The Nutri-Score nutrition label

A public health tool based on rigorous scientific evidence aiming to improve the nutritional status of the population

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Abstract: Nutri-Score is a front-of-pack nutrition label with summary graded colour-coding, which aims to inform consumers, in a simple and understandable way, of the overall nutritional value of foods, in order to help them to make healthier choices at the point of purchase and to encourage manufacturers to improve the nutritional quality of their products. It is based on a five-colour scale (from dark green to dark orange) associated with letters, from A to E, to optimize logo accessibility and understanding by the consumer. Nutri-Score does not merely characterize foods as "healthy" or "unhealthy". Rather, the graded logo provides semi-quantitative information, depending on the colour/letter, of the relative overall nutritional composition of a food product compared to other similar products as to whether it is more or less favourable to health. Nutri-Score is the only proposed labelling scheme that adheres entirely to the concepts and processes that were published by the World Health Organisation (WHO) Europe concerning the validation studies that are required to select and evaluate a front-of-pack nutrition label. The aim of the present paper is to present the scientific basis for the design of the Nutri-Score and to summarize the various studies to validate its calculation method and its graphic format. We explore its effectiveness and superiority compared to other labelling schemes that have been implemented in other countries or supported by pressure groups. The necessity for objective, impartial consideration of how best to use Nutri-Score and avoid misunderstandings is highlighted.

Keywords: Nutri-Score, nutrition labelling, nutritional quality, validation studies, food choices

Introduction

The Nutri-Score is a front-of-pack nutrition label with summary graded colour-coding, based on a five-colour nutritional scale (from dark green to dark orange) associated with letters, from A to E, to optimize logo accessibility and understanding by consumers of food products [1] (Figure 1). Intended to be affixed to the front of food packaging, the Nutri-Score nutrition label aims to inform consumers, in a simple and understandable way, of the overall nutritional value of foods, in order to help them to make better-informed and healthier choices at the point of purchase. The second objective of the Nutri-Score is to encourage manufacturers to improve the nutritional composition of their products through reformulations and/or innovations, in order that their products are better positioned on the Nutri-Score colour scale and ultimately less harmful for consumers.

An important characteristic of the Nutri-Score is the comprehensive, unbiased and impartial nature of the evidence on which it is based. Its construction relies on robust scientific observations, including data from more than 40 studies published in international peer-reviewed scientific journals, which have validated its calculation method and its graphic format, and demonstrated its effectiveness and its superiority compared to other labels that have been implemented in other countries or supported by food-industry aligned lobbying groups. The aim of the present paper is to present the scientific basis that enabled the construction of the Nutri-Score and the various studies that were conducted to validate its calculation method and its graphic format.

Scientific basis for the development of Nutri-Score

The development of Nutri-Score incorporated a large amount of previous nutritional scientific work. The computation for assigning the Nutri-Score colours/letters was based on a nutritional profile system that was initially developed by researchers at the University of Oxford, for the UK Food Standard Agency (FSA), with the goal of setting

Figure 1. Graphical format of Nutri-Score.

rules for regulating television advertising to children [2–7]. A rigorous process incorporating numerous studies had been used to justify the nutrients or elements retained in the algorithm and to limit, through sensitivity studies, their number and to avoid redundancy between elements. For example, the inclusion of fruits and vegetables in the calculation was shown to be an excellent proxy for the quantity of certain vitamins, such as vitamin C and pro-vitamin A (beta carotene) [2, 3]. Similarly, proteins were selected as a proxy for the quanity of minerals and trace elements in food products, such as calcium and iron. Finally, this work allowed the identification and inclusion in the final global nutritional score of only those nutrients and elements that were relevant for nutritional health and whose consumption should either be limited or promoted in the public health interest.

A fundamental requirement of any practically applicable labelling system is the inclusion of nutrients and elements that are already described in the mandatory nutritional tables and lists of ingredients found on the back of food products in Europe (which can be difficult for many consumers to interpret). The decision to base the Nutri-Score algorithm on composition data which is already available and accessible to consumers allows complete transparency and the ability for everyone to verify the correct attribution of the colour/letter of the Nutri-Score. By taking into consideration proxies for some vitamins and minerals, the algorithm takes into accounts more items than only those listed for its calculation.

