Practice Paper of the Academy of Nutrition and Dietetics: Selecting Nutrient-Dense Foods for Good Health

ABSTRACT
The 2015 Dietary Guidelines for Americans encourage selection of nutrient-dense foods for health promotion and disease prevention and management. The purpose of this Academy of Nutrition and Dietetics practice paper is to provide an update regarding the science and practice of nutrient-dense food identification and selection. Characterization of tools used to identify nutrient density of foods is provided and recommendations for how registered dietitian nutritionists and nutrition and dietetics technicians, registered, might use available profiling tools to help consumers select nutrient-dense foods is discussed.

Research Suggests American diets are energy-rich and nutrient-poor. Regular consumption of nutrient-dense foods for health promotion and disease prevention continues to be a mainstay of dietary recommendations provided by registered dietitian nutritionists (RDNs) and nutrition and dietetics technician, registered (NDTRs). Scientific and professional organizations such as the American Diabetes Association and the American Heart Association, whose memberships advocate optimal nutrition, prominently feature the concept of nutrient density in their dietary guidance. The recently released 2015 Dietary Guidelines for Americans (DGA) recommend that individuals choose and consume a variety of nutrient-dense foods from among the basic food groups, including whole grains, low-fat milk, fruit, vegetables, lean meats and poultry, beans and peas, and nuts and seeds, prepared with little or no solid fats and added sugars, refined starches, and sodium. This practice paper builds upon the 2007 nutrient density practice paper, which introduced the concept of nutrient density and posed thoughtful questions and answers intended to bridge gaps between research and practice. The objective of this practice paper is to assist RDNs and NDTRs in guiding clients in making nutrient-dense food choices by summarizing the current knowledge regarding the science of nutrient density as it relates to individual foods, identifying consumer trends relevant to the selection and consumption of nutrient-dense foods, and describing nutrient-density profiling tools available to help consumers identify and choose nutrient-dense foods. Addressing nutrient-dense dietary patterns is not within the scope of this practice paper.

Defining Nutrient Density
The core concept of nutrient density is the concentration of nutrients per amount of that food or caloric contribution of that food. The DGA definition of nutrient-dense foods are those that "provide vitamins, minerals, and other substances that contribute to adequate nutrient intakes or may have positive health effects, with little or no solid fats and added sugars, refined starches, and sodium." Ideally, these foods and beverages also are in forms that retain naturally occurring components, such as dietary fiber. According to the DGA Executive Summary, "All vegetables, fruits, whole grains, seafood, eggs, beans and peas, unsalted nuts and seeds, fat-free and low-fat dairy products, and lean meats and poultry—when prepared with little or no added solid fats, sugars, refined starches, and sodium—are nutrient dense foods." Highly nutrient-dense dietary patterns are synonymous with higher consumption of whole grains, low-fat dairy, vegetables, and fruits; that is, foods whose consistent intake has been associated with prevention of chronic disease. In addition to a renewed focus on these foods, the DGA include practical suggestions for selecting these foods to optimize nutrient density of diets. Primarily, optimizing nutrient density is done by shifting typical food and beverage choices (items high in solid fats, added sugars, refined starches, or sodium) to more nutrient-dense options. Although the DGA recommend to focus on food first, fortified products

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### Nutrient Density Profiling Tools, United States

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<tr>
<th>Tool</th>
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<tr>
<td>NuVal Nutrition Scoring System (previously the Overall Nutritional Quality Index)</td>
<td>Helps consumers understand the nutrient density of the food they purchase by generating a summative score based on presence or absence of ≥30 nutrients; uses Institute of Medicine Dietary Reference Intakes and the Dietary Guidelines for Americans; scores range from 1-100.</td>
<td>Scores correlate with health outcomes. Incorporates measures for quality of protein, fat, carbohydrates, calories, and n-3 fatty acid content and distinguishes between nutrients to encourage (eg, vitamins, minerals, and antioxidants) and nutrients to limit (eg, added sugar, sodium, trans fat, and cholesterol).</td>
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<td>Nutrient Rich Foods Index</td>
<td>This validated index is a sum of percent Daily Values for 9 nutrients to encourage minus the sum of percent daily value for 3 nutrients to limit with all Daily Values calculated per serving size.</td>
<td>Distinguishes between nutrients to encourage (eg, vitamins, minerals, and antioxidants) and nutrients to limit (eg, sugar, sodium, and saturated fat). Versatile across individual foods, total diet, and menus and allows calculation of nutritional value of food per unit cost.</td>
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<td>Affordable Nutrition Index</td>
<td>Scoring system based on the Nutrient Rich Foods Index that produces a nutritional value per dollar score to help consumers identify low-cost, nutritious foods.</td>
<td>Provides nutrition value per dollar tool that could help clients of federal food assistance programs (eg, WIC and SNAP), distinguishes between nutrients to encourage (eg, vitamins, minerals, and antioxidants) and nutrients to limit (eg, added sugar, sodium, and saturated fat).</td>
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**a**WIC=Special Supplemental Nutrition Program for Women, Infants, and Children.  
**b**SNAP=Supplemental Nutrition Assistance Program.

