyme cofactors (facilitators), that help enzymes in their work as catalysts in various metabolic pathways. In this role, vitamins may be tightly bound to enzymes as part of prosthetic groups: for example, biotin is part of enzymes involved in making fatty acids. Alternately, vitamins may also be less tightly bound to enzyme catalysts as coenzymes, detachable molecules which function to carry chemical groups or electrons between molecules. For example, folic acid carries various forms of carbon group – methyl, formyl and methylene - in the cell. Although these roles in assisting enzyme-substrate reactions are vitamins' best-known function, the other vitamin functions are equally important.

Until the 1900s, vitamins were obtained solely through food intake, and changes in diet (which, for example, could occur during a particular growing season) could alter the types and amounts of vitamins ingested. In the early 1920s, many vitamins were produced in the laboratory and thus became commercially available in the form of food fortification (folic acid in cereals) as well as food supplements to be taken for therapeutic or prophylactic reasons. A whole new industry of nutritional supplements was created and has grown to a multibillion dollar industry in the last 60 years of so. There are a lot of good and a lot of bad issues regarding this industry and this will be left to be discussed in a separate issue that will deal with the nutritional supplements industry as a whole.

This issue of the newsletter presents current knowledge on the health benefits of vitamin D that have been discovered in recent years. Research has shown that there is no tissue of the human body that does not have receptors (molecular structures made specifically to accept a given substance much like the keyhole and the key) for vitamin D. Such receptors are present in the brain, the adrenals, the kidneys, the heart, the bone, the skin and a lot more tissues. In this capacity, vitamin D is indeed a hormone and as we will see in the rest of the article, a very important hormone for maintaining a healthy body.

Vitamin D Metabolism in the Human Body

Vitamin D can be obtained from the diet and by the action of sunlight on the skin. Exposure of the skin to the UV rays of sunlight induces the photolytic conversion of 7-dehydrocholesterole to pre-vitamin D_3. Only a few natural food sources contain significant amounts of vitamins D_2 and D_3, but many foods are now fortified with vitamin D. Vitamin D_3 is the active form of vitamin D. Despite fortification of foods with vitamin D, vitamin D deficiency persists in more than 80% of European and North American populations due to nutritional deficit and lack of sunlight exposure. Most of us have been trained to avoid sunlight and to always use sunscreens whenever we have to be out on the sun. This is a serious health care concern because as we will see in this issue, vitamin D deficiency has been associated with many devastating chronic diseases

such as cancer, autoimmune diseases (lupus, Alzheimer's, thyroid etc.), diabetes and hypertension. In addition, some of the actions of vitamin D3 are the following:

•Endocrine actions (distal tissue effects)

- •intestinal calcium transport
- •bone metabolism
- •renal calcium re-absorption
- •blood pressure
- •insulin secretion

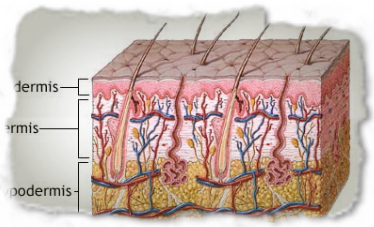
•Autocrine/paracrine actions (local tissue effects)

- •inhibition of cell proliferation (anti-cancer effect)
- •promotion of cell differentiation (anti-cancer effect)
- •regulation of the immune system

Vitamin D and its metabolites are lipophilic molecules (need fatty environment to be absorbed and to enter the target cells). There are not soluble in aqueous (watery) solutions and for this reason in the blood they are attached to a special transporter molecule. This molecule is called Vitamin D binding protein (DBP). Approximately 99% of vitamin D circulating in the blood is bound to DBP.

Vitamin D and the Skin

The skin represents one of the key tissues for the human body's vitamin D endocrine system, which is of critical importance for a broad variety of independent physiological functions. It is well known that vitamin D3 (the active form) is essential for mineral homeostasis (regulation) and bone integrity. The critical importance of the skin for the human body's vitamin D endocrine system is documented by the fact that the skin is, first the site of vitamin D_3 synthesis, and second a target organ for it. Vitamin D_3 is essential for a broad variety of physiological functions including regulation of growth and differentiation in a broad variety of normal and malignant tissues, including cells derived from prostate, breast and bone tissues. Vitamin D is a potent agent for the treatment of various skin conditions and specifically psoriasis (red, scaly patches on the skin) in addition to skin melanoma, and scleroderma.



