The Front-of-Pack nutrition label Nutri-Score: a public health tool to improve the nutritional status of the population that is based on rigorous scientific background

Group of European scientists supporting the implementation of Nutri-Score in Europe

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, on the overall nutritional quality of foods to help them to make healthier choices at the point of purchase. The second objective of the Nutri-Score is to encourage manufacturers to improve the nutritional quality of their products through reformulations and/or innovations in order to be better positioned on the Nutri-Score color scale that is beneficial for consumers.

The interest of Nutri-Score is that it is based on a very complete scientific background. Its construction relies on strong scientific work and more than 40 studies published in international peer-reviewed scientific journals have validated its calculation method and its graphic format, and demonstrated its effectiveness and its superiority compared to other existing labels, implemented in other countries or supported by pressure groups.

1. Scientific basis that enabled the construction of the Nutri-Score

In its very construction, Nutri-Score relies on solid scientific work. The computation for assigning the Nutri-Score colours/letters is based on a nutritional profile system that was initially developed by researchers of the University of Oxford for the UK Food Standard Agency (FSA) to set rules for regulating television advertisements to children (2-7). A very rigorous scientific process incorporating numerous studies have been used to justify the nutrients or elements retained in the algorithm and to limit, through sensitivity studies, their number and to avoid redundancies between elements. For example, the inclusion of fruits and vegetables in the calculation was shown to be an excellent proxy for vitamins such as vitamin C, beta carotene… Similarly, proteins have been selected as a proxy for the food content of minerals such as calcium and iron. Finally this long scientific work permitted to retain in the final global nutritional score only the useful nutrients and elements whose consumption has to be limited and those whose consumption has to be promoted from a public health viewpoint. Moreover a fundamental constraint to provide a feasible system is to rely on nutrients and elements present in the mandatory table of nutritional declaration and in the list of ingredients found on the back of packages (that are incomprehensible for the vast majority of consumers). The fact of relying the Nutri-Score algorithm on composition data available and accessible to all allows a total transparency and the possibility for everyone to verify the correct attribution of the color/letter of the Nutri-Score. So via its proxies, the algorithm takes into account many more items than the only list of those displayed for its calculation.

The final nutrient profiling system (named FSA NPS) initially intended to be used in a binary way in the United Kingdom to authorize (or not) TV advertisement for foods aiming children was the subject in 2015 of studies and modelizations led in France by the French High Council of Public Health (HCSP), an independent agency providing collective expertise in the field of public health for policymakers (8), to set the 4 thresholds defining the 5 colours/letters of Nutri-Score (from A/Green to E/Red). On a public health basis, the HCSP has defined slight 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) to improve the evidence of the variability of nutritional quality within these 3 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 the fact that the initial algorithm placed all cheeses in

the same category (E) and thus did not take into account the contribution of this food group to nutritional recommendations (concerning dairy products) in particular with regard to calcium intake and did not allow consumers to discriminate between the difference of nutritional qualities of the cheeses. After the modest adjustment of the algorithm by the HCSP (systematic consideration of proteins, proxy of calcium content), the cheeses are mainly distributed in D and E (with some in C such as Italian Ricotta and Mozarella cheeses) allowing consumers to visualize their differences in nutritional quality. 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), the French Public Health Agency (Santé Publique France) in charge of the management of Nutri-Score has secondarily integrated olive oil (and nuts and rapeseed oils) in the positive elements taken into account in the algorithm permitting to switch olive oil from D to C (such as rapeseed and nut oils), corresponding to the best score possible for added fats, in coherence with the Mediterranean diet model and with the nutritional recommendations of most European countries where the added fat must be consumed in limited quantities and favouring certain vegetable oils more favourable to health.

2. Scientific studies demonstrating the effectiveness of Nutri-Score

To assess the real quality of a nutritional front-of-pack label, it is necessary to be able to estimate both the relevance of the algorithm that underpin its computation and the performance of its graphic format. For that, there is a conceptual scheme described in the scientific literature (9,10) and a detailed process published by the WHO (11-13), describing the validation studies required to evaluate and select a nutritional front-of-pack label. It is interesting to note that Nutri-Score is the only logo that followed the whole conceptual scheme and the different stages of the validation process. Numerous scientific publications in peer-reviewed international journals demonstrated the validation of both its computational algorithm and its graphic format (14).