**Figure 1.** Nutrient density profiling tools, United States.

and supplements may also be used to boost consumption of underconsumed, or shortfall, nutrients (eg, vitamin D, calcium, fiber, folate, vitamin E, and vitamin C) in certain instances when food alone may not be enough to meet needs.

### ASSESSING NUTRIENT DENSITY OF FOODS

Nutrient density of a food can be characterized through its systematic ranking or classification based on nutrient composition. Using established algorithms, the presence or absence of specific nutrients is noted and the food is assigned a score based on the a priori criteria. The resulting scoring system can be transformed into a practical tool to help consumers identify foods that appropriately balance essential nutrients, such as protein and mono- and polyunsaturated fats and dietary fiber, with overconsumed nutrients associated with poorer health outcomes, including added sugars, saturated fat, trans fat, and sodium.

Although no single nutrient-density profiling tool or system has been endorsed, more than a dozen tools have been developed and pilot tested in the public sector. Figures 1 and 2 provide a description of selected nutrient-density profiling tools available through retail grocery stores and some foodservice settings in the United States (Figure 1) and internationally (Figure 2) designed to provide consumers with point-of-purchase nutrient density guidance to help them choose among similar products.

RDNs and NDTRs should be mindful of several factors when recommending or using nutrient-density profiling tools to determine the nutrient density of individual foods. Firstly, all nutrient-density profiling tools generally consider both beneficial (and typically underconsumed) nutrients such as fiber and some vitamins and minerals, as well as those known to negatively influence health when consumed in excess (eg, added sugars, saturated fat, trans fat, and sodium); however, inclusion of these nutrients depends on the tool—some are more narrowly focused on several essential nutrients rather than the entire spectrum. In addition, some tools will highlight nutrients based on their known influence on important health outcomes. For example, scores in the NuVal system reflect what is known about relationships between saturated fatty acids, n-3 fatty acids, and cardiovascular disease, and promote n-3 fatty acids as beneficial for cardiovascular disease prevention. Finally, systems for evaluating the nutrient density of individual foods use different methods to present critical information. For instance, the Guiding Stars program assigns foods between one and three stars indicating nutrient density (0=Not rated, or lowest levels...
of nutrient density and 3—High nutrient density), whereas NuVal scores range from 1 to 100, with a higher score indicating higher nutrient density.

MEETING NUTRIENT GOALS WITHIN CALORIE GOALS

Energy density, defined as the amount of energy per weight of food or beverage, is relevant to recommendations to increase consumption of nutrient-dense foods. Low-energy-dense foods contain high amounts of water and fiber, which contribute gram weight and volume without excess energy. Importantly, low-energy-dense foods are also typically lower in saturated fat and added sugars, and higher in nutrient density.

A systematic review of dietary energy density and body weight suggested that a diet composed of low-energy-dense foods supported weight loss and weight maintenance in adults. Several factors are believed to contribute to this observed effect, including that higher fiber and water intake from low-energy-dense fruits, vegetables, and whole grains may promote greater satiety and the potential displacement of high-energy-dense foods with low-energy-dense foods. This might result in lower overall calorie intake.

The DGA stress that to stay within energy requirements while meeting nutrition needs, choices in each food group must be nutrient-dense, and when possible, without additional calories from added sugars, refined grains, solid fats, or a combination of those. Shifting from typical foods to more nutrient-dense choices is an important principle in maintaining caloric balance. At calorie levels between 1,200 and 1,800, <10% of the total calorie budget remains after all food group requirements have been met in nutrient-dense forms, necessitating limits on added sugar, refined grains, and solid fats. Sugar-sweetened beverages, such as sweetened carbonated beverages, sports drinks, and fruit drinks, are of particular concern given their high energy density and low nutrient density (and high prevalence of sugar). Their consumption should be managed within overall limits on calories and calories from added sugar.