The final nutrient profiling system (named FSA NPS) was initially intended to be used in a binary way in the United Kingdom to authorize (or not) TV advertisement for foods aimed at children. This system was the subject in 2015 of modelling studies by the French High Council of Public Health (HCSP), an expert independent agency providing public health advice for policymakers [8]. This agency set the four thresholds defining the five colours/letters of Nutri-Score, from A (dark green) to E (dark orange). On a public health basis, the HCSP made some specific adjustments of the original FSA NPS for three food categories; beverages, cheeses and added fats (as suggested by the French Food Safety Agency ANSES and the scientific designers of the Nutri-Score) with the aim of improving the evidence of the variations of the nutritional quality within these three food groups. Contrary to what is sometimes argued, it is not the fact that France is a "cheese country" that led to these changes, but rather that the initial algorithm placed all cheeses in the same category (E) and thus did not take into account the contribution of different items included in this food group to nutritional recommendations (concerning dairy products) in particular with regard to calcium and fat content. After modest adjustment of the algorithm by the HCSP (incorporating a consideration of proteins as a proxy of calcium content), the cheeses are mainly distributed in categories D and E with some in C, such as Italian Ricotta and Mozzarella cheeses, allowing consumers to visualize their relative differences in nutritional composition. The same reasoning was applied for beverages and added fats to allow a better discrimination of products within these groups in accordance with public health nutritional recommendations. Based on scientific data (and in particular results of recent intervention studies with olive oil) [9], the French Public Health Agency (Santé Publique France) responsible for developing Nutri-Score has subsequently included olive oil (as well as nuts and rapeseed oils) as positive and desirable elements in the algorithm, moving these products from D to C. Category C is the best possible class for added fats, consistent with the Mediterranean diet model and with the nutritional recommendations of most European countries where added fats should only be ingested in limited quantities, with a preference for certain vegetable oils.

Scientific studies demonstrating the effectiveness of the Nutri-Score

To assess the real quality of a nutrition front-of-pack label, it is necessary to be able to estimate both the relevance of the algorithm on which its computation is based as well as the performance of its graphic format. For that, there is a conceptual scheme described in the scientific literature [10, 11] and a detailed process published by the WHO [12–14], describing the validation studies required to evaluate and select a nutrition front-of-pack label. Nutri-Score uses the only logo that adheres to the entire conceptual scheme and all stages of the validation process (Figure 2). Numerous scientific publications in peer-reviewed

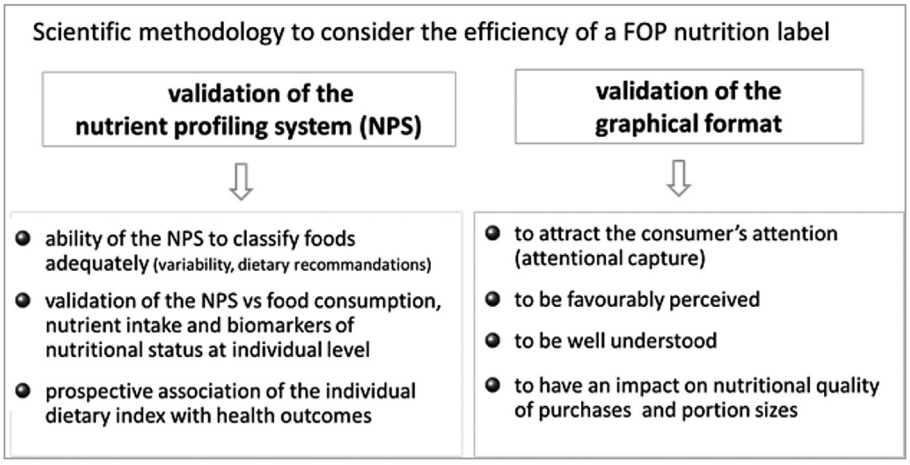

Figure 2. Conceptual scheme describing the validation studies required to evaluate and select a nutrition front-of-pack label.

international journals have validated both its computational algorithm and its graphic format [15].

