

Criteria for the nutritional evaluation of foods.
The Netherlands tripartite classification model for foods.

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Introduction

Education about a healthy diet is meant to enable consumers to make healthy choices from the huge assortment of foods offered in many places and sometimes with tempting promises. For the average consumer it is far from simple to translate the often complex message of a healthy diet into concrete food choices. The Netherlands Nutrition Centre therefore developed a system for aiding consumers to make a 'healthy' food choice. This system is intended for nutrition information and fits in with both scientific insights pertaining to a healthy diet and the way of thinking and daily practice of consumers. The aim of the system is to enable consumers to compose a varied diet that contains, in principle, all essential nutrients taking into account at the same time scientific insights into the relation between diet and risk of chronic disease. The system departs from classification of the whole food assortment into product groups. The product groups with a high nutrient density together constitute the basic diet. Next, within each of these product groups of basic foods, preferred products at the one end of the spectrum are distinguished from products that should be included in the diet just exceptionally on the other end, with a category of products categorized as a neutral choice in between. The criteria for this tripartite classification are based on an analysis of the composition as the typical Dutch diet in relation to the desired composition based on data from scientific (epidemiological) research. Depending on the product group, what matters is the amount of dietary fibre, saturated fat, energy and/or specific micronutrients contained in the food product.

This paper describes the system and derivation of criteria for nutritional evaluation of foods as used in the Netherlands. In addition, it discusses possible applications for other objectives such as product development and nutritional profiles for the purpose of nutrient fortification or health claim regulations.

1. Classification into product groups and composition of the basic diet

A classification of foods into product groups (Table 1) on the basis of nutritional composition and use is an approach to evaluate the nutritional quality of foods. This appears to fit the way consumers think about the choice of their foods.

As a first step, a number of product groups are characterized as basic foods, i.e. groups of foods with a high nutrient density that are in the typical Dutch diet important for micronutrient supply. The other groups of products, with a low nutrient density, but usually a high energy density, are considered not to be part of the basic foods. Beverages have a low nutrient density, but are important for fluid supply and are hence considered as basic foods.

As a qualitative guideline for an adequate supply of micronutrients, in conformity with Dutch dietary reference intakes, recommended quantities have been defined for all groups of basic foods. This is called the basic diet. To this end, model calculations have been made. On the basis of these calculations it can be said that the basic diet provides roughly the recommended amounts of the various micronutrients but, generally speaking, not sufficient energy. Therefore, consumers may choose from the other product groups to fill this gap. However, this should not lead to too high an energy intake.

2. Choices within the product groups

The second step in composing a healthy diet is making deliberate choices within product groups belonging to the basic diet. This enables to make the diet in better keeping with recommendations aimed at prevention of chronic diseases. For communication about this matter a tripartite classification has been made for each separate product group:

Subgroup A, 'preferably': products with a positive influence on achieving a diet in keeping with recommendations for prevention of chronic diseases;

Subgroup B, 'middle road': products that are neutral regarding achievement of a diet in keeping with recommendations for prevention of chronic diseases;

Subgroup C, 'exceptionally': products with a negative influence on achieving a diet in keeping with recommendations for prevention of chronic diseases.

This tripartite classification is based on the nutritional quality of products and indicates favourable and less favourable choices within the separate subgroups. For example, for bread 5 slices are advisable in a healthy diet for adults and the tri-partition indicates that dark bread types are the preferred choice. The tri-partition helps consumers to weigh food choices: by making favourable choices more often, room is created for unfavourable choices. Thus, it cannot be said that a basic diet comprising exclusively preferred products should be sought after. Consumers should seek to shift their choices among the basic foods towards more preferable products.

3. Criteria for classification of products within product groups

In developing the criteria a choice was made for a specific approach by selecting those nutrients that are considered to be most relevant in the light of prevention of chronic diseases. The nutrients involved are discussed below.

- saturated fatty acids

Saturated fatty acids have an unfavourable effect on the serum lipid spectrum, in particular by lowering the total/HDL cholesterol ratio, a risk marker for cardiovascular disease (1,2). Reduction of saturated fatty acid intake can yield appreciable health benefits (3,4)

The effect of trans fatty acids on the serum lipid spectrum is even more unfavourable than that of saturated fatty acids. This makes it desirable to combine saturated fatty acids and trans fatty acids in nutrition education. Therefore, products are classified on the basis of the sum of saturated and trans fatty acids.

