Nutrient Rich Foods Index: A Science-Based Approach to Measuring Nutrient Density

A Summary of Scientific Publications

The Nutrient Rich Foods Coalition (NRFC) has been working with leading researchers to develop a scientifically valid definition of nutrient density, as well as an educational tool to translate the science into a consumer-friendly application. The following is a summary of research studies and articles related to nutrient profiling models and the Nutrient Rich Foods (NRF) index.

Review Articles

- In the January 2008 issue of *Nutrition Reviews*[i], NRFC scientists outlined several criteria or guiding principles by which all nutrient profiling systems should be developed and evaluated, as follows:
    - Objective: The application should be based on accepted nutrition science and labeling practices.
    - Simple: The algorithm should be based on published daily values and meaningful amounts of food.
    - Balanced: The application should be based on both beneficial nutrients and nutrients to limit.
    - Validated: The chosen model should be validated against an independent measure of a healthy diet, such as the USDA's Healthy Eating Index, a measure of dietary conformance to federal dietary guidance.
    - Transparent: The algorithm should be based on published formulas and open-source data.
    - Consumer-driven: The application should be based on consumer research that proves useful and valuable to the consumer ultimately helping them build more healthful diets.

- A paper published in the June 2009 *Journal of Nutrition*[ii] recommended that a scientifically validated nutrient density profiling system be instituted as a nutrition platform in the Dietary Guidelines for Americans in order to help people choose more nutrient-dense foods and plan healthful diets. The article sets forth guiding principles for the development and implementation of such a system, and recommends that the development of this system should include testing for effectiveness against accepted measures of diet quality.

- In an article in *Nutrition Today*[iii], Adam Drewnowski, PhD, MA, provided an update on the nutrient profiling environment in Europe and the U.S., including the diverse implications nutrient profiling of individual foods has for regulatory agencies, the food industry and the consumer. In the European Union, health claims are the basis for profiling and the focus has been on nutrients to limit (fat, trans fat, sugar, sodium). In contrast, the Naturally Nutrient Rich (now Nutrient Rich Foods) approach maintains that the nutrient profiling score of a food should be based on both nutrients to encourage as well as nutrients to limit.

- In a review article[iv] describing the various attempts to define the nutrient density of foods over the last 30 years, author Adam Drewnowski, PhD, MA highlighted the concept of the Naturally Nutrient Rich (now Nutrient Rich Foods) score, which can be used to assign nutrient density values to foods within and across food groups.

- An article published in *Nutrition Today*[v] summarized the Naturally Nutrient Rich Scientific Symposium held in March 2004, which explored research developments toward creating a nutrient-density index as an educational tool to help consumers choose foods that are naturally nutrient-rich. The article supported the idea that nutrient density can provide the foundation for dietary guidance and education. By allowing for the consumption of all foods, this system can enable consumers to first choose foods that are naturally highest in quality, and then determine how much room is left over for foods that are less nutrient-rich.

Studies

- A study published in the June 2008 issue of the *Journal of Nutrition*[vi] showed that nutrient profiling systems, traditionally used to rank foods based on their nutritional content, can also help identify foods of good nutritional quality for their price.
- In a study published in the May 2009 edition of the *European Journal of Clinical Nutrition*[vii], researchers found that nutrient profile models based on protein, fiber, vitamins and minerals were inversely correlated with energy density (the number of calories in an amount of food). Models based on fat, sugar and sodium were directly correlated with energy density.
- Findings from a cross-sectional analysis of data[viii] from the 1999-2002 National Health and Nutrition Examination Survey (n = 9,688) of U.S. adults ≥20 years old found dietary energy density to be independently and significantly associated with:
    - Higher BMI in women and a trend toward a significant association in men
    - Higher waist circumference in women and men; elevated fasting insulin and metabolic syndrome

  These findings represent an important preliminary examination of the role of dietary energy density, the amount of calories per a designated portion of food, in obesity and related disorders.
- In a 2005 study published in the *Journal of the American Dietetic Association*[ix], a scoring system was developed to estimate the nutritional adequacy of vegetables and fruits three different ways: per weight (nutrient adequacy), per calorie (nutrient density), and per unit cost basis (nutrient-to-price ratio). Fruits and vegetables had the highest nutrient density because they were nutrient-rich in relation to their calories. They also had a relatively high nutrient-to-price ratio, showing that they provided nutrients at a reasonable cost when compared with other foods. Although dairy and lean meats were not specifically analyzed, the authors noted that lean meats and low-fat dairy foods represent many of these same qualities of low energy density and high nutrient content.

