



Knowledge and Awareness of Vitamin K Therapy among Dental Students

**Hena Mariam Fathima¹, Dhanraj Ganapathy^{2*}, R. Subhashree²
and V. Rakshagan²**

¹Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences,
Saveetha University, Chennai, India.

²Department of Prosthodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical
and Technical Sciences, Saveetha University, Chennai, India.

Authors' contributions

This work was carried out in collaboration among all authors. Author HMF designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors DG and RS managed the analyses of the study. Author VR managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2020/v32i1730666

Editor(s):

(1) Dr. Mohamed Salem Nasr Allah, Weill Cornell Medical College, Qatar.

Reviewers:

(1) Mohammed Nahidh, University of Baghdad, Iraq.

(2) Cherif Adel Mohsen, Egypt.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/59726>

Original Research Article

**Received 27 May 2020
Accepted 01 August 2020
Published 24 August 2020**

ABSTRACT

Vitamin K is a fat-soluble vitamin, important for the function of numerous proteins within the body, such as the coagulation factors, osteocalcin, and matrix-Gla protein. Vitamin K exists naturally as vitamin K1 (phylloquinone) and vitamin K2 (menaquinone). Vitamin K has a plethora of potential implications, including prevention and treatment of arterial calcifications, coronary heart disease, and cancer, improvements in bone strength, and reduced risks of fractures as well as improvements in insulin sensitivity. The survey was cross-sectional in design. Following participant self-administered enrolment in the study, data were collected by a questionnaire that assessed participants' knowledge about vitamin k therapy. This study was conducted among the clinical dental students in different dental colleges across Chennai. The questionnaire consisted of 10 multiple-choice questions. From the results, it is seen that only 10% of the participants knew that Vitamin K2 can increase bone mass while most of them were unsure. Only 16% were aware that Vitamin K2 can improve the salivary buffering capacity via its impact on the secretion of calcium

*Corresponding author: E-mail: ghanraj@saveetha.com;

and inorganic phosphates while a large 65% were not aware. Only 18% knew that Vitamin K can actually build new dentin and 60% were unsure of the same. The level of knowledge and awareness of vitamin k therapy among dental students in dental students was poor.

Keywords: Awareness; bleeding; dental; knowledge; Vitamin K.

1. INTRODUCTION

Vitamin K is a fat-soluble vitamin, important for the function of numerous proteins within the body, such as the coagulation factors (II, VII, IX, X, and protein C, and protein S), osteocalcin (a bone-forming protein), and matrix-Gla protein (MGP) (an anti calcification protein). [1–3] Vitamin K1 is mainly found in green leafy vegetables as well as olive oil and soybean oil, whereas vitamin K2 (menaquinone) is found in small amounts in chicken, butter, egg yolks, cheese, and fermented soybeans (better known as natto). [4–7]

Vitamin K1 and vitamin K2 are required for the γ -glutamyl carboxylation of all vitamin K-dependent proteins. Despite the fact that mammalian bacterial intestinal flora are able to produce vitamin K2, the amount produced is thought to be negligible.² The adequate intake (AI) for vitamin K has been proposed to be 90 μ g/day for women and 120 μ g/day for men. [8] However, it has been speculated that the AI for vitamin K (90–120 μ g/day) is not sufficient to induce complete carboxylation of all vitamin K-dependent proteins [8–10].

Vitamin K, a fat-soluble vitamin, is a necessary cofactor for the activation of coagulation factors II, VII, IX, X, and protein C and S. Vitamin K deficiency may lead to Vitamin K Deficiency Bleeding (VKDB). The VKDB is a disorder of hemostasis in which coagulation parameters are quickly corrected by vitamin K supplementation. The term VKDB replaced the wording of hemorrhagic disease of the newborn since vitamin K deficiency bleeding may also occur in the postnatal period [11].

Additionally, vitamin K may even play a vital role in the stabilization of INR control for patients on warfarin. On the basis of previously presented data, warfarin may increase arterial calcifications and osteoporosis through the inhibition of vitamin K.

The diagnosis is suggested by an International Normalized Ratio (INR) ≥ 4 or a Prothrombin Time (PT) greater than 4 times the normal values, in the presence of a normal platelet count and normal fibrinogen level. Diagnosis

confirmation requires vitamin K-dependent factors dosage, which levels are quickly corrected by parenteral administration of 1 mg of vitamin K [12].