Validation of the algorithm (nutrient profiling system) underlying the Nutri-Score

Ability of the nutrient profiling system to classify foods adequately

Various studies analysing generic food composition tables from eight European countries (EUROFIR database [16]) and a large database of branded products covering the food markets of 13 European countries (Open Food Facts database [17]) have highlighted that for all the tested European countries, the food classification by Nutri-Score was generally consistent with public health nutritional recommendations : the majority of products containing mainly fruit and vegetables are classified in A or B, while the majority of sweet and salted snacking products, sauces and animal fats are classified in D or E. The consistency was also confirmed within specific food groups: in the starch food group, pulses, pasta and rice are overall ranked more favourably than breakfast cereals; in the dairy group, milk and yogurt are better ranked than cheeses. Composite dishes are widely distributed, highlighting the variability of products in this specific category. Finally, concerning beverages, while the majority of fruit juices are classified C, sodas are classified E and only water is A. In addition, in all European countries, high variability was observed for all food groups, insofar as the foods in each category were systematically distributed into at least three classes of the Nutri-Score. For similar products of different brands, at least two colour classes are identified each time. The ability of the Nutri-Score to identify differences in nutritional quality of foods is particularly useful in enabling consumers to compare foods within specific categories.

Validation of the nutrient profile system vs food consumption, nutrient intake and biomarkers of nutritional status at individual level

The scoring underlying the Nutri-Score was then validated in various epidemiological studies (in general populations of volunteers and in representative random samples) based on data from individual food surveys conducted on several thousand participants (with biological markers in some studies) [18–21]. Individuals with a nutritional profile of dietary intake corresponding to a better Nutri-Score have higher consumption of fruits, vegetables and fish, lower consumption of sweet, fatty and salted snacking products, higher intake of fibre, vitamin C, beta-carotene, calcium, zinc and iron, lower saturated fatty acid intakes, better adherence to public health nutritional guidelines and more favourable antioxidant profiles (higher blood levels of vitamin C and beta-carotene) [20]. These studies demonstrate that eating foods that are better ranked on the Nutri-Score scale is associated with better overall nutritional quality of the diet and better nutritional status of individuals.

Prospective association of the individual dietary index (corresponding to the nutrient profiling system) with health outcomes

Ultimately, the most important consideration regarding the usefulness and importance of Nutri-score is whether or not it is associated with and predicts health outcomes in individuals. The Nutri-Score has been validated in this way in several prospective cohort studies. The Nutri-Score algorithm has been studied in large cohorts in France, Spain and elsewhere in Europe (Table 1). The French SU.VI. MAX study (6,435 subjects followed for 13 years) [22–25]

Table 1. Prospective studies testing the association of the individual dietary index (corresponding to the nutrient profiling system underlying the Nutri-Score) with health outcomes