Relevant Articles, Practice Papers and Background Papers

- Research published in the *Journal of Nutrition*[x] indicated that nutrition profiling must be based on science, and that quality indices must be validated against proven measures of diet quality. Further, the paper validated several different indices with varying combinations of nutrients and selected the final NRF Index based on which nutrient combination best correlated with the USDA's Healthy Eating Index (HEI), which currently is the gold standard for measuring diet quality. This article also provided scientific evidence that the total nutrient package approach is a better determinant of the HEI score rather than nutrients to limit alone.
- The November 2008 *Journal of Food Science*[xi] summarized information presented at the July 2007 Institute of Food Technologists' annual meeting. The presentation, titled "Nutrient Rich Foods: Applying Nutrient Navigation Systems to Improve Public Health," emphasized that the American diet is high in calories, but low in nutrients. A nutrient profiling system that rates individual foods based on their nutrient content needs to be both science-driven and user-friendly, allowing consumers to make more healthful food choices within and across each food group.

- The continued interest in nutrient density or nutrient profiling prompted a practice paper[xii] by the American Dietetic Association (ADA), where the authors summarized the current understanding of nutrient density. Practice papers are evaluative summaries of scientific and evidence-based information that address ADA member-identified practice topics. This paper provided a brief history of approaches to assessing the nutrient quality of foods, identified issues related to the development of a more precise definition of nutrient-dense foods, and provided guidance to dietetics practitioners for using the current concept of nutrient density to improve the food choices of patients, students, clients and consumers.
- In an evidence-based background paper[xiii] about point-of-purchase nutrition programs, the Dietitians of Canada supported the Naturally Nutrient Rich (now Nutrient Rich Foods) index as an objective scale that describes the ratio of nutrients to calories contained in a food. The report stated that having point-of-purchase nutrition programs that use the same objective criteria as the NRF approach would facilitate consistent food product comparisons within and across food groups.

Visit www.NutrientRichFoods.org for more on these studies and other information, including recipes, meal ideas and a supermarket shopping list to help build and enjoy a nutrient-rich lifestyle.

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[i] Drewnowksi A, Fulgoni V 3rd. Nutrient Profiling of Foods: Creating a Nutrient-rich Food Index. Nutrition Reviews, January 2008.
[ii] Miller G, Drewnowski A, Fulgoni V, Heaney R, King J, Kennedy, E. It is Time for a Positive Approach to Dietary Guidance Using Nutrient Density as a Basic Principle. The Journal of Nutrition, June 2009.
[iii] Drewnowski A. An Update on Nutrient Profiling in the European Union and the U.S.: What's in Store for Nutrition Labeling and Health Claims? Nutrition Today, September 2007.
[iv] Drewnowski A. Concept of a Nutritious Food: Toward a Nutrient Density Score. American Journal of Clinical Nutrition. October 2005.
[v] Zelman K, Kennedy E. Naturally Nutrient Rich: Putting More Power on Americans' Plates. Nutrition Today. March/April 2005.
[vi] Maillot M, Ferguson E, Drewnowski A, Darmon N. Nutrient Profiling Can Help Identify Foods of Good Nutritional Quality for Their Price: a Validation Study with Linear Programming. The Journal of Nutrition, June 2008.
[vii] Drewnowski A, Maillot M, Darmon N. Testing Nutrient Profile Models in Relation to Energy Density and Energy Cost. European Journal of Clinical Nutrition, May 2009.
[viii] Mendoza JA, Drewnowski A, Christakis DA. Dietary Energy Density is Associated with Obesity and the Metabolic Syndrome in U.S. Adults. Diabetes Care. April 2007.
[ix] Darmon N, Darmon M, Maillot M, Drewnowski A. A Nutrient Density Standard for Vegetables and Fruits: Nutrients per Calorie and Nutrients per Unit Cost. Journal of the American Dietetic Association. December 2005.
[x] Fulgoni VL 3rd, Keast DR, Drewnowski A. Development and Validation of the Nutrient-Rich Foods Index: A Tool to Measure Nutritional Quality of Foods. Journal of Nutrition. August 2009.
[xi] Drewnowski A, Fulgoni VL, Young MK, Pitman S. Nutrient-rich Foods: Applying Nutrient Navigation Systems to Improve Public Health. Journal of Food Science, November 2008.
[xii] Practice Paper by the American Dietetic Association. Nutrient Density: Meeting Nutrient Goals within Calorie Needs. Journal of the American Dietetic Association, May 2007.
[xiii] Evidence-based Background Paper on Point-of Purchase Nutrition Programs, Dietitians of Canada, September 2006.