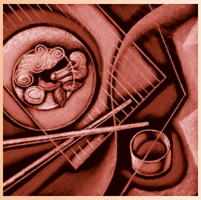

What's Next for Nutrition Labeling and Health Claims?

An Update on Nutrient Profiling in the European Union and the United States

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Nutrient profiling of foods is defined as the science of categorizing foods based on their nutrient composition. Nutrient profiles, based on some combination of key nutrients relative to calories, can have multiple applications. For health professionals, identifying nutrient-dense foods using nutrient profiling can be a valuable tool for consumer education and dietary guidance. The *2005 Dietary Guidelines for Americans* referred specifically to nutrient density as a way to help consumers identify the most nutrient-rich foods within and among food groups. For regulatory agencies, nutrient profiles can be the basis for disallowing nutrition or health claims and for regulating advertising to children. The European Union has adopted nutrient profiling as the basis for regulating nutrition and health claims. Whereas the US approach has emphasized positive nutrients, the European approach has focused squarely on the foods' content of fats, *trans*-fats, sugars, and sodium. As a result, the development of competing nutrient profiles by researchers, regulatory agencies, and the food industry in the European Union and the United States has been marked by different priorities, pressures, and concerns. However, the development of nutrient profiles needs to follow specific science-driven rules. These include the selection of reference nutrients and reference amounts, the creation of an appropriate algorithm for calculating nutrient quality scores, and the validation of the chosen scheme against objective measures of a healthy diet. Additional studies need to test the usefulness of the concept among nutrition professionals and among consumers. Nutr Today. 2007;42(5):206–214

The American diet is said to be increasingly energy-rich but nutrient-poor.[1] To help improve the nutrients-to-energy ratio, the *2005 Dietary Guidelines for Americans* recommended that consumers replace some of the foods in their diets with more nutrient-dense options.[2] Nutrient-dense foods were defined as those that provided substantial amounts of nutrients in relation to few calories.[2] Consumers were advised to select such foods first to meet their nutrient goals without exceeding energy needs.[2] The 2005 US Department of Agriculture MyPyramid.gov likewise made reference to the nutrient-dense foods within food groups as a way of promoting nutrition education and dietary guidance.[3]

The *2005 Dietary Guidelines for Americans* marked a resurgence of interest in the quality of individual foods,[1] as opposed to total diets.[4,5] Previous work on this topic, some conducted more than 3 decades ago, led to the creation of food quality indices, nutrient quality profiles, and nutrient-to-nutrient ratios.[1] The Naturally Nutrient Rich (NNR) score,[1] introduced at a symposium held in Washington, DC, in 2004,[6] provided a set of objective criteria to assign a nutrient profile of nutrient density values to individual foods. Based on the amount of beneficial nutrients in foods in relation to the foods' dietary energy, the NNR score was intended to assist people in making healthier choices both within and across food groups. It was also intended to be a communication tool for health professionals who offered dietary advice to the public.[6] Without a scientifically valid definition of what a nutrient-dense food is, many nutritionists still resort to the subjective approach of "I know it when I see it."[1]

> *We need common agreed-upon definitions of when a food is nutrient-rich if we are to help people to understand the concept and better implement dietary guidelines and recommendations.*

Whereas consumer guidance was the main reason for developing nutrient density concepts in the United States, parallel efforts at nutrient profiling in the European Union were largely driven by regulatory issues.[7–9] In the European Union, the main purpose of nutrient profiling was to identify those foods and food groups, which, because of their nutrient profiles, would be disqualified from making a health claim. Additional applications of nutrient profiling were directed toward food labeling,[10] new product development,[11] and the regulation of marketing and advertising to children.[12,13]

The European Commission's proposal on the use of nutrition claims for foods was adopted in May 2006 by the European Parliament.[7] That proposal mandated the creation of science-driven nutrient profiles as an indispensable condition for the making of health claims. Article 4 of the draft regulation specifically required that nutrient profiles take into account such potentially disqualifying nutrients as total fats, *trans*-fats, total sugars, and sodium.[7] Positive nutrients, that is, those known to be beneficial to health, were also to be included in nutrient profile models. Finally, nutrient profiles were to consider the importance of the food in the population's diet and in the diets of children and other special groups.

