

Proposed maximum levels for the addition of phosphorus/phosphate 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 not to use phosphorus for nutritional purposes in food supplements and fortified foods (Table 1).

Table 1: Proposed maximum levels

Food category	Maximum levels
Food supplement (per daily recommended dose of an individual product)	no addition*
Other foodstuffs (per 100 g)	no addition*

* for nutritional purposes

In view of the undesirable health effects discussed in relation with high intakes of phosphorus/phosphate or disturbed phosphate homeostasis, there are no reasons for a targeted addition of phosphorus to food supplements or conventional foods. Phosphates may, however, occur in food supplements or conventional foods in combination with other essential minerals or vitamins added in the form of phosphate compounds. In these cases, the phosphorus intake is restricted by the maximum levels established for the mineral or vitamin added as phosphorus compounds.

2 Rationale

2.1 Tolerable Upper Intake Level¹ (UL) and Dietary Reference Value

In 2005, the European Food Safety Authority (EFSA) concluded that healthy adults can tolerate phosphorus intakes up to 3.000 milligrams per day (mg/day) without adverse health effects. Although adverse gastrointestinal effects have occurred in some cases with supplementation > 750 mg/day, the data were not sufficient to derive a UL for phosphorus (EFSA, 2005, Table 2).

In recent years, high phosphate intake or disturbed phosphate homeostasis, especially in people with kidney disease, were discussed in association with an increased risk for cardiovascular diseases (Foley, 2009; Anderson, 2013; Itkonen et al., 2013; Menon and Ix, 2013; Mona et al., 2014) and, with coinciding suboptimal calcium status, with a risk for negative effects on bone health (Calvo and Uribarri, 2013; Takeda et al., 2014). However, in an EFSA opinion on these observations, it was stated that due to the nature of the scientific data available to date (observational studies), it is not possible to establish a causal relationship between phosphorus/phosphate intake from food, additives or serum levels and the observed adverse effects (EFSA, 2013).

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.

The D-A-CH Societies² have derived a Dietary Reference Value of 1,250 mg/day for children aged 15-18 years and of 700 mg/day for adults above 18 years. For pregnant and lactating women, higher DRVs of 800 and 900 mg/day, respectively, were derived (D-A-CH, 2015, Table 2).

EFSA set an Adequate Intake (AI) for phosphorus, which is at 640 mg/day for children between 11 and 17 years and at 550 mg/day for adults, including pregnant and lactating women (EFSA, 2015; Table 2).

Table 2: Dietary reference values (recommended intake) and UL

Age groups	Recommended Intake (D-A-CH, 2015)	Adequate Intake (EFSA, 2015)	UL (EFSA, 2005)
	mg/day		
Adolescents	1,250 (15- < 19 years)	640 (11-17 years)	-
Adults	700	550 (≥ 18 years)	
Pregnant women	800*	550	
Lactating women	900**	550	

* Pregnant women < 19 years: 1,250 mg

** Lactating women < 19 years: 1,250 mg

2.2 Exposure

Phosphorus/phosphates are naturally present in the human diet and often found in processed foods as additives³.

In Germany, no representative data on phosphorus/phosphate intake are available. Based on data from nine EU countries, EFSA estimated a mean phosphorus intake of 1,000 to 1,767 mg/day in adults (EFSA, 2015).

Assuming that these data are also applicable to Germany, it can be stated that the dietary reference value is achieved or even (far) exceeded on average. Notwithstanding the fact that no reliable data on phosphorus intake are available, it can be assumed that the actual intake is largely underestimated, as the use of phosphate as an additive cannot be taken into account in nutrition surveys.

2.3 Aspects considered in deriving maximum levels for food supplements and fortified conventional foods

Based on the available data, it can be assumed that (more than) sufficient amounts of phosphorus/phosphate are ingested through the normal diet, so that a deficiency of phosphorus can be virtually excluded in healthy individuals. Taking into account the supply situation of the German population as well as the potential risks discussed with a high phosphate intake, no reasons can be identified that would argue for a targeted addition of phosphorus to foods.