There are different forms of VKDB: early, classic, and late. Early form occurs within the first 24 h of life in infants born from mothers treated during pregnancy with anticonvulsants (carbamazepine, phenytoin, and barbiturates), antituberculosis drugs (isoniazid, rifampicin), some antibiotics (cephalosporins) or vitamin K antagonists (warfarin) and who did not receive vitamin K prophylaxis before the delivery [11]. Its incidence in at-risk neonates without vitamin K supplementation varies from 6% to 12%. The classic form occurs between 24 h to 7 days of life and is more often idiopathic; in term-born not receiving vitamin K prophylaxis it presents an incidence of 0,25–1,5% in older reviews [13] and 0,01–0,44% in more recent reviews [14]. The classic form is related to the low placental transfer of vitamin K, low concentration in breast milk, lack of gastrointestinal flora in the newborn gut, and poor oral intake that commonly occurs in the newborn period as breastfeeding is initiated. The late form occurs between the 2nd week and the 6th month of life, with a peak between 3 and 8 weeks after birth; it has an incidence of 1/15.000–1/20.000 births and it is typical of exclusively breastfed infants or newborns with malabsorption or cholestasis because vitamin K absorption is closely dependent on the intestinal availability of bile. The hemorrhagic manifestations mainly involve the gastrointestinal tract and skin, but also the central nervous system in late forms [15,16] Late VKDB carries a significant morbidity and mortality rate, with a mortality as high as 20–50% and morbidity characterized by neurologic defects including hydrocephalus, cerebral atrophy, encephalopathy, epilepsy, and developmental delay [17].

Breastfeeding has been implicated as risk factor for the development of VKDB because human milk vitamin K concentration (median 2.5 mg/L [0.85–9.2 mg/L]) is significantly lower than currently available formula milk (4–25 mg/100 kcal approximately corresponding to 24–175 mg/L) [18,19] On average daily vitamin K intake

of breastfed infants is < 1 mg within the first 6 months of life, whereas the intake of formula-fed infants is on average up to 100 times higher [20].

Vitamin K deficiency leads to the synthesis of under-carboxylated proteins called PIVKA (protein induced by vitamin K absence), that are unable to bind calcium and therefore inactive. PIVKAs are released from the liver into the blood and their level increases with the severity of the deficiency. PIVKAs are, however, much more commonly reported in breastfed infants [20].

Previously our department has published extensive research on various aspects of prosthetic dentistry [21–31] this vast research experience has inspired us to research about knowledge and awareness of Vitamin K therapy among dental students.

2. MATERIALS AND METHODS

This descriptive cross-sectional study was conducted at Saveetha Dental College and Hospitals, Chennai. The sample size was 100 which consisted of dental students. The study instrument was a structured questionnaire consisting of 10 multiple-choice questions (MCQs), with 3 questions eliciting demographic variables and the remaining 7 questions eliciting responses on encompassing aspects of Vitamin K therapy. An online survey was conducted and the participants were asked to fill the questionnaire. Two reviewers were involved in the study. The study was carried out in December 2019. To minimize sampling bias, all responses were included. There was no sorting of responses done. Internal validity was convenience sampling and the external validity was the need for more samples. Dependent variables included were Vitamin K therapy, dental awareness and independent variables were ethnicities, age, and gender. Once the survey was complete, the data was tabulated, followed by verification by an external reviewer after which it was imported to SPSS which is a statistical software by IBM. Statistical analysis and chi-square test was carried out.

- Age
- Gender
- Year of Graduation
- Did you know K2 can actually increase bone mass?

- Did you know maintaining anticoagulation with Vitamin K antagonists during dental interventions, the postoperative bleeding risk can be reduced by adopting local hemostatic measures?
- Did you know oral phytonadione has the same efficacy as IV phytonadione?
- Did you know Vitamin K can build new dentin?
- Did you know Vitamin K can sustain and improve salivary buffering capacity?
- Did you know Vitamin K can help in preventing caries?
- Did you know Vitamin K can sustain and improve salivary buffering capacity?

