

Role of vitamin k status in cardiovascular health



**ASSIGN
BUSTER**

The Role of Vitamin K Status in Cardiovascular Health

Background

Vitamin K is a fat-soluble vitamin that can be found in many foods. The two natural forms of vitamin K in food are phylloquinone (vitamin K1) and menaquinones (vitamin K2). Phylloquinone is found primarily in dark green leafy vegetables and vegetable oils and is considered to be the major vitamin K source in the Western diet. The dietary recommendation for vitamin K is solely based on phylloquinone. Meanwhile, menaquinone is mainly presented in animal foods such as dairy and meats. In addition, many fermented foods including natto are good sources of vitamin K2. ¹ There is no RDA for vitamin K due to the lack of adequate information. An Adequate Intake (AI) has been established, which is based on observations and experimental evidence. The daily AI for vitamin K is 90 mcg for women and 120 mcg for men aged 19 years and over. ²

Vitamin K is an essential micronutrient that required for many metabolic processes in the human body. The major role of vitamin K is to function as an enzyme cofactor for the post-translational carboxylation of vitamin K dependent proteins. Reduced vitamin K acts as a cofactor in the carboxylation of glutamic acid residues (Glu) into gamma carboxylation acid residues (Gla). This change allows proteins to bind calcium and functions as normal. Blood-clotting proteins are a major class of protein that dependent on vitamin K as the cofactor. Besides involved in blood coagulation, vitamin K dependent proteins are also important in bone metabolism, prevention of vessel mineralization, and regulation of various cellular functions. ²

Research Question

Cardiovascular disease is a leading cause of death around the world. One characteristic of cardiovascular disease is the presence of atherosclerotic plaques in arterial walls. Plaque rupture which leads to the formation of blood clot in vessels is the common cause of a myocardial infarction or stroke. Vitamin K has been proposed to have a protective role against CVD because of its role in vitamin K-dependent proteins. Matrix Gla protein (MGP) is the most studied vitamin K dependent protein in vascular tissue, which inhibits calcification when it is carboxylated. Calcification of the atherosclerotic plaques will occur as atherosclerosis progresses and may cause future CVD events. ²

According to the report from the National Health and Nutrition Examination Survey III, vitamin K intake was inversely related to mortality. Compared with individuals with inadequate vitamin K intake, people with adequate intake had a 22% lower risk for cardiovascular disease-related mortality and a 15% lower risk for all-cause mortality. ³ In a prospective cohort study which included 7, 216 older participants with risks for developing CVD, individuals who increased their intake of dietary phylloquinone had a lower risk of cardiovascular mortality risk while no association between changes in menaquinone intake and cardiovascular mortality was observed. ⁴

Another large prospective study followed 35, 476 healthy Dutch adults for 12. 1 years also found that there was not a significant association between dietary vitamin K intake (phylloquinone and menaquinone) and risk of incident stroke. ¹ A recent prospective cohort study included 3, 075 older
<https://assignbuster.com/role-of-vitamin-k-status-in-cardiovascular-health/>

adults. Vitamin K status was not significantly associated with CVD risk overall, but low plasma phylloquinone was associated with a higher CVD risk in older adults treated for hypertension. ⁵

Based on all the researches above, there are mixed results about the relationship between vitamin K status and cardiovascular disease. Therefore, I am interested in investigating the role of vitamin K status in cardiovascular health as my research direction.

Methods

In order to gather more information about vitamin K and CVD, I first did a brief research on PubMed. I learned about some recent findings about vitamin K and its role in cardiovascular disease. If there are any knowledge gaps that current researches could not address thoroughly, I may include it as my interview questions. For example, “ what are some diseases conditions that can be influenced by vitamin K status?” I also formulate questions based on my research online in finding public claims and concerns about vitamin K and vitamin K supplementations. For instance, “ what is your opinion on vitamin K supplements?” Overall, my interview questions progressed from general scientific questions about vitamin K status and CVD to the opinions of experts about the current messages on the lay media.

From this interview project, I learned the process of conducting an interview from scratch. I become familiar with conducting pre-interview research, connecting with experts, , preparing interview questions, following up after the interview. During the interview project, I found that the most effective interview question is open-ended questions such as “ what do you think <https://assignbuster.com/role-of-vitamin-k-status-in-cardiovascular-health/>

about xxx?” or “ How does xxx work?”. This type of questions will allow the interviewee to talk about their opinions in depth and may lead to other interesting topics that are not in the original list of questions.

In the future, I would practice the interview questions ahead to make sure that I am very familiar with each of the questions. During the interview process, it is highly possible that you need to change the sequence of your questions based on the content your expert talked. Therefore, be more familiar with the questions and be able to adjust the question according to the discussion is helpful when conducting the interview.

Findings

From this interview with the Vitamin K Laboratory team, I expanded my knowledge about vitamin K and its role in human health.

First, we talked about the complexity of vitamin K biomarkers. Currently, there is not a golden standard vitamin K biomarker for scientific researches. Plasma circulating phylloquinone can reflect dietary vitamin K intake, but different parts of the body may have different vitamin K concentrations, thus researchers may measure vitamin K in two or more parts of the body to get a more accurate value. Dephosphorylated-ucMGP (dp-ucMGP) is another vitamin K biomarker with controversies. The carboxylation of MGP happened in the blood vessels but dp-ucMGP levels in the blood may not reflect the extent of coronary artery calcification, thus cannot be related to heart diseases. One study followed 438 healthy older adults found that plasma dp-ucMGP was associated with vitamin K status biomarkers and was reduced following phylloquinone supplementation. Plasma dp-ucMGP did not reflect

<https://assignbuster.com/role-of-vitamin-k-status-in-cardiovascular-health/>

coronary artery calcification in healthy older adults.⁶ Therefore, it is not an accurate/reliable standard to measure the vitamin K status regarding CVD risks. In addition, dp-ucMGP measurement has not been validated in other studies as a biomarker.