The proposal was broadly adopted by the European Commission's council of ministers of health in June 2006 and is now being ratified by the new member states of the European Union. Expert groups were given a 2-year window to develop and validate appropriate nutrient profiling schemes. The British Food Standards Agency (FSA), which is similar to the Food and Drug Administration (FDA) in the United States, began this work in advance of others, and its final report is now available online.[10,14] In particular, the FSA-Ofcom score (Office of Communications) is to be the basis for regulation broadcast advertising of foods to young children.[14] Other regulatory agencies, including the Agence Française de Sécurité Sanitaire des Aliments, the French equivalent of the FDA, are also preparing their own reports.[7]

The European Commission is interested in defining nutrient density for regulatory, rather than solely educational purposes.

At the same time, food companies have begun using nutrient profiles to guide consumer choice.[15] In the United Kingdom, 5 food companies (Danone, Kellogg's, Kraft, Nestle, and PepsiCo) and 2 grocery chains (Tesco and Sainsbury's) have developed their own food labeling systems, largely based on the foods' content of fat, sugar, and salt.[15] In the Netherlands, Unilever has come up with a nutrition score to improve the nutritional quality of foods in the company portfolio.[16] In the United States, provisional third-party labeling schemes have also been developed by some food companies (PepsiCo, Kraft, and McDonald's) and by a supermarket chain (Hannaford).[17,18]

The key question is whether consumers will understand the concept of nutrient profiling and use it to make better food choices. Thus far, the impact of existing "better-for-you" label icons on consumer behavior in the United States has been mixed and, in some cases, disappointing. According to industry reports, PepsiCo's Smart Spot will be overhauled, harmonized with the Kraft or Unilever systems, or withdrawn altogether.[18] Industry sources further suggest that some of the major transnational food companies in Europe will work together to harmonize their own nutrient profiling schemes.

In an increasingly global marketplace, the multiplicity of profiles, which differ across countries and continents, can only be confusing to consumers and legislators alike. However, the many approaches to nutrient profiling have many science-driven elements in common. These include the selection of reference nutrients and reference amounts, the creation of an appropriate algorithm for score calculation, and the validation of the chosen scheme against some objective measure of a healthy diet. A discussion of similarities and differences in how these issues are being handled in the European Union and in the United States is the topic of this review.

Approaches to Nutrient Profiling

Most foods contain different proportions of nutrients, including some that are reported to be beneficial to health and some that are not. Nutrient profile models can be based on positive nutrients, negative nutrients, or some combination of both. In addition, points can be added or subtracted depending on what category the food belongs to.

The list of negative nutrients is relatively short. As defined by the European Commission, negative nutrients are saturated fats, *trans*-fats, total sugars, and sodium.[7] As operationalized in the models of the British FSA, negative nutrients are energy, saturated fat, total (or added) sugar, and sodium.[10,13,14] As defined by the FDA, the disqualifying nutrients are total fat, saturated fat, cholesterol, and sodium.[19] As recently formulated by the US Department of Agriculture's Center for Nutrition

Policy and Promotion, the problematic nutrients were solid fat, added sugar, and alcohol.[20] Other schemes have further distinguished between total and added sugars.[16] Although there is general agreement on what the nutrients are, there is no consensus on what to call them. Words such as negative, limited, restricted, problematic, or avoidance nutrients have all been used.

In contrast, the list of positive or beneficial nutrients has been much broader. Most often, the list would include selected macronutrients (protein, fiber, essential fatty acids), vitamins (vitamins A and C), and minerals (calcium and iron). The choice of positive nutrients for inclusion in the score was based on previously documented efforts to define healthy diets (see Drewnowski[1] for review). For example, 5 nutrients—protein, calcium, iron, vitamin A, and vitamin C—are integral to the Women, Infants, and Children's Supplemental Food program because they were most likely to be lacking in the diets of low-income women.[1] The Women, Infants, and Children's Supplemental Food program also tracks the intakes of folate, vitamin B_6, and zinc. Among additional nutrients of public health significance, as listed by the National Cancer Institute, are fiber, carotene, vitamin E, and magnesium.[1] The 2 models developed for the British FSA also took food categories into account, awarding extra points for the content of fruit, vegetables, or nuts.[13,14]

Table 1 shows selected examples of nutrient profiles that may emphasize positive nutrients, negative nutrients, or some combination of both. The list includes the 2 FSA models: SSCg3d[13] and the more recent WXYfm.[14] A more complete list of past models has been published recently elsewhere.[21] As indicated, the number of positive nutrients, mostly macronutrients, vitamins, and minerals, has ranged from a low of 2 to a high of 23. In contrast, the most frequently used negative nutrients were saturated fat, added sugars, and sodium.