2.1. Concerning the validation of the algorithm underlying Nutri-Score, the three steps of the conceptual scheme have been carried out

2.1.1. First step: Various studies analysing generic food composition tables from 8 European countries (EUROFIR database (15)) and a large database of branded products covering the food markets of 13 European countries (Open Food Facts database (16)) highlighted that for all the tested european countries, the food classification by Nutri-Score is overally 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 is also displayed within specific food groups: in the starch food group, pulses, pasta and rice are overall better ranked 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 is observed for all food groups, insofar as the foods in each category were systematically distributed into at least three classes of Nutri-Score. In addition, for similar products of different brands, at least two colour classes are identified each time. The ability of Nutri-Score to identify differences in nutritional quality of foods is particularly useful in enabling consumers to compare foods within categories.

2.1.2. Second step: The score underlying Nutri-Score was then validated in various epidemiological studies (in general population 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) (17-20). Subjects 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 fiber, vitamin C, beta-carotene, calcium, zinc and iron, lower saturated fatty acid intakes, better adherence to public health nutritional guidelines and better biological status in antioxidants (higher blood levels of vitamin C and beta-carotene). These studies demonstrate that eating foods better ranked on the Nutri-Score scale is associated with better overall nutritional quality of the diet and better nutritional status.

2.1.3. Third step : Finally, and this is the most compelling step to judge the appropriateness of the algorithm, validation of Nutri-Score has also been studied in terms of association, at individual level, with health criteria in prospective cohorts. The algorithm underlying the Nutri-Score has been studied in large cohorts in France, Spain and at European level. In France, analysis in the SU.VI.MAX cohorts (6,435 subjects followed for 13 years (21-24) and the NutriNet-Santé cohort (46,864 subjects followed for 6 years) (25.26), showed that the consumption of foods with lower FSA NPS corresponding to consumption of foods with more favourable rating in the Nutri-Score scale, is associated with a lower risk of developing chronic diseases, including cancers, cardiovascular diseases, weight gain and metabolic syndrome. In Spain, the SUN cohort (20,503 subjects; 10 years of follow-up) (27) and the ENRICA cohort (12,054 adults followed 10 years) (28) also showed that the consumption of foods with a less favourable classifications on the Nutri-Score scale was associated prospectively with a higher rate of all-cause mortality, cancer mortality (27) and cardiovascular mortality (28). Two studies carried out within the European EPIC cohort (more than 500,000 participants in 10 European countries with a follow-up of more than 15 years) confirmed these results on a very large european population. In the first study (29), analysing the occurrence of 49,794 cancers, participants consuming on average more foods with a score corresponding to unfavourable rating on Nutri-Score, presented an increased risk of developing cancer. This increased risk was more specifically observed for cancers of the rectum, upper aerodigestive tract and stomach, lung in men, liver and breast (post-menopausal) in women. In the second EPIC cohort study (30), after more than 17 years of follow-up and analysis of 53,112 deaths, participants who consumed more foods with less favourable Nutri-Score, showed increased mortality (total mortality and mortality related to cancer and diseases of the circulatory, respiratory and digestive systems).

It is also interesting to take into consideration in the framework of the studies aimed to validate of the algorithm underlying the Nutri-Score, the results in the NutriNet-Santé cohort involving more than 71,000 participants followed for 9 years (31) showed that all the variants of the FSA NPS used in the world are associated with weight gain and obesity but the variant used to calculate the Nutri-Score (FSA-NPS modified by the HCSP) was the most strongly associated with the risk of weight gain and obesity, compared to the original model and the other versions of the score 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 prospective cohort studies conducted in different contexts found an association between the consumption of foods well classified by Nutri-Score and a lower risk of chronic disease and lower 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 is strongly validated. This step of validation constitutes an important argument in favour of the relevance and the reliability of this algorithm in terms of the choice of the elements incorporated in its computation and the allocation of points to the differents constituent elements.

It should also be noted that in the Spanish cohort SUN (27), it was confirmed that the algorithm for calculating the Nutri-Score was consistent with the Mediterranean diet model evaluated by recognized indices.

