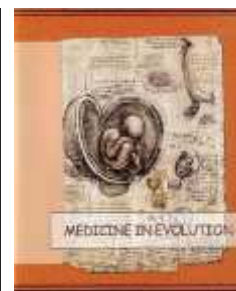


Vitamine k2 and the “calcium paradox” in dental prophylaxy



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Abstract

In the absence of vitamins D3 and K2, calcium is not used efficiently by the body and this can lead to ample transformations within it such as kidney stones, cardiovascular afflictions or changes in the dental or bone structure as a whole. Without questioning the quality of the materials used in medical and dental practice or the competences of the medical practitioner, deficits in these vitamins lead to a decay in tooth and dental structure resistance. Furthermore, chronic deficits in these vitamins will affect the harmonious development of both dental structure and other bones. Most of the recent studies highlighted the necessity of using these two vitamins combined, and recommend future dosage of K2 vitamin in the blood as a routine procedure especially in organizing the prophylaxis of the dental system.

Keywords: Vitamin D3, Vitamin K2, bone system.

INTRODUCTION

Regardless of the quality of the materials used in dental treatment (curative or preventive) and the competency of the medical practitioner, if the human body presents with certain deficits such as Iron, Calcium, Vitamin D or Vitamin K, the resistance of the dental structure can become very frail and this can lead to the development of secondary pathologies.

Recent studies show the importance in combining Vitamin D3 with Vitamin K2 in order to ensure a proper absorption of Calcium throughout the body. In the future, routine blood dosages of Vitamin K2 as well as correcting any other established deficits will be a plus when discussing a well-organized dental prophylaxis which will ensure an optimal level of dental health [1].

Currently, vitamin D is supplemented with Vitamin K2. Common dosages of these two vitamins improves the effect of each one and, at the same time, with the two working in synergy, we can ensure that there will be no arterial calcification as a result of the dosage. As such, vitamin K2 has the important role of guiding the absorption of vitamin D and of removing the negative effects of vitamin D overdose [1,2].

Aim and objectives

The objective of this analysis is represented by the importance that needs to be given to utilizing and administering vitamins D3 and K2 in order to facilitate a proper absorption of Calcium at the level of the bone and dental systems.

MATERIALS AND METHODS

It appears that vitamin K currently occupies the place that vitamin D did a few decades ago in regards to the appreciation it gathers as a vital element with a lot more benefits than initially conveyed. According to dr. Cees Vermeer, one of the top researchers in the world in regards to vitamin K, almost everyone has a deficit of this vitamin as well as vitamin D.

The levels of vitamin K in plasma can be measured accurately but the results are not entirely useful as they are usually based on your last few meals. Most people absorb sufficient vitamin K from meals in order to maintain proper blood coagulation but not enough so that they are protected against a vast array of medical issues such as: arterial calcification, cardiovascular diseases, varicose veins, osteoporosis, cancers of the prostate, lungs, liver or blood and certain brain diseases such as dementia [3,4].

Vitamin K is part of the fat-soluble vitamin group, which present with a unique distinguishing function from other vitamins through their crucial role in blood coagulation. Two groups of vitamin K are known as being able to seriously influence the optimal functioning of the human body: **K1 - phylloquinone** - major role in blood coagulation and **K2 - menaquinone** - a newer form which is important in building and maintaining bone and teeth integrity.

Vitamin K1 is known for its role in blood coagulation since 1929 when Henrik Dam and his fellow researchers were investigating the role of cholesterol in the diet by analyzing hemp seeds and managing to isolate a factor that prevented clotting. This factor was then named the "coagulation vitamin" and had the letter K attached, the discovery leading to a Nobel Prize win for professors Henrik Dam and Edward Doisy in 1943 (Figure 1) [5,6].

Vitamin K2 is the newer form of vitamin K and has a major importance in the building and maintenance of bone integrity and the prevention of arterial calcium deposits, according to studies undertaken in the past decade. As a supplement it exists under varied forms depending on the length of the lateral chain which can vary from 4 to 13, of which the more

frequent are **menaquinone-4, synthetic MK-4** and **menaquinone-7, natural MK-7** (Figure 1) [5,6]