3. RESULTS AND DISCUSSION

From the results, it is seen that only 10% of the participants knew that Vitamin K2 can increase bone mass while most of them were unsure (Fig. 1) When maintaining anticoagulation with VKAs during dental interventions, the postoperative bleeding risk can be reduced by using local hemostatic measures was only known by 28% which is quite poor, 40% were unsure and 32% were unaware (Fig. 2). When asked if oral phytonadione has the same efficacy as IV phytonadione most of the participants (48%) were unsure.(Fig. 3). Only 18% knew that Vitamin K can actually build new dentin and 60% were unsure of the same (Fig. 4).

Only 16% were aware that Vitamin K2 can improve the salivary buffering capacity via its impact on the secretion of calcium and inorganic phosphates while a large 65% were not aware (Fig. 5). When asked if they knew if Vitamin K can help prevent caries, 68% were unaware (Fig. 6).

Fig. 7 shows the association of responses to the question “Did you know Vitamin K can sustain and improve salivary buffering capacity?” and the graduate level of the participants. The association between graduation levels and knowledge about salivary buffering capacity of Vitamin K therapy was explored. The X-axis represents the graduate level and Y-axis represents the number of participants in the study where no (blue) unsure (red) yes (green), (Pearson Chi-square test; $P=0.79$, $P >0.05$) statistically not significant.

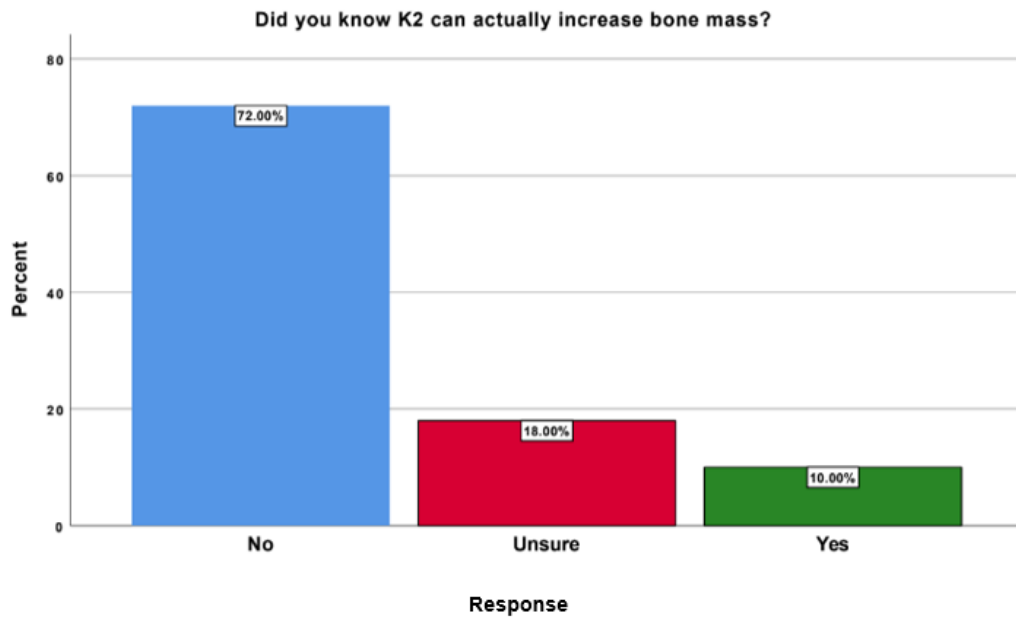


Fig. 1. This bar graph shows responses to the question, “Did you know K2 can actually increase bone mass?” X axis represents the response of participants and Y axis represents the percentage of participants. Most of the participants were unaware