It should be emphasized that both the FDA and the US Department of Agriculture's Food Safety and Inspection Service have long relied on the nutrient content of foods to prevent misleading advertising and to regulate health claims. In the FDA food labeling guide, regulated terms such as "free," "low," or "reduced/less" can apply to calories, total or saturated fat, sodium, sugars, or cholesterol. In contrast, the terms "good source of" or "excellent source of" are used to describe protein, vitamins, minerals, dietary fiber, or potassium per reference amount. As in Europe, the goal was consumer

Table 1. A Comparison of Positive and Negative Nutrients Used to Construct Selected Nutrient Profile Models

Score and Reference	Macronutrients	Vitamins	Minerals	Negative Nutrients
Naturally Nutrient Rich Drewnowski[1]	Protein, fiber, MUFA	Vitamins A, C, D, and E; thiamin; riboflavin; vitamin B_{12}; folate	Calcium, iron, zinc, potassium	
Nutrient density score Maillot et al[22]	Protein, fiber, linoleic acid, linolenic acid, DHA	Vitamins A, C, D, and E; thiamin; riboflavin; vitamin B_{12}; folate; niacin; vitamin B_6	Calcium, iron, zinc, potassium, copper, iodine, selenium, magnesium	
Ratio of recommended to restricted food components Scheidt and Daniel[23]	Protein, fiber	Vitamins A, C	Calcium, iron	Energy, saturated fat, total sugar, sodium, cholesterol
FSA model SSCg3d Rayner et al[13]	n-3 fatty acids, F + V (g)		Calcium, iron	Energy, saturated fat, added sugar, sodium
FSA model WXYfm (FSA-Ofcom score) Rayner et al[14]	Protein, fiber, F + V + nuts (g)			Energy, saturated fat, total sugar, sodium
Limited nutrients score Maillot et al[22]				Saturated fat, added sugar, sodium
Unilever nutrition score Nijman et al[16]				Saturated fat, sugar (total and added), sodium, *trans*-fats

FSA indicates Food Standards Agency; MUFA, monounsaturated fatty acids; DHA, docosahexanoic acid; F + V, fruit and vegetables.

protection, and the use of negative nutrients has been primary. However, those nutrient-specific descriptors were never combined into a composite nutrient density score for a given food, for which the FDA has no recent precedent. The application of nutrient profiling to labeling and health claims, although based on recognized criteria, represents a radical new departure.

Scores for foods based on many nutrients are complicated and raise challenging questions that nutrition scientists need to agree upon and answer.

Basing a new score on multiple nutrients presents many challenges. There are some dangers inherent in basing a nutrient density score on too few or on too many nutrients. Some nutrients are highly correlated with each other. For example, the energy and the fat contents of foods tend to be correlated, as are saturated fat and cholesterol. A score that includes energy, total fat, saturated fat, *trans*-fat, and cholesterol is a score that discriminates among foods based purely on their fat content. On the other hand, an unweighted score based on a large number of vitamins, minerals, trace elements, and other micronutrients may have little discriminating power, especially if all nutrients are treated as equally important and all scores tend toward the mean. Selecting the optimal number of nutrients, based on some objective criteria, is one priority for future research.

Another fundamental question is whether to base the nutrient density profile on positive nutrients, with some acknowledgment of the negative ones, or the other way around. The NNR score, initially based on 14 positive nutrients and fiber, did not directly consider the foods' content of fat, sugar, or salt.[1] However, given that the score was calculated based on 2,000 kcal of food, it did in fact give lower scores to foods with a higher energy density and a higher content of added sugars and fats.[1] It is fair to say that scores based on positive nutrients were developed primarily for consumer education, whereas scores based on negative nutrients were developed in response to regulatory concerns. In essence, the selection of key nutrients demonstrates one major difference between the European and the US approaches.

