



InterClinical Laboratories Newsletter

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Vitamin D The controversial magic bullet in nutritional medicine today.

Vitamin D supplementation has become a hot topic amongst health professionals. Although, some current opinions support an increase in supplementation and dosage levels, there is a substantial amount of evidence to the contrary, suggesting that more caution should be used with the dosage of vitamin D, especially high and/or long-term dosage levels.

Vitamin D is not like other vitamins and it is questionable if it should be called a 'vitamin'. Vitamin D metabolites in the body are affected by multiple enzymes and receptors which are involved in complex feedback networks. Vitamin D therefore acts more like a steroid (prohormone) than a vitamin. This complexity alone should be enough to realise that vitamin D's impact on the immune system is also complex. The decision to supplement calls for more careful consideration than simply accepting a basic blood test reading.

There is little doubt that vitamin D is involved in immune system function. However evidence suggests that a dysfunction of vitamin D receptors may be the ultimate cause of immune disorders, not simply the amount of vitamin D circulating around the body (Waterhouse et al, 2009). We know that there are two main forms of vitamin D that are of interest to the health practitioner; the intermediate form 25-hydroxyvitamin D (25-D) and 1,25-dihydroxyvitamin D (1,25-D), the active form produced in the kidneys. Ordinarily, only 25-D is measured in blood tests and arguably does not provide the whole picture of immune health. Some very interesting research has emerged in the last few years that highlights the existence of chronic intracellular bacteria that alter vitamin D metabolism by causing vitamin D receptor dysfunction within the cells. The result can be high

blood levels of 1,25-D, with a corresponding fall in 25-D. As 1,25-D is seldom measured, the low level of 25-D can be misinterpreted as deficiency. This undercurrent of chronic bacterial interference appears to be one of the factors influencing autoimmune disease.

It is important to remember that recommended dosage of vitamin D have changed dramatically over the last 20 years, especially in the last 5 years. Previously recommended therapeutic dosages began at 100IU per day, but has since increased to 400, 1000, 5000IU and even higher. Very high doses of vitamin D (above 10,000 IU per day) have been known to cause kidney and tissue damage, especially when taken long term (Institute of Medicine, 2010).

In this newsletter, Dr David Watts describes how vitamin D is influenced by mineral ratios and other hormonal, dietary and environmental factors. It is important to consider this other side to vitamin D, to ensure that you are providing the best possible long-term care for your patients.

InterClinical's position of Vitamin D is a conservative one. Tolerable Upper Intake Levels for food-source and supplemental vitamin D range from 1000-4000IU (Linus Pauling Institute), yet some clinicians prescribe much higher dosages. Low levels of vitamin D in the body may be indicative of lowered intake from food or solar sources, or from a dysfunction with vitamin D receptors, yet the conversion into the active form is rarely tested. So the question is, have we considered this other research when we prescribe vitamin D for our patients?

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Vitamin D By David L. Watts, Ph.D., Director of Research, TEI

Vitamin D has recently been in the news, with claims of promoting weight loss when taken with increased levels of calcium and milk products in the diet. It has also been proposed that vitamin D may prevent several types of cancers and be helpful in preventing influenza.

Based upon these findings it has even been proposed that the recommended daily intake of vitamin D be raised significantly. However, many of these new reports are controversial. Some studies seem to support the benefits of increasing

vitamin D intake while others do not (1,2). Thankfully, through individual hair tissue mineral analysis (HTMA) patterns we have the ability to determine the potential benefits as well as the potential pitfalls of vitamin D therapy.

Nutritional, Hormonal, and Metabolic Effects of Vitamin D

Most everyone is aware of the functions of vitamin D in relation to the role it plays in building

and maintaining the integrity of bones and teeth. From a mineral standpoint, vitamin D is most closely associated with the mineral calcium (Ca), affecting both its absorption and regulation. Rickets and osteomalacia are two major conditions related to vitamin D deficiency. Phosphorus (P) is also affected by vitamin D, as well as the balance between Ca and P in the body. The minerals zinc (Zn), copper (Cu), potassium (K), sodium (Na), magnesium (Mg) and others are also impacted by vitamin D status.

Vitamin D also shares a synergistic and antagonistic relationship with other vitamins as well, which will be discussed later.