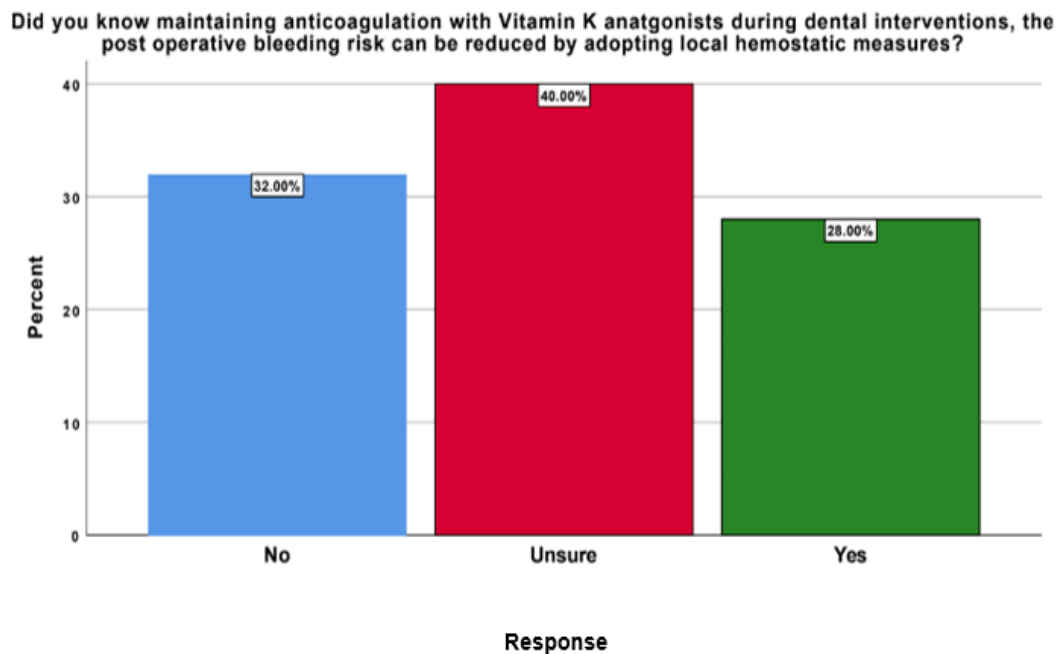


Fig. 2. This bar graph shows responses to the question, “Did you know maintaining anticoagulation with Vitamin K antagonists during dental interventions, the post operative bleeding risk can be reduced by adopting local hemostatic measures?”. X axis represents the response of participants and Y axis represents the percentage of participants. Most of the participants were unsure

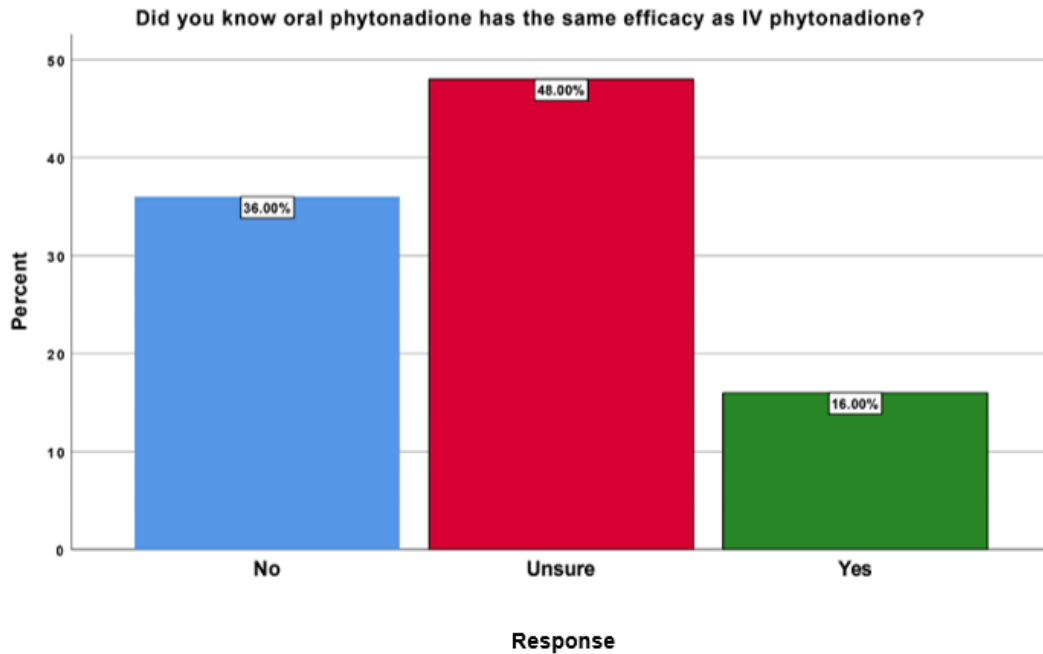


Fig. 3. This bar graph shows responses to the question, “Did you know oral phytonadione has the same efficacy as IV phytonadione?”. X axis represents the response of participants and Y axis represents the percentage of participants. Most of the participants were unsure