2.2. Concerning the validation of the graphic format, the different steps of the conceptual scheme were also carried out for the Nutri-Score front-of-pack nutrition label

Numerous studies have evaluated the effectiveness of the five colours, graded, Nutri-Score graphic format at consumer level, especially compared to other existing logos. The results of scientific studies performed on large populations (several thousand or tens of thousands of subjects) (32-34) and consumer surveys carried out in France (35), Spain (36), Belgium (37), Germany (38), etc. are convergent showing the good efficiency and the best performance of Nutri-Score compared to the other nutritional labels tested, in terms of perception, ease of identification or speed to be understood. All studies show that Nutri-Score is strongly supported by consumers and appears as the preferred format compared to other labels especially by populations with the lowest levels of nutritional knowledge. But it is not sufficient that a graphic format is well perceived, appreciated and preferred by the population. We must ensure that the logo is really effective to help consumers in their food choices. This is why to select a nutrition label it is recommended to verify that the graphic format is well understood and really help consumers to correctly classify foods according to their nutritional quality. Here again, Nutri-Score has been the subject of extensive studies, particularly in 12 European countries (39) on more than 12,000 subjects and 6 countries in North America, Latin America, Asia and Oceania (out of 6,000 subjects) (40). These studies have shown that Nutri-Score is the most effective label vs other labels (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 quality whatever the socio-demographic category. A specific study carried out in France on more than 14,000 subjects (41) showed that the probability of correctly classifying products with Nutri-Score in relation to a control situation was particularly high in subjects with lower socio-economic level and those considering having no knowledge of nutrition.

But of course the most powerful studies to affirm the relevance and effectiveness of a nutrition label is the demonstration of its impact on the nutritional quality of purchases. Several studies have tested the effect of Nutri-Score compared to a situation with no label and with other labels on consumers' choices in terms of nutritional quality of shopping baskets: four studies were carried out in virtual supermarkets (testing purchasing intentions in the general population, in students, in subjects with chronic diseases and in populations of low socio-economic level) (42-44); two studies were carried out in experimental stores on several hundred subjects testing the effect of several labels on real purchases (45-47); and a full-scale study was carried out in real conditions in France in 60 French supermarkets (10 supermarkets displaying Nutri-Score; 10 the Traffic Light; 10, the SENS proposed by the distributors; 10 the GDA/Ris proposed by the manufacturers; and 20 supermarkets without logo); 1.7 million cash receipts were analysed (48,49). The results of all these studies on purchasing are consistent and show that the presence of Nutri-Score improves the overall nutritional quality of shopping baskets and the performance of Nutri-Score is superior to all other tested labels. According to the studies, the overall nutritional quality of the shopping cart improved from 4.5 to 9.4% by the use of Nutri-Score and the effect of Nutri-Score was particularly clear in disadvantaged populations.

A modelling study (using the UK PRIME model) (50) based on the effect of Nutri-Score on the improvement of the nutritional quality of the shopping baskets observed experimentally permitted to estimate the expected impact of Nutri-Score on chronic disease mortality. The presence of Nutri-Score

on all foods packages could help to reduce chronic disease mortality by 3.4% due to changes in food consumption.

Moreover, another study (51) showed that 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 Nutri-Score by public health bodies, differents european states (in addition to France, Belgium, Germany, Spain, Luxembourg, the Netherlands and Switzerland), consumer associations (in particular the BEUC gathering 43 European associations) and some food companies (several hundred in Europe adopted it after fighting it for several years (52-54)) are 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 presents such a scientific background validating its interest. All the studies carried out with a rigorous methodology showed a superiority and better performance of Nutri-Score compared to other labels. These scientific studies support today the choice of governments to deploy Nutri-Score in several European countries.

3. Necessity to join an appropriate communication about how to use Nutri-Score properly and avoid misunderstandings

Of course, it is important to keep in mind what can be expected and not expected from a front-of-pack nutrition label like Nutri-Score to define the communication campaigns that must be associated with its implementation and relayed by all health professionals and stakeholders (medical doctors, dieticians, pharmacists, etc.) and influencers and bloggers likely to affect a large segment of the population:

3.1. To avoid any confusion or misinterpretation, a major point must be highlighted: Nutri-Score does not aim to inform about the nutritional quality of foods in absolute value. It is not intended to characterize foods as "healthy" or "unhealthy" as does a binary logo (such as the Scandinavian Key Hole to mark "recommended" foods or the Chilean Warnings to mark foods to "avoid"). Nutri-Score is a gradual logo 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 favourable, thus facilitating comparisons of nutritional quality across the foods. However, this comparison between foods is only of interest, if it concerns foods the consumer needs to compare in real-life situations during purchases or consumption. Here again it should be remembered that the Nutri-Score allows for a comparison of the nutritional quality of:

a) foods belonging to the same category, for example in breakfast cereals, comparing mueslis vs chocolate cereals, vs chocolate and filled cereals; or in biscuits, comparing fruit cookies vs. chocolate cookies; or meat lasagna vs. salmon lasagna vs. spinach lasagna; or different pasta dishes; different types of pizzas; or different types of beverages (water, fruit juices, fruit drinks, sodas, etc),. In each of these categories the Nutri-Score can vary largely, and so it provides an useful information for consumers permitting them an informed choice;

b) same food item 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. Again, Nutri-Score can vary largely E, which is also useful information to help consumers recognize foods of better nutritional quality;

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 “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 the breakfast, in starter, in dessert, as an aperitif...) or conditions of purchases (alternatives sold in the same aisles e.g beverages shelves, oils shelves, ready meals shelves, dairy products shelves, breakfast cereals shelves, sandwiches shelves, etc.).

So we have to make it clear that Nutri-Score does not give a seal of approval and therefore does not recommend foods classified A or B on the pretext that they would be « healthy ». It only emphasizes that these products are to be preferred over their less-ranked Nutri-Score equivalents or alternatives that can be “competitive” with the consumer at the time of purchase or consumption.

In the same way, foods classified as D or E (especially traditional foods) can perfectly be consumed as part of a balanced diet but Nutri-Score make consumers aware that they need to be eaten in limited quantities/frequencies (which is totally consistent with the principles of the Mediterranean Diet Model and with the food-based dietary guidelines).

3.2. Another major point that is important to highlight in the communication is that Nutri-Score (like all front-of-pack nutrition labels) is not a substitute for generic 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 (fruits and vegetables, legumes, dairy products, meat, fish, added fats, sweet products, etc.). For some of these food groups, a quantitative frequency of consumption is provided (for example at least 5 fruits and vegetables a day, fish twice a week, a handful of unsalted nuts a day, etc.), while qualitative advice can be given for others (such as limiting salt, sugar, fat, give preference to whole grains and vegetable fats over animal fats, give preference to olive oil, etc.). 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, patty, breaded, chopped, etc. all of these forms fall within the definition of the "fish" group. Food-based dietary guidelines recommend to eat fish, especially fatty fish. But fish (for example salmon), depending on the form of sale, may not contain salt (if fresh) or up to 3 to 4g of salt per 100g if smoked (corresponding to 1/2 to 2/3 of the daily recommandations for salt). The Nutri-Score provides information on the differences in overall nutritional quality according to the variation of the 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 «eat fish» does not differentiate the potential nutritional compositions of the different forms of the same food. Therefore, Nutri-Score appears as complementary to nutritional recommendations as it can help consumers easily adjust 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 (for example, crisps or sweet desserts or pizzas), there is also great variability in terms of nutritional composition for salt, saturated fatty acids, sugar, calories, fiber,... Thus, even if the generic recommendation is to limit the consumption of these products that are salty and/ or sweet and/ or fatty, the Nutri-Score can help consumers to identify those with the least unfavourable composition. Nutri-

Score is also interesting for comparing similar products with the same name on packaging (e.g. “cheese pizza”, “chocolate cookies »,…) but with major differences in nutritional quality according to brands. While pizza consumption should be limited overall, it is important to allow consumers to identify the brands proposing pizzas with the best Nutri-Score. This could include incentives for companies to reformulate their products.

Once again, Nutri-Score does not claim that cheese pizzas or breakfast cereals even correctly ranked by Nutri-Score are healthy, but only it helps consumers who have decided to eat them to choose the product with the least unfavourable composition (best ranked by Nutri-Score).

The alignment of 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 within both food categories to promote and food categories to limit, Nutri-Score provides a supplementary information to orient consumers toward foods with a better nutritional composition (with less unfavourable nutrients and /or more favorable elements). Even if there may be some discrepancies and misclassifications (which can be resolved in the future by minor modification of the components in the algorithm), Nutri-Score appears as a complementary tool to food-based dietary guidelines. However, it is necessary to have a perfectly adapted communication reminding that it is important to first follow the nutritional recommendations indicating which food groups should be promoted or limited to to reach overall healthy dietary patterns, including a preference for no or minimally processed home-made foods,. And then for each food group, if pre-packed foods have to be selected, it is advised to use the Nutri-Score to choose those with better nutritional quality in the category or in the brand, and adapt the amount/frequency of consumption..