Nicklas and colleagues identified several challenges related to recommending nutrient-dense foods in a 2014 commentary. They questioned whether nutritious foods that are also very energy-dense (e.g., olive oil, avocados, meats, and nuts and seeds) should be recommended with the same enthusiasm as less-energy-dense foods. As Nicklas and colleagues point out, fruits and vegetables vary widely in their nutrient-density scores (e.g., dried fruit vs fresh fruit vs fruit juice); thus, generalizations about the nutrient density of entire food groups is not nuanced enough, and ignores health benefits gained from incorporating highly-energy-dense foods that are also high in nutrient density into the overall diet. The DGA address the varying nutrient density within each category, and a primary focus the guidelines present for nutrition educators and consumers is shifts within each food group from typical to nutrient-dense choices, an important principle for maintaining caloric balance.

The DGA provide a variety of strategies for individuals to choose nutrient-dense foods in each food group within recommended daily calorie limits. These strategies, including using liquid oils in place of, not in addition to, solid fats; choosing fat-free and low-fat dairy; selecting lean cuts of meat and poultry; varying choices in the vegetable category; and limiting foods high in added sugars with few or no beneficial nutrients. Specific examples of switches within each food group to nutrient-dense choices are provided as concrete examples of what RDNs and NDTRs could use in educating patients and clients.

COMMUNICATING THE NUTRIENT DENSITY OF FOODS TO THE PUBLIC

In response to a rise in chronic diseases worldwide and calls to action by leading health advocacy groups, several global scientific communities, food manufacturing industries, regulatory agencies, and public health advocacy groups from the Americas, United Kingdom, Europe, Australia, New Zealand, and the Netherlands have developed nutrient-density profiling tools to guide consumers in making nutrient-dense food choices. The general purpose of these tools is to promote increased consumption of fruits, vegetables, fiber, and whole grains, while decreasing consumption of added sugars, saturated fat, trans fatty acids, and sodium.

Perhaps the most recognized application of these efforts has been fact-based, front-of-package (FOP) labeling, usually represented by a symbol or logo representing the food quality and any health claims. In the United States, fact-based labeling restates facts already existing on the Nutrition Facts panel, such as amounts of calories and nutrients and their respective percentage Daily Value per serving. Several different approaches exist, but generally, foods are ranked as high or low in specific nutrients based on a priori criteria, with the ranking communicated directly to consumers through a combination of logos, symbols, and/or colors. The US Facts Up Front campaign, a voluntary joint effort of the Grocery Manufacturers Association and the Food Marketing Institute, represents the most significant coordinated attempt to date at FOP consumer guidance in the United States. Facts Up Front labeling is designed to draw consumers’ attention to calories per serving, three “nutrients to limit” (saturated fat, sodium, and sugar), and up to eight “nutrients to encourage.” The encouraged nutrients—fiber, potassium, calcium, iron, protein, vitamin C, vitamin A, and vitamin D—only appear on a package in cases where the product contains 10% or more of the Daily Value per serving of that nutrient. Notably, this voluntary program is associated with a fee; thus, it is up to food manufacturers to make the decision of whether or not to include Facts Up Front on the principal display panel of the package.

Findings from FOP consumer research efforts in the European Union suggest that an ideal application of these tools would be simple, easy-to-understand information presented as easily recognized graphic designs in attractive contrasting colors. The most widely used and consumer-accepted FOP nutrient density profiling tool in multiple EU countries (Sweden, Denmark, Norway, and the United Kingdom) has been The Healthy Eating System, which provides guidance regarding how frequently specific
foods should be consumed to meet dietary guidelines. However, for widespread adoption across the European Union to be realized, any FOP guidance must meet three criteria: the tool must help consumers meet dietary guidelines, be used to guide or inform public policy, and aid in the prevention of chronic diseases for diverse populations throughout the life span.\(^{23}\) As a result, the Healthy Eating System has not yet been adopted widely across the European Union.

In the Americas, consumer research conducted with Canadian consumers regarding FOP nutrition education and symbols indicate that more than 50% of the population desires a government-regulated FOP, and the Canadian Institute of Medicine Committee on the Examination of Front-of-Package Nutrition Rating Systems and Symbols has endorsed FOP nutrition education as a viable way to aid consumers in selection of healthier foods.\(^{22-24}\) More recently, the Pan American Health Organization has proposed a Nutrient Profile Model to assess the nutrient density of foods and guide consumers in identifying products with high amounts of added sugars, sodium, total fat, saturated fat, and trans fat.\(^{25}\) The model is intended to inform policies and regulations promoting decreased consumption of foods high in added sugar, sodium, saturated fat, and trans fat, including FOP labeling and nutrition guidelines for school food environments.

