Proposed maximum levels for the addition of vitamin K to foods including food supplements

The accompanying main opinion "**Updated recommended maximum levels for the addition of vitamins and minerals to food supplements and conventional foods**" can be found here: https://www.bfr.bund.de/cm/349/updated-recommended-maximum-levels-for-the-addition-of-vitamins-and-minerals-to-food-supplements-and-conventional-foods.pdf

1 Results

The German Federal Institute for Risk Assessment (BfR) recommends the following maximum levels for the addition of vitamin K to food supplements and to conventional foods:

Table 1: Proposed maximum levels

Food category	Maximum levels
Food supplements (per daily recommended dose of an individual product)	
Vitamin K_1	80.0 µg
Vitamin K_2	25.0 µg
Conventional foods (per 100 g)	no addition

In addition, the following note of caution is recommended:
People taking anticoagulant medications should seek medical advice before consuming vitamin K-containing supplements.

2 Rationale

2.1 Tolerable Upper Intake Level[1] (UL) and Dietary Reference Value

Due to insufficient data, the former Scientific Committee on Food (SCF) of the European Commission – predecessor of the European Food Safety Authority (EFSA) – was unable to derive a UL for vitamin K.

Currently available studies indicate a low acute and chronic toxicity of orally administered vitamin K. However, the therapeutic effect of oral anticoagulants of the coumarin type (vitamin K antagonists) is attenuated by the intake of vitamin K. Persons taking these drugs should therefore keep their vitamin K intake as constant as possible and use vitamin K-containing food supplements only under medical supervision (SCF, 2003).

The EFSA Panel on Nutrition, Dietetic Foods and Allergies (NDA Panel) derived an Adequate Intake (AI) for vitamin K and considered 1 microgram per kilogram body weight (µg/kg bw) per day as adequate for all age and gender groups (EFSA, 2017; Table 2).

Similar estimated values for an adequate intake of vitamin K have been proposed by the D-A-CH Societies[2] (D-A-CH, 2015; Table 2).

[1] Tolerable Upper Intake Level = Maximum level of total chronic daily intake of a nutrient (from all sources) considered to be unlikely to pose a risk of adverse health effects to humans.

[2] German-Austrian-Swiss Nutrition Societies

Table 2: Dietary reference values (estimated values for an adequate intake)

Age groups	Estimated values for an adequate intake (D-A-CH, 2015) m	f	Adequate Intake (EFSA, 2017)
	µg/day		
4 to under 7 years	20		20
7 to under 10 years	30		30
10 to under 13 years	40		45
13 to under 15 years	50		45
15 to under 18 years	70	60	65
18 to under 51 years	70	60	70
51 to under 65 years	80	65	
65 years and older	80	65	
Pregnant and lactating women		60	

2.2 Exposure

The second National Food Consumption Survey (NFCS II) does not provide data on vitamin K intake. From the nutrition module of the 1998 Federal Health Survey, a mean intake of vitamin K of 404 µg/day (eastern Germany) and 431 µg/day (western Germany) was determined for adults (Mensink and Beitz, 2004). Data for children (6-11 years) can be found in the EsKiMo study (nutrition module in KiGGS[3]), in which age- and gender-dependent median vitamin K intakes of between 162.4 and 190.9 µg/day and high intakes (P95) of 263.1 to 395.7 µg/day were determined. However, the vitamin K intake estimates in the two nationally representative studies are subject to uncertainty, as the information regarding vitamin K content in the Federal Food Code is of low quality.

Regional intakes of vitamin K were assessed in the 2nd Bavarian Consumption Study (1,050 persons, 13 to 80 years of age) and in the EPIC Heidelberg cohort study (25,540 persons between 40 and 65 years of age). In the Bavarian population, the median vitamin K intake was 112.3 µg/day in women and 128.4 µg/day in men. The intakes in the respective P95 were 387.4 µg/day (f) and 351.3 µg/day (m) (Nimptsch et al., 2009). These results are confirmed by the data from the EPIC study, in which the median intake of vitamin K_1 was at 93.6 µg/day and that of vitamin K_2 at 34.7 µg/day (Nimptsch et al., 2008). Thus, the data available in Germany from the EsKiMo study and from two regional studies are in good agreement with the results from other EU countries, where mean intakes of between 70 and 250 µg/day have been determined for vitamin K (SCF, 2003).