Even if Nutri-Score has some imperfections (no front-of pack nutrition label is 100% perfect), it is important to keep in mind that it works all the same perfectly for tens of thousands of foods. And to improve it regularly, an update of the algorithm underlying Nutri-Score is planned every 3 years (next is scheduled in 2021). This update is planned to be based exclusively on scientific data (without leaving room for lobbies who would like to distort Nutri-Score in their favour). Of course, questions, such as the position of sweetened beverages, the ability to better discriminate whole grains,… will no doubt be addressed by the committee independent scientists who will be in charge of this update at European level in the near future…

3.3. Finally, it should also be clearly highlighted that Nutri-Score, like all front-of-pack nutrition labels is only one element of a public health nutrition policy. It complements other public health measures and in particular nutrition education, communication on generic recommendations, marketing and advertising regulation, taxation/subsidies systems to facilitate access to nutritionally good food for all,…

Communication and education on Nutri-Score must mobilize all relevant actors: nutrition and public health institutions, nutritionists and dietitians, health professionals, teachers, actors in the field, etc.

The implementation of front-of-pack nutrition label Nutri-Score is not, by itself, able to solve all the nutritional problems European countries have to face. But this simple measure of transparency, which has scientifically demonstrated as effective, will be an important step to help European consumers make more healthy food choices.

Only science should guide policy-making in the field of public health. The choice of the single harmonised nutrition front-of-pack nutrition label for Europe, as foreseen by the European Commission as part of its Farm to Fork strategy must meet this single requirements and not the interests of economic operators (manufacturers, retailers or specific food sectors) or states that defend them. Nutri-Score is the only

front-of-pack nutritional label in Europe that has demonstrated on a strong scientific basis its effectiveness and relevance to consumers and public health and its superiority to other labels implemented in other countries or supported by pressure groups.

Références

1. Julia C, Hercberg S (2017). Development of a new front-of-pack nutrition label in France:the 5-Colour Nutri-Score. Public Health Panorama. 3:712–25

2. Rayner M, Scarborough P, Stockley L, Boxer A (2005). Nutrient Profiles: Further Refinement and Testing of Model SSCg3d. London: Food Standards Agency.

3. Rayner M, Scarborough P, Boxer A, Stockley L (2005). Nutrient Profiles: Development of Final Model. London: Food Standards Agency.

4. Rayner M, Scarborough P, Stockley L (2004) . Nutrient Profiles: Options for Definitions For use in Relation to Food Promotion and Children's Diets. London: Food Standards Agency, 2004

5. Rayner, M, Scarborough, P, Stockley, L. (2005). Nutrient Profiles: Applicability of Currently Proposed Model for Uses in Relation to Promotion of Foods to Children Aged 5–10 and Adults London: Food Standards Agency.

6. Arambepola, C, Scarborough, P & Rayner, M (2008). Validating a nutrient profile model. Public Health Nutr 11, 371–378.

7. Rayner M, Scarborough P, Lobstein, T (2009). The UK Ofcom Nutrient Profiling Model - Defining 'healthy' and 'unhealthy' food and drinks for TV advertising to children. https://www.ndph.ox.ac.uk/food-ncd/files/about/uk-ofcom-nutrient-profile-model.pdf

8. Haut Conseil de la Santé Publique (2015). Avis relatif à l'information sur la qualité nutritionnelle des produits alimentaires.HCSP :Paris. Accessible at: http://www.hcsp.fr/Explore.cgi/avisrapportsdomaine?clefr=519

9. Townsend MS (2010). Where is the science? What will it take to show that nutrient profiling systems work? Am J Clin Nutr; 91:1109S-15S.

10. Grunert KG, Wills JM (2007). A review of European research on consumer response to nutrition information on food labels. J Public Health;15:385-99.

