

## Invited Commentary

# When nutrient profiling can (and cannot) be useful

In a fascinating article by Nicklas and colleagues<sup>(1)</sup>, the authors tackle the problem of imprecise definitions of the nutritional quality of foods. In particular, they are concerned with the term ‘nutrient density’, used in the 2010 Dietary Guidelines for Americans (DGA)<sup>(2)</sup>, which is used to guide food selections in order to ensure a healthy diet. ‘Nutrient dense’ foods are described in the 2010 DGA as ‘those foods that provide substantial amounts of vitamins and minerals and relatively few calories’ and, more rigorously (but possibly contradictorily), as ‘all vegetables, fruits, whole grains, fat-free or low-fat milk and milk products, seafood, lean meats and poultry, eggs, beans and peas (legumes), and nuts and seeds, that are prepared without added solid fats, added sugars, and sodium’<sup>(2)</sup>. Nicklas *et al.* discuss the inherent difficulties in rigorously defining the term ‘nutrient density’ for the purpose of dietary advice, with reference to the growing literature on nutrient profiling, and in doing so they provide a very useful commentary on the challenges that surround nutrient profiling. In the present commentary, we also tackle the difficulties introduced by vague definitions of the nutritional qualities of foods. We then provide a description of what a nutrient profile model is, before describing situations where the precise measures provided by a nutrient profile model can be helpful. We conclude by arguing that a nutrient profile model that robustly defines ‘nutrient density’ would not be useful for provision of dietary advice.

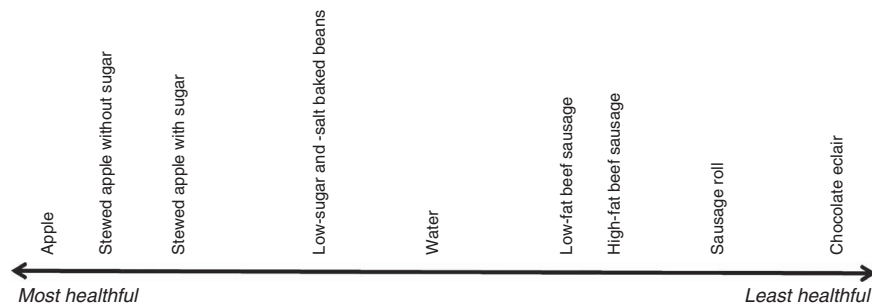
### Difficulties in describing the nutritional quality of foods

The 2010 DGA uses the term ‘nutrient dense’ to indicate foods that Americans should eat in order to achieve a healthy diet (e.g. the definition of ‘nutrient density’ concludes by stating ‘eating recommended amounts from each food group in nutrient-dense forms is the best approach to achieving ... a healthy eating pattern’)<sup>(2)</sup>. In this context, the term ‘nutrient density’ seems to be a synonym for ‘healthy’ or ‘healthful’. There are various terms that are used by academics, nutritionists, dietitians, public health policy makers and the lay public to describe the nutritional quality of foods, including healthy/unhealthy, healthful/unhealthful, healthier/less healthy, nutrient dense/energy dense and good/junk. These terms are rarely defined explicitly and if they are the definitions are frequently contested. For example, as described in the paper by Nicklas *et al.*<sup>(1)</sup>, the 2010 DGA definition of nutrient density includes vegetables, but not vegetables

with added salt, despite the fact that adding a small amount of salt to a vegetable has a negligible impact on the amount of beneficial nutrients per unit of food. This example suggests that the term ‘nutrient dense’ is being used as a synonym for ‘healthier’, where the concept of ‘healthier-ness’ is based on providing beneficial nutrients to the diet while limiting the consumption of added solid fat, sugar and/or salt. We think the DGA’s term nutrient dense is closer to ‘healthier’ rather than ‘healthy’ or ‘healthful’ as the DGA’s definition of nutrient density seems to be implicitly based on comparison – by most standards a radish with a small amount of salt added is a healthful food, but it is not as healthful as a radish without salt added, and it is this comparison that excludes vegetables with added salt from the DGA definition of ‘nutrient dense’.