The third important question is whether the nutrient profile should be developed separately for each food group or whether it should apply across the board. Several scores listed in Table 1, including the NNR score,[1] are across-the-board scores that make for easy comparisons both within and across food groups. The FSA final model,[14] although nutrient based, awards extra points if the food contains fruit, vegetables, or nuts. On the other hand, the Swedish and Dutch schemes are both category-specific, as is the Unilever score.[16]

The application of scores based on negative nutrients to all foods in the food supply may lead to whole categories of foods failing the nutrient profile test. Industry groups and some regulatory agencies are therefore said to lean toward category-by-category nutrient profiling schemes. For example, a summary report of the French Nutrition Institute meeting in June 2006[7] noted that the category-by-category approach was favored by the April 2006 workshop of European branch of the International Life Sciences Institute (Europe)[9] and may be adopted by the French regulatory agency, Agence Française de Sécurité Sanitaire des Aliments.[7]

The development of category-based scores will require a separate set of definitions of what exactly constitutes a food category. As of now, the Dutch use 14 food categories, the Swedes and the Danes have 26 food groups, and the Eurofoods system uses 33 food groups.[7] One recent study used 7 major and 25 minor food groups.[23] The caution here is that the selection of food categories is often culture-specific: whereas the French include a separate subcategory for croissants ("viennoiseries"), the US system emphatically does not. Harmonizing cultural differences, defining food groups, and selecting appropriate nutrient profiles for each food category or food group are another important topic for further research.

Reference Amounts, Distribution, and Bioavailability

A number of methodological issues also need to be resolved. Chief among them are the basis of score calculations and the selection of reference amounts. Nutrient density is typically defined as the ratio of the nutrient composition of a food to the nutrient requirements of the human being.[24] To compare the two, calories are the most appropriate common denominator, rather than food servings or portion sizes. Formal comparisons between the nutrient composition of foods and reference daily values (DVs) are meaningful only if made on a standard-per-calorie basis, usually per 2,000 kcal. The resulting nutrient density ratio is then independent of serving size.[1]

However, potential applications to food labeling may very much depend on portion size. For this reason, researchers have a choice of calculating percentage DVs based on 100 g, 100 kcal, or on some government-mandated portion or serving size of a given food. One early calories-for-nutrient score was based on values calculated per 100 g of food; the NNR score was based on percentage DVs per 2,000 kcal. Other studies used percentage of the French recommended dietary allowances for each nutrient based on 8 MJ (1,913 kcal) of food as consumed.[23] The selection of an appropriate method will have implications for validating the chosen scheme against some measure of a healthy diet.

A number of important factors still need to be considered. Chief among these are the biological quality of nutrients in the food source, their bioavailability, and the distribution of the nutrients in the food supply. The NNR score is an unweighted score with each nutrient assigned the same importance. However, there are instances of weighted nutrient density scores, where some nutrients are assigned higher weights.[1]

Whereas some nutrients are widely distributed, others are restricted to a narrower range of food sources or are found in sufficient quantities in a small number of foods. A preliminary ranking of the nutrient content of more than 200 component foods from a food frequency questionnaire showed that some nutrients were more broadly distributed than others. For comparison purposes, each nutrient was expressed as percentage DV in 2,000 kcal of food. Most of the foods contained protein. On the other hand, only a fraction of foods contained vitamin C, most of them vegetables and fruits. Relatively few foods contained vitamins E and B_{12}, which makes these 2 nutrients nonubiquitous. A weighting system for the NNR score could be based on the distribution and the relative rarity of the nutrients in the food supply.

Bioavailability of nutrients by food source would be another way to weight the NNR score. Calcium in milk is more bioavailable than the calcium in spinach, and heme iron in meat is more bioavailable than the iron in plant-based products. Although some of these issues are handled by the setting of DV amounts, a weighted NNR score might address it as well.

Validation: A Fundamental Issue

The nutrient density approach needs to be validated against some objective measure of a healthy diet. Ideally, diets composed of nutrient-dense foods should also be scored as more healthy by some independent criteria. However, few such studies have been conducted. Instead, nutrient profiling schemes have been simply compared to expert opinion of what constituted a nutritious food. Opinions of health professionals were used to set the scoring criteria[25,26] and to evaluate the resulting scores.[27,28]

> *Nutrient profiles are compared to expert opinion, but even expert opinions are subject to the vagaries of fashion. Better, less subjective validation methods must be found.*

The Padberg score was a weighted nutrient quality index, developed in 1993, at the height of consumer concerns with dietary fat.[25] The importance of each nutrient was based on a survey of 372 US dietitians, and regression analyses were used to assign nutrient weights. Consistent with then-current trends, the dietitians assigned major importance to total fat (weight, 0.30) and less to saturated fat (weight, 0.17); viewed calcium as less important (weight, 0.04); and virtually disregarded iron (weight, 0.00005). However, a nutrient popularity poll has inherent limitations because the prevailing opinions can change. By 1998, saturated fat became a major dietary concern. Australian dietitians asked to perform a similar task for the Nutritious Food Index[26] now assigned higher weights to saturated fat (0.5) than to total fat (0.31) and equal weights to both calcium and iron (0.114).