Tools designed to help individuals choose and consume nutrient-dense foods should be grounded in science, validated against objective measures of diet quality, and most importantly, be able to effectively translate recommendations into actionable strategies. This means a simple and user-friendly interface or display, allowing for easy identification of nutrient-dense food choices within and across food groups. Limited consumer research suggests the term nutrient\(_d\) dense does not resonate with consumers—rather, nutrient-rich or rich in nutrients is preferable.\(^{5,16}\) Furthermore, consumers are highly responsive to the visual aspects of packages, including color, characters, images, and FOP claims, and use these elements to make a determination about whether a food is healthy.\(^{22-24}\)

The revised US Nutrition Facts label is a response to consumer preferences

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<td>Guiding Stars(^{19})</td>
<td>Uses information from the Nutrition Facts panel and ingredients list to rate nutrition quality. Foods receive a score of 0-3 stars based on credits (eg, presence of vitamins, minerals, fiber, whole grains, and n-3 fatty acids) and debits (eg, presence of saturated fat, added sodium, and added sugar). High nutrient density means more stars (1=Good, 2=Better, and 3=Best).</td>
<td>First storewide nutrition-related guidance system developed by retail stores for foods and beverages. Tiered star icon system distinguishes between nutritious and non-nutritious foods. Each product must provide 5 kcal/serving or more to be rated. 100-kcal standard serving may result in over- or underestimation of nutrient density.</td>
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<td>Healthy Eating Systems(^{23})</td>
<td>FOP(^{4}) system derived from Traffic Light and Guideline Daily Amounts jointly developed by Sanitarian Health &amp; Wellbeing Company and Australia’s Public Health Association.</td>
<td>Color coding based on recommendations from Food Standards of Australia and New Zealand. Provides guidance on how frequently to eat foods to meet dietary guidelines (eg, often, occasionally, or sparingly).</td>
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<td>International Choices Programme(^{17,22})</td>
<td>Uses FOP labeling model that incorporates more than 20 countries’ dietary guidance. It focuses on basic and essential nutrients—vitamins, minerals, and water—and those that negatively influence health (eg, added sugar, sodium, trans fat, and saturated fat).</td>
<td>Publicly available data underlying the algorithm. Reassessment of the system conducted every 3 y by a panel of international scientific committee.</td>
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<tr>
<td>Nutrient Density Climate Index(^{25})</td>
<td>Based on Nordic Nutrition Recommendations for 21 essential nutrients. Uses greenhouse gas emissions expressed in grams of carbon dioxide to assess whether the nutrient density of beverages can change or offset their emissions cost. Beverages with the highest emissions have the highest Nutrient Density Climate Index score. Nutrient density of beverages was calculated based on presence of</td>
<td>Does not consider bioavailability of foods and quality of carbohydrate, protein, and fat.</td>
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Figure 2. International nutrient density profiling tools.
There is a continuous and high demand for access to health information and tools, and many individuals monitor their food, physical activity, and sleep behaviors with help from their smartphone’s software applications (apps). Thousands of diet-related apps have flooded the market, providing users with the ability to learn the calorie and nutrient content of foods instantaneously, help them set weight loss goals, or assist them with food preparation. Most lack a scientific evidence base for their use. Although easy and instant access to information through digital tools is now the norm, consumers may find it challenging to leverage the features and functions of these apps to select nutrient-dense foods or build a nutrient-dense eating plan based on those foods without the guidance of an RDN.

There are few apps that address nutrient density; however, any number of diet-focused apps include standard features and functions that allows users to enter foods and beverages consumed and can be used to complement a diet history collected by an RDN during a one-on-one consult. Estimated calorie goals are frequently provided within the context of the app (based on body weight, age, sex, and participant weight management preferences); however, implementation of any dietary adjustments is typically left up to the consumer. An RDN’s clinical judgment and familiarity with evidence-based practice can guide consumers to the best app for their goals and health needs. RDNs and NDTRs can guide consumers, using these apps, to assess an individual food’s nutrient density or build a nutrient-dense eating plan. Based on a client’s individual nutrition needs, RDNs and NDTRs can educate clients on how to use apps to identify foods with the most beneficial levels of these nutrients within their calorie needs. These tools can also help clients identify low nutrient-dense foods that can be swapped for more nutrient-dense options.