- N-3 long chain fatty acids in fish

The n-3 long-chain fatty acids docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) appear to reduce the risk of fatal myocardial infarction, in particular through the positive effect of these fish fatty acids on cardiac rhythm. Because of the supply of n-3 fatty acids propagation of fish consumption is thought to be desirable (1). As fish species vary in levels of n-3 fatty acids, it is meaningful to subdivide the fish subgroup by level of n-3 fatty acids.

- dietary fibre

A diet rich in dietary fibre appears to be associated with a favourable serum lipid profile and a reduced risk of cardiovascular disease (4). Such a diet also has a favourable effect on the intake of micronutrients since most high-fibre foods are generally richer in micronutrients. A high-fibre content also renders foods more voluminous, thus contributing to prevention of overweight.

- energy

Overweight is a major risk factor for several chronic diseases including cardiovascular disease, type 2 diabetes mellitus and some cancer types. It is a consequence of a disturbed energy balance (4,5). For an increasing proportion of the Dutch population, it is important to pay attention to their body weight, preferably by focusing on a combination of a healthy diet and physical exercise.

For the daily diet this implies attention for the quantities of the various product groups consumed and the choice within product groups, with emphasis on the energetic value of the individual products.

In practice, restriction of the intake of saturated fatty acids automatically results in most cases in a lower total fat intake and hence a lower total energy intake. For the product groups for which this applies, no extra criterion for energy value is therefore needed.

In contrast, criteria for energy value have been defined for product groups from which extra energy can be derived in the form of sugars or oils low in saturated fatty acids. For the product groups to which sugars may be added (for example, in the food group of milk and products a low-fat yoghurt product with sugar added), a criterion for amount of monosaccharides and disaccharides has been defined. For product groups in which oils low in saturated fatty acids may have been used (for example, full-cream cheese products with oil) a criterion for energetic value has been defined.

- vitamin C and folate in vegetables and fruit

Stimulation of consumption of vegetables and fruit is a point of special attention in promotion of healthy dietary patterns because a diet rich in vegetables and fruit is associated with a reduced risk of chronic diseases, notably cardiovascular disease (4,6,7).

The importance of vegetables and fruit in the daily diet is twofold. On the one hand, they contribute to supply of micronutrients including vitamin C, folate and dietary fibre. On the other hand, they play a role by reducing the risk of a number of chronic diseases. It is still unknown what constituents are responsible for that effect. However, it is believed that, in addition to the micronutrients mentioned, a broad range of bioactive compounds play a role. The natural presence of vitamin C, folate and fibre is considered to be an indicator of the presence of bioactive compounds. Therefore, the natural presence of vitamin C, folate and dietary fibre is used as criterion for the classification of vegetables and fruit and products based on these foods.

- expression of criteria on a weight basis

It has been decided to express the criteria in units of weight of each nutrient per 100 g of product, rather than in units of consumption, or servings. This fits with the way nutritional values are declared on the food labels and the information in food composition tables. Such a comparison of the criteria on a weight basis is justified, as for each product group units of consumption of products within that group are usually in the same range of order.

For the sake of convenience, the criteria for the various product groups are clustered whenever possible. Nonetheless, in nutrition education the product groups can be subdivided, for example by splitting the product group 'bread and breakfast cereals' into 'bread' and 'breakfast cereals'.

- fortified foods

Fortified foods, i.e. foods enriched with vitamins, minerals or other nutrients, are classified on the basis of criteria that hold for the original product group, i.e. the criteria that apply for the non-fortified products. For example, milk with extra calcium added, like other milk types, is classified only by its

content of saturated fatty acids. In individual cases it may, however be meaningful to take into account the added nutrients..

4. Numerical definition of the criteria

In defining the criteria for saturated fatty acids and dietary fibre, the starting point is the difference between current intake and the desired, or optimal intakes. Optimal intakes are based on the Dutch dietary reference intakes (DRI), set by the Health Council (1,8,9,10), while actual intakes were taken from the third Dutch National Food Consumption Survey (DNFCS-3) (11). For saturated fat the actual intake on a population basis was 14,3 En-%, while the goal for maximum intake has been set at 10 En-%. Therefore a reduction by 30% would bring the average intake at the desired level. For dietary fibre, the actual intake is around 2,3 g/MJ, while the DRI has been set at 3 g/MJ, indicating a desired increase by 25%.