A different conception of the nutritional quality of foods, and the language that can be used to describe it, is presented below. Note that this conception is not by any means the only one possible (indeed, the fact that there are many different ideas about what is meant by a nutrient dense/healthy/healthful food contributes to the confusion surrounding the terms). Our conception places all foods onto a continuous spectrum ranging from ‘most healthful’ to ‘least healthful’ (or ‘most unhealthful’). Within this spectrum, it is possible to compare any two foods, or any two sets of foods. Figure 1 provides an illustration of this concept and shows how ‘stewed apple with sugar’ is considered less healthful than ‘stewed apple’, and how ‘high-fat beef sausage’ is considered less healthful than ‘low-fat beef sausage’, but both sausages are considered less healthful than both stewed apples with or without sugar. Note that the mechanisms used to measure the healthfulness of each food (e.g. the nutrients to include, the unit of measurement to use) are not yet relevant – it is the concept of the continuum of healthfulness that is important here. We prefer the word ‘healthful’ (and ‘healthfulness’) rather than ‘healthy’ (and ‘healthiness’) as foods do not develop disease so it does not make sense to describe a food as healthy. We acknowledge that diets also do not develop disease, so it is anomalous to describe diets as healthy – we do so here to avoid conflicting terms.

The ‘correct’ order of the foods on the spectrum is dependent on how the spectrum is to be used. For this illustration, we are defining a healthful food as one that, when consumed, makes the total diet more healthy (and the greater the contribution to healthiness of the diet the more healthful the food is). For this reason, we have placed water in the middle of the spectrum representing



**Fig. 1** One possible continuum of 'healthful' foods

that it makes neither a positive nor a negative contribution to the healthiness of the diet (note that for different spectrums water will be placed in different places – if the spectrum is based purely on the presence of beneficial nutrients then water will not be considered healthful. If based purely on the absence of nutrients to be limited then water will be considered healthful).

Note our concept of a healthful food is not a food that is likely to contribute to a healthy diet. Foods are eaten in patterns and combinations that can result in apparent anomalies in the comparison of healthful foods with healthy diets. For example, as Nicklas *et al.* point out<sup>(1)</sup>, high-sugar breakfast cereals are often found to be components of a healthy diet<sup>(3)</sup>, and they therefore argue that breakfast cereals should be defined as 'nutrient dense'. We disagree. There are many foods that are likely to be found to be a part of a healthy diet that have little to do with their nutritional quality but are due to the combinations in which they are eaten. For example, salad dressing is often a part of a healthy diet because it is eaten with salad rather than because it is healthful in and of itself. In our conception, high-sugar breakfast cereals are not defined as healthful as when consumed they make a (generally healthy) diet less healthy.

A couple of important points should be made explicit here. First, whether or not high-sugar breakfast cereals make total diets more or less healthy is entirely dependent upon the weight placed on beneficial nutrients and nutrients to be limited, whether fortificants are included in the calculations, etc. This is all well covered in the article by Nicklas and colleagues<sup>(1)</sup>. Second, high-sugar cereals may be more healthful than some breakfast alternatives (e.g. a croissant and chocolate spread), but still not healthful *per se*. This is allowed by our conception of a continuum of healthfulness, but may not be allowed by other conceptions that are based on comparisons of foods.

### What is (and isn't) nutrient profiling?

Once a robust conception of 'healthfulness' is agreed, the next stage is to operationalise this conception. One way of doing this is to group foods into categories and to distribute the categories along the continuum with (for example) fruits more healthful than chocolates. While this may be

good enough for many purposes it is an unsatisfactory representation of the conception that we have built, as there is no room for differences within food categories and the positioning of food categories along the spectrum is arbitrary, leading to a ranking of food categories rather than a continuous scale. We need a process that unambiguously places each food at a single point on the continuum based on some predefined criteria, and this is one of the things that a nutrient profile model can do.

A nutrient profile model is defined by the WHO as a set of equations or algorithms that 'categorise foods for the purpose of health on the basis of their nutritional properties'<sup>(4)</sup>. The key points here that define nutrient profile models are that they must only use information about a food in isolation (i.e. they do not take account of how often the food is consumed, in what context or in combination with what other foods) and they are specifically concerned with health. Therefore a model that aims to regulate health claims on high-fat, -salt or -sugar products by using a score for all foods on the basis of their fat, sugar and salt levels is a nutrient profile model; a model that estimates a 'sustainability score' on the basis of their carbon, water and land footprint is not a nutrient profile model; and a model that generates a score for a food based on the probability that the food is consumed in a sub-sample of a population that consumes a healthy diet is not a nutrient profile model.