Expert opinion has also been used to test nutrient density scores. In the UK, more than 700 nutrition professionals were asked to rate 120 foods for perceived nutritional value along a 6-point category scale.[27] Nutrient profile scores for the same 120 foods, obtained using a variety of methods, were then correlated with the subjective responses. A similar comparison of nutrient profiling systems done in France[26] was based on responses from only 12 nutrition experts who rated 125 foods along 5-point scales ranging from healthier to least healthy. That validation panel included 10 experienced scientists in nutrition, sitting on official expert committees, and 2 dietitians. The panel was not provided with nutrition information, save for the fat/sugar content of fresh dairy products and visible fats. The FSA score came closest to reflecting the panel's opinions, which, as the authors pointed out, reflected no only knowledge and expertise but also personal and cultural points of view.[28]

Comparisons with expert (or inexpert) opinion do not represent a true validation of nutrient profiling. If supposedly "objective" scores are created and validated using experts sitting on official advisory panels, then those panels are more likely to endorse a score that was based on their opinion in the first place. The main criterion then becomes whether a given sequence of foods seems "right,"[27] and the test method becomes merely a veneer for subjective opinions.

Being able to validate nutrient profiles against some objective measures of healthy diet and even health outcomes is the highest research priority.[1,7] The critical question is whether regular consumption of foods with favorable nutrient profiles will predict overall diet quality, as established using existing and independent measures. At this time, no published study has established a link between nutrient profiles of foods and other measures of diet quality such as the Healthy Eating Index.[29] On the other hand, there are data suggesting that nutrient density of frequently consumed foods may affect the consumption of key nutrients in the diet. Studies[30] showed that more frequent consumption of "low nutrient dense" foods by children and adolescents was associated with lower dietary intakes of calcium, iron, vitamin A, vitamin B_6, folate, magnesium, and zinc.

Early reports[7] suggested that one approach of validating nutrient profiles may be based on identifying healthy diets and then looking for correlations with indicator foods. Another possibility may be to apply similar criteria to diets and then look for correlations with health outcomes.[2] More sophisticated validation methods need to be developed because the selection of the optimal score depends on its performance with respect to healthy diets and some objective assessment such as "goodness of fit" from the statistical standpoint.

Two Approaches to Nutrient Profiling: A Comparison

The differences between the US and the European approaches to nutrient profiling are epitomized by the NNR score and by the British FSA nutrient profile model WXYfm.[14] The NNR score was developed for consumer education and to help implement dietary guidelines. The FSA nutrient profile was developed to provide the scientific basis for regulating broadcast advertising to children.[14] Beginning in April 2007, the British media and communications regulator Ofcom introduced broadcasting restrictions to reduce the exposure of children to television advertising of foods high in fat, saturated fat, sugar, and sodium.

The NNR approach emphasized positive nutrients, although it did include energy density in score calculation. The FSA-Ofcom nutrient profile emphasized negative nutrients, with some acknowledgment of positive ones (protein and fiber), and favored foods belonging to desirable food groups (fruit, vegetables, and nuts).

It is interesting to see how the 2 scores behave when applied to the same set of foods. The NNR score is a nutrient-to-calories ratio based on percentage DVs calculated per 2,000 kcal of food. The initial version was based on 14 nutrients (see Table 1): protein, calcium, iron, vitamin A, vitamin C, thiamin, riboflavin, vitamin B_{12}, folate, vitamin D, vitamin E, monounsaturated fat, potassium, and zinc. The NNR score now also includes fiber and is the arithmetic mean of percentage DVs for a total of 15 nutrients, calculated as follows:

$$NNR\ score = \textstyle\sum_{1-15}(Nutrient/DV) \times 100)/15$$

In its previous version, the NNR score was based on percentage DVs truncated at an arbitrary limit of 2,000%, so that the contribution of any single nutrient would not contribute disproportionately to the total score.