² German-Austrian-Swiss Nutrition Societies

³ Diphosphates (di- tri-, tetrasodium diphosphate; tetrapotassium diphosphate; dicalcium diphosphate; calcium dihydrogen diphosphate) may be used *quantum satis* (in sufficient quantity) in food supplements in accordance with the Additives Regulation.

According to the German Food Supplements Regulation or Annex I of Directive 2002/46/EC on the approximation of the laws of the Member States relating to food supplements and according to Annex I of Regulation (EC) No 1925/2006, the addition of phosphorus to food supplements and conventional foods is generally permitted. According to Annex II of both legal texts, however, it can be assumed that phosphorus is predominantly used in combination with other substances. A restriction of the resulting phosphate exposure may be achieved through the maximum amounts specified for the mineral or vitamin deliberately added as phosphorus compound.

Further information on the BfR website on the subject of minerals

Topic page on the assessment of vitamins and minerals in foods:

https://www.bfr.bund.de/en/vitamins_and_minerals-54417.html



"Opinions app" of the BfR

3 References

Anderson JJ (2013). Potential health concerns of dietary phosphorus: cancer, obesity, and hypertension. *Ann N Y Acad Sci.* 1301: 1-8.

Calvo MS, Uribarri J (2013). Public health impact of dietary phosphorus excess on bone and cardiovascular health in the general population. *Am J Clin Nutr.* 98: 6-15.

D-A-CH (2015). German Nutrition Society, Austrian Nutrition Society, Swiss Nutrition Society (eds.). *Dietary Reference*. 2nd version of the 1st edition 2015, Neuer Umschau Buchverlag.

Directive 2002/46/EC on the approximation of the laws of the Member States relating to food supplements. <http://eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:32002L0046&from=DE>; last accessed 1 March 2021.

EFSA (2005). European Food Safety Authority. Opinion of the Scientific Panel on Dietetic Products, Nutrition and Allergies on a request from the Commission related to the Tolerable Upper Intake Level of Phosphorus. *The EFSA Journal.* 233:1-19. <https://www.efsa.europa.eu/en/efsajournal/pub/192>; last accessed 1 March 2021.

EFSA (2013). European Food Safety Authority. Assessment of one published review on health risks associated with phosphate additives in food. *The EFSA Journal.* 11: 3444. http://www.efsa.europa.eu/sites/default/files/scientific_output/files/main_documents/3444.pdf; last accessed 1 March 2021.

EFSA NDA Panel (EFSA Panel on Dietetic Products, Nutrition and Allergies) (2015). Scientific Opinion on Dietary Reference Values for phosphorus. *The EFSA Journal.* 13: 4185. http://www.efsa.europa.eu/sites/default/files/scientific_output/files/main_documents/4185.pdf; last accessed 1 March 2021.

Foley RM (2009). Phosphate levels and cardiovascular disease in the general population. *Clin J Am Soc Nephrol.* 4: 1136-1139.

Itkonen ST, Karp HJ, Kemi VE, Kokkonen EM, Saarnio EM, Pekkinen MH, Kärkkäinen MU, Laitinen EK, Turanlahti MI, Lamberg-Allardt CJ (2013). Associations among total and food additive phosphorus intake and carotid intima-media thickness--a cross-sectional study in a middle-aged population in Southern Finland. *Nutr J.* 12: 94.

Menon MC, Ix JH (2013). Dietary phosphorus, serum phosphorus, and cardiovascular disease. *Ann N Y Acad Sci.* 1301: 21-6.

Mona S. Calvo, Alanna J. Moshfegh, Katherine L. Tucker (2014). Assessing the Health Impact of Phosphorus in the Food Supply: Issues and Considerations. *Adv Nutr.* 5: 104-113.

Takeda E, Yamamoto H, Yamanaka-Okumura H, Taketani Y (2014). Increasing dietary phosphorus intake from food additives: potential for negative impact on bone health. *Adv Nutr.* 5: 92-7.

Regulation (EC) No 1925/2006 on the addition of vitamins and minerals to foods. <http://eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:32006R1925&from=DE>; last accessed 1 March 2021.

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.

This text version is a translation of the original German text which is the only legally binding version.