Publication country	Cohort number of subjects mean follow-up	Main outcome	Method of computation of the score	Exposition	Association	P trend
Julia et al., 2015 [23] France	SU.VI.MAX n=6,435 13 years	Metabolic syndrome	Arithmetic mean of the algorithm underlying the continuous Nutri-Score, weighted by the energy consumed	Quartile 4 vs. Quartile 1	1.43 (1.08; 1.89)	0.02
Egnell et al., 2020 [31] France	NutriNet-Santé n=71,403 10 years	Overweight	Arithmetic mean of the algorithm underlying the continuous Nutri-Score, weighted by the energy consumed	Tertile 3 vs. Tertile 1	1.27 (1.17; 1.37)	<0.0001
		Obesity		Tertile 3 vs. Tertile 1	1.14 (1.00; 1.30)	0.05
Julia et al., 2015 [24] France	SU.VI.MAX n=6,435 13 years	Overweight in men	Arithmetic mean of the algorithm underlying the continuous Nutri-Score, weighted by the energy consumed	Quartile 4 vs. Quartile 1	1.61 (1.06; 2.43)	0.02
		Overweight in women		Quartile 4 vs. Quartile 1	0.74 (0.54; 1.02)	0.04
		Obesity in men		Quartile 4 vs. Quartile 1	1.91 (1.12; 3.26)	0.01
		Obesity in women		Quartile 4 vs. Quartile 1	0.91 (0.56; 1.49)	0.39
Adriouch et al., 2016 [22] France	SU.VI.MAX n=6,515 13 years	Cardiovascular diseases	Arithmetic mean of the algorithm underlying the continuous Nutri-Score, weighted by the energy consumed	Quartile 4 vs. Quartile 1	1.61 (1.05; 2.47)	0.03
Adriouch et al., 2017 [25] France	NutriNet-Santé n=75,801 13 years	Cardiovascular diseases	Arithmetic mean of the algorithm underlying the continuous Nutri-Score, weighted by the energy consumed	Quartile 4 vs. Quartile 1	1.40 (1.06; 1.84)	0.01
		Coronary heart diseases		Quartile 4 vs. Quartile 1	1.62 (1.12; 2.35)	0.01
		Stroke		Quartile 4 vs. Quartile 1	1.17 (0.77; 1.77)	0.28
Donnenfeld et al., 2015 [21] France	SU.VI.MAX n=6,435 13 years	Cancers (overall)	Arithmetic mean of the algorithm underlying the continuous Nutri-Score, weighted by the energy consumed	Quintile 5 vs. Quintile 1	1.34 (1.00; 1.81)	0.03
		Prostate cancer		Quintile 5 vs. Quintile 1	1.31 (0.74; 2.33)	0.4
		Breast cancer		Quintile 5 vs. Quintile 1	1.08 (0.60; 1.94)	0.9
Deschasaux et al., 2017 [26] France	NutriNet-Santé n=46,864 13 years	Breast cancer	Arithmetic mean of the algorithm underlying the continuous Nutri-Score, weighted by the energy consumed	Quintile 5 vs. Quintile 1	1.52 (1.11; 2.08)	0.002
		Pre-menopausal breast cancer		Quintile 5 vs. Quintile 1	2.46 (1.27; 4.75)	0.004
		Post-menopausal breast cancer		Quintile 5 vs. Quintile 1	1.25 (0.85; 1.84)	0.09
Deschasaux et al., 2018 [29] Europe (10 countries)	EPIC n=471,495 adults 15.3 years	Cancers (overall)	Arithmetic mean of the algorithm underlying the continuous Nutri-Score, weighted by the energy consumed	Quintile 5 vs. Quintile 1	1.07 (1.03; 1.10)	<0.001
		Colo-rectal cancer		Quintile 5 vs. Quintile 1	1.11 (1.01; 1.22)	0.02
		Breast cancer		Quintile 5 vs. Quintile 1	1.06 (0.99; 1.14)	0.05
		Prostate cancer		Quintile 5 vs. Quintile 1	1.07 (0.98; 1.17)	0.04
Deschasaux et al., 2020 [30] Europe (10 countries)	EPIC n=501,594 adults 17 years	Mortality (all causes)	Arithmetic mean of the algorithm underlying the continuous Nutri-Score, weighted by the energy consumed	Quintile 5 vs. Quintile 1	1.06 (1.03; 1.09)	<0.001
		Cardiovascular mortality		Quintile 5 vs. Quintile 1	1.04 (0.98; 1.11)	0.02
		Cancer mortality		Quintile 5 vs. Quintile 1	1.08 (1.03; 1.13)	<0.001

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Table 1. (Continued)

Publication country	Cohort number of subjects mean follow-up	Main outcome	Method of computation of the score	Exposition	Association	P trend
Gomez-Donoso et al., 2020 [27] Spain	SUN n=20,503 10 years	Mortality (all causes)	Arithmetic mean of the algorithm underlying the continuous Nutri-Score, weighted by the energy consumed	Quartile 4 vs. Quartile 1	1.82 (1.34; 2.47)	<0.001
		Cancer mortality		Quartile 4 vs. Quartile 1	2.44 (1.54; 3.85)	<0.001
		Cardiovascular mortality		Quartile 4 vs. Quartile 1	1.02 (0.52; 1.98)	0.953
Donat-Vargas et al., 2020 [28] Spain	ENRICA n=12,054 10 years	Mortality (all causes)	Mean consumption of products according to their Nutri-Score (classes 1/A to 5/E)	Quartile 4 vs. Quartile 1	2.15 (1.56; 2.97)	<0.001
				Quartile 4 vs. Quartile 1	1.93 (1.34; 2.79)	<0.001
				Quartile 4 vs. Quartile 1	1.72 (1.21; 2.43)	0.002
		Mortality (all causes)	Consumption (g/d) of products classified Nutri-Score D or E	Tertile 3 vs. Tertile 1	2.08 (1.52; 2.85)	0.013
		Cardiovascular mortality	Arithmetic mean of the algorithm underlying the continuous Nutri-Score, weighted by the energy consumed	Tertile 3 vs. Tertile 1	2.82 (1.47; 5.34)	0.093
		Cancer mortality		Tertile 3 vs. Tertile 1	1.94 (0.98; 3.82)	0.036
			Mean consumption of products according to their Nutri-Score (classes 1/A to 5/E)			