11. WHO (2019). Guiding principles and framework manual for front-of-pack labelling for promoting healthy dietPre-formatted final draft - May 2019, https://www.who.int/nutrition/publications/policies/guidingprinciples-labelling-promoting-healthydiet.pdf?ua=1

12. WHO (2020). Manual to develop and implement front‑of‑pack nutrition labelling. Guidance for countries on the selection and testing of evidence‑informed front‑of‑pack nutrition labelling systems in the WHO European Region https://apps.who.int/iris/bitstream/handle/10665/336988/WHO-EURO-2020-1569-41320-56234-eng.pdf?sequence=1&isAllowed=y

13. WHO (2020). Appendix : Detailed description of additional validation studies that may be considered to select and evaluate a front-of-pack labelling scheme https://apps.who.int/iris/bitstream/handle/10665/336989/WHO-EURO-2020-1570-41321-56235-eng.pdf?sequence=2&isAllowed=y

14. Ministère des Solidarités et de la Santé. Scientific articles and papers published on the Nutri-Score. https://solidarites-sante.gouv.fr/prevention-en-sante/preserver-sa-sante/nutrition/article/articles-scientifiques-et-documents-publies-relatifs-au-nutri-score

15. Dréano-Trécant L, Egnell M, Hercberg S, Galan P, Soudon J, Fialon M, Touvier M, Kesse-Guyot E, Julia C (2020). Performance of the Front-of-Pack Nutrition Label Nutri-Score to Discriminate the Nutritional Quality of Foods Products : A Comparative Study across 8 European Countries, Nutrients, 12(5), 1303

16. Szabo de Edelenyi F, Egnell M, Galan P, Hercberg S, Julia C (2020). Ability of the front-of-pack nutrition label Nutri-Score to discriminate nutritional quality of food products in 13 European countries and consistency with nutritional recommendations https://solidarites-sante.gouv.fr/IMG/pdf/rapport_eren_off_7_countries.pdf

17. Julia C, Ducrot P, Peneau S et al (2015). Discriminating nutritional quality of foods using the 5-Color nutrition label in the French food market: consistency with nutritional recommendations. Nutr J. 14:100

18. Julia C, Kesse-Guyot E, Touvier M, Mejean C, Fezeu L, Hercberg S (2014). Application of the British Food Standards Agency nutrient profiling system in a French food composition database. The British journal of nutrition, 112:1699-705

19. Julia C, Mejean C, Touvier M et al (2015). Validation of the FSA nutrient profiling system dietary index in French adults-findings from SUVIMAX study. Eur J Nutr.

20. Deschamps V, Julia C, Salanave B, Verdot C, Hercberg S, Castetbon K (2015). Score de qualité nutritionnelle des aliments de la Food Standards Agency appliqué aux consommations alimentaires individuelles des adultes en France. Bulletin Epidémiologique Hebdomadaire; 466-75.

21. Donnenfeld M, Julia C, Kesse-Guyot E, Méjean C, Ducrot P, Péneau S, Deschasaux M, Latino-Martel P, Fezeu L, Hercberg S, et al (2015). Prospective association between cancer risk and an individual dietary index based on the British Food Standards Agency Nutrient Profiling System. Br J Nutr. 114:1702–10.

22. Adriouch S, Julia C, Kesse-Guyot E, Méjean C, Ducrot P, Péneau S, Donnenfeld M, Deschasaux M, Menai M, Hercberg S, et al (2016). Prospective association between a dietary quality index based on a nutrient profiling system and cardiovascular disease risk. Eur J Prev Cardiol. 23:1669–76.

23. Julia C, Fézeu LK, Ducrot P, Méjean C, Péneau S, Touvier M, Hercberg S, Kesse-Guyot E (2015). The Nutrient Profile of Foods Consumed Using the British Food Standards Agency Nutrient Profiling System Is Associated with Metabolic Syndrome in the SU.VI.MAX Cohort. J Nutr. 145:2355–61.

24. Julia C, Ducrot P, Lassale C, Fézeu L, Méjean C, Péneau S, Touvier M, Hercberg S, Kesse-Guyot E (2015). Prospective associations between a dietary index based on the British Food Standard Agency nutrient profiling system and 13-year weight gain in the SU.VI.MAX cohort. Prev Med. 81:189–94.

25. Adriouch S, Julia C, Kesse-Guyot E, Ducrot P, Péneau S, Méjean C, Assmann KE, Deschasaux M, Hercberg S, Touvier M, et al (2017). Association between a dietary quality index based on the food standard agency nutrient profiling system and cardiovascular disease risk among French adults. Int J Cardiol. 234:22–7.

