

## Why Do Scientists Call for an Action against Vitamin D Deficiency and What is Behind the Scene?

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### ABSTRACT

Vitamin D deficiency is a worldwide epidemic and 40-75% of the world's population is vitamin D deficient. Vitamin D is a hormone not just a vitamin where its intracellular receptors found in almost all body cells, bone, muscle, stomach, intestine, central nerve system, endocrine system, kidney, liver, lungs, heart, blood vessels soft tissues, skin and the root of a hair.

### INTRODUCTION

Vitamin D deficiency is a worldwide epidemic and 40-75% of the world's population is vitamin D deficient. Vitamin D is a hormone not just a vitamin where its intracellular receptors found in almost all body cells, bone, muscle, stomach, intestine, central nerve system, endocrine system, kidney, liver, lungs, heart, blood vessels soft tissues, skin and the root of a hair. Vitamin D is called “the sunshine vitamin”; it is synthesized by our body through exposing our skin to sunshine during the midday. The UVB (ultra-violet B-light) converts cholesterol (7-dehydrocholesterol) in our skin to the inactive cholecalciferol (Vitamin D3), which will then be activated by the liver and kidney.

Through our whole body cells, vitamin D plays a pivotal role in our metabolic pathways by regulating hundreds of our genes in a cell-specific pattern. The function of vitamin D is totally dependent on our body cells types and it plays different roles all over our body organs and tissues:

- Increases Calcium, Phosphate and Magnesium intestinal absorption. The direct action of vitamin D is approved on increasing our bone strength and density to protect against rickets in children as well as osteomalacia in adults. Having said that, however, the relationship between vitamin D deficiency and osteoporosis and fall in the elderly, is well documented with the evidence-based medical studies.
- Inhibits cell growth, angiogenesis and cell differentiation and protects against cancer (breast, colon, prostate).
- Plays anti-oxidative and neuroprotective role and prevents schizophrenia, Alzheimer's, dementia, autism and depression.

- Modulates immune system and reduces inflammation and protects from multiple sclerosis, lupus and arthritis.
- Affects smooth muscle tone, endothelium and cardiomyocytes and protects from cardiovascular disease, hypertension and stroke.
- Controls glucose metabolism and prevents diabetes mellitus type 1 and 2 by protecting and increasing pancreatic  $\beta$ -cell function and insulin sensitivity.
- Increases neuromuscular stability and prevents musculoskeletal pain, myofascial pain and myopathy.
- Stimulates the immune system to fight against TB, bacterial, fungal and viral infections.

### WHY DO SCIENTISTS CALL FOR AN ACTION AGAINST VITAMIN D DEFICIENCY?

Vitamin D scientists and experts call for an urgent action against vitamin D deficiency and consider it as a public health issue. They urge to raise public awareness of harnessing the sun's power for our health. Sun provides 90-95% of our vitamin D daily requirement in comparison with 5-10 % obtained by food. Some scientists see the possibility of reducing the incidence of many diseases by 20-50%, if the

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deficiency of vitamin D is overcome.

In USA, many healthcare societies and committees call for an action to alert the public about the importance of keeping vitamin D serum levels between 40 to 60 ng/ml (100-150 nmol/l). They supported their action by accumulating evidence-based published articles assuring that, vitamin D level of 40-60 ng/ml has preventive role, not just from bone diseases, but also against cancer, cardiovascular diseases, diabetes, Alzheimer, multiple sclerosis, autism, psoriasis, preeclampsia, gestational depression, etc. In 2012, Luxolda showed that our ancestors had an average of 46 ng/ml of vitamin D in their blood.



**WHAT IS BEHIND THE SCENE?**

These days there is still a big debate about what is vitamin D sufficiency versus deficiency among healthcare entities, on the national and international levels. In USA, there are different policies by many health organizations and bodies regarding vitamin D deficiency versus sufficiency and recommended daily intake. After the testing of vitamin D (25-hydroxy cholecalciferol), we must understand the value of its blood level to have an action. Vitamin D blood level tell us how much vitamin D supplements we need daily or how much time we should expose to sunlight daily to reach the desired blood level. Different American health organizations and bodies use different reference ranges to illustrate the meaning of vitamin D deficiency, insufficiency or sufficiency.

The following table represents deficient, insufficient, or sufficient vitamin D blood level in nanogram/milliliter (ng/ml) among different US healthcare entities such as IOM (Institute of Medicine), American Endocrine Society, Vitamin D Council. The **Table 1** illustrates the contradictions between these societies in terms of sufficient versus deficient. Also, it explains why the recommended daily allowance is different among them.

**Table 1.** Contradictions between the societies.

	IOM	American Endocrine Society	Vitamin D Council
Deficient	0-11	0-20	0-30
Insufficient	12-20	21-29	31-39
Sufficient	> 20	30-100	40-80
Recommend Daily Intake of vitamin D for an adult	↑ AIM	↑ AIM	↑ AIM
	600 IU	200-3000 IU	5000 IU

## IU (INTERNATIONAL UNIT)

Scientists and experts illustrated that, the IOM report concerning the Recommended Dietary Intakes of 600 IU/day of vitamin D is below their expectations. They commented that this dietary intake will just protect 99% of children of having rickets and will satisfy their sufficient vitamin D level of 20 ng/ml. Others said that the IOM got it wrong in term of vitamin D and they have to increase their dietary allowance by 2-5 times. Also, in his review to IOM statistics, Dr. Veuglers showed that the IOM estimate was wrong in terms of their recommended dietary intakes (RDI). He found that, 600 IU/day of Vitamin D did not give 97.5% of the population the 20 ng/ml level in their blood and just 50% of them satisfied this level.

The American Endocrine Society recommended for 30-100 ng/ml to be sufficient and less than 20 ng/ml to be insufficient. This society urges to have 2000 IU/day of vitamin D supplements aiming to keep the vitamin D blood level 30 ng/ml or above. However, Vitamin D Council suggests that 50 ng/ml is the ideal level for everyone. For this reason, they recommend that the adults should take 5000 IU/day of vitamin D supplements to reach and maintain their targeted level (40-80 ng/ml).

In the end, although there are still gaps between different healthcare bodies, taking an action against vitamin D deficiency by having higher doses than the recommended daily intake is better than not. The Institute of Medicine (IOM) reported in 2010 that taking 4000 IU/day of vitamin D can be considered a safe upper intake level for adults aged 19 and older. Moreover, American Endocrine Society and Vitamin D Council indicate 10,000 IU/day is considered safe and with no observed adverse effect.