as well as the NutriNet-Santé cohort (46,864 subjects followed for 6 years) [26, 27], showed that the consumption of foods with lower FSA NPS scores (corresponding to a more favourable rating with Nutri-Score) was associated with a lower risk of developing chronic diseases, including cancers, cardiovascular disease, weight gain and metabolic syndrome. In Spain, the SUN cohort (20,503 subjects; 10 years of follow-up) [28] and the ENRICA cohort (12,054 adults followed 10 years) [29] also showed that the consumption of foods with a less favourable Nutri-Score classification was associated prospectively with a higher rate of all-cause mortality, cancer mortality [28] and cardiovascular mortality [29]. Two studies were carried out within EPIC, (the European Prospective Investigation on Cancer and nutrition) a very large European population including 521,000 participants in 10 European countries with a follow-up of more than 15 years. The first study [30], including data on 49,794 cancers diagnosed during the follow-up period, found that the consumption of foods with an unfavourable Nutri-Score rating was associated with an increased risk of developing cancer, most notably of the gastrointestinal tract as well as lung cancer in men and liver and breast cancer in women. In the second EPIC cohort study [31] where 53,112 deaths occurred during more than 17 years of follow-up, consumption of food with a less favourable Nutri-Score predicted greater all-cause-, cardiovascular- and cancer-related mortality.

Regarding the association between diet and weight gain, several studies were designed to validate the algorithm underlying the Nutri-Score using the data of the NutriNet-Santé cohort, involving more than 71,000 participants followed for 9 years [32]. The statistical analyses showed that all the versions of the FSA-NPS used in the different countries around the world were associated with weight gain and obesity. Interestingly, the variant used to calculate the Nutri-Score (FSA-NPS modified by the HCSP) was even more strongly associated with the risk of weight gain and obesity than the original model and the other versions of the FSA NPS score (i.e. the one modified for the calculation of the Australian/New-Zealand front-of-pack Health Star Rating or to define health claims in Australia/New Zealand).

Finally, all the prospective cohort studies conducted in different contexts have consistently found an association between the consumption of foods with a favourable Nutri-Score and a lower risk of chronic diseases as well as reduced all-cause mortality. These results lead to the conclusion that, if each of the nutritional elements taken into account in the calculation of the Nutri-Score has a solid scientific justification, the aggregation of these components within the overall algorithm of its calculation has been strongly validated. This validation confirms the relevance and the reliability of the algorithm in terms of the different constituent elements that have been selected to be

incorporated, and the allocation of points to them. In the Spanish cohort SUN [28], the algorithm for calculating the Nutri-Score was consistent with the Mediterranean diet model evaluated by recognized indices (such as the *a priori* nine-item Mediterranean Diet Score proposed by Trichopoulou et al. [33]).

Validation of the graphic format of the Nutri-Score

Numerous studies have evaluated the effectiveness of the five-colour, graded, Nutri-Score graphic format at consumer level, particularly compared to other existing logos.

Perception, attractiveness and preferences

The results of scientific studies performed on large populations (several thousand or tens of thousands of subjects) [34–36] and consumer surveys carried out in France [37], Spain [38], Belgium [39] and Germany [40] consistently demonstrate the superiority of Nutri-Score compared to the other nutrition labels tested, in terms of perception, ease of identification and speed of interpretation. All studies show that the Nutri-Score is perceived favourably by consumers and appears as the preferred format compared to other labels, particularly in populations with the lowest levels of nutritional knowledge. However, it is not sufficient that a graphic format is well perceived, appreciated and preferred by the population. The logo must also be effective in influencing consumers' food choices. For this reason, the graphic format should be shown to be well understood and helpful to consumers, in order to allow them to correctly categorise foods according to their nutritional quality.