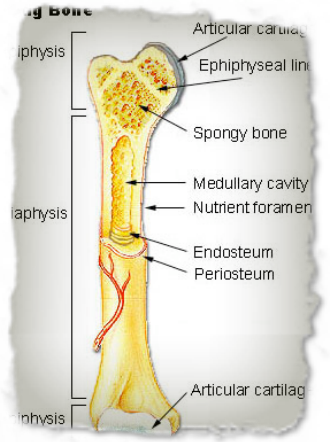
Vitamin D and Intestine

Vitamin D is essential to enhance the efficiency of the small intestine to absorb dietary calcium and phosphate (together they form our bones). By means of specialized receptors, vitamin D facilitates the absorption of calcium from the intestine and thus increases the availability of calcium for bodily functions by increasing the delivery of calcium to the blood stream. The intestine also expresses receptors that create a negative feedback mechanism. This mechanism controls the absorption of calcium to prevent calcium overload. So, when we are low on calcium, the intestine increases the absorption and

when we are high, it shuts down the absorption of calcium. Calcium toxicity is lethal to humans and most other species.

Vitamin D and Skeleton Health

I will not devote too much energy here. The bone effects of vitamin D are the oldest known effects; in fact, rickets (a skeletal disease) was the reason we discovered vitamin D. Vitamin D is essential for the development and maintenance of a mineralized skeleton. Vitamin D deficiency results in rickets in young growing children animals and osteomalacia (weakening of the bones) in adults. Vitamin D mediates its effects on the bone system by modulation of the actions of specialized bone cells known as osteoblasts (build new bone) and osteoclasts (break down bone) and by its effects on the parathyroid gland of which vitamin D is a potent modulator.



Vitamin D and Immune System

The immune system defends the body against microbial invasion by activating both adaptive and innate mechanisms. The innate immune system (first line of defense against outside infectious insults) is the more primitive system, built into cells that are on the front line for defense against bacterial and viral invasion, including epithelial (top lining) cells in the skin, gut, and lung, as well as macrophages and neutrophils. The adaptive immune system provides a more specific response but takes longer to develop; once developed, however, it provides a powerful response against invading organisms and is the system that provides life-long immunity after the first infection with an invading microorganism. The adaptive immune system develops over time in response to antigenic insults such as bacteria, viruses, organic environmental substances, environmental industrial toxins etc. Vitamin D regulates both types of immunity, suppressing adaptive immunity but potentiating the innate immune response.

Although the role of 1,25(OH)2D3 (vitamin D_3) is generally beneficial to our health, it may become detrimental if abused. However, vitamin D deficiency has long been known to predispose to a variety of infections, indicating an important role for vitamin D in host immune defense. Increasing evidence suggests that vitamin D has a beneficial role in preventing and treating various autoimmune diseases and prolonging the survival of transplanted organs. Thus, though the benefits of vitamin D in preventing and treating osteoporosis are well known, its role in protecting against infections and self destruction is becoming better appreciated.

Vitamin D and Diabetes

In experimental animals, vitamin D deficiency associates with an earlier and more aggressive onset of diabetes, probably related to the

Childhood obesity and diabetes are on the rise and vitamin D deficiency is certainly at least in part responsible for the epidemic

abnormalities in immune function, and impaired glucose-mediated insulin secretion that can be reversed with vitamin D replenishment. This effect can be mediated via effects on intracellular pancreatic cell calcium or via a direct effect on the pancreatic cells by vitamin D binding to specialized receptors. The pancreatic cells that secrete insulin (beta-islet pancreatic cells) express local receptors for the attachment and function of vitamin D in an autocrine (local cell) function. This becomes evident when administration of vitamin D in patients with low insulin secretion and low calcium levels, corrects the insulin defect before normalization of intracellular calcium.

Vitamin D and Muscle Function

Patients with vitamin D deficiency experience muscle weakness and atrophy (muscle wasting), with electrophysiological abnormalities in muscle contraction and relaxation. This happens to patients with nutritional vitamin D deficiency as well as deficiency that is caused by other conditions such as chronic kidney disease and prolonged use of anti-convulsant drugs.

Vitamin D and Cardiac Function

In the heart, vitamin D controls hypertrophy in cardiac myocytes (muscle cells of the heart) and the production and release of atrial natriuretic factor; this factor regulates the blood volume of the heart in various cardiac conditions. In patients with cardiac weakness from cardiomyopathy, vitamin D administration improves contractility and function of the heart. The precise mechanism is not known. A variety of studies published recently has shown that vitamin D hormone (calcitriol) exerts important physiological effects in cardiomyocytes, vascular smooth muscle cells, and the vascular endothelium (lining of vessels). Some of the cardiac effects of vitamin D deficiency may be mediated by its effects on the renin-angiotensin system which regulates our blood pressure and any deficiency leads to high blood pressure (hypertension). Low levels of the calcitriol precursor 25-hydoxyvitamin D are associated with myocardial infarction, congestive heart failure, and calcific aortic stenosis. Deficient calcitriol concentrations probably contribute to the massive vascular calcification seen in chronic kidney disease. In patients with end-stage renal disease and end-stage heart failure, very low-circulating calcitriol levels or nonuse of active vitamin D or both are independently associated with high mortality rates. Despite these exciting data, it is still too early to recommend exact dosages for the prevention or therapy of coronary heart disease. Prospective, randomized controlled trials with

different amounts of vitamin D and probably with its active form calcitriol are needed to determine whether vitamin D can prevent coronary heart disease events and mortality. There is ever increasing evidence that vitamin D deficiency is linked to excess overall mortality. However, future studies should clarify to which extent vitamin D supplementation can improve survival in the aging population and in specific patient groups.

