

ORIGINAL ARTICLE

Development of international criteria for a front of package food labelling system: the International Choices Programme

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Background: A global push to reduce the amount of saturated and *trans*-fatty acids, added salt and sugar in processed food, and to enhance fruit, vegetable and whole grain intake, while limiting energy intake, exists for most populations.

Objectives: To redesign the International Choices Program (note: this is unrelated to the US Smart Choices Program), initially Netherlands focused, by an international board of scientists to create a generic, global front-of-pack nutrition logo system that helps consumers make healthier food choices and stimulates product reformulation.

Methods: The Programme is a product-group-specific-nutrient-profiling approach with a distinction between basic and discretionary foods. The basic product groups are main contributors of essential and beneficial nutrients, and are based on food-based dietary guidelines from more than 20 countries across the globe. Generic criteria are derived from international nutrient recommendations for *trans*-fatty acids, saturated fatty acids, sodium, added sugar, fibre and energy, and evaluated against food composition data from 12 countries across Europe and market reality (actual foods on the market). Selected debates such as the source of fibre are also presented.

Results: Generic criteria and a decision framework were developed to further define food categories, so as to meet the unique country- and region-specific dietary needs. The result is a complete set of criteria that is evaluated on a regular basis to ensure its alignment with international dietary patterns, new scientific insights and current developments within the food market.

Conclusions: These guidelines are currently used in a number of countries across the globe, and are being evaluated for effectiveness. Completed studies have demonstrated an increase in consumer awareness, a positive effect on product innovation and a potential impact on nutrient intakes.

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Introduction

Excessive and unbalanced intake of energy, saturated fatty acids, *trans*-fatty acids, salt and sugar lead to increased risk for chronic non-communicable diseases (Joint WHO/FAO consultation, 2003). Reducing or minimising consumption of these nutrients in our diet, while increasing our consumption of fruits, vegetables and whole grains, has been the focus of extensive action by a number of governments and the food industry.

Front-of-pack (FOP) labelling and food reformulation have become subject to international stakeholder debate by regulators, scientists, the public health community and the food industry. The scientific community is concerned with aspects relating to science and credibility (Drewnowski and Fulgoni, 2008; Nestle and Ludwig, 2010; Scarborough *et al.*, 2007, 2010), whereas the food industry would like to create a level playing field and global harmonisation (Trichterborn

and Harzer, 2007; Lupton *et al.*, 2010). Consumer organisations and the public health community want to protect consumers from being misled or confused, while also stimulating healthy eating. This is illustrated by initiatives in the United Kingdom on salt reduction and labelling (Food Standards Agency, 2005, 2009), and in Europe and Australia, where legislative bodies work on defining nutrient criteria for foods that are eligible to carry a health claim (Food Standards Australia New Zealand, 2007; EU Regulation (EC), 2007). In the United States, the Institute of Medicine and the Food and Drug Administration are evaluating existing FOP labelling systems following the failure of a multi-stakeholder initiative—the Smart Choices Program—led by the food industry. Unrelated to the International Choices Programme, it failed owing to criticism that its nutrient criteria allowed high sugar and high fat products to carry a healthy choice logo (Wartella *et al.*, 2010). This highlights the importance of an independent scientific committee to define the actual criteria. In the fast changing food markets in developing countries, there is a growing interest in and need for tools to help consumers make healthier choices while their food supply is changing rapidly (Reardon *et al.*, 2003; Popkin, 2008; Rivera *et al.*, 2008).

Triggered by a governmental request to the food industry for one single healthy choice logo, the Choices Programme was first introduced in the Netherlands in 2006. The two main aims of the Programme are to help consumers make healthier food choices and to encourage food manufacturers to improve the composition of their products. Initially, criteria were developed and set for the Dutch market by an independent Dutch scientific committee advising the Choices Foundation Board (Dötsch-Klerk and Jansen, 2008). Since then, over 100 partners in food manufacturing, retail and food service (80% of the catering market) have joined the initiative in the Netherlands, and the Choices logo is being adopted in various other countries across the globe. This international roll-out has necessitated a complete re-evaluation of the criteria for further international applicability. In 2008, an international scientific committee was created, comprised of scientists from around the world. This paper describes the work of the international scientific committee, in terms of redefining product groups as well as the full set of criteria. The International Choices Programme has been subject to many complex and critical scientific debates, including on how to judge and monitor the food supply, and how to define what is healthy. Several critical issues that have been addressed are described within this paper.

Methods

A product-group-specific approach and selection of nutrients

The average population intake aims (Joint WHO/FAO consultation, 2003) have served as the starting point for developing criteria to evaluate food products according to their nutrient content. However, the range of fat, salt, added sugar,

fibre and other nutrients between foods and beverages is far too great to create one set of criteria for all food products. Thus, product grouping is needed (Scarborough *et al.*, 2007, 2010) to assure alignment with the aims of the International Choices Programme: to help consumers choose within a product group and to stimulate producers to improve the nutrient composition. This can only be achieved if criteria are separately set for different product groups—such as fats and beverages, rather than with a single set of criteria that compares foods across the food supply (Rayner *et al.*, 2005; Drewnowski and Fulgoni, 2008; Katz *et al.*, 2010).