- general method of derivation

To obtain a system of consistent criteria, a general ‘calculation rule’ has been formulated, which is applied for each individual product group. In this calculation rule the B/C threshold is by definition the current intake of a given nutrient. This is derived from DNFCS-3 data by exploring how much of a product group is consumed on average at the level of the total population, and how much saturated fat and dietary fibre is provided by 100 g of these products. For establishing the A/B threshold the point of departure is the change desired for that particular nutrient. As stated above, this means a reduction by 30% for saturated fat and an increase by 25% for dietary fibre relative to current intake. For example, in an average diet the amount of meat consumed provides 5.3 g saturated fatty acids per 100 g, which is the B/C threshold by definition. The A/B threshold is 30% lower, namely 3.8 g per 100 g. The amount of bread consumed on average per day provides 4.8 g fibre per 100 g (the B/C threshold). The A/B threshold is 25% higher, i.e. 6 g per 100 g. To avoid spurious accuracy, the values for the criteria have been rounded to whole numbers.

- exceptions to the general rule

The primary approach is to follow the general method of derivation. A precondition is that the eventual classification of each product group is in keeping with the main communication message for that group. This proved not to be the case for every product group. Therefore, other approaches were followed wherever needed.

For example, for some product groups the Dutch Commodities Act encompasses regulations for the levels of some nutrients of relevance in the context of prevention of chronic diseases (e.g. the fat content of milk). Because communication should focus on daily practice, it is useful to take these rules into account in defining the criteria (e.g. skimmed milk is A, low-fat milk is B, whole milk is C). Furthermore, in some cases the levels of a nutrient naturally present is already favourable. This is the case, for example, for vitamin C, folate and fibre in vegetables and fruit. Therefore, the natural presence of these nutrients was adopted as criterion.

The criteria for classification of fish depart from the number of fish servings per week required to achieve the recommended intake of n-3 fatty acids recommended in the Netherlands (0.2 g/day). In addition, fat fish is a source of saturated fatty acids. Therefore, for fish the criteria are based on n-3 fatty acids and saturated fatty acids combined.

- ***multiple criteria per product group***

For some product groups it is relevant to base classification on multiple criteria, for example, bread on the basis of both fibre and saturated fatty acids. The point of departure is that products are ranked A when they score A on all criteria. Products ranked B must score at least B on all criteria.

Table 2 lists all criteria used for the various product groups. In Table 3 rankings are presented for a number of common foods in each product group.

- ***classification of the non-basic foods***

For the other product groups the energy content determines the choice of the individual products. Because none of these product groups is essential for the provision with (essential) nutrients, they are exchangeable in principle on the basis of energy content. Therefore, no ranking using a tri-partite classification scheme was chosen for these product groups. In the choice of these products it is primarily the energy content that matters in relation to the quantity consumed. Therefore tailored information about the energy content per serving seems more useful and informative for the consumer. In addition it might be useful, to give information on the presence or absence of a specific nutrient such as saturated fatty acids or dietary fibre. To present this information in a uniform and standardized way, threshold values have been defined for 'little' or 'much' saturated fatty acids or dietary fibre for these product groups. The method of derivation corresponds with the criteria for tri-partition for the groups of basic products. These threshold values are listed in Table 4.

5. Applications

- ***nutrition education***

The system of product classification described in this paper, using a tri-partition for the groups of basic products, has been applied successfully in nutrition education and advice on special diets in the Netherlands for over a decade. Nutrition education experts have experienced that education using this approach is highly suited in practice.

A survey among hypercholesterolemic patients who were advised to use a special diet to lower blood cholesterol levels has shown that those subjects informed by means of this tri-partition classification of product groups achieved a stronger decline in serum cholesterol than those receiving other forms of information about their diet (12).

- ***product development***

In the food industry there is an increasing trend to develop 'new' products that could contribute to attainment of a healthy diet. The criteria described above, which have been developed primarily on behalf of nutrition education, might also be used as a guideline for the nutritional composition of newly developed products. Obviously, much health benefit can be gained if consumers have a broader choice of 'preferred' products in each product group. It would facilitate 'healthy' choices.

In some countries, including France and the UK, initiatives have been taken to prompt the industry to reduce the salt content of their products. In criteria used in regulations about enrichment and health claims the salt (sodium) content of products is often also taken into account. In the Netherlands, reduction of salt intake via deliberate product choices is not a priority yet. Therefore, the criteria mentioned in this paper, which are primarily meant for consumer education, do not include salt. In the context of product development, however, reduction of salt content might indeed be relevant. Recent meta-analyses have shown that salt reduction yields health benefits even for normotensive individuals, with no clear threshold value (13).

An additional salt criterion could be included using a similar ‘calculation rule’ as for the other nutrient criteria.