Objective understanding

Here again, the Nutri-Score has been the subject of extensive studies, particularly in 12 European countries [41] on more than 12,000 subjects and six countries in North America, Latin America, Asia and Oceania on more than 6,000 subjects [42]. These studies have shown that Nutri-Score is the most effective label compared to other labels (e.g. UK Multiple Traffic Light, Chilean Health Warnings, Australian Health Star Ratings, GDA/Ris supported by food companies) to improve the ability of consumers to correctly classify foods according to their nutritional value irrespective of their socio-demographic category. A specific study carried out in France on more than 14,000 subjects [43] showed that the probability of correctly classifying products using Nutri-Score, compared to a control situation with no label available was particularly high in subjects from lower socio-economic backgrounds and those with lower levels of nutritional knowledge. Recently a study performed on a representative sample of 4,404 British participants, comparing four FOP nutrition labels and a control group with no label found that all FOPLs were effective in improving participants' ability to correctly rank products according to healthiness with the greatest effectiveness seen for Nutri-Score, followed by Multiple Traffic Lights [44].

Impact on the nutritional quality of food purchases

The most important and relevant studies to examine the effectiveness of nutrition labels consider their impact on the nutritional quality of food actually purchased by the consumers. Several studies have tested the effect of Nutri-Score compared to no label or with other labels on consumers' choices in terms of nutritional composition of shopping baskets: four studies were carried out in virtual supermarkets (testing purchasing intentions in the general population, in students, in participants with chronic diseases and in populations from low socio-economic backgrounds) [45–47]; two large studies were carried out in experimental stores testing the effects of several labels on real purchases [48–50]; and a "real-world" study was carried out in 60 French supermarkets (10 supermarkets displaying the Nutri-Score; 10 the Traffic Light; 10 the SENS proposed by food retailers; 10 the GDA/Ris proposed by food product manufacturers; and 20 supermarkets without any labelling); In total, 1.7 million cash receipts were analysed [51, 52]. The results of all these studies on purchasing are consistent and show that the presence of the Nutri-Score improves the overall nutritional quality of shopping baskets and the performance of the Nutri-Score is superior to all other tested labels. These studies found that the overall nutritional quality of the shopping cart, assessed using the UK FSA NPS improved from 4.5 to 9.4% with Nutri-Score use and that the effect of Nutri-Score was particularly clear in participants from lower socio-economic backgrounds.

A modelling study (using the UK Preventable Risk Integrated Model (PRIME)) [53] based on the observed effects of Nutri-Score on the nutritional quality of the food product selections in shopping baskets estimated that overall mortality from chronic diseases could be reduced by 3.4% with its implementation. Moreover, another study [54] showed that the Nutri-Score was the most effective label to reduce the size of the portions chosen by consumers for products with a "low nutritional quality" thus helping to limit the overconsumption of these products.

Finally, the adoption of the Nutri-Score by public health bodies, different European states (in addition to France, Belgium, Germany, Spain, Luxembourg, the Netherlands and Switzerland), consumer associations (in particular the BEUC [Bureau européen des unions de consommateurs] gathering 43 European associations) and some food companies (several hundred in Europe adopted it after fighting it for several years) [55–57] is based on the large range of results of the scientific validation studies that followed

the methodology proposed by WHO Europe and demonstrated the relevance of the computation algorithm and the effectiveness of its graphic format. These validation studies were conducted by independent academic research teams and have been published in peer-reviewed international scientific journals. No other labels currently discussed in Europe present such a robust scientific basis to validate their use. All these studies were methodologically rigorous when confirming the superior performance of Nutri-Score compared to other labels. These findings support widespread adoption and deployment of the Nutri-Score by governments in several European countries.

The need for appropriate communication about how best to use the Nutri-Score and avoid misunderstanding

Of course, any adoption and implementation of Nutri-Score must include an effective communications strategy which outlines evidence for its impact and effectiveness in a clear and transparent way. Relevant information will have to be relayed not just by nutritional scientists and other health professional stakeholders (e.g. medical doctors, dieticians, pharmacists) but also by less conventional dissemination strategies such as with social media influencers, which may be more likely to reach larger segments of the population.