Nutrient criteria have been developed for *trans*-fatty acids, saturated fatty acids, sodium and added sugars, because high intakes of these nutrients negatively affect health. The nutrient definitions and related health risks are provided in Table 1. The focus is not only on limiting the intake of nutrients with a negative impact on health, but also on ensuring the intake of essential and beneficial nutrients. To achieve this, a distinction has been made between basic foods and discretionary foods. Basic food product groups were based on product group classifications from food-based dietary guidelines used in more than 20 countries worldwide (see legend to Table 2), which significantly contribute to the intake of essential and beneficial nutrients (for example, vitamins, minerals) and water. Discretionary product groups do not significantly contribute to the intake of beneficial nutrients. They are included because they are eaten frequently, are important sources of *trans*-fatty acids, saturated fatty acids, sodium, added sugar and energy, and therefore targets for product innovation.

An emphasis on healthy choices in basic product groups is encouraged by setting the criteria for discretionary foods at a more restrictive level than for basic foods. This is explained below. Table 2 (second column) provides an overview of all product groups.

Fibre was the subject of much debate. Indeed, manufacturers often add artificial or isolated fibres such as inulin as a 'beneficial nutrient' to many foods. However, the effects on health of these isolated fibres are inconclusive (Cummings *et al.*, 2009), and these purified fibres do not provide the micronutrients and phytochemicals that are present in sources of naturally occurring fibre, such as whole grains (Pascoe and Fulcher, 2008). The significance of this in terms of public health is great for countries such as Mexico, where tortillas represent around a quarter of the calories consumed (Popkin, 2008). Therefore, to promote fibre intake, a fibre criterion was added for relevant product groups. In line with the evidence, and to ensure sufficient micronutrient intake, the source of fibre must originate from the actual ingredients of the product group (for example, whole grain, vegetables).

Furthermore, as the Choices Programme aims to promote appropriate energy intake, an energy criterion has been defined for product groups that either substantially contribute to energy intake (for example, main courses and filled sandwiches) or for which a limited consumption is

Table 1 Nutrient definitions and health risks

<i>Nutrient</i>	<i>Definition</i>	<i>Health risk with excessive intakes</i>	<i>Comments</i>
SAFA	The sum of all types and sources of saturated fatty acids	Cardiovascular diseases, blood lipids (Joint WHO/FAO consultation, 2003; Joint FAO/WHO Expert Consultation on Fats and Fatty Acids in Human Nutrition, 2008; Elmadfa and Kornsteiner, 2009)	
TFA	All the geometrical isomers of monounsaturated and polyunsaturated fatty acids with non-conjugated, double carbon-carbon conjugations in the <i>trans</i> -configuration, and which are separated by at least one methylene group. Natural <i>trans</i> -fatty acids from meat and milk are excluded	Coronary heart disease, blood lipids (Joint WHO/FAO consultation, 2003; Joint FAO/WHO Expert Consultation on Fats and Fatty Acids in Human Nutrition, 2008; Elmadfa and Kornsteiner, 2009)	There are no limiting criteria for naturally occurring <i>trans</i> -fatty acids in dairy and meat, because these are difficult to influence through product reformulation. The saturated fat criteria defined for dairy and meat are considered sufficient to define the healthier options
Sodium	This includes both added sodium (for example, by salt or MSG) and sodium that is naturally present in one of the ingredients (for example, in yeast extract, protein hydrolysates)	Cardiovascular diseases, blood pressure (Joint WHO/FAO consultation, 2003; Strazullo <i>et al.</i> , 2009)	
Added sugar	All monosaccharides, disaccharides and polyols with a caloric value of > 3.5 kcal/g, from sources other than fruit, vegetables and milk products. This also includes natural sugars such as honey, syrups and (more than twice) concentrated fruit drinks. It is assumed that 'added sugar' is the same as 'free sugar'	Dental diseases, obesity (Joint WHO/FAO consultation, 2003)	There are no physiological arguments to distinguish free or added sugar from total sugar. Added sugars, however, can be manipulated by manufacturers. In addition, fruit- and milk-based products should not be penalized for their intrinsic sugar content. Products high in free/added sugars are often nutrient-poor and energy-dense providing the so-called 'empty calories'
Energy	The amount of energy from food products that is available for the metabolism of the body, expressed in kJ or kcal	Obesity, cardiovascular disease, diabetes, cancer (Joint WHO/FAO consultation, 2003)	
<i>Health risks with too low intakes</i>			
Dietary fibre	The collective term for those substances that are not digested or taken up by the human small intestine and which have the chemical character of carbohydrates (suitable for human consumption) or compounds analogous to carbohydrates (see Codex)	Cardiovascular diseases, blood lipids, obesity (Joint WHO/FAO consultation, 2003) Insufficient micronutrient intakes with plant-based diets (Pascoe and Fulcher, 2008)	Codex fibre definition is currently under revision (Cummings <i>et al.</i> , 2009) Source of fibre should be the main ingredients of the product

Abbreviations: MSG, monosodium glutamate; SAFA, saturated fatty acids; TFA, *trans*-fatty acids.

recommended (discretionary product groups): for example, sugar-sweetened beverages (Popkin *et al.*, 2006).