Vitamin D is actually a pro-hormone, the precursor to the production of calcitriol. Some of the major hormones that are related to, or affected by vitamin D include oestrogen, progesterone, testosterone, insulin, thyroid, parathyroid and the adrenal hormones. Vitamin D can have a synergistic or promoting effect on some endocrine glands and their hormones and conversely, an inhibiting or antagonizing effect upon others (3). From a metabolic standpoint we consider vitamin D a parasympathetic, anabolic nutrient. Thus vitamin D has a sedative effect on metabolic activity in general. This is due to vitamin D's influence on certain vitamins and minerals as well as its effect on the parasympathetic neuro-endocrine and immune systems (4).

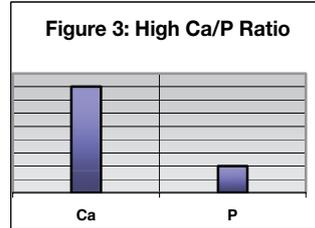
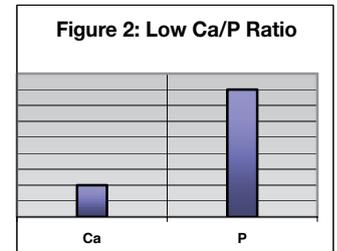
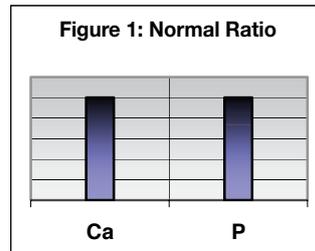
Assessing Individual Requirements for Vitamin D

In order to assess a person's need for extra vitamin D we must view them as individuals rather than making broad assumptions based upon general population studies or disease processes. One must also be aware of individual metabolic types and the influence of vitamin D as well as any other nutrient, or substance that can affect that particular metabolic type. Those of you who are familiar with our metabolic typing through HTMA patterns will remember that we categorize individuals into eight metabolic types which fall under the two major categories, the Fast and Slow Metabolic types.

Approximately seventy-five per cent of the American population is found to be in the Slow Metabolic category and the other twenty-five per cent are in the Fast Metabolic category. Knowing a person's metabolic type alone provides a greater understanding of a person's need for vitamin D, thus providing optimum clinical benefit and more importantly avoiding the potential adverse effects of too much vitamin D.

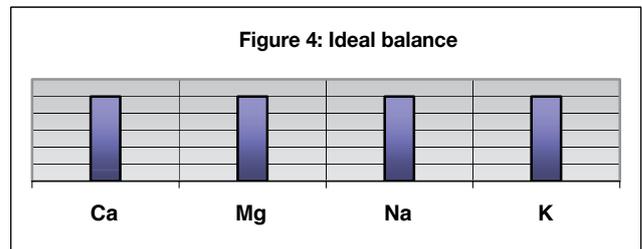
As mentioned previously vitamin D not only affects the absorption of the minerals calcium (Ca) and phosphorus (P), it also helps in regulating the normal balance between the two. The ideal HTMA Ca level is 60 milligrams per cent (mg%) with a range of 22 to 97 mg%. The ideal P level is 16 mg% with a range of 11 to 20 mg%. However, the relationship between these two minerals is far more important than maintaining their respective normal levels or ranges. The ideal balance or ratio between Ca and P is 2.63 to 1 with a range of 1.6 to 3.6. From this relationship alone we can approximate the need for vitamin D for an individual.

Figure 1 shows a normal Ca/P ratio, indicating an ideal balance between the two minerals as well as adequacy of vitamin D. Figure 2 is showing a low Ca/P ratio, indicating that vitamin D requirement is relatively increased for an individual with this tissue mineral pattern. In the next illustration (Figure 3) we can see that Ca is dominating the picture relative to P therefore, vitamin D requirement would be much less for this particular mineral pattern.

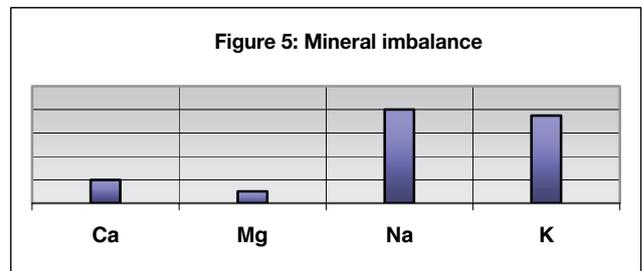


Note: Other minerals influenced by vitamin D are not shown in these illustrations for clarity.

