Student name
Student number
Nutritional Determinants of Health
HSS2342 [A]

VITAMIN D SUPPLEMENT; AN HEALTHY ALTERNATIVE TO VITAMIN D DEFICIENCY

Presented to:
Dr. Atiq Rehman

21/03/2019
University of Ottawa

Health Science Faculty

Abstract:

Lately, supplements are more and more common considering that the population is increasingly aware of the importance of an healthy and balance diet providing the necessary nutrients. One of these nutrients are vitamins. Stephanie, a 20 year old engineering student, wonders the effect of vitamin D on her bone health. Therefore, vitamin D was studied, in term of its food sources, the daily recommended intake and whether supplement consumption is suggested, using PubMed to retrieve information from peer-reviewed articles, employing different keywords, such as “vitamin D”, “bone health effects” and “supplement”. A book was also utilized. Overall, vitamin D is an hormone that has an impact on the minerals essential for bone health. It is not an essential nutrient, since it can be synthesized by the skin with the help of the sun. However, it can also be provided from food, like from fortified milk and oily fish. For an healthy adults, the recommended amount of vitamin D per day is 600 IU, and for an individual living in northern latitude, resulting in less exposition to sunlight, supplement can be a good alternative. Nevertheless, it is important to consume them in moderation. Thus, during summer, fall and spring, Stephanie should not be worried about her vitamin D consumption and should not use supplements. On the other hand, during winter, assuming she live in a country like Canada, supplements could be required.

Introduction:

Our body is a big machine that requires a bunch of elements to function properly. More precisely, it needs essential nutrients such as the building block of proteins and carbohydrates (obtained from food), and nonessential nutrients (synthesized by the body), like some vitamins

and cholesterol. Vitamin D, a non essential nutrient synthesized by the body with the input of sunlight, has the reputation to maintain bone health among other functions. Stephanie, a 20 year old engineering student, wonders if she should consume vitamin D supplements, since she is worried about her bone health. To answer Stephanie, an investigation on what is vitamin D, its food sources, its daily recommended intake and supplements is necessary.

Materials and methods:

To collect information, the following questions needed to be answered: what is vitamin D, what are the food sources of vitamin D, what is the daily recommended intake of vitamin D, and the effect of vitamin D supplements on the human body. To retrieve information, peer reviewed articles from PubMed were used. To get the right information, different keywords were employed such as "vitamin D", "bone health", "health effects", "recommended daily intake" and "supplements", singly or combined. A book was also utilized. It was a book on nutrition, and a full section on the different nutrients, including vitamin D, was available. All the sources were recent (none of them is older than 2007). Moreover, the information of one source was often confirmed with another one, which added to their credibility.

Results and discussion:

First of all, vitamin D, is a nonessential nutrient. Indeed, the body can manufacture vitamin D when a precursor, produced in the liver that derives from cholesterol, receives sunlight (Whitney, Rolfes, Hammond, & Piché, 2016). Therefore, when a person spends an appropriate amount of time outside, exposed to the sun, a diet is not required to provide the recommended

daily intake of vitamin D. However, it is possible to get vitamin D from certain aliments. Actually, many kinds of vitamin D exist, for instance Vitamin D_2, also called ergocalciferol, and Vitamin D_3, known as cholecalciferol (Holick, 2007). Vitamin D_2 comes from plants and vitamin D_3 from animals, when consumed from food (Whitney et al., 2016). To synthesize vitamin D, two pathways are possible, either by the skin or diet, as mentioned previously. For cutaneous synthesis, an ultraviolet ray from the sunlight is required to reach the precursor, named 7-dehydrocholesterol, forming previtamin D_3. At that point, the heat of the body transforms previtamin D_3 into vitamin D_3 which, afterwards, is activated in the liver and kidneys, by hydroxylation, to yield activated vitamin D. On the other hand, when ingested from food, either from a plant or an animal, it is already synthesized into vitamin D_3. Then, the two following hydroxylation reactions remain the same for the final activation of vitamin D. (Whitney et al., 2016)

Vitamin D activated form is an hormone (McGee, 2019). In other words, vitamin D is manufactured by the body and then released into the bloodstream where it is transported (assisted by a binding protein) to the bones, intestine and kidneys, which, in their turn, react to vitamin D by producing the essential minerals for bone growth and health (Whitney et al., 2016). Indeed, vitamin D aids in the absorption of calcium and phosphorus, which is crucial to keep a balanced blood concentration of these minerals (Holick, 2007). The absorption and deposition of calcium and phosphorus allows the bones to become larger, longer and more solid (Whitney et al., 2016). In the past years, it has been proved that vitamin D has many other roles than bone health. Actually, some tissues, such as “cells of the immune system, brain and nervous system, pancreas, skin, muscles and cartilage, and reproductive organs” (Whitney et al., 2016, p.428), are

influenced by vitamin D. Furthermore, vitamin D improves or restrains gene activity that has an influence on cell growth (Whitney et al., 2016).