Development of criteria: the scientific approach

Generic criteria and reference amounts. A first step in the development of the nutrient criteria relates to the energy-based translation of international nutrient recommendations (Joint WHO/FAO consultation, 2003) into *food-specific* generic criteria. The generic criteria are defined as 'nutrient recommendation + 30%'. This additional 30% has been added to the criteria, as the average diet consist of many foods—not all of which contain nutrients that should be limited (saturated fatty acids, *trans*-fatty acids, sodium, added sugar). An additional 30% allows more room for foods that do contribute to the intake of these nutrients on top of

recommendations (Table 2). This 30% is an arbitrary starting point, which can be lowered when the nutritional quality of the diet has improved. Intake modelling was used to substantiate that adding 30% does not counter the objectives of the programme (Van Raaij *et al.*, 2008; Roodenburg *et al.*, 2009).

In developing the criteria, it was important to look at products with low absolute levels of nutrients or energy. This is because the generic criteria expressed as a percentage of energy might lead to unrealistic scores (for example, saturated fatty acids in soups). Therefore, to ensure that low-energy-dense products would not be needlessly excluded, specific criteria were developed for these 'insignificant levels' of nutrients. A 'level of insignificance' was defined as '< 5% of the daily nutrient recommendation in grams or milligrams per 100 g of a food product', according to an energy intake of 2000 kcal per day (Table 2).

Table 2 Overview of generic and product-group-specific criteria^a for basic and discretionary product groups^b

Product group	Comments	Energy	Nutrients to limit				Fibre
			Saturated fat	Trans-fat	Sodium	Added sugars	
Daily nutrient recommendations	From joint WHO/FAO consultation (2001, 2003)	2000 kcal per day	< 10 en%	< 1 en%	2000 mg per day = 1 mg/kcal (based on 2000 kcal per day)	< 10 en%	25 g per day = 1.3 g/100 kcal (based on 2000 kcal per day)
Generic criteria (energy based)	Generic energy-based criteria = daily nutrient recommendation + 30%	NA	≤ 13 en%	≤ 1.3 en%	≤ 1.3 mg/kcal	≤ 13 en%	≥ 1.3 g/100 kcal
Generic criteria, insignificance levels (per 100 g)	Generic insignificance levels = 5% of daily nutrient recommendation per 100 g (based on 2000 kcal per day)	NA	≤ 1.1 g/100 g	≤ 0.1 g/100 g	≤ 100 mg/100 g	≤ 2.5 g/100 g	NA
Basic product groups Fruit and vegetables ^c	All products without additives comply	NA	NA	NA	NA	NA	NA
	Fresh or fresh-frozen fruit, vegetables and legumes						
	Processed fruit and vegetables	NA	≤ 1.1 g/100 g	≤ 0.1 g/100 g	≤ 100 mg/100 g	Not added	≥ 1.3 g/100 kcal
	Fruit juices	NA	≤ 1.1 g/100 g	≤ 0.1 g/100 g	≤ 100 mg/100 g	Not added	≥ 0.75 g/100 kcal
Water ^c	Water (plain)	NA	NA	NA	≤ 20 mg/100 ml	NA	NA
Sources of carbohydrates ^c	Potatoes (unprocessed)	NA	NA	NA	NA	NA	NA
	Potatoes (processed), pasta, noodles	NA	≤ 1.1 g/100 g	≤ 0.1 g/100 g	≤ 100 mg/100 g	Not added	≥ 1.3 g/100 kcal
	Rice	NA	≤ 1.1 g/100 g	≤ 0.1 g/100 g	≤ 100 mg/100 g	Not added	≥ 0.7 g/100 kcal
	Bread	NA	≤ 1.1 g/100 g	≤ 0.1 g/100 g	≤ 500 mg/100 g	≤ 13 en%	≥ 1.3 g/100 kcal
	Grains and cereal products	NA	≤ 1.1 g/100 g	≤ 0.1 g/100 g	≤ 100 mg/100 g	≤ 2.5 g/100 g	≥ 1.3 g/100 kcal
	Breakfast cereal products	NA	≤ 13 en%	≤ 0.1 g/100 g	≤ 500 mg/100 g	≤ 20 g/100 g	≥ 1.3 g/100 kcal
Meat ^c	Meat, poultry, eggs (unprocessed)	NA	≤ 1.1 g/100 g or ≤ 13 en%	≤ 0.1 g/100 g	≤ 100 mg/100 g	Not added	NA
	Processed meat, meat products and meat substitutes	NA	≤ 1.1 g/100 g or ≤ 13 en%	≤ 0.1 g/100 g	≤ 900 mg/100 g	≤ 2.5 g/100 g	NA
Fish ^c	Fresh or fresh-frozen fish, shellfish and crustaceans	NA	≤ 1.1 g/100 g or ≤ 30% of total fat	≤ 0.1 g/100 g	≤ 100 mg/100 g	Not added	NA
	Processed fish or fish products	NA	≤ 1.1 g/100 g or ≤ 30% of total fat	≤ 0.1 g/100 g	≤ 450 mg/100 g	Not added	NA

