Assessment of Dietary Intake of Phosphorus in Relation to Tolerable Upper Intake Levels

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Authors’ contributions

This work was carried out in collaboration between all authors. The opinion has been assessed and approved by the Panel on Nutrition, Dietetic Products, Novel Food and Allergy of VKM. All authors read and approved the final manuscript.

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ABSTRACT

The Norwegian Scientific Committee for Food Safety (Vitenskapskomiteen for mattrygghet, VKM) has, at the request of the Norwegian Food Safety Authority (Mattilsynet; NFSA), evaluated the intake of phosphorus in the Norwegian population. VKM has also conducted scenario calculations to illustrate the consequences of amending maximum limits for phosphorus (to 1000, 2000 or 2500 mg/day) in food supplements.

Phosphorus is an essential nutrient and is involved in many physiological processes, such as in the cell’s energy cycle, in regulation of the body’s acid-base balance, as a component of the cell structure, in cell regulation and signalling, and in the mineralisation of bones and teeth. In the human body, phosphorus is present in different forms. Serum contains mainly inorganic phosphates (Pi) (dihydrogen and monohydrogen phosphate), bone contains phosphorus largely in

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the form of hydroxyapatite, whereas the soft tissues and extracellular fluids contain organic phosphates in complex with carbohydrates, lipids and proteins. Phosphorus is the main mineral constituent of bones. About 85% of the body's phosphorus is in bones and teeth, and together with calcium account for around 80-90% of bone composition. The remaining 15% of the body's phosphorus is essential in functions ranging from the transfer of genetic information to energy utilisation. Phosphorus is a structural component of the nucleic acids DNA and RNA and thus involved in the storage and transmission of genetic material. It is an essential component of phospholipids (e.g. phosphatidylcholine) that form all membrane bilayers throughout the body. Phosphorus is also an essential component of adenosine triphosphate (ATP), the body's key energy source.

Currently there is no reliable biomarker of phosphorus status, and serum phosphorus increases for a short period after ingestion of a meal and then decreases and remains within a relatively narrow range as a result of homeostatic mechanisms.

The EFSA recommendations (2015) for adequate intake (AI) of phosphorus is 550 mg/day for adults, both sexes, whereas the recommended intake (RI) in the Nordic Nutrition Recommendations (2012) is 600 mg/day. Adolescents have a higher requirement of phosphorous because of bone accretion (640 mg/day EFSA and 700 mg/day NNR).

EFSA (2005) concluded that the available data were not sufficient to establish a tolerable upper level for phosphorus, however, data indicate that normal healthy individuals can tolerate phosphorus intakes up to 3000 mg/day. EFSA advised supplemental intake not to exceed 750 mg/day, because mild gastrointestinal symptoms have been reported when this dose was increased. EFSA gave no UL suggestions for children, lactating or pregnant women, while Institute of Medicine set a UL for total intake of phosphorous for children at 3000 mg/day and 4000 mg/day for adolescents and adults and 3500 mg/day for lactating women.

In accordance with EFSA (2005), VKM suggests to use 3000 mg/day as a provisional UL for total intake of phosphorus for adults, and suggests 750 mg/day as an upper level for supplements. Because of lack of data no provisional ULs are set for adolescents or children. Accordingly, all the suggested doses from NFSA (1000, 2000 and 2500 mg/day) in supplements exceed 750 mg/day, the suggested UL for supplemental phosphorus for adults.

Keywords: VKM; risk assessment; Norwegian Scientific Committee for Food Safety; phosphorus; food supplement; upper level; exposure.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.