26. Deschasaux M, Julia C, Kesse-Guyot E, Lécuyer L, Adriouch S, Méjean C, Ducrot P, Péneau S, Latino-Martel P, Fezeu LK, et al (2017). Are self-reported unhealthy food choices associated with an increased risk of breast cancer? Prospective cohort study using the British Food Standards Agency nutrient profiling system. BMJ Open. 7:e013718.

27. Gómez-Dono so C, Martínez-González MÁ, Perez-Cornago A, Sayón-Orea C, Martínez JA, Bes-Rastrollo M (2020). Association between the nutrient profile system underpinning the Nutri-Score front-of-pack nutrition label and mortality in the SUN Project : a prospective cohort study. Clin Nutr. 17: S0261-5614(20)30359-9

28. Donat-Vargas C, Sandoval-Insausti H, Rey-García J, Banegas JR, Rodríguez-Artalejo F, Guallar-Castillón P (2021). Five-color Nutri-Score labeling and mortality risk in a nationwide, population-based cohort in Spain: the Study on Nutrition and Cardiovascular Risk in Spain (ENRICA). Am J Clin Nutr, https://doi.org/10.1093/ajcn/nqaa389

29. Deschasaux M, Huybrechts I, Murphy N, Julia C, Hercberg S, Srour B, Kesse-Guyot E, Latino-Martel P, Biessy C, Casagrande C, et al (2018). Nutritional quality of food as represented by the FSAm-NPS nutrient profiling system underlying the Nutri-Score label and cancer risk in Europe: Results from the EPIC prospective cohort study. PLoS Med. 15(9):e1002651

30. Deschasaux M, Huybrechts I, Julia C, Hercberg S, Egnell M, Srour B, Kesse-Guyot E, Latino-Martel P, Biessy C, Casagrande C (2020) Association between nutritional profiles of foods underlying Nutri-Score front-of-pack labels and mortality: EPIC cohort study in 10 European countries. BMJ. 2020 Sep 16;370:m3173

31. Egnell M, Seconda L, Neal B, Ni Mhurchu C et al (2020).Prospective associations of the original Food Standards Agency nutrient profiling system and three variants with weight gain, overweight and obesity risk : results from the French NutriNet-Santé cohort. British journal of nutrition, septembre 2020.

32. Ducrot P, Mejean C, Julia C, Kesse-Guyot E, Touvier M, Fezeu L, et al (2015). Effectiveness of Front-Of-Pack Nutrition Labels in French Adults: Results from the NutriNet-Sante Cohort Study. PLoSOne. 10:e0140898.

33. Julia C, Péneau S, Camille Buscail, Rebeca Gonzalez, Touvier M, Hercberg S, Kesse-Guyot E (2017). Perception of different formats of front-of-pack nutrition labels according to sociodemographic, lifestyle and dietary factors in a French population : cross-sectional study among the NutriNet-Santé cohort participants. BMJ open 7, 6 : e016108

34. De Temmerman J, Heeremans E, Slabbinck H, Vermeir I (2021). The impact of the Nutri-Score nutrition label on perceived healthiness and purchase intentions. Appetite, 57, 1 February 2021, https://www.sciencedirect.com/science/article/abs/pii/S0195666320316172?dgcid=rss_sd_all

35. Sarda B, Julia C, Serry AJ, Ducrot P. Appropriation of the Front-of-Pack Nutrition Label Nutri-Score across the French Population: Evolution of Awareness, Support, and Purchasing Behaviors between 2018 and 2019. Nutrients. 2020 Sep 22;12(9):2887.

36. Hispacoop, Survey on Nutri-Score (2020) https://www.eurocoop.coop/news/281-HISPACOOP-Survey-on-Nutri-Score.html

37. Test Achat (2020) https://www.test-achats.be/action/espace-presse/communiques-de-presse/2020/peiling-nutri-score

38. BMEL (2020) https://www.bmel.de/SharedDocs/Downloads/DE/_Ernaehrung/Lebensmittel-Kennzeichnung/Ergebnisbericht_Fokusgruppenbefragung_TeilB_eNWK.pdf?__blob=publicationFile&v=3

39. Egnell M, Talati Z, Galan P, Andreeva V, Vandevijvere S, Gombaud M, Dréano-Trécant L, Hercberg S, Pettigrew S, Julia C (2020). Objective understanding of the Nutri-score front-of-pack label by European

consumers and its effect on food choices : an online experimental study. International Journal of Behavioral Nutrition and Physical Activity. 17:146

40. Egnell M, Talati Z, Hercberg S, Pettigrew S, Julia C (2018). Objective Understanding of Front-of-Package Nutrition Labels: An International Comparative Experimental Study across 12 Countries. Nutrients. 10: 1542.