Table 2 Continued

Product group	Comments	Energy	Nutrients to limit				Fibre
			Saturated fat	Trans-fat	Sodium	Added sugars	
Dairy ^c							
Milk (products)	Naturally occurring trans-fat from milk is excluded	NA	≤1.4 g/100g	≤0.1 g/100g	≤100 mg/100g	≤5 g/100g	NA
Cheese (products)	Naturally occurring trans-fat from milk is excluded	NA	≤1.5 g/100g	≤0.1 g/100g	≤900 mg/100g	Not added	NA
Oils and fats ^c	Naturally occurring trans-fat from milk is excluded	NA	≤30% of total fat	≤1.3 en%	≤1.3 mg/kcal	Not added	NA
Composite dishes							
Main course	Naturally occurring trans-fat from meat or milk is excluded Source of fibre can only be one of the main ingredient (for example, potatoes, vegetables, grains)	400–700 kcal per serving	≤1.1 g/100g or ≤13 en%	≤0.1 g/100g or ≤1.3 en%	≤2.2 mg/kcal	≤2.5 g/100g or ≤13 en%	1.25 g/100 kcal
Filled sandwiches/rolls	Naturally occurring trans-fat from meat or milk is excluded Source of fibre can only be the main ingredients (for example, vegetables, grains)	≤350 kcal per serving	≤1.1 g/100g or ≤13 en%	≤0.1 g/100g or ≤1.3 en%	≤1.9 mg/kcal	≤2.5 g/100g or ≤13 en%	≥0.8 g/100 kcal
Discretionary product groups							
Soups		≤100 kcal/100g	≤1.1 g/100g	≤0.1 g/100g	≤300 mg/100g	≤2.5 g/100g	NA
Meal sauces		≤100 kcal/100g	≤1.1 g/100g	≤0.1 g/100g	≤450 mg/100g	≤2.5 g/100g	NA
Other sauces (on water basis)		≤100 kcal/100g	≤1.1 g/100g	≤0.1 g/100g	≤750 mg/100g	NA	NA
Other sauces (emulsions)		≤350 kcal/100g	≤1.1 g/100g or 30% total fat	≤0.1 g/100g or 1.3 en%	≤750 mg/100g	≤2.5 g/100g or ≤13 en%	NA
Snacks (pastry, edible ice, sweet and savoury snacks)		≤110 kcal per serving	≤1.1 g/100g or ≤13 en%	≤0.1 g/100g or ≤1.3 en%	≤400 mg/100g	≤20 g/100g	NA
Beverages		≤20 kcal/100 ml	≤1.1 g/100g	≤0.1 g/100g	≤20 mg/100g	NA	NA
Bread toppings incl. hummus-like products		NA	≤13 en%	≤1.3 en%	≤400 mg/100g	≤30 g/100g	NA
All other products			≤1.1 g/100g or ≤13 en%	≤0.1 g/100g or ≤1.3 en%	≤100 mg/100g or ≤1.3 mg/kcal	≤2.5 g/100g or ≤13 en%	NA
National deviation example							
Soft white cheese (Israel)	Naturally occurring trans-fat from milk is excluded	NA	≤2 g/100g	≤0.1 g/100g	≤400 mg/100g	Not added	NA

Abbreviation: NA, not applicable.

^a1 kcal = 4.186 kJ; en% = for a specific food: energy delivered by this nutrient (kcal), divided by the total energy content (kcal) of the food, multiplied by 100.^bCriteria are applicable to all foods and beverages, except infant and follow-up formulas; products containing > 0.5% alcohol.^cFor a detailed description of product groups, see Supplementary Appendix 4 'Overview of product group descriptions, criteria and rationales'.^dBasic product groups are based on the product group classifications as used in food-based dietary guidelines in more than 20 countries: Australia, Belgium, Canada, China, Denmark, Finland, France, Germany, Greece, Hungary, Malaysia, Mexico, Namibia, The Netherlands, Philippines, Portugal, Singapore, Spain, Sweden, Turkey, UK and Europe. See Supplementary Appendix 4 for references.^eIf possible, the generic criteria are fixed per product group: either as en% or g/100g. However, if this leads to the needless exclusion of low-energy foods, both generic criteria (en% or as g/100g) can be used.