[3] German Health Interview and Examination Survey for Children and Adolescents

2.3 Aspects considered in the derivation of maximum levels for food supplements

As no UL could be derived for vitamin K, the procedure used by the BfR for deriving maximum levels for other vitamins and minerals for the addition to food supplements and conventional foods is not applicable here.

The BfR considers the antagonistic interactions of vitamin K with anticoagulant drugs (vitamin K antagonists of the coumarin type) as an undesirable effect, which has to be taken into account for the derivation of maximum levels for vitamin K.

Vitamin K_1 (phylloquinone) and vitamin K_2 (menaquinone) differ in their potency to attenuate the therapeutic effect of anticoagulants. In two studies involving twelve healthy subjects, the dose-response relationship of this effect was systematically investigated. For this purpose, by application of the coumarin derivative acenocoumarol, the subjects were adjusted to an INR (International Normalised Ratio - standardised value for blood clotting time) of 2.0 and supplemented with daily increasing doses of 50, 100, 150, 200, 250, 300 and 500 µg of synthetic vitamin K_1 (Schurgers et al., 2004) or of 10, 20 and 45 µg vitamin K_2 (Theuwissen et al., 2013), respectively, for seven weeks. For vitamin K_1, a dose of 150 µg/day and for vitamin K_2, a dose of 45 µg/day was determined to be the threshold for a statistically detectable decrease in INR. The potency of vitamin K_2 in attenuating the therapeutic effect of acenocoumarol was thus approximately 3.5 times that of vitamin K_1.

Using an uncertainty factor of approximately 2, the BfR maintains its previous proposal (BfR, 2004a) for a maximum level of 80 µg of vitamin K_1 for food supplements, while a maximum level of 25 µg is proposed for vitamin K_2.

In addition, the following note of caution is recommended:

People taking anticoagulant medications should seek medical advice before consuming vitamin K-containing supplements.

2.4 Aspects considered in the derivation of maximum levels for fortified conventional foods

The consumption data in Germany do not indicate an insufficient supply of vitamin K in the general population and/or in specific age groups.

Attenuation of the effect of vitamin K antagonists (coumarin-type anticoagulants) can already occur through consumption of vitamin K-rich foods (Couris et al., 2006; AdKÄ, 2012). Furthermore, it has been shown that the consumption of adequate amounts of vitamin K through common foods, which are composed in such a way that the vitamin K intake is both adequate and relatively constant, facilitates the adjustment of the therapeutically optimal dose of oral coumarin-type anticoagulants (de Assis et al., 2009; Zuchinali et al., 2012; Violi et al., 2016).

The BfR therefore proposes to exempt conventional foods from fortification with vitamin K, as the use of vitamin K antagonists for thrombosis prophylaxis is widespread, especially in the elderly population[4].

[4] For example, Barmer GEK reported in its 2014 drug report that a total of 5,529,000 packs of oral anticoagulants were sold in hospitals and pharmacies in Germany in 2012, of which 75.9% corresponded to the vitamin K antagonists phenprocoumon and coumadin.

Further information on the BfR website on the subject of vitamin K

Topic page on the assessment of vitamins and minerals in foods:
https://www.bfr.bund.de/de/bewertung_von_vitaminen_und_mineralstoffen_in_lebensmitteln-54416.html
https://www.bfr.bund.de/en/vitamins_and_minerals-54417.html

"Opinions app" of the BfR

3 References

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About the BfR

The German Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the Federal Ministry of Food and Agriculture (BMEL) in Germany. It advises the German federal government and German federal states (“Laender”) on questions of food, chemical and product safety. The BfR conducts its own research on topics that are closely linked to its assessment tasks.

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