Phosphates in Our World: Food and Non-Food Uses of Phosphates Webinar
Frequently Asked Questions (FAQ)
March 3, 2020

Responses from speakers with additional input from the International Food Additives Council (IFAC) and the Phosphate Forum of the Americas (PFA):
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1. **Q: How and why are phosphates used to cover lead pipes?**

   A: Phosphates are used in municipal water systems to create an insoluble layer between the metal pipes and the water flowing through them - this prevents corrosion of the plumbing and keeps metals like lead and copper from leaching into the drinking water.

2. **Q: Are phosphates used as a water buffer and, if so, does this add to the phosphorus content of drinking water? Could that contribute to dietary intake?**

   A: Phosphates are not added to buffer water. There may be very low levels of phosphate in drinking water (about 0.3-1.3 parts per million) due to corrosion control, i.e. to prevent the leaching of lead and copper from metal pipes.

3. **Q: Are plastic bottles lined with a "puff of phosphorus" as a preservative?**

   A: PFA is not aware of the use of phosphorus or phosphates to line plastic bottles or preserve their contents.

4. **Q: Is the Recommended Dietary Allowance (RDA) for phosphorus based on absorption from food? Is there a concern with the difference in our intake and absorption of phosphate additives versus from phosphates naturally occurring in food? When it comes to the RDA, should we be absorbing that much or consuming that much - again based on our ability to absorb from different sources and varying degrees of absorption?**

   A: Typically, Dietary Reference Intakes (DRIs) – which are made up of RDAs, Adequate Intake levels (AIs), Tolerable Upper Intake Levels (ULs), and Estimated Average Requirements (EAR) – are based on metabolic balance studies, and many are very old and don't contain many novel technologies used today. One looking to develop a DRI for phosphorous would monitor phosphorous excretion as a result of a person's diet to determine how much phosphorous the body is giving off and theoretically know how much the body needs to maintain homeostasis.

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If you think about a bell curve from statistics, the EAR represents where people might land and the RDA represents the 97th percentile or most of the population. Looking at studies of people who have high intakes, we really only have data for adults and it is extrapolated down by weight for children. The RDA is a good reference but not extremely accurate or reflective of current science.

5. **Q: What is the evidence to suggest that inorganic phosphorus -- when consumed in tandem with inorganic calcium from fortification and supplementation -- can lead to calcification of soft tissues (as a metabolic risk factor) even in people with normal physiologic regulation (such as those who do not have chronic kidney disease (CKD))?**

   A: Evidence to date does not suggest that higher intakes of phosphorus or calcium (regardless of the form) contributes to calcification of the soft tissues in healthy individuals free of CKD.

   See Dr. Wallace's commentary/mini-review on calcium supplementation and potential cardiovascular effects in the Journal of the American College of Nutrition (https://doi.org/10.1080/07315724.2019.1681202).

6. **Q: When you say "diet driven calcification of the intima," does this include highly processed (such as high fat/high carbohydrate) foods that can also be high in phosphate additives? Is there any research that identifies the correlation from the causation between these often co-occurring nutrients? Is someone at risk for over consuming highly bioavailable phosphorus if they are eating more highly-processed foods?**

   A: The terms "highly processed" and "minimally processed" can be misleading when it comes to food. For instance, milk powder would be considered "highly processed" by most definitions, but it provides a lot of nutrition to those in the developing world and is viewed as a positive contributor to health and nutrition.

   Calcification of the intima, or soft tissues in the body, is typically due to inflammation or vascular insult. A diet high in saturated- or trans-fat is a good example of something that would cause an issue. Obesity is also a cause. Regardless of their bioavailability, the body homeostatically regulates phosphorus and calcium…so serum levels stay relatively constant.

7. **Q: How are phosphate additives calculated in food?**

   A: Phosphate additives are used in food to achieve a specific technological function – such as to help leaven bread, act as a buffer in a dairy product, or preserve a meat product – and are only used in the amounts needed to achieve that function. While phosphates are not a human health concern except in certain subpopulations that have underlying health conditions, some people may be interested in the level of phosphate in a food.

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Additive levels are calculated based on the typical levels used in certain foods. As an example, researchers at Case Western Reserve University in Cleveland reviewed the labels of 2,394 best-selling branded grocery products in northeast Ohio for the presence of phosphorus additives. The top five best-selling products containing phosphorus additives from each food category were compared to similar products that did not contain phosphorus additives and analyzed for phosphorus content. Four days of sample meals were created consisting of foods with and without phosphorus additives, and daily phosphorus and pricing differentials were computed. Source: https://www.ncbi.nlm.nih.gov/pubmed/23402914.

8. **Q: How can we know that dietary phosphates are not causing a problem if we do not know how much phosphate additives are in foods? Can IFAC work on being transparent and report total/added amounts of phosphorus in food since they are now ubiquitous in manufactured foods?**

A: Phosphate additives must be declared on the ingredient list of a product label, so anyone wanting to know whether a food contains phosphates may simply review this list. Phosphates are typically used at low levels, and only to achieve the desired technical function in the finished product. For example, during the webinar, it was noted phosphates are used at 0.5% maximum in meat products.

The mission of the International Food Additives Council (IFAC) is to be the recognized global leader for food ingredient information, education and science, advocating for sound food ingredient policies. IFAC is committed to promoting science-based regulations, standards, and specifications for food ingredients worldwide.

IFAC has sponsored research to explore both the potential health implications of phosphate additives as well as the presence of phosphate additives in the food supply. In 2010, IFAC commissioned Cato Research to conduct a literature review and develop a whitepaper reviewing the available science around phosphate additives and human health. A manuscript summarizing this work, titled "Dietary Food-Additive Phosphate and Human Health Outcomes," was published in the journal *Comprehensive Reviews in Food Science and Food Safety* in September 2017. Cato reviewed 110 primary research articles examining phosphate consumption and health effects, and was unable to make a definitive conclusion as to whether the consumption of phosphates results in negative health effects for the healthy, general population.