In contrast, the FSA nutrient profile model WXYfm (FSA-Ofcom score for short) was based on 4 negative and 3 positive nutrients. The negative items were energy, saturated fat, total sugars, and sodium, all calculated per 100 g. The positive items were protein; non–starch polysaccharide fiber; and the food content of fruit, vegetables, and nuts, the latter derived using a rather complex formula. The desirable or positive components were then subtracted from the negative component score to yield the final score, unless the negative score exceeded 11.[14] The final desirable score was actually negative, with numbers below 0 denoting the more nutritious foods. Conversely, the undesirable score of negative nutrients was actually positive. It is unclear if this reverse polarity scale will be embraced by the average consumer.

Figure 1 shows the relationship between the 15-nutrient NNR score plotted along a logarithmic scale and energy density of more than 300 foods (MJ/kg). Score points were not taken away if the food contained fat, saturated fat, sugar, cholesterol, or sodium. However, because percentage DVs were calculated based on 2,000 cal, energy density did enter into NNR calculations and the less energy-dense foods did tend to have a higher score.

The distribution of NNR scores by food category shows a wide spread of nutrient density scores both across and within food groups. Within the fruit and vegetable categories, most items were low-energy-density foods, with the exception of nuts, fried potatoes, and potato chips. The NNR scores for fresh produce were high. However, the more caloric items such as raisins

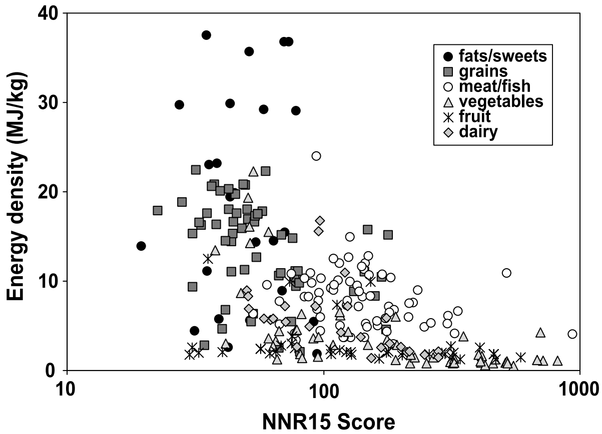

Figure 1. Relationship between NNR score and energy density of foods by food group.

or fruit in heavy syrup had lower NNR scores than did fresh grapes, fruit in light syrup, or other fresh fruit. Importantly, fat content did not preclude avocados or nuts from having relatively high NNR scores when calculated based on a nutrient-to-energy ratio. Similarly, legumes such as peas, beans, or lentils received high NNR scores despite their relatively high energy density. Conversely, low energy density did not help the scores of sweetened beverages, given their low nutrients-to-energy ratios. The low end of the range was truncated at 10; some sweetened beverages scored below that cutpoint.

Figure 2 shows the relationship between the FSA-Ofcom score and energy density for the same 300 foods. It can be seen that the FSA-Ofcom score was largely a function of energy density of foods. In preliminary regression models, energy density alone accounted for 53% of the variance, whereas the contribution of other components to the score was relatively minor. Given that the FSA-Ofcom score was largely based on the energy, saturated fat, and sugar content of foods, the high correlation with energy density was not surprising. However, that also means that the score tends to penalize energy-dense foods, that is, those foods that are dry.[31] Grains, in particular, tended to score poorly on the FSA-Ofcom score.

Because all vegetables, fruits, and nuts got extra points by virtue of being themselves and regardless of their nutrient content, the FSA score did not discriminate well within the fruit and vegetable category. That food group did not vary a great deal in the content of saturated fat, sugar, or sodium, and all scores were uniformly good. Another surprise was that sweetened soft drinks score relatively high, in close proximity to milk!

Nutrient Profiles, Pleasure, and Cost

The development of nutrient profiling schemes must not neglect consumer research. Nutritional quality of foods is one reason why consumers select healthy diets.[32] However, their food choices are also influenced by eating pleasure and by food costs.[23,33] If consumers are to use nutrient profiling to make better food choices, those factors too need to be taken into account.

Some of these considerations may be lost in the single-minded pursuit of optimal nutrition. The Unilever score, developed to evaluate and improve the nutrient quality of beverages and foods, was based on the foods' content of saturated fats, *trans*-fats, sugars, and sodium.[16] As recently reported, foods meeting global dietary recommendations were skim milk, apple, boiled potato, diet soft drink, and leaf tea, making for a nutritionally sound but joyless diet. Boiled egg and clear vegetables soup were in the gray area, whereas full-fat milk, cream of asparagus soup, brown bread, beef stew, ravioli, and ice cream failed to meet any recommendations altogether. Clearly, the development of scientifically sound nutrient profiles is only the first step. Additional research needs to be done on the likely consumer response, lest the well-meaning recommendations are rejected by consumers altogether.