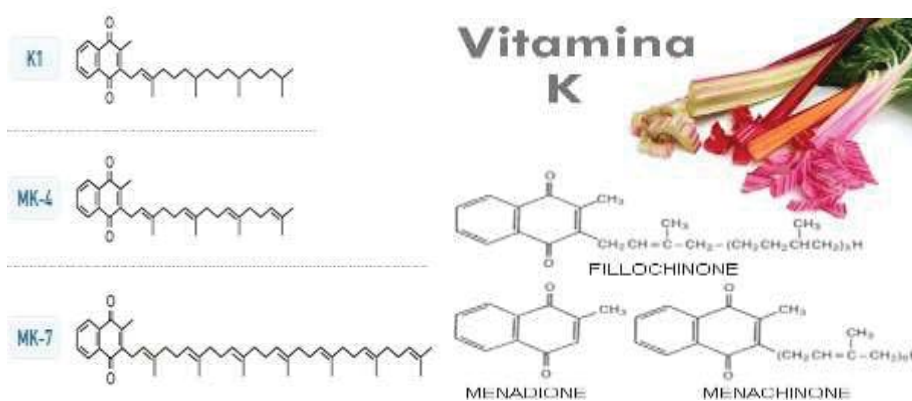


Figure 1. Chemical Structure of Vitamin K

The mechanism through which Vitamin K helps assimilate Calcium in the human body is given by the capacity of this vitamin (especially K2) to activate osteocalcin in bones as well as the MSP protein in the arteries and the coagulation factors in the liver. An insufficient quantity of vitamin K leads to what is called the **“CALCIUM PARADOX”**, with too little Calcium weakening the bones and too much Calcium leading to arterial deposits. A compromised metabolization of Calcium leads to the simultaneous destruction of bone tissue and an accumulation of Calcium on vessel walls. While bones do need Calcium, excessive calcifications on arteries or in soft tissues (including the skin) can appear. Vitamin K2 is an essential co-factor involved in the correct use of Calcium because it activates proteins responsible with cleaning minerals that circulate within the arteries and binding them to the bone matrix [7,8].

Important sources of vitamin K:

K1 - vegetal origin, present in greens (spinach, broccoli, cabbage) as well as soy oil; goes straight to the liver and helps maintain the blood coagulation system in good shape, with it being extremely important for children (Figure 2).



Figure 2. K1 - vegetal origin

K2- synthesized at intestinal level but excreted within feces, found as an external source in cheeses, chicken, beef, pork, Natto fermented soy (Figure 3, Table 1).

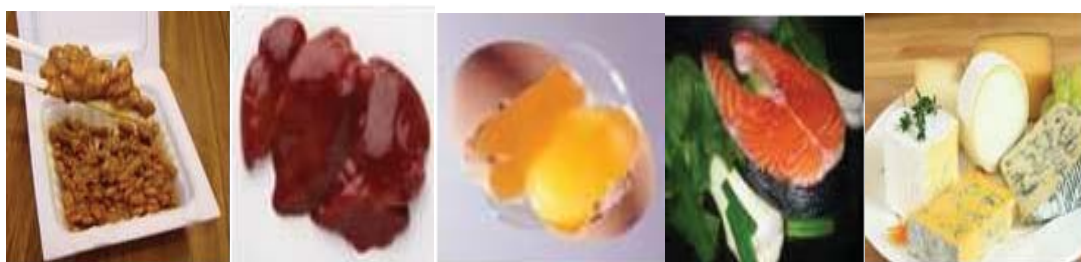


Figure 3. K2 - external source

Table 1. Content of vitamin K2 in 100 grams of produce

Goose liver	369 mcg MK-4	Gouda	76 mcg MK-8,MK-9
Chicken liver	14 mcg MK-4	Brie	56 mcg MK- 8,MK-9
Egg yolk	15-30 mcg MK-4	Cheddar	10 mcg MK -8,MK-9
Whole milk	1mcg MK-4	Miso	30 mcg MK-7
Salmon	0,5 mcg MK-4	Natto	900-1200 mcg MK-7

Bacteria present in the intestine produce vitamin MK-7. Vitamin K2 of MK-7 form can be found in produce with bacterial fermentation, especially types of soy. The highest content of this type of vitamin is found in **natto**, which contains between 900 and 1200 micrograms of vitamin K2 per 100 grams, of which 90% is MK-7 and 8% is MK-8. We should remember that vitamin K2 in MK-7 form is only produced by *Bacillus subtilis*, because **miso**, which is another soy product, has a reduced content of only 30 micrograms of Vitamin K2 while **tempeh** has none [9].

Clinical studies have proven that the regular intake of natto or using the other two diet supplements extracted from natto – nattokinase enzyme and Vitamin K2, form MK-7 – promotes the synthesis of coagulation factors, maintains calcium in the bones and teeth as well as improves the flexibility and shape of blood vessels, tendons, cartilages and other conjunctival tissues [9].