Vitamin D via its effect upon Ca also affects the minerals magnesium (Mg) sodium (Na) and potassium (K). The next illustration (Figure 4) shows the ideal balance between Ca/Mg, Ca/K and Ca/Na. When the Ca/ K and Ca/Na ratio is low (Figure 5) then vitamin D requirements are increased. A reverse of these ratios would indicate a reduced need for vitamin D. The ideal relationship between Ca and Mg can also be disrupted by vitamin D status. An elevated Ca/Mg ratio in the slow metabolic type would indicate that vitamin D needs are reduced and that vitamin D therapy should be reduced in a patient with this mineral pattern.



The minerals zinc (Zn) and copper (Cu) can also provide an indication of vitamin D requirements. An elevated Zn/Cu ratio may indicate an increased requirement, while a low Zn/Cu ratio may indicate a reduced need for vitamin D depending upon the metabolic type.



Vitamin D and Weight Loss?

Recently there has been a great deal of buzz in the popular press claiming a significant role for the increased intake of vitamin D, calcium and dairy for weight loss. At present the evidence of increasing dairy, calcium and vitamin D for aiding weight loss is inconclusive. This is due to the fact that the

groups involved in the study also consumed a low calorie weight loss type of diet.

From HTMA studies, weight loss will not occur simply by increasing the dietary intake of calcium, vitamin D and milk for most people, but may be beneficial for some. Since approximately seventy-five per cent of the U.S. population fall into the slow metabolic category and since vitamin D as well as calcium are sedative, increasing their intake would further sedate the slow metabolic type. This is due to several factors. Probably the number one factor is that excess vitamin D and calcium will reduce thyroid and adrenal expression (5).

Calcium absorption is actually increased in the presence of low thyroid activity. This can be attributed to increased parathyroid hormone activity which increases with under-activity of the thyroid. Low thyroid activity in turn leads to reduced adrenal activity. Therefore, increased intake of vitamin D, calcium and dairy can further reduce the metabolic rate in a person who is already predisposed, resulting in a reduction of caloric expenditure and weight gain instead of desired weight loss. Further, vitamin D shares a synergistic relationship to insulin and parathyroid hormone (PTH). Insulin, also an anabolic hormone as well as having lipogenic properties, enhances the synthesis of vitamin D and conversely vitamin D enhances the synthesis of insulin. Both of which influence the production of PTH, another anabolic hormone, all of which can further reduce metabolic activity through suppression of the thyroid with a corresponding decrease in adrenal activity. The cumulative effects result in a reduced metabolic rate and a corresponding reduction in the burning of calories.

The combined effects of vitamin D, calcium, PTH and insulin along with increased intake of dairy products would more likely contribute to further peripheral (hips and thighs) fat deposition and weight gain rather than weight loss in the majority of the population of slow metabolic types.

On the other hand, fast metabolic groups, approximately 25 per cent of the population, may benefit from increasing dairy products, vitamin D and calcium resulting in weight loss instead of weight gain, specifically in those with abdominal obesity (6). Fast metabolic types are more prone to the metabolic syndrome and have the tendency for abdominal or central fat deposition which is influenced by the opposite endocrine involvement than that of the slow metabolic population. That is, an increased metabolic rate contributed to by increased thyroid and adrenal cortical activity with low PTH activity and insulin antagonism. Vitamin D, calcium and dairy would have a reducing effect on the over-activity of the thyroid and adrenal hormones, enhance PTH activity which in turn would enhance calcium absorption and increase the action of insulin.

Vitamin D and Infections

Many people have asserted that the seasonal increase in the incident of the flu virus may be due to vitamin D deficiency. This is a logical assumption since vitamin production from irradiation of the skin by the sun is less in winter months. Studies have shown that supplementing cod liver oil reduces the incidence of viral infections in children during the winter months (7).

However, at TEI we classify vitamin D as having a more anti-bacterial activity than anti-viral (8). We have classified vitamin A as being anti-viral (9). There is little research in this area, but what does exist supports our anti-bacterial and anti-viral classifications of vitamins D and A. The studies that showed a reduction in viral respiratory infection in children during winter months used a cod liver oil supplement. It is true that cod liver oil is a source of vitamin D; however it contains over ten times

more vitamin A than vitamin D. Perhaps the anti-viral effect attributed to vitamin D was erroneous in these studies owing to the markedly increased intake of vitamin A in these children from the cod liver oil supplements.

