It Is Time for a Positive Approach to Dietary Guidance Using Nutrient Density as a Basic Principle 1,2

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Abstract
The consumption of nutrient-dense foods and beverages, which would ultimately be identified by a scientifically validated nutrient density profiling system, should be instituted as a nutrition platform in the Dietary Guidelines as a part of a larger educational effort to help people choose more nutrient-dense foods and as the guiding principle for consumers to plan healthful diets. By consciously choosing more nutrient-dense foods and beverages, Americans will be in a better position to meet their nutrient requirements without overconsuming energy. An objective, science-based, and validated nutrient density profiling system is needed to characterize foods based on their nutrient composition and this concept should be integrated into the Dietary Guidelines. This article sets forth guiding principles for the development and implementation of a nutrient density profiling system based on the current knowledge of diet and health and recommends that the development of a nutrient density profiling system include testing for effectiveness against accepted measures of diet quality, such as the Healthy Eating Index, and measurable public health markers, such as blood lipids and blood pressure. J. Nutr. 139: 1198–1202, 2009.

Introduction
The consumption of nutrient-dense foods and beverages, identified by a scientifically validated nutrient density profiling system, is the guiding principle for consumers to plan healthful diets and should be instituted as a nutrition platform in the Dietary Guidelines as part of a larger educational effort to help people choose more nutrient-dense foods. Nutrient-dense foods have been loosely described as those that provide substantial amounts of nutrients and relatively little energy, but a science-based definition is lacking (1). By choosing nutrient-dense foods and beverages, consumers will be in a better position to meet their nutrient requirements without overconsuming energy (1). Providing a practical tool that aids consumers in making more nutrient-dense food choices has the potential to improve the diets of all Americans.

This paper sets forth guiding principles for the development of a nutrient density profiling system that will help to better define nutrient density, as called for by the 2005 Dietary Guidelines Advisory Committee (DGAC) and others (2–6) and will aid consumers in identifying nutrient-dense foods.

Current methods to measure overall diet quality include the Healthy Eating index (HEI) (2), the Diet Quality Index (3,4), and the Alternative HEI (5). Such measures are most useful for retrospectively analyzing the diet quality of populations and for monitoring changes over time. Nutrient density is distinct from such measures, as it applies to individual foods. However, a nutrient density profiling system could also provide a clear measure of the nutrient density of the overall diets of individuals and of populations. Nutrient profiling, commonly understood as the science of characterizing foods according to their nutrient composition, distills a large amount of nutritional information into a single useful indicator or index (6,7). The concept is very distinct from, yet complementary to, the present Nutrition Facts Panel (8). To that end, it is recommended that any nutrient density profiling system ultimately be tested for effectiveness against established measures of diet quality, biochemical indicators of nutritional status, and measurable public health outcomes, including blood lipid levels and blood pressure (9).

The time has come for a paradigm shift in dietary guidance. It is recommended that nutrient density be instituted as a basic
principle of dietary guidance and that the development of a scientifically validated nutrient density profiling system that can be used to improve Americans’ diets become the focus of research efforts.

**Dietary guidance and the concept of nutrient density**

Dietary guidance is at a crossroads; the approach taken over the last several decades, which has focused on the avoidance of negative nutrients, such as saturated fat, cholesterol, sodium, and added sugar, has not yielded improvements in Americans’ diets and they continue to fall short of recommendations (8). Overall, the diets of Americans have become energy rich, yet nutrient poor (1). One consequence of this increasingly common dietary pattern is that the U.S. population is becoming undernourished while at the same time being overfed (1,10). As measured by the HEI, only 10% of the population consumes a “good” diet and few meet the recommendations put forth in the USDA Food Guide Pyramid (11). As individuals consume more foods and beverages that are low in nutrients, it becomes increasingly difficult to consume sufficient nutrients without weight gain, especially for sedentary individuals. As obesity rates continue to climb, it is imperative that individuals make all energy intake count in terms of nutritional value. Acknowledging this trend, the 2005 DGAC recommended that individuals increase consumption of nutrient-dense foods, but a clear definition of what constitutes a nutrient-dense food was not provided (1). In its report, the 2005 DGAC called for the development of a scientifically valid definition for “nutrient density” that could be useful on the food label and be helpful in developing the criteria necessary for foods to meet this definition (1).

This recommendation was based on the idea that for the past decade, a widespread concern has been that some foods may be classified as less nutrient-dense than others and these foods may be eaten at the expense of other foods that are, by comparison, better sources of essential nutrients” (1). The document encouraged Americans to consume a variety of nutrient-dense foods and beverages within and among the basic food groups, while choosing foods that, at the same time, limit intake of SFA, trans fatty acids, cholesterol, added sugars (those added during processing), salt, and alcohol (1).