- *application of nutritional profiles within the framework of legislation*

In countries like the USA and Canada, food- or nutrient-based criteria are used in regulations for product enrichment or for exclusion of products from health claims. The forthcoming EU proposal on nutritional and health claims, too, proposes nutrition profiles to exclude products with an ‘unhealthy’ composition from the use of health claims. The aim of such an exclusion criterion is to prevent foods that do not contribute positively to attainment of a healthy diet from gaining a positive image in the eyes of consumers through enrichment or a health claim.

Recently, the Food Standards Agency (FSA) has made an inventory of possible models for formulating such nutritional profiles (14). These models depart from variable combinations of nutrients including contents of total fat, saturated fatty acids, sodium and/or added sugars, expressed in grams per 100 g or grams per serving. These criteria are, however, identical for all product groups and based on historical and/or pragmatic grounds such as acceptance and issues like enforcement and monitoring. The general conclusion of FSA is that all these models have their limitations.

The system described in this paper appears to be also applicable in drafting of nutritional profiles within the framework of legislation and might even be advantageous relative to models applied in other countries and discussed in the FSA report. First, the criteria focus explicitly on achievement of a healthy diet and have been defined numerically in a systematic and objective manner. Second, the current criteria are based on a national (Dutch) situation and priorities but can be extended, if required, with other nutrients considered to be relevant. Third, the system can also be used in other countries, with criteria being derived specifically on the basis of the discrepancy between current and desired situation in those countries regarding supply of the various nutrients.

The differing criteria for the different product groups enable a more product-specific approach allowing for the natural composition of the products. The natural presence of a specific nutrient may vary strongly from one product group to another. If one criterion would be used for all product groups, product groups would be excluded that do contribute to a healthy diet. For example, in the Dutch diet cheese contributes appreciably to the supply of calcium and B vitamins but also to the intake of saturated fatty acids. This drawback can be circumvented by using a criterion for the content of saturated fatty acids in the cheese product group and classifying low-fat cheese variants as ‘preferred’ products.

Finally, it is plausible that it is more comprehensible to consumers if the same criteria for evaluation of foods are used for legislation and nutrition communication.

6. Conclusion

Any classification of foods into ‘healthy’ and ‘unhealthy’ products is an oversimplification of the complex message of a healthy diet. The translation from a healthy dietary pattern to ‘healthy’ products is complicated since healthiness is determined not only by the composition of a product but also by the quantity consumed and the position of the product within the total diet. In the system described in this report the central focus is on the importance of a varied diet and a classification is made within the product groups qualified as belonging to the basic diet. The classification criteria are based on attainment of health benefits and enable a balanced classification allowing for both positive and negative aspects of products. The primary aim of the system remains promotion of healthy dietary patterns (as positive incentive) and discouragement, but not prohibition, of ‘unhealthy’ products.

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Table 1: Overview of product groups

Basic foods	Source of	Daily recommendation *
Bread, bread substitutes, (breakfast) cereals, rice, pasta, pulses	carbohydrate, protein, fibre, minerals, B vitamins	175–245 g bread, 150–250 g potatoes or rice, pasta or pulses
Vegetables, fruit and vegetable and fruit juices	vitamin C, folate, fibre	200 g vegetables, 200 g fruit
Milk and milk products, cheese, meat, meat products, fish, chicken, eggs, vegetable meat substitutes	protein, B vitamins, minerals	400 ml milk, 20 g cheese, 100–120 g meat or meat substitutes, including fish twice a week
Fat spreads, preparation fats	vitamins A and D, essential fatty acids	20–35 g
Beverages	water	1.5 litres
Other product groups		
Cake and pastry Sweets, sweet filling Nuts and savoury snacks Snacks Savoury filling Savoury sauces	primary source of energy	consumption should not lead to too high an energy intake; quantities dependent on the energy content of the basic diet

* daily recommendations for adults, 20 – 50 years; other groups have different recommendations, depending on dietary reference intakes

Table 2: Criteria for product groups

Note: 'saturated fat' is understood to be the sum of saturated and trans fatty acids.