Anti-Bacterial Effects of Vitamin D and Anti-Viral Effects of Vitamin A

Numerous studies have shown the effectiveness of vitamin D against bacterial infections (10,11,12).

Specifically, vitamin D has been used in the treatment of tuberculosis during the pre-antibiotic era. Photo therapy was also successful for the treatment of lupus vulgaris or tuberculosis of the skin since sun exposure naturally increased vitamin D production (13).

Our classification of the anti-bacterial effects of vitamin D as well as its pro-viral effects is based upon vitamin D's relationship with Ca, P, Cu, Zn and Fe. An increase in the tissue concentration of Ca is known to enhance the activity and proliferation of dormant viruses whereas, increasing tissue concentrations of P inhibits viral activity (14). Increased tissue calcium accumulation is of course enhanced by vitamin D. Low tissue Cu is associated with increased susceptibility to bacterial infections (15). Vitamin D is synergistic to the mineral Cu. Since the Fe/Cu ratio or balance is also important for the prevention of Cu deficiency induced bacterial infections, both vitamin D and Ca are antagonistic to Fe. Lastly, vitamin D has been found to enhance the production of HIV (16). Our HTMA studies have shown individuals with ARC and AIDS have a slow metabolic mineral pattern in conjunction with a markedly low Zn/Cu ratio (17).

Vitamin A is well known to combat viruses. The papilloma virus is suppressed by vitamin A and it has been found that HIV-1 replication is inhibited by vitamin A (18,19). Seroconversion to measles vaccine and inhibition of the herpes simplex virus replication has been noted with vitamin A therapy (20,21). Animal studies have shown the antiviral effects of vitamin A on the canine distemper virus as well (22). Vitamin A is synergistic to Zn a mineral known for its antiviral effects. Vitamin A also reduces tissue Ca concentrations relative to P.

Vitamin D and Cancer Prevention

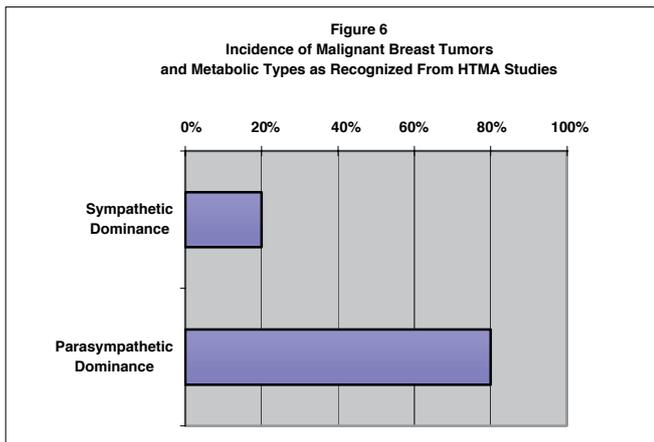
The potential role of vitamin D in protecting individuals from developing cancer has gained a great deal of interest over the past year. Some evidence is supportive while some is negative and yet others reveal no association (23,24). Light can be shed on this dilemma when cancer is viewed from a metabolic standpoint via tissue mineral analysis studies and the interrelationship between vitamin D and other nutrients, endocrine and immunological factors.

Cancer, Vitamin D and Metabolic Types

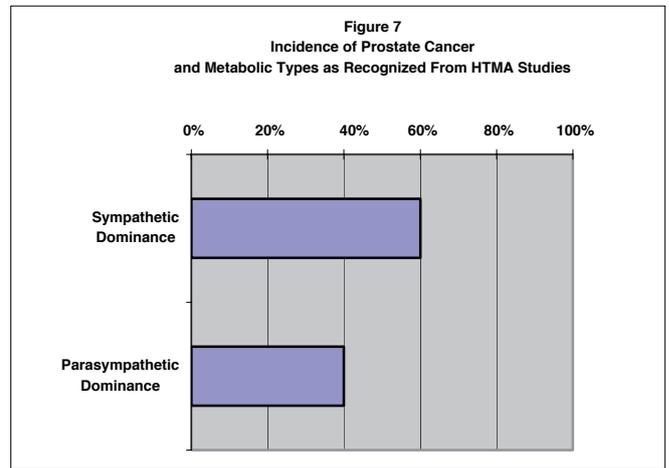
Often malignancies are classified as being hormonally sensitive or hormonally driven. However, cancer development is most often contributed to by a myriad of factors and not merely a single entity such as an individual hormone, vitamin deficiency, bacteria, virus or xenobiotic. It would be best to view malignancies as being caused by a number of multiple, complex interrelated factors including the environment, neurological, endocrine, metabolic, immunological and nutritional status. We typically see specific HTMA patterns and metabolic categories associated with various types of malignancies which can therefore be categorized into Sympathetic or Parasympathetic conditions.