In comments to the 2005 DGAC, the American Dietetic Association suggested that a new guideline on nutrient density be created to allow people to more easily choose the most nutrient-dense foods among similar items within foods groups and also to help them identify those foods they may want to moderate (12). The concept of nutrient density also has been featured as an important component of dietary guidance by the Institute of Medicine (13), the American Diabetes Association (14), and the AHA (15).

**Defining nutrient density and identifying nutrient-dense foods**

There is currently no science-based definition for either nutrient density or nutrient-dense foods (16). Without a definition that has been developed using an objective, scientific approach, the concept of what is a “nutritious” food is subjective and, therefore, inconsistent (17). Because of concerns that diets of a large portion of the American population are too high in nutrients to limit, such as saturated fat, sugars, and sodium, a “nutritious food” is often identified based primarily on low content of problematic nutrients, as opposed to a high content of beneficial ones (6). A wide variety of nutrient criteria are currently used in health and nutrition programs and on food labels. The AHA’s Heart-check mark is awarded to foods that meet the requirements for a heart health claim: they contain ≤3 g fat, ≤1 g saturated fat, ≤20 mg cholesterol, ≤480 mg sodium, and ≤0.5 g trans fat per serving (18). A food must also contain at least 10% of only 1 of 6 beneficial nutrients (vitamin A, vitamin C, iron, calcium, protein, or dietary fiber). These nutrients were chosen because of their public health importance. The National Heart, Lung and Blood Institute, as part of the Dietary Intervention Study in Children, categorized some foods within food groups as “Whoa” or “Slow,” as opposed to “Go” foods, largely based on their fat content (19). More recently, the European Commission has determined that foods may be disqualified from future nutrition and health claims if they contain above-specified amounts of fat, saturated fat, sugars, or sodium (20).

A nutrient density profiling system based upon a scientifically established definition of nutrient density would also differ from some existing profiling or rating systems that indicate only the nutrients to limit in a particular food. For example, the traffic light system adopted by some retailers in the UK conveys only a food’s content of fat, sugars, and sodium in a straightforward, simple manner (21). In the US at this time, there is a proliferation of front-of-pack labeling schemes developed by manufacturers, retailers, government organizations, and academics to indicate nutrient quality of foods.

Like the UK’s traffic light system, some of the composite front-of-pack symbols entering the marketplace have been based on nutrients to limit and fail to take into consideration the total nutrient package of a food or beverage. Competing nutrient labeling systems, combined with a lack of standardized criteria to define the nutritional quality of foods and beverages and a failure to consider the whole nutrient package a food offers, can communicate misinformation and result in consumer confusion (17). Several examples of nutrient profiling and nutrient labeling models have been or are currently being developed (Table 1). All of these recent efforts attest to the need for a clear, uniform definition of nutrient density for use in nutrition education and/or on food labels.

To address the increasing number of attempts to define “better-for-you” or nutritious foods by using front-of-pack logos and icons in the marketplace, the FDA convened a public hearing called “Food Labeling: Use of Symbols to Communicate Nutrition Information, Consideration of Consumer Studies and Nutritional Criteria” in September, 2007. The hearings were held to gather insight into the use of nutrient symbols on the front of packages as a way to identify the healthfulness of individual foods and to elicit comments (22). While ideally based on current knowledge and nutrition standards, an acceptable nutrient density profiling system must be adaptable to the inevitable changes in nutrition science and in the regulations governing nutrition labeling. In addition, it may need to change as the knowledge and understanding of the factors that affect consumer nutrition knowledge, food purchasing behavior, and health outcomes increase.

The development and evaluation of a nutrient profiling system, if done effectively, is complex and resource intensive. It is recommended that the development, testing, and validation of nutrient density profiling models, which has already begun, continue. The ultimate goal of this process is to objectively and quantitatively measure the nutrient density of individual foods in a manner that takes the full nutrient package (both beneficial nutrients and nutrients to limit relative to energy) into consideration. The specific nutrients most critical for public health may...
need to be determined and incorporated into a nutrient profiling system. Any nutrient profiling system that is developed should be tested against a full range of foods available to consumers, both across and within food categories. Previous efforts to educate consumers regarding nutrients to avoid have left them confused about nutrition priorities. By making nutrient density a primary message, dietary guidance would provide a positive pathway to a more healthful dietary pattern for Americans, i.e. encouraging consumption of nutrient-dense foods rather than providing negative messages regarding nutrients to avoid.

