



Health Connections

LINKING NUTRITION RESEARCH TO PRACTICE

NUTRIENT FORTIFICATION:

Panacea or Pandora's Box?

Introduction

Opinions about nutrient fortification span the extreme – from either a panacea to improve diets to a Pandora's Box potentially placing many consumers at risk from excess nutrient intakes. When choosing fortified foods, clients need information on the risks of both inadequate and excessive intake. This issue of *Health Connections* discusses how health professionals can assess a client's need for and provide guidance regarding fortified foods in a balanced and health-promoting diet.

Nutrition Science and Fortification

Nutrient fortification can be an effective strategy to improve the nutrient density of the food supply for the population as a whole, and to meet specific needs of subgroups. Nutrition science impacts fortification efforts when it raises the nutrient requirement bar. *The Dietary Guidelines for Americans 2005*¹ suggest consumers meet recommended nutrient intakes within energy needs by adopting a balanced eating pattern such as the **USDA Food Guide** or the **DASH Eating Plan**. However, the Guidelines recognize that sedentary consumers should take in less energy while still meeting nutrient needs; that there are nutrients of concern in the American diet e.g. calcium, potassium, fiber, magnesium, vitamins E, C and A; and that specific population groups are at risk for low nutrient intake due to increased need based on age, gender, life stage or for other socioeconomic reasons. Accordingly, among its recommendations, the Guidelines include iron and folic acid fortified foods for women of childbearing age who may become pregnant; B12 fortified foods for adults over age 50; and vitamin D fortified foods for older adults, those with dark skin or without sufficient exposure to sunlight.

Policies and Principles

Historically, governmental and voluntary programs enabled processors to add vitamins and minerals to food products to reduce the population's risk for nutrient deficiencies.² Examples include the addition of iodine to salt to prevent goiter; vitamin D to milk to prevent rickets; B vitamins and iron to flours and breads to prevent beriberi, pellagra, and iron deficiency anemia. Since 1998, FDA has required folic acid fortification of specific flour, breads and other grain products to reduce the risk of women having a pregnancy affected with neural tube defects (NTD). Folic acid fortification represented a slight shift in fortification intent: for the benefit of a large *subpopulation group* – women who may become pregnant – rather than for the benefit of the *whole population*. Folic acid fortification also represented a shift away from the “one nutrient – one disease” model (NTD) to potentially lowering the risk of diseases associated with low vitamin B status.

To provide for the rational addition of nutrients to foods, the Food and Drug Administration (FDA) encourages manufacturers to follow its codified Fortification Policy³ (see sidebar on page 3). While FDA cannot require manufacturers to comply with this set of principles and qualifying conditions, FDA regulates and enforces label claims about fortified products. To prevent manufacturers from

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fortifying low nutrient foods for the benefit of making health claims, FDA established minimum nutrient contribution requirements. FDA's policy discourages indiscriminate fortification and considers fortification of fresh produce, meat, poultry or fish products, sugars, candies and carbonated beverages inappropriate.

In 2003, a committee of the Institute of Medicine's Food and Nutrition Board proposed a series of Guiding Principles for Nutrition Labeling and Fortification⁴ focused on the scientific justification and public health need for increased availability of nutrients in the food supply. The committee suggested the Dietary Reference Intakes (DRIs) be used to assess the prevalence of nutrient inadequacy, and that the Tolerable Upper Intake Level (UL) be examined in different mathematical models to explain how current exposure to the nutrient in question would be changed by discretionary fortification. Modeling and subsequent monitoring are essential because fortification adds to a consumer's perception of a food's healthful benefits. Health-conscious individuals who scan nutrition labels for nutrient content levels and

claims already may be consuming higher-than-average levels of fortified foods as well as taking dietary supplements, placing them at risk for reaching the UL for certain nutrients.

Meeting Nutrient Needs from Food First

Technology and an ample and increasingly processed food supply offer the tools and opportunity for manufacturers to provide products with a "nutrient upgrade." Some believe that we should let food be food – without such intervention – to help maintain nutrient balance and optimal nutrient bioavailability. Bioavailability in both basic and fortified foods depends on the nutrient's form, food matrix, and presence of other nutrients in the total diet.

Nutrient-dense foods enjoyed in moderation remain the foundation of a health-promoting diet. These foods provide macro and micronutrients, dietary fiber and other bioactive compounds in forms and ratios more likely to maximize utilization and support nutrient balance. Getting nutrients from "foods first" lowers the risk of exceeding toxicological thresholds identified by the UL.⁵



Carl Keen, PhD

Dr. Keen, Professor of Nutrition and Internal Medicine, and Chair, Department of Nutrition, University of California, Davis, provides additional insight on benefits and risks of fortification practices as well as a look into the future.

Q. What are the primary drivers of fortification efforts?

A. In this age of wellness, we now ask food to do something historically it has not done – step up to the plate, nourish us, and protect our health in a manner similar to pharmaceuticals. Previous generations grew up on diets supporting them well into their fourth and fifth decades. Today, we expect food to support our physical health and our ability to play, think and concentrate well into our eighth and ninth decades.