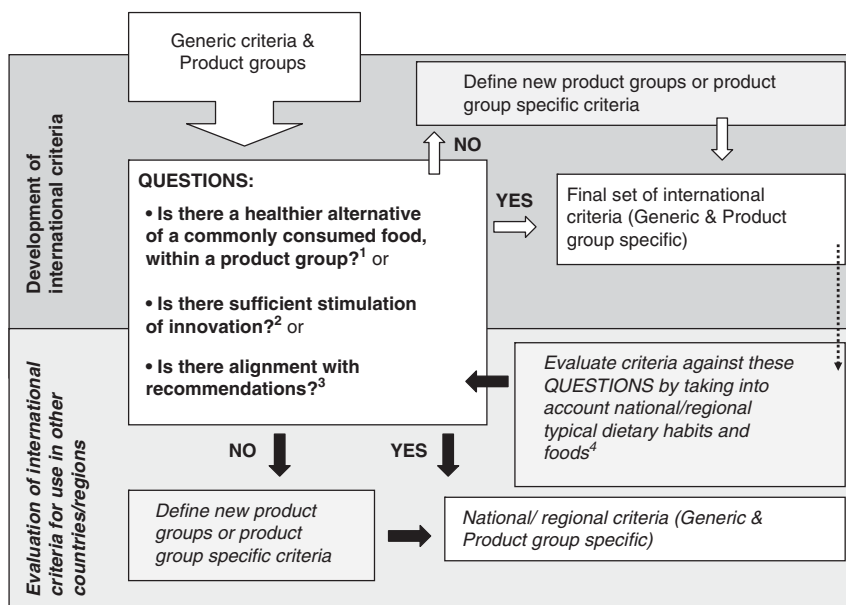


Figure 1 Decision framework for defining new product groups or new product-group-specific criteria. ¹In this question, we assume that people choose within a product group. Example: a new product group ‘Rice’ was derived from ‘Grains and cereal products’ by defining a product-group-specific criterion for fibre, so that some high fibre rice can comply. ²Examples: product-group-specific criterion for sodium was defined for soups, because of taste reasons (as a generic sodium criterion would lead to soups without a salty taste), whereas for sodium in cheese and bread it was defined according to technological constrains (that is, salt is needed for the preparation of bread and cheese). ³Example: a product-group-specific criterion for SAFA was defined for the product group ‘Fish products’ to allow more products to comply, which are important for unsaturated fatty acid intake. ⁴Within the Israeli diet, soft white cheese is an important source of calcium and protein. As previous criteria for ‘Cheese’ were too lenient and not encouraging innovation, it was therefore adapted (see Supplementary Appendix 1).

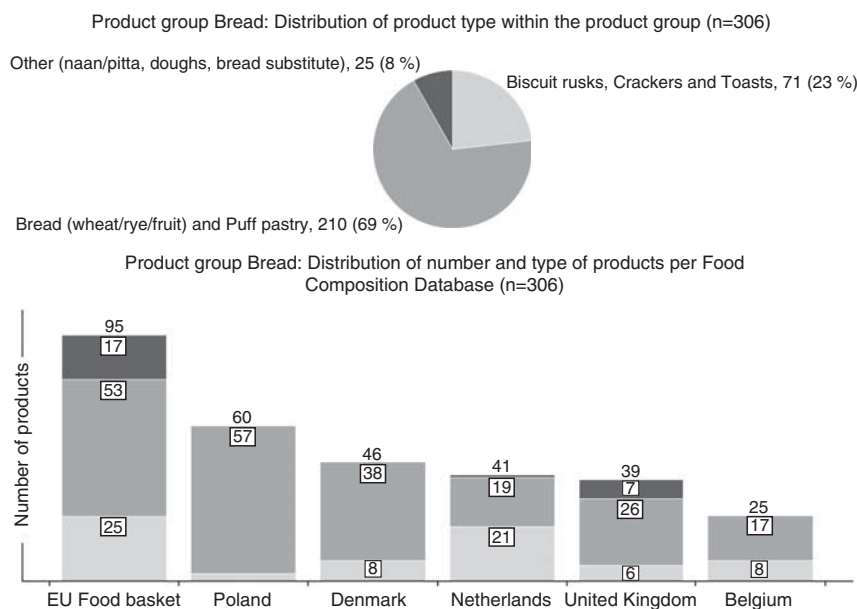


Figure 2 Description of the test database on food composition for the product group bread: number and type of products. This database consists of 7000 foods from the following sources: 21% of the foods come from the limited EU database (EFSA, 2008), in the following quantities: France (29%), Spain (17%), Germany (12%), Italy, Sweden, UK, Denmark (each 8%), Ireland (7%) and Norway (6%). Foods from other databases are as follows: the Netherlands (20%) (Stichting Nederlands Voedingstoffenbesluit, 2006), the United Kingdom (17%) (Food Standards Agency, 2002), Belgium (Rijksadministratief Centrum, 2004) and Denmark (Danish Institute for Food and Veterinary Research, 2005) (both 14%), Poland (13%) (National Food and Nutrition Institute (IZZ, 2005).