**Principles for defining and developing a nutrient density profiling system**

Faced with a proliferation of nutrient profiling systems, as well as a lack of an agreed-upon definition for nutrient density, it is critical that criteria should be established for the development of a nutrient density profiling system that conforms to a set of uniform, rigorous, and science-driven rules.

The system should be objective, simple, balanced, validated, transparent, and effective at improving diet quality. Objectivity can be achieved if the system is based on accepted nutrition science and labeling practices and takes into account those nutrients most important for public health. Simplicity can be achieved by integrating the system, to the extent possible, with science and labeling practices and takes into account those nutrients most important for public health. Balance can be achieved if the system is based on both beneficial nutrients and nutrients to limit. Validation of the system can be achieved if it is tested against measures of a healthful diet and health outcomes. Transparency can be achieved using peer-reviewed published algorithms and open-source data, including all assumptions, rationale, and analyses conducted. Effectiveness should be determined by a system’s demonstrated ability to improve overall diet quality and health variables.

The system should be consumer-oriented and be compatible with and support MyPyramid, the consumer translation of the U.S. Dietary Guidelines. More than simply serving as an isolated piece of nutrition information, such as a front-of-pack icon or label, a nutrient density index, derived from a nutrient density profiling system, must be coupled with consumer education. This will be critical for a nutrient density profiling system to be able to serve as an effective guide for individuals to make better food choices and consume more healthful diets.

The system should set criteria for fortification. A question has been raised as to whether nutrient density profiling would encourage capricious fortification, i.e. whether food manufacturers would begin fortifying their products with nutrients to increase a food’s nutrient index score. Potential unintended consequences of such fortification should be identified and fully evaluated. It is important to recognize that added nutrients do not always confer proportionately added value and thus this statement recommends that the issue be studied.

A system should be developed that allows foods to be rated according to nutrient density along a continuum of nutrients relative to energy (23). The application of a nutrient density profiling system based solely or mainly on nutrients to limit could lead to whole categories of foods being categorized as being undesirable (20). The system should be able to take into account those nutrients that are essential for health and those that may be harmful in excess.

**TABLE 1** Nutrients currently used in nutrient profiling and nutrient labeling models

<table>
<thead>
<tr>
<th>Model nutrients</th>
<th>Macronutrients and food groups</th>
<th>Vitamins</th>
<th>Minerals</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrient profiling formulas</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSAWXYfm (27)</td>
<td>Protein, fiber, fruits + vegetables + nuts</td>
<td>–</td>
<td>–</td>
<td>Energy, saturated fat, total sugar, sodium</td>
</tr>
<tr>
<td>LIM (31)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>Saturated fat, added sugar, sodium</td>
</tr>
<tr>
<td>NRF 9.3 (32)</td>
<td>Protein, fiber</td>
<td>Vitamins A, C, E</td>
<td>Calcium, iron, magnesium, potassium</td>
<td>Saturated fat, added sugar, sodium</td>
</tr>
<tr>
<td>Front-of-pack labeling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swedish Keyhole (33)</td>
<td>Fat, fiber</td>
<td>–</td>
<td>–</td>
<td>Fat, saturated fat, trans fat, sugars, sodium</td>
</tr>
<tr>
<td>NuVal (ONQI) (34)</td>
<td>Protein, fat and carbohydrate quality, energy density</td>
<td>Fiber, folate, vitamins A, C, D, E, B-12, and B-6, (n-3) fatty acids, bioflavonoids, carotenoids</td>
<td>Potassium, calcium, zinc, magnesium, iron</td>
<td>Saturated fat, trans fat, sodium, sugar, cholesterol</td>
</tr>
<tr>
<td>PepsiCo Smart Spot (35)</td>
<td>Protein, fiber</td>
<td>Vitamins A and C</td>
<td>Iron</td>
<td>Fat, saturated fat, trans fat, cholesterol, added sugar, sodium</td>
</tr>
<tr>
<td>Smart Choices (36)</td>
<td>Fat, fiber, and food groups to encourage (fruits, vegetables, whole grains and fat-free/low-fat milk products)</td>
<td>Vitamins A, C, E</td>
<td>Calcium, potassium, magnesium</td>
<td>Total fat, saturated fat, trans fat, cholesterol, added sugars, sodium</td>
</tr>
<tr>
<td>UK Traffic Light Labeling (21)</td>
<td>Fat</td>
<td>–</td>
<td>–</td>
<td>Total fat, saturated fat, sugar, sodium (as salt)</td>
</tr>
<tr>
<td>Unilever Nutrition Score (37)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>Saturated fat, trans fat, sugar (total + added), sodium</td>
</tr>
</tbody>
</table>

account those nutrients identified as being most critical for public health, i.e. nutrients in which most Americans’ diets fall short. A nutrient density profiling system not only should have the ability to score individual foods but also to aid individuals in building more healthful diets.