In addition, since 2014, IFAC has been working with an outside researcher to separate and identify the amount of "added phosphorus" and "natural phosphorus" in the U.S. food supply, and determine whether the levels of added phosphorus are changing over time. Using National Health and Nutrition Examination Survey (NHANES) data from 1988 to present, usual intakes of phosphate food sources are compared with physiological measures to assess risk factors for developing disease. The data suggests "added phosphorus" is not

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associated with an increase in mortality. IFAC is planning to make this information public in the near future.

It should also be noted that the European Food Safety Authority (EFSA), an independent scientific organization that provides advice and opinions to the European Commission, recently completed its re-evaluation of phosphates used in the European food supply and published their findings in 2019. EFSA took into account all the potential sources of phosphates in the diet, including dietary supplements, and generally concluded phosphates do not raise safety concerns, including in infants. EFSA also analyzed whether the source of phosphorus in the diet was naturally occurring or added, and found the contribution of added phosphate in the diet is up to 20% of overall exposure, with 80% coming from natural sources in foods. Source: http://www.efsa.europa.eu/en/efsajournal/pub/5674.

Additional information regarding phosphate additive quantities is included in question #11 below.

9. **Q: Do you know of any research studies comparing absorption of naturally occurring phosphorus versus phosphate additives in humans?**

   A: Yes, see the examples noted above referring to NHANES and EFSA. There are numerous studies on this topic, including a 2017 literature review by IFAC which found insufficient evidence to support claims that the consumption of phosphates in food causes negative effects in humans (link to study here: https://onlinelibrary.wiley.com/doi/full/10.1111/1541-4337.12275).

10. **Q: Studies have shown that American intake of added phosphates have potentially more than doubled since the 1990s and that nutrient databases underestimate added phosphate intake by approximately 25%. Based on this, do you think it may be more likely that Americans may actually be consuming more phosphates than represented here?**

    A: Dietary intake of phosphorus is based both on levels of phosphorus in foods and how much of those foods are being consumed. The regulations we have in place that limit the use of phosphate additives have not changed since before 1990. The intake of "all natural" foods has become more popular, which do not allow for added phosphates in order to meet "natural" claims. However, it is possible "added" phosphorus intake has gone up over the years from food *choices*, but there has not been a major change in the food *supply* due to regulations that are in place. This data is currently being reviewed in the NHANES research, noted above, and IFAC is exploring publication options of the data findings. It is likely phosphate additives are underestimated, but to the exact extent is unclear.

11. **Q: Why does the Nutrition Labeling and Education Act (NLEA) not require the Nutrition Facts label to list information on phosphorus? Are**

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phosphates in most food applications considered to be processing aids and, therefore, exempt from labeling?

A: Phosphorous labeling is currently optional on the Nutrition Facts label. Labeling also does not distinguish between naturally occurring vs. phosphorous added. Phosphates can be used as processing aids only if they meet this definition. For more information on the definition, please refer to this website: https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=101.100. In most cases, although they are used at low levels, phosphates must be included in the list of ingredients in the product either as "sodium, potassium, or calcium phosphates" or by their common chemical name such as Disodium Phosphate, Sodium Hexametaphosphate, Potassium Tripolyphosphate, etc. Both the U.S. Department of Agriculture (USDA) and the Food and Drug Administration (FDA) set limits of the amounts of added phosphates that can be used in certain applications, such as 0.5% maximum added in meat products. USDA also does not allow use of phosphate additives for certain applications that have a standard of identity (SOI) or products that are considered "all natural" since phosphates do not meet this definition due to their purification and process we use to manufacture them (acid-base chemical reaction).

IFAC continues to assess opportunities to better educate consumers on food ingredients, like phosphates. This includes closely monitoring the Dietary Guidelines for Americans (DGA) process, and assessing legislation such as the Food Labeling Modernization Act of 2018 (HR 5425) that would require phosphorus labeling on the Nutrition Facts label.

12. **Q: Is the phosphorus upper limit (UL) based on naturally occurring phosphates, or does it also include phosphate additives?**

    A: The UL for phosphorus needs updating. To my knowledge it does not take into account the source of phosphorus (intake databases were not around when the DRIs were updated last).

13. **Q: Is there a biological marker of phosphorus intake?**

    A: Not a good one. Like calcium, the body keeps serum levels fairly constant…so a good blood marker is currently lacking.

14. **Q: Is phosphorus intake a concern for a person with nephrotic syndrome?**

    A: Yes, it is a concern for anyone with impairment of the kidneys.

15. **Q: Why are some food companies looking for ways to replace phosphorus in products if they provide so many benefits?**

    A: There a few reasons for this – very often they are removed because they are too chemical sounding, and manufacturers are trying to create labels that have

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more "simple" ingredients. Typical consumers are also not familiar with phosphates and therefore think they can be harmful. Other reasons are because they are not allowed to be used in products with "all natural" claims since phosphates, although from mineral origin, do not meet the "minimally processed" definition for all-natural ingredients per USDA.

16. **Q: Recent studies have shown that the level of phosphate intake is increased in those with cancer. Can you comment on it?**

    A: IFAC is not aware of the studies noted in the question, but observational studies can suggest associations between all kinds of inputs and outputs. However, they cannot establish causation and oftentimes contain numerous confounding variables. For example, many foods that contain phosphates are also high in sugar, saturated fat, salt, etc. Neither IFAC nor Dr. Wallace are aware of any biological premises for why phosphates would increase the risk of cancer.

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