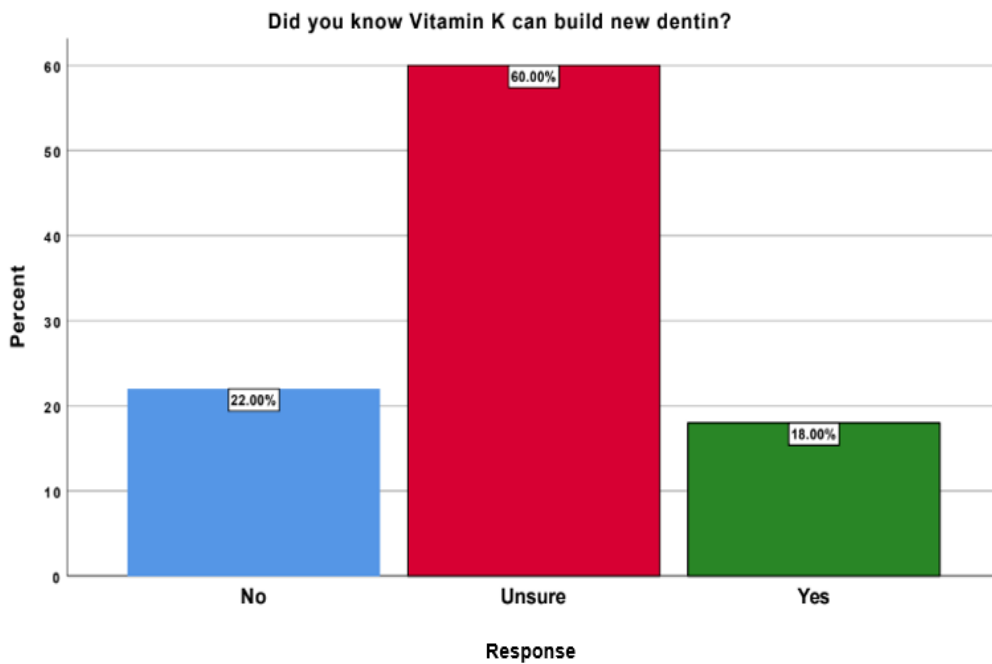


Fig. 4. This bar graph shows responses to the question, “Did you know Vitamin K can build new dentin?”. X axis represents the response of participants and Y axis represents the percentage of participants. Most of the participants were unsure