Potential applications
There are several potential applications for the concept of nutrient density and a corresponding science-based nutrient density profiling system. Developing a system to identify the nutrient density of foods across all supermarket aisles can help bridge the gap between the USDA’s MyPyramid and the information provided in nutrition facts panels on food labels and, in so doing, may help to implement the Dietary Guidelines. Ideally, the concept of nutrient density can provide the foundation on which future dietary guidance can be built (24). Nutrient density profiling also can help identify affordable nutrient-dense foods that are well accepted by the consumer (25,26).

While consumer education that provides guidance on choosing nutrient-dense foods and creating nutrient-dense diets is the primary goal of nutrient density profiling in the US, there is also great potential both in the US and abroad for the application of a nutrient density based profiling system for regulatory purposes. The system could be used to set guidelines for federal nutrition programs, health claims on foods, fortification, and marketing or advertising to children (6).

In the EU, the main purpose of nutrient profiling has been to identify those foods and food groups that, because of their nutrient profiles, would be disqualified from health claims (20). The European Commission has issued a proposal, now adopted by the European Parliament, on the use of nutrient profiles in the making of health claims (20). Efforts to develop, validate, and test nutrient profiling systems have been underway in the UK. The Food Standards Agency, the British equivalent of the FDA, has issued a report on its findings and recommended a nutrient profiling system that uses a simple scoring system (points for beneficial nutrients or attributes minus points for negative nutrients) based on the nutritional content of 100 g of a food or drink (27). Foods or drinks that score above certain cutoffs are classified as “less healthy.” The Agence Française de Sécurité Sanitaire des Aliments, the French counterpart to the U.S. FDA, has also prepared a report on nutrient profiling (28). In 2004, the FDA expressed interest in using a nutrient density approach instead of the currently used 10% nutrient contribution requirement for health claims (29), but no such action has been taken by the agency.

Given that there are several potential applications, the creation of a profiling system based on nutrient density must satisfy what may appear to be multiple objectives (6,30). The goal of a nutrient density profiling system is to help individuals identify more healthful, nutrient-dense food choices and ultimately improve Americans’ diets. To that end, it must be simple, consumer friendly, and identify the best food choices both within a food group and potentially across food groups (16). Although the terms “nutrient dense” and “nutrient density” are commonly used, consumer research has found that the term “nutrient dense” has a negative connotation among consumers; “nutrient rich” or “rich in nutrients” resonates better with them (Shugoll Research, unpublished data). It will be important for consumer education tools, derived from a scientifically validated nutrient density profiling system, to be translated in a way that provides meaningful consumer messages that lead to behavior change, resulting in more nutrient-dense diets. Any nutrient density profiling system will need to be field tested to ensure that consumers are interpreting and using the resulting nutrient density scores in the intended manner. Ongoing testing and adjustments of a system based on these results is critical. Those working to develop nutrient profiling systems should look to new technologies for simple, effective ways to communicate the concept of nutrient density to consumers.

It is critical that the system be objective, based on science, transparent, and based on open-access data and calculations (30). If the proper steps are taken in its development and implementation, a single, uniform nutrient density profiling system has the ability to meet all of these goals.

Recommendations for nutrient density
A scientifically valid definition of nutrient density that takes into account a food’s balanced nutrient package, including beneficial nutrients, nutrients to limit, and energy, should be established and incorporated into the Dietary Guidelines and MyPyramid and used to complement the nutrition facts panel.

Nutrient density, based on an objective, science-based, and validated nutrient density profiling system, should be instituted as a nutrition platform in the Dietary Guidelines and as the guiding principle in planning healthful diets. As nutrient profiling indexes that are developed from a science-based nutrient density profiling process are translated into consumer educational tools or messages, translation must be grounded in consumer research that demonstrates consumers’ purchasing behaviors within food groups and potentially across food groups and across dietary patterns. When educating consumers regarding the nutrient density of foods and applying a nutrient density profiling index across a continuum of nutrients relative to energy, consumer-friendly language, such as “nutrient rich” instead of “nutrient dense” should be used. A science-based nutrient density profiling system should be validated against objective measures of diet quality, such as the HEI, and recognized health parameters, such as BMI, blood pressure, and blood lipids. A nutrient density profiling system should have the ability to measure the nutrient density of foods (reflecting the total nutrient package), meals, and the total diet while taking into account those nutrients most important for public health. Any accepted nutrient density profiling system must be demonstrated to do what it is intended to do: help individuals choose and consume more healthful diets.

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