### Restrictive or Therapeutic Diets and Influence on Nutrient Density

Popular diets and nutrition trends often advocate eliminating or restricting foods or entire food categories, thereby negatively influencing nutrient density. Notable among recent restrictive or therapeutic diets is the avoidance or complete elimination of gluten. A growing body of evidence suggests celiac disease, an autoimmune condition that affects approximately 1.8 million US adults, and nonceliac gluten sensitivity, characterized by gut and systemic reactions to consumption of several types of fermentable carbohydrates in addition to gluten, are on the rise. However, even consumers without celiac disease or nonceliac gluten sensitivity have become interested in gluten-free foods, which include those products containing wheat, barley, rye, as well as malt and oats, that are not gluten-free. Several popular diets have capitalized on consumer demand for gluten-free foods, suggesting elimination of not just wheat, but all grains, beans, legumes, dairy, added sugars, and alcohol, and some fruits. RDNs can ameliorate potential nutrient shortfalls that arise from restrictive eating plans by determining whether specific foods or food groups are being avoided and refocusing nutrition guidance on alternative food sources of essential nutrients. RDNs and NDTRs can continue to communicate to clients and patients the value of a nutrient-dense diet and strategies on how to achieve this eating pattern by selecting nutrient-dense foods within limitations of a restrictive diet when possible. The DGA emphasize shifting food choices between food categories and within each food group from lower to higher nutrient-density foods. A variety of examples are provided in the DGA, providing a framework for RDNs and NDTRs to work from in counseling patients and clients on making food choices within each category that lead to overall eating patterns consistent with the DGA recommendations. In addition, any one of the three US Department of Agriculture food patterns identified by the DGA are valuable tools for RDNs and NDTRs to use in evaluating a client’s current diet and providing

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<td>Powerhouse Fruits &amp; Vegetables</td>
<td>Nutrient density approach used by the Food and Agriculture Organization of the United Nations and the Institute of Medicine related to consumption of so-called powerhouse fruits and vegetables that provide an average 10% or more daily value per 100 kcal of 17 nutrients.</td>
<td>Excludes other food groups that could also be nutrient-dense. Phytochemicals not considered in calculation of nutrient density score.</td>
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*FOP=Front of package.

**Figure 2. (continued) International nutrient density profiling tools.**
counseling on more nutritious food choices.

**Costs of Nutrient-Dense Foods**

Limited data suggest that nutrient-dense foods may have a higher per-calorie cost compared with less nutrient-dense food choices. This is concerning, particularly because more than 40% of households with incomes below the federal poverty line experience combined food insecurity and obesity. Notably, this hunger—obesity paradox disproportionately affects households headed by minority women. Although it remains to be determined whether nutrient-dense diets are priced beyond the reach of all low-income households, RDNs and NDTRs should remain sensitive to income-related constraints when counseling clients and patients and be able to recommend nutrient-dense options on a budget. Numerous online resources for RDNs and NDTRs (and consumers) seeking information about healthy eating on a budget are available.

**SUMMARY AND IMPLICATIONS FOR PRACTICE**

The DGA provide a valuable framework for RDNs and NDTRs to use in defining, identifying, and helping clients and patients select nutrient-dense foods. Examples include guidance on making shifts within each food group from traditional to nutrient-dense food choices, leveraging strategies to add foods with higher nutrient density, considering the nutrient density of beverages, and focusing on food groups that provide underconsumed nutrients and nutrients of public health concern. It is also important for RDNs and other health care professionals to maintain an awareness of dietary trends that might influence nutrient-dense food choices and the available tools to help consumers enhance dietary nutrient density.

Finally, RDNs are valuable allied health professionals who should collaborate with policymakers, other nutrition and dietetics practitioners, and food manufacturers to reach a consensus definition of nutrient density for use by these stakeholders. Although many consumer-ready options to assess the nutrient density of foods exist, data demonstrating the influence of these tools on food choices and health outcomes remain limited, in part because of the lack of consistency in defining and assessing nutrient density. More detailed guidance for health professionals and consumers will become available as these tools are used and evaluated across diverse populations. In the meantime, RDNs and NDTRs can continue to help their patients, clients, and consumers meet individual health needs through nutrient density by maintaining an awareness of tools and systems available in their geographic region that are best suited for their population.

**References**


9. Townsend MS. Where is the science? What will it take to show that nutrient profiling systems work? J Am Clin Nutr. 2010;91(suppl):1109S-1115S.