Another concern, gradually rising in importance, is that *healthier diets simply cost more*. After examining the relative prices of healthy and less healthy foods, Dietitians of Canada[15] expressed a concern that the recommended healthy foods may not be affordable, given that the healthy food basket from Health Canada is not accessible to many Canadian families. The report also pointed to the need

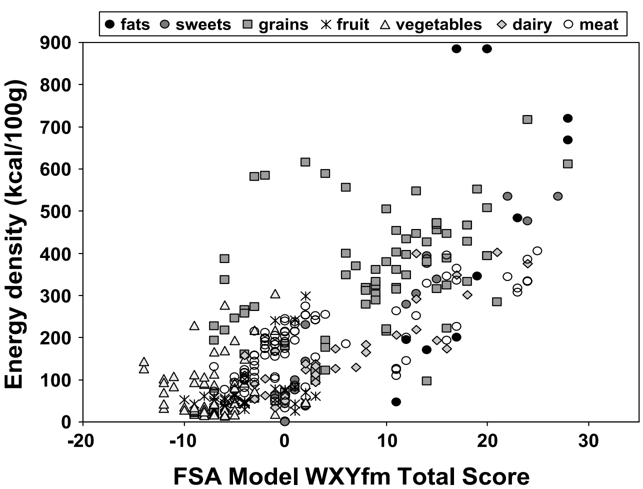

Figure 2. Relationship between the FSA-Ofcom score and energy density of foods by food group.

for rigorous consumer research with diverse consumer groups, including low-income households.[34]

People eat to live, but they also live to eat, and pleasure as well as cost enter into food choices. All of these factors must be kept in mind in giving nutritional advice.

Preliminary calculations using FSA-Ofcom scores and Seattle food prices showed that the estimated energy costs of foods with FSA scores in the −14 to 0 range (ie, good foods) were significantly higher than those for bad foods with scores in the +1 to +28 range. Data based on 375 foods and 2006 food prices in Seattle estimated the energy cost of the more healthy foods at approximately $13.00 per 1,000 kcal and that of unhealthy foods at only $3.50 per 1,000 kcal, a 4-fold difference. One important question is whether nutrient profiling programs aimed at improving population diets inadvertently exclude low-income households. If so, then the higher costs of healthier diets represent another major challenge for public health.

Conclusions

Nutrient profiling of individual foods can have multiple applications. At the regulatory level, nutrient profiling can be the basis for nutrition labels, health claims, and advertising to children.[35] Nutrient profiling can also be used to monitor and improve the nutrient-to-calorie ratio in the food portfolio of major companies.[17] Among health professionals, nutrient profiling can be a valuable tool for consumer education, used to promote healthy dietary patterns and discourage regular consumption of unhealthy diets.[36]

The direction of research on this topic is subject to many political influences. The major impetus in Europe was supplied by the European Commission's intent to establish nutrient profiles as the basis for regulating nutrition labeling and health claims. This will require a development of a food profiling system to determine which foods will be allowed to make or will be disqualified from making a nutrition or health claim. As a result, the focus has been on negative nutrients—fat, sugar, and sodium—even though the European Commission's draft proposal (Article 4) also made reference to the beneficial positive ones.

The nutrient-rich philosophy has been that healthful foods should be defined by the presence of beneficial nutrients, rather than exclusively by the absence of problematic ingredients—fat, sugar, and sodium. However, the application of these concepts to nutrient profiling continues to evolve because the negative ingredients are a mandated component of nutrient profiling in Europe and may become so in the United States.

Past attempts to quantify or profile the nutrient density of foods have been based on a variety of calories-to-nutrient scores, nutrients-per-calorie indices, and nutrient-to-nutrient ratios. Successful approaches based on transparent and validated algorithms can be used to assign nutrient density values to foods within and across food groups. Such nutrient density scores will permit consumers to identify and select nutrient-dense foods while permitting some flexibility where the discretionary calories are concerned.[1] The nutrient density approach has further implications for food labeling, nutritional policy making, and consumer education. Given the current dietary trends, the nutrient density approach can be a valuable tool for nutrition education and dietary guidance.

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