Vitamin D and the Nervous System

Vitamin D actions in the nervous system induce the development of vitamin D receptors (VDR) in the brain and on several regions of the central and peripheral nervous system. This improves the conductance velocity (speed of transmission of nerve impulses) of the motor neurons, and the synthesis of neurotrophic factors (factors that stimulate the nervous tissues to grow), such as nerve growth factors and neurotrophyns that prevent loss of injured neurons. In addition, vitamin D enhances the expression of glial cell derived neurotrophic factor, a potential candidate for treatment of Parkinson's disease. Vitamin D has been shown to exert neuroprotective effects on brain tissues injured by ischemia (low blood supply). The association of vitamin D deficiency and abnormal brain development makes vitamin D an attractive candidate for treatment of schizophrenia, a disorder resulting from gene-environment interactions that disrupt brain development.

What should you do to optimize your vitamin D levels for best health?

Critical findings in the last five years have improved our understanding of vitamin D bioactivation and actions and the relevance of the vitamin D endocrine system in disease prevention. In my opinion, it will take many years before all the questions regarding the health benefits of vitamin D are answered. The fact of the matter is that there evidence so far overwhelmingly shows that vitamin D is a very important regulator of human health and it is prudent, both scientifically as well as from a clinical point of view, that all healthy individuals take all actions necessary to maintain proper vitamin D levels as outlined below:

☑ First and foremost have your vitamin D levels checked by a simple blood test that can be performed by all commercial laboratories.

☑ Normal levels range according to the laboratory used. Most laboratories use a range of normal values between 30 and 100 ng/mL. However, like all normal values, this value does not mean much other than as a general reference. For optimal body health vitamin D levels should range between 50 ng/mL and 70 ng/mL.

☑ If exposure to UV sun rays was not a problem, all of us would have plenty of vitamin D manufactured in our own skin. This is not the case however and

for the most part from early fall to late spring, we should take vitamin D supplements to maintain healthy levels. I would venture to advise you to take vitamin D supplements during summer time also since most of us avoid exposure to sun and when we do it, we always wear some kind of sunscreen which blocks UV rays and thus limits vitamin D production.

☑ The best and only vitamin D supplement that is worth taking is vitamin D_3. This is the only usable form of vitamin D that is ready to be metabolized and does not require further conversion by sun exposure.

☑ Never follow any special advice on the amount of vitamin D you should consume on a daily basis. The safest way is to measure your levels once and depending on the result, your doctor should advise you on the number of IUs (international units) that you need to consume daily. To avoid toxicity, especially during summer, one should test his/her vitamin D levels once or twice a year in order to maintain a tight optimal range (50-70 ng/mL).

☑ Although many foods contain enough vitamin D_3 if consumed, for one or another reason most of us do not get enough of it; for this reason, 80% of the population is deficient. For example, cod liver oil is rich in vitamin D. However, most of the fish oils go through intense processing to reduce the various environmental pollutants. In the process of cleaning, vitamin D is also removed and the commercially available supplements with fish oil might provide some vitamin D but should not be taken in lieu of vitamin D supplements. Other foods such as noted on the table below may contain vitamin D but for one reason or another, most of us either cannot take enough of these foods, or if we do, we may also take many more unwanted substances such as environmental toxic substances, cholesterol and many others. Therefore, it may be prudent to always take vitamin D supplement based on your vitamin D levels and not based on what foods you eat. Those found to be deficient should try to normalize their levels by prudent sun exposure as well as dietary supplementation.

Foods rich in vitamin D

- Pure Cod liver
- Salmon
- Mackerel
- Tuna
- Sardines
- Milk
- Margarine (fortified)
- Milk products (fortified)
- Cereals (fortified)
- Eggs

☑ Finally, pregnancy is a unique situation. There are not enough studies relating to vitamin D deficiency and pregnancy complications; it is clear so far that the general health problems associated with vitamin D deficiency are bad enough for a pregnant woman that there is no doubt that prudent vitamin D_3 supplementation during pregnancy according to the maternal blood levels should be part of good prenatal care. For this reason, we advise all pregnant women to check their levels and act accordingly. More importantly, all women of childbearing age should evaluate their levels prior to getting pregnant and if deficient, take the proper amount of vitamin D_3 (2000-5000 IUs daily) in order to normalize their blood levels. Mothers should not only take care of their vitamin D levels but also educate the entire family about the importance of this vitamin/hormone and make sure all family members have optimal vitamin D levels for long term health benefits.