Product group	A: 'preferable'	B: 'middle course'	C: 'exceptional'
Potatoes, rice, pasta, pulses	<u>Fibre</u> : min 3 g/100g <u>Saturated fat</u> : max 1 g/100g	<u>Fibre</u> : 2-3 g/100g <u>Saturated fat</u> : max 1 g/100g	<u>Fibre</u> : less than 2g/100g
Bread, bread substitutes, breakfast cereals	<u>Fibre</u> : min 6 g/100g <u>Saturated fat</u> : max 1 g/100g	<u>Fibre</u> : 5-6 g/100g or <u>Fibre</u> : min 6 g/100g <u>Saturated fat</u> : min 1 g/100g	<u>Fibre</u> : less than 5 g/100g
Vegetables, fruit and fruit juices	<u>Vitamin C</u> : min 1 mg/100g <u>Folate</u> : min 1 mcg/100g <u>Fibre</u> : min 1 g/100g <u>Saturated fat</u> : max 1 g/100g <u>Sugars</u> : not added	<u>Vitamine C</u> : min 1 mg/100g <u>Folate</u> : min 1 mcg/100g	<u>Vitamin C</u> : not present
Milk and milk products	<u>Saturated fat</u> : max 0,5 g/100g <u>Sugars</u> : max 6 g/100g	<u>Saturated fat</u> : 0,6-1 g/100g or <u>Saturated fat</u> : max 0,5 g/100g <u>Sugars</u> : more than 6 g/100g	<u>Saturated fat</u> : more than 1 g/100g or <u>Saturated fat</u> : 0,6-1 g/100g <u>Sugars</u> : more than 6 g/100g
Cheese	<u>Saturated fat</u> : max 12 g/100g <u>Energy</u> : max 300 kcal/100g	<u>Saturated fat</u> : 13-18 g/100g or <u>Saturated fat</u> : max 12 g/100g <u>Energy</u> : more than 300 kcal/100g	<u>Saturated fat</u> : more than 18 g/100g
Meat, prepared meat products, chicken, eggs	<u>Saturated fat</u> : max 4g/100g <u>Energy</u> : max 200 kcal/100g	<u>Saturated fat</u> : 4-5 g/100g or <u>Saturated fat</u> : max 4 g/100g <u>Energy</u> : more than 200 kcal/100g	<u>Saturated fat</u> : more than 5g/100g
Fish	<u>Saturated fat</u> : max 4 g/100g <u>n-3 fatty acids</u> : max 2 portions for	<u>Saturated fat</u> : 4-5 g/100g <u>n-3 fatty acids</u> : 2-4 portions for	<u>Saturated fat</u> : more than 5 g/100g <u>n-3 fatty acids</u> : more than 4 portions for

	recommendation energy: max 200 kcal	recommendation	recommendation
Spread and cooking fats	Saturated fat: max 16 g/100g	Saturated fat: 17-24 g/100g	Saturated fat: more than 24 g/100g

Table 3: Overview of the position of the most frequently used products per product group.

Product group	A: preferable	B: 'middle course'	C: 'exceptional'
Potatoes, rice, pasta, pulses	Boiled potatoes, pulses, wholemeal macaroni	Unpolished rice	Pasta, white rice, chips,
Bread and bread substitutes	Wholemeal bread,	Brown bread,	White bread,
Vegetables	All types (fresh, frozen, canned and jarred)	Creamed vegetables, tomato juice	
Fruit	All types of fresh fruit	Pineapple, grapefruit and orange juice, preserved fruit	Apple, grape and pear juice, applesauce, dried fruit
Milk and milk products	Skim milk, low-fat yoghurt,	Low-fat milk, low-fat fruit yoghurt	Whole milk, whole yoghurt,
Cheese	20+ en 30+ cheese,	40+ cheese (Edam), cheese product with polyunsaturated fatty acids	Gouda cheese (48+)
Eggs	Boiled egg		Fried egg
Meat, prepared meat products	Chicken fillet, low-fat beef, low-fat pork, ham, smoke-dried beef,	Chicken with skin	Minced meat (all types), hamburger, lamb, stewing steak, all types of sausages, pâté, bacon
Fish	Trout, herring, sardines, salmon	Codfish, tuna, plaice	Steamed mackerel, fish fingers
Fats	Low-fat margarine, margarine with less than 17 g/100 g saturated fat, oil, liquid frying product	Low-fat butter, margarine with 17–24 g/100 g saturated fat	Solid frying product, solid fat for deep-frying, butter
Beverages	(mineral) water, coffee, tea, l light soft drinks		Soft drinks, fruit drinks, alcoholic beverages

Table 4: Threshold values for saturated fatty acids (SFA) and fibre for other products.

Product groups	'low'in SFA	'high'in SFA	'high'in fibre
Snacks, spicy filling	max 4 g/100g	> 5 g/100g	n.a.
Sauces	Max 2g/100g	>4 g/100g	n.a.
Cake, pastry, nuts, savoury snacks	Max 6 g/100g	> 6 g/100g	≥ 2 g/100g
Sweets, sweet filling	Max 3 g/100g	> 4 g/100g	≥ 1 g/100g
Cream	Max 12 g/100g	> 18 g/100g	n.a.
Evaporated milk	Max 1 g/100g	> 3 g/100 g	n.a.