This allows the recognition of the specific co-existing factors involving malignant conditions including the neuroendocrine-immunological-metabolic-nutritional-environmental factors.

For instance, so called oestrogen-driven tumours are most often seen in individuals who are showing a slow metabolic mineral pattern or Parasympathetic Dominance (See Figure 6). Therefore, an elevated tissue Ca and Cu are common along with an elevated Ca/Mg, Ca/P and low Zn/Cu. A malignancy in this pattern could be considered as being driven by the Parasympathetic neuroendocrine-immune-nutritional-metabolic systems. This metabolic pattern does indicate oestrogen dominance, but other factors are involved as well including insulin, PTH, and cellular immune dominance (25,26). In this case involving elevated tissue calcium, vitamin D may only be acting in concert with Ca to encase a malignant growth such as a breast tumour in an effort to prevent metastasis. The serum level of vitamin D has been found to be elevated in individuals with early stage breast cancer (27). Whether this is causative or a result of the malignancy remains to be determined. However, we can speculate that in such a case, vitamin D would not be preventive, but may very well be acting as a protective agent against metastasis. Since some malignancies are known to be related to underlying viral initiators with corresponding over-active cellular immune activation, vitamin D therapy would not be related to prevention. However, from our previous discussions we can strongly speculate that vitamin A would be preventive.



Malignancies that are not so-called oestrogen-driven, but may be called androgen or progesterone driven (See Figure 7) is most often seen in tissue mineral patterns of low Ca and Cu, low Ca/P with elevated Fe/Cu and Zn/Cu ratios. This pattern could be termed a Sympathetic condition involving the sympathetic neuroendocrine-immune-nutritional-metabolic systems with adrenal cortical, thyroid, testosterone and humoral immune dominance, with low insulin, oestrogen and PTH. A deficiency of copper as well as an excess of Fe leads to increased production of free radicals resulting in significant cellular damage. In this instance vitamin D and its synergistic co-factors may well be preventive. On the other hand we can surmise that increased vitamin A intake would further enhance the Sympathetic malignancy.



The scenarios discussed above can also help determine where vitamin A fits into this picture. Since vitamin A has the opposite effects of vitamin D, vitamin A may be helpful in preventing malignancies that could develop in patients with a slow metabolic rate.

Vitamin D and the Immune System

Both vitamins D and A are synergistically involved in the normal immune response. In certain circumstances, vitamin A and D are also antagonistic to each other. We consider vitamin D having a more pronounced effect on the cellular immune response. Too much vitamin D could precipitate a cellular auto-immune response in susceptible individuals. Whereas, vitamin A is closely related to the humoral immune response and excessive intake could lead to a dominant humoral autoimmune response.

Vitamin D Requirements and Summary

Based upon some of the above cited studies and from test results of blood levels of vitamin D, it is being suggested that the recommended daily allowance (RDA) for vitamin D be raised. Some propose up to 1000 I.U. per day for the general adult population. This may be an unwise step until further investigations are completed. The action of vitamin D does not depend upon adequate serum levels alone. Although circulating levels of vitamin D are related to dietary intake and synthesis from solar radiation, its conversion to an active form may be lacking in some individuals. Vitamin D receptors, other enzymes, hormones and nutritional status and nutritional interrelationships all affect vitamin D requirements. We have discussed the relationship of vitamin D to Ca, Mg, P, Zn, Cu, Fe, vitamin A, the hormones insulin, oestrogen, progesterone, androgen, PTH, the immune system as well as the thyroid and adrenal activity adding up to over a dozen factors that are known to affect vitamin D status. Actually there are numerous other relationships, far too many to be discussed within the confines of this cursory review. Suffice it to say that tissue mineral analysis can reveal many of these significant interrelationships and can be an intricate tool in assessing individual vitamin D requirements.

References available on request.

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