The Nutri-Score is a graded label providing comparative information in relative terms

To foster an accurate understanding of Nutri-Score and avoid any confusion or misinterpretation, an important consideration is that it does not inform consumers about the absolute nutritional value of food products, only their relative terms in comparison to other similar products. It is not intended to characterize foods as "healthy" or "unhealthy" as a binary labelling scheme would, such as the Scandinavian Key Hole to mark "recommended" foods or the Chilean warning logos which mark foods to "avoid"). The Nutri-Score is a gradual label with five categories which makes it possible to provide information in relative value on the fact that, depending on the colour/letter, the overall nutritional composition is more or less nutritionally favourable, thus facilitating comparisons of nutritional value across different foods. However, this comparison between foods is only of interest if it concerns foods the consumer needs to compare in real-life situations during purchase or consumption. Here again it should be remembered that the Nutri-Score allows for a comparison of the nutritional value of:

a) Foods belonging to the same category, for example in breakfast cereals, comparing mueslis to chocolate cereals, or chocolate and filled cereals; or in biscuits, comparing fruit cookies to chocolate cookies; or meat lasagna to salmon lasagna or spinach lasagna; or different pasta dishes; different types of pizzas; or different types of beverages (e.g. water, fruit juices, fruit drinks, sodas). In each of these categories the Nutri-Score can vary largely, with the ultimate aim of providing useful information with which consumers scan make an informed choice;
b) Similar food items proposed by different brands, e.g., comparing chocolate-filled cereal from one brand to its "equivalent" from another brand or chocolate cookies from different brands. The Nutri-Score can vary largely, which is also useful information to help consumers recognize foods of better nutritional value;
c) Foods belonging to different categories but taking into consideration that these comparisons are of interest and meaningful only if they are truly relevant, comparing foods that are really "comparable" in their conditions of use (alternatives used under the same conditions of usage, e.g. the different fats for cooking or seasoning; or in connection with the same period of consumption e.g. food taken for snacking, at breakfast, in dessert, or as an aperitif) or conditions of purchases (alternatives sold in the same aisles e.g. beverage sections, cooking oil sections, ready-meal sections, dairy products, breakfast cereals or sandwiches).

Thus, it is important to note that the Nutri-Score does not endorse or give a "seal of approval" and therefore does not recommend foods classified as A or B on the pretext that they would be "healthy". Rather, Nutri-Score serves to emphasize that these products are preferable over their lower-ranked Nutri-Score alternatives that might be "competing" for purchase or consumption.

In the same way, it may be perfectly reasonable to consume foods that are classified as D or E as part of a balanced diet, especially traditional foods, but Nutri-Score ought to prompt consumer awareness that they need to be eaten only in limited quantities and infrequently. This is entirely consistent with the principles of the Mediterranean Diet Model and with food-based dietary guidelines.

The Nutri-Score is not a substitute for general public health recommendations

Another major point that is important to highlight in communication to the public is that the Nutri-Score (like all front-of-pack nutrition labels) is not a substitute for general public health recommendations and particularly for food-based dietary guidelines that aim to direct consumers towards a healthy diet. The two approaches are absolutely complementary. While nutrition logos apply to specific products, nutrition recommendations focus on

the consumption of large "generic" food groups (e.g. fruits and vegetables, legumes, dairy products, meat, fish, added fats, sweet products). For some of these food groups, a quantitative frequency of consumption is provided (e.g. at least five fruits and vegetables a day, fish twice a week, a handful of unsalted nuts a day), while qualitative advice can be given for others (such as limiting salt, sugar, fat, giving preference to whole grains and vegetable fats over animal fats, giving preference to olive oil). Finally, it is recommended to promote the consumption of unprocessed or minimally processed foods and limit ultra-processed foods and to promote home-made meals.

However, within generic food groups (recommended or not), there is a large variability in composition across the range of industrial foods available to consumers. For example, fish can be bought raw, canned, smoked, breaded or chopped. All of these forms fall within the definition of the "fish" group. Food-based dietary guidelines recommend eating fish, especially fatty fish. But fish, depending on the form of sale, may not contain any salt (if fresh) or up to 4 g of salt per 100 g if smoked (corresponding to a large proportion of the daily recommendations for salt). The Nutri-Score provides information on the differences in overall nutritional value according to variations of that particular type of food: fresh salmon is classified A, canned salmon is classified B and smoked salmon is classified D. This is particularly useful for consumers since the generic recommendation to "eat fish" does not differentiate the potential nutritional compositions of the different forms of the same food. Thus, the Nutri-Score acts in a complementary way to nutritional recommendations as it can help consumers modify the amount and frequency of consumption of different forms of fish and other foods.