As the evolving role of food in supporting optimal health is clarified and we learn more about the genetic bases of chronic disease risk, we need to ask when, or should, we take an approach to food guidance and nutrient fortification that is more similar to that used for pharmaceutical research. Drugs are effective for some individuals but not others, and in different doses. Biological variation in the disease process may reflect differences in one's genetics, environment, and culture. Similar to

the considerations physicians have when prescribing drugs, dietary recommendations in the future will be increasingly individualized, as we know that individuals can vary significantly in their nutritional needs. The extent to which these differences need to be considered with respect to fortified foods is an issue of active debate.

Q. What is your vision for nutrient fortification in the future?

A. Optimal nutrition remains a moving target. As nutrigenomics identifies individuals with higher, or at least different nutrient requirements, nutrient fortification can help to optimize an individual's nutritional plane. However, it must be stressed that genes alone do not dictate an individual's nutritional needs, rather they are driven by multiple factors including one's environment, lifestyle habits, age, presence of disease and genetic background.

The discovery of new compounds with health-promoting effects will call for new strategies involving both nutrition guidance and

fortification. As nutrition research is increasingly focused on the identification of “new” nutrients that provide health benefits (i.e. nutrients beyond the essential vitamins and minerals that have been the focus of attention in most nutrition departments), we may well discover that there are a number of health promoting nutrients that are found in relatively few foods. We may, or may not, choose to use fortification to deliver these nutrients to the population as a whole. But fortification offers the flexibility to distribute these nutrients more broadly throughout the food supply, potentially bringing additional health benefits to more consumers.

Q. Isn't the emphasis on food synergy/whole foods somewhat contradictory to nutrient fortification?

A. Synergy should be considered in the context of *nutrient* synergy – not just the interaction of the nutrients within a particular food – but the interaction of nutrients across food choices. For example, consumption of many different foods fortified with vitamin C may increase the absorption of non-heme iron by those consuming primarily a plant-based diet.

In contrast to supplementation, nutrient fortification is a “food-based” strategy to improve the nutrient density of the food supply.

Nutrient fortification supports, complements and helps implement dietary guidance that encourages the selection of nutrient-dense foods – both “natural” food sources AND fortified sources.

Q. What are some of the long-term issues related to fortification that need to be addressed?

A. Are we fortifying the most appropriate foods with the nutrients needed by those who consume those foods? Ideally, fortification would be targeted to predictable food categories consumed preferentially by those with specific needs. Compared to early fortification efforts, fortification today is not mutually exclusive to a specific food or food categories and there are many products that are interchangeable with regard to a specific nutrient. It is important to monitor who's eating which fortified foods. Folic acid fortification is an excellent example of the unintended consequences of widespread fortification having, in most cases, positive outcomes.^{6,7} Perhaps the same will be said for other fortification efforts in decades to come. And because fortification has commercial ramifications, we (the United States) will need to address harmonizing our food fortification policy to compete in a global food supply.

**SIDEBAR:
FDA Fortification Policy⁸**

Nutrients may appropriately be added to a food:

- To correct dietary insufficiency recognized by the scientific community to exist and known to result in nutritional deficiency disease when sufficient information is available to identify the nutritional problem, the affected population groups and food suitable to act as a vehicle for the added nutrients
- To restore nutrients lost during storage, handling or processing
- To avoid nutritional inferiority in a food that replaces a traditional food in the diet
- When the nutrient is:
 - Stable in the food under customary conditions of storage, distribution and use
 - Physiologically available from the food
 - Present at a level with reasonable assurance that consumption will not result in excessive intake considering cumulative amounts from other sources in the diet

PRACTICE POINTS FOR THE HEALTH PROFESSIONAL

Nutrient fortification, well beyond passively improving nutrient intakes of consumers, offers opportunity to individualize health-promoting diets. We generally evaluate adequacy of dietary *habits* over time rather than adequacy of individual *foods*. Here are some suggestions for assessing, evaluating and guiding choices from foods and beverages first and fortified sources if necessary:

- Evaluate lifestage, lifestyle and other factors that influence a client's nutrient needs before determining if and how fortified foods are needed.
- Query on supplement usage, assessing any potential adverse interactions with other nutrients in the diet or metabolic imbalances related to excess levels.
- Assess the need for fortified products periodically because food products in the marketplace, food preferences and client health needs change throughout the lifecycle.
- Evaluate how fortified products are used in the context of the client's existing food pattern. Do they substitute for other nutrient-dense foods? Are dietary adjustments needed to restore nutrient balance?
- Read the *Nutrition Facts* and other label information which often provide more current nutrient content information than government and commercial analysis databases.
- Keep current on research on nutrient interaction and bioavailability in basic as well as fortified foods. If additional information is needed, contact food manufacturers for documented studies about the efficacy of the fortification system used in specific products.
- Evaluate research about the role of new nutrients with significant health benefits, the evolving understanding of optimal nutrition and increased nutrient needs.