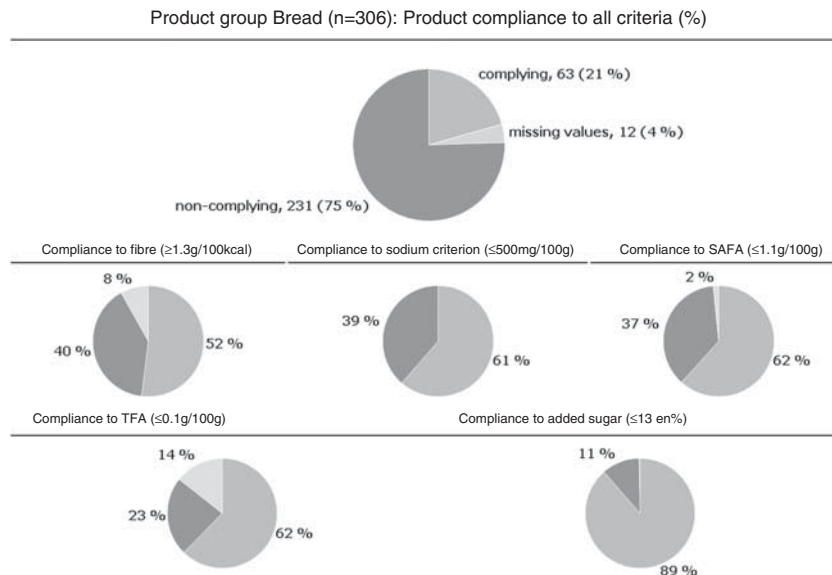


Figure 3 Product group bread: the percentage of complying and non-complying products are given: overall product score and a score per nutrient. Examples of complying foods (eligible to use the logo): rye bread, average^b; wholemeal bread average^c, crisp bread rye 18% fibre Ryvita Markt (dark)^d; examples of foods that do not comply (including non-complying nutrients): white bread, premium^c (sodium, fibre), crackers^e (TFA, SAFA, sodium, fibre); crisp bread, knackerbrot, wheat, fine^f (SAFA, fibre). Sources: ^bStichting Nederlands Voedingstoffenbesluit (2006); ^cFood Standards Agency (2002); ^dEFSA (2008); ^eRijksadministratief Centrum (2004); ^fDanish Institute for Food and Veterinary Research (2005). SAFA, saturated fatty acids; TFA, *trans*-fatty acids; en%, for a specific food: energy delivered by added sugar (kcal), divided by the total energy content (kcal) of the food and multiplied by 100.

Product-group-specific criteria. Generic criteria were applied where possible. In addition typical food habits need to be taken into account. In principle, the number of product groups should be limited and are determined by a decision framework: a new product group or product-group-specific criteria can only be defined under the conditions outlined in Figure 1.

To encourage the intake of essential and beneficial nutrients, consumers should have access to more healthy choices within basic product groups—as these provide essential nutrients—than within the discretionary product groups. For basic product groups, the aim was to have at least 20% of products comply with the criteria within a given product group, and approximately 10% for the discretionary product groups. These percentages (10 and 20) were used as a starting point for deciding when a product-group-specific criterion is needed and what the criterion should be. To determine the actual percentages and the existing variations in product composition on the international market, a food composition test database was created. It consists of food composition data for 7000 foods from 12 European countries (Belgium, Denmark, France, Germany, Ireland, Italy, the Netherlands, Norway, Poland, Spain, Sweden and the United Kingdom; for details see legend of Figure 2). This selection was based on geographic representation, data completeness, costs and availability—both electronically and in the English language. For more details, see Supplementary Appendix 2 ‘Development of a test database on food composition’.

During the scientific debates, factors such as public health nutrition, food market reality (actual foods on the market)

and the typical examples of indicator foods were used to further define the criteria. Some examples are addressed in the next section.

Most of the work was carried out between February 2008 and June 2009, during which time the International Scientific Committee of the Choices Programme met four times. Final changes were made in May 2010, and decisions were made with the consensus of all committee members.

Results

Definition of the actual criteria

For the product group bread, Figure 2 shows the data description and Figure 3 shows the percentage of products that comply (overall and per key-nutrient). The legend in Figure 3 shows examples of indicator foods that do or do not comply with the criteria. Statistics, distributions and plots of the key-nutrient content were used when necessary (data not shown). For all product groups, all of this information is available in Supplementary Appendix 3 ‘Detailed characteristics per product group’. Table 2 shows the overall criteria for all product groups.

To illustrate the scientific debate, a few examples are addressed below. Supplementary Appendix 4 ‘Overview of product group descriptions, criteria and rationales’ contains all of the debated rationales for the product-group-specific criteria, including an overview of the changes made to the original Netherlands-based criteria.