Even for foods whose consumption must be limited according to nutritional recommendations (e.g., crisps or sweet desserts or pizzas), there is also great variability in terms of nutritional composition for salt, saturated fatty acids, sugar, calories and fibre. Thus, even if the generic recommendation is to limit the consumption of these products that are high in fat, salt or sugar, Nutri-Score can help consumers to identify those with the least unfavourable composition. Nutri-Score is also informative when comparing similar products with the same name on their packaging (e.g. "cheese pizza", "chocolate cookies"), but with major differences in nutritional composition between brands. While pizza consumption should be limited overall, it is important to help consumers to identify the brands offering pizzas with the best Nutri-Score. This could ultimately incentivise food companies to reformulate their less healthy products.

Once again, the Nutri-Score does not claim that cheese pizzas or breakfast cereals even correctly ranked by Nutri-Score are necessarily "healthy", rather its objective is to help consumers who have decided to eat them to choose the product with the least unfavourable composition (best ranked by Nutri-Score).

The alignment of the Nutri-Score with nutritional recommendations appears globally consistent for a very large majority of foods present on the food market. Due to the high variability apparent both in food categories to promote as well as food categories to limit, Nutri-Score provides supplementary information to orient consumers toward foods with a better nutritional composition (with less unfavourable nutrients and/or more favourable elements). Even if this may lead to occasional discrepancies and misclassifications, these can be resolved in the future by minor modification of the components in the algorithm. The Nutri-Score should serve as a complementary tool to food-based dietary guidelines. However, it is crucial to have accurate and clear communication to consumers, which emphasises the primacy of nutritional recommendations on which food groups should be promoted or limited for optimal dietary health, including a preference for no or minimally processed, home-made foods. Only then, for each food group, if pre-packed foods have to be selected, Nutri-Score can inform the selection of those packaged products with better nutritional value in any given category.

Even if Nutri-Score has some limitations (as all FPLs do), it is important to bear in mind that it works all the same perfectly for tens of thousands of foods. In order to improve it regularly, an update of the algorithm underlying the Nutri-Score is planned every three years. This update is planned to be based exclusively on scientific data (without leaving room for lobbies who might wish to distort the Nutri-Score in favour of commercial interests). Of course, considerations such as the position of sweetened beverages or the ability to better discriminate whole grains will need to be considered by the scientific committee composed of independent experts who are currently in charge of this update at European level.

The Nutri-Score is only one element of public health nutrition policy

Finally, the Nutri-Score, like all front-of-pack nutrition labels is only one element of any public health nutrition strategy. It complements other public health measures and in particular nutrition education, communication on generic recommendations, marketing and advertising regulation, as well as taxation and subsidies schemes to facilitate access to nutritionally healthy food for all.

Communication and education on Nutri-Score must mobilize all relevant actors: nutrition and public health institutions, nutritionists and dietitians, other health professionals, as well as stakeholders from wider society including teachers, policy makers and other actors. The implementation of the Nutri-Score front-of-pack nutrition label is not,

by itself, able to solve all the nutritional problems European countries have to face. But this simple measure of transparency, which has been scientifically demonstrated as effective, will be an important step to help consumers make more healthy food choices.

Conclusion

In May 2020, the European Commission (EC) announced the intended adoption of a mandatory FOPNL before the end of 2022, as part of its Farm-to Fork-Strategy. However, only scientific evidence must guide political decisions of the EC in the field of public health and the choice of a nutrition label for Europe must correspond to this requirement alone, and not to the interests of economic power players or the member states that defend them. The Nutri-Score, developed by academic researchers without any conflicts of interest – is the only front-of-pack nutrition label in Europe that has been the subject of a large number of scientific studies published in peer-reviewed international scientific journals, demonstrating its effectiveness, relevance, and utility to consumers and to public health, as well as its ability to outperform other existing labels or labels supported by industry lobbyist groups. The extensive research body of work concerning the Nutri-Score supports the adoption of the Nutri-Score by EC as a harmonised and mandatory nutrition label for Europe.

Electronic Supplementary Material

The electronic supplementary material (ESM) is available with the online version of the article at https://doi.org/10.1024/0300-9831/a000722

ESM 1. Group of European scientists supporting the implementation of Nutri-Score in Europe (PDF)

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