Some new properties have been recently discovered such as roles in controlling inflammatory processes, cell migration, division and specialization, etc. Studies were undertaken using MenaQ7 – with an individual dose of 45 micrograms of Vitamin K2 extracted from natto, with the results being remarkable [9]:

- Daily administering of 4x45 mcg or 8x45 mcg of vitamin K2 prevents osteoporosis;
- Administering 360, 720 and 1080 mcg of Vitamin K2 in three-day intervals helps with the regeneration of calcified arteries;
- Weekly consumption of 3-4 packs of 40-50 grams of natto in Japan is a tradition and thus helps keep levels of osteoporosis, atherosclerosis or cardiovascular diseases very low.

For over a century, the K vitamins have been recognized as necessary only in normal blood coagulation. Research in this area has gone through significant progress and has shown that vitamin K2 has effects in regards to the development of prostate cancer, decreasing this risk by 30% (**study of European Prospective Investigation into Cancer and Nutrition – EPIC, published in March 2010 by the American Journal of Clinical Nutrition**).

Other remarkable research has revealed the protective effects of Vitamin K2 in regards to osteoporosis [10].

- A series of Japanese studies have shown that vitamin K2 completely reverses losses in bone mass and, in some cases even increases bone mass in people with osteoporosis;
- Proof from 7 Japanese studies show that supplementing vitamin K2 in the human body reduces the risk of vertebral fractures by 60% and the risk of hip or other non-vertebral fractures by 80%;
- Dutch researchers have shown that vitamin K2 is three times more efficient than vitamin K1 in increasing osteocalcin, which controls bone construction.

Even if there are no human studies which test these facts on a direct level, the studies undertaken on animals show that Vitamin K2 can have benefic effects on **dental health** [11]. One of the main proteins involved in dental health is osteocalcin, which is the same protein that is critical for the bone metabolism and is activated by vitamin K2. Osteocalcin launches a mechanism which stimulates the growth in dentine, which is the calcified tissue under the

enamel of teeth. Vitamins A and D play an important role in this process, in synergy with Vitamin K2. It is also maintained that vitamin K is vital for remineralizing teeth and preventing cavities.

It is important to understand that vitamin K does not act alone. It needs “collaborators” such as vitamin D (a very important one at that). These two agents work together to increase the MGP protein (GLA matrix protein), which is responsible with protecting blood vessels and preventing calcification. These proteins are dependent on vitamin K in order to bind Calcium to the bones and prevent deposits of Calcium in arteries as well as helping blood coagulation [12].

The results of clinical studies in both humans and animals suggest that the simultaneous use of both vitamin K2 and vitamin D may substantially reduce the loss of bone mass and can further increase the levels of dental health.

RESULTS AND DISCUSSIONS

Vitamin K2 is an essential co-factor in utilizing Calcium through activating the proteins responsible with eliminating mineral deposits that may clog the arteries and binding them to the bone matrix. For over 50 years there has been recognized importance of vitamin K not only in clotting. Recent studies demonstrated the importance that it has in activating the MGP protein.

Most studies have proved that both adults and children have a K2 deficit, leading to the phrase “most healthy people have a deficit of vitamin K2”. In order to maintain good bone health and healthy teeth we need to have a balanced nutritional triangle: vitamin D, vitamin K and Calcium. An increase in the quantity of Calcium is good for the bones but not as good for the arteries, which can become calcified, but vitamin K prevents this from happening through vitamin synergy, which needs more attention to it in order to properly optimize benefits [12].

One of the main proteins involved in dental health is osteocalcin, the same protein that is critical in order to maintain a healthy bone structure and is activated by vitamin K2. Osteocalcin launches a mechanism that stimulates the growth of new dentine, which is the calcified tissue under the enamel of teeth. It is suggested that vitamin K2 is vital for remineralizing teeth and preventing cavities.

CONCLUSIONS

Studies undertaken within the last decade indicate the fact that a good level of vitamin K2 contributes to a healthy metabolism of Calcium and is extremely important in correctly approaching dental prophylaxis in children. It is important to combine vitamin D3 with vitamin K2 in order to achieve a better absorption of Calcium at bone and dental structure levels.

In the future there is a growing necessity towards blood dosages of vitamin K2 especially in children, as well as correcting any imbalances in order to properly assimilate Calcium. Both types of clinical studies (on humans and animals) indicate that utilizing vitamin K2 and vitamin D simultaneously substantially reduces the loss of bone mass and contributes to ensuring an optimal level of oral health.

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