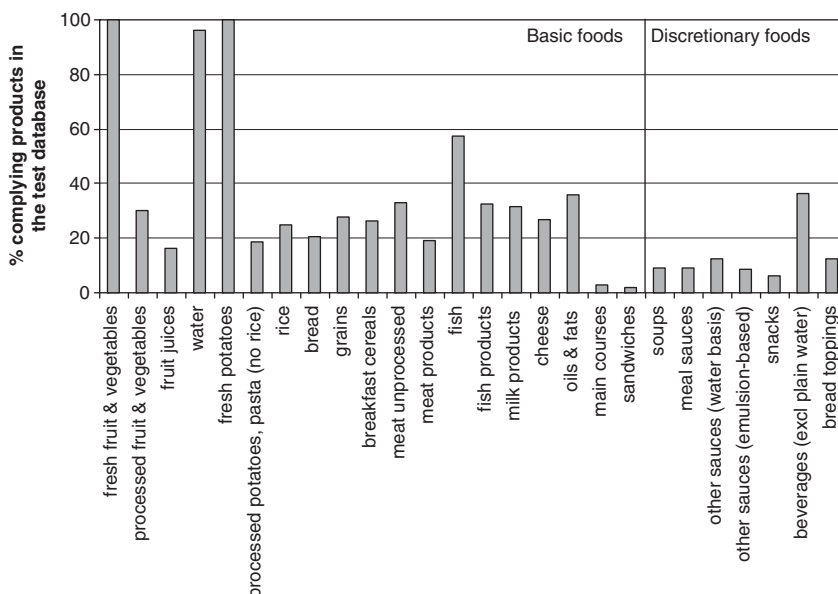


Figure 4 Percentages of products that comply based on the test database. Results are shown per product group, for basic foods and discretionary foods.

For example, the rationale for encouraging innovation (Figure 1) was applied to the energy criterion in beverages. Owing to concerns that the consumption of sugar-rich beverages can adversely affect energy intake, weight gain and increase the risk of health problems (Vartanian *et al.*, 2007), beverages should not contribute by more than 10% to daily energy intake (Popkin *et al.*, 2006). However, people will continue to consume these sugar-sweetened drinks. Therefore, reformulation should be encouraged. Currently, standard energy containing drinks contain 10–12 g of sugar/100 g (40–48 kcal/100 g). As a first step without forcing manufacturers to use artificial sweeteners, the criterion has been set at 20 kcal/100 g or 100 ml, which is the equivalent of 5 g of sugar. This will be progressively lowered over time. It is also important to note that on the one hand a considerable number of consumers do not consume sweeteners (Euromonitor International, 2009; Mattes and Popkin, 2009), and on the other, there are concerns about the possible effects of excessive sweetness on long-term habituation to sugar and sweet foods (Avena *et al.*, 2009). By relying on a gradual sugar reduction approach, it is expected that once consumers have gotten used to a less sweet taste, this will also facilitate the lowering of sugar levels in other product groups such as milk products and breakfast cereals.

Another example is pure (100%) fruit juice consumption, which contributes to the intake of fruit, but also to a high-energy intake and the possibility of weight gain and diabetes (Sanigorski *et al.*, 2007; Odegaard *et al.*, 2010). As sugar levels are determined by legislation (Codex, 2005), there is little room for innovation. Therefore, an energy criterion has been set at 48 kcal/100 ml to exclude fruit juices that are too high in energy. Thus, the rationale applied here

is alignment with the recommendations (Figure 1) to stimulate fruit intake, but also to limit energy intake from fruit juices.

The decision framework can be used to evaluate the criteria globally against other dietary habits and food compositions. For example: for white soft cheese—a major contributor of protein and calcium in Israel—the existing criteria did not discriminate the healthier option. Therefore, new criteria were defined (Table 2). The International Scientific Committee used the feedback from the Israeli Scientific Committee (Appendix 1 ‘Israeli case study’) as a basis for the rationales to decide on needs to add product groups and criteria (Figure 1).

Figure 4 shows the percentage of products that comply with the test database, and illustrates that there are more products that comply within the basic product groups than within the discretionary product groups. In some cases, the percentage of complying products are far below (for example, sandwiches and main courses) or above (for example, fresh fruit and vegetables, fresh potatoes, water and beverages) the targeted 20% for basic foods or 10% for discretionary foods. For sandwiches and main courses, data from the test database are limited. Real examples from the (Dutch) market illustrate that criteria did stimulate food manufactures to innovate. Consumption of fresh fruit and vegetables, fresh potatoes and water needs to be encouraged, as these provide essential nutrients. These foods are therefore all eligible to carry the Choices logo. Regarding the discretionary product groups, there is a relatively high percentage (36%) of beverages that comply. These are however exclusively limited to coffee, tea, flavoured water and light beverages.