When someone doesn't have enough vitamin D in their system, it is frequent that the vitamin D deficiency will be asymptomatic (Whitney et al., 2016). Cutaneous synthesis is affected by the "season, latitude, skin pigmentation, sunscreen use, clothing and aging" (Holik, 2007, p.1017). Hence, the most susceptible individuals to vitamin D deficiency are those with darker skin, breastfeeding and not taking supplement, that don't spend enough time in sunlight, and those not consuming fortified milk (Whitney et al., 2016). Too little vitamin D results in a decrease of the production of an important protein that bind to calcium allowing it to be absorb in the GI tract. Without the absorption of calcium, the bone won't receive any, and consequently, the chance of some disease, like rickets (a disease affecting the bones; these can't calcify properly which lead to skeletal deformity and delayed growth), osteomalacia (a disease where the bones become weak) and osteoporosis (decrease density of the bone, increasing the possibility of their rupture), to emerge will be intensified. (Whitney et al., 2016)

On the other side of the spectrum, one can synthesize too much vitamin D. Indeed, when vitamin D is excessively ingest, the concentration of calcium in the blood will dramatically increase, thus the calcium will regroup in the soft tissue and create stone mainly in the kidneys to purposely get excreted (Whitney et al., 2016). Moreover, too much calcium may induce the narrowing of the blood vessels, which can lead to death if major arteries are affected, such as the one in the brain, heart and lungs (Whitney et al., 2016). That being said, the tolerable upper intake level (UL) is 4000 IU per day (Whitney et al., 2016). Accordingly, for vitamin D to be toxic for an individual, more than the UL needs to be consumed.

Earlier, it was suggested that vitamin D can be provided by the diet from either plants or animals. Indeed, the main food sources of vitamin D are oily fish like salmon and mackerel, cod liver oil, irradiated mushrooms, egg yolk, and some fortified milk, orange juice, margarine, cereals, yogurts, cheese, and bread. (Holick, 2007) Furthermore, the recommended dietary allowance (RDA) for vitamin D is 600 IU per day for adults between 19 to 70 years old and 800 IU for individuals older than 70. (Whitney et al., 2016)

Nowadays, more and more human are concerned with their health and want to make sure that their diet is providing all the necessary nutrients in good concentration. That being said, one of these concerns is about vitamin D. Vitamin D is known to contribute to bone health, therefore its ingestion in appropriate amount is obviously desirable. Moreover, since one of the principal source of vitamin D is sunlight, people living in northern latitude and working mainly inside, might be anxious to know if they should take supplements. In Canada, more specifically, during winter and fall the sun is less present, consequently, cutaneous synthesis tends to diminish (McGee, 2019). Considering that to get enough vitamin D from the sun a recommended amount of 5 to 15 minutes exposure to UV ray of sunlight on the face, harm and legs, 2 to 3 times a week between 10 am and 3 pm, is necessary; for a person living in Canada during winter, where the sun is often nonexistent, and due to cold temperature warm clothes usually covers their whole body, cutaneous synthesis can be a problem (Holick, 2007). Thus, it is understandable that supplement appears to be a good alternative. Actually according to Holick (2007) for someone with vitamin D deficiency, supplement are essential. Hence a question remains, is it safe to ingest vitamin D supplement and does it contribute to bone health? An experiment that compared a placebo group to a group of participants who ingested either vitamin D_2 or D_3 , from 400 to

10000 IU per day, shown that the differences between the number of case of hypercalcemia and hypercalciuria were statistically insignificant (Cranney, Weiler, O'Donnell, & Puil, 2008). As a consequence, it suggests that vitamin D consumption in an higher dose than the one recommended by RDA (which result in taking supplements), does not increase the risk to get a disease. Plus, according to Cranney et al., (2008) vitamin D supplementation enhance bone health. Other experiments conclude that to get intoxicated or have an overdose of vitamin D, someone should consume more than 10000 IU daily which is way more than the dosage found supplements and diet combined (Holick, 2007). Therefore, supplement do contribute to bone health and do not induce unfortunate side effects such as disease when consumed reasonably. Finally, human being that lack of sunlight exposure should use vitamin D supplement or another option could be to ingest 500 ml of fortified milk (in canada fortified milk gives 350 to 470 IU per litre) per day. (Whitney et al., 2016)

Conclusion:

In conclusion, vitamin D is an hormone that has an impact on the minerals essential for bone health among other roles. It can be synthesized by skin using sunlight or food. The major food provider of vitamin D are fortified milk and oily fish. For an healthy adults, the recommended amount of vitamin D per day is 600 IU, and for an individual living in northern latitude, resulting in less exposition to sunlight, supplements can be a good option. However, it is important to consume them in moderation. Therefore, assuming that Stephanie, either doesn't work outdoor, simply doesn't spend a lot of time outside, or live in a country like Canada, where

during winter, exposure to the sun is rare, it could be a good alternative to take some vitamin D supplements, or add fortified aliment, such as milk, and oily fish to her diet.