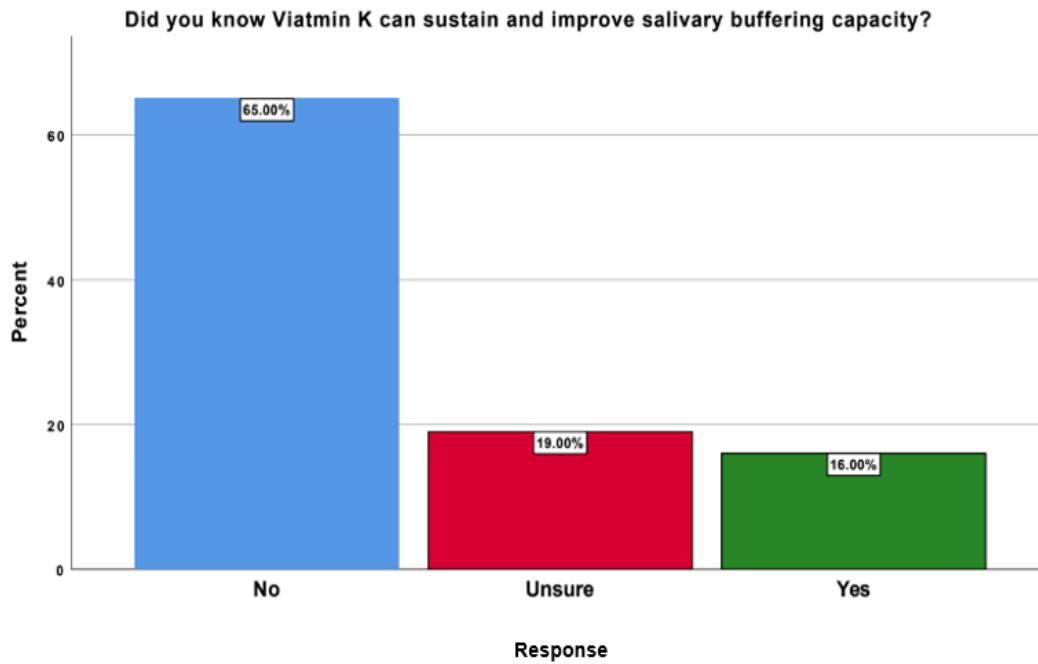


Fig. 5. This bar graph shows responses to the question, “Did you know Vitamin K can sustain and improve salivary buffering capacity?”. X axis represents the response of participants and Y axis represents the percentage of participants. Most of the participants were unaware

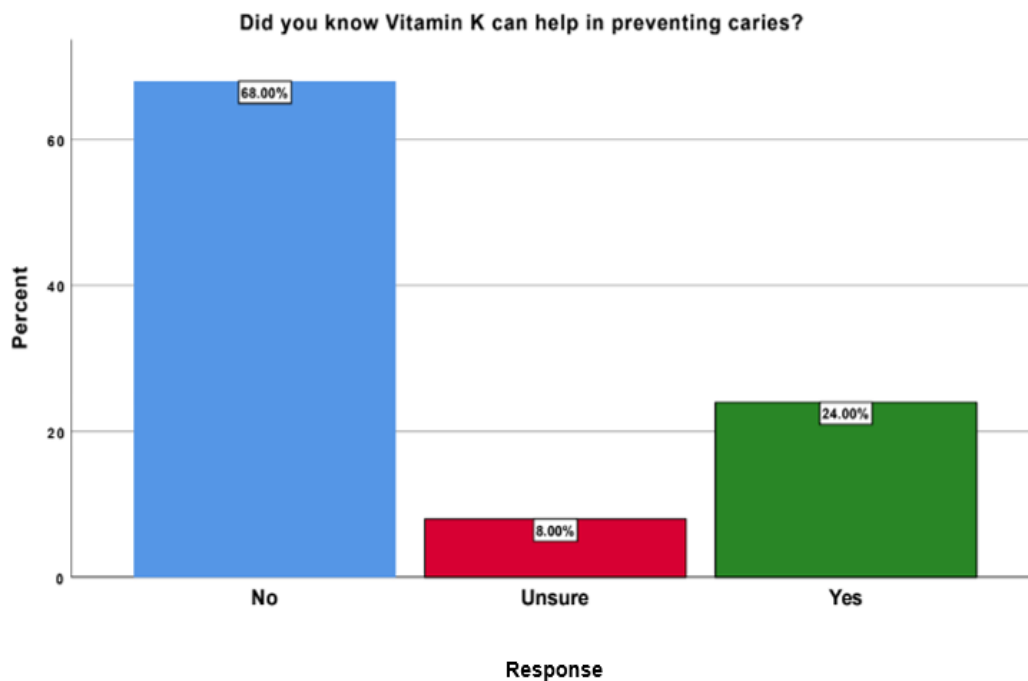


Fig. 6. This bar graph shows responses to the question, “Did you know Vitamin K can help in preventing caries?”. X axis represents the response of participants and Y axis represents the percentage of participants. Most of the participants were unaware