Discussion

This paper provides an overview of the development of nutrient profiles used for determining international Choices logo eligibility. It involves a product-group-specific approach, with a distinction between basic and discretionary foods. It is assumed that consumers should have a healthier choice within a given product group. The nutrient criteria are evaluated on a regular basis (every 3 years) by an independent scientific committee. The evaluations take into account the latest developments in nutrition science and food technology, as well as within the market place, with the ultimate aim of achieving the population dietary intake aims (Joint WHO/FAO consultation, 2003). The unique feature of this nutrient-profiling system is its decision framework that enables international applicability and translation to other dietary habits.

Many different organisations have developed nutrient-profiling systems for various purposes (Stockley *et al.*, 2007). Some—such as the Swedish Keyhole (Livsmedelsverket, 2009) and the New Zealand Pick the Tick (The National Heart Foundation, 2002)—have been around for more than 20 years. Others such as the traffic light system in the United Kingdom (Food Standards Agency, 2009) have been promoted by government agencies. Systems that rely on one set of criteria for the entire food supply (Rayner *et al.*, 2005; Drewnowski and Fulgoni, 2008; Katz *et al.*, 2010) are less aimed at stimulating product reformulation within a product category, and may actually reinforce current high animal source food diets (Drewnowski and Fulgoni, 2008). In addition, within these systems, there is little scientific reasoning behind the applied weighing of ‘nutrients to limit’ against ‘nutrients to encourage’.

The scientific basis behind the nutrient profiles that are presented here are the international nutrient recommendations (Joint WHO/FAO consultation, 2003) and food composition data. Others have based their nutrient profiles on expert judgment, and dietary requirements (Rayner *et al.*, 2005; Drewnowski and Fulgoni, 2008), on actual intakes (Food Standards Agency, 2005) or on existing food standards and technical and taste arguments in addition to the dietary intake aims (Nijman *et al.*, 2007). Ultimately, it is difficult to judge which nutrient-profiling system is better than the other. Indeed, although various validation methods for nutrient profiles have been published (Azais-Braesco *et al.*, 2006; Arambepola *et al.*, 2008; Scarborough *et al.*, 2010), there is no gold standard (Towsend, 2010). The Choices criteria have been evaluated by an independent scientific committee, and by estimating their potential improvements on habitual nutrient intakes (Van Raaij *et al.*, 2008; Roodenburg *et al.*, 2009).

However, the scientific approach behind the Choices Programme has some limitations. Indeed, the food composition databases that are used represent—at best—average nutrient composition values. In most cases, they are fairly outdated and cannot keep pace with thousands of new foods

continuously introduced onto the food market. Nevertheless, the major advantage of the current approach is its transparency—all the data are publically available. Furthermore, evaluation of the nutrient criteria according to European food composition data is a first step in developing nutrient criteria for international use. International applicability requires the evaluation of criteria against data from other regions on dietary habits and food composition (if available) based on the above-mentioned decision framework. This has been carried out for Israel. An additional advantage of this process is the coinciding incentive of collecting food composition data in regions where these data are limited.

Consumer research in four European countries demonstrates that a simple front-of-pack label—such as a health logo—is most appropriate within a shopping environment where quick decisions have to be made (Feunekes *et al.*, 2008). This has served as the basis of the Choices logo: since the launch of the Choices Programme in the Netherlands, studies are being carried out on its effectiveness. These studies reveal that there is increasing recognition and appreciation of the logo by consumers, especially from those interested in health (Vyth *et al.*, 2009). A study on current consumer behaviour in supermarkets reveals that people who are health conscious purchase more products bearing the Choices logo (Vyth *et al.*, 2010a). Effects of the Choices logo on sales in Dutch workplace canteens are limited (Vyth *et al.*, 2011). Others have shown mixed effects on sales of front-of-pack labelling in the supermarket environment (Sacks *et al.*, 2009; Sutherland *et al.*, 2010). Additional studies demonstrate positive effects on product reformulation (Vyth *et al.*, 2010b); thus, by improving the composition of products, consumers with less interest in health can also be reached. Currently, effectiveness research is not limited to the Netherlands, as it has also been initiated in other countries, including Poland.

In summary, the nutrient criteria for logo eligibility developed by the international Choices Programme’s global panel of scientists are a transparent, science-based tool designed to encourage both consumers and producers towards a healthier food supply. International applicability makes these nutrient profiles a useful tool to stimulate product innovation and consumer choice globally. This is also true for the fast-changing food markets of developing and transitional countries, including India, Mexico and Brazil.

Conflicts of interest

NS, GP, GV, MDA, MR, MG, RE, VS and JCS have no financial conflict of interest. BP receives his salary funding from NIH (70%), the University of North Carolina (UNC) and the Robert Wood Johnson foundation (25%). He is involved in random-controlled trials at UNC and the Mexican National Institute of Public Health funded by Nestlé’s Water and Danone Water research groups, respectively. AA receives

compensation as a consultant for Danone and the California Almond Board, and is a member of the the Global Dairy Platform's executive board. He also receives speaker fees from various food producers as well as research grants and food products for research purposes from more than 100 different food companies. AR is employed by Unilever and seconded at the VU University Amsterdam.

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