There are at least two questions relating to this definition of a nutrient profile model. First, does the definition allow for nutrient profile models that measure nutrients on a per serving basis? This depends on whether 'serving size' is considered to be a property of a food. This is hard to justify since so many foods are eaten in very different serving sizes depending on context (e.g. milk as a drink has a large serving size but as an addition to coffee has a small serving size). A strict reading of the definition would therefore suggest that nutrient profile models should not use a per serving basis, but in practice many nutrient profile models use this measurement and it is generally accepted. Indeed, Nicklas *et al.* state that '[a] challenge [for defining nutrient density] is to identify a standard unit that reflects a reasonable serving for some foods and is a concept that consumers can understand'<sup>(1)</sup>. We think that nutrient profile models are best suited to comparing the

nutritional quality of foods (irrespective of the serving size they are consumed in) and considerations of how important the nutrient profile scores are for foods that are eaten in large or small quantities should be left to the users of the nutrient profile model.

Second, how should 'a food' be defined? In most cases this is unproblematic, but in some cases foods are rarely if ever eaten in the form that they are sold (e.g. flour, dried pasta, instant drinking chocolate, breakfast cereal). Here it is necessary for each nutrient profile model to explicitly state whether the model should be applied to foods as sold or foods as consumed, and if the latter then how these consumed foods should be constructed.

Nutrient profile models can provide a precise score representing the healthfulness of all foods, but this precision can be deceptive. What do the nutrient profile scores mean? They are based on many decisions and assumptions; for example, which nutrients should be included in the model, what weighting should be placed on each nutrient. These decisions have been detailed elsewhere<sup>(15)</sup>. It has been shown that different nutrient profile models sometimes agree and sometimes do not agree with each other<sup>(6,7)</sup>. This may be because the nutrient profile models are based on different conceptions of 'healthfulness' (e.g. one based on the presence of health-promoting micro-nutrients such as the Nutrient Value Score (NVS)<sup>(8)</sup> and one that balances positive and negative nutrients such as the SAIN:LIM score<sup>(9)</sup>), or because they have been developed in very different ways. While nutrient profile models can be useful tools for public health regulations, their inherent limitations should not be overlooked.

It is important to separate the nutrient profile model from its application. For example, the UK Food Standards Agency/Ofcom model that provides a healthfulness score for all foods is used to support the regulation of broadcast advertising of foods to children in the UK<sup>(10)</sup>. The regulation itself is clearly not a nutrient profile model. Similarly, the Choices International logo, applied to many food products internationally to identify healthy choices, is supported by a set of nutritional criteria and equations to identify healthy foods<sup>(11)</sup>. The criteria and equations are a nutrient profile model, whereas the logo itself is not. This distinction may seem simple, but the confusion between nutrient profile model and application is rife (e.g. Townsend<sup>(12)</sup>). In the following section, we discuss applications where nutrient profile models would be helpful and those where they would not.

### When nutrient profiling can (and cannot) be useful

A public health intervention could potentially benefit from a nutrient profile model if: (i) it is concerned with improving nutrition; and (ii) it operates on the food level (i.e. it does not take into account information about the diets or health status of individuals). Some examples of interventions that meet these criteria include: (i) regulation

of health claims; (ii) restriction of foods supplied in school vending machines; (iii) criteria for front-of-pack nutrition labelling and health symbols; (iv) health-related food taxes and subsidies; and (v) restriction of marketing of unhealthy foods.

The second criterion here is crucial in uniting these interventions – they are all applied in contexts where individual foods must be considered independent of the context in which they are consumed. This is not the case for dietary advice, where the aim is to provide advice about foods in the context of how they can combine to create a healthy diet. In this situation, the context provides more information which a nutrient profile model does not use in its calculations; for example, the combination in which foods are consumed, the need for dietary variety, the context-specific serving size in which foods are consumed, etc. Nicklas *et al.*<sup>(1)</sup> describe some unintended consequences associated with using a 'nutrient density' approach for dietary advice, including that nutrient-dense foods are often eaten in combination with energy-dense foods, and suggest that to demonise one could affect consumption of the other. They argue that 'the value of a food should be determined within the context of the whole diet'. Where this is possible – as in the case of dietary advice – we agree, and given the definition of nutrient profiling provided above, this precludes the use of a nutrient profile model.

### Conclusion

There is confusion among policy makers and nutrition academics regarding the role of nutrient profile models. Much of this confusion is due to the vague definitions of 'healthy', 'healthful' and 'nutrient dense' that are often applied to foods without a complete conception about what is meant by these terms. Therefore, when a nutrient profile model (which must have an explicit basis for the categorisations or scores that it produces) is compared against these vague definitions, many apparent 'anomalies' are found, which may be due to poorly fitting nutrient algorithms but could also be due to the mismatch between different conceptions of 'healthfulness'. Nutrient profile models can be useful tools for supporting a large range of public health interventions where only information on the nutritional quality of the food is available. Where additional information about the role of foods in the overall diet is available, nutrient profile models are less useful.

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