41. Ducrot P, Mejean C, Julia C, Kesse-Guyot E, Touvier M, Fezeu LK, et al (2015). Objective Understanding of Front-of-Package Nutrition Labels among Nutritionally At-Risk Individuals. Nutrients 7: 7106‑25.

42. Ducrot P, Julia C, Mejean C, Kesse-Guyot E, Touvier M, Fezeu LK, et al (2016). Impact of Different Front-of-Pack Nutrition Labels on Consumer Purchasing Intentions: A Randomized Controlled Trial. Am J Prev Med. 50, 627‑36.

43. Egnell M, Boutron I, Péneau S, Ducrot P, Touvier M, Galan P, Buscail C, Porcher R, Ravaud P, Hercberg S, Kesse-Guyot E, Julia C (2019). Front-of-Pack Labeling and the Nutritional Quality of Students' Food Purchases: A 3-Arm Randomized Controlled Trial. Am J Public Health. 109, 8, 1122-1129.

44. Hercberg S (2020). From nutritional research to public health measures.Nutri-Score: past, present and future, XI Simposio Anual Ciberobn "Obesity and Nutrition in the 21st century" 26-29 octubre 2020.

45. Crosetto P, Muller L, Ruffieux B (2016). Réponses des consommateurs à trois systèmes d'étiquetage nutritionnel face avant Cahiers de Nutrition et de Diététique, 51, 3, 124-131.

46. Crosetto P, Lacroix A, Muller L, Ruffieux B (2017). Modification des achats alimentaires en réponse à cinq logos nutritionnels. Cahiers de Nutrition et de Diététique, 52, 3, 129-133

47. Crosetto P, Lacroix A, Muller L, Ruffieux B (2020). Nutritional and economic impact of five alternative front-of-pack nutritional labels : experimental evidence. European Review of Agricultural Economics, 47, 2, 785–818.

48. Ministère des Solidarités et de la Santé. Evaluation ex ante de systemes d'etiquetage nutritionnel graphique simplifierapport final du comite scientifique https://solidarites-sante.gouv.fr/IMG/pdf/rapport_comite_scientifique_etiquetage_nutritionnel_150317.pdf

49. Dubois P, Albuquerque P, Allais O, Bonnet C, Bertail P, Combris P, Lahlou S, Rigal N, Ruffieux B, Chandon P (2020). Effects of front-of-pack labels on the nutritional quality of supermarket food purchases : evidence from a large-scale randomized controlled trial. J. of the Acad. Mark. Sci. (2020). https://doi.org/10.1007/s11747-020-00723-5

50. Egnell M, Crosetto P, D'Almeida T, Kesse-Guyot E, Touvier M, Ruffieux B, Hercberg S, Muller L., Julia C (2019). Modelling the impact of different front-of-package nutrition labels on mortality from non-communicable chronic disease. Int. J. Behav. Nutr. Phys. Act., 16, 56.

51. Egnell M, Kesse-Guyot E, Galan P, Touvier M, Rayner M, Jewell J, Breda J, Hercberg S, Julia C (2018). Impact of Front-of-Pack Nutrition Labels on Portion Size Selection : An Experimental Study in a French Cohort. Nutrients 10, no 9: 1268.

52. Julia C, Hercberg S (2016). Research and lobbying conflicting on the issue of a front-of-pack nutrition labelling in France. Arch Public Health. Nov 28;74:51.

53. Mialon M, Julia C, Hercberg S (2018). The policy dystopia model adapted to the food industry : the example of the Nutri-Score saga in France. World Nutrition 9, no 2: 109 20.

54. Julia C, Hercberg S (2018). Big Food's Opposition to the French Nutri-Score Front-of-Pack Labeling Warrants a Global Reaction. Am J Public Health. Mar;108(3):318-320.