The relationship between vitamin K and CVD is complex and can be influenced by many factors. Individuals with different disease conditions may have different vitamin K status and CVD risks. Among older adults with hypertension, low plasma phylloquinone was associated with a higher CVD risk. However, there was no association between low plasma phylloquinone and incident CVD among those with untreated hypertension or no hypertension.⁵ In addition, diabetes patients may also have the same association between vitamin K and CVD risks. Renal patients have low Vitamin K status and higher risks of CVD but the mechanism is not clear. Moreover, it is unclear that the relationship between vitamin K and CVD is due to the vitamin K status or due to other factors that contribute to both the low vitamin K status and diseases.

Ethnicity is another factor may interact with both vitamin K and CVD. Studies found that there is a race interaction with vitamin K status. In a multi-ethnic community-based cohort, there were more Caucasian, African-American, and Hispanic participants in the lowest quartile and more Chinese-Americans in the highest quartile of serum phylloquinone.⁷ In the Healthy ABC study, African-American participants have lower dp-unMGP levels compared with Caucasian participants.⁵

There is no documented side effects of vitamin K intakes. High dose of menaquinone 4 is used as a treatment for osteoporosis in Japan and patients reported skin irritation after using it.⁸ Other possible side effects are gastrointestinal tract symptoms such as discomfort of stomach and diarrhea since vitamin K is a fat-soluble vitamin. There is no optimal dosage of vitamin K supplements for CVD prevention purpose. Young, healthy individuals can get adequate amounts from their diets since vitamin K is highly available from foods.

Many questions in the field of vitamin K remain unsolved. However, it is clear that cardiovascular disease and Vitamin K status have some relationship. For the general healthy population, there is no need to take extra vitamin K supplementation for the purpose of reducing CVD risk. For people with certain disease conditions such as hypertension, renal, diabetes, they may benefit from extra vitamin K regarding CVD prevention but more studies are warranted.

Discussion

Observational studies showed that there is an inverse relationship between vitamin K status and cardiovascular disease. However, the underlying mechanism behind the association is complex and remains unclear. One thing I learned from this interview is that race and ethnicity can interact with vitamin K status differently, leading to inequivalent exposure to CVD risks. However, current studies did not find conclusive results. Future studies in racially and ethnically diverse groups are needed to identify how race and ethnicity play a role in the association between vitamin K status and CVD.

For further investigation, I would like to work towards identifying the association between vitamin K status and CVD in different ethnic groups. In addition, people with certain diseases may benefit from vitamin K supplement regarding CVD. I would also like to investigate more about whether chronic kidney disease patients may benefit from vitamin K supplements. The research finding could shed lights on an effective approach in decreasing the patients' CVD risks and enhancing the health condition of renal patients.

References:

1. Vissers, Linda E. T., et al. " Intake of Dietary Phylloquinone and Menaquinones and Risk of Stroke." *Journal of the American Heart Association* , vol. 2, no. 6, 2013, doi: 10. 1161/jaha. 113. 000455.
2. " Vitamin K." *Linus Pauling Institute* , Linus Pauling Institute, 26 Nov. 2018, lpi. oregonstate. edu/mic/vitamins/vitamin-K#coagulation.
3. Cheung, Ching-Lung, et al. " Vitamin K Intake and Mortality in People with Chronic Kidney Disease from NHANES III." *Clinical Nutrition* , vol. 34, no. 2, 2015, pp. 235–240., doi: 10. 1016/j. clnu. 2014. 03. 011.
4. Juanola-Falgarona, et al. " Dietary Intake of Vitamin K Is Inversely Associated with Mortality Risk." *OUP Academic* , Oxford University Press, 19 Mar. 2014, academic. oup. com/jn/article/144/5/743/4615722.
5. Shea, M Kyla, et al. " Circulating Vitamin K Is Inversely Associated with Incident Cardiovascular Disease Risk among Those Treated for Hypertension in the Health, Aging, and Body Composition Study (Health ABC)." *The Journal of Nutrition* , vol. 147, no. 5, 2017, pp. 888–895., doi: 10. 3945/jn. 117. 249375.

6. Shea, M. Kyla, et al. “ Circulating Uncarboxylated Matrix Gla Protein Is Associated with Vitamin K Nutritional Status, but Not Coronary Artery Calcium, in Older Adults.” *The Journal of Nutrition* , vol. 141, no. 8, 2011, pp. 1529-1534., doi: 10. 3945/jn. 111. 139634.
7. Cushman, Mary, et al. “ Associations between Vitamin K Status and Haemostatic and Inflammatory Biomarkers in Community-Dwelling Adults.” *Thrombosis and Haemostasis* , vol. 112, no. 09, 22 May 2014, pp. 438-444., doi: 10. 1160/th13-12-1003.
8. “ Vitamin K.” Gale Encyclopedia of Nursing and Allied Health. . Encyclopedia. com. 10 Dec. 2018 .