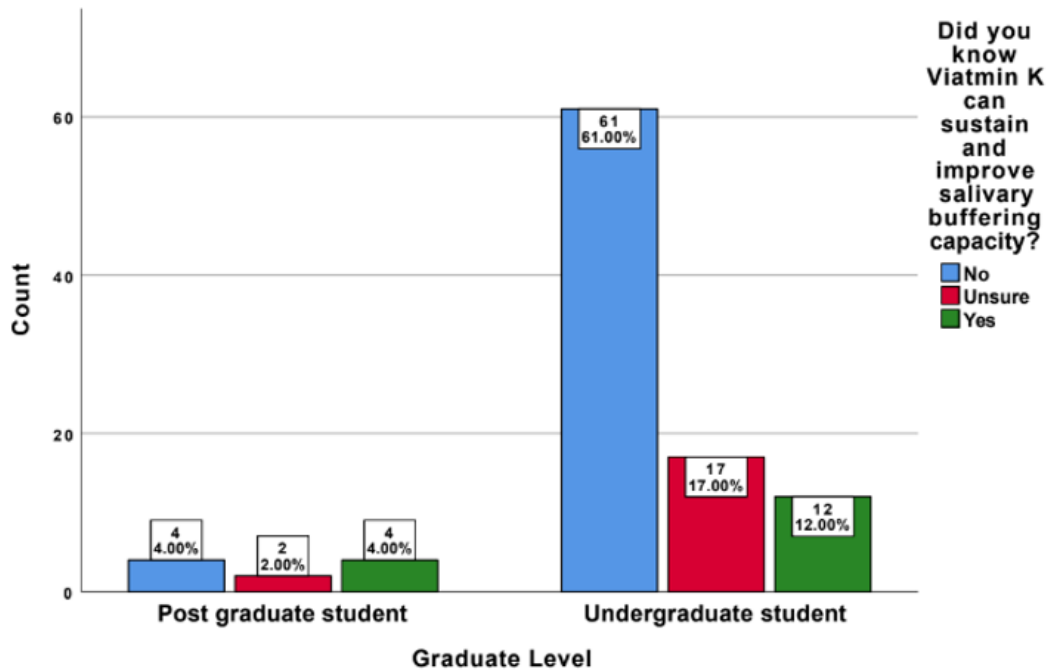


Fig. 7. This bar graph shows the association of responses to the question “Did you know Vitamin K can sustain and improve salivary buffering capacity?” and the graduate level of the participants. X axis represents the graduate level and Y axis represents the number of participants in the study where no (blue) unsure (red) yes (green), (Pearson Chi square test; $P=0.79, P >0.05$) statistically not significant

Since the influence of vitamin K on oral warfarin was demonstrated in humans [32], many reports have implicated dietary vitamin K as a factor contributing to unwanted disturbances in anticoagulation, sometimes with life-threatening consequences. Increases in vitamin K intake can precipitate abnormal clotting or warfarin-resistance. For example, Kempin [33] reported a diet-induced warfarin resistance in two patients consuming large amounts of broccoli.

Similarly, Walker [34] noted myocardial infarctions due to warfarin resistance in patients following weight-loss diets, including large amounts of green leafy vegetables rich in vitamin K. In contrast, decreases in vitamin K intake are associated with warfarin potentiation and a tendency for abnormal bleeding. Colvin and Lloyd [35] documented severe coagulation defects attributed to dietary deficiencies of vitamin K1.

Chow [36] reported instability of anticoagulation with hemorrhagic complications in two warfarin-anticoagulated patients due to dietary modifications that lowered the intake of vitamin K. Therefore, when the amount of vitamin K in

the diet remains constant, regardless of the level of consumption, it poses a little problem to anticoagulant dosing. Experts recommend that patients who are receiving warfarin therapy limit their daily variations in vitamin K consumption to no more than 250 to 500 g from baseline intakes [37].

Lasswell [38] has previously reported gaps in the knowledge of physicians about drug-nutrient interactions. However, such deficiencies among any member of the healthcare team with regard to warfarin-vitamin K interactions could lead to inappropriate patient counseling, disruption in anticoagulant outcomes, and adverse medical consequences. In this assessment of knowledge among healthcare professionals, pharmacists and dietitians scored well in their respective areas of expertise, i.e., drug and food interactions, respectively, but did not perform as well in other areas. Scores of physicians were similar to those of pharmacists in general drug-nutrient interactions but were lower in other areas assessed by the questionnaire. This study observed the knowledge and awareness of Vitamin K therapy among dental students in Chennai was poor and this could be attributed to

the lacunae in incorporating various therapeutic regimen in dental school curriculum. Hence there is a strong need for updation of dental syllabus with special impetus to emerging trends.

4. CONCLUSION

The level of knowledge and awareness of Vitamin K therapy among dental students in Chennai was poor. The trend of Vitamin K therapy is growing each day and therefore, sufficient knowledge and awareness must be present in each individual. There should be more awareness regarding Vitamin K therapy as this will help in better diagnosis and prompt treatment if a patient does have Vitamin K deficiency. Dental students must be taught about Vitamin K and its various functions and activities to administer prompt treatment when needed for the patient.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

The study was approved by the institutional ethical committee.

ACKNOWLEDGEMENT

We would like to acknowledge